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THE PLANS FOR THE FOUR NEW MONITORS, authorized in the last naval appropriation bill, call for the following general dimensions: Length on normal load water line, 225 ft.; extreme beam at water line, 50 ft.; mean draft at normal displacement, 12½ ft.; normal displacement, about 2,700 tons; total coal capacity, loose stowage, 200 tons. They are to be harbor-defense vessels and are to cost not more than $1,250,000, exclusive of armament. They must be built within 27 months from time of contract. The hull will be of steel, unsheathed, with double bottom and water-tight divisions; there will be one military mast. The side armor belt will be 11 ins. thick and taper to 5 ins. at the ends; it will be 5 ft. deep. The barbettes for the 12-in. guns will be 11 ins. thick; the protective deck will be 1½ ins. thick and the conning tower 7½ ins. thick. There will be two vertical triple-expansion engines, operating twin screws, and four water-tube boilers working up to 250 lbs. steam pressure. Two 12-in. guns will be mounted in a barbetted turret amidships forward, with four 4-in. rapid-fire guns in broadside on the superstructure deck, and a secondary battery of seven rapid-fire guns. The ship must develop a speed of 12 knots for two consecutive hours, with a penalty of $5,000 per quarter knot below that to 11 knots; if the speed is below 11 knots the vessel will be rejected.

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THE CLIMATE OF CUBA AND MANILA is made the subject of a special report by W. F. R. Philips, of the U. S. Weather Bureau. In both cases the sources of information are very meager; those of Cuba being practically confined to Havana. At this place the highest temperature recorded in ten years is 100.6° F., while it has been 104° F. at Washington, D. C., in that period. The mean annual temperature at Havana, for the years 1888-97, is about 77° F. July is the warmest month, with an average of 82.4° F.; in January the average is 70.3° F. At Santiago de Cuba, the only data available would indicate a mean temperature of 80° F., with a range of only 6° between the hottest and coldest months. The average diurnal range in temperature about Havana is about 10°. The average Havana rainfall is about 52 ins. per year, and the rainy season occurs between May and October, with the greatest rainfall in October and the next greatest in June. The relative humidity averages about 75% of saturation and is practically constant for the year; the absolute humidity is very great; the Havana average is about 7.5 grains of vapor to one cubic foot of air. This varies from 6.2 grains in January to 8.9 grains in September. On the average rain falls in one day out of three at Havana, with heavy down pours of short duration as the characteristic. The heaviest daily rainfall recorded is 6.27 ins. in May and 5.32 ins. in October. The average wind velocity at Havana, from the "Northeast Trades," is 7.5 miles per hour, varying from 8.5 to 6.5 miles. The heaviest tropical storms occur in August, September and October.

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Manila, the capital of the Philippine Islands, is situated in latitude 14° 35′ North and in longitude 121° East of Greenwich. Observations have been made for many years at the Observatorie Meteorologico de Manila, and rainfall and other notes have been published for 17 years. From these we find the average temperature for the year to be 80° F., with April, May and June as the hottest months. December and January are the coolest, with an average of 77° F. The highest reading of the thermometer is 100° and the lowest recorded is 74°. The average relative humidity is 78%, with 85% in September and 70% in April. The average absolute humidity is 8.75 grains in a cubic foot. The average annual rainfall is 75.43 ins., of which more than 57% falls in July, August and September. The last is the most rainy month of the year, the rainfall averaging 15.01 ins.; and February is the dryest month, with 0.47 ins. The annual rainfall is marked by irregularity; as much as 120.98 ins. have fallen in one year; and only 35.65 ins. in another. In one September the rainfall was 61.43 ins., and in another September only 2 ins.

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THE HIGHEST METEOROLOGICAL STATION IN the world is on top of El Misti, with an elevation of 19,200 ft. above sea level; it is on an extinct volcano near the town of Arequipa, Peru. This station is one of a series of eight operated in connection with Harvard University near Arequipa, with the lowest only 55 ft. above sea level. and two others of 13,400 and 15,700 ft. elevation respectively. These establishments are the result of a bequest to Harvard, left by Mr. Uriah A. Boyden in 1887. The purpose of the bequest was to establish an observatory at such an elevation as to be as free as possible from the atmospheric influences effecting other stations. The highest station on El Misti is 3,500 ft. higher than the one on Mont Blanc. The instruments used include dry and wet bulb minimum and maximum thermometers, rain-gage, Richard baragraph, thermograph and hydrograph, also a meteorograph, designed to run for three months and record temperature, pressure, humidity and wind direction and velocity. These stations are regularly visited about once in a month, to wind up the clocks and change the record-sheets. Though the road is easy enough the trip to the top of El Misti is an exceedingly exhausting one to the uninitiated.

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THE ANNUAL RAINFALL AT RIVAS, near the Pacific coast of Nicaragua, says Dr. Earl Flint, of that town, was 123.43 ins. in 1897, or the greatest during the 18 years of his observations. Rivas is about 4 miles to the west of Lake Nicaragua and nearly on the line of the proposed Nicaragua Canal. Previous records by Dr. Flint, as reported by the engineers of the Nicaragua Canal Co., ranged from 30 to 90 ins. for the year. On the Atlantic side of Nicaragua, at Greytown, the annual rainfall in 1890 was 320.48 ins., with 274.85 ins. in the Deseado Valley, 12 miles inland.

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THE PHILIPPINE ISLANDS, as described by U. S. Consul O. F. Williams, of Manila, cover 150,000 sq. miles and have a population of 8,000,000 to 10,000,000. The Island of Luzon, on which Manila is situated, is larger than the States of New York and Massachusetts and has 5,000,000 population; the Island of Mindanao is nearly, if not quite, as large. In all, there about 2,000 islands in a land and sea area of 1,200 miles in latitude and 2,400 miles in longitude. Of the hemp exports of 1897, 914,055 tons, 41% went to the United States; more than 55% of the 1,582,904 tons of sugar, exported in the same year, came to this country. The average annual value of hemp and sugar exports to the United States, for the last ten years, was $8,926,372. There is but one railway in the islands, the 123 miles from Manila to Dagupin. This is a well built, single track line, with steel rails, stone or iron bridges and English locomotives making 45 miles per hour. The government assisted in the building of this railway by granting valuable land concessions and guaranteeing 8% on the stock for 99 years. The road pays more than 10% per annum. There are about 25,000 Europeans in the islands, of which 12,000 are at Manila. Trade is in the hands of English, Spanish and German houses.

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred June 28 at Vine Grove, on the Illinois Central R. R., about 37 miles from Louisville, Ky., and resulted in the death of two persons, the engine driver and fireman. The train was a coal special bound for Louisville, and was running at a good rate of speed, when, owing, it is stated, to the spreading of the rails, the locomotive and twelve cars left the track. The damage is estimated at $6,000.——A passenger train derailment on the Wabash R. R., near Burlington Junction, Mo., on June 29, resulted in the injury of some 20 persons, several of them seriously.——The explosion of a locomotive boiler on a suburban branch of the Erie R. R., at Essex Falls, N. J., on July 4, resulted in the injury of the engine crew. The cause of the explosion is not yet known.

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THE FAILURE OF A HIGHWAY BRIDGE crossing the Mohican River at Shelby, O., on July 4, precipitated about 1,000 people into the river 18 ft. below. Four persons were killed and nearly 100 injured. A public wedding was being celebrated on the bridge at the time of the accident.

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A TORNADO-LIKE STORM which occurred along the North Atlantic coast on July 4 resulted in a large amount of damage to property and the death of a number of people. At Hampton, N. H., four persons were killed by the destruction of a crowded skating rink and five were drowned by the capsizing of a yacht sailing off the beach. The foundering of the excursion steamer "Surf City" in the harbor at Beverly, Mass., resulted in the death of eight persons. Less serious accidents occurred to pleasure craft and sea shore resorts at other points on the New England coast.

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THE SINKING OF THE STEAMSHIP "LA BOURGOGNE" with the loss of 553 lives is reported in dispatches from Halifax, N. S., as we go to press. According to the latest reports, the "La Bourgogne" when about 60 miles south of Sable Island on her regular trip east, collided with the British steamer "Cromartyshire," at about 5 o'clock a. m., on July 4, and sunk within a few minutes after the collision. There were on board of the French liner at the time of the collision 75 first cabin, 123 second cabin and 285 steerage passengers, and a crew of 233 men, in all 716 persons. Of this number, 53 passengers and 110 of the crew escaped in boats and were picked up by the "Cromartyshire," which was herself badly damaged, and had to be towed into Halifax by the steamer "Grecian" of the Allan Line. According to the statement of the captain of the "Cromartyshire" the collision took place in a fog, and the French steamer was running at a high rate of speed when his ship struck the liner amidships, tearing a great rent in her plates. When the fog lifted, one-half hour later, the "La Bourgogne" had disappeared, having sunk, and only two boats and some life rafts, crowded with passengers from the ill-fated vessel, were visible. The sunken steamer was 7,400 tons gross tonnage, and was the third largest ship of the fine fleet of the Compagnie Generale Transatlantique. She was 508 ft. long, 52 ft. beam, and 38 ft. deep, and had engines of 9,000 I. HP. This was the third collision which the ship had had. On Jan. 4, 1890, she collided with the British steamer "Torridon" near the Scilly Islands, carrying away the stern of the British vessel and suffering slight injuries herself, and in February, 1896, she ran into and sunk the steamship "Ailsa," during a fog in the lower bay of New York harbor. There was no loss of life in these two earlier accidents. The "Cromartyshire," which suffered in this last collision, was a three-masted iron freight steamer of 1,554 tons gross tonnage, 249 ft. long and 32.8 ft. beam. All of the officers of the "La Bourgogne" were among the drowned, except the purser and three engineers.

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THE "WHALEBACK" STEAMER "Alexander McDougall," launched at Superior, Wis., on June 25, was designed by Mr. Albert C. Diericx, of the American Steel Barge Co. She is 430 ft. long over all, 414 ft. keel, 50 ft. beam and 27 ft. molded depth. There is a 5-ft. double bottom, with a water-ballast capacity of 2,000 tons and her displacement is nearly 10,000 tons, with a cargo capacity of 7,200 tons. She has quadruple expansion engines. The vessel has 13 hatches for loading, each 24 × 8 ft. in the clear and 24 ft. apart on centers; her coal capacity is 350 tons and she is fitted with two 90-ft. masts.

BUILDINGS AT THE OMAHA EXHIBITION.

In our issue of May 19 we briefly described the scope and purpose of the Trans-Mississippi & International Exhibition, now being held at Omaha, Neb., and also gave some particulars of the principal buildings. We now present views of four of the buildings, and from these and the particulars already given it will be evident that the exhibition has been planned upon the artistic basis so perfectly carried out in the design of the ever-memorable Columbian Exhibition at Chicago in 1893.

The U. S. Government Building, Fig. 1, is at the head of the "grand canal," and consists of a central portion and two wings. The former is 208 ft. long, 150 ft. deep and 58 ft. high to the top of the parapet above the cornice. The dome is surmounted by a figure of "Liberty," whose torch is 178 ft. above the ground. The wings are each 148 × 100 ft., and 44 ft. high. They are connected by colonnades with the Fine Arts Building and the Agricultural Building. The total frontage is 504 ft., and the floor space devoted to exhibits aggregates 50,000 sq. ft. This building was designed by the Supervising Architect of the U. S. Treasury Department.

The Manufactures Building, Fig. 2, is 400 ft. long and 40 ft. high to the main cornice. The main entrance, 24 ft. wide and 34 ft. high, is in a center pavilion 64 ft. long, and at each corner of the building is a pavilion 40 × 40 ft. The height to the top of the group of statuary over the main pavilion is 85 ft., while the height to the tops of the flat domes of the corner pavilions is 65 ft. The windows are 10 ft. wide and 24 ft. high, placed 16 ft. apart. The architect was John J. Humphrey, of Denver, Colo.

The Mining Building, Fig. 3, is treated in a somewhat more ornate style, and has a circular portico or main entrance 50 ft. in diameter, surmounted by a dome formed as a series of circular steps. The top of the dome is 75 ft. above the ground. This portico projects beyond the face of the building, and is flanked by open colonnades extending to the towers at the corners. The building was designed by S. S. Beman, of Chicago.

The Horticultural Building, Fig. 4, is 310 ft. × 130 ft., with a height of 160 ft. to the top of the central tower, or belfry, in which will be placed a set of chimes. The central portion of the building is octagonal in plan, formed by square towers with connecting curtain walls, and above this is a glass dome surmounted by a gallery accessible to the public. The main entrance is a Greek portico, and domed pavilions mark the corners of the building. The architect of the building was Charles F. Beindorf, of Omaha, Neb.

The exhibition was opened on June 1 by President McKinley at Washington, who pressed an electric button, starting the machinery and unfolding a flag on the Government Building. It will remain open until November.

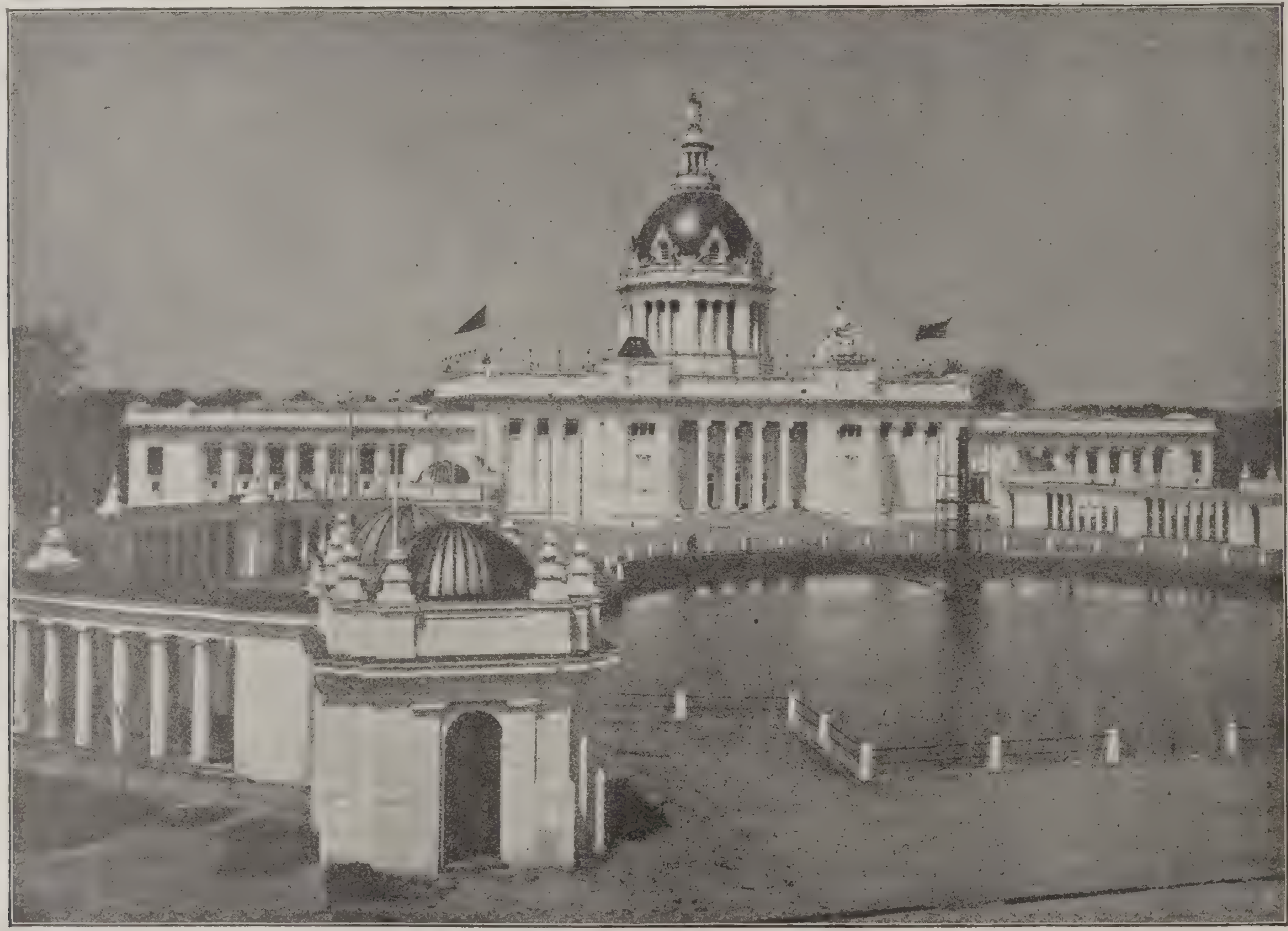

FIG. 1.—UNITED STATES GOVERNMENT BUILDING. TRANS-MISSISSIPPI AND INTERNATIONAL EXHIBITION.

THE NEW U. S. GOVERNMENT NEEDLE DAM AT LOUISA, KY., ON THE BIG SANDY RIVER.

(With double-page plate.)

General Features.

The new Poiree needle dam, which was opened for public use on Jan. 1, 1897, at Louisa, Ky., on the Big Sandy River, is a radical departure in many particulars from the dams of this type heretofore built in France and Belgium, where the Poiree system originated and has been most extensively used. First among its notable features probably is that it sustains a head of water which considerably exceeds that supported by any other dam of the trestle or wicket type yet constructed. Besides this, however, the construction and operation of the trestles, needles and raising and lowering machinery also embody new features never employed before, and finally it is stated that the cost of the dam was relatively smaller than that of previous Poiree dams, so far as is known. These facts alone are sufficient to make the new dam worthy of notice, but as we point out elsewhere in this issue, it also deserves attention as a representative example of the very high class of structures which the latest improvements of our inland rivers for navigation is calling upon engineers to design.

Through Mr. B. F. Thomas, M. Am. Soc. C. E., U. S. Assistant Engineer, who designed and constructed this dam, we have, therefore, secured a number of photographs of the completed work, which we supplement with the accompanying description and line drawings abstracted from the official report of the same officer published in the "Report of the Chief of Engineers" for 1897.

Conditions Governing Type of Dam.—The new dam is located near Louisa, Ky., just below the junction of the Levisa and Tug rivers, which unite to form the Big Sandy River, which in turn empties into the Ohio River about 26 miles north of the junction. The Levisa River is navigable by steamboats during a good part of the year for a distance of 100 miles, and the Tug River for a distance of 60 miles. Beyond these points push-boat navigation is possible throughout the year, except in periods of extreme low water, which are usually of short duration. Both streams carry a large amount of sand and debris, which would be very likely to form bars and snags in a permanent pool, such, for example, as would be caused by a fixed dam.

A more important reason why a movable dam seemed desirable was the nature of the commerce, which is very largely timber in rafts. There are times when rafting stages of the river are infrequent, and hundreds of rafts are awaiting sufficient water to reach the Ohio River. When the long-delayed rise comes, it is often of short duration and has to be taken advantage of at once. In such cases the delay necessary to pass the commerce through the lock of a fixed dam would very likely result in a failure to reach the markets along the Ohio and Mississippi rivers during an entire season. The same argument applied to the shipment of coal in barges, which seems likely to become a quite important portion of the traffic as soon as the neighboring coal fields are developed. There were various other reasons why a movable dam seemed preferable to a fixed dam, which was the type of structure originally contemplated, but they need not be detailed here.

Choice of System of Movable Dam.—A movable dam having been decided upon, the next step was to choose a system best adapted to the conditions. These conditions were briefly as follows: (1) An unprecedented head of water to be sustained; (2) sudden and unexpected rises in the stream; (3)

the great amount of sediment and drift carried; (4) the great difference in level between high and low water, and (5) the small low water discharge. The high lift was unfavorable to the use of needles; the sudden freshets were an argument against any form requiring much time for maneuvers; the drift and sediment, to any system having trestles; the height of high water and the high banks, to bridge dams; and the small discharge of the river, to wickets of the Chanoine type. The Chanoine wicket and the Poiree needle seemed upon study, however, to have the fewest disadvantages, and it was finally decided to build a needle dam, with a supplementary lock. The works as finally constructed (Fig. 1), therefore, consisted of (1) a lock on the right, or Virginia bank, 52 ft. wide and 255 ft. long over all; (2) a navigation pass next the lock 130 ft. long, having a depth of 13 ft. of water on its sill, and (3)) a weir 130 ft. long separated from the pass by a masonry pier 12 ft. wide and terminating in an abutment 17½ ft. wide on the left, or Kentucky bank. The weir has a depth of 7 ft. of water on its sill.

Lock.

The lock, which is of sandstone masonry, is 255 ft. in length, with a distance between quoins of 190 ft. and a clear width of 52 ft. The walls stand 21 ft. above the lower miter sill level. The lower miter sill is at an elevation of 9 ins. below the low water mark of 1883, and the upper miter sill is 2 ft. above the lower. The gates are of wood, and are of the miter pattern. The filling of the lock takes place through valves in the upper gates and the discharge through culverts in the side walls, which connect the lock chamber with the pool below. In constructing the lock the entire site was enclosed by a coffer-dam, inside of which the excavation and masonry work were carried on by ordinary well-known methods. The cost of the lock, including everything properly chargeable, was $120,372. The object of the lock is, of course, to pass the traffic during stages of low water when the dam is raised.

Construction of Movable Dam.

As already stated, the movable dam proper is divided by a pier into two parts, the navigation pass and the weir. The purpose of the pass, as its name indicates, is to accommodate the navigation during high water, while that of the weir is to pass the surplus water. In deciding upon the dimensions to be adopted, the pass, of course, had to present an opening long enough to be run safely by the rafts, tows, etc., of the kind that navigate the Big Sandy River, and deep enough so that its sill should not form an additional obstruction; that is, it had to be below the highest natural obstructions in the river. To satisfy the first condition it was thought that an opening of 130 ft. would be ample, while the depth would be sufficient if the sill were placed 1 ft. below the low water level of recent years. The conditions to be satisfied in dimensioning the weir were: (1) The area of discharge must be sufficient, when taken in connection with those of the pass and lock to permit the passage of discharges corresponding to all stages up to the level of the top of the pier and abutment, without causing a greater swell head than 0.5 ft.; (2) the discharge area of the weir should be sufficient to pass all discharges corresponding to stages up to that at which the natural river is navigable, without the removal of any needles from the pass. It was found that these conditions would be satisfied by placing the sill of the weir 6 ft. above that of the pass and making it 140 ft. long.

Substructure.—The dam is founded on sandstone, varying in depth below low water from 3 ft. at the lock wall to 24 ft. at the abutment. Upon this, after removing the overlying sand and gravel and the softer top parts of the ledge proper, was built the substructure of concrete and sandstone masonry. Figs. 2 and 3, transverse sections through the pass and weir respectively, show the construction of this substructure quite clearly. In the pass it is 22 ft. wide at the coping and in the weir 17 ft. wide, while the heights are, respectively, 12 ft. and 24 ft.

Trestles.—The pass is closed by 31 and the weir by 34 steel trestles, spaced 4 ft. apart c. to c., which terminate in eyes at the bottom and are connected to journal boxes by pins. The pass trestles, Fig. 4, are 15 ft. 2 ins. high, and weigh 1,140 lbs. each, and the weir trestles are 9 ft. 8 ins. high and weigh 920 lbs., and they have bases 9 ft. 10½ ins. and 6 ft. 5 ins. long, respectively. The other features of the trestle construction are shown by the drawings, Figs. 2, 3 and 4.

The trestles are rigidly connected by two independent constructions, and the maneuvering chain constitutes still a third connection. One of these connections is the bar which forms the upper support of the needles. This bar is hinged vertically to each trestle at the pool level so as to swing horizontally, and has its opposite end formed into a hook on its upstream side, which engages with a lip or projection on the next trestle. It is held in position by a crank-shaped rod which may be turned from the walkway by a wrench when it is desired to let the bar swing free. When in use the crank-shaped rod is held from turning by a latch, which is disconnected when the wrench is dropped over the head of the rod. The second means of connecting the trestles is the sheet-iron floor plates. Each floor plate is hinged to its trestle horizontally and spans the opening to the next trestle, to which it connects by means of hooks at two points. A latch moved by the foot holds each section in position.

In a frame bolted into the head of each trestle is a combined ratchet and chain wheel, over which a chain passes from one end of the pass to the other. There is also a similar chain for the weir. One end of each chain is fastened, in the case of the pass to the trestle nearest the pier, and, in the case of the weir, to the trestle nearest the abutment. The other ends of these chains are wound on chain crabs, located respectively on the lock wall and the pier. By means of a pawl dropping into the ratchet, the rolling of the chain wheel may be stopped, and when this occurs the trestle is attached to the chain and the winding of the crab will move it as desired. Fig. 5 shows the construction just described quite clearly, and a little further on its operation in raising and lowering the trestles will be described.

Needles.—The needles are of white pine and are 12 ins. in width. The pass needles are 14 ft. 3 ins. long, 8 ins. thick at the bottom, 4 ins. thick at the top, and weigh when wet 263 lbs. each, and the

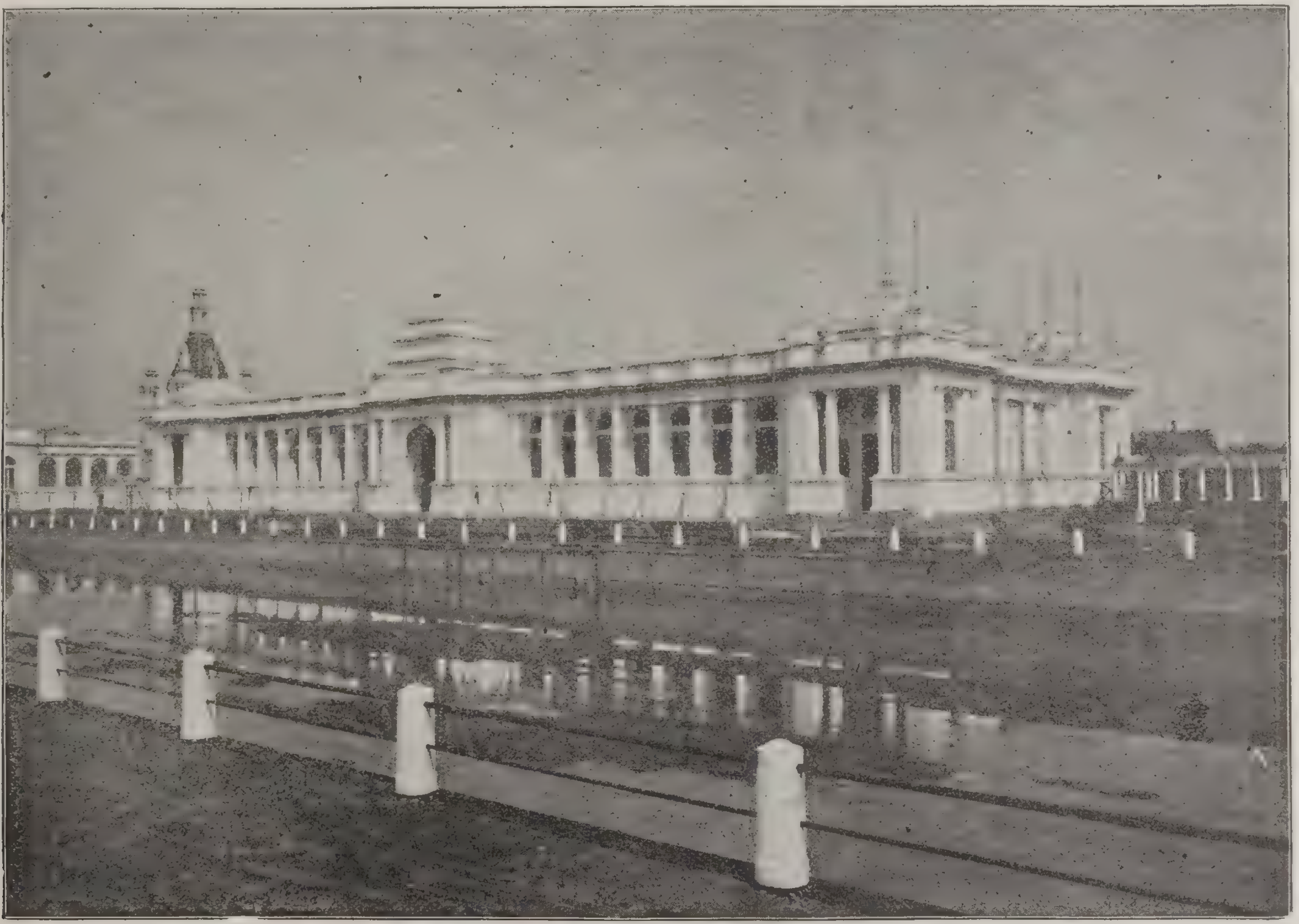

FIG. 2.—MANUFACTURES BUILDING. TRANS-MISSISSIPPI AND INTERNATIONAL EXHIBITION.

weir needles are 8 ft. 3 ins. long, 3½ ins. thick at the bottom, 2½ ins. at the top, and weigh about 80 lbs. All needles are banded at the top and bottom, the bands being countersunk, and carry iron handles and suitable attachments for connecting the chains to place and remove them. In the sides of the pass needles a shallow groove is cut which will hold a strip of rubber should it become desirable to restrict the leakage. The pass needles when not in use are stowed on a boat built for the purpose. This boat is provided with two overhead tracks on which run trolleys for lifting the needles from the piles and carrying them to the end of the boat when they are to be put in the dam and for piling them when they are to be stored.

Drift Boom.—The river, as already stated, carries a large quantity of drift which, if it were not deflected, would interfere with the operation of the dam and might even injure it seriously. To deflect this drift the drift boom has been provided. This boom consists of four parallel timbers rigidly bolted together and having rudders at intervals of 30 ft., and reaches from a point some distance above and on the opposite bank from the lock to the crib at the river wall of the lock, thus guiding all drift into the lock through which it is passed. The rudders on the boom are controlled by a wire wound on a capstan at the end, and by setting them at the proper angle the boom can be held out in the stream at any point required.

FIG. 3.—MINING BUILDING. TRANS-MISSISSIPPI AND INTERNATIONAL EXHIBITION.

Operation of Movable Dam.

From the description and illustrations just given the construction of the several parts of the Big Sandy River needle dam will be pretty clearly understood. A brief explanation will be sufficient to make its operation equally clear.

Raising the Trestles.—The raising of the trestles may be accomplished in two ways: (1) By a crab located as already stated, on the pier, for the pass trestles, and on the lock wall, for the weir trestles; (2) by the needle boat anchored above and raising the chain passed over a sheave and leading to the drum of the boat engine. Up to the present time the latter method has been but little employed owing to the lack of a suitable engine on the needle boat.

By the first method the chain is wound in by the crab and is stowed away in a suitable recess in the masonry. As the chain is wound in it brings up the first trestle and starts others. When the first trestle is nearly upright the attendant standing on the masonry lifts the end of the floor section a few inches which depresses one end of the pawl and raises the opposite end out of the ratchet in the chain wheel, as shown by Fig. 5. This severs the former rigid connection between the trestle and the chain, and the attendant can handle the trestle at will without the crabman stopping the winding in of the chain. He, therefore, hooks the floor section into place and fastens it with the foot latch, and then, standing on the bridge thus formed, swings the connecting bar into place and locks it by a turn of the crank bar. By this time the floor of the second trestle comes within easy reach, and the attendant proceeds to lock this trestle just as he previously did with the first. A repetition of this process raises the entire number of trestles, the work for either the pass or the weir consuming about 40 minutes.

It will be observed that, by winding in the length of chain at which the trestles are spaced, each trestle is brought up. After the first one, which has a sufficient length of chain to reach from the top to the bottom of the masonry, and thence to the head of the trestle when down, the length is generally 4 ft.; that is, the trestles themselves are 4 ft. between centers, and, by allowing 8 ft. of chain to each it is only necessary to wind in 4 ft. of this to bring the trestles properly into position. When the last trestle has been raised, a rolling bridge is drawn out from a recess in the masonry and connected with it, and thus a foot bridge is completed from one part of the masonry to the other.

Lowering the Trestles.—In lowering the trestles the attendant stands on the foot bridge and first unhooks the rolling bridge and pushes it back into its recess. He then disconnects the escape bar of the last trestle and throws it around against its trestle and then unhooks the floor section, which falls upon the chain and rests there. The crabman then slacks the chain, allowing the trestle to fall. When the chain has been run out about 4 ft. the attendant throws the pawl of the standing trestle into its ratchet and thus the descending restle is stopped. The escape bar and floor section of this trestle are then relieved and it begins to fall as the chain is paid out, until when the chain has run out about 4 ft. the operation of throwing the pawl into the ratchet of the next standing trestle is repeated. A repetition of these maneuvers brings all the trestles to their beds with their floor sections resting on top of them. The time required for lowering either pass or weir is about 40 minutes.

Placing the Needles.—Two methods have been employed for placing the needles in the dam.

(1) The pass needles, as previously stated, are stored on a special boat (Fig. 6), which is anchored so that its bow is only a few feet upstream from the trestles, with their heads or tops all in one direction toward the dam. A trolley track runs over the pile of needles on each side of the boat, and the trolleys have sheaves over which pass chains having hooks at their free ends. At about the center of weight of each needle is a ring. By placing the chain hook in this ring and pulling down on the free end of the chain the needle is raised from the pile. Near the hook is a catch or claw on the chain, the purpose of which is to hold the bight of that part of the chain pulled down in raising the needle. Thus the needle, after being raised, remains suspended, and by pushing it the trolley rolls along the track overhead and carries it out to the bow of the boat. When the needle is brought to the end of the trolley track its head projects over the foot bridge, where it is grasped by the attendant and placed on the support bar alongside the last needle put in.' The trolley track projects over the hull of the boat several feet, so that when the head of the needle is in its proper place on the trestles the butt or foot is just at the bow. When all is ready a quick jerk on the free end of the trolley chain releases it from the claw and the weight of the needle pulls the chain over the sheave. When the needle strikes the water the current carries it against the sill, the force of the

blow being lessened by the men holding the free end of the chain, thus allowing it to come to place easily. As soon as the strain is off the chain, the hook drops out of the ring. A stage-plank projects about 15 ft. from one side of the boat parallel with the dam, so that it is possible to place about 30 ft. of dam by allowing the needles to float out to position without moving the boat.

(2) In the second method the needles are left in the river instead of being stored on the boat, and are lifted from the water by a light derrick on the needle boat (Fig. 6), and placed vertically, either on swinging shelves suspended on the upstream side of the trestles, or on a suitably constructed frame resting on the sill at the bottom. In placing the needles every fourth one is put in its proper place against the sill instead of on these shelves or frames. These act as guides to the others when they are let into the water, and the shelves or frames themselves prevent the needles from being carried downstream by the current (Fig. 7). After all the needles have been placed on the resting planks or frames they are dropped into the water as rapidly as practicable and the whole dam is in before the head has appreciably increased. The shelves and frames are then loosened and taken to the bank.

The weir needles are placed before those of the pass, and while there is still some water on the weir sill. This is easily and rapidly done by men standing on the masonry above the sill and taking the needles from a light boat or directly out of the river. The principal advantages of this method is that the closing of the weir increases the current through the pass and tends to scour out any deposit on the trestles which are not raised until after the weir is closed.

Removing the Needles.—When a rise approaches, the wickets in the lock gates are opened, and when they fail to keep the pool down to its normal level, alternate needles in the dam are "repoussed;" that is, the heads of alternate needles are pushed upstream and struts or sticks 12 ins. to 15 ins. long are placed between them and the support bars (Fig. 8). This permits the escape of a great quantity of water. When this fails to keep the pool down, the weir needles thus standing out may be removed entirely, or, if indications point to a considerable rise, all the weir needles may be removed. A continuation of the rise may finally necessitate the removal of all the needles standing out in the pass, or even the whole of the pass.

This last process is conducted in the following manner: Near the top of each needle is a countersunk handle for use only in removing the needle. A chain much longer than the length of the dam is passed along the upstream side of the needles and connected by hooks with these handles. There is considerable length of slack chain between each pair of handles. The end of the chain is fastened to a long line leading to the engine on the needle boat, which is anchored well upstream, or to a crab on the lock wall or on shore. By starting the engine or crab the first needle is pulled away from its support at the top, and when it has traveled the length of the slack chain leading to the next, the second is started, and so on. This maneuver is very rapid, the time required being simply that which is necessary to wind the rope on the drum of the engine.

Results of Operation.—Considerable interest is attached to the results obtained in the actual operation of this dam, and in a paper read before the American Society of Civil Engineers on March 16, 1898, by Mr. B. F. Thomas, the following information is given regarding this matter:

> The dam has, at this writing, been in operation nearly one year. The early part of the present season was one of violent thunder storms and sudden freshets, which brought much driftwood into the river. About the last of July a drouth set in which was of unusual duration. The discharge of the river became reduced to less than 50 cu. ft. per second. The pool has remained full at all times, except when drawn off to assist small craft below or to perform necessary work about the lock and dam. The greatest head so far attained was 12 ft. 2¼ ins., and the leakage through the pass was only 5.19 cu. ft. per second, and that of the weir too small to take into account, being but one gallon in 38 seconds.
>
> No trouble has been experienced with the pass; the needles have been removed and placed, and the trestles have been lowered, each time without difficulty of any kind. In raising the trestles the chain was broken on two or three occasions, caused by heavy deposits of sand on the floors which form the foot-bridge when up. With one exception this has occurred only on the trestles which lie in the pier recess. It has been found impracticable to leave the lock gates open on account of the increase of this deposit, due to the greater discharge section and consequent reduction in current velocity. By closing the lock and erecting the weir some time before the water level reaches its masonry crest, considerable scour takes place through the pass and no further trouble from this deposit is anticipated. In the pier recess the removal of the floor sections, before lowering the trestles, will prevent a deposit of sufficient weight to break the chain. On the weir there has been a little trouble with drift, but it was of slight consequence. The raising of the trestles and the removal and placing of the needles is done with the greatest facility. What difficulty there has been has arisen from permitting the trestles to stand after the removal of the needles in the drift-laden torrent caused by the release of so much water. The larger drift is held back by the boom, but small pieces, brush, etc., are drawn under the boom by the increased current, caused by opening the dam, and some of this lodges against the standing trestles. With trestles of wider span and by lowering the trestles simultaneously with the needles, most, if not all, of this difficulty can be obviated. It has not been practicable to do this, however, owing to lack of bank protection below the abutment. The opening of the needles from the abutment end of the weir causes great scour for some distance below and endangers the paving, so that it has been considered advisable to make the first openings in the dam at the pier end. Thus it was necessary for the trestles to stand until all the needles were removed, when the lowering could begin at the abutment. Even with this drawback the total delay caused by drifts has not exceeded two hours in the whole year, and but one trestle has been bent and only slightly.
>
> On account of the great quantity of drift running in this river it was originally proposed to use wickets on the weir, raised without the use of a foot-bridge and lowered by a tripping bar; thus no trouble would be encountered by drift lodging against the trestles as now occurs on wicket dams operated from trestles. This arrangement, in the light of experience, would have been preferable, so far as disposing of the drift is concerned, but the leakage would have been more than the entire low-water discharge of the river, unless improvements could have been made over those now in use. Either method has its objections and its advantages and neither is wholly suited to a weir through which drift must pass. The only serious objection, outside of the lodging of drift on the trestles, is the difficulty of replacing the wide needles

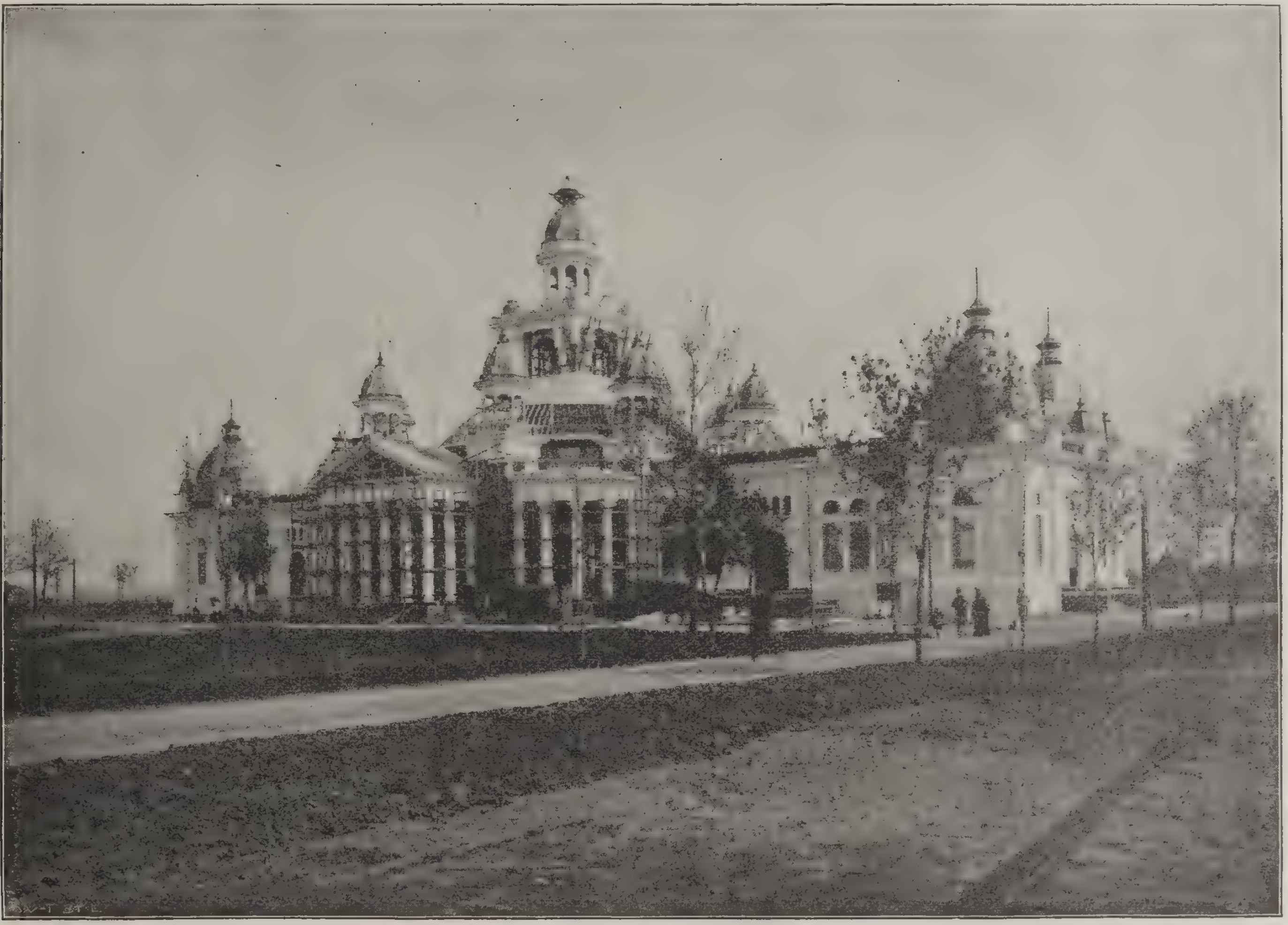

FIG. 4.—HORTICULTURAL BUILDING. TRANS-MISSISSIPPI AND INTERNATIONAL EXHIBITION.

under the full head after they have once been removed to pass a moderate rise, but even this is not impossible and is rarely necessary. The width of weir needles can be advantageously reduced without seriously increasing the leakage and thus assist materially in this contingency.

In addition to the leakage wickets would be objectionable on this weir because they could never be put on the swing for fear of drift-wood lodging against the horses and thus complicating the maneuvers. Thus, pool regulation could not be effected in small rises with the certainty that it can by repoussing needles; but they have the advantage that they can be raised against the full head of water at any time desired, and thus prevent too great a lowering of the pool in passing small freshets. The author believes that the construction could be so altered as greatly to decrease the leakage and thus to a considerable extent eliminate this objection. Considering the untried methods necessary in this dam, it may be said that the maneuvers have all been fairly satisfactory so far. The dam has been operated in one or two instances under especially difficult conditions, and it is safe to predict success under all ordinary circumstances which may occur. A rapidly rising river, filled with drift arriving at night in snow or rain, might complicate matters considerably, and change an apparent success into a certain failure, without warning. All precautions possible, except the construction of telephone lines owned and operated by the government, have been taken to provide against surprise, and results are now to be awaited and difficulties met with courage and intelligence.

The experience so far gained with this dam indicates that its operation will be at least as speedy, easy and safe as is that of the wicket dams on the Great Kanawha or of the needle dams of the old type in Europe, while this dam is much less wasteful of water than any of these, which is an important item in this and many other streams.

Cost.—The total cost of the Big Sandy River needle dam and its auxiliary constructions was $349,155, divided as follows:

Lock	$120,372
Movable dam	76,251
Approaches, protection work, etc.	35,553
Fixed dam and abutment	26,734
Miscellaneous	29,263
Engineering, superintendence, etc.	40,440
Office expenses at Cincinnati	20,542
Total	$349,155

This total would have been considerably less if the original design had not been for a structure differing considerably from the one actually built, which acted in various ways to increase the expense. It was estimated by the engineers that under favorable conditions the dam could be built for $198,152.

* * *

A RECENT EXAMPLE OF AUTOMATIC, INTERLOCKING MACHINERY FOR OPERATING A SWING BRIDGE.

By Charles H. Wright.*

There is no more interesting work falling to the lot of the bridge engineer than the designing of the machinery for a large draw span, and there is, perhaps, no branch of his work in which such marked advance has been made in the last few years. It is no longer sufficient to provide means for rotating the span, and for supporting the ends, when the span is closed; the break in the rails at the ends of the span must be bridged over, a continuous bearing surface provided for the car wheels, and the rails clamped rigidly in line. Some form of latch must be used to assist in bringing the span to rest at the end of the return swing, and to bring the end locks into line. Danger signals must also be thrown at the ends of the bridge and at points several hundred feet distant out on the track. The machinery for performing all these movements must be under the full control of the operator in the engine-house, and many of the movements must be automatic in their action. A regular order must be followed, in performing the several operations, and the levers controlling them must be so interlocked that any variation from the fixed order of operation is impossible. Indicators attached at various points must show the exact stage of each operation at any time, as when the end lifts are fully drawn, partly driven, or with ends lifted, etc. Often a small electric light plant is installed on the bridge, and if steam power is used the little remaining space left in the engine house is taken up by the tanks and pumping machinery necessary for supplying the boilers, etc.

The interlocking and automatic devices used on a long span recently constructed by the Edge Moor Bridge Works, are shown in Figs. 1 and 2. There are three sets of friction clutches operated by the levers at A, B and C. At Y there is a set of equalizing gears for distributing the load equally to the two pinions. Fig. 1 shows the bridge closed, with all the levers locked, with the exception of lever A, which can be thrown to the right. The action briefly described is as follows:

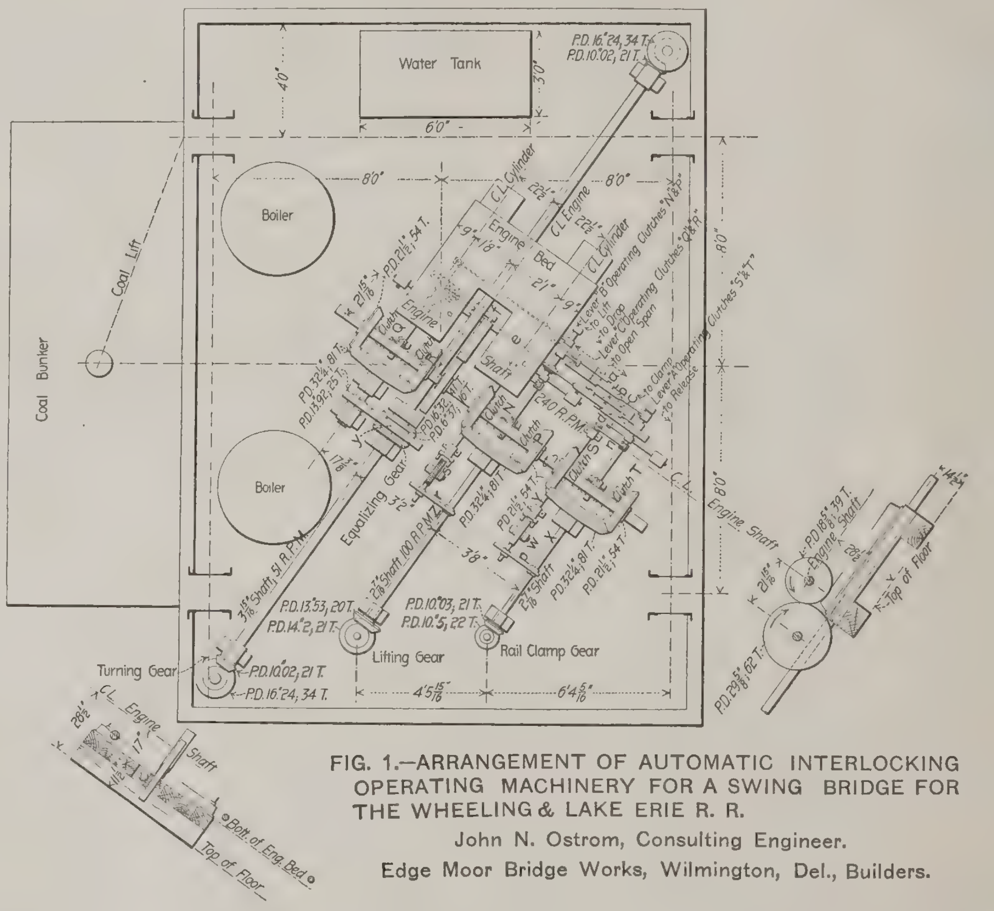

FIG. 1.—ARRANGEMENT OF AUTOMATIC INTERLOCKING OPERATING MACHINERY FOR A SWING BRIDGE FOR THE WHEELING & LAKE ERIE R. R.

John N. Ostrom, Consulting Engineer.

Edge Moor Bridge Works, Wilmington, Del., Builders.

Assume the draw closed, the ends lifted and the signals showing a clear track. If the bridge is now to be opened the first operation will be to throw the signals and draw the rail clamps. By throwing lever A, which controls the clutches S and T, to the right, clutch T is engaged and drives the line of machinery, which releases the danger singals at the end of the span, and at points 400 ft. distant. These signals are thrown by springs or counterweights, which are released by the withdrawing of an arm which upon the return movement revolves the vertical shaft to which the signals are attached and compresses the springs. At the same time that the signals are thrown to danger the rail clamps are drawn back by a system of gears and levers, controlled by the same shaft which operates the signals.

When the lever A was thrown to the right it pulled the lock bar, a, to a position where it unlocked the lever B, which operates the end lifts. The bar b, however, still locks this lever. The lever C is also locked, so that the turning machinery cannot be moved in either direction. After shaft X has revolved a certain time, sufficient to draw the rail clamps, the chain gear p has turned the worm wheel w until the projection shown on the right-hand side of the wheel strikes the arm on the fork, which is attached to shaft Y, and by revolving this shaft throws the rocker n and brings the lever A to a vertical position again, which frees clutch T, and stops this portion of the machinery. As the lever A moves back to the vertical position it brings the notch in lock bar b opposite the lug on lever B, and thus releases this lever. Lever B can now be thrown to the right, but is still locked to the left. If B is now thrown to the right, clutch P is engaged and the end lifts are drawn. This motion of B throws the lock bars c and d, which lock A, and also throws e and f, f being thrown so as to unlock lever c, while the bar e still locks it. Lever A is now locked in one direction by the bar c, and in the other by the worm wheel and rocker n. Lever C is also still locked. When the shift Z has revolved a sufficient time to draw the end lifts, the chain gearing and the worm wheels (similar to the arrangement on shaft X) throw the clutch P out of gear and brings the lever B to a vertical position again. As B moves to the vertical position it throws the bar e, which unlocks lever C. This lever can now be thrown in either direction for turning the draw.

Lever A is meanwhile locked in both directions and B in one. In closing the draw the operation just described is reversed. There are indicators which show the progress of the different operations.

The interlocking and automatic cut-off machinery was designed by Mr. Chas. H. Wright, Chief Draftsman of the Edge Moor Bridge Works, and the Moore & White Co., of Philadelphia, who manufactured this part of the machinery. It has worked perfectly.

Fuller descriptions of parts of this bridge will be found in the work on "Draw Spans" by Mr. Wright, now in press.

* * *

RECENT RESEARCHES IN TERRESTRIAL MAGNETISM.

The obscure subject of terrestrial magnetism and the cause of the remarkable vagaries of the magnetic needle which occur, have been for some time under investigation by French and Russian scientists in connection with a large area in Central Russia. Recent press dispatches give some of the results of the experiments made on the country between Moscow and Kharkov, two cities 850 miles apart. It was found that the greatest aberration of the magnetic needle occurred in the Province of Kursk. At a station in the north of the Province the needle was deflected 20°, and at a place 150 miles to the southeast of the first point it was deflected 96°. At the latter station the needle pointed practically East and West, instead of North and South. The meager accounts so far received do not permit an explanation of this remarkable deflection, nor do they give any geological or other data upon which any reasonable explanation can be offered.

But, in a late paper presented to the Franklin Institute, Mr. Benjamin Smith Lyman, a mining engineer and geologist of long experience, notes a case of compass variation in Pennsylvania that seems to show some relation between magnetic and geological phenomena, in this connection. In 1883, Mr. Rudolph Hering, M. Am. Soc. C. E., made for the Water Department of Philadelphia a topographical survey of the Perkiomen Creek and the surrounding region, in Bucks and Montgomery counties. At the same time a magnetic map was made of this section, and curves of equal declination were drawn for every tenth of a degree. These curves were remarkable in their tracery; showing a fairly regular northeastward tendency or bend on an axial line which in itself bent the aggregate of lines of equal declination appearing somewhat like folds over some central object. The lines were so regular in their irregularity, and so much at variance with the simple straight lines of previous less detailed maps, that, in the absence of any obvious topographical or other known reason for their being, they were doubted by some and ascribed to mistaken observations or to lack of sufficiently accurate data.

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*Chief of Drafting Department, Edge Moor Bridge Works, Wilmington, Del.

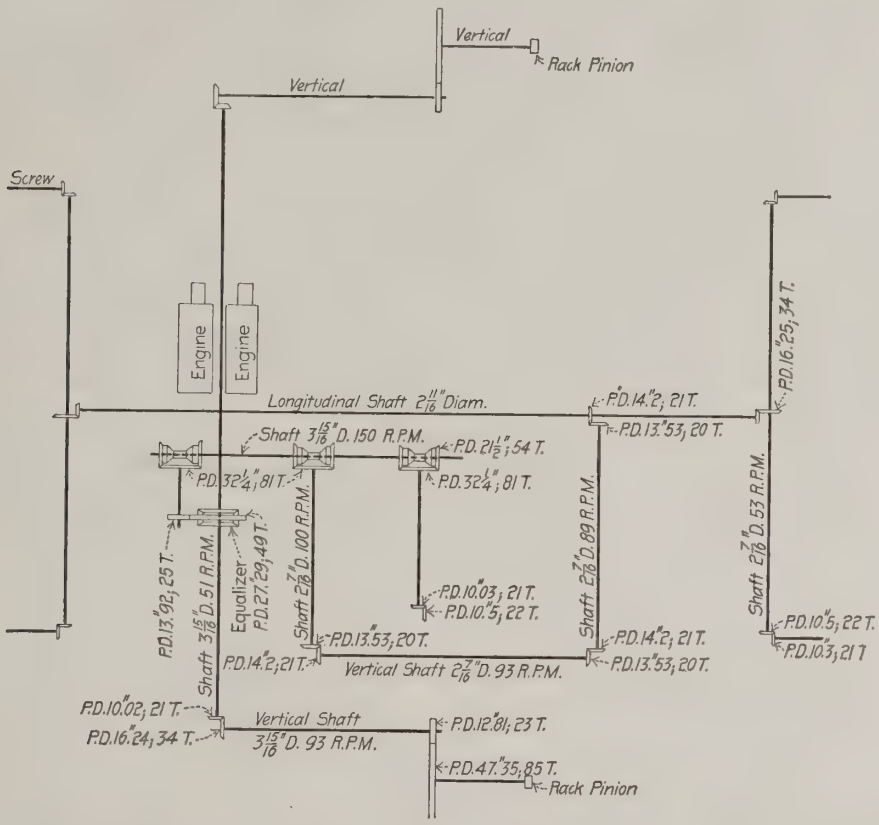

FIG. 2.—DIAGRAM SHOWING SIZES OF SHAFTING AND GEARING LEADING FROM ENGINE TO POINTS WHERE POWER IS USED.

But in 1887 a geological survey of these two counties was commenced, and a geological map was finally published, in 1893, giving the direction and amount of the dip at some thousands of points. This geological map, made without the least reference to the earlier magnetic map, beautifully confirmed the first, and by underground geology vindicated the general correctness of the observations made upon the magnetic deflection. The axis of the bend in the magnetic curves is itself greatly bent, almost at a right angle; and the geological survey has proved beyond a question the existence of an enormous fault of about 14,000 ft., lying almost exactly on this magnetic axis. The topography of the country shows no strongly marked ridge following the axis of the magnetic curves, and the long, rather high ridges run in other directions. Further, the form of the outcropping rock beds, sedimentary or igneous, does not correspond in any degree with the magnetic curves. Mr. Lyman does not believe that these curves could have been produced by any known deposits of iron ore or trap in these countries, whether they were strongly or weakly magnetic; and he adds that deposits of iron ore seldom affect the most delicate magnetic needle at a distance of more than a few hundred feet.

It is clear to him that the remarkable magnetic peculiarity observed must be closely related to the equally remarkable and completely corresponding geological structure; and this theory seems to be confirmed by the two thoroughly independent pieces of work noted. Perhaps some light is here thrown upon this obscure subject; for while the nature of the relation is not easily determined, it seems certain that the internal structure of the earth's crust has an important influence upon terrestrial magnetism. As Mr. Lyman remarks, some authorities explain this magnetism and its changes by solar influences alone; no longer considered as exerted by the direct action of the sun as a magnet, but by the heating of the atmosphere and of the earth's crust by the sun. The present experience, however, seems to point to more strictly terrestrial processes as the true cause, and to suggest that the solar influences may partly, at least, be exerted through the attraction of gravitation as well as through heat.

The author thus offers the following explanation: The enormous and locally unequal strains produced by the contraction of the earth's crust in cooling would be particularly liable to be affected by the presence of a deep fault or sharp anticlinal, both present in this case. These lines would indicate a yielding of the crust, and the existence of points where the strain has been to some extent relieved. This condition is here further proven by the recent occurrence of earthquakes along the New Jersey end of this very fault line, showing that the resistance of the crust is less, and the remaining strain must likewise be less. On such a comparatively weak and yielding line the rock beds, in readjusting themselves, even without any violent earthquake, must occasion not only a certain amount of strain, but also of friction and heat, and the latter may give rise to electrical currents.

A decided magnetic effect has been found to accompany, and sometimes to precede, earthquakes; and the attraction of the sun and moon may cause electrical currents by occasioning certain strains and readjustment in the earth's crust. A temporary local variation in temperature may follow the breaking or arching of rock beds, and set up electrical earth currents. Hence Mr. Lyman concludes that terrestrial magnetism may not only arise from the action of the sun's heat on the air and crust of the earth, but also from the internal movement of the crust and the tidal effect of the sun and moon upon the air, the ocean and the earth. This is a subject well worth following out, and magnetic investigation should accompany or follow the geological survey of underground conditions. In the Pennsylvania case the maximum declination, or magnetic variation, was not quite 7°. If the peculiar curves noted in this case were either occasioned by, or in some way related to, the fault line of 14,000 ft., which so closely follows the axial line of the magnetic curve, what should be the underground conditions which accompany the enormous deflections reported from Russia? If there is any fixed relation between terrestrial magnetism and geological formation, as the Pennsylvania surveys would seem to prove, the Russian case should present exceptional opportunities for further and conclusive investigation in this field. Mr. G. R. Putnam has lately been investigating magnetic disturbances on St. George Island, in Bering Sea, and reports them practically as follows in the "Journal of Terrestrial Magnetism":

"The Pribilof Islands, in the Bering Sea, and of which St. George is the second in size in the group, are entirely volcanic in origin. The Island of St. George is about 12 miles long by 5 miles wide, and its surface is covered with lava rock and scoria, with a heavy growth of grass around the borders. During the work of the U. S. Coast and Geodetic Survey parties on this and the neighboring island of St. Paul, regular magnetic observations were made at a base station, and the declination was observed at 24 scattered points on the eastern two-thirds of the island. These declinations showed a range from 5° 14′ East of North, to 20° .03′ East. Another station showed a declination of 5° 54′; while at three stations within one-quarter mile, and north northeast and southeast of the summit where the first was taken, the declinations were 14° 55′, 15° 38′ and 15° 27′. The variations appear to be chiefly due to the magnetic properties of the local surface materials. Small pieces of the rock or scoria would deflect the needle ¼°; and around a bank of red scoria the declination varied 3° in 60 ft."

◆

TRIAL OF SELF-PROPELLING CABS IN PARIS.

A trial of self-propelling cabs has lately taken place in Paris, including three electric and one petroleum motor. One of the first named type was really a double Victoria, says "The Engineer" in reporting the trial, entered by Bouhey & Co. It weighed 30 cwt. and ran with 60 cells weighing 32 lbs. each, developing 8 HP. It met with much trouble on the steeper Paris grades; the pneumatic tires gave way under its weight, but it finally succeeded in finishing the 37-mile course by giving the accumulators a 20-minute rest.

The course selected included one-third of bad road and steep gradients, one-third of heavy traffic streets and one-third of good roads. Nearly all the cabs proved that they were capable of making 37 miles, under the above conditions, daily for nine consecutive days. In an endurance test for the accumulator capacity the Jeantaud hansom made 53.6 miles; the Krieger cabs made from 56 to 62 miles, and the Jenatzy cab made 65 miles. On a descent of 8% most of the cabs stopped in about one dozen yards under the brakes.

In commenting on the trial "The Engineer" says that the test proved that electricity was the most suitable, cheapest and most convenient power for this type of service. But it also proved that something must be done before these cabs can be relied upon. As yet there is much tinkering on the road, and the ordinary driver cannot be relied upon to do this. With a few exceptions the vehicles tested made their daily runs at from 7.4 to 9.3 miles per hour, and some performed this work without the slightest attention. With others, however, stops had to be made for screwing up the brushes and fixing parts that had become loose or disarranged. In a Krieger cab the engineer spent 20 minutes in overhauling the cab to find why the current was interrupted, and finally discovered the fault in one of the accumulator connections. If an expert spent this time in finding a defect what could be expected of an ordinary driver? The mechanism must be made stronger and simpler and more reliable before the electric cab can be depended upon.

As to the pneumatic tires, in hard daily use these last about six months. The first cost of an electric cab is heavy; but in Paris the cost of electric power is 6 cts. per kilo-watt, and that of petroleum spirit is 11 cts. per liter, and as a consequence the electric vehicle is more economical in the end.

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The complete destruction of the Spanish fleet of armored cruisers and torpedo boat destroyers off the coast of Santiago, Cuba, on Sunday, July 3, by the United States fleet under Commodore Sampson, is an achievement of American arms, and we believe we may truly add of American engineering, unparalleled in modern naval history. The four armored cruisers sunk were among the finest naval vessels afloat. They had heavy armor belts of Harveyized nickel steel, guns and armament almost equal in power to those of our own battleships, and engines which should have enabled them to outrun any United States vessel afloat except the "Columbia" or "Minneapolis." Yet in the naval battle which followed the attempted escape from Santiago Bay, the Spanish vessels were unable to outrun the American; they were pierced by shot and shell until their crews could no longer fight them, and, most astonishing of all, their guns inflicted hardly a single injury upon the vessels of the attacking fleet.

When the United States victory at Manila was proclaimed, unfriendly European critics were not slow to say that the Spanish ships in that action were mere old tubs, unfit for fighting. We showed in our issue of May 12 that while our ships at Manila were unquestionably better vessels, the armament of the Spanish vessels was not so very much inferior to ours, and neither fleet had armor that could be expected to prove effective in keeping out anything but the smallest projectiles.

Our foreign critics have now to reflect on the fact that in another naval battle, nine weeks after the battle of Manila, four of the best vessels afloat in the Spanish or any navy are sunk or driven ashore in a sinking condition or on fire, with hundreds of their crews killed. On the American side one man killed marks the total of casualties.

◆

Our esteemed contemporary, "The Engineer," of London, in its issue of June 3 appeared to think that the entry of Cervera's fleet into Santiago was a great piece of generalship on the part of its commander. We remarked a fortnight ago that this was the place of all others where the American commanders wanted him to go, and we presume "The Engineer" understands by this time the reasons for our assertion.

In this connection we are interested to note that in its June 24 issue our contemporary declares that "the war is rapidly reaching a ludicrous stage. Every natural item that can be invented has already been invented by the American Press."

We acknowledge that the great inventive powers usually accredited to Americans are shared by our newspaper reporters; but they have not had time to do much inventing this week. Recent events may also seem ludicrous to "The Engineer," but we very much doubt whether the Spanish people will find anything in them of a ludicrous nature. Nor is there anything ludicrous to Americans in the condition of a defeated foe. For Spain's unfortunate soldiers and sailors and for her common people, Americans have genuine sympathy; and they deeply regret that in order to put an end to a century old system of misgovernment and oppression this government has been forced to add to the sum of their sufferings.

◆

At the outbreak of our present war with Spain the fleet of torpedo boat destroyers belonging to the latter nation was the occasion of much uneasiness on this side of the Atlantic, not only among the people at large but in our navy itself. We had no vessels at all of this class, while those of Spain were of the latest English models and build, thoroughly equipped, of great speed, and credited with a capacity for untold mischief to our slow and heavy ships of war as soon as fate should bring them together. These fast destroyers, rather than the cruisers of Cervera's fleet, were supposed to be the dangerous element in the attack upon our battleship "Oregon," which was at one time deemed possible; and even after Cervera's fleet took refuge in the Bay of Santiago there was always a chance that these fleet little war engines would dash out and make trouble for the United States vessels outside. Naval authorities of all nations anxiously awaited the results of the battle between destroyers and battleships, neither of which had been fairly tested in modern naval warfare, and the general impression among the Continental powers was that it would be the United States that would be badly hurt.

The result of two months' experience with torpedo boats and "destroyers"—as handled by Spaniards—is almost ridiculous. At Manila some torpedo boats made a brave and reckless dash at the ships of Admiral Dewey, but they were met by such a hail of well-directed rapid-fire projectiles that they were riddled and had to turn and run for the beach. At San Juan, lately, a torpedo boat destroyer, one of the finest afloat, came out and attacked a converted Atlantic liner, but she was forced to turn back in a sinking condition, with part of her crew killed, before she could get near enough to her opponent to discharge a torpedo.

Later still, when Cervera's fleet made the desperate dash out of Santiago Harbor, two of the destroyers ran toward the "Brooklyn" with the apparent intention of torpedoing her. Before they could carry out their purpose, however, they were both attacked and sunk by the "Gloucester," a converted pleasure yacht formerly known as the "Corsair" and owned by Mr. J. Pierpont Morgan. Admiral Cervera is said to have given way to tears when a few minutes later he found himself a prisoner of war on this same "Gloucester," and it is small wonder if he did. His four very powerful and heavily armored warships had all been sunk without damage to a single ship of the enemy and with only one man killed on the entire American fleet; and he found himself a prisoner on board the very vessel, a mere pleasure yacht, that had destroyed two of his redoubtable "destroyers."

While a different story would probably follow an attack of torpedo boat destroyers when manned by English or American sailors and with their movements directed by officers of either of these nations, there are some lessons to be learned from the fate of the Spanish vessels of this class. The first is that with rapid-fire batteries properly handled by men who can shoot, and hit what they shoot at, there is every probability that a destroyer can never come near enough to the enemy to inflict any damage with her torpedoes. The destroyer is a fast but very vulnerable craft, but the projectiles of modern guns are far faster, and a very few of them of moderate caliber are capable of putting her out of action. Many naval authorities have long agreed that the proper function of torpedo vessels is in night attacks; but the recent perfection of naval searchlights has greatly lessened the chances of torpedo boat success even in the night time.

It will not be strange if experience with torpedo vessels in the present war should lead to the naval powers assigning them less prominence in their armaments. At the same time it must be fairly said that the lesson of the war which is far more strongly emphasized is that neither personal bravery nor the possession of powerful vessels can compensate for the lack of mechanical skill, good marksmanship and able generals.

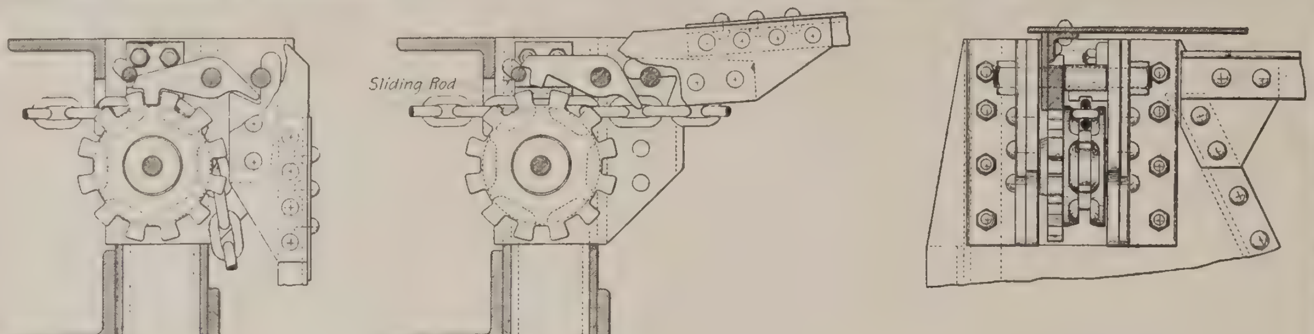
◆

The conclusions of the special committee report on "Tests for Constant Volume of Portland Cement" that was presented at the annual meeting of the Association of German Portland Cement Manufacturers in February, 1898, which is quite fully reported elsewhere in this issue, should, we think, be accepted with some reservation by American engineers. The committee, it will be noted, asserts bluntly that in its opinion accelerated tests are of no value in determining the durability of cements in practical use. If the committee means by this that in their present experimental stage the adoption of accelerated tests in cement specifications generally is of very doubtful wisdom, we think that most engineers who have studied the matter carefully will agree with it. But if the committee means to convey the impression that its experiments have shown accelerated tests to be entirely without promise of merit, its conclusions are open to grave doubt. Unfortunately all the data of the committee's investigations are not available for study, but judging from the abstract of the report furnished to us it seems to base its conclusions upon the fact that the cements selected for study stood the ordinary short time cold water test, and also, when made into large disk shaped medallions, endured uninjured an exposure of 1½ years in air despite the fact that the majority failed to withstand the boiling and hot water tests of Michaelis, Tetmajer and Maclay. With this evidence alone and with the record of previous tests in mind it may, we think, be fairly said that the conclusions of the committee do not stand proven. The fact that the cement pats tested by it withstood the cold water test has no place in the argument at all, for the reason that the advocates of accelerated tests deny the efficiency of the cold water test. On the other hand, the durability of the cement and sand medallions exposed 1½ years to the atmosphere is admissible evidence. It is, however, not conclusive evidence that the test pieces would not have failed ultimately. In the elaborate tests made by Prof. Tetmajer (Eng. News, Oct. 31, 1895), the majority of the cement pats exposed to air failed only after a year's time, and if we are not mistaken some of them lasted nearly three years but ultimately disintegrated. It may be possible that a longer exposure of the medallions in air would have confirmed the showing of the accelerated tests that the cements were unreliable. We are far from the opinion that the value of heat tests has been conclusively shown, but the evidence of most of the tests which have been made, and the attitude of such bodies of experts as the "German Conference Upon the Methods of Testing" and the "French Commission Upon Methods of Testing," speak strongly enough in their favor to warrant engineers in awaiting conclusive proof of their worthlessness before discrediting them altogether.

◆

The municipal art number of "Municipal Affairs" deserves a word of special mention. This is a subject which has hitherto received scarcely any attention by the vast majority of our American cities. Perhaps more has been done in this way in connection with city parks than in any other manner, but even that has often been largely incidental to the main and proper object of providing places where people could get near to

[illegible]
OF THE
[illegible]



Chain Wheel and Latch Locked, when Floor is down.

Chain Wheel and Latch Freed, by Raising Floor.

Sections through Head.

Side Elevation of Head and Fittings.

FIG. 5. DETAILS OF HEAD OF TRESTLE SHOWING OPERATION OF HOISTING CHAIN.

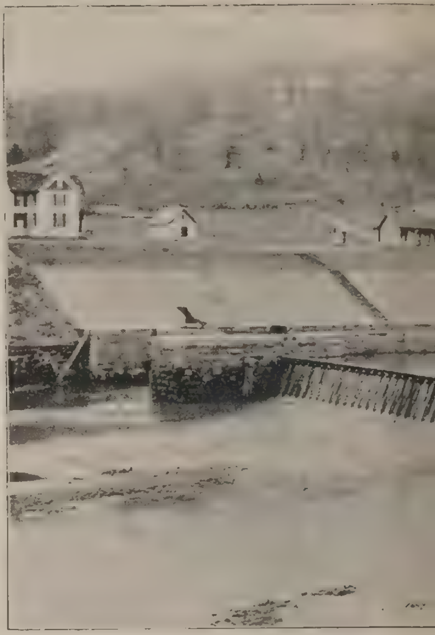


FIG. 1. VIEW OF DAM AND LOCK
(This view shows the pool 3 ins. abo
is 12 ft.

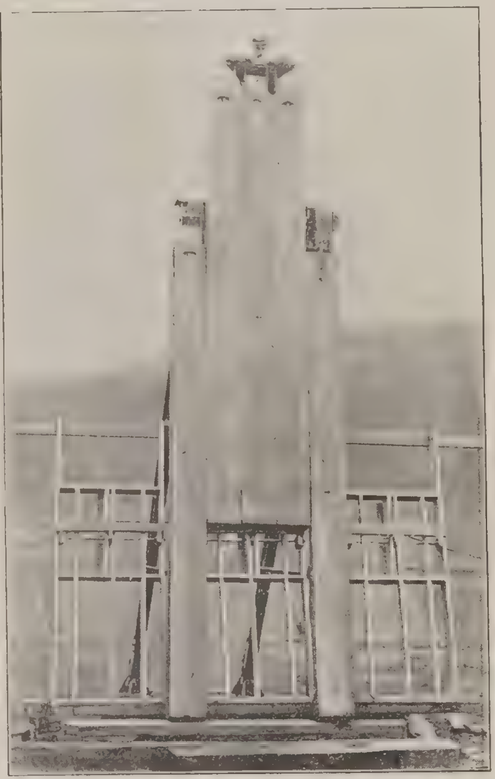


FIG. 7. VIEW OF TRESTLES SHOWING FRAME SUPPORTING NEEDLES READY TO TRIP.
(The needles shown to the right and left against the sill are for guides.)

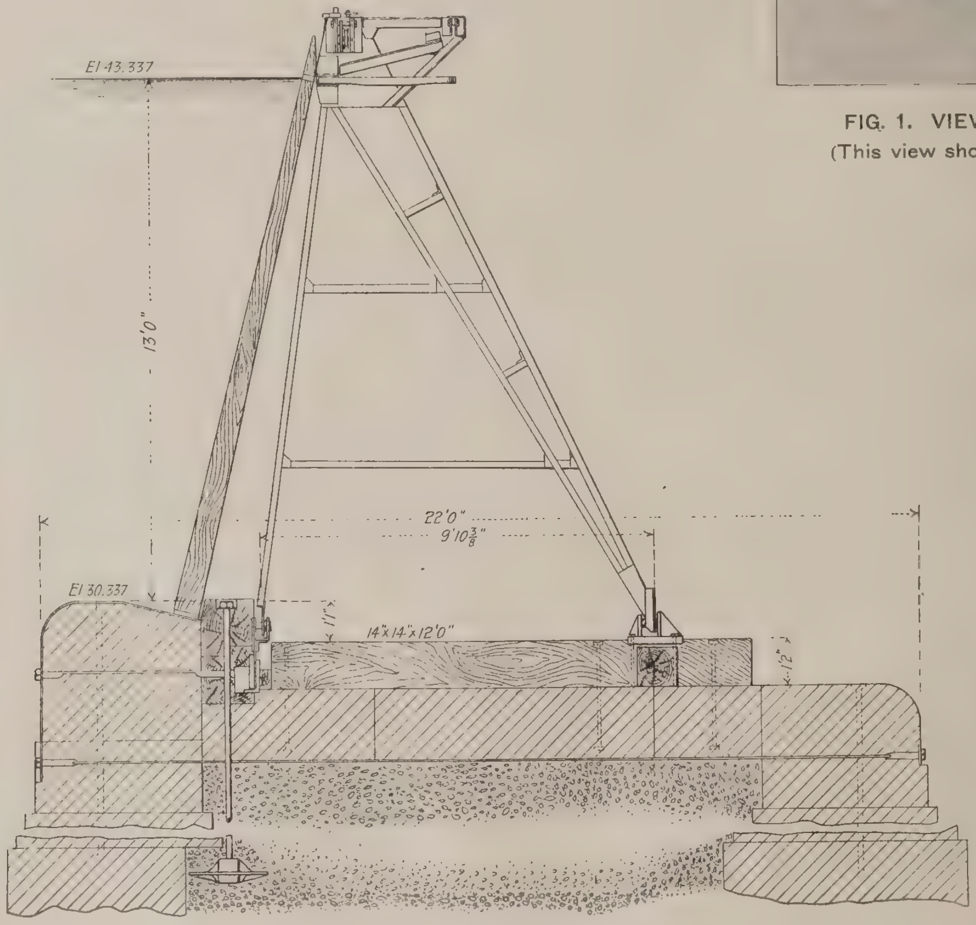


FIG. 2. TRANSVERSE SECTION THROUGH PASS.

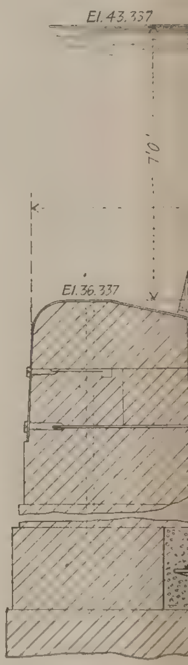


FIG. 3. T

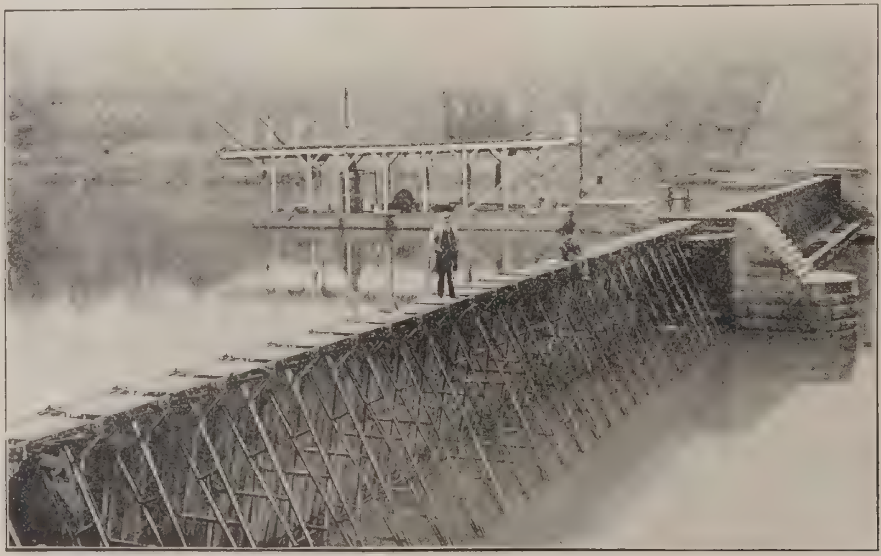


FIG. 6. VIEW OF DAM FROM BELOW SHOWING BOAT FOR HANDLING NEEDLES.
(The head or difference in level between the two pools is 12 ft. 2 ins.)

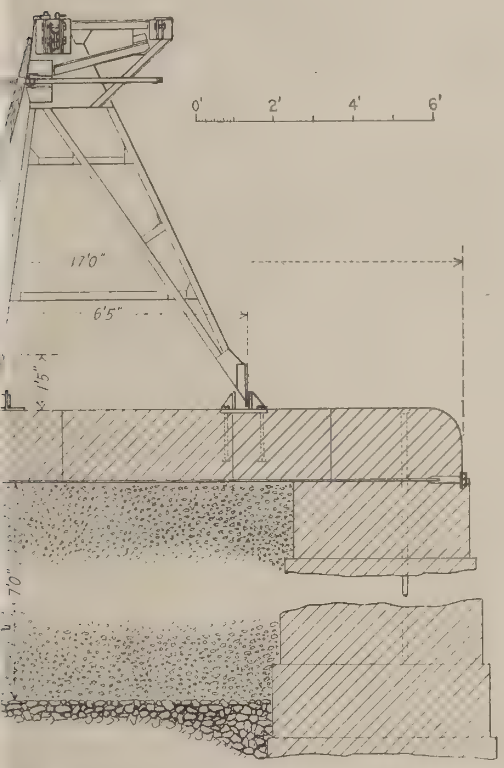
POIREE NEEDLE DAM ON

AT LOUI

Major James F. Gregory, U.

B. F. Thomas, M. Am. Soc. C.

OM BELOW ON THE KENTUCKY SIDE.
he normal level and running over. The head
. from pool to pool.)



SVERSE SECTION THROUGH WEIR.

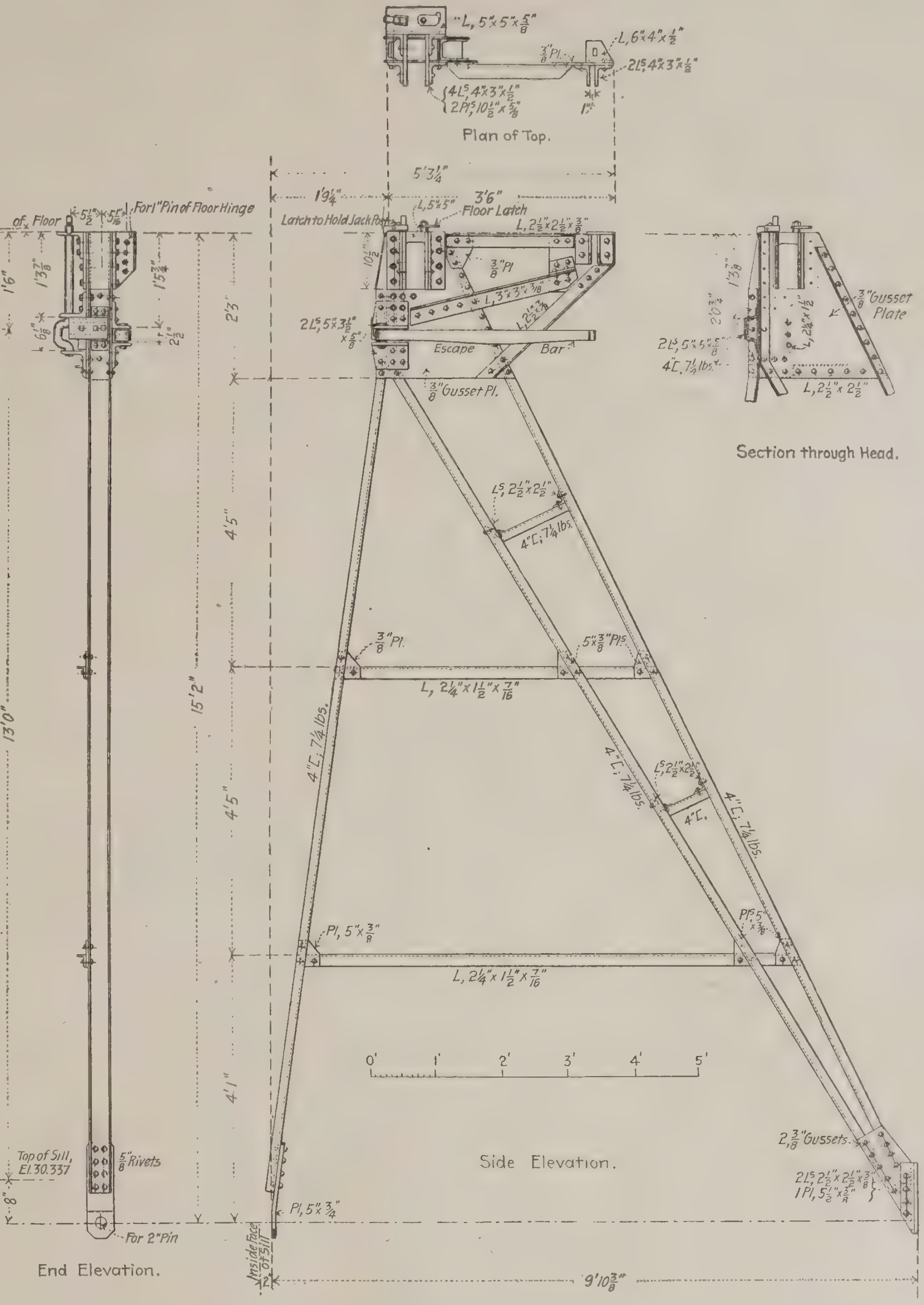


FIG. 4. GENERAL DETAILS OF PASS TRESTLE.

HE BIG SANDY RIVER

KY.

A., Engineer in Charge.

U. S. Assistant Engineer.

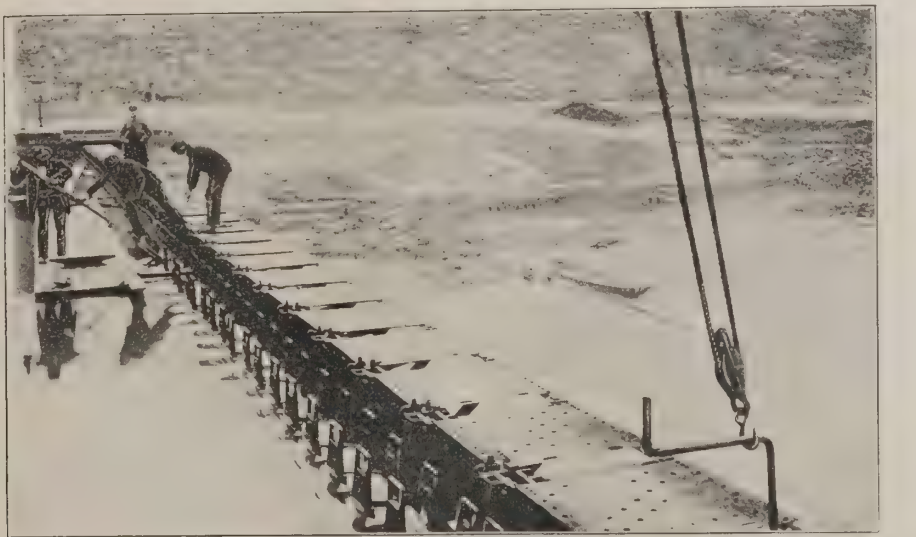


FIG. 8. VIEW SHOWING NEEDLES PUSHED BACK AND BLOCKED.
(This is done to waste water on a rising river.)

UNIVERSITY OF ILLINOIS

nature rather than study art. Next to parks, and perhaps ranking first, municipalities have made an attempt at the artistic when providing themselves with city halls and school buildings, but here the results have more often than otherwise been disappointing, quite commonly through mistaking ostentatious display for artistic expression. The articles in the journal in question, which are mentioned more particularly under our New Publications, show the wide range of possibilities for municipal art, embracing the plan of the city; the material and character of its buildings, both public and private, including color effects; sculpture for parks, public places and buildings; mural paintings, and, finally, even such details as street signs, flags and banners. A radical change in municipal art might be accomplished without adding materially to city expenses. In fact, beauty would be cheaper than much of the ugliness so apparent in many of our cities. Art often depends more upon an appreciation of the appropriateness of things than upon the expenditure of additional sums of money. We should all do what we can as cities and as individuals to cultivate an appreciation of municipal art.

◆

The new needle dam on the Big Sandy River, near Louisa, Ky., which is fully described elsewhere in this issue, calls deserved attention to the very high character of some of the engineering construction which is now being done by Government engineers in developing slack water navigation on the rivers of the Ohio Valley and the South. This dam not only sustains a greater head of water than any dam of the same type previously built, but, what is of greater importance, its very successful operation with this unprecedented head gives promise that movable dams, if properly designed, can be built and operated with still greater lifts at a cost which is not exorbitant compared with that of fixed dams when we take into account the obvious advantages of the movable structure for securing slack water navigation. The object of damming a navigable stream is simply to conserve the water during the season of medium flow so that navigation can still go on uninterruptedly through the lock which is provided for that purpose. With a fixed dam the navigation must of course pass through the lock at all times, while with a movable dam it is possible upon the approach of sufficient water for free navigation to restore the stream to its natural condition by lowering the dam and thus throw the whole width of channel open to the passage of craft. This is a very material advantage in the case of many of our inland rivers where slack water navigation exists. A large bulk of the traffic in these streams consists of the shipment of coal in barges and lumber on rafts, which accumulate in vast quantities in periods of low water waiting for the first rise to take them to their destination. If the rise is of short duration the delay caused by passing everything through the lock may result in the failure of many of the accumulated craft to receive any benefit from the long-watched-for flood waters. Still another adadvantage of the movable dam is that in times of freshet it does not raise the flood level above its accustomed height in the original condition of the stream, and can therefore be applied safely to much higher lifts than can a fixed dam.

The one great drawback of movable dams, however, has been their expense, the explanation of which recent authorities have come to believe is to be found in the fact that they have nearly always been built with lifts which would allow of the needles being placed and removed by hand. Such a restriction of course makes the cost very great in proportion to the length of river made navigable, for the reason that the cost of the foundation and substructure, which constitute the bulk of the cost of a movable dam, is largely independent of the height of superstructure placed upon them. The most paying efforts in the direction of future improvements in movable dam construction, therefore, are those which lead to increasing the practicable lift with which they can be operated, and it is because of its decided advance over other dams in this regard that the Big Sandy River dam is particularly instructive.

The successful operation of this dam against a head of water of 12 ft., or nearly twice that of any previous dam, is made possible, as the article published elsewhere clearly shows, by the use of special appliances to handle the trestles and to place and remove the needles. In its broad features of design and operation the dam does not differ materially from the low lift needle dams constructed in many places both in the United States and Europe, but while previous dams have been kept pretty rigidly within that limit of height which would allow of the needles being maneuvered by hand, the Big Sandy River dam has been provided with machinery capable of handling needles of great weight and size, and the advantage thus gained has been utilized to increase the height of lift. There seems to be no insurmountable reason, moreover, why still more powerful and better adapted mechanism for operating the needles and trestles cannot be designed and employed, with a further gain in the height of lift with which a needle dam can be operated.

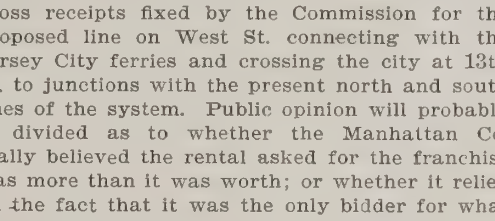
◆

The negotiations between the Manhattan Ry. Co. and the New York Rapid Transit Commission looking to extensions of the Manhattan Elevated Ry. system in New York city, which have been proceeding for some months, have finally come to a halt, and from present appearances are not likely to be resumed until Fall, if indeed they are not permanently closed. The rock on which the negotiators split was the rental of 5% of the gross receipts fixed by the Commission for the proposed line on West St. connecting with the Jersey City ferries and crossing the city at 13th St. to junctions with the present north and south lines of the system. Public opinion will probably be divided as to whether the Manhattan Co. really believed the rental asked for the franchise was more than it was worth; or whether it relied on the fact that it was the only bidder for what the city had to sell, to force down the price. The supercilious and insulting tone adopted, in the negotiations with the Rapid Transit Commission, by the young multi-millionaire and the sage dealer in puts and calls who control the destinies of the Manhattan Company, incline an unprejudiced observer to the latter view.

◆

SOURCES, MODES OF SUPPLY AND FILTRATION OF PUBLIC WATER SUPPLIES IN THE UNITED STATES.

Through the courtesy of Mr. Benj. H. Flynn, of the graduating class of the University of Ohio, at Columbus, O., we are enabled to present a summary of the sources and modes of the public water supplies of the United States and the number and kind of the filtration plants in use. The figures formed a part of Mr. Flynn's graduating thesis. They were compiled from "The Manual of American Water-Works" for 1897. As originally tabulated the figures were so presented as to give the data separately for cities of six different sizes in four sections of the country. We have omitted the classification by populations, giving only the totals by groups of States. The boundaries of these groups are indicated on the accompanying map. In table I. we have added the three columns of sub-totals, and Table III. has been rearranged.



Sketch Map Showing Groups of States Used in Summarizing Water Supply Statistics.

Perhaps the three most striking things shown by Table I. are: (1) That 1,822 of the 3,356 sources of supply are wholly ground water; (2) that nearly all the filtration plants are connected with surface supplies, and (3) that while in some foreign countries nearly all surface supplies are filtered, this being practically required by law in Germany, in the United States only 14 per cent. of the surface supplies have even the name of being filtered. That some of the so-called filtration plants are of no real value is a fact spoken of further on. It is true that many of our surface supplies are from such sparsely settled, rocky and wooded districts as to insure great natural purity, but this by no means accounts for the difference in practice between our own and foreign countries. There are indications that we are on the eve of a great change in this respect. Many filtration plants are under construction or proposed, and at the water-works conventions it is becoming more and more common for speakers to state as their opinion that in the future all surface supplies must be filtered. It is not organic matter or sewage pollution alone that makes filtration of surface waters necessary or desirable. Turbidity and color are objectionable to say the least. In practically all of the Southeastern section, in much of the North Central, and in all but the mountainous portion of the great Western section, and even in some parts of that, turbidity is present in all surface waters, and at times is almost intolerable. Settling reservoirs are employed in many cities, but on the whole they are comparatively few in number and diminutive in capacity, besides which they must in many cases be supplemented by filtration if an agreeable water is to be supplied.

Although so few of our ground water supplies are being filtered, by no means all of the remainder are above suspicion of sewage pollution, and later years will doubtless show a great increase in filtration plants for the removal of iron, of which some half dozen or less have been built.

The large number of ground water supplies in use, coupled with the many plants where water is pumped to reservoirs, shown by Table III., suggests another broad field for engineers and contractors; the covering of storage reservoirs. Of course not all the reservoirs indicated in Table III. are used to store ground water, but some storage, even if small in amount, is frequently provided wherever ground water is used. When exposed to the sun such water is likely to give rise to various organic growths which, while entirely harmless in themselves, cause very unpleasant tastes and odors. Such troubles can often be avoided by covering the reservoirs. The practice is common abroad but has been followed but little here, especially for large reservoirs. Roofs or coverings in Europe have commonly been of masonry, and it has often been thought, essential to have the covering surmounted with earth, thus increasing the load to be borne. Most reservoir coverings in this country have been of wood. So far as we know they have served their purpose very well, but whether as well in all cases as masonry, and whether they will prove as cheap as masonry in the long run we will not attempt to say.

Before leaving Table I. it should be said that of the 502 sources of supply credited to springs probably some are quite as truly surface waters, spring water having so very attractive a sound that it is sometimes applied to water from small streams which, while undoubtedly spring-fed, yet derive a goodly portion of their yield from surface flow. It is also true that many surface supplies are greatly augmented by springs.

The number of filtration plants of the various types is shown by Table II. The total here is 60 greater than in Table I., owing to that number of filter galleries added to this table. It must not be understood that there are 291 (or 231 on omitting the galleries) efficient filtration plants in the United States. Practically all of the 66 plants under the heading "Miscellaneous" and some of those under "Sand Filters" really ought not to be classed as filter plants, being at best only screens, and in some cases poor ones at that. Doubtless there are 126 mechanical filter plants in the country. The majority of these were put in to improve the appearance of the water rather than to remove organic pollution, but some of them are doing good work in both lines, and probably all, or nearly all, are greatly improving the water in one way or another. As to the actual number of effective sand filters in use it may be said that the June issue of the Journal of the New

TABLE I.—Sources of Water Supplies of Cities and Towns in the United States, Divided into Unfiltered and Filtered.*

		Surface						Ground.								Surface and ground.												
		Rivers.	Lakes.	Impounding reservoirs.	Rivers and lakes.	Rivers and impounding res.	Total.	Wells.	Springs.	Galleries and tunnels.	Wells & springs.	Wells and galleries.	Springs and galleries.	Wells, springs and galleries.	Total.	Rivers and wells.	Rivers & springs.	Rivers and galleries.	Rivers, wells and impounding res.	Rivers, wells and springs.	Rivers, wells and galleries.	Lakes and wells.	Lakes & springs.	Lakes, wells and springs.	Impounding res. and wells.	Impounding res. and springs.	Total.	Grand total.
Northeastern	Unfiltered	276	122	128	12	3	541	167	293	8	25	4	..	3	500	19	53	2	1	3	2	4	4	1	6	1	96	1,137
	Filtered	60	7	7	0	0	74	2	7	1	1	0	..	0	11	8	4	0	0	0	0	0	2	0	2	0	16	101
	Total	336	129	135	12	3	615	169	300	9	26	4	..	3	511	27	57	2	1	3	2	4	6	1	8	1	112	1,238
Southeastern	Unfiltered	97	5	16	..	1	119	100	71	..	8	..	..	..	179	7	7	..	..	1	..	..	..	..	..	1	16	314
	Filtered	19	1	4	..	0	24	0	1	..	0	..	..	..	1	1	0	..	..	0	..	..	..	..	..	0	1	26
	Total	116	6	20	..	1	143	100	72	..	8	..	..	..	180	8	7	..	..	1	..	..	..	..	..	1	17	340
North Central	Unfiltered	91	58	9	2	..	160	407	25	11	13	5	1	..	462	28	4	..	..	3	1	11	..	4	..	..	51	673
	Filtered	26	4	3	0	..	33	1	2	1	0	3	0	..	7	1	0	..	..	0	0	1	..	0	..	..	2	42
	Total	117	62	12	2	..	193	408	27	12	13	8	1	..	469	29	4	..	..	3	1	12	..	4	..	..	53	715
Western	Unfiltered	220	22	37	0	2	281	521	103	13	11	8	1	1	658	32	16	2	..	2	1	3	..	..	4	2	62	1,001
	Filtered	36	2	9	1	0	48	4	0	0	0	0	0	0	4	6	0	1	..	1	0	1	..	..	1	0	10	62
	Total	256	24	46	1	2	329	525	103	13	11	8	1	1	662	38	16	3	..	3	1	4	..	..	5	2	72	1,063
Grand total	Unfiltered	684	207	190	14	6	1,101	1,195	492	32	57	17	2	4	1,799	86	80	4	1	9	4	18	4	5	10	4	225	3,125
	Filtered	141	14	23	1	0	179	7	10	2	1	3	0	0	23	16	4	1	0	1	0	2	2	0	3	0	29	231
	Total	825	221	213	15	6	1,280	1,202	502	34	58	20	2	4	1,822	102	84	5	1	10	4	20	6	5	13	4	254	3,356

*Filtered supplies do not include those where the water is collected by filter cribs and galleries, of which there are 60, as shown by Table II.

England Water-Works Association contains a list of 14 plants, compiled by Mr. Allen Hazen, Assoc. M. Am. Soc. C. E., and including all which he deemed worthy of the name. Some of these, we believe, were not in use when the "Manual" was published. It is quite probable that some of the 25 plants which are in Mr. Flynn's list but not in Mr. Hazen's are doing fairly good work, at least as good as some of the mechanical filter plants. Filter galleries, in many instances, are designed more to develop a supply than to filter one, in which case they are comparable with driven wells. These comments on the filtration statistics are not to be taken as reflections on either Mr. Flynn's work or on the "Manual," as each aimed to give such information as was available for what it was worth.

Little need be said regarding Table III. except to call attention to the number of water-works relying wholly upon direct pumping, 418, and the number of stand-pipes (which term includes tanks) in use, 1,465 in all, not allowing for the fact that there are two and sometimes more of these structures connected with some water-works. It would be interesting to see a classification of stand-pipes by material and date of erection, and to note the exact majority of steel over iron in the last few years. As against 1,465 works in which water is pumped to stand-pipes there are but 671 instances of pumping to reservoirs. Of course there are hundreds of additional reservoirs used on gravity supplies, nearly one-fourth of all the water-works in the country depending on gravity works alone.

TABLE II.—Number of Water Filtration Plants of Various Types in the United States.

	Filters				
	Mechanical.	Sand.	Miscellaneous.*	Filter galleries.	Total.
Northeastern	46	22	32	20	120
Southeastern	21	2	3	4	30
North Central	24	6	12	20	62
Western	35	9	19	16	79
Total	126	39	66	60	291

*Miscellaneous includes gravel screens and embankments and all supplies reported as filtered without stating the method.

TABLE III.—Number of Cities and Towns in the United States Supplied with Water by Gravity, Pumping Direct, Pumping to Stand-Pipes* and Reservoirs, and by Combinations of Such Methods..

	Northeastern.	Southeastern.	North Central.	Western.	Total.
Gravity	490	41	11	194	736
Gravity and pumping					
Direct	62	7	2	15	86
To reservoir	38	1	2	13	54
To stand-pipe	11	2	2	5	20
Direct and to reservoir	1	0	0	1	2
" " " stand-pipe.	3	1	3	1	8
To reservoir & st'd-pipe	4	0	0	8	12
Total	119	11	9	43	182
Pumping					
Direct	74	33	221	90	418
To reservoir	128	62	79	114	383
To stand-pipe	245	139	218	358	960
To reservoir & st'd-pipe.	26	11	14	20	71
Direct and to reservoir	33	11	27	45	116
" " stand-pipe.	41	20	115	185	361
" " res.& std-p	3	2	18	10	33
Total	550	278	692	822	2,342
Natural pressure	0	9	2	10	21
Grand total	1,159	339	714	1,069	3,281

*Stand-pipes includes all tanks and metal structures to which water is pumped.

The distribution of the various sources and modes of supply by sections is interesting, as may be seen by referring to the tables.

Two interesting facts brought out by Mr. Flynn's population groupings may be noticed: (1) That only two places with 50,000 population or over, and only eight with over 25,000 population are getting their supplies wholly by gravity, and (2) that five places with more than 50,000 inhabitants and 19 with more than 25,000 are depending wholly upon direct pumping. The towns having a population of 5,000 or less contribute 656 of the 736 gravity supplies, 291 of the 418 direct pumping works and 847 of the 960 works where water is pumped to stand-pipes, none of the combined systems being included in any of the figures. It should be borne in mind that these towns of 5,000 or less make up 2,569 of the 3,281 public water supplies included in Table III.

In conclusion it may be said that the figures we have reviewed indicate the vastness of the water-works interests of the country and give some hints of the opportunities for further improving our public water supplies, especially in the matter of quality.

◆

LETTERS TO THE EDITOR.

The Graham Automatic Draw-Bar Height Adjuster. —Correction.

Sir: In the brief description of our automatic draw-bar height adjuster in your issue of June 16 we wish you would correct the statement that it is not in general use. We have been equipping our trucks since June, 1894, with this device, and it is in service in both the United States and France. Car builders to-day have to meet two very great difficulties, keeping the draw-bars at a proper height from the rail, and finding ample space between car and truck so they can increase the depth of both car and truck bolsters to provide for the increased carrying capacity. Our adjuster will permit increasing the general height of the car from the rail fully 6 ins. and comply fully with the law, which states that the draw-bar on an empty car must not be higher than 34½ ins. With our adjuster, when the car is loaded and the springs are deflected 3 ins. the draw-bar would be 37½ ins. from the rail, a difference of 6 ins., which is a clear gain for the car builder in which to increase his bolsters. The adjuster will never drop the draw-bar below the point set when car is empty, and as the load always carries the draw-bar upward, there is no fear of having it below the minimum 31½ ins. The law has not said anything about how much above 31½ ins. the draw-bar of a loaded car must be; it simply states that it must not be below 31½ ins., therefore anything above that point is within the requirements of the law. Sincerely, The Graham Equipment Co.

Boston, Mass., June 21, 1898.

◆

A Theory for Placing Stiffeners in Plate Girders.

Sir: In your issue of June 9 there appears a criticism by "E. M." of Mr. Beach's letter (Eng. News, May 19) on stiffening plate girders which deserves some comment. In attacking the views of another the burden of proof rests with the critic, and this "E. M." seems to have entirely forgotten while making his assertions. Thus he asserts that the analogy between a stiffened plate girder and a Pratt truss exists neither in theory nor in fact, as Professors Johnson and Burr have pointed out that it did not, but he fails entirely to offer proof himself or to state where these authorities have given it.

A careful study of the discussion on the internal stresses in the stiffened plate girder brought out by Mr. Joseph M. Wilson's paper on "Specification for Iron Bridges" (Trans. Am. Soc. C. E., 1885) is disappointing indeed, since the eminent mathematicians who took part in it appear to have expended their energy rather in trying to decide what the master mind of Rankine might or might not have thought on the subject than to solve the problem themselves.

In discussing the condition of internal stress in any given structure it is well to bear in mind that it is not a Professor but Dame Nature herself that actually determines the stresses, and that the Professor, notwithstanding his learning, is frequently a forgetful fellow, leaving out of consideration a few of the practical conditions of the problem and thus arriving at conclusions inapplicable to the case in hand. Dame Nature, on the contrary, not only understands fully how to allow for all practical conditions, but never forgets them, and the result is that her determinations are ever rational and accurate beyond question.

Moreover, she is ever a willing teacher, ready to answer all questions to him who but possesses the ingenuity to ask them in the right way, and she frequently discloses her methods to the practical observer.

Evidently the first step towards arriving at a rational method of proportioning stiffness is a rational analysis of the internal web stresses of the stiffened girder. The treatment of this subject in most of our text books is of little value, since their authors have apparently forgotten the practical condition that when the stiffeners are riveted to the web they form a part of it, and cannot therefore be disregarded in any logical analysis of the internal web stresses.

About nine years ago, while looking over a girder viaduct, the writer noticed a web plate slightly buckled in the end panel of a deep girder, and just then a heavy freight train coming upon the girder this buckle appeared to pull out flat for a width of about a foot along the tensile diagonal of the panel, indicating action similar to a Pratt truss as the buckle resumed its previous form after the train had passed. The correctness of this observation appears to have been verified by a laboratory experiment, noted in your issue of Oct. 28, 1897. The buckled web of the girder used in the experiment referred to was regular in form, so that its distortion under load indicated the direction of the maximum web stress beyond question.

In stating that the proportioning of stiffness and also the spacing of them is merely a matter of guess (empiricism), and that Mr. Beach's guess is wrong because slightly different from his, "E. M.," has not given a very logical reason for the criticism. Respectfully yours,

June 15, 1898. "Practical Bridge Builder."

◆

A Visit to the Virginia Military Institute.

Sir: It is just ten years since I left my native Pennsylvania and became a citizen of the "Mother of Presidents." Although my professional duties made it possible for me to roam over nearly the entire state, and thus become intimately acquainted with the geography, yet it had never been my good fortune to visit the "Athens" of the South, the historic town of Lexington. And stranger yet to admit, the cause of my first visit to this place so revered by Virginians, was due to my being officially connected with a Sunday-school picnic excursion. The town of Lexington is situated in the heart of the famous Shenandoah Valley; and "Yankee" though I am, I must admit that, if there is any "Switzerland of America," Lexington is its center. The sublimity of its surrounding scenery is indescribable, and the exhilaration of its atmosphere! Why, even an engineer corps of the old school type could become total abstinence men and still be gay and happy there.

Lexington is the home of the Virginia Military Institute, a famous old school endowed by the state of Virginia, and is also the seat of the still older Washington and Lee University. The grounds of these schools join each other. The location is an ideal one, on the crest of a high ridge or plateau, overlooking North River. Your readers will also recall the fact that beneath the sod of Lexington rest Robert E. Lee and Stonewall Jackson, whose very names inspire the hearts of all true men.

While on my visit, it was my very good fortune to meet

Col. R. A. Marr, professor in charge of the Department of Engineering and Drawing, of the Institute.. And, by the way, I think it was a kinsman of the Colonel who was the first soldier to lay down his life for his cause in the Civil War. Col. Marr, who spent 13 years of his life on the U. S. Coast Survey, is a Virginian by birth, and it is unnecessary to state that he left nothing undone which could conduce to my comfort and pleasure. Under his guidance I visited the various departments of the institution, and I was indeed astounded with what I witnessed when I came to visit his own department. An engineer well knows that practice necessarily precedes instruction, and that institutions of learning must, as a rule, be content to follow rather than lead, and in patience await the advent of a treatise or text book before instructing their students respecting the new methods and appliances which are continually being brought forward. I was astonished, therefore, when Prof. Marr showed me plans, profiles, specifications, models, etc., of a large number of engineering works recently completed or now in progress. How gratifying all this was to me can well be understood when I recall the graduates of some other first-class institutions who have applied to me for employment; and, after examining them as to their knowledge of present-day methods of work, I found that, so far at least as railway work was concerned, their methods had long been superseded by more advanced and economical ones. Col. Marr may well be congratulated on the fact that his graduates are not filled with antediluvian methods, but can enter into the whirl of present-day practice with that sense of security which characterizes an "old timer." It is needless to say that the physical culture of the young men is as carefully looked after as is their mental training.

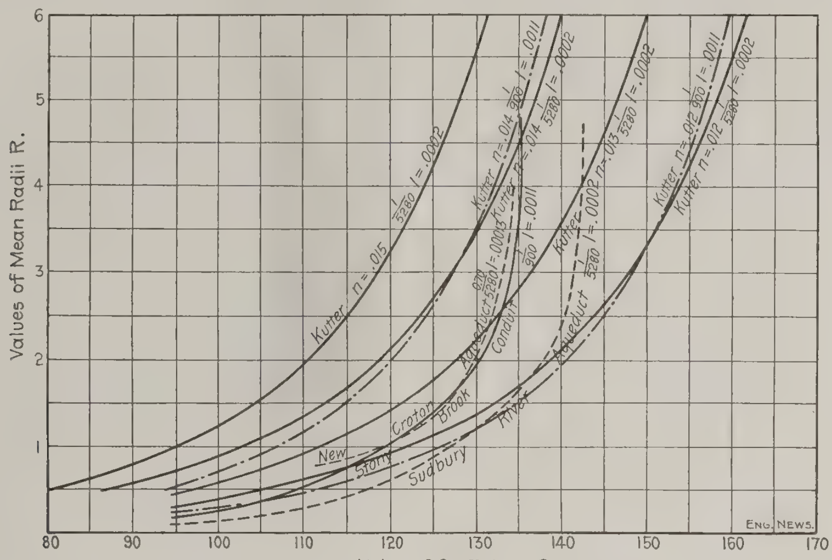


FIG. 1.—APPROXIMATE CURVE OF COEFFICIENT C ADOPTED FOR THE STONY BROOK CONDUIT, COMPARED WITH OTHER CURVES FOR C.

James Francis Desmond, Assistant Engineer.

It is probably unnecessary to say, in conclusion, that Engineering News finds a conspicuous place in the Professor's teachings.

Theo. Low,
Supt. N. & W. Ry.
Lynchburg, Va., June 27, 1898.

◆

The Design of Extensions to the Stony Brook Conduit, Boston, Mass.

Sir: Believing that the results of a careful investigation relative to the design and determination of discharge for various depths of a large brick channel to provide for the storm water flow from a drainage area of about 12½ square miles, which I recently had occasion to make, may be of interest to engineers engaged in that class of hydraulic work, I present them herewith.

These conclusions are presented simply as the result of a graphical analysis of 260 gagings on various channels lying within certain limits in regard to the coefficient of roughness.*

It has been the common practice in this Department to use Ganguillet and Kutter's curves for C, assuming .015 for sewers and storm water channels of any diameter and value of R.

In the year 1886 a commission composed of Messrs. Jas. B. Francis, Eliot C. Clarke and Clemens Herschel was appointed to report measures for the prevention of floods in this territory. They reported that the maximum flood discharge should be taken at 2,000 cu. ft. per sec. after the district had become well built up, and that a well built channel nearly 17 ft. in diameter with an hydraulic gradient of 1 in 900 would be required to provide for this quantity. They used the expression

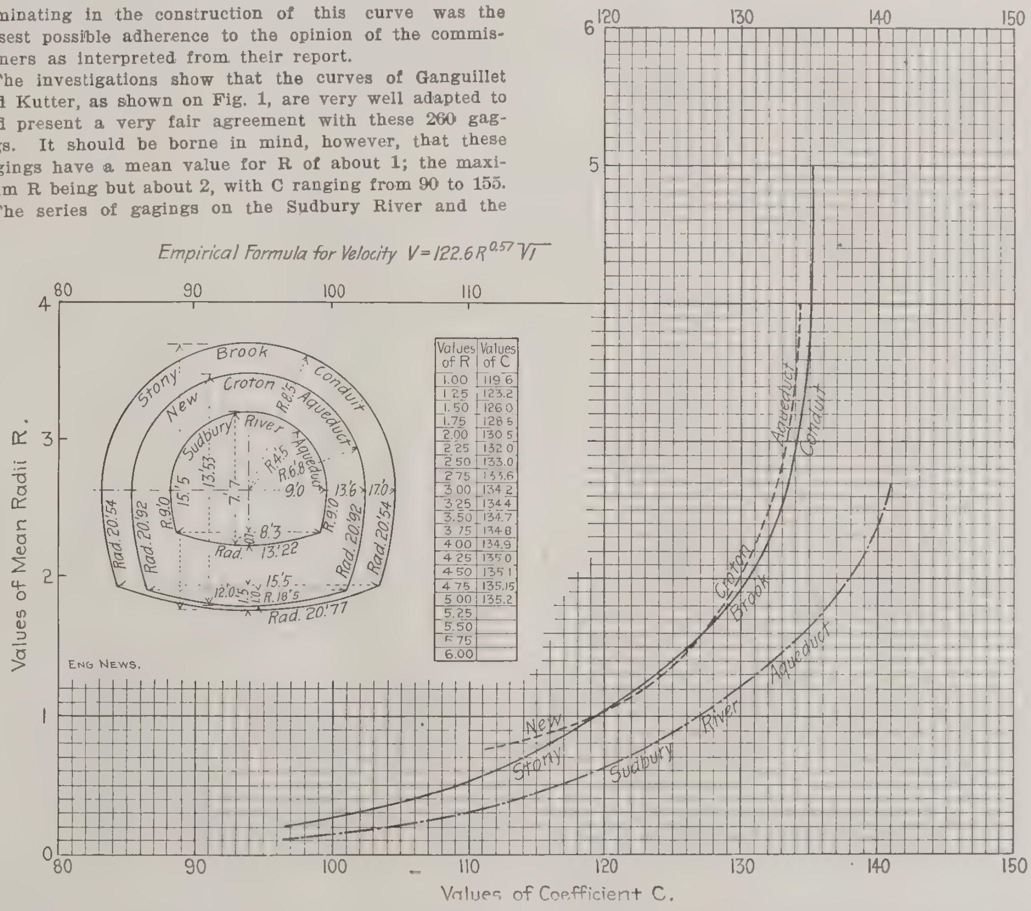
$$v = c\sqrt{RI},$$

assuming a value for $C = 135.0$ when $R = 4.25$. On their recommendations 4,500 ft. of channel were built in that year. At various times since the channel has been continued along the lines laid down by the commission. Up to the time of writing nearly 12,000 ft. have been built.

It becomes necessary now, for various reasons arising since 1886, to deviate from the commissioners' lines; to change the location; lower the hydraulic gradient, thereby increasing the size and with it the hydraulic mean radius, the latter to about 5 ft. These changes necessitated the adoption of a curve for C in relation to R for greater values of R for the main channel, and lesser values of R for branch channels. The influence predominating in the construction of this curve was the closest possible adherence to the opinion of the commissioners as interpreted from their report.

The investigations show that the curves of Ganguillet and Kutter, as shown on Fig. 1, are very well adapted to and present a very fair agreement with these 260 gagings. It should be borne in mind, however, that these gagings have a mean value for R of about 1; the maximum R being but about 2, with C ranging from 90 to 155.

The series of gagings on the Sudbury River and the new Croton Aqueducts were plotted as shown on Figs. 1 and 2, and these gagings were finally used as the basis for the curve under consideration as best representing this form of channel and this class of work; although, as will be noticed, there is no harmony between these curves and Ganguillet and Kutter's for value of R greater than 1.5.



Values of R	Values of C
1.00	119.6
1.25	123.2
1.50	126.0
1.75	128.5
2.00	130.5
2.25	132.0
2.50	133.0
2.75	133.6
3.00	134.2
3.25	134.4
3.50	134.7
3.75	134.8
4.00	134.9
4.25	135.0
4.50	135.1
4.75	135.15
5.00	135.2
5.25	
5.50	
5.75	
6.00	

FIG. 2.—APPROXIMATE CURVE OF COEFFICIENT C ADOPTED FOR THE STONY BROOK CONDUIT, BASED ON THE GAGINGS OF THE SUDBURY RIVER AND NEW CROTON AQUEDUCTS.

The empirical formula

$$v = 122.6\ R^{0.57}\sqrt{I}$$

deduced from this curve, I believe to be at least worthy of consideration in calculating the discharge of storm water channels of this form and class of work—that is, for good, clean brick, well made joints and easy curves for values of R from 1 to 5, with I varying from 0.001 to 0.0002. Perhaps the range given to I may be considered by engineers as rather a wide one, but I have reason to believe, from a close study of the matter, that the variations in C due to this are slight.

In the absence of more material on which to build I leave to the judgment of the engineer the real value of this curve.

Very respectfully,
James Francis Desmond,
Assistant Engineer, Sewer Department.
28 Court Square, Boston, Mass., June 1, 1898.

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*These gagings may be found in Hering and Trautwine's translation of Ganguillet and Kutter's "A General Formula for the Uniform Flow of Water."

◆

The New York Fireproofing Tests.

Sir: An inquiry received this morning from a customer of ours leads me to address you for some information, thinking that as a public newspaper you might be able to secure answer to certain inquiries that we cannot.

This customer of ours writes to know where he can secure printed reports of the fireproofing tests made by the Building Department on our form of construction, together with others made about the same time.

You doubtless will remember that during the fall of 1896 and the spring of 1897, fireproofing tests were going on very frequently. There occurred, within twelve months, not less than 20 in all, at an average cost to each of the individuals or concerns, whose materials were tested,, of not less than $1,000, to say nothing about a still vaster sum of official red tape that enveloped the whole transaction.

It was a public boast that these tests were to be the most famous in the history of building material. But alas! the $20,000 and miles of red tape, have apparently all gone for naught. Each of the concerns, whose material was tested, received an official document entitled "Result of the Test." They were written, doubtless, weeks after the tests themselves. This I say, for the reason that the reports were very cold and deep. The reports were merely a mass of figures, indicating temperatures, strains, etc., with no conclusions drawn or other statements made which would in any wise guide the inquiring, interested public.

The inquiry I desire to make of you is: "What benefit was the expenditure of all this money to the public, or for that matter to the people who expended it?" Why were not the reports of these official tests published? We are told that the building department to-day refuses to acknowledge the existence of any such tests. The engineers of the department will not even refer to the records on file, to establish the slightest fact connected with any part of the test.

The situation savors very strongly of "a Senegambian in the lumber heap." Will the vigorous inquiry department of the Engineering News please find him, and much oblige one of the contributors to the $20,000 expense fund?

Very truly yours,

A Cash Sufferer.

New York, June 21, 1898.

(We presume our correspondent can answer the questions which he propounds quite as well as we. As some of our readers may not be so well informed, however, we will endeavor to answer his questions. In the first place, the tests of fireproof floors to which our correspondent refers were in many respects well planned, and did give a great amount of valuable information to the profession as to the strength and fire-resisting powers of the styles of fireproof floor construction. The reports of these tests, which were published in Engineering News, give fairly complete records of their results. It is certainly unfortunate that an impartial and concise report of all the tests was not published by the city authorities at their close, and we can hardly blame those who contributed to this "$20,000 expense fund" for feeling very sore at its absence. The reason why no such report was made, to the best of our knowledge, is first, that such reports as were presented were so long and detailed that their publication would have been of little benefit to any one, and second, that lack of harmony between the Superintendent of the Building Department then in office and the city financial authorities prevented any appropriation of funds for this purpose.

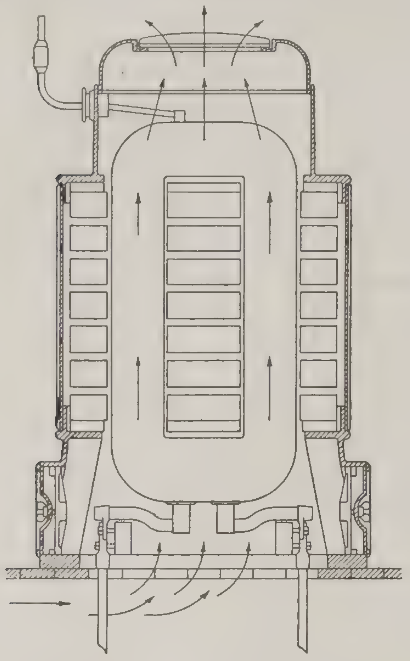
Fig. 1.—Section of Air Blast Transformer Showing Direction of Air Current.

General Electric Co., Schenectady, N. Y., Builders.

As to the reason why the present administration ignores the results of the tests made during the last administration, we thought best to let the administration speak for itself, and with that in view we submitted a proof of this letter to Superintendent Brady, of the New York Building Department with an invitation to present a reply for publication in connection with the above letter, in accordance with our usual rule when communications sent for publication contain matter criticising the acts of any person.

That official, however, has made no reply whatever, and after waiting ten days we are compelled to conclude that he has no reply to make. Comment on the autocratic methods in the Building Department which our correspondent's inquiry discloses is needless.

We deem it well to call especial attention to the things set forth in the above letter, because other city authorities are apt to look to New York, the largest city in the country, for guidance in the matters of building laws and building inspection. If they do so now they should do so with the full understanding that not a few things in the New York law and its administration are the result of influence and political pulls, without regard to the real value of materials and methods from an engineering point of view.—Ed.)

METHODS OF COOLING TRANSFORMERS OF LARGE SIZE.

The transformer, as its name implies, is a device for changing electric energy furnished under one set of conditions to the same kind of energy for use under a different set of conditions. This transformation is accomplished by making use of induction and the magnetic properties of iron, but with a loss which is greater or less according to the character of the material used, its amount and its distribution. The loss always takes the form of heat, which must be dissipated as fast as generated or it will gradually accumulate in the transformer and raise its temperature to a point where serious injury will be done to the insulation. The removal of heat from a large transformer is really the element on which its capacity chiefly depends, and provision for it is therefore among the most important elements in its design. Small transformers have so large a surface in proportion to their bulk that they are sufficiently cooled by radiation and the natural circulation of air about them. As the size increases, however, the ratio of the volume to surface exposed also increases, and artificial means of cooling become necessary for both economy and safety. If these are not employed the designer must depart from the most compact and most economical proportions and sacrifice material and strength to obtain sufficient external surface to radiate the heat. It is usually necessary for mechanical protection to enclose the transformer, and this materially interferes with the cooling by natural radiation.

A practice in extensive use with transformers of moderate size is filling the case with oil, which acts as both an insulating and a cooling medium and considerably increases the capacity. Various designs have been adopted in which provision is made for the circulation of the oil through the interior of the transformer. If ducts passing entirely through the body of the winding are provided, however, they must be narrow or the size and cost of the transformer will be excessive and the efficiency low, not to mention the greater space required. On the other hand, with narrow ducts oil is not a reliable cooling medium. Its circulation under the best conditions is sluggish, while the ducts tend to close gradually from the swelling of the insulating wrapping on the coils and the collection in the ducts of a deposit derived from the slow solution of the various liquid insulations employed when winding the coils.

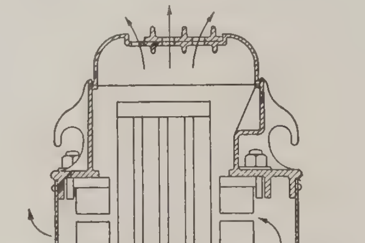
Fig. 2.—Section of Air Blast Transformer Showing Position of Coils, Core, and Casing and Direction of Air Currents.

To overcome these drawbacks a new design was introduced in which the height of the laminated core is small compared with the external dimensions of the punchings. A large proportion of the copper is external to the core, and the exposed ends are so spread apart as to give wide openings between the coils for the access of the oil. This design insures a low temperature in the exposed part and even a moderate average temperature (measured by increase in resistance), but the central portion often becomes dangerously hot without giving any direct evidence of the fact; and it is of course no less serious to have a high temperature in any part of the transformer than to have the entire winding at an unsafe temperature.

In large transformers the use of oil is undesirable for reasons other than its poor efficiency as a cooling medium. Small transformers are usually installed out of doors and contain so small a quantity of oil that danger from fire is almost impossible. Large transformers, on the other hand, form ordinarily part of extensive plants, many units being banked together within a single building, and the chances of fire would be greatly increased by the use of oil. Moreover, it is almost impossible to make large transformer cases oil tight. For these reasons satisfactory results are not obtainable with large transformers if dependence is placed entirely on external surface heat regulation or on oil as a cooling medium.

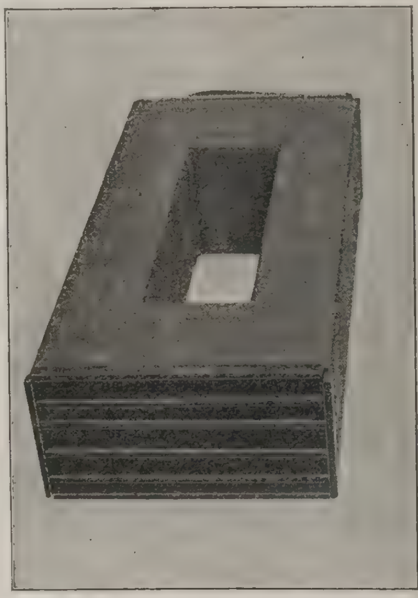
Fig. 3.—Coils Assembled with Diaphragms in Place and Insulation On.

The General Electric Co. has adopted the air cooling system for its large transformers. In this type of transformer currents of air are made to pass through small ducts and channels in the interior of the transformers and take up the heat from the large amount of surface thus exposed. Two methods are employed as standard practice by the General Electric Co. in the construction of its large transformers. In the "Air Blast" type, Figs. 1, 2 and 5, the current of cool air is forced upward through the core and windings. In the "Natural Draft" type the coils and core are so proportioned and placed that large surfaces are exposed and the temperature kept within safe limits by the natural circulation of the air. In the "Air Blast" type the cooling current of air is obtained from a motor-driven blower and is forced from below through separate paths at right angles to each other vertically through the windings and horizontally through the core, Figs. 1 and 2. The admission of air is controlled by shutters at the top and at the sides of the transformer. The power used by the blower seldom exceeds ¼ of 1% of the total capacity of the transformer, and in most cases is much less, frequently not more than 1-10%. It is considerably less than that which would be required to pump oil through an oil-cooled transformer of the same capacity.

The air blast type is designed for continuous operation, large output and high potential. In it the windings are subdivided into numerous independent coils, each separately and heavily insulated. With such subdivision the voltage generated in a single section is low, even in transformers wound for a voltage of 15,000 to 20,000 volts, and the numerous air ducts between all the coils which this subdivision allows in addition to the spaces in the iron lamenation of the core, Fig. 4, limits the rise in temperature to a few degrees. The coils are wound with flat copper conductors cemented together by an insulating compound before the exterior insulation is applied. The use of rigid coils is important in large transformers since the magnetic force tending to move the conductor is great, and vibration, abrading the insulation, might be set up. The primary and secondary coils are assembled in small intermixed groups with air spaces between the coils, and between every adjacent primary and secondary section are solid insulating diaphragms which completely encase the primary winding except at either end of the core, necessarily left open to allow the air to circulate freely. At the end, however, the diaphragms project far beyond the coils, so that a surface insulation of great extent is provided between the primary and secondary. An additional insulation casing is placed around the entire structure of assembled primary, Fig. 3, and secondary coils and separates the whole winding from the iron punchings assembled within and around them. The method of insulation employed assures a factor of safety of at least 3, and the insulation test between the high potential windings and the core is made at a voltage equal to twice the rated potential.

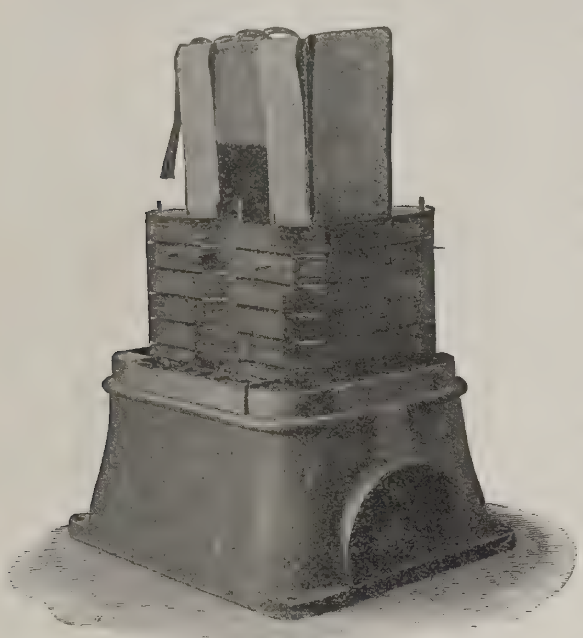

Fig. 4.—Building Up the Core, Showing Assembled Coils in Place and Core Partially Built Up.

Calculating the temperature of the interior of the air blast transformer by the rise in resistance of its windings, the rise in temperature is guaranteed not to exceed 40° C. above that of the surrounding air.

Air blast transformers are used on 15,000 volts potential or less, and are constructed for higher potential when necessary. Over 100,000 HP. in these air blast transformers have been installed, and no record yet exists of a burn-out due to heating or overload.

ANNUAL MEETING OF THE ASSOCIATION OF GERMAN PORTLAND CEMENT MANUFACTURERS.

Abstracted by S. B. Newberry, Assoc. M. Am. Soc. C. E.,[*] from the Official Report.

The annual meeting of the Association of German Portland Cement Manufacturers took place in the audience room of the Architects Institute, Berlin, Feb. 23 and 24, 1898. The membership of the association includes representatives of 83 factories, having a total production in 1897 of 17,150,000 barrels of Portland cement. This production is divided amoung various countries, as follows:

Germany 66	factories,	product	14,950,000	barrels.
Austria 10	"	"	1,150,000	"
Other countries.... 7	"	"	1,050,000	"
Total 83	"	"	17,150,000	"

The United States is represented in the association by one factory only, the Alamo Cement Co., of San Antonio, Texas.

Dr. Prussing reported on the unfair competition of the "Natural Portland Cements" of Belgium against the true artificial Portland cement of Germany. These Belgian cements are chiefly made by the direct burning of a limestone of approximately the composition of a correct cement mixture. The variations in the proportions of lime and clay present in the rock, however, cause great fluctuations in the quality of the product, and much of the Belgian cement is greatly inferior to true Portland. Most Belgian manufacturers sell their product under foreign labels as "Portland cement of highest quality," and in many cases well-known German labels are purposely counterfeited.

At a meeting of English and German cement manufacturers, held in Cologne in July, 1897, it was resolved to take the following steps to meet this fraudulent competition:

1. Samples of Belgian natural cement are to be purchased in open market and tested at the Royal Testing Station at Charlottenburg, and by competent experts in England.
2. An attempt is to be made to secure from the Belgian government an official definition of Portland cement.
3. A pamphlet is to be published, showing the untrustworthiness of the so-called "Natural Portland cements," and stating the names of the Belgian factories which produce a genuine and reliable article. This pamphlet is to appear in German, English, French and other languages, and is to be circulated as widely as possible in all countries.

Report of the Committee on the Action of Sea-Water on Hydraulic Cements.

R. Dykerhoff stated that the committee had decided to extend their observations over a period of 10 years. A part of the test-pieces of the series of 1896, exposed to the action of sea-water at the Island of Sylt, were destroyed or damaged by heavy storms. Only the rich cement mortars, especially those of Portland cement and sand, 1 to 1, had perfectly resisted the mechanical and chemical action of the sea. Poorer mixtures, and especially the trass-lime mortars, were more or less attacked.

At the meeting of the committee, held in February, 1897, it was resolved to limit the experiments, for the present, to the determination of the effect of the addition of trass on the resistance of Portland cement mortar to the action of sea-water. Trass is a volcanic scoria found near the Rhue, and similar to the Pozzuolana of Italy in its power of conferring hydraulic properties upon slaked lime. According to Dr. Michaelis, trass has the power or neutralizing the possible injurious effect of the high proportions of lime contained in Portland cement, and thus increasing its power of resistance to the chemical action of sea-water. This view is opposed by many of the leading authorities on cement, who have shown that dense Portland cement concretes have given excellent results over long periods of years when exposed to the action of the sea.

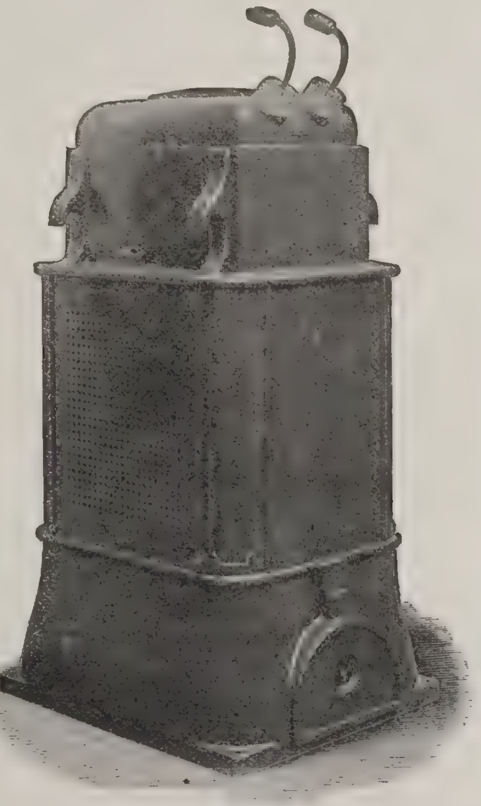

Fig. 5.—Transformer Completed with Cap and Casing in Place.

The committee decided to make a long series of tests of the effect of trass, using

1. A cement high in lime and low in alumina.
2. A cement high in lime and high in alumina.
3. A cement low in lime and high in alumina.

These are to be tested with various proportions of sand, with and without the addition of trass. The test pieces are to be placed in sea-water in such a manner as to be protected from the direct force of the waves, but exposed to the ebb and flow of the tide. Tests are to be made at 7, 28 and 90 days, 1 year, and longer periods.

Referring to the possibility of chemical action between the silica of trass, or other forms of silica, and the lime set free in hardening of cement, Dykerhoff referred to an interesting paper lately published by Lunge[*] on the action of various forms of silica on caustic alkalies and alkaline carbonates. Lunge found that quartz, a form of silica generally considered entirely insoluble in alkalies, may be rendered considerably soluble in caustic alkalies or even alkaline carbonates by extremely fine pulverization (elutriation). It might therefore appear probable that very fine quartz sand may enter into combination with the lime set free in the hardening of cement. To determine whether this is the case, Dykerhoff made a careful series of tests with mixtures of cement and natural sand, 1 to 2 and 1 to 4, in which one-half the cement was replaced by

1. Sand passing a sieve of 28 meshes to the inch.
2. Ground sand passing a 75-mesh and retained on a 177-mesh sieve.
3. Ground and passing a 177-mesh sieve.

Complete tables showing the results obtained are given in the report, but would occupy more space than can be allowed in this abstract. It was found that the replacement of one-half the cement by fine sand lowered the strengths materially, but that the finer the sand was ground the less the strength was reduced. From this it might appear that some chemical action between the fine sand and the cement had taken place. The comparative weight of the briquettes showed, however, that the decrease in strength was nearly proportional to the density, and that the higher results obtained with the finely ground sand are probably due to more perfect filling of the voids.

In order to determine whether a slight chemical action might not have taken place, the effect of finely ground sand and finely ground marble were compared. Both sand and marble were ground to pass a 177-mesh sieve. The results were as follows:

Tensile Strength in Pounds Per Square Inch.

	400 cement, 1,600 normal sand.	400 cement, 200 grnd. sand, 1,-600 normal sand.	400 cement, 200 grnd. marble, 1,600 normal sand.
7 days.................	221	256	255
28 days.................	249	307	307
90 days.................	309	366	372
Weight of 5 briquettes..	786 grams	825 grams	820 grams

From the above table it will be seen that the two finely pulverized materials have increased the strength equally. Since the carbonate of lime of the mortar is chemically entirely inactive, it is evident that the finely divided sand has exerted no chemical action. Whether a slight chemical effect may take place at long periods is of no consequence from a practical point of view. The use of finely ground sand to increase the strength of poor mixtures of cement and coarse sand will hardly be applied in practice, since equal, or even higher strengths can be obtained by the use of natural sands of graded fineness. This is shown by the following comparative tests at 90 days:

	Tensile strength.	Weight of 5 briquettes.
400 cement, 1,600 normal sand......	309	786 grams.
400 cement, 200 ground sand, 1,600 normal sand	366	825 "
400 cement, 1,800 Rhine sand........	362	805 "
400 cement, 1,600 Rhine sand.......	426	827 "

This table shows how the density and strength of mortars are influenced by the character of the sand employed. In marine constructions the density of the concrete, as well as its strength, is of great importance. It is therefore especially necessary, in this class of work, to select sands containing the smallest possible proportion of voids.

Calcium Hydroxide, Ca (O H_2), in Hardened Portland Cement.—Professor Schuliatschenko presented an account of the investigations of Ljamin, a Russian engineer, on this subject. Le Chatelier, in 1885, advanced the view that the hardening of Portland cement consists in the conversion of the tri-calcium silicate, 3 Ca O, SiO_2 under the influence of water, into a crystalline mass of hydrated mono-silicate and calcium hydroxide. This view was founded on a microscopic study of the process of hardening. Ljamin finds that it is possible to separate the hydroxide from the other constituents of hardened cements by use of a mixture of methylene iodide and benzol, of a specific gravity of 2.3. In this liquid the hydroxide (sp. grav. 2.1) rises to the surface, and may be quantitatively determined. He finds that the proportion of hydroxide in hardened cement increases rapidly during the earlier stages of the hardening, and reaches 31 to 33% at 90 days. After this time the increase is slight.

This result was confirmed by another method, based upon the different temperatures at which the hydrated silicates and the hydroxides give up their combined water. According to Ljamin, the hydrated silicates are decomposed at 160° C., while a temperature of 480° C. is required to decompose the hydroxide. The results obtained by the two methods agree very closely. These observations, and also the remarkable parallelism which is shown in the progressive gain in strength of cements and the percentage of calcium hydroxide formed, served as an important confirmation of the Le Chatelier hypothesis.

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[*] Manager Sandusky Portland Cement Co., Sandusky, O.

[*] Thonindustrie Zeitung, 1898, p. 800.

Roman (natural hydraulic) cement, on the other hand, showed after 60 days hardening only 2% of hydroxide. It is evident, therefore, that the reactions which take place in the hardening of Roman and of Portland cement are radically different.

For the purpose of studying the effect of sea-water on Portland cement, Ljamin analyzed samples from well-preserved blocks of concrete which for 30 years had been exposed to the water of the Black Sea at Potihafen. These blocks showed a very hard crust, about one-eighth of an inch thick, on their surface. This crust contained 20% of carbon dioxide. One-fourth inch from the surface the proportion of carbon dioxide was only 5%, and at a depth of 1 in. only traces were found. Free calcium hydroxide was not found in the outer crust, but in the interior of the blocks this substance was present to the amount of 33%. It is evident, therefore, that the presence of large amounts of free hydroxide in hardened cement is no cause of injury by sea-water.

Report of the Committee on Tests for Constant Volume of Portland Cement.—A series of experiments on tests of constant volume was begun early in 1896. Ten Portland cements which were thought to be imperfect in the matter of constant volume were assigned to the various members of the committee to be independently tested. In addition, a number of medallions, 12 ins. in diameter and 1¼ ins. thick, and rosettes 10 ins. in diameter and 2 ins. thick, were prepared with the same cements. These were made with a surface of one of cement to one of sand and filled in with mixtures of cement one, sand two, and cement one, sand four. The medallions and rosettes so prepared were kept damp for three days in a closed room and then exposed to the weather.

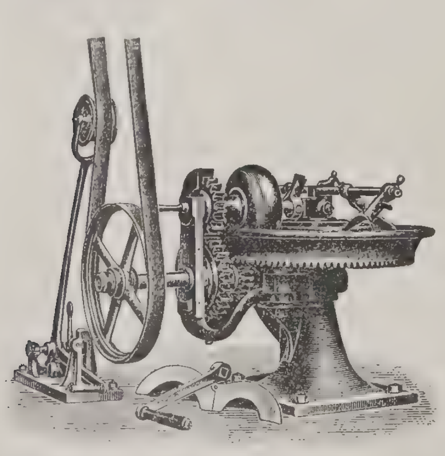
The ordinary cold pat tests of all the ten cements were fully satisfactory. Accelerated tests at higher temperatures gave varying results. Most of the samples stood the oven test at 100° C., but the majority failed in the Michaelis and Tetmajer boiling tests and the Maclay hot water test. No cement passed all the accelerated tests satisfactorily.

Observations of the medallions and rosettes after exposure of 1½ years to the weather showed that all were hard, well preserved and faultless. It is generally agreed that the durability of artificial stone prepared from a given Portland cement is the best evidence of constancy of volume. The committee therefore concluded that accelerated tests are of no value in determining the durability of cements in practical use.

Report of the Committee on the Steinbruck Mortar-Mixer for Cement Testing.

It is well known that in the ordinary methods of mixing cement with sand and water for testing purposes the method followed and the personal equation of the operator are of great influence on the results. A widespread desire exists, therefore, for a more uniform mixing process. The apparatus which the committee consider the mixing-machine of the future is shown in the accompanying illustration.

The capacity of the apparatus is about 4 lbs. of mixture of cement 1, sand 3. The roller and plows may be easily and quickly removed for the purpose of emptying and cleaning the pan. Careful experiments have shown that no pulverization of the sand takes place during the operation. The gearing is so designed that 50 turns of the handle give 8 revolutions of the pan.



The Steinbruck Mixer for Preparing Mortar for Cement Test Briquettes.

Made by the Chemisches Laboratorium fur Thonindustrie, Berlin, Germany.

Tests of a slow-setting Portland cement gave the results shown in the following table. Each figure represents the average of 10 test-pieces:

	Tensile strength, lbs. per sq in.		
	Cement 1, sand 3.		
	7 days.	28 days.	90 days.
Hand mixing	278	349	438
Machine mixing—			
6 pan revolutions	266	356	434
8 " "	283	362	455
10 " "	273	361	468
15 " "	294	371	480
20 " "	302	403	452
30 " "	295	390	421
40 " "	319	386	471
50 " "	339	382	482
70 " "	330	395	519
100 " "	338	403	568

This table shows that about 8 revolutions of the pan are required to give the same results as those obtained by hand-mixing. The strength continues to increase greatly with increasing number of revolutions, and does not appear to have reached a maximum at 100 turns. It is to be expected that at a certain point the strength will begin to decrease in consequence of incipient setting of the mortar. Careful experiments to determine this point are now in progress, and tests thus far completed seem to indicate that a maximum is reached at about 150 revolutions.

The machine is arranged to be driven by hand or by power. When turned by hand it is found that a convenient speed is about 8 pan revolutions per minute. The apparatus in its improved form is now offered for sale by the Chemisches Laboratorium fur Thonindustrie, Berlin.

On the Action of Water Containing Carbonic Acid on Portland Cement.—In the report of the 1897 meeting a number of cases of corrosion of reservoir linings by carbonated water were mentioned. At the 1898 meeting Schiffner gave an account of an interesting series of experiments on this subject. Briquettes of the following mixtures were prepared:

Trass, 1; lime, 1; normal sand, 1.

Portland cement. 1; ground trass, 1; normal sand, 2.

Portland cement, 1; ground sand, 1; normal sand, 2.

The "ground trass" and "ground sand" had been pulverized to such fineness as to pass a sieve of 177 meshes to the linear inch.

These briquettes were kept in moist air one day, then in water in the laboratory three to six weeks. One-half of them were then placed in baskets and suspended in the water of the water-works spring at Bonn on the Rhine, while the remaining half remained in water in the laboratory. After 16 to 18 months the briquettes were inspected.

Those kept in the laboratory were found to be completely intact and well hardened, while those exposed to the action of the spring water showed more or less decrease in volume and strength. The reduction in volume was as follows:

Trass and lime	13.76%
Cement and ground trass	8.90%
Cement and ground sand	7.78%

The addition of trass appears, therefore, to have given no better results than that of fine sand.

Later tests with a mixture of Portland cement 1, normal sand 1, showed after three months' action of the spring water a loss in volume of only 1.77%.

Immersion of the briquettes in solutions of fluorides proved to diminish the corrosive effect of the water. The best result was obtained with lead fluoride. Briquettes of Portland cement with 3 parts normal sand were prepared, kept in moist air one day, then three times immersed, for 24 hours each, in a solution of lead fluoride, and dried. These were then placed in the spring water, and after 9½ months showed a loss in volume of only 0.06%.

The water supply at Bonn is obtained from a spring, and shows the following composition, in grams per liter (parts in 1,000):

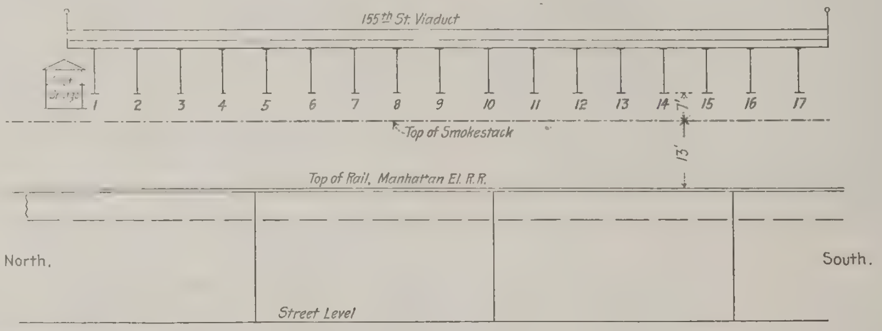
Sodium chloride	0.1246
" sulphate	0.0689
" bicarbonate	0.0477
Calcium carbonate	0.2400
Magnesium "	0.0605
Silica, iron oxide and alumina	0.0165
Organic matter	0.0043
Carbon dioxide, dissolved gas	0.3985

The water of the river Rhine at Bonn shows only ⅛ as much carbon dioxide and 1-14 as much sodium chloride as that contained in the spring-water.

TESTS OF VARIOUS PAINTS ON THE 155TH ST. VIADUCT, NEW YORK CITY.

In our issue of Sept. 23, 1897, the method of cleaning the iron work of this viaduct, as a preliminary to repainting the structure, was fully described. The cleaning was done by the Tilghman sand-blast process, the mixed air and sand striking the paint with a velocity of 250 to 300 ft. per second. Mr. M. E. Evans, the engineer in charge for the Department of Public Works, reported at the time that the surface of iron thus cleaned was exceedingly susceptible to rust, and if not at once covered with paint a few hours' exposure to ordinarily humid air resulted in a thin coating of red oxide. For this reason the work of cleaning and painting was carried on alternately each day, the sand-blast gang commencing operations at 6 A. M. and stopping at 3 P. M., when the painters at once began applying a priming coat and worked until 6 P. M., completely covering all of the surface cleaned that day. The paint used was supplied by seventeen different firms, each section being painted with a different paint. The paints were applied by workmen employed by the city.

As the painted surface is exposed to the gases from the locomotives of the Manhattan Elevated R. R., which pass directly under the structure, and as all the paints were applied to a clean iron surface, the comparative test is probably the fairest and most complete that has even been made of paints for the protection of iron work exposed to locomotive gases.



CROSS-SECTION OF 155TH ST. VIADUCT. SHOWING POSITION WITH RELATION TO MANHATTAN ELEVATED R. R.

A report upon the condition of these various paints has recently been made by Mr. Henry B. Seaman, M. Am. Soc. C. E., and we present it in full herewith as follows.

On April 12th, 1898, the writer made an examination of the different paints on that span of the 155th St. Viaduct which is directly over the tracks of the Manhattan Elevated Railroad at 8th Ave., and submits the following report:

This part of the bridge spans three tracks and two platforms, at the 155th St. station of the Elevated Railroad, and is composed of 17 lattice girders carrying floor beams upon which are riveted buckle plates, which in turn carry the roadway of the 155th St. Viaduct. These 17 girders are of 69 ft. span and 9 ft. in depth, being spaced 9 to 10 ft. apart, and having the bottom flanges about 7 ft. above the tops of the locomotive stacks. For convenient reference in this report, these girders are numbered from 1 to 17 consecutively, beginning at the north end.

A foot-bridge, located just north of girder No 1 also crosses above the tracks. The floor of this bridge is about 4 ft. below the bottom flange of girder No. 1 and about 3 ft. away from it in the clear. The 155th St. station being the terminus of the railway, the two outside tracks are in constant use by arriving and departing trains, while the middle track is used mainly by switching locomotives.

During the greater part of the day, trains arrive three minutes apart, alternating between the easterly and westerly tracks. The locomotives of the north-bound trains on the easterly track stop with the stack directly under girder No. 5, and remain about 20 seconds before hauling out. Incoming trains on the westerly track do not stop until the locomotive has passed north beyond the foot-bridge. All trains approach the station with steam shut off, except that used for brakes. It will thus be seen that the only girders which constantly receive the direct blast of the engine are girders No. 1 to 5 inclusive, the remaining girders receiving blasts only upon the occasional switching of engines, and in making up trains. In all other cases the girders are exposed alike to only such gases as the locomotives emit while the steam is shut off.

In making the examination, a careful general scrutiny was given to each girder from the platform below, and each was given a percentage mark, denoting the amount of surface free from rust. These percentages were then carefully compared and reviewed so that they might correctly represent the comparative condition of each girder. When these tests were completed, a thorough inspection was made by climbing through the structure and the character of rust was denoted for each girder. After completing the examination and recording the results, the kinds of paint used for each girder, with the number of coats and comparative rapidity of drying, were obtained from Mr. M. E. Evans, C. E., under whose direct supervision the girders were cleaned and the various paints were applied. The accompanying table gives the summary of the results:

Results of Tests of Paints on 155th St. Viaduct, New York City.

No. of girder.	Kind of paint.	Number of coats.	Rate of drying.	% free from rust.*
1	Lead, graphite and lucol oil.	3	Medium.	97[1]
2	Graphite and linseed oil.	2	Slow.	80[2]
3	Red lead, "Antoxide F," "Antoxide D."	2	Fast.	25[3]
4	Graphite.	2	Slow.	75[4]
5	"Nobrac."	3	Medium.	99[5]
6	"Carbon black."	2	Slow.	85[4]
7	"Durable metal coating."	2	Slow.	75[4]
8	"Black manganese iron."	2	Fast.	30[6]
9	"Carbonizing coating."	2	Slow.	80[1]
10	"Mineral rubber."	4	Fast.	78[7]
11	"Black."	2	Medium.	58[8]
12	Carbon.	2	Medium.	92[4]
13	Graphite.	2	Medium.	67[4]
14	Graphite.	2	Slow.	70[4]
15	Asphalt.	2	Very slow.	65[9]
16	"Ruberine."	2	Medium.	58[10]
17	"Black Diamond."	2	Medium.	70[11]

*Percentage of surface free from rust, April 12, 1898.

[1] Paint crumbling in places, as though rotten; very little rust.

[2] In fair condition, but discolored; rust coming through.

[3] Very badly rusted. [4] Rust not deep.

[5] Slight rust on top flange of one panel; rest of girder clear.

[6] Rust very deep; buckle plates bad.

[7] Area of rust spots small; rust very deep.

[8] Rust bad and deep.

[9] Deeply rusted; buckle plates still good.

[10] Rust deep and angry; buckle plates mildewed.

[11] Small pimples of rust, as though formed under paint.

It will be noticed, both by the percentage of clear surface and the character of rust on close examination, that girder No. 5 is preserved better than any of the set. When it is also considered that the priming coat of this girder was the one first applied, that it has been the most severely exposed to sulphur fumes, and that a portion of the priming coat was applied with the humidity averaging 96% for the day (where 100% is absolute saturation), the comparative condition in favor of girder No. 5 is very marked.

Respectfully,

Henry B. Seaman.

40 Wall St., New York city, May 24, 1898.

A FACTORY BUILDING OF STEEL AND GLASS.

The accompanying illustration is a view of a machine shop designed and built by the Berlin Iron Bridge Co., of East Berlin, Conn., for the Veeder Mfg. Co., of Hartford, Conn., the makers of the well-known Veeder cyclometer for bicycles. In the design of the building one of the principal ideas was that it should have an abundance of light on every square foot of floor space, so that it could all be available for carrying out the very fine operations required in the manufacture of cyclometers. The framework of the building is entirely of steel, the greater portion of the construction being steel and glass. It is three stories in height, 30 ft. in width, and 110 ft. in length, the three floors giving nearly 10,000 sq. ft. of floor surface. The glass sides of the building are arranged in sections, and every other panel swings on center pivots, so that they can be easily opened and closed. In warm weather, by opening enough of the panels to allow plenty of air to circulate, the interior may be kept as cool as that of any other kind of building under the same conditions of weather. The glass used in the sides is roughened or corrugated plate glass about ⅛-in. thick.

FACTORY OF THE VEEDER MFG. CO., HARTFORD, CONN.
Built by the Berlin Iron Bridge Co., East Berlin, Conn.

The floors are carried by girders spanning the entire width between the sides of the building, so that the floor space is entirely unobstructed by columns. The roof trusses are of sufficient strength to carry shafting, pulleys, hangers, etc., in addition to the roof load.

The heating of the building is done by the blower system, hot air being forced into the interior from an adjoining boiler-room. The air ducts are located in and made part of the supporting columns of the building. This feature was designed by Mr. C. H. Veeder, president of the Veeder Mfg. Co., and adopted by the Berlin Iron Bridge Co. in its design. The blower system may also be used for blowing cool air into the building in the summer.

An interesting question in relation to this building, on which we trust the Berlin Iron Bridge Co. may give us some information next year, is what will it cost to heat the building in cold weather? It is generally considered by heating and ventilating engineers that the emission of heat from glass surfaces is much greater than that from ordinary walls and roofs of buildings. If this is true, the heating of this building would be somewhat expensive. At any rate, the building offers a good chance to get some valuable data on the subject. We would suggest that an approximate idea of the cost of heating, independent of the power needed to circulate the warm air, could be obtained by measuring the drip from the air heating coils by means of a water meter. A reading of the meter taken every night and morning, together with the records of registering thermometers, one recording the temperature inside and the other that outside of the building, would furnish a set of data that should be of great value to heating and ventilating engineers and to mill architects.

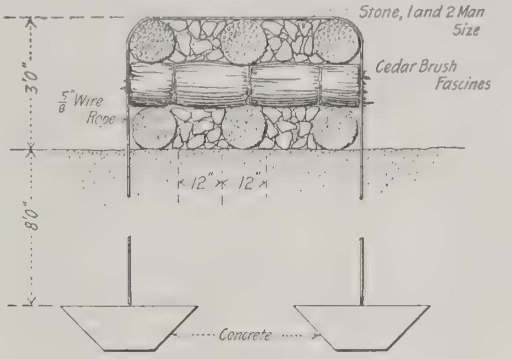
A NOVEL FIXED ANCHOR CONSTRUCTION FOR JETTIES, BUOYS AND LIGHT SHIPS.

We illustrate herewith a rather novel, and, according to all reports, a very efficient system of anchors employed in the construction of a small jetty built at Atlantic City, N. J., in 1897, to break the force of the waves, which were gradually tearing away the bathing beach and rendering it unfit for use. This jetty extends out from the shore a distance of 200 ft., and is built of cedar brush fascines, laid cob-house fashion, with the interstices filled with stone and anchored down to the sand bottom. Fig. 1 shows the arrangement of the fascines and anchor system in this jetty, and Fig. 2 shows the construction of the anchors proper in more detail. These anchors have been patented, the patent having relation to

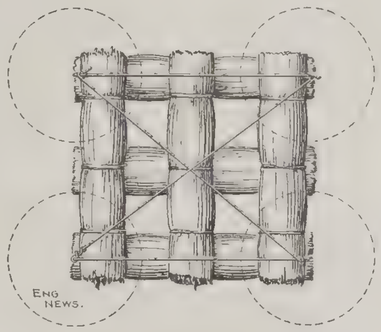
> anchors for securing jetties, buoys, piers, dykes, lightships, and like constructions which require permanent fixed anchors for holding them in position, and consists in the devices hereinafter described constructed to accomplish the ready sinking of the anchor and the retaining its desired position when sunk to the proper depth.

The inventor is Mrs. Gertrude Stuart Baillie, of Philadephia, Pa., and the use and sale of the system is controlled by the Sea Coast Jetty Co., 1420 Chestnut St., Philadelphia, Pa.

The construction of the Atlantic City jetty is shown very clearly by Fig. 1. The fascines were of cedar brush, bound by wire in the usual manner, and were 1 ft. in diameter. The bottom fascines were laid parallel to the longitudinal axis of the jetty 1 ft. apart in the clear. On the top of these came a layer of fascines laid at right angles to the first and 1 ft. apart, and finally another layer of longitudinal fascines laid like the first. The interstices between the three layers of fascines were filled with stone, and the whole was anchored down by a system of ⅝-in. wire cables attached to the special concrete anchors. The cost of the jetty was less than $10 per lineal foot.



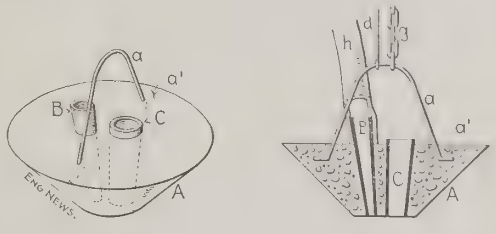
Elevation.



Plan.

Fig. 1.—Sketch Plan and Section Showing Construction and Anchorage of Jetty Breakwater at Atlantic City, N. J.

Turning now to the enlarged drawings of the anchor, A represents the main body of the anchor, which is made preferably of a wedge or cone-shape to allow it more readily to bury itself as the sand or earth is loosened or displaced from beneath it. In the upper portion of the body A is provided a staple a, secured from displacement by the hooked ends a' or by other suitable means. Perpendicularly through the anchor near the center is a pipe B, the upper end of which protrudes above the top of the anchor and is adapted to receive the end of a flexible water-supply pipe secured thereto by any desirable means, as by being stretched over the mouth of the pipe B. When the anchor is settled to its desired position, the flexible hose is pulled off or cut off at the water's edge, dropped, and thus disposed of. A waste-escape pipe C is also provided perpendicularly through the anchor adjacent to the water-supply pipe B.



View. Vertical Section.

Fig. 2.—Special Concrete Anchor for Atlantic City Breakwater, Showing Attachments for Water Jet Used in Sinking.

In operation the anchor, fitted with a lowering cord d and the securing chain attached to the staple a and with the supply-hose h properly attached to the pipe B, is dropped overboard at the desired point from a boat or platform. When bottom is reached, the water-supply from a pump or water-main is turned on. The force of the water as it is ejected from the lower end of the pipe-nozzle B at the bottom of the anchor forces away the sand or earth immediately below and about it. The weight of the anchor settles it in the cavity left by the displaced sand or earth. The stream continuing, the anchor buries itself gradually deeper, and so much of the escaping sand or earth which does not pass up along the sides of the anchor, as it settles, is forced up through the escape-pipe C and falls on top of the anchor, thus helping to bury it. The anchor keeps on descending and burying itself as the hose plays until the desired depth is reached, when the water is turned off and the flexible hose h is pulled off and abandoned.

When two anchors are desired for securing the object, such, for instance, as the Atlantic City jetty or a breakwater, a second anchor of like construction, with the other end of the chain g of the proper length attached to it, is in a similar manner dropped to its position and sunk to the desired depth by the same operation and the jetty firmly secured to the bottom, as illustrated. When the anchor is once in position, it is securely held by the sand or earth above and below it.

In constructing the Atlantic City jetty the anchors varied from 4 ft. to 3 ft. across the tops, the smaller sizes being used close to the shore, and they were sunk to a depth of about 7 ft. below the bottom. The material penetrated was sand, and after the water was turned on it took about 20 minutes to sink each anchor. For the information from which this description has been prepared we are indebted to the officers of the Sea Coast Jetty Co.

◆

THE ATLANTIC TRANSPORT LINE, largely an American corporation, has bought the fleet and business of the competing Wilson and Furness-Leyland Line, for about $5,000,000. Seven vessels are included in this purchase; all built within the past year or two and five of these are of 7,000 tons register. In addition to these the Atlantic Transport Line has five large cargo-carrying steamers built in England. These vessels will be 600 ft. long, 65 ft. beam, 44 ft. deep, with twin screws and engines capable of developing 16 knots. They will carry 300 first-class passengers, with 15,000 tons of freight and 1,500 cattle. This company sold all but two of its former fleet to the U. S. government a week ago for troop transports.

◆

AN ELECTRIC CANAL MOTOR is to be tested by Mr. W. G. Wagenhals, General Manager of the Cincinnati & Miami Valley Traction Co., on the line of the Miami & Erie Canal. He proposes to run upon an ordinary standard gage track, laid along the towpath, a specially designed electric motor car weighing about 30 tons. It will be driven by a 100-HP. motor geared for five different speeds, ranging from one-quarter mile to ten miles per hour. The motor will take current from an overhead wire about 12 ft. above the track. and an electric shoe will also take the current from a conduit when bridges or culverts prevent the use of the overhead wire. If successful 100 steel barges will be built to be towed by the motor cars, each of which is to be capable of hauling five heavily loaded barges. The trains of barges would be run on regular schedules.

◆

A MOTOR-SUSPENSION PATENT granted to Frank J. Sprague, Aug. 25, 1895, and now the property of the General Electric Co., has been sustained by a preliminary injunction issued by Judge Lacombe on June 21, against the Nassau Electric R. R. Co., of Brooklyn, N. Y. The motors were manufactured by the Steel Motor Co., of Johnstown, Pa. The injunction provides that within 30 days 250 motors must be removed; within 60 days 250 more; 250 within 90 days, and the balance in 120 days from date.

◆

AN ELECTRIC POWER AND TRANSMISSION PLANT, recently installed in Yuba county, Cal., and described in the "Journal of Electricity" for May, has a canal 23 miles long, with a section of 9 ft. and 5 ft. × 2½ ft. deep. The flume is built of timber, is 5 ft. × 3 ft. and 7⅞ miles long. The pipe line is 850 ft. long and gives an effective head of 292 ft. It is 42 ins. in diameter and made of steel varying from ⅛-in. to ¼-in. Three 40-in. Pelton impact wheels are used, each wheel having two 4-in. nozzles. The capacity of each is 700 HP., with a speed of 400 r. p.m. These are directly connected to Stanley two-phase generators of 360 K-W. at 2,400 volts and a periodicity of 8,000 per second; 12 Stanley transformers of 125 K-W. each, with a primary voltage of 2,400 and secondary voltage of 16,700 are used. One transmission line is 18¾ miles long, and the other 7¼ miles. Poles of 30, 35 and 40 ft. were used spaced 44 to the mile, with 3 × 4-in. × 5-ft. cross-arms, and pins 18 ins. apart. The No. 6 B. & S. medium-hard drawn copper wires are supported on 5½-in. triple-petticoat Locke insulators.

ELECTRIC TRACTION IN BERLIN, says the "Elektrotechnische Zeitschrift," for March 10, 1898, is somewhat behind the practice in other German cities. This is due to the importance of the interests involved, the difficulty of making arrangements and the prohibition of the overhead trolley system in the central parts of the city. In 1896 the Berlin Tramway Co. established a system which had an overhead trolley for part of the way and an electric conduit system for the remainder; and a similar line was built about the same time by Siemens & Halske. But there are many break-downs with the conduit system employed and the general results are unfavorable. On March 1, 1898, another line was established combining the overhead trolley and accumulators. The four-wheeled cars weigh 16 tons, and the battery weighs 2.6 tons and is supposed to store sufficient electric energy to make the round trip over the 10,725-ft. section of line thus operated. The cars are about 33 ft. long and seat 28 persons, with 12 places outside. It is proposed to thus transform all the tramway lines in Berlin within the next three or four years. The system is about 184 miles in extent, and 14% of this will be operated by accumulators, and the remainder by the overhead trolley.

◆

STREET RAILWAY FRANCHISES IN CHICAGO, according to resolutions adopted by the Chicago Federation of Labor, will not be acceptable "to wage-earners" hereafter unless they provide for 4-ct. fares, compensation to the city for the use of the streets, a 20-year limit to the life of the franchise, provision for the purchase of the system at the expiration of the franchise, eight hours as the maximum length of a working day for employees and freedom from persecution or discharge of employees on account of belonging to labor unions.

◆

A STEAM-MOTOR OMNIBUS, built by M. F. Weidknecht, of Paris, is described as follows: It is intended to carry 16 passengers, all inside, and about 1,000 lbs. of baggage. The main feature of the design is the concentration of all the power-generating plant and transmission gear in front of and entirely distinct from the body of the vehicle, and this mechanism is carried on two 4½-ft. wheels acting as drivers. This gives a practically constant load on the axle, and is intended to give increased adherence with less tendency to sliding on the pavement. The body is suspended by three plate springs on two wheels placed well toward the rear. The length of the omnibus over all is 18 ft., with 11 ft. in body; the distance between axle centers is 7 ft. 10 ins. In the motor section the frame is made of light channel iron, to which the boiler, tank, etc., are riveted. The boiler is of the vertical multiple tubular type, with a super-heater, and a heating surface of 64.56 sq. ft. Coke is used for fuel and there is an automatic stoker attachment. The engine has two 4.9-in. cylinders, and develops about 20 HP. The power is transmitted from the main shaft of the engine, through gear wheels, to an intermediate shaft, and from the latter to the front axle by the usual chain and sprocket wheel. The two rates of speed provided for are 4.6 and 9.3 miles per hour, at 350 engine revolutions per minute. By regulating the admission of steam the speed may be run up to 12½ miles per hour. A band foot-brake, on the rear wheels, and a hand screw-brake, on the driving wheels, are provided. Tests have been made showing a consumption of about 14 lbs. of coke per mile run on ordinary roads; though it is claimed that this can be reduced to 10.7 lbs. on good level roads. The weight of the omnibus is 4 tons 14 cwt. empty, and about 7 tons loaded.

◆

AN ELEVATOR SHAFT to the summit of Mont Blanc, with a shaft 1½ miles deep and a 3½ mile tunnel to the bottom of the shaft, is proposed by a French engineer, Paul Issartier, of Marseilles. The tunnel would rise 600 ft. in 18,864 ft., terminating 7,500 ft. above sea-level. The vertical shaft would be 10 × 13 ft., and have a depth of 8,200 ft., and he proposes to excavate it from below. He has devised a "rising chamber," made of strong steel plates, in two stories divided by steel doors; on the upper floor would be the rock-drilling machinery, driven by compressed air. To avoid lowering the "chamber" out of the way of blasts, he would drill only on one side first, then roll the drilling machines to the other side and protect them by lifting steel doors. To catch the fragments of rock he proposes a series of strong steel gratings, placed at an angle of 45° and protected by fascines; these are supposed to permit the passage of the gases of explosives while retaining all the rock. On the lower story this rock would be "pulverized" and then passed down a 12-in. tube to the bottom of the shaft, and thence carried outside by a stream of water propelled by centrifugal pumps. The "chamber" would rest upon and be raised by strong steel racks placed in the four corners of the shaft. He presents no estimate of cost, and the proposition is chiefly interesting as a somewhat wild attempt to solve some novel engineering problems.

◆

SIAMESE RAILWAYS, says "Indian Engineering," include the following, as the only lines in existence at present: The 13-mile line from Bangkok to Paknam, owned by a Danish company, and 87 miles of the line northward to Ayuthia. The latter line is to be extended to Khorax and will then be 164 miles long. A concession to a Danish company proposes another railway about 140 miles long, extending from Bangkok to Phetchabouri; but the most important line proposed is the extension of the Bangkok-Ayuthia railway northward 310 miles in a direct line to Zimme (Chiengmai).

◆

BERLIN STREET PAVEMENTS, says Consul-General Goldschmidt, in answer to queries, had an area of 6,500,405 sq. yds. on March 30, 1898. Of this area a little less than 74% is stone pavement; about 25% is asphalt and a little over 1% is wood. The use of asphalt is steadily increasing. The subsoil is a coarse, gritty sand, and forms an excellent foundation for the 8-in. concrete course underlying the 2-in. asphalt pavement. The average price for asphalt pavement in Berlin is $2.80 per sq. yd.; the contracts for laying the pavements run for 20 years, and the contractor keeps them in repair for five years free of cost to the city, and thereafter receives 10 cts. per sq. yd. per year for this service.

◆

PHILADELPHIA'S AVERAGE DAILY WATER CONsumption for 1897 was 187 gallons per capita, with an estimated population of 1,385,734. In 1887 the consumption per capita was 89 gallons, the increase in ten years being more than 100%. The Chief of the Water Bureau, Mr. John C. Trautwine, Jr., very properly remarks that no one will pretend to believe that this 187 gallons per head per day represents water legitimately used for household or manufacturing purposes. It is simply, in great part, a waste of water that costs the city $3.16 per million gallons pumped 100 ft. high, and every gallon consumed in that city is pumped. For some reason, meter service is not regarded with favor in that city; though the application of some such check upon waste would seem to be largely demanded, and it would certainly be profitable to the city. There is evidently no lack of water, such as it is, and the recommendation to purify the supply by sand filters should be supplemented by the adoption of means to stop the needless waste of water.

◆

CAST-IRON WATER PIPE at $16.60 per net ton delivered in Boston seems to be a record low price. The Warren Foundry & Machine Co., of Phillipsburg, N. J., lately made a contract with the Metropolitan Water Board to deliver 937 tons of 12 to 36-in. pipe at that price; the pipe to be delivered at Brighton, Forest Hills, Glenwood and Clinton, on the line of the new Metropolitan Water Supply. Nearly one-half the pipe ranged in diameter from 30 to 36 ins. We believe the transportation cost on the contract will be about $3 per ton, making the actual price received for the pipe at the foundry little more than $13.

◆

THE STATUS OF THE SEPTIC TANK SYSTEM of sewage treatment, so far as the Local Government Board of England is concerned, has been made known by the action of the board in the Exeter case. In our issue of Jan. 13, 1898, we described the septic tank, including the trial and proposed plant at Exeter, England. The board has approved the loan necessary to carry out the scheme, but the approval is conditioned on the understanding that if the system is unsatisfactory the city will substitute some plan of chemical precipitation and artificial filtration, and also that the city will, at the start, supplement the septic tank system with land treatment exactly as would be required in the case of chemical precipitation; that is, provide one acre of filtration area for each 2,000 population. We are indebted to the London "Surveyor" for the above information.

◆

ANOTHER SUCCESSFUL WAVE MOTOR PUMP is reported from California. It has been built by William and Edward Armstrong at Santa Cruz, Cal. From descriptions given in the Santa Cruz "Sentinel" and "Surf," it appears that the apparatus consists of a well 6 ft. diameter and 40 ft. deep, sunk in the rock a short distance from the water's edge, the bottom of the well being connected by a 6-ft. tunnel with the open sea, a float weighing about 800 lbs., which rises and falls in the well with the movement of the ocean wave, and a 6-in. direct-acting pump, whose plunger is operated by the motion of the float. The work now done by the motor is the spouting of a jet of water from a 2-in. hose pipe to a height of 50 to 100 ft. above the level of the cliff.

◆

THE UNITED STATES AT THE PARIS EXPOSITION of 1900 is especially reported upon by Mr. Thomas W. Cridler, Third Assistant Secretary of State. and the successor of the late Moses P. Handy as Special Commissioner of the United States for the Exposition. Mr. Cridler's report is published as Senate Document No. 293 for the 2d Session of the 55th Congress. It contains his report upon the progress of the Exposition buildings and detailed plans and elevations of the spaces allotted to the United States in the several buildings. Mr. Cridler earnestly recommends, for commercial reasons, a full and representative exhibit by the people of the United States.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

VOL. XL. No. 2.

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THE JAPANESE PROTECTED CRUISER "KASAGI," built at the Cramp's shipyards in Philadelphia, had her contract trial trip on July 12, and with rough water and a strong tide setting almost at right angles with the course, a mean average speed of 22.75 knots per hour was developed. The course was 20 miles long, in four legs, and the following table shows the results of the run up and down the course, a total of 40 miles:

Run up.	Elapsed time. min. sec.	Speed. Knots.
First lap	12:54	23.25
Second lap	13:07	22.90
Third lap	13:00	23.07
Fourth lap	13:00	23.07
Total interval, 52:09. Average, 23 knots.		
Run down.		
First lap	13:14½	22.65
Second lap	13:14	22.67
Third lap	13:33	22.12
Fourth lap	13:19	22.55

Total intervals, 53:20. An average of 22½ knots. Mean speed for the run, 22.75 knots.

The revolutions rose from 158 at the beginning of the run to 164 at the end. To show the perfect condition of the machinery a series of progressive trials was run as soon as the main trial was over, in order to get the speed at 80, 125, 150 and 162 revolutions. The "Kasagi" is 374 ft. long and 48 ft. beam, and is one of the heaviest armed cruisers of her size afloat. She will carry two 8-in. breech-loading rifles and ten 4.7-in. rapid-fire guns. The vessel was completed six months ahead of the contract time.

◆

THE LAKE STEAMER "HENDRICK S. HOLDEN" was launched at the yard of the Globe Iron Works Co., of Cleveland, O., on June 25. This vessel is 430 ft. long and 410 ft. keel, 50 ft. beam and 28 ft. deep. The hull is built of mild steel and her masts are also steel; she has twelve cargo hatches spaced 24 ft. between centers. Her quadruple expansion engine has 20¼, 30¼, 44 and 63½-in. cylinders with 42-in. stroke. The three Scotch boilers supply steam at 230 lbs. working pressure, and these boilers are fitted with the Ellis & Eaves system of induced draft. The carrying capacity of the vessel is 5,500 tons.

◆

BROOKLYN DRY-DOCK NO. 3 has been officially declared safe and ready for use by Mr. P. C. Asserson, C. E., U. S. N., in charge of the Brooklyn Navy Yard. Naval Constructor F. T. Bowles, U. S. N., in charge of the repairs, is now relieved from further responsibility. The coffer-dam at the entrance has yet to be removed, and the entrance will then be dredged out to the full depth.

◆

THE LAKES ST. CLAIR AND ERIE SHIP CANAL project, says the New York "Sun," is again attracting attention, and there is a prospect that active work may be commenced upon it within a year. The line of the canal, commencing in the channel in Lake St. Clair and about 5 miles from the head of the Detroit River, would pass 17½ miles over the "Flats" to the shore line; the actual cutting across the neck of land to Lake Erie is about 14 miles, and the mouth of the canal on the latter lake would be about 60 miles easterly of the usual route through the Detroit River, with an actual saving in distance of 79 miles. The estimated cost of the canal is $5,500,000, and it could be built in two years. The promoters figure that a toll of 3 cts. per ton would be sufficient to make the enterprise a paying one, provided two-thirds of the tonnage now passing Detroit could be deflected to the new route.

◆

THE MISSISSIPPI RIVER COMMISSION has made the following allotments for levee work, according to the Memphis "Commercial": Tensas District. $100,000; St. Francis Levee District, $34,000; the Upper Yazoo, $26,000; Lower Yazoo, $90,000. This latter is Major Wm. Starling's district.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a freight train collision on the Pittsburg & Connellsville line of the Baltimore & Ohio R. R., at Foley's, Pa., on July 9, in which one man was killed and six were injured. The accident was a head-end collision and. it is stated, was due to an error in the train orders. ——The collision of a freight train with a switching engine in the yards of the Pittsburg & Lake Erie R. R., near Pittsburg, Pa., on July 7, resulted in the serious injury of one man, the destruction of several freight cars, and considerable injury to the colliding locomotives.——A derailment at Ridgewood, N. J., on the Erie R. R. on July 9 resulted in injuries to the fireman and engineer and wrecked 26 freight cars. A westbound freight train was pulling out onto the main line at high speed when the locomotive jumped the frog, owing, it is thought, to the spreading of the rails. The cars crashed into the engine and were thrown from the track.

◆

THE BROOKLYN BRIDGE TROLLEY SERVICE was blocked for 30 minutes on July 9, owing to the burning of one of the switch boxes used to control the power on the bridge by a stroke of lightning which grounded the wires. The box is of wood, about 2 × 3 ft. in size, and contains four switch levers, which connect or disconnect the current to different portions of the bridge. The explanation of the engineers is that lightning striking the electric wire on the bridge grounded the current, and formed an arc in the switch box, which destroyed it. The damage was intensified by the attempt to counteract the grounding by sending the full force of the current from the power house through the switch box.

◆

AN EXPLOSION AT THE LAFLIN-RAND POWDER Works, at Pompton Lake, N. J., on July 9, caused the death of nine and perhaps of eleven persons, and wounded a number of others, besides destroying property amounting to about $30,000. Nine buildings were destroyed, including two mixing-houses, two guncotton-houses, the assembling-room, two traverses and the boiler and powder houses, the latter two being destroyed by fire. The first explosion, there being two, started in the northern mixing-house. In the mixing-rooms is a combination of guncotton, glycerine and nitric acid in process of manufacture. To the east of the mixing-rooms is a stone wall, 10 ft. high and 4 ft. thick, with an opening at about the center, through which the workers disappear and take refuge behind the stone wall when the machinery in the mixing-room is started. The men return to work after the machinery is started, and it was at this juncture, it is thought, that the explosion occurred. Captain Aspinwall, the Superintendent of the works, states that the mills will be delayed about two months in their orders. There were 60,000 lbs. of powder on the ground ready for shipment to the army when the accident occurred, but luckily this was not injured. Of the 47 buildings on the premises 38 are intact. The door of a building containing the store of guncotton was blown off, but the high explosive remained unharmed. An investigation has been commenced to determine the cause of the explosion.

◆

FIRE DESTROYED THE STEAMER "DELAWARE," of the Clyde Line, off Barnegat, N. J., on the morning of July 9. All the passengers, 66 in number, including the crew, were saved by taking to the boats. The "Delaware" was a wooden vessel and was 19 years old. It is supposed that the fire started in a quantity of wood stored under the main saloon deck. When discovered the flames had gained so much headway that all attempts to put out the fire were found to be useless, and the whole attention of the ship's crew was turned toward saving the lives of the persons on board. The ship, which was some 10 miles from shore when the fire was discovered, was run in to within about 2 miles of the shore, and the passengers and crew transferred to the ship's boats, from which they were taken by the tug "Ocean King" to New York. Wrecking tugs, which were sent to the scene of the accident at once, attempted to tow the burned hull to New York, but after proceeding a short distance the hull sank off Point Pleasant, N. J.

◆

A STREET CAR COLLISION in Washington, D. C., on July 10, resulted in the death of one and the injury of nearly 30 persons. The accident occurred opposite St. Elizabeth's Government Asylum for the Insane. A steep hill runs from the asylum into Anacostia, and the brake chain broke as the car started to make the descent. The motorman jumped without reversing his motor, and when the car reached the bottom of the hill it had gained a speed, it is stated, of 70 miles an hour. The horse car was standing on the turntable at the end of the line, and the driver jumped just in time to save his life. Many of the passengers were injured by jumping from the car during its flight down the hill.

◆

A BROKEN PISTON ROD on the steamer "Lucania," of the Cunard Line, compelled that vessel to enter Liverpool on her last trip under one engine. The rod which broke belonged to the port engine, and the accident occurred on July 7. The passengers were in bed at the time and did not know of the accident.

◆

THE STEEL INTAKE CRIB for the new intake tunnel of the Cleveland water-works was towed to place and sunk in position on July 1. The crib has an exterior diameter of 100 ft. and was sunk in nearly 50 ft. of water at a point some four miles from the shore. The inner wall of the crib forms a well 50 ft. in diameter. Between the inner and outer walls are water-tight bulkheads, 24 in number. The plates for both walls and the bulkheads are of ⅜-in. steel plates. The compartments will be filled with stone. The contractor for the crib is the Van Dorn Iron Works, of Cleveland. Mr. M. W. Kingsley, M. Am. Soc. C. E., is superintendent of the water-works and chief engineer of the new tunnel. Mr. C. F. Schulz is first assistant engineer of the water department.

◆

ANOTHER ACCIDENT IN THE CLEVELAND WATER-works tunnel occurred on the evening of July 11, in which ten or eleven men are supposed to have lost their lives through a gas explosion. The men were at work under air pressure some 6,500 ft. from the shore shaft and just beyond the scene of an explosion that occurred on May 11, which caused the death of eight men.

◆

STREET CAR FENDERS are to be used in Chicago if the new ordinance passed July 5 is carried into effect. Similar ordinances have been passed, but have been declared void by the courts to which the street railway companies appealed for relief. The present ordinance provides for fenders of the basket type, built of steel. Some of the companies' officials claim that the transverse plank in front of the wheels is all that is necessary and that basket fenders will be a constant source of danger.

◆

PLANS AND ESTIMATES for a filtration plant for Philadelphia, to be made by the department of public works, and to be ready by Oct. 1, were ordered by the lower branch of the city council on July 11. The same body has indefinitely postponed consideration of an ordinance providing for the construction of a filtration plant.

◆

THE FILTRATION OF THE WATER SUPPLY of Providence, R. I., is again under consideration by the city council, after having been dropped for a number of years. A review of the several plans for filtration and a critical abstract of a report by Mr. Edmund B. Weston, M. Am. Soc. C. E., Assistant Engineeer in Charge of the Water Department, was published in Engineering News for April 16, 1896.

◆

THE BROAD ST. BRIDGE, over the Phila. & Reading Railway subway in Philadelphia, was opened to traffic on July 2. This bridge is 113 ft. wide, with 69 ft. in the driveway and two 22-ft. sidewalks. It is carried over the depressed tracks by a steel plate-girder structure of five spans, having a total length of 265 ft. and containing over 1,000 tons of steel. This bridge also carries beneath its floor five lines of 12-in. gas mains and 36 galvanized iron pipes carrying electric cables. The bridge was built in sections, the first half being commenced on Dec. 30, 1897, and that part was opened to travel on April 14, 1898. The other half was commenced on April 21, and completed as above.

◆

THE FIRST IRON BRIDGE IN OHIO was erected in 1851, on the Central Ohio Division of the Baltimore & Ohio Railway, over Salt Creek, in Muskingum County. It was a single span Bollman deck truss of 71 ft. Mr. Bollman was at that time Chief Engineer of Construction on the B. & O. Railway. This bridge, after 47 years' service, has just been removed.

◆

A PILE-DRIVING RECORD is reported from Manitowoc, Wis., where Mathews & Keith, contractors of that city, are building a grain elevator for the Northern Grain Co., of Chicago. On June 22, pile-driver No. 5 drove 151 piles in ten hours, and pile-driver No. 4 drove 140 piles in the same time. These piles were from 20 to 24 ft. long, and they were driven from 18 to 20 ft. into the ground to a hardpan stratum. The pile drivers were specially designed by the above firm and have a 5,000-lb. hammer, operated by 30-in. double drums and a 30-HP. engine. Similar drivers were used at Buffalo, N. Y., in putting in the foundations for the Great Northern Steel grain elevator.

THE SINKING OF A STEAMSHIP AT SEA.

Mr. Cecil Lightfoot, of the Lynde British Refrigeration Co., has furnished to several of the English illustrated journals an account of the foundering of the Japanese steamship "Tai Hoku," in the Atlantic Ocean, August, 1897, on her maiden trip to Osaka. The photographic views taken ot the sinking of the steamer are the interesting features, and we here reproduce three of them from the "Indian and Eastern Engineer."

The "Tai Hoku" was a steamer of 3,100 tons, built at Middleboro, England, for the Osaka Steam Navigation Co., and she was fitted with a refrigerating plant by the company with which Mr. Lightfoot was connected. Having sailed to Antwerp to complete her cargo, the steamer left that port on Aug. 6, 1897, for Japan. On the following Sunday she passed into a heavy fog bank, off Cape Raso, and at about 9 p. m. the steamer collided violently with another vessel. At first it was supposed that no serious damage had been done; but in half an hour 5 ft. of water was reported in the forehold. The water gained at the rate of about 2 ft. per hour, and the ship gradually settled by the head.

At 4 a. m., on Monday, there were 16 ft. of water in the forehold, and all the pumping power available made no impression upon the inflow. At 5 a. m. all hands took to the boats and pushed off a few hundred yards from the sinking steamer; and at 8.30 a. m. the party was rescued by the steamer "Millfield." By this time the fog had cleared away, and the stern of the "Tai Hoku" could be seen gradually rising in the air. Shortly before 1 p. m. she began to roll heavily and then she plunged and sunk. In the 15 minutes previous to her final disappearance four photographs were taken; of which three are here reproduced.

When the "Tai Hoku" went down, there was, of course, considerable steam pressure in her boilers, possibly 60 or 70 lbs. When the bridge collapsed, the siren and fog-horn cords being attached to it, both the siren and fog-horn sounded, just as the vessel disappeared. The third and final view shows, apparently, an explosion. But, as a matter of fact, says Mr. Lightfoot, there is little doubt that when the water reached the boiler flues there was a sudden generation of steam and gas, which rushed with almost an explosive effect up the flues and smoke-stack, carrying with it quantities of soot which remained suspended in the air for some minutes after the ship disappeared. There was not the least sign of the proverbial whirlpool when the ship went down, though there were abundant surface signs of the gradual escape of the air imprisoned in the hull.

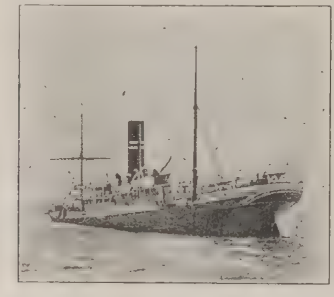


Fig. 1.—Fifteen Minutes Before Sinking.

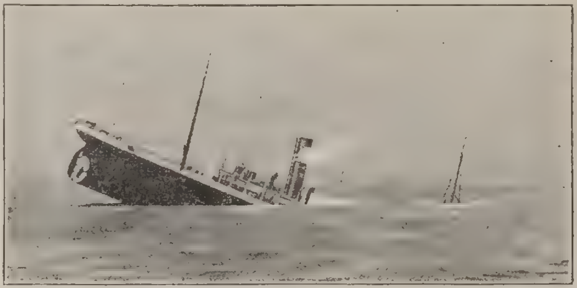


Fig. 2.—Five Minutes Before Sinking.

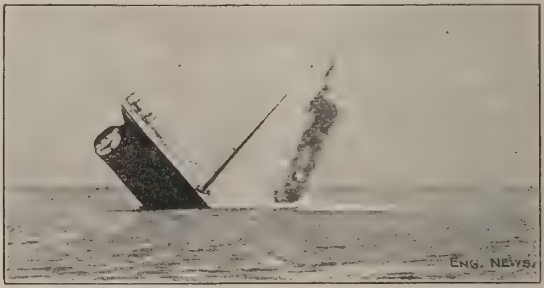


Fig. 3.—The Final Plunge.

THE SINKING OF THE STEAMER "TAI HOKU" OFF CAPE PASO, FRANCE, AUGUST, 1897.

THE STEEL DOME FOR THE YERKES OBSERVATORY, LAKE GENEVA, WIS.

(With two-page plate.)

Those of our readers who saw the model of the great Yerkes telescope intended for the University of Chicago, as it stood in the Manufactures' Building, at the World's Columbian Exposition, have doubtless often speculated regarding the future home and work of this remarkable instrument as their eyes have caught from time to time the newspaper reports concerning the progress of work upon the 40-in. objective lens and other parts of the elaborate machinery. The Yerkes telescope, as is quite generally known, is the largest refracting telescope in the world, its object glass being 4 ins. greater in diameter than that of the Lick Observatory telescope at Mt. Hamilton, California, and it is needless to say that astronomers expect much usefulness from it in the particular line of astronomical research to which it is to be applied. Besides being of especial interest to the astronomical world, however, the great refractor is of great interest to the mechanical and structural engineer, for the skill of both has been called into service in designing its ponderous and delicate operating machinery and the building which it is to occupy. From information furnished by the astronomical department of the University of Chicago and by the engineers and contractors who designed and built the observatory dome and its operating machinery, we present here a pretty complete description of the features of particular interest to engineers:

The observatory building, in which the great telescope has been installed, is located at Lake Geneva, Wis., and, like the telescope, was presented to the University of Chicago by Mr. Charles T. Yerkes, of Chicago, Ill. Its general appearance is pretty clearly shown by Fig. 1, which is from a photograph taken before the covering had been placed on the main dome, and before the steelwork of the two smaller domes had been erected. The form of the building, as will be observed, is that of a Latin cross, with the three towers or domes at the extremities. The long axis of the building runs east and west, and is 326 ft. in length. The large dome which contains the 40-in. telescope is at the western extremity and is 90 ft. in diameter. The building is constructed of brown Roman brick with terra cotta ornaments of the same color. The credit of the architectural design is due to Mr. Henry Ives Cobb, of Chicago, Ill., but the general form of the building and its interior arrangements were determined by Prof. Geo. E. Hale, the Director of the Yerkes Observatory.

The chief interest of the observatory from an engineering standpoint lies in the main dome, and its operating machinery, but a brief statement may be made of some of the minor features of construction and equipment. The northeast tower or dome will contain a 12-in. telescope now located at the Kenwood Observatory of the University of Chicago, and is 30 ft. in diameter. The southeast tower is also 30 ft. in diameter and will contain a 16-in. telescope. Between the three towers the space on the two floors of the building will be occupied by a meridian room, a heliostat room, spectroscopic and chemical laboratories, instrument and computing rooms, library, instrument and optical shops, and numerous smaller rooms for different special operations connected with the work of the observatory. A power-house for supplying the necessary power for the various machines is located about 750 ft. from the large dome of the observatory, and is equipped with two 8×10 ins. Ideal engines, each operating a Seimens-Halske dynamo, with a capacity of 200 amperes at 125 volts.

The main tower, in which the 40-in. telescope is located, may, for the purpose of this description, be divided into the revolving dome, the rising floor, the operating machinery and the telescope proper. The circular wall of the tower terminates at a height of 52 ft., and is surmounted by a dome 90 ft. in diameter and 60 ft. high, which revolves on a circular track on the tower walls. Figs. 2 and 3 show a plan and vertical section of the steelwork for the dome. As will be seen the framework is composed of two main girders or arches, standing on each side of the observing slit, and 18 secondary arches, all of lattice girder construction. These main members carry lattice purlins, which act as sway frames, and also jack rafters of channels, which support the sheathing. This sheathing is 1-in. matched pine, covered with tin, the whole idea being, of course, to make the structure as light as possible, since it has to be revolved around to accommodate the telescope.

The principal difficulties in the designing, it will be seen, were, first, that a clear opening, 12 ft. wide, had to be left in the dome from about the horizontal to 6 ft. beyond the vertical, and, second, no ties were possible across the bottom to hold the feet of the arches together. The second of these difficulties was overcome by constructing a heavy circular lattice girder around the rim, to which the feet of the arches were attached. To provide against the first difficulty the strength and rigidity of the main arches had to be depended upon. The opening for the telescope or observing slit, was covered by two shutters, each made up of two curved plate girders, braced together by angle iron bracing and resting on rollers at the top and bottom. These shutters roll each way from the center of the slit to allow for the necessary opening. Besides the regular shutters for covering the opening it was necessary to provide for a light canvas curtain to cover the slit, when the shutters were rolled back, with the exception of what little space was needed for the end of the telescope. This was accomplished by having a track below the girders carry a little carriage on which the canvas curtain rolled.

As previously stated the dome revolves on a circular track, carried by the tower walls. Fig. 4 shows the construction of this track and of the weather guards at the outer edge of the tower wall. As will be seen, the track consists simply of an 85-lb. T-rail resting on a cast-iron girder bolted to the masonry. This girder was laid in sections 7 ft. 3 58-64 ins. long, or eleven sections, each 30° of arc. Twenty-two cast-steel wheels, 36 ins. in diameter carry the dome on the circular track. The journals carrying these wheels are fitted with roller bearings and are so mounted that the wheels are left free to adapt themselves to any possible inequalities of track.

The object of the rising floor was to render the eye-piece of the telescope equally accessible to the observer at all positions of the instrument. Briefly described, this is a circular floor, 75 ft. in diameter, which is so supported and counterbalanced that it can be made to rise and fall vertically through a distance of 23 ft. A balcony around the inner wall of the tower at each extremity of the travel of the floor gives access to it at these points, while at intermediate points of its travel it is entered from two stairways which connect the two balconies. Figs. 3, 5 and 6 show pretty clearly the general construction of the rising floor, and also several details of the dome construction not shown by the previous illustrations. As will be noticed, an opening is left in the rising floor for the standard supporting the telescope. In construction the floor consists of lattice girders, thoroughly braced, and carrying steel joists, which are covered with a wood floor. The total weight of the rising floor is 37.5 tons.

The machinery for rotating the dome and operating the rising floor is located in the basement, and consists of both hand and power machinery for each duty. To rotate the dome an endless wire cable passes around an angle fastened to the inside of the dome at the bottom. This cable coming from opposite directions passes over two vertical idlers, thence down and around a vertical operating sheave, thence around a tension pulley. The operating sheave is geared with an electric motor or with a hand operating device, as may be desired. An endless hand rope also runs from the sheave in the basement to one on the upper balcony, which allows the dome to be turned from either balcony or any intermediate point between them. The method of operation, it will be seen, is quite simple; the wire cable runs entirely around the dome horizontally, as if it were a large drum, and is held taut by the tension weight, while the operating sheaves give it the required motion. To raise and lower the rising floor four rope drums are placed, as shown by Fig. 7, and operated by worm gears on shafts radiating from a central motor. These drums are place 90° apart, where the columns, which guide the counterweights, are also placed. At each column is a wire cable which is attached to the top of the floor and thence passes to and over a sheave, and has its opposite end fastened to the counterweight. From the bottom of the counterweight another cable passes to and around the drum in the basement and thence to an attachment on the bottom of the floor. The floor and counterweight thus form links in an endless cable, whose movement is controlled by the operating drum.

From the foregoing the construction and operation of the 90-ft. dome will be pretty clear. As will be imagined, the erection of the various parts required great care and skill, particularly as the height of the top of the dome from the ground was 115 ft., and as severe storms arise with great suddenness in this region. The framework being mounted on wheels and also being very light, the effect of a sudden heavy wind storm upon the partly connected members was very likely to be disastrous. No accident with the dome proper occurred, however, with the method adopted, which is illustrated in the accompanying cuts.

A derrick was first erected on the brick foundation for the telescope, which was at the center of the tower. The mast of this derrick was about 50 ft. high and the boom 110 ft. long, or long enough to cover the top of the circular tower wall with ease. With this derrick the circular track and the greater part of the dome framing was placed. The first thing done was to erect the two main arches. These being too large to be raised entire inside the tower, the middle section, 35 ft. long, of each was first raised and then the two end sections were raised and connected with it. The feet of the arch were then sprung out to their positions on the circular track. Fig. 8 shows the main arches erected and one-half each of three of the smaller arches connected with them. All the smaller arches were assembled on the ground inside the building, and the halves raised complete with the wheels attached, Fig. 9. The purlins, horizontal girder and bracing between the arches were connected as fast as the arches were placed, Fig. 10 shows the dome framework practically complete, and the shutters in the process of erection. Following the completion of the dome, the standard carrying the telescope was erected, and, finally, the telescope, tube, rising floor, and minor structures put in place. This completed the main structural work of the dome and tower.

It will not be out of place in connection with the foregoing to say a few words regarding the great telescope for which the structures described have been constructed, and through the courtesy of Prof. Geo. E. Hale, Director of the Yerkes Observatory, we have been furnished with the following description:

> Representing as it does an increase in aperture of but 4 ins. over the largest equatorial refractor hitherto constructed, the Yerkes telescope might not at first sight be supposed to offer any special difficulties of construction or design. As a matter of fact, however, the problem of designing a suitable mounting for the 40-in. objective was by no means a simple one. The great weight of the objective, about 1,000 lbs. in its cell, and the desirability of attaching an equally heavy spectroscope at the eye-end made necessary the construction of a tube of exceptional rigidity. The consequent great weight of the moving parts must inevitably increase the difficulty of moving the telescope, and for this and other reasons it was decided to provide a complete system of electric motors and clamps, for the purpose of effecting the various operations usually performed by hand. It will thus be seen that the greatest experience and skill would be required of the designer of a really successful mounting.
>
> After carefully examining most of the great telescopes in American and European observatories, the writer decided to recommend to Mr. Yerkes that the contract for the mounting be awarded to Messrs. Warner & Swasey, not only because of the well-known excellence of their workmanship, but more especially on account of the invaluable experience gained by this firm in designing and constructing the mounting of the 36-in. Lick refractor.
>
> The cast-iron column consists of four sections, tapering from 11 × 5 ft. at the base to 10 × 5 ft. at the junction with the head. These four sections are bolted together, and rest on a cast-iron foot which is firmly anchored to a massive brick pier supported on a concrete foundation 32 × 28 × 5 ft. At the top of the column is the equatorial head, which is cast in a single piece. The column and head rise to a height of 43 ft. above the lowest position of the rising floor, and weigh 50 tons. Surrounding the head is an iron balcony, accessible from the rising floor by means of a spiral stairway on the south side of the column, which also leads to the clock room in the upper section of the head.
>
> The polar and declination axes are of hard forged steel, and weigh 3½ and 1½ tons respectively. The polar axis, 13½ ft. long, has a diameter of 15 ins. at the upper bearing and 12 ins. at the lower bearing. At both of these points the friction is relieved by means of live rings of steel rolls, running in steel yokes, and held against the axis by spring levers. The lower end of the axis rests on a double set of 40 hardened steel balls, 1 in. in diameter. The upper end carries the main driving gear, which has 330 teeth, is 8 ft. in diameter, and weighs one ton. This is driven by a worm geared to the driving clock, and when clamped to the axis sets in motion a mass weighing 20 tons.
>
> The declination axis which runs in Babbitt bearings in the declination sleeve is 12 ins. in diameter and 11½ ft. long. The pressure of this axis upon its bearings, amounting, with the weight of the tube, to about 8 tons, is relieved by a live ring of steel rolls, which greatly reduces the friction.
>
> The tube is made of sheet steel, varying in thickness from 7-32-in. at the center to ⅛-in. at the ends. Its diameter is 52 ins. at the center, 42 ins. at the objective end and 38 ins. at the eye end. It is 60 ft. long, and weighs 6 tons. For the central station, to which the declination axis is bolted, it was considered necessary to use some material more reliable than cast-iron, which is ordinarily employed in smaller mountings. The heavy sheet steel selected for this purpose seems to be in all respects satisfactory.
>
> The driving clock stands in the clock room in the upper section of the column, where it is easily reached from the spiral stairway. The double conical pendulum, mounted isochronously, makes sixty revolutions per minute. It is provided with a simple electric control. An electric motor automatically winds the clock when the driving weight has reached a point near the limit of its run.
>
> The telescope is so designed that it would be in perfect balance with the spectroscope weighing about ½ ton attached to the eye end. When the spectroscope is removed iron weights are clamped to the tube near the eye end in order to restore the balance.
>
> The clamps and slow motion can be operated by the observer at the eye end, where the fine declination circle can also be read. An assistant on the balcony can move the telescope in both right ascension and declination, and read the fine hour circle. The divisions of the coarse circles are visible from the floor.
>
> In addition to the ordinary appliances just referred to for actuating the quick and slow motions and clamping the telescope, a complete system of electric motions, clamps and illumination is also provided. Conveniently placed switches at the eye end and on the equatorial head, enable the observer or his assistant on the balcony to start or stop the slow motion motors, and to clamp or unclamp in right ascension and declination by simply pressing knobs. The quick motion motors are controlled from the balcony by switches, and from the eye end by cords. The circles are illuminated by incandescent lamps, connected with switches at the eye end and on the head. Provision is also made for electric illumination of the micrometer wires.
>
> The 40-in. objective of the Yerkes telescope was made by the firm of Alvin Clark & Sons, Cambridgeport, Mass., from disks furnished by Mantos of Paris. The crown lens is about 2½ ins. thick at the center and ¾-in. at the edge; it weighs 200 lbs. The flint lens, which is separated from the crown by a distance of 8⅜ ins., is about 1½ ins. thick at the center, 2 ins. thick at the edge, and weighs over 300 lbs. The lenses are mounted upon aluminum bearings in cast-iron cell.

The structural work for the dome and rising floor was designed by the King Bridge Co., Cleveland, O., Mr. W. P. Brown, Assoc. M. Am. Soc. C. E., Engineer, under the direction of Warner & Swasey, of Cleveland, O., who had the contract for the dome as well as for the telescope. The erection was done by R. S. Write & Co., of Pittsburg, Pa. We are indebted to these various firms and to Prof. Geo. E. Hale, of Yerkes Observatory, for the information from which this description has been prepared.

NOTES FROM RECENT WATER-WORKS REPORTS.

Unusual precautions to secure water tightness were taken in the construction of the larger Wachuset aqueduct of the Metropolitan water system where it is laid on the Assabet bridge. This bridge is of masonry, 359 ft. long, with 30 ft. of masonry aqueduct not on the bridge. The interior lining of the aqueduct is of 8 ins. of brick. A continuous lining of sheet lead was placed back of the brick. The sheets were 16 ft. long, 9 ft. wide, and weighed 5 lbs. per sq. ft. They were burned together without the use of solder. Before placing the lead the bottom and sides of the aqueduct against which it was to be placed were smoothly plastered, and then painted with asphalt. After the lead sheets were in place they were covered with a thick layer of asphalt. The top of the whole bridge was covered with granolithic material laid on two thicknesses of roofing felt, covered with coal tar. This was done to prevent the rain from soaking into the masonry, as well as to give the bridge a suitable finish. Various other features of the work of the board have been described in these columns from time to time. The report of the board for 1897 is a very interesting document. Mr. F. P. Stearns, M. Am. Soc. C. E., of Boston, Mass., is Chief Engineer of the work, and Mr. Thos. F. Richardson is Engineer of the Dam and Aqueduct Department, under which head comes the job described above.

The entire flooded area of the new Hobbs Brook storage and settling reservoir of the water-works of Cambridge, Mass., was cleared of all muck and other soil containing organic matter until sand, gravel or boulders were reached. The basin has an area of 653 acres and a storage capacity of 1,500,000,000 gallons. About 300 acres of land surrounding the water surface was bought by the city for the sanitary protection of the water. A large amount of riprapping of artificial slopes of the basin was done in order to prevent the growth of vegetation and erosion of the banks by waves, each of which might prove deleterious to the stored water. The riprapping, to the close of 1897, had cost about $125,000. The cost of removing the soil, mentioned above, is not stated, but it must have been large. This work is one of the most notable instances of water supply protection that has yet arisen in this or any other country. Practically nothing of the sort has been done outside of New England, and most of this work there has been confined to Massachusetts, and in that state to Boston and its vicinity. Mr. Edwin C. Brooks is Acting Superintendent of the Cambridge water-works.

A wrought-iron water tank, 65 ft. in diameter, 55 ft. high, and having a capacity of 1,365,000 gallons, was built at Fall River, Mass., in 1897. The bottom of the tank is made of ½-in. plates. The side plates are from 11-16 to 5-16-in. thick. Angle irons ½-in. thick are placed at the top and bottom. The bottom angle is 5 × 5 ins., on the outside, double-riveted to the bottom and sides. The top angle is 5 × 5 ins., with the horizontal member down. Although the water consumption at Fall River in 1897 was only 36.29 gallons per inhabitant, or 37.64 per consumer, Mr. Patrick Kieran, Superintendent of the water-works, shows by tables and diagrams that 40% of the pumpage can be accounted for only by leakage from the mains or else by leakage and waste through unmetered services. Of 6,422 services, 5,954 are metered. The water unaccounted for is heaviest in the winter months, indicating that unmetered consumers let the water waste to prevent their pipes from freezing. Mr. Kieran advises that meters be placed in a number of places where the premises are connected with the sewers.

The new Hawkes Brook storage reservoir of the water-works of Lynn, Mass., yielded good water when first drawn from, contrary to the experience with many new reservoirs. This is attributed by Mr. John C. Haskell, Superintendent of the water-works, to the stripping of the site of all organic matter down to "the level at which water can waste from the pond," and covering the remainder of the flooded portion "with about 1 ft. of gravel and sand." The reservoir has an area of 75 acres and a capacity of 300,000,000 gallons. The extra work just described cost about $23,000. In 1894-5-6 much soil was removed from the bottom of Walden pond and the swamps in the drainage area were drained. In 1897 the water from this source was much better than in previous years, when it had had a disagreeable taste and odor.

Two heavy rainfalls occurred at New Bedford, Mass., in 1897, as recorded by Mr. Thos. Rodman, and given in the last report of Mr. R. C. P. Coggeshall, Superintendent of the water-works. On Aug. 16, there was a thunderstorm, during which 3.57 ins. of rain fell in three hours, or 1.19 ins. per hour. Sewers were overtaxed and much damage was done. During a 36-hour storm, beginning on Nov. 1, there fell 5.67 ins. of rain, of which 5 ins. fell in 20 hours. From May 1 to Sept. 1 the total rainfall was 22.69 ins.

Algae growths in the Ludlow reservoir of the water-works of Springfield, Mass., continue to give trouble, as they have to a greater or less extent ever since the reservoir was constructed, now many years ago. The last report of the water commissioners states that by emptying the reservoir five years ago the water from it was greatly improved for two years, but towards the end of the season of 1894, algae again became abundant, while in 1897 the water was rendered unfit for use. The rainfall was so abundant last season that this did not matter much, but the board says the storage will be more necessary in the future, so that "something will soon have to be done to purify this large body of water." The capacity of this reservoir, according to "The Manual of American Water-Works" for 1897, is 2,000,000,000 gallons. Mr. J. C. Hancock is superintendent of these works.

The approximate cost of laying ordinary water pipes at Providence, R. I., with all appurtenances except hydrants, and including iron at $30 per long ton, is given in the last report of Mr. Otis F. Clapp, City Engineer of Providence, as follows:

Size, ins.	Cost, per lin ft.	Size, ins.	Cost, per lin. ft.
4	$0.498	16	$2.403
6	.725	20	3.359
8	.973	24	4.454
10	1.244	30	6.348
12	1.593	36	8.540

Mr. Edmund B. Weston, M. Am. Soc. C. E., is the Assistant Engineer in Charge of the water department.

A special report on "The Relation of the Water Supply, of Elmira, N. Y., to the Typhoid Fever Epidemic of 1896," has recently been published by the Board of Health of that city. The report was made by Prof. Olin H. Landreth, M. Am. Soc. C. E., of Schenectady, N. Y., Consulting Engineer to the New York State Board of Health, and the conclusions drawn were noted in these columns shortly afterward. The water company has since installed a mechanical filtration plant.

The total amount of water pumped at Poughkeepsie, N. Y., was less in 1897 than in 1886, notwithstanding the fact that the number of taps has increased from 1,699 to 2,947 in the last eleven years. This consumption per tap averaged only 572 gallons a day in 1897, against 1,003 gallons in 1886. These figures are doubtless to be accounted for by the fact that of the 1,699 taps in use in 1886, only 433, or less than one-fourth, were metered, while in 1897 over three-fourths of the taps, or 2,244 out of 2,947, were metered. It should also be noted that the water supply of Poughkeepsie has been filtered through these and previous years, and that the filters have long been operated at least to their full capacity. Had the total consumption been allowed to increase as in many other cities, the duplication of the filter plant, recently effected, would have been imperative long ago. The population of Poughkeepsie in 1890 was 22,000, and the average daily consumption in 1897 was 1,688,298 gallons. Mr. Chas. E. Fowler is, and has been for many years, superintendent of the water-works at Poughkeepsie.

Only some 20 to 30 of the 4,187 service pipes connected with the water-works of Yonkers, N. Y., were unmetered at the close of 1897. The estimated population of the city was 42,000, of which it is estimated that 35,000 were on streets provided with water and 34,000 were actually supplied. The average daily consumption, stated in a variety of ways, was as follows: Total, 3,588,307 gallons; per inhabitant, 83; per consumer, 102; per tap, 857; per domestic meter, 174; per manufacturing meter, 7,396 gallons. About 20% of the total consumption passed through the 4,031 domestic meters. Mr. A. W. Kingsbury is now acting clerk of the works, Mr. Jos. Lockwood, for many years superintendent, and lately clerk in addition, having died last August.

The benefits of the meter system are still further illustrated by the last report of Mr. W. C. Hawley, Assoc. M. Am. Soc. C. E., Superintendent at Atlantic City, N. J. The cost of coal used at the pumping stations has been greatly reduced through the reduction in consumption; and enlargements to the plant estimated to cost $250,000 have been indefinitely postponed. Tin-lined galvanized iron has been used with satisfaction for service pipes. Mr. Hawley states that it costs less than the tin-lined lead pipe, and is believed to be as durable. The commissioners of these works state that a reduction in the meter rate from 18 and 14 to 12 cts. per 1,000 gallons has been made possible by raising $12,100 by general taxation, thus placing the burden of fire protection and water used for other public purposes where it belongs, upon the property benefited. The commissioners recommend that the minimum meter rate vary with the amount that would be charged for water at fixture rates.

A special report on filtration has been published by the water commissioners of Reading. Slow sand filtration is recommended, as previously noted in this journal. The pamphlet contains reports by Mr. Emil Nuebling, Superintendent and Engineer of the works, and Mr. Allen Hazen, Assoc. M. Am. Soc. C. E., Consulting Engineer, 220 Broadway, New York city, and copies of reports for the city of Philadelphia, by Prof. E. G. Smith, Madison, Wis., Prof. Wm. P. Mason, Troy, N. Y., and Mr. Rudolph Hering, M. Am. Soc. C. E., New York city. During the investigation preceding the reports, experimental filters were operated for a number of months, including ordinary filter beds and beds built on the plan of the Pennsylvania Sanitation Co., of Philadelphia. Numerous analyses of applied water and effluent are given in the report.

The Great Falls dam across the Potomac River, at Washington, D. C., was raised 2½ ft. in height for a distance of 2,095 ft. in the years 1895 and 1896. As a strong current of water, giving a head of from 3 to 5 ft. on the upstream side, flows over the dam, and as the river carries much driftwood at times, it was decided to use cofferdams, enclosing as much of the dam as the workmen could raise in a single day. Two wooden bulkheads, each 30 ft. long, were placed at the upper face of the dam, inclining upstream and held in place by the pressure of water above, resisted by 1½-in. iron bolts sunk into the old masonry. The bulkheads were composed of five 2 × 12-in. Georgia pine planks, placed edge to edge, fastened together longitudinally by five 2 × 12-in. cleats, 40d. nails being used.

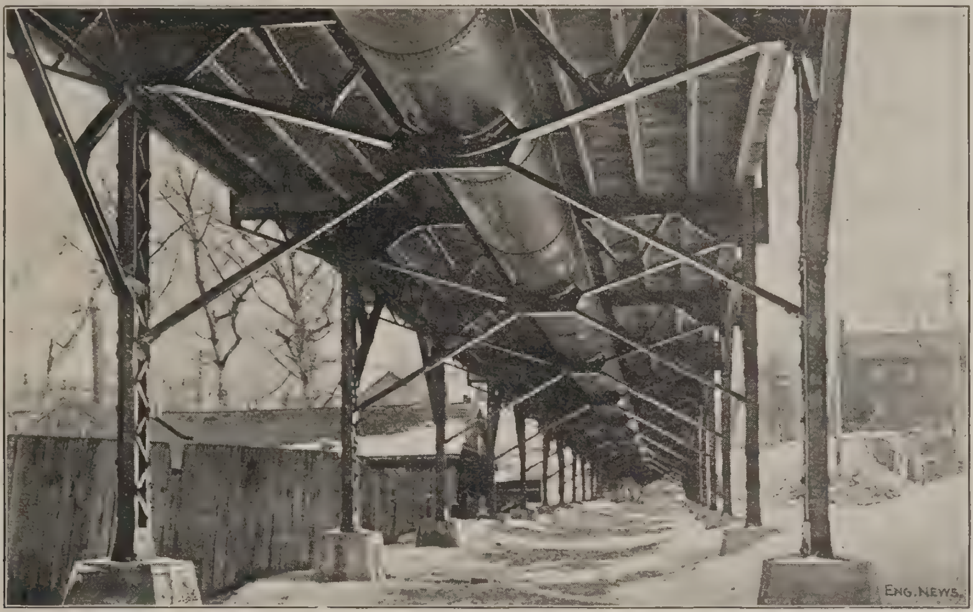
Sand bags were used for end dams. The average width of the masonry was about 8 ft. The work was done by contract in 176 working days, 84 working days being lost by high water, and 23 by lack of stone. The total cost of the cofferdams, including furnishing, setting and calking, was $2,064, or 98½ cts. per lin. ft. The total cost of raising the dam 2½ ft. for a distance of 2,095 ft. was $86,373, including $10,245 for a suspension cableway furnished by Mr. R. H. Hood, of Washington, D. C. The work was carried out under the direction of Capt. D. D. Gaillard, Corps of Engineers, U. S. A., in Charge of the Washington Aqueduct, and is described, with illustrations, in Appendix AAA. of the Annual Report of the Chief of Engineers for 1897.

The above report, which doubtless may be obtained by addressing Captain Gaillard, contains an interesting account of measurements of the flow through the old Washington Aqueduct. In this work the velocity was obtained by using a Buff & Berger current meter, provided with an electric register. Readings were taken through manholes, an index frame marked to correspond to 33 different points in the cross-section of the aqueduct being employed in taking the readings. The readings recorded were the average of two readings at each point, the second set in inverse order. The cross-section of the aqueduct was divided into 16 areas, "and the volume of flow per second through each of these areas was computed. The mean velocity was then computed by dividing the sum of these volumes by the total area of the conduit section." The carrying capacity of the conduit at low water in the Potomac was found to be about 75,000,000 gallons per day. The report contains a discussion of some of the hydraulic problems involved which might be of interest to those having large aqueducts in their charge, although the local conditions at Washington are in some respects exceptional.

Crude oil was used for fuel by the Detroit water-works for several years, but was discontinued in 1896, after the price had been raised from 1.55 to 2.8 cts. per gallon. For the year 1895, with crude oil at 1.55 cts. per gallon, the cost of fuel was $2.18 per 1,000,000 gallons. In 1897, using semi-bituminous coal costing from $2.40 to $2.60 a ton, the cost of fuel was $1.40 per 1,000,000 gallons, and the pressure had been increased 4½% meanwhile. The Detroit works continue to show the beneficial results of waste prevention, the total pumpage for 1897 being less than it was in 1887, although the number of families supplied has increased from 34,486 to 54,945. There seems to be plenty of room for further improvement, as the daily consumption in 1897 is given as 125 gallons per capita. The already low water rates were cut in half during 1897, and it estimated that the average amount paid by each family for water in 1898 will be only $4.02. Mr. L. N. Case is general superintendent of the works, and Mr. Gardner S. Williams is civil engineer. During the year Mr. Williams has made studies, by means of temperature observations and otherwise, of the possible pollution of the supply at the intakes from shore currents. The temperature studies were based on the fact that the shore currents would be warmer than the others.

The report of Mr. F. E. Herdman, Chairman of the Water Committee of Winnetka, Ill., is a good example of the value of an engineer as a member of a water board. Winnetka is a small suburb of Chicago, which built works in 1893. In his report Mr. Herdman presents a careful analytical study of the financial operations of the works, and shows how economies might be introduced by improvements in the plant. His report is a strong contrast with those of most small and many large works, and shows the value of accurate scientific records. Comparatively few works, if we can judge from the annual reports received, have their records kept in a way designed to throw the proper light on the economy of the operation of the different parts of the plant. Judging from the experience at Detroit, cited above, Mr. Herdman's allowance of 1.7 cts. per gallon as the price at which crude oil could be bought as fuel is too low, unless freight rates and other conditions would be more favorable in the vicinity of Chicago than at Detroit. The latter city paid only 1.5 cts. per gallon for oil at the start, but the price was advanced slightly soon afterwards, and finally, by a sudden raise, was fixed at 2.18 cts.

The last report of Mr. F. W. Cappelen, City Engineer of Minneapolis, contains descriptions of improvements to the water-works system, including a double line of 50-in. steel force and distributing mains 16,676 ft. long, 890 ft. of single 50-in. steel pipe, and 15,758 ft. of single 16-in. cast-iron drain pipe, apparently in the same trench as the steel pipe. The pipe line included a submerged river crossing about 750 ft. in length. The contract for this work, with all appurtenances, was let to the T. A. Gillespie Co., of Pittsburg, Pa., for $343,726. Winston Bros., of Minneapolis, bid $477,500 for the job, using cast-iron throughout.



VIEW UNDERNEATH APPROACH TO THAMES RIVER BRIDGE, LONDON, ONT., SHOWING STEEL PIPE SEWER.

A. O. Graydon, City Engineer; Willis Chipman, Consulting Engineer; E. Leonard & Sons, London, and Central Bridge & Engineering Co., Peterboro, Contractors.

The coating for the steel pipe was mineral rubber asphalt from Utah, manufactured by the Assyrian Asphalt Co., of Chicago, the pipe being dipped vertically in a bath at a temperature of 300° F. This coating, or some other equally good, was named in the specifications, the final determination to be made by the city engineer. Mr. Cappelen tested this coating, together with Trinidad asphalt, mixed with dead oil, used by the Hugo Iron Works, of Duluth, Minn., on the new 42-in. steel pipe in that city; California asphalt from Waldorf, Cal., and the same mixed with about 40% of maltha; and finally a coating from Dennis, Long & Co., of Louisville, Ky. The details of these tests and analyses of the mineral rubber, Trinidad and combined California asphalt and maltha coatings, which three were considered the best of the five, are given in the report. Regarding the mineral rubber coating, Mr. Cappelen says:

> Coating covered the pipe splendidly in all cases and somewhat thicker for the 300° (against 400°) temperature and stood hammer test perfectly. The material is so elastic that by cutting into the coating and entirely removing some of it, the opening can be covered by simply hammering the edges around the space so that it is impossible to see the joint. The coating did not foam even up to 700° F.
>
> The mineral rubber coating (on special plates.—Ed.) was not affected by muriatic acid (H C L) nitric acid ($H N O_3$) nor by sulphuric acid $H_2 S O_4$.

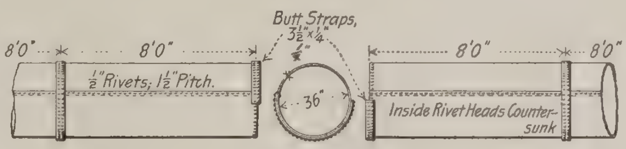
The cost per ton of the mineral rubber coating is given as about $60; for the Trinidad, $45; and for the California and maltha, $40. The contract for this pipe line was executed on June 22, the award having been made on June 18, and the contract time for doing the work being five months, with a bonus and penalty clause of $250 per day. Ground was broken July 18, the first pipe was laid July 29, and the work completed Nov. 9, the contractors thus earning a bonus of $2,250. A force of 500 men, two steam shovels, for trenching and back-filling, respectively, two air compressors and one pumping outfit were employed. On Aug. 24 there were laid 1,120 ft. of 50-in. steel pipe, which Mr. Cappelen says "is a record unequalled anywhere."

The report contains a "Chart Showing Relations Between Rainfall, Sanitary Improvements and Typhoid Fever in Minneapolis, Minn., from 1870 to 1897." The chart shows that while sanitary improvements have lowered the typhoid death rate very materially, there is still opportunity for much further improvement, there having been 70 deaths per 100,000 from typhoid in 1897. Filtration of the whole water supply is a part of the scheme of improvements adopted some time ago.

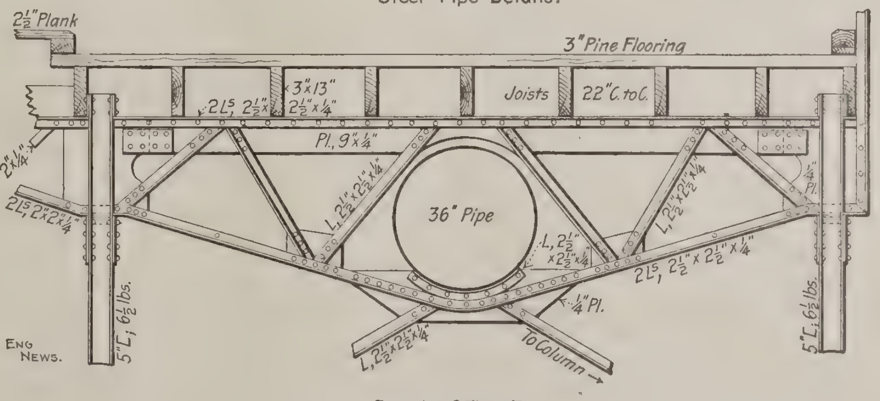
To encourage the use of meters at St. Paul, they are furnished by the water department without charge to the consumer, and also set free of charge. We have already expressed our opinion on this subject to the effect that meters should be considered as a part of the water-works plant and charged to construction. Of course there may be exceptions to this, as well as any other detail of water-works practice. In some cases the financial condition of the works, or the powers granted to the water department, will not allow the practice, but generally these difficulties might be surmounted if the resulting advantages were half appreciated. Mr. John Caulfield is secretary of the St. Paul works.

CARRYING A STEEL PIPE SEWER ACROSS A BRIDGE AT LONDON, ONTARIO.

In the construction of the intercepting sewers for London, Ontario, it was necessary to carry a 36-in. main sewer across the River Thames at an elevation of 24 ft. above low water. The portion of the sewer exposed is about 630 ft. long, and it was thought advisable to construct a steel truss bridge, of 162 ft. span, with viaduct approaches of 468 ft. to carry a 16-ft. roadway and 4-ft. walk, and supporting beneath the floor a 36-in. steel pipe for the sewage flow. The floor beams throughout were spaced 18 ft. apart, and their construction is clearly shown on the cut herewith.



Steel Pipe Details.



Details of Floor Beam.

CROSS-SECTION OF THAMES RIVER BRIDGE, SHOWING METHOD OF SUPPORTING STEEL PIPE.

The sewer pipe was built of ¼-in. plates, 8 ft. long, lap-jointed longitudinally and butt-jointed transversely. Below the horizontal diameter all rivet holes were countersunk, thus leaving the bottom half perfectly free from obstructions. The pipes were given two coats of pure graphite paint (inside and outside), over one coat of red lead. They were put together in the shop in 32-ft. lengths, and, to facilitate jointing in the field, the butt-strips on their ends were made in halves (upper and lower alternately). No difficulty was found in putting them in position, as much as 200 ft. being erected in one day under the viaduct. There are three curves in the pipe line and these were made to conform to a central radius of 74 ft.—the center of each seam coming on the arc of the circle.

The piers and pedestals (for columns) were made of concrete throughout, with four stone bridge-seats. The main body of the work was composed of concrete of the following proportions: Six parts of crushed stone, two parts sand, one part crusher screenings, one part Portland cement. The whole of the exposed surfaces were faced with 3 ins. of 2 to 1 mortar deposited at the same time as the rest of the work, and pressed firmly against the molds.

The concrete was laid in layers of from 9 to 12 ins. and gently rammed, not more than 3 ft. in depth being laid in any one day. On removing the molds the main piers were washed over with three coats of cement wash. The tops of the piers and pedestals are finished with 6 ins. of a concrete made of one part of cement, one part of sand and three parts of crusher screenings. A stonemason having to cut out some of this concrete a month later, said "it was harder cutting than limestone."

The molds used were of smooth 2-in. planks made in 4-ft. frames, held in position by iron rods passing through the piers, and so arranged that small bolts with hooks at their ends could be easily drawn out when the molds were to be removed. The west river pier was laid on a 10-in. timber foundation, resting on piles spaced 2 ft. 6 ins. on centers, while for the east pier hard clay was found at about 6 ft. below the river level. About 425 cu. yds. of concrete were laid. Canadian Portland cement was used throughout, giving high tensile tests and being very finely ground. Not more than 5% residue was left on a 2 sieve of 100 meshes per inch.

The work was designed and carried on under the direction of Mr. A. O. Graydon, City Engineer, and Mr. Willis Chipman was Consulting Engineer for the sewer system. The steel pipe was built by E. Leonard & Sons, of London, and the Central Bridge & Engineering Co., of Peterboro, built the bridge and erected the pipe. The cost of the work was about $12,750. We are indebted to Mr. W. T. Ashbridge, Assistant Engineer, in charge of sewers, for the material from which our illustrations and description are prepared.

TRACK ELEVATION AND DEPRESSION AT THE 16TH ST. CROSSING, CHICAGO.

One of the most extensive and complicated systems of railway tracks in the world is that which occupies the district along the Chicago River, from 14th St. to 22d St., which district contains the freight and terminal yards of a number of railways, and through which run a multitude of main tracks, crossing and connecting in a most bewildering manner. In fact, if a person undertakes to walk across this district he finds it somewhat difficult to keep his bearings. On the large proportion of this district, which is devoted exclusively to railway purposes, there is little need of track elevation, and safety to the train service entering and leaving the district is ensured by a complete interlocking switch and signal plant established at the outlet at Stewart Ave. and 21st St. This plant was described and illustrated in our issues of Sept. 22, 1892, and Nov. 16, 1893, and in the latter issue we published a map of the tracks throughout this entire district.

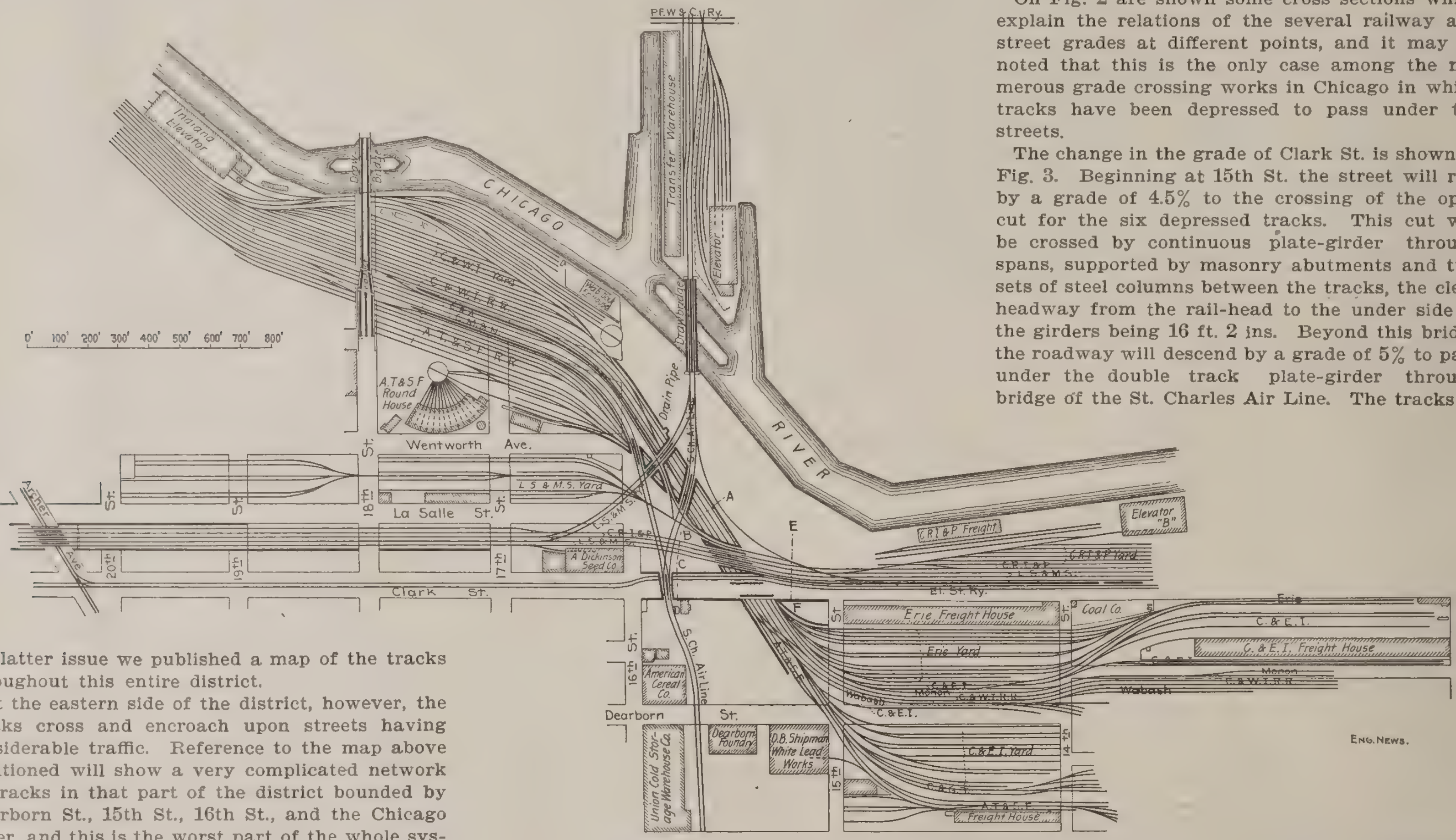


FIG. 1.—PLAN OF TRACK ELEVATION AND DEPRESSION TO ELIMINATE THE GRADE CROSSINGS AT 15TH AND 16TH STS., CHICAGO.

James Dun, M. Am. Soc. C. E., Supervising Engineer;
G. W. Vaughn, M. Am. Soc. C. E., Engineer in Charge.

At the eastern side of the district, however, the tracks cross and encroach upon streets having considerable traffic. Reference to the map above mentioned will show a very complicated network of tracks in that part of the district bounded by Dearborn St., 15th St., 16th St., and the Chicago River, and this is the worst part of the whole system, as there is a constant traffic of trains and switching movements, interfering with and endangering the street traffic. It is this section of the district which is dealt with in the present article. The interlocking plant above mentioned does not protect any tracks or crossings north or east of 18th St., and the railway crossings of this section were protected only by flagmen, while the Clark St. crossing was protected by gates.

This particular section, known as the 16th St. crossing, is probably the most complicated system of grade crossings in Chicago. It comprises a network of connecting and intersecting tracks, over which there is a continual traffic, including main line and suburban passenger trains, freight trains, light engines, and freight and passenger switching movements, to say nothing of the constant service of electric cars on Clark St. There is a daily movement of 5,000 cars and 500 engines, and the passage of this crossing was often enough to try the nerves of the street car passengers, who beheld engines and trains apparently moving upon them from all directions.

At this point the parallel tracks of the Chicago, Rock Island & Pacific Ry. and the Lake Shore & Michigan Southern Ry., running south from the Van Buren St. terminal station, and close to the west side of Clark St., are crossed diagonally by the tracks of the Atchison, Topeka & Santa Fe Ry. and the Chicago & Western Indiana R. R., which start from the Polk St. passenger terminal station and the various freight yards east of Clark St. Just beyond, the roads first mentioned are crossed at right angles by the tracks of the Chicago, Madison & Northern Ry. and the St. Charles Air Line (Illinois Central R. R.), which connect with the Illinois Central R. R. main line tracks on the lake front. These are not merely crossings, but every line is connected with every other line and with numerous freight tracks in order to provide for the interchange of cars between the various roads. Some idea of the traffic may be gathered when it is explained that, in addition to the roads named, the trains of the New York, Chicago & St. Louis Ry. now run into the Van Buren St. terminal station, and that the Chicago & Western Indiana R. R. is a terminal road used by no less than seven railways (the Atchison, Topeka & Santa Fe Ry., Chicago & Eastern Illinois R. R., Grand Trunk Ry., Chicago, Indianapolis & Louisville Ry., Erie R. R. and Wabash R. R.).

When the city of Chicago undertook in earnest the elimination of the numerous grade crossings of the streets by compelling the railways to elevate their tracks, this crossing came up for consideration, but the difficulties of preparing a satisfactory plan which would be accepted by the city and by all the railways interested were so great that the matter has been laid aside from time to time until the present year, when, by agreement, the entire work was put into the hands of Mr. James Dun, M. Am. Soc. C. E., Chief Engineer of the Atchison, Topeka & Santa Fe Ry. The difficulties arose largely from the fact that it was desired, in making the change, to separate the grades of the different railways, and thus, as far as possible, eliminate track crossings as well as highway crossings at grade. Considering that the tracks had still to be connected by switches and turnouts, it will be seen that the problem to be solved was difficult and complicated. The plans were finally agreed upon, however, by all parties concerned. Work was commenced on April 24, and is to be completed this season. Major G. W. Vaughn, M. Am. Soc. C. E., is the Engineer in Charge.

The accompanying plan, Fig. 1, shows the arrangement of tracks as it will be when the work is completed. The four tracks of the C., R. I. & P. Ry. and the L. S. & M. S. Ry. (running north and south), will be elevated about 12 ft., as a continuation of their track elevation which now extends north from Englewood to 16th St. (Eng. News, March 17.) The six diagonal tracks (two for the A., T. & S. F. Ry. and four for the C. & W. I. R. R., and the lines using it), will be depressed about 9 ft., passing under the elevated lines and under Clark St. in an open cut with vertical concrete retaining walls. The St. Charles Air Line and C., M. & N. Ry. will be elevated, so that there will still be one railway crossing at grade, a double track line crossing four tracks at right angles. The arrangement makes it necessary to change the grade of Clark St., which will be raised to pass over the depressed tracks and then inclined downward to pass under the elevated tracks of the St. Charles Air Line. The elevation of this latter line has made it necessary to raise the grade of the South Side Elevated R. R., which crosses it just east of State St.

On Fig. 2 are shown some cross sections which explain the relations of the several railway and street grades at different points, and it may be noted that this is the only case among the numerous grade crossing works in Chicago in which tracks have been depressed to pass under the streets.

The change in the grade of Clark St. is shown in Fig. 3. Beginning at 15th St. the street will rise by a grade of 4.5% to the crossing of the open cut for the six depressed tracks. This cut will be crossed by continuous plate-girder through spans, supported by masonry abutments and two sets of steel columns between the tracks, the clear headway from the rail-head to the under side of the girders being 16 ft. 2 ins. Beyond this bridge the roadway will descend by a grade of 5% to pass under the double track plate-girder through bridge of the St. Charles Air Line. The tracks of the Clark St. electric line, however, will descend on a somewhat steeper grade. These tracks will be at one side of the street, as shown in Figs. 1 and 2, and the portion of the roadway which they occupy, 26 ft. in width, will be separated from that used for street traffic, 42 ft. wide, by a dwarf wall and iron fence. Under the Air Line railway bridge the clear headway will be 12 ft. for the roadway and 13 ft. 6 ins. for the electric railway. South of this bridge the grades of the roadway and the car tracks will rise, approaching each other until they coincide at the point where they meet the present grade of the street, just north of 16th St. The new grade of the street will be about 10 ft. above the present grade at the depressed tracks, and about 1.6 ft. below it at the bridge under the St. Charles Air Line.

The retaining walls are all of concrete, and present a very good appearance, while the great advantage of this material is its low cost and the rapidity with which the walls can be built. The foundations are in a good stiff clay, the engineers having been agreeably disappointed in not finding the soft spots or pockets which had been expected. The concrete is mixed by machinery in a work train consisting of cars loaded with cement, sand and broken stone, a flat car at the head of the train being equipped with an engine and boiler to drive the mechanical mixer. When the train is in place on the side track, planks are nailed upon the cars, along which the materials are carried in wheelbarrows to the mixing plant. The concrete is made very wet, is carried to the site in iron wheelbarrows, and is kept well rammed. Two of these mixing plants are in use, being operated by the Brownell Improvement Co., which has the contract for the concrete work, which work is to be finished by August.

The incidental work includes the laying of new gas mains across the site, and the laying of pipes to drain the open cut for the depressed tracks. For this latter purpose 12-in. pipes will lead to three 24-in. pipes discharging into the river. To prevent flooding by high water in the river, there will be a pump house, with stop wall and gates built just behind the retaining wall. The gates will be closed by the back pressure from high water in the river, and a centrifugal pump will then lift the drainage water from a well or sump and discharge it into the river. During construction there is a continual rearrangement of the tracks. There are still in use 35 grade crossings within a radius of 150 ft., and the handling of trains over these various crossings is effected by a system of watchmen and flagmen who are very expert in keeping the traffic moving without confusion or accident. During the work a part of Clark St. has been closed to traffic and the electric cars have been diverted to another route.

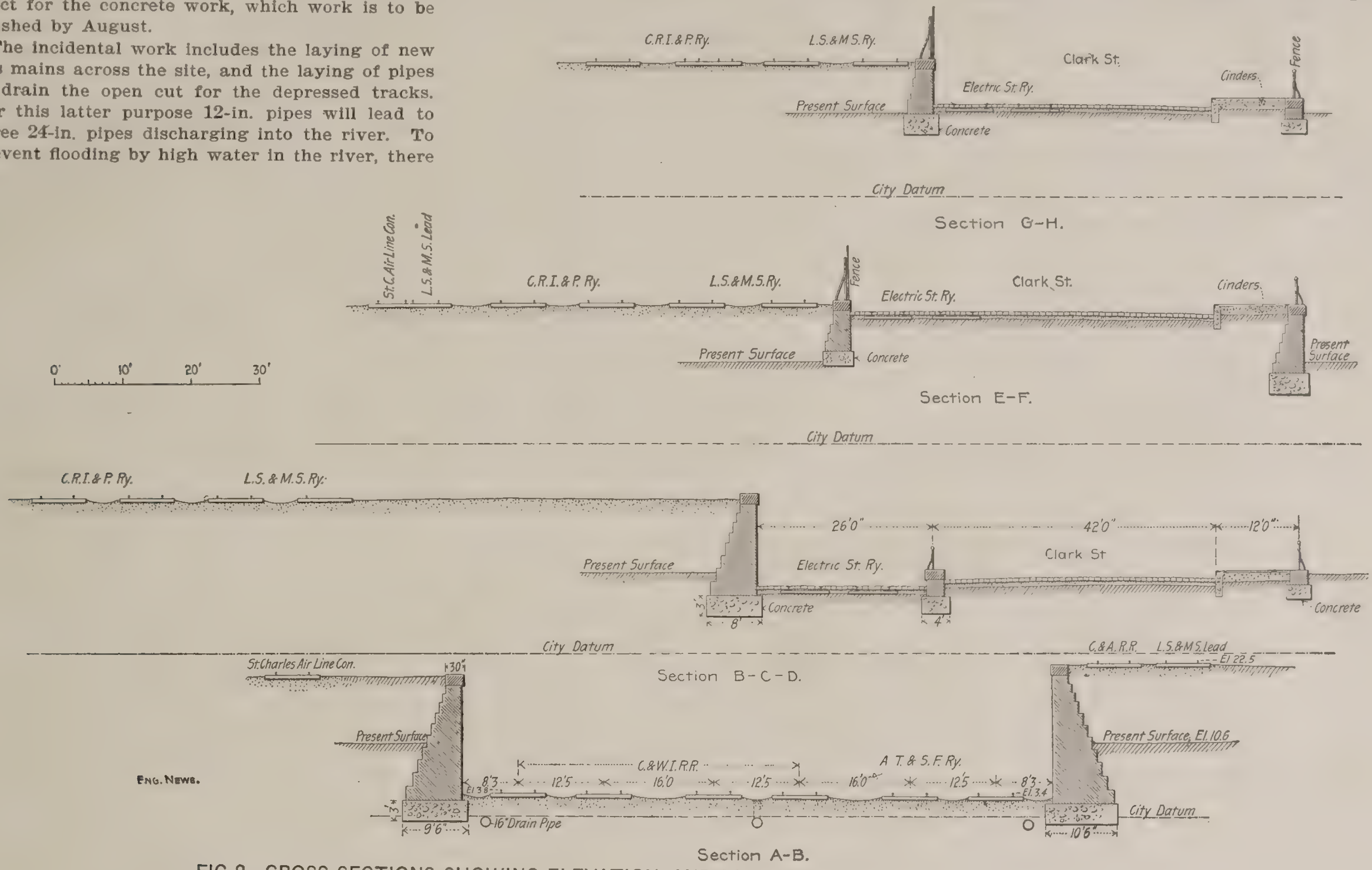


FIG. 2.—CROSS SECTIONS SHOWING ELEVATION AND DEPRESSION OF RAILWAY AND STREET GRADES.

When the retaining walls are built as far as the existing arrangements will permit, the filling in will be done for the elevation of the tracks of the L. S. & M. S. Ry. and C., R. I. & P. Ry. to their permanent grade. At the same time, some of the tracks of the A., T. & S. F. Ry. and C. & W. I. R. R. (which are ultimately to be depressed) will be raised to the same grade by sand filling, and will temporarily cross the other elevated tracks at grade. When this is done, the other tracks of the two latter roads, remaining on the surface, will be lowered to their permanent grade, and as soon as these are ready for traffic the temporarily elevated lines will also be depressed. The plan of gradually elevating the tracks by filling in with sand has been adopted as the one enabling the work to be carried out with the least interference to the heavy traffic. There is no specially important work of a structural character, but the most interesting feature is the execution of the work of making such radical changes in the grades of this complicated system of tracks, with all their switches and frogs, without stopping or interfering with the traffic.

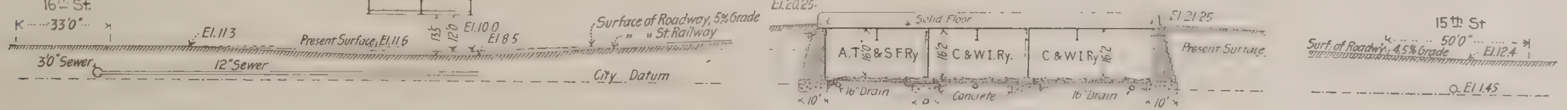


FIG. 3.—PROFILE OF NEW GRADE OF CLARK ST.

It is estimated that the work will cost about $400,000, but the apportionment of cost between the several railway companies interested can only be determined after the work is done, as previous to that time the monthly apportionments will vary as the work done for the benefit of each during the month varies.

* * *

THE NEWFOUNDLAND RAILWAY CONTRACT, entered into on March 15, 1898, between the Governor of Newfoundland and Mr. Robert G. Reid, of Montreal, is briefly presented, as follows, by Mr. M. J. Carter, U. S. Consul at St. Johns: In 1893 Mr. Reid contracted to build certain railways in this island for the government and received in land subsidies 2,500 acres per mile of road. By the present contract Mr. Reid controls the whole 775 miles of railway in Newfoundland for 50 years, and is to maintain and operate them under fixed maximum rates for transport of passengers and goods, and a subsidy of $42,000 per annum for mail service. In consideration of these obligations the government grants him in fee simple, in addition to the subsidies received in 1893, 5,000 acres of land for each mile of main line or branch throughout the entire system operated. These lands will be laid off in blocks one mile in length and ten miles deep, on either side of the line; the contractor and the government alternately selecting the blocks. Mr. Reid agrees to renew the rails on certain lines to the extent of $100,000, and to build a new branch from Topsail to St. Johns for $15.600 per mile paid by the government. For improved mail steamer service the government grants special subsidies; it transfers to the contractor the St. Johns dry-dock, for $325,000, and gives him control and management of the government telegraph lines, until April 15, 1904, on payment of $10,000 per year, and after that, to the end of the 50-year lease, the contractor must maintain these lines free of cost to the colony. The contractor agrees to have an electric railway built in St. Johns, while the government is to pave certain streets at a cost not exceeding $140,000. All disputes are to be referred to two arbitrators appointed by the two principals, and a third named by the Supreme Court. In consideration of the new contract Mr. Reid agrees to reassign and transfer to the government, at the end of 50 years, 2,500 acres of land for each mile of railway, to be deducted out of the land subsidies. The properties transferred to Mr. Reid, exclusive of land, cost the Newfoundland government as follows: Railways, $12,000,000; St. Johns dry-dock, $600,000; telegraph lines, $130,000; total, $12,730,000. For this Mr. Reid pays $1,000,000, out of which subsidies are to be returned for improvements. The government losses in operating these properties, per annum, were estimated as follows: On railway, $300,000; on telegraph lines, $18,000; on St. Johns dry-dock, $20,000; a total of $338,000 per year.

◆

PRIZE DESIGNS FOR ARTISAN HOMES are requested by the Executive Committee of the Twentieth Triennial Exhibition of the Massachusetts Charitable Mechanics' Association. The prize offered for the best design is $750, taken from a fund provided by Dr. Geo. C. Shattuck. The nature of the work required is described as follows:

Upon a city block, 200 × 800 ft., surrounded on the four sides by streets, it is required to develop a scheme for housing, under the requirements of the Boston Building Laws, in the most convenient, sanitary and economical way, in other than a single structure, such number of artisan households as will promise a fair income on the investment. The land is to be reckoned as costing $1.50 per ft., and the rentals paid are to be considered as follows: Single room, $1.00 per week; two rooms, $1.50 per week; three rooms, $2.00 per week, and four rooms, $2.50 per week. It must be borne in mind that suites of four rooms are more in demand than smaller suites, and that single rooms are in comparatively little demand.

Full particulars regarding the number, size and scale of the drawings and other information concerning the competition can be had by addressing the Association at Mechanics' Building, Huntingdon Ave., Boston, Mass.

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The report of the board of officers appointed to examine the wrecks of the four Spanish armored cruisers, sunk off Santiago, makes interesting reading to naval experts throughout the world. There has never been so good an opportunity to test the efficiency of modern warships and their armament in actual combat, and as a result some remodeling will be necessary in the design of future ships of this class. One of the most important lessons taught is that torpedo tubes on battleships and cruisers, at least when located above the water-line, not only introduce an unnecessary complication into the armament, but form a great and positive danger to the ship itself. The report shows that the Spanish cruiser "Vizcaya" was practically destroyed by one of her own torpedoes; and while it is not stated whether the explosion was brought about by the direct impact of a projectile, or by the fire resulting from the explosion of the shells from the attacking fleet, the fact remains that several hundred pounds of gun-cotton did explode on this ship and wrought greater havoc than the hail of projectiles to which she was subjected.

The enormous value of rapid-fire batteries is attested in this battle where four ships protected by 12-in. armor belts were destroyed. It appears that only one 12-in. projectile struck any of these vessels, and yet they were destroyed in a comparatively short time. The terrific and accurate fire of our sailors drove the Spaniards from their guns, killed many men, pierced the parts unprotected by the heaviest armor, and set fire to one after another of the Spanish ships. The fact that fire played such an important part in the destruction of at least two of the Spanish ships fully justifies the efforts of our naval authorities in reducing the amount of woodwork on battleships to a minimum, and leaving it out entirely wherever possible. Early in the Santiago fight the water pipes on the "Infanta Maria Teresa" were broken, and when a bursting 6-in. shell set her on fire there was no way of putting it out.

As a result of the Santiago fight it is very evident that rapid and accurate gun-fire, combined with speed in the vessels and good seamanship, will virtually decide the battle of the future before the heavy ships can approach each other near enough to use a torpedo on the enemy's hull. Hence, torpedoes on this type of vessel are useless as a means of attack, and dangerous when exposed to the long-range fire of an enemy. The accuracy of the Yankee gunners is shown by the fact that the "Almirante Oquendo" was struck 66 times in the parts of the ship not now submerged; the "Infanta Maria Teresa" contains 33 shot-holes, the "Vizcaya" 24, and the "Cristobal Colon," which was purposely shielded by the others, was struck 8 times in the hull. The torpedo boat destroyers were so completely wrecked by our projectiles that they are beyond all hope of raising. We can honor the reckless valor of the Spanish admiral and his men, and regret the destruction of so much valuable property; but the experience is extremely useful in the design of our future naval armaments, and the United States, as in 1862, has the opportunity to teach European nations a few things relating to ships and guns that they did not know before.

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The American wire rod industry has had a remarkable history. Previous to 1882 nearly all the rods made in the United States were imported, the importations reaching nearly 200,000 tons in one year. In 1882 a rod mill was built at the Cleveland (O.) Rolling Mill by Mr. William Garrett, which was far in advance of any other mill in its capacity for turning out product at a minimum cost for labor. Soon Mr. Garrett was building new mills at other steel works, each one an improvement on the one preceding. In 1897 the United States produced nearly 1,000,000 tons of rods, 80% of them in mills of the Garrett type, and American rods are exported to every quarter of the globe. The sequel to this story is now told by the "Iron Trade Review," which says that Mr. Garrett has been occupied abroad for the past six months in equipping foreign manufacturers with American machinery which will enable them to meet American competition. An improved Garrett mill has been erected at Havre, France, and one of the largest wire rod manufacturers in Germany is about to duplicate the twin mill at Joliet, Ill., with the exception that it will begin rolling with a 5-in. instead of with a 4-in. billet. It is apparent from this that the French and German manufacturers are getting ready to put a stop to the exports of wire rods from the United States into European markets.

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The far-reaching importance of the application of electric traction to street and suburban railways, which has been made in the past decade, is well pointed out in a recent article in the St. Louis "Globe-Democrat." The writer makes the reasonable assumption that the average city worker cannot afford to spend more than an hour in transit between his home and his business, and this unit of time practically limits the availability of suburban districts as economic places of residence. With the old horse-car a speed of 6 miles an hour was the best attainable, and from any one center this gave a diameter of 12 miles and an area of about 110 square miles for the district within an hour of the central business section. Electric traction, however, increases the rate of speed to 10 miles per hour, and the area within an hour of a given center to over 300 square miles, or nearly three times the area accessible in this time by the horse-car. The electric car has thus much the same influence on the growth of cities that the horse-car originally had when it did away with the old-time necessity of living within walking distance of one's place of work. The benefit to the workingman in both cases was the possible removal of his home from crowded and unsanitary centers to a location in more remote, cheaper and healthier districts. While in Europe street railway rates are regulated by the distance traveled, as on steam railways, the American system of uniform fare provides for a short ride at a comparatively high rate, and very cheap long distance travel. Thus, the extension of the one hour radius by the application of electricity does not, as a rule, increase the rate of fare.

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There is no doubt as to the widespread benefits resulting from the use of electricity on suburban lines; both to the workingman, in providing cheaper and better houses, and to the community at large by increasing property values in converting agricultural land into building sites. But our contemporary omits consideration of one important element in comparing the speed of the electric car and the horse-car and the areas affected. In our issue of June 11, 1896, Dr. Louis Bell presented a study of the City of Boston and its suburbs, showing the areas within 15 and 30 minute distance of the business district by both horse and electric cars. Dr. Bell showed that in crowded business centers the average speed of both vehicles is almost the same for the first 15 minutes at least, the common rate being about 6 miles per hour. But for the second 15 minutes the electric cars gain over the horse-cars, in proportion as the streets become less crowded with business traffic; and, in the case of Boston, 57% is added to the area accessible within one-half hour's travel by the application of electricity to street railways. While this practical study of actual conditions considerably modifies the comparison of relative speeds and of residence areas assumed by our contemporary, it does not upset its general conclusion of great gain to the public by the use of electricity.

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There is still another way in which the electric car has operated to build up suburban districts which is not alluded to by either Dr. Bell or the journal referred to above. We refer to the building up of manufacturing districts in the outskirts of cities where land for factories, yards, and warehouses, and for employees' dwellings can be had at a small cost, and where by means of electric railways the city itself is still within easy reach. Under the old conditions, it was difficult to induce workmen to leave the crowded city with its social attractions, and its opportunities for cheap purchases; and there were also disadvantages in locating a manufacturing establishment where communication with the business center was difficult. The electric car has removed both these obstacles, and the influence it has had in building up manufacturing suburbs is not the least of the benefits it has brought.

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A conservative view of the possibilities of utilizing garbage as a fuel for electric light stations is taken by Mr. Jos. Lobley, M. Inst. C. E., Borough Engineer of Hanley, England, in a recent report. Several of his main points are very much the same as some made by us in an editorial discussion of the subject in our issue of Aug. 26, 1897. Mr. Lobley urges that the total amount of power now required by the local electric lighting plant at Hanley is about 1,150 HP., and that this will soon be greatly increased. He figures on only 100 HP. as available from the refuse destructors, after satisfying the demands for power at the garbage plant. He proposes to install a generator at the proposed garbage plant for the generation of 100 HP. to be used for the day load on the electric station. The two plants cannot be operated together owing to the lack of a suitable site. Mr. Lobley conveys the idea that the only combined garbage burning and electric lighting plants actually installed in England thus far are the two at St. Pancras and Shoreditch. The St. Pancras combined plant shows for the year a cost per electric unit of 1.33d., against 0.76d. at another electric light station owned by the same authorities where no garbage is used. The conditions at St. Pancras, however, are said to be unfavorable for the combined plant. At Shoreditch results for anything like a year were not available when Mr. Lobley's report was written, but he points out that a large expenditure was made there for storing heat, which of course means heavy capital charges. One point made by Mr. Lobley is well worth quoting, as follows:

> Though the generation of electricity by steam raised by the burning of house refuse may have good economical results in certain places, I am inclined to think that the spare heat evolved will be better utilized in the future by improvements that may be brought about in the destruction, or preparing for destruction, of the refuse itself. In other words, this means that a given number of cells will do the work now performed by a greater number.

The remarks quoted appear to be especially applicable to this country, where less progress has thus far been made in reducing the fuel cost of garbage cremation than is the case in England,

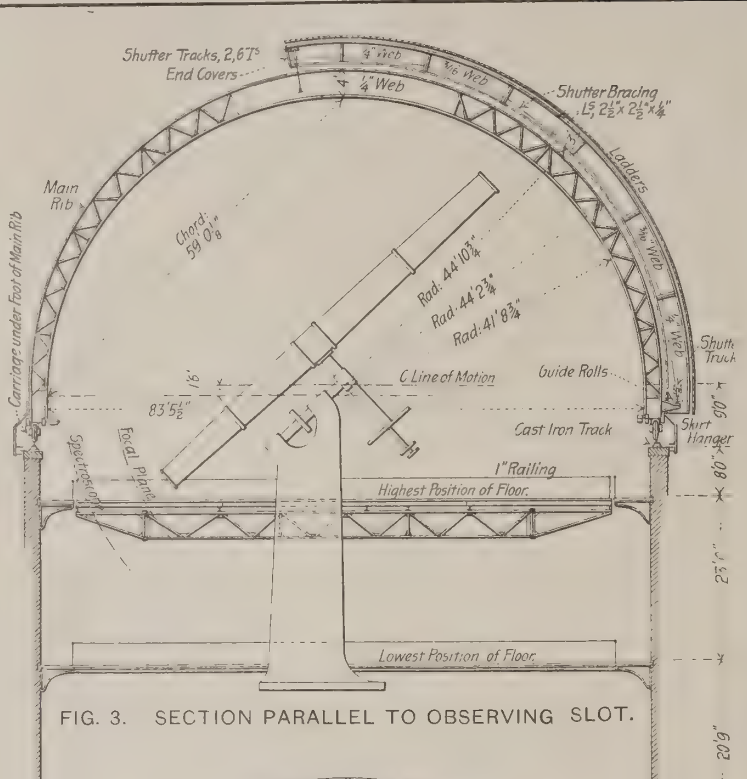


FIG. 3. SECTION PARALLEL TO OBSERVING SLOT.

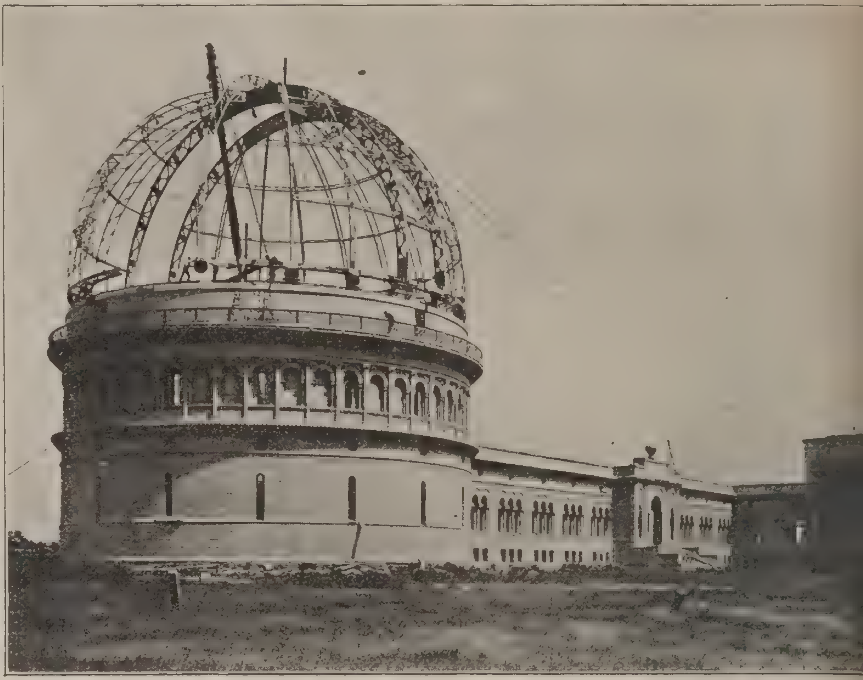


FIG. 9. ERECTION OF SMALL ARCH WITH WHEEL ATTACHED.

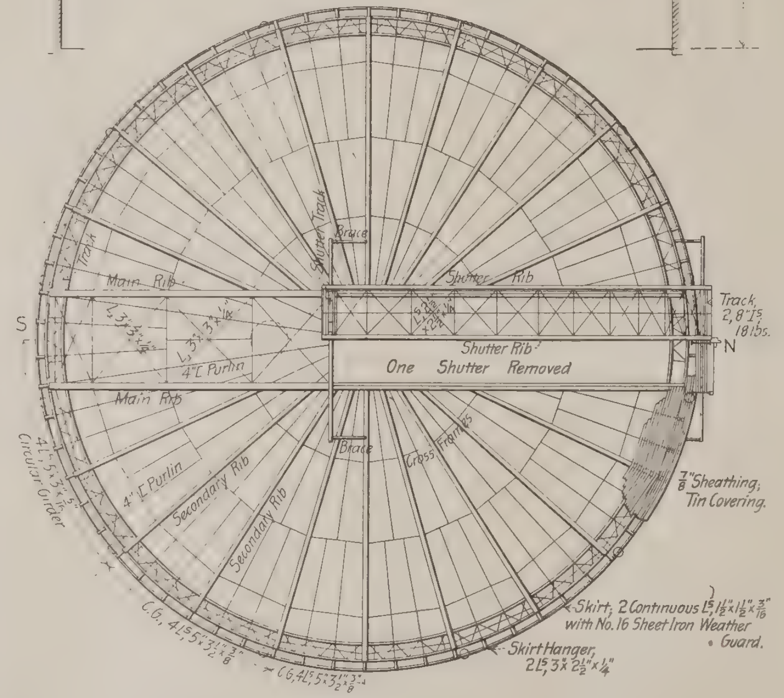


FIG. 2. PLAN OF STEEL FRAMING FOR DOME.

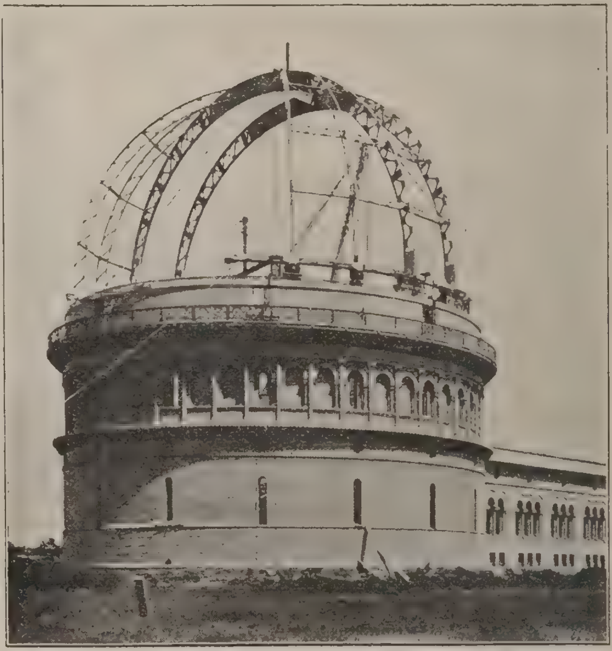
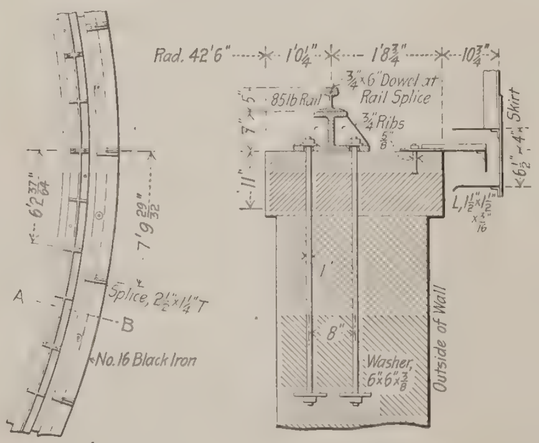


FIG. 8. DOME WITH MAIN ARCHES ERECTED.



Part Plan.

Section A-B, Enlarged.

FIG. 4. DETAIL OF CIRCULAR TRACK.

STEEL DOME FOR THE
YERKES OBSERVATORY, LAKE GENEVA, WIS.

Warner & Swasey, Cleveland, O.,
General Contractors.

King Bridge Co., Cleveland, O.,
Contractors for Structural Work.

R. S. Wright & Co., Pittsburg, Pa.,
Contractors for Erection.

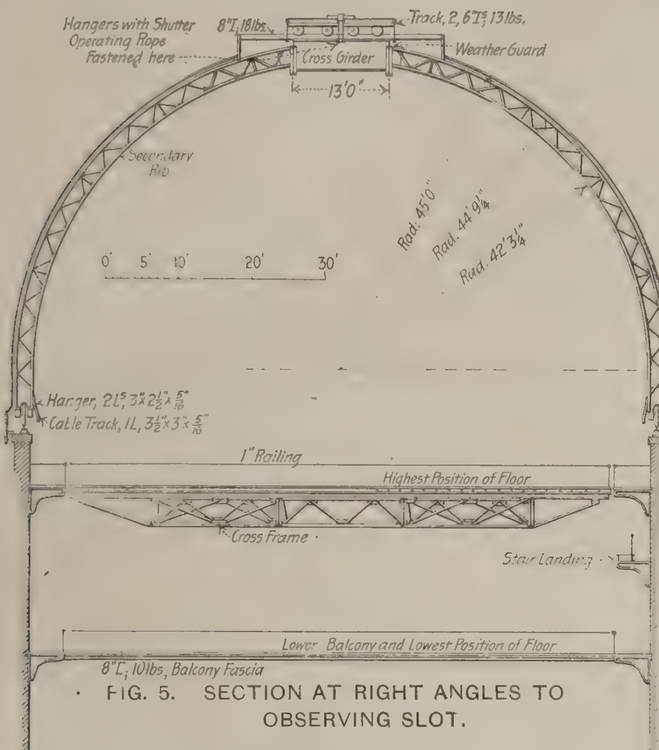

Hangers with Shutter Operating Rope Fastened here
8"I, 18lbs.
Track, 2, 6"I's 13lbs.
Cross Girder
Weather Guard
13'0"
Secondary Rib
Rad. 45'0"
Rad. 44'9¼"
Rad. 42'3¼"
0' 5' 10' 20' 30'
Hanger, 2L's 3½"x 2½"x 5/16"
Cable Track, 1L, 3½"x 3"x 5/16"
1" Railing
Highest Position of Floor
Cross Frame
Stair Landing
Lower Balcony and Lowest Position of Floor
8"[, 10lbs, Balcony Fascia

FIG. 5. SECTION AT RIGHT ANGLES TO OBSERVING SLOT.

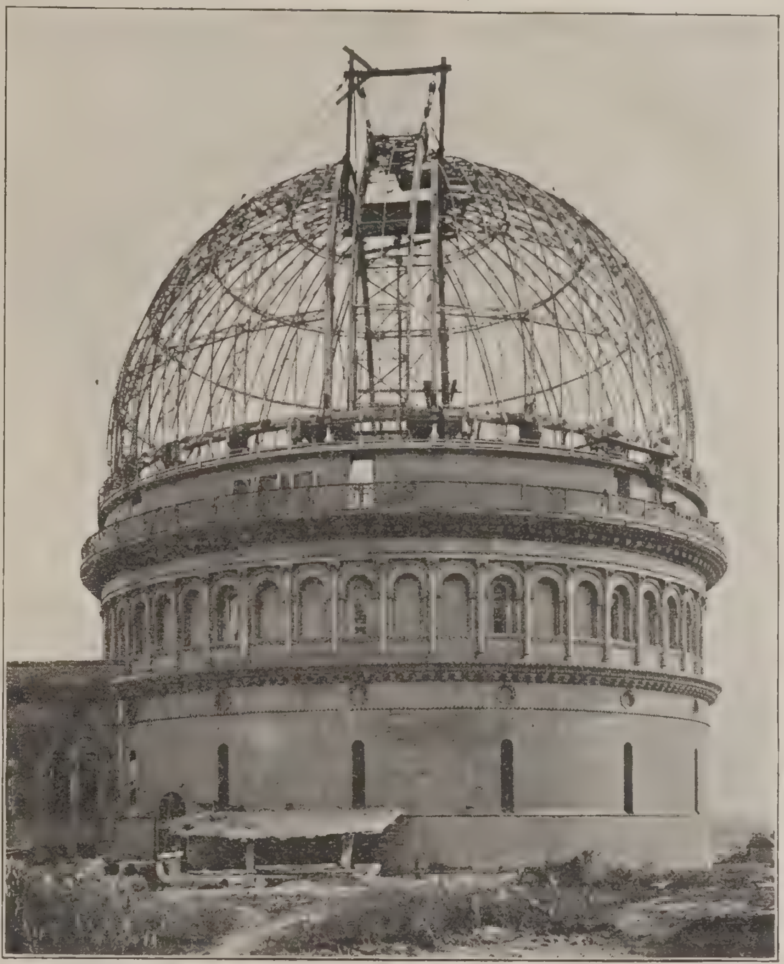


FIG. 10. DOME FRAMING COMPLETE AND SHUTTERS BEING ERECTED.

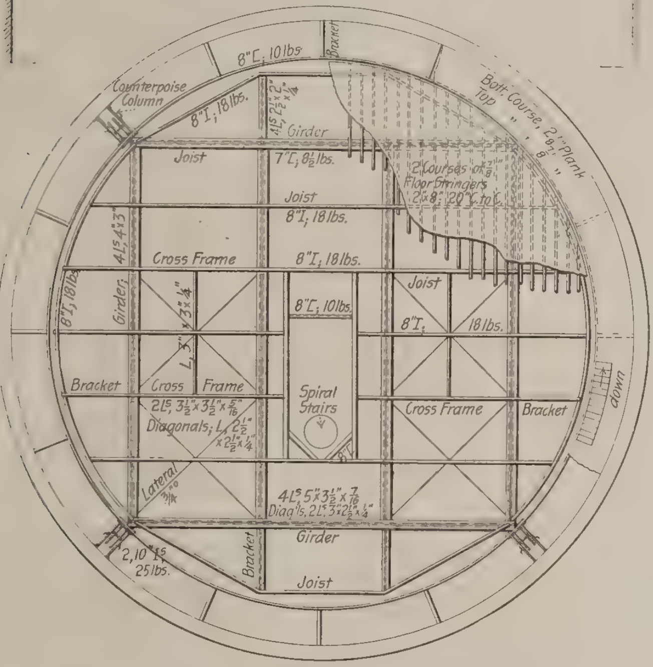


FIG. 6. PLAN OF FRAMING FOR RISING FLOOR.

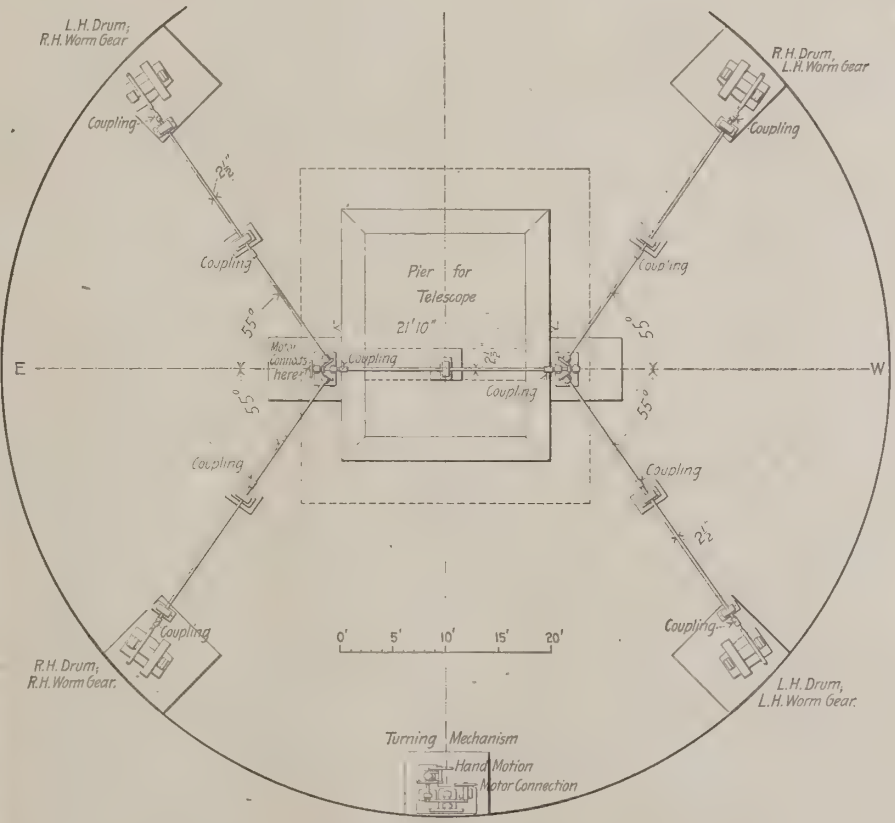
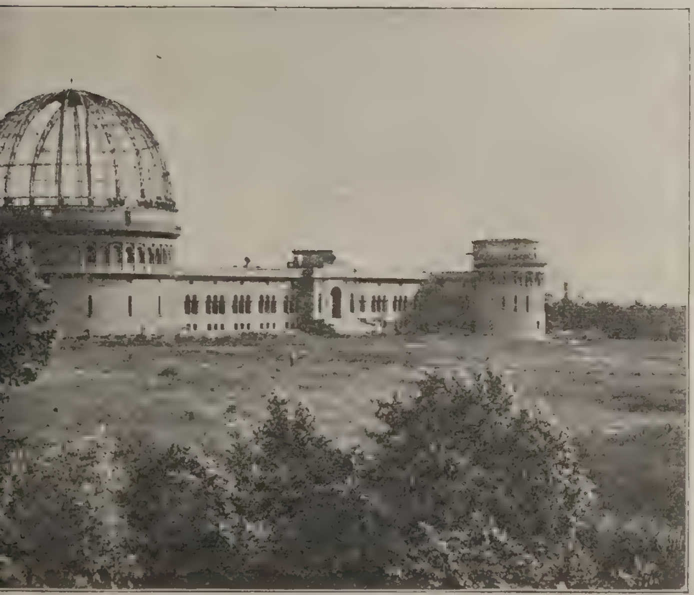


FIG. 7. PLAN OF OPERATING MACHINERY IN BASEMENT OF TOWER.



1. GENERAL VIEW OF OBSERVATORY.
elwork for the 90-ft. Dome alone Erected.)

and scarcely anything of practical value has been accomplished in utilizing heat for the operations of the garbage disposal works themselves.

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Manufacturers who wish to do an export business must have their circulars and catalogues translated into foreign languages, but care should be taken that the translator is not only a good linguist, but also an expert in the particular business to which the documents to be translated refer. Otherwise the translation is apt to be a matter of ridicule to those to whom it is sent. We cannot well give an instance to show how an English circular might be translated into bad German, for example, but the London "Engineer" gives us the following illustration of a translation from another language into English which is probably no worse than many translations from English:

> "We pique ourselves," says the circular, "on making you known that the sale of the —— has, by us, undertaken. This preparated, exclusively arranged by some vegetables, is entirely spoiled about something hurtful to the steam boiler blades. By our preparated every calcarious substance is neutralized, reducing it to power, and at the same time steam boiler blades are conserved from the usual corrosion, not only, but the ebullition, is totally avoided, as it appears about some very interesting experiments, which have been made in several establishments." In conclusion the circular adds: "To be willing, this preparated may be decomposed."

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THE PREVENTION OF STEAMSHIP COLLISIONS.

The disaster to the transatlantic steamer "La Bourgogne," on July 4, by which 560 of her passengers and crew lost their lives, is the most serious marine disaster, with respect to the number of persons lost, that has occurred for many years. So far as we have been able to find, no such great loss of life has occurred in an ocean steamship accident since the White Star steamer "Atlantic" was wrecked on the coast of Nova Scotia, on April 1, 1873. The number lost on that vessel was almost the same as on the unfortunate "Bourgogne."

The terrible loss of life in this accident calls world-wide attention to the greatest danger which now attends ocean travel, that of collision, and to the possible means of guarding against it. The other dangers which formerly attended ocean travel have been greatly reduced by the stanch construction of modern steam passenger vessels, by the perfection which has been reached in propelling machinery, and by the extent to which navigation is now assisted by signals upon the coasts of all civilized countries. The danger of collision, however, has been greatly increased by the improvements in ocean navigation. In the days when the sailing packet was the fastest method of passenger travel by sea, collisions were almost unknown. It was not possible with sailing vessels to follow so closely the shortest route in a trans-oceanic voyage; and in a fog, when collisions usually occur, a sailing vessel is either stationary or moving slowly with light winds.

The danger of collisions is, in fact, almost entirely an outgrowth of the conditions of steam navigation. The number of vessels plying on the ocean has greatly multiplied, the size has been increased, they run in closely-defined routes, and most important of all, the energy stored in the swiftly moving bulk of a modern passenger steamship has become so enormous that her engines cannot check her headway till she has gone a long distance, and if she strikes another vessel the force exerted is so great that no construction that can possibly be devised can resist it without serious injury.

Of course much can be done, and is done, by the best steamship designers to reduce the dangers that result from any injury to a vessel's hull. The division of the hull into water-tight compartments, and the adoption of a bow projecting above the water-line to absorb part of the shock of a collision before the space below the water-line has to suffer, are examples of the methods adopted to reduce the danger of loss from collision. But water-tight compartments are not always water-tight. Bulkheads are essentially emergency constructions, not likely to be actually put to use in the entire life of the vessel. Naturally the tendency is to make them as light as possible. An experienced marine architect, not many years ago, expressed the opinion that a large proportion of ship bulkheads would be so strained as to leak badly if the compartment of the hull on one side were filled with water, and that adjoining were empty. If this is true of the uninjured structure, what are the probabilities when a ship has suffered such a shock as that which sent "La Bourgogne" to the bottom? Such a shock must inevitably strain every plate and rivet anywhere near the point where the blow is received. Doubtless improvements will be made in the hull construction; but there appears no reason to expect more than a trifling diminution in the dangers of collision on account of improvements in this direction.

We have alluded to the fact that steam vessels are able to keep very closely to the shortest route in sailing between two ports. It is manifest that this tends to bring two vessels sailing between the same ports, but in opposite directions, in danger of collision. In the case of the much-traveled path between the principal American ports on the Atlantic seaboard and the chief ports of England, France and the North Sea, the danger has become so manifest that most of the transatlantic steamship companies have agreed to use different routes for east bound and west bound vessels. It is stated that the French Line, to which "La Bourgogne" belonged, is the only one of these companies which did not join in this agreement. The ill-fated "La Bourgogne," when struck by the "Cromartyshire," on July 4, was not only about 160 miles north of the course usually taken in the summer by eastbound steamers from New York, but was from 60 to 90 miles north of the usual route of the west bound vessels. The route on which "La Bourgogne" was sailing is nearer the short, great circle course, it is true; but besides putting a vessel in the track of steamers proceeding in a contrary direction, the more northern route is much more subject to fogs and icebergs than the southern. It is probably safe to say that after the bitter lesson it has had, the French Line will conform to the general custom and send its vessels eastward on the usual course pursued by other vessels.

On the other hand, it is well to point out that the fixing of different routes for vessels sailing in opposite directions, important though it is, still leaves large risks of collisions unaffected. Naturally such a separation of routes will only be made in the case of the most traveled ocean lanes, and even where such a separation is made and observed, there is still chance of collision where the course is crossed by that of vessels sailing for other ports, and by vessels which are driven by stress of weather from the usual path, or which go astray in their reckoning.

Whatever blame may attach to the managers of the French Line, for adopting their present east bound course for their vessels, it seems to us that we shall be getting much nearer to the important cause of this terrible calamity if we emphasize the fact that the vessel at the time of collision was running at high speed through a thick fog. This disaster makes plain the risk that always attends this too common practice.

According to the best information, the ill-fated steamship was steaming at a speed of 17 to 18 knots when she collided with the "Cromartyshire," a sailing vessel which was drifting before a light breeze at a speed of only four or five knots, and which was hardly one-fourth the size of the big French liner.

It is a popular excuse for the maintaining of high speed in fogs, that it is really safer for the fast vessel to do so, as she will cut down anything she may run foul of with little injury to herself. The fishing schooners on the Newfoundland Banks have a well-founded hatred of the great steamships, which come flying through the fog at railroad speed, and which are believed to have sent many a sailing vessel's crew to a watery grave. But the sinking of "La Bourgogne" proves that the theory of making the Atlantic greyhound into a projectile to protect her from collisions does not always work. It was the French steamer's high speed and enormous momentum that caused her own destruction, when she fouled the drifting sailing vessel. With the experience of "La Bourgogne" fresh in mind, steamship companies can no longer claim that it is the safety of the great number of lives in their care that causes them to maintain high speed in fogs, notwithstanding the dangers in which other vessels are placed by their action.

It is fair to say, however, that in this matter the French Line is no more at fault than every other transatlantic steamship company, so far as we know. One has but to see the regularity with which these vessels come into port, notwithstanding the fogs that are so frequently encountered, to appreciate the fact that the so-called slacking of speed in fog really amounts to very little. When one considers the great distance which a vessel at a 15 to 17-knot speed will run before her reversed engines can absorb her headway, it is easy to see that for the fast liners to slow down two or three knots in a fog really accomplishes little in the way of added safety. It is said that in one recent case the Courts have held that a speed of 10 knots in a fog was excessive; and the decision seems in accord with sound engineering. If a high-powered steam vessel slows down to a speed of 7 to 8 knots in a dense fog, she can pretty surely be brought to a stop before striking a vessel ahead after the lookout first hears her signals. Vessels with less powerful engines, which take longer to check their headway, ought to run still more slowly in a dense fog, if the safety of ocean travel is to be fully ensured.

Notwithstanding these plain facts, it is not likely the steamship companies will change their practice as to high speed in fogs, even with the fatal accident to "La Bourgogne" as a warning. The public demands high speed; and it is quite doubtful whether a company which should advertise that all its vessels slowed down to 8 knots in thick weather would find its passenger lists increased thereby. The steamship companies are in business to give the public what it demands. They do not run steamers at high speed because of the freight they carry, but because of the passenger list. If the travelers on ocean steamships manifest a strong preference for slower and safer voyages, the companies will doubtless be found ready to meet the demand; such a change would mean, doubtless, a lengthening of the time schedules, to make allowance for possible or probable delays by fogs. Both for their own profit and the convenience of their passengers the steamship companies strive to move their boats with the greatest regularity. If a 7-day boat is delayed two days by slowing up for fog, it may not be possible to get her cargo removed and the new lading in in time for her start at the scheduled hour on the return voyage. But a lengthening of the time schedule, means fewer trips for a vessel during the season, and a reduction in its earnings.

Taking all these things into consideration, it does not seem probable that steamship companies will generally adopt the practice of running at a safe speed during fogs. We must look for greater safety, then, in the direction of improvements in the methods by which vessels approaching each other may be more surely warned of each other's presence.

The problem of making light rays penetrate a fog appears to be impossible of solution. A searchlight beam may, it is true, be seen for a considerable distance at certain times, when only a thin mist covers the water; but in such fogs as those on the Banks of Newfoundland, a searchlight beam cannot begin to reach as far as the present sound signals, and in daytime, of course, the searchlight is of no use at all.

As light waves cannot penetrate fog, we have left two possible directions in which to look for systems of signaling, by sound waves and by electric waves. The former of these is represented by the system now in use; but it is applied with a crudity which is amazing when one considers the great interests at stake. According to the present laws, steam vessels are required to sound a steam whistle at certain intervals, when enshrouded in fog, while sailing ships must ring a bell or blow a horn. The ineffectiveness of the average sailing vessel's fog warning is too well known to call for comment. On the other hand, the fog sirens, with which many light stations are equipped, can be heard for many miles out at sea, not alone because of their power, but because they are designed to concentrate the sound and project it in the desired direction.

The laws of acoustics are well known, and there is really no difficulty, not only in creating a sound of almost any desired pitch and volume, but in concentrating and directing it toward the quarter where the warning is needed. Under the present system nothing whatever is done in the way of directing the sound. In the case of the fog signal on ocean steamers, the fog whistle is usually located amidships, and the sound from it is radiated in all directions. Again, it is by no means certain that the discordant note of the steam whistle is the best form that a marine sound signal could take; some purer musical tone might penetrate quite as far and be more readily recognized.

We have alluded to the fact that electric waves can traverse a fog as well as sound waves. In the so-called system of telegraphing without wires, messages have been sent and received over a distance as great as 14 miles. It is quite within the bounds of possibility that two ships equipped with proper apparatus might be able to determine each other's presence and approximate position by means of electric waves alone, when both were enveloped in fog. We say it is possible; but it is a very far cry from this to any practical plan for the adoption of radiant electric energy as a fog signal for general use on board vessels.

An inherent defect in any such system, no matter how perfect it might otherwise be made, would be the necessity of skill and care in handling the instruments. Their derangement or failure to indicate correctly might be the source of disaster, and the same thing is true of any momentary lapse on the part of the operator. A danger signal that every man on board can see or hear is worth forty which require a skilled operator to watch a magnetic needle or a gold-leaf electroscope, whose indications attract no attention save from the one who knows their significance.

In dealing with matters of ocean navigation, it must be remembered that sailing vessels, large and small, as well as steam vessels, must be taken into account. It is visionary to expect that anything in the shape of complicated electrical appliances could come into use on vessels of this class as a fog warning, or that it would be so operated as to be effective if it were brought into use.

In conclusion, then, it appears to us that the best that can be done to reduce the danger of collision at sea is to improve the sound signals at present in use. If fast-running steamers wish to continue on their course in a fog with little or no checking of speed, let them provide themselves with some device at their bows that will project a volume of sound which will be audible for several miles ahead. Sailing vessels which are near enough to the course to hear this warning will be impelled to an instant reply with their own fog signals. It would be quite practicable for sailing vessels in such emergencies to discharge explosives which would produce a volume of sound that would reach the approaching steamer even if she were some miles away, and warn her to at once slacken her speed.

With such improvements in practice as respects the production of sound signals, might well come improvements in the system of listening for and detecting them. The "Eophone,"[*] by which the direction from which a sound comes is accurately located, is already in use on some American coasting vessels, and seems to deserve a more general adoption in steamship service; and it is quite possible that other inventions may make it possible to detect sounds at a greater distance than is possible with the unaided ear.

We are aware that it is exceedingly difficult to introduce anything in the shape of an innovation on board ship. There is no place where prejudice and conservatism have a stronger hold. But if owners of ocean vessels elect to risk the property and lives in their care by running at high speed in fogs, they ought to welcome every method by which the danger arising from this practice may be lessened.

Since the above was in type, we have received reports of the first day's proceedings in the official investigation of the accident. According to the testimony of the captain of the "Cromartyshire" in this inquiry, the whistle of "La Bourgogne" was first heard on board his vessel not more than ten minutes before the collision, and it was heard seven or eight times before the vessels came together. If "La Bourgogne" was going 18 knots, as claimed, this would indicate that the sailing vessel first heard the steamer when she was about three miles away. The lookout on board "La Bourgogne," however, is said to have heard the sailing vessel's foghorn only four or five times before the collision; and it does not appear that the engine was reversed, or even stopped, before the vessels came together.

If these statements are correct, our suggestion above, that sailing vessels ought to have some more efficient means of warning approaching steamers in a fog, appears to be especially appropriate to the circumstances of this disaster. It must be said, however, that if engines are not immediately reversed to check the headway of a steamer as soon as warning is heard of the proximity of another vessel, all the improvements in signaling systems that ingenuity can devise will be of small effect. We have tried to make it clear above that to run at high speed through a fog is and must always be dangerous. If steamship companies persist in taking this risk, however, they should certainly see to it that as soon as the signal of another vessel is heard, the engines are reversed to check the speed as quickly as possible. To pursue any other course is a sort of gambling with death that cannot be condoned.

LETTERS TO THE EDITOR.

Note on the Behavior of Some Cements With Diluted Hydrochloric Acid.

Sir: Having occasion recently to analyze certain cements, it was noticed that some on treatment with hydrochloric acid, gave off hydrogen sulphide, while others gave off free chlorine. In all seven cements were examined: four Portland and three natural cements. All were well-known brands and most of them had been tested with satisfactory results in the engineering laboratory of this university. It was found that all of the Portland cements gave off hydrogen sulphide, while all of the natural cements gave off chlorine.

It was assumed that the evolution of hydrogen sulphide indicated the presence of a sulphide or of a compound of the nature of the ultramarine pigment, and that the evolution of chlorine indicated the presence of a peroxide.

As neither a sulphide nor a peroxide appeared in the reports of analyses found in the literature consulted, it was thought worth while to determine the amounts of hydrogen sulphide and chlorine given off, respectively.

The following table gives the results, which are in all cases the average of well agreeing duplicates:

Portland.	Sulphur given off as hydrogen sulphide.	Correspond'g to calcium sulphide, (Ca S.)
Marked "La Farge"	0.05%	0.11%
" "Giant"	0.04%	0.09%
" "Alsen"	0.02%	0.05%
" "Belgian"	0.02%	0.05%
Natural.	**Chlorine.**	**Correspond'g to manganese dioxide (MnO_2.)**
Marked "N. Y. & Rosendale"	0.25%	0.31%
" "Hoffmann"	0.23%	0.28%
" "XXX Rosendale" .	0.20%	0.24%

Although the amounts of hydrogen sulphide and of chlorine are so small, one or the other could be detected in every case by the sense of smell, and by the usual simple chemical tests.

Walter E. Pettigrew, C. E.

New York University, June 27, 1898.

The Effect of Temperature on the Flow of Water Through Soils.

Sir: In connection with the letter in your issue of June 30, from Prof. L. G. Carpenter, upon the effect of temperature upon the flow of water through soils, I beg leave to call your attention to the formula which I have commonly used, and which was referred to in the editorial article in your issue of May 12. This formula is as follows:

$$\text{Temperature factor} = \frac{t\ (\text{Fahr.}) + 10}{60},$$

unity being taken as the velocity of flow at a temperature of 50° F.

In the following table are given the temperatures and velocity factors, as computed by Prof. Carpenter, from the formula of Poiseville, together with the temperature factors as determined by my formula, and also these last multiplied by 1.36, this being approximately the factor representing the difference between the standard temperature of 50°, which is taken as the basis of my formula, and the standard temperature at the freezing point, as in the formula of Poiseville. As the factors express only the relative flows at different temperatures and have no absolute significance, the introduction of a constant factor is unimportant.

Temperature, degrees, F.	Temperature factor, $\frac{t + 10}{60}$	Temperature factor, Multiplied by 1.36.	Factor as given by Prof. Carpenter.
32	0.700	0.952	1.000
42	0.867	1.179	1.195
52	1.033	1.405	1.403
62	1.200	1.632	1.625
72	1.367	1.859	1.860
82	1.533	2.085	2.109
92	1.700	2.312	2.372

It will be noticed that for temperatures between 42° and 82°, the differences between the two formulas hardly amount to 1%, and this is the range of temperature for which most calculations of this class are made. For temperatures but little above the freezing point my formula gives considerably lower results than the other.

I do not know upon what data the formula of Poiseville was based. My own was based solely upon experiments which I personally executed, with the flow of water through fine sands at carefully controlled temperatures, and the results were afterward checked by very numerous experiments upon the flow of water through long and fine capillary tubes under constant pressures and completely immersed in water kept at exactly the desired temperature. The results thus secured evidently followed the same law as the results obtained with sand, and were more accurate, owing to more perfect control of all the conditions, and were thus taken as the basis of the formula.

These experiments were carried out from the freezing point, with the whole apparatus packed in ice, to the highest summer temperatures. All of the results agreed very closely with the formula as given, and I am strongly of the opinion that it is very nearly correct for all temperatures between the freezing point and 100° F. I am also of the opinion that it applies to the flow of water through soils, or through long and fine passages. It applies also to fine gravels, as far as the rate of flow is influenced principally by the viscosity of the water. With coarse gravels and high rates other factors than viscosity exert controlling influences, and the temperature factor disappears.

Very truly yours, Allen Hazen.

St. Paul Building, New York, June 30, 1898.

A NEW FORMULA BY BAZIN FOR COMPUTING FLOW OF WATER IN OPEN CHANNELS.

In the "Annales des Ponts et Chaussees," for the fourth quarter of 1897, Mr. H. Bazin, Inspector General of Bridges and Roads, gives a new formula, for calculating the flow, or delivery, of water in open channels, which he believes is less complicated and of wider general application than those now in use. Space forbids our giving the full paper, with all its accompanying experiments; but the new formula and the reasons for deducing it may be briefly set forth as follows:

After discussing the difficulties besetting the problem of fairly meeting all conditions, Mr. Bazin says that the simplest, monomial formula is:

$$A = \alpha + \frac{\beta}{R} \qquad (1)$$

In which A is an abridgment of the relation $\frac{R\,I}{U^2}$, and α and β are two constants; in these and other formulas, R = the mean radius; I = the slope, and U = the mean velocity. The above formula was adopted by Mr. Darcy as the result of his experiments upon pipes, in 1850; and it answered well for pipes, by reason of the constancy of the transverse profile, always circular, and because of the relative smallness of the coefficiet β. But it is less applicable to open channels, owing to the diversity of profile and the nature of the sides causing α and β to vary within very wide limits. It must be admitted that this formula is open to a double objection. It provides for no relation between α and β, the last coefficient increasing very rapidly with the roughness of the sides; and, if we assume that the mean radius R increases indefinitely, A would be different for each kind of side. But it would seem, on the contrary, that if the width of a channel were increased while the sides remained identical, the inequalities of the sides should be gradually effaced as the dimensions of the bed increase. As a consequence, the values of A, for all the broad divisions of side roughness, should progressively approach each other and converge towards a common limiting point.

As it is impossible to find a simple relation between α and β, Mr. Bazin proposes, in Equation

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[*] See Engineering News, Jan. 6, 1898.

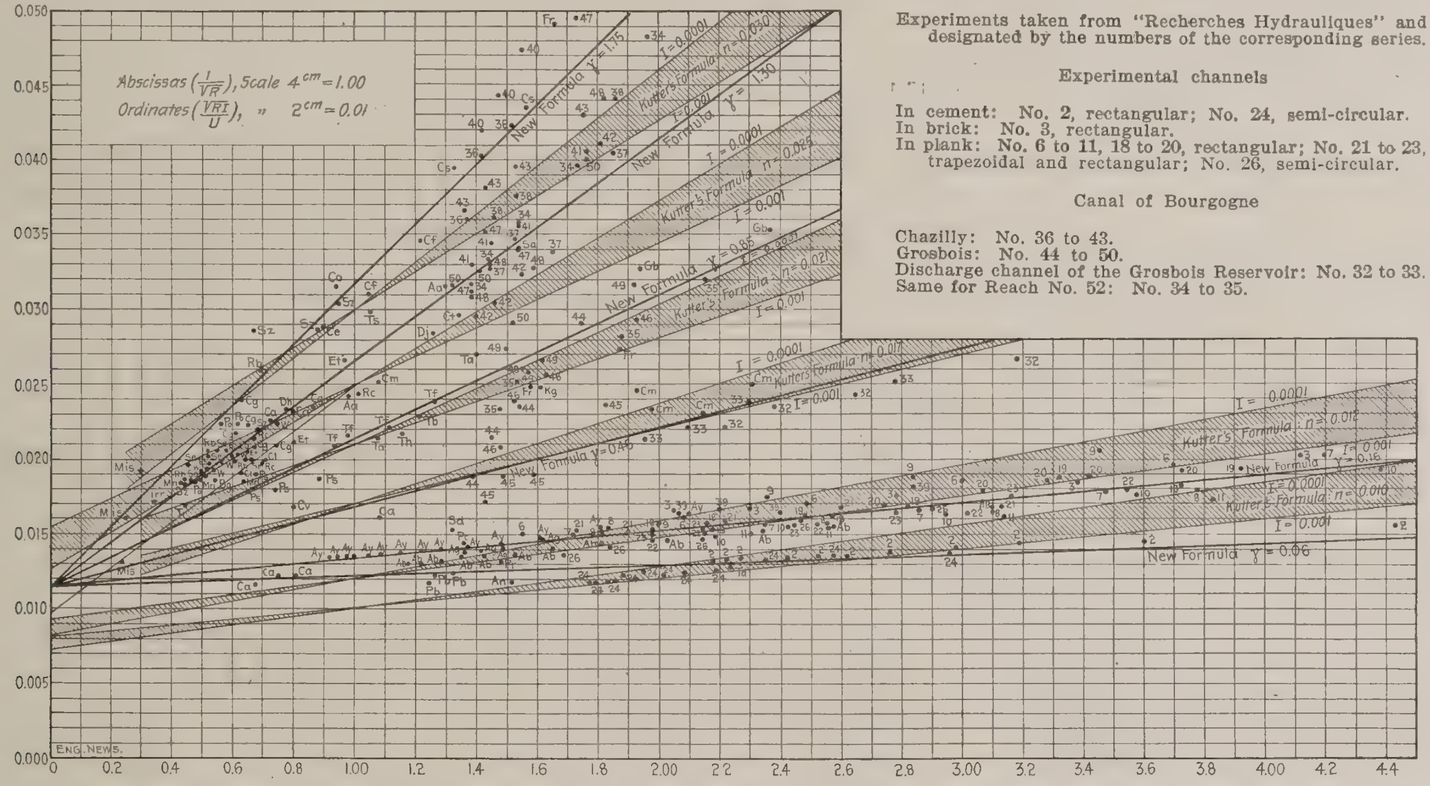
1, to replace A and R by their square roots, which vary less rapidly. He then has

$$\sqrt{A} = \alpha + \frac{\beta}{\sqrt{R}} \qquad (2)$$

We are enabled to obtain a sufficient approximation by assuming that α remains constant, and that the values of A, for the different states of the sides, always converge towards the limit α. The coefficient β then alone varies, becoming thus the characteristic of the degree of roughness of the sides.

In 1889, Messrs. Ganguillet and Kutter approached Equation 2 by writing it under the equivalent form of:

$$U = a\left[1 - \frac{b}{b + \sqrt{R}}\right]\sqrt{RI}$$



Experiments taken from "Recherches Hydrauliques" and designated by the numbers of the corresponding series.

Experimental channels

In cement: No. 2, rectangular; No. 24, semi-circular.
In brick: No. 3, rectangular.
In plank: No. 6 to 11, 18 to 20, rectangular; No. 21 to 23, trapezoidal and rectangular; No. 26, semi-circular.

Canal of Bourgogne

Chazilly: No. 36 to 43.
Grosbois: No. 44 to 50.
Discharge channel of the Grosbois Reservoir: No. 32 to 33.
Same for Reach No. 52: No. 34 to 35.

DIAGRAM ILLUSTRATING NEW FORMULA FOR COMPUTING FLOW OF WATER IN OPEN CHANNELS.

Aa.—Aa.
An.—Naples Aqueduct.
Ca.—Cavour Canal.
Cg.—Ganges Canal.
Pb.—Boston Aqueduct, Charles River Bridge.
Pr.—Roquefavour Aqueduct.
Td.—Cement Pipe; Dijon.
Ab.—Boston Aqueduct.
Ag.—Glasgow Aqueduct.
Ay.—Croton Aqueduct.
Pc.—Aqueduct bridge of Crau.
Po.—Po, at Fossa d'Albero.
Ps.—Canal of Solani.
Ti.—Tiber, at Rome.
Eb.—Elbe, at Jetschen.
Fr.—Millrace at Freyberg.
Cm.—Marseilles Canal.
Cv.—Verona Canal.
Cb.—Grebenau experiment.
Ta.—Tauber.
Tb.—Beacon St. tunnel, Boston Aqueduct.
Th.—Thun Canal.
Tf.—Outlet of Lake Fucino.
Ts.—Tessien.
Cl.—Linth Canal.
Ct.—Lauteo Canal.
Dj. Dh.—Dubuat experiments.
Dj.—Canal du Jard.
Dh.—Hayne River.
Irr.—Irrawaddi.
Ro.—Rhone at Scex.
Kg.—Millrace. Kagiswyl.
Mis.—Mississippi.
Mri.—Missouri.
Rg. Rs. Rh.—Rhine at Germersheim; at Spire; in Holland.
Sa.—Saalach.
Sd.—Dorchester Bay Siphon, Boston.
Se.—Seine.
So.—Saone.
Sz.—Salzach.
W.—Weser.
Ce.—Escher Canal.
Cf.—Collector of Lake Fucino.
Co.—Chesapeake Canal.
Cs.—Simmen Canal.
Rb.—Rhine at Basle.
Rc.—Rhine near the Falls.

They gave to a the constant value of a = 100, and attributed to b twelve different values, increasing from 0.12 to 2.44. But they complicated this simple expression by making its coefficients depend upon the slope I; and they did this to embrace some exceptional experiments made by Humphreys and Abbot upon the Mississippi River. Their definite formula, still much used in spite of its complication, is, in metrical measures:

$$U = \frac{23 + \frac{0.00155}{1} + \frac{1}{n}}{1 + \left(23 + \frac{0.00155}{1}\right)\frac{n}{\sqrt{R}}}\sqrt{RI} \qquad (3)$$

In this n is the coefficient of roughness. By making $23 + \frac{0.00155}{1} = K$, by an easy transformation, they wrote the formula:

$$\frac{\sqrt{A}}{n} - 1 = \frac{Kn}{1 + Kn}\left(\frac{1}{\sqrt{R}} - 1\right) \qquad (4)$$

Under this form $\sqrt{A}$ becomes equal to n and independent of the slope, when R = 1 meter. The factor between parentheses changes in sign, as R is inferior or superior to one meter, and the influence of the slope upon the value of $\sqrt{A}$ changes in the same degree and is not appreciable except for excessively slight slopes.

Returning to formulas 1 and 2, in admitting the first, we distinguish* four separate classes or types of sides, as follows:

1. Sides very smooth.........A = 0.00015 $\left[1 + \frac{0.03}{R}\right]$
2. Sides smooth ....A = 0.00019 $\left[1 + \frac{0.07}{R}\right]$
3. Sides slightly smooth......A = 0.00024 $\left[1 + \frac{0.25}{R}\right]$
4. Sides in earth ....A = 0.00028 $\left[1 + \frac{1.25}{R}\right]$

Admitting Equation 2, we would give to α the constant value 0.0115, in making β increase with the degree of roughness of the sides; from 0.0007, for very smooth sides, to 0.0150 for sides in earth.

The formula of Ganguillet and Kutter makes n vary between 0.010 and 0.025.

The comparison of the different formulas, as based upon given experiments, is graphically shown. If we take for the ordinates y the values of $\sqrt{A}$, and for the abscissas x the values of $\frac{1}{\sqrt{R}}$, the new formulas, as derived from the expression 2, would make,

$$y = 0.0115 + \beta x; \qquad (5)$$

or better still, if we designate by γ the ratio $\frac{\beta}{\alpha}$,

$$y = 0.0115\,(1 + \gamma x).$$

These would be represented by a number of straight lines all emanating from a single point ($x = 0$; $y = 0.0115$) situated on the axis of the ordinates. The inclination of these straight lines, measured by the angular coefficient 0.0115 γ, increases with the roughness of the sides. The Kutter formula for the same expression would be:

$$y = n + \frac{Kn^2}{1 + Kn}(x - 1) \qquad (6)$$

But instead of a single radiating bundle of straight lines, this expression would give for each value of n a separate bundle, departing from a variable point ($x = 1$; $y = n$). This set of bundles would be included between two straight lines corresponding to the two extreme values of I (I = OO; I = O), and having for angular coefficients, $\frac{23\,n^2}{1 + 23\,n}$ for the first, and n for the second; this last would pass through the origin. The inclination of all these lines, depending upon the term $\frac{0.00155}{I}$, increases just as I diminishes.

Not to complicate the figure given, Mr. Bazin only indicates the lines corresponding to the values I = 0.001 and 0.0001, except for the fourth type of roughness, where there has been added the very small slope I = 0.00004. The experiments referred to are represented by so many points, each having for co-ordinates the values of $\sqrt{A}$ and $\frac{1}{\sqrt{R}}$, corresponding to the particular experiment. These, however, are so numerous that the figure would become very confused if all were separately indicated; some, therefore, have been united to each other in groups, where the elements varied but little; and these are represented by a single point indicating the average of the group.

Mr. Bazin then goes on to the detail of the many experiments from which he deduces his new formula; but, as before remarked, space forbids entering into that part of his discussion.

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*"Recherches Hydrauliques," Darcy-Bazin. 1865.

A MODERN ELECTRIC CENTRAL STATION.*

By George A. Damon.

The plant of the Imperial Electric Light, Heat & Power Company, of St. Louis, Missouri, is a good example of the present tendency in electric power station practice.

The territory to be supplied with electrical energy was a down-town district, and the character of the load to be expected included arc and incandescent lighting as required in stores, hotels, office buildings, and theatres, with more than the ordinary amount of motor work for elevators and light manufacturing establishments.

In planning an installation for a commercial enterprise of this character two conditions are imposed upon the designer. First, the service supplied the customer must be absolutely reliable. The second problem is to deliver to the customer electrical energy at the least possible cost, considering interest upon first investment, maintenance, and all other factors which enter into operating expenses.

The system which has been adopted as the one best fulfilling all the conditions in this particular case, involves the use of the direct current 220-volt incandescent lamp; the location of the station as near as possible to the center of distribution; the operation of generators capable of delivering current at a potential of 500 volts, a special arrangement of the generating units, and the installation of a storage battery in the plant to act as an accumulator, and also in parallel with the generators as an equalizer. The generators are run at a potential enough greater than 440 volts to overcome the line loss, and the motor circuits are at present operated at this potential. The storage battery across the outside mains allows 220-volt incandescent lighting feeders, to be distributed over the district.

The greatly reduced investment required for copper distributing feeders for a 220-volt system from that required by the usual direct current 110-volt system, the enlargement therefore of the territory which could be supplied, as well as the better quality of light and the possibility of operating 220-volt motors on the same circuits and thus making it possible to connect in many motors all ready in use in the city, were the main advantages which led to the adoption of the 220-volt lamp. The comparative lower efficiency and higher first cost of the lamp as compared with the 110-volt type was recognized, but these points are yielding to development, and it is thought that the difference between the two lamps in respect to efficiency and price is sure to become much less as the demand for the new lamp increases.

Local conditions made the location of the plant a much simpler problem than is usually the case. To have secured free water for condensation purposes would have removed the plant much too far from the center of distribution. The difference between drayage charges on the coal delivered to the station on its present site, and the cost of bridge tolls and switching charges which would have been necessary if the coal had been delivered directly from the cars, is only 15 cents per ton in favor of the latter plan, and this is not enough to justify the extra expense in feeders which would have been required to secure the location of the plant on a railroad switch. No doubt, therefore, was entertained in regard to the advisability, in this particular case, of carrying the fuel of the plant in wagons from the railroad to the station at the center of supply, rather than transmitting the product of the plant over copper conductors the same distance.

The advantages of supplying all classes of service from one type of generator, thus simplifying the distribution circuits as well as the arrangement of the station, and at the same time increasing the economy of the plant by reducing the amount of both fuel and labor required were not forgotten. At periods of light loads it is possible to furnish the entire output for incandescent lamps, arc lights and motors from one generator, while during the hours of minimum demand the load may be carried by the accumulator.

The battery acts in the same manner in carrying the peak of the load. This peak usually extends over a period of from one to three hours, and in an ordinary plant the equipment which is necessary to supply the extra demand at this time is inoperative during the remainder of the day. The storage battery auxiliary improves the unfavorable conditions, first, by evening up the load line, and thus increasing the efficiency of the generating plant, and second, by decreasing the total amount of investment required. The advantages of convenience and reliability of an accumulator in a central station cannot be questioned.

In the generating station proper every precaution known to modern practice has been adopted to deliver at the switchboard as much as possible of the energy originally contained in the fuel.

The engine room and the boiler rooms are upon the ground level, which arrangement ensures plenty of light, good ventilation, and convenience in operation. The engine room basement is used for the storage batteries, while in the boiler room basement is located the coal storage bin, the ash-handling apparatus, the piping, pumps, hot well and condenser. A second floor is added to the building for the offices of the company, for the storage of supplies and for a machine and repair shop.

The furnaces of the boiler are of the down-draft type. Considerations of availability and cost limit the fuel supply to coal from Southern Illinois mines, which produce a bituminous slack containing about 11,000 B. T. U. per pound. As the wagons deliver the coal directly on the boiler room floor, automatic coal-handling machinery was not thought to be a good investment.

Horizontal water tube boilers were adopted on account of their quick steaming properties, the comparatively small amount of floor space occupied by large capacities, their economy of fuel, and their safety under high steam pressures, the pressure adopted for this plant being 175 lbs. In determining the size of the boilers, due allowance was made for the fact that they were to be operated in conjunction with economizers, and their capacity was reduced accordingly. The question of economizers was thoroughly considered, and they were adopted only after careful estimates had been made, which demonstrated that the probable saving of fuel effected by their use would be sufficient to cover the usual allowance for depreciation, insurance, etc., and yet leave a very good margin for interest on the investment. As no steam-driven auxiliaries are to be used in the plant, there will consequently be no other feed-water heater besides the economizer. The economizer for each battery of two 375-HP. boilers consists of 320 pipes, and the heavy weight is carried on special iron framework which places the economizer at the back and above the boilers, as shown in the figure. The flue passages and stack connections are so arranged and fitted with dampers that the flue gases can pass either directly to the stack, through the economizer to the stack, or to the mechanical draft fan in series.

A mechanical draft fan is now considered by many engineers a necessary adjunct to a power station, and especially is this true if economizers are used. Unfortunately in this particular plant the city ordinances required a stack which would carry the gases up above the surrounding buildings. For this purpose a steel chimney has been built, but it is a disadvantage rather than a benefit as far as the question of draft itself is concerned.

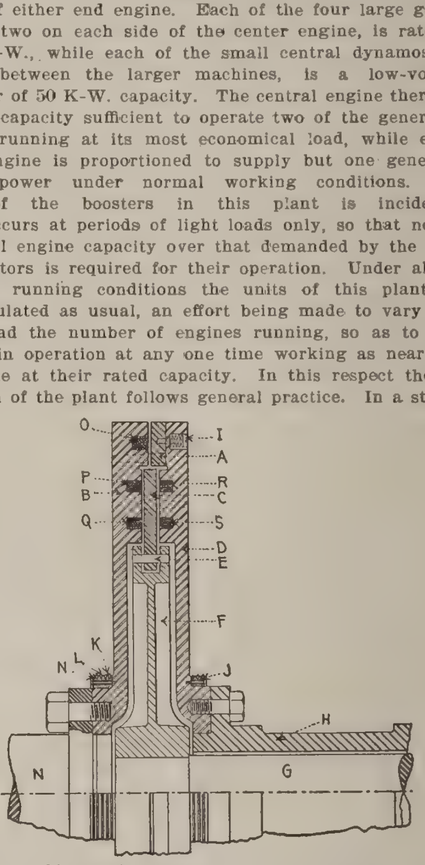
The engines are compound-condensing, and are the only steam using parts of the entire station equipment, all auxiliary apparatus being operated by means of electric motors. The steam thus passes directly from the boilers into the engines with a minimum amount of steam piping exposed for radiation losses. The steam from the engines exhausts into a surface condenser placed in the basement below the boiler room, from which, when condensed, it is pumped into the hot-well and through the economizers back into the boilers.

The condensing water is taken from the bottom of a cooling tower located upon the roof at an elevation of 50 ft. above the condensing apparatus. After this water passes through the condenser it is forced back to the top of the cooling tower by means of centrifugal circulating pumps. The water circuit is arranged so that the weight of the descending column is used to balance the weight of the ascending column of water. The work actually required of the circulating pump, therefore, is represented by the amount of power required to raise the water through the height of the tower, or about 30 ft., and the net result is the same as if the tower had been located on the ground level.

The plans for the completed station contemplate a total capacity of 5,000 K-W. There are at present, however, installed in the station but two engines, one of 750 HP. and the other of 1,500 HP. capacity. These engines are of the cross-compound marine type, of massive design, and run at a speed of 150 r. p. m. They are expected to develop an indicated horse-power hour on less than 14 lbs. of water per hour. Each engine is designed, however, to stand a continuous overload of 100%. This will be developed by means of admitting high pressure steam directly into the low pressure cylinder. The conditions under which it is expected to operate the engines in this manner will be referred to later. The cylinders are placed side by side, each piston acting upon a separate crank. Between the cylinders is located the receiver, which is provided with copper reheating coils. The high pressure cylinder is steam-jacketed on the barrel, and both cylinders have a steam-jacket on the heads. Both receivers and cylinders are protected with a non-conducting covering. Each engine is provided with a heavy flywheel located in the center of the frame between the cylinders. The speed is regulated by a shaft-governor operating an eccentric connected to the cut-off valves of the high-pressure cylinder, and in addition to this governor, each engine is provided with an additional automatic safety-valve, designed for the protection of the engine in case the speed should be abnormally increased for any reason. The engines also have a speeding device attachment by means of which they may be brought to the same rate of speed under frictional load as under full load.

The engines are directly connected to three 500-K-W. generators and two 50-K-W. boosters. These dynamos are of the multipolar type with ironclad bar wound armatures. Provision is made for sliding the field casting parallel with the shaft a sufficient distance to allow the field coils to be removed and the armatures reached for repairs. The brush holders are carried in a circular iron frame, arranged to be moved by means of a threaded rod and a hand wheel, so that the position of the brushes may be adjusted. An additional hand-wheel is provided for lifting the brushes from the commutator.

The engines and generators are connected by means of the "Arnold System." This system of power station design is well known, but its application to this particular station will be of interest. The general idea of the system is to improve upon the usual direct-connected unit principle by mounting each generator in such a manner that it can be operated by more than one engine. The line of engines and generators as they will eventually appear as the output of the station is increased contains three engines, the capacity of the center engine being 1,500 HP. and double that of either end engine. Each of the four large generators, two on each side of the center engine, is rated at 500 K-W., while each of the small central dynamos, located between the larger machines, is a low-voltage booster of 50 K-W. capacity. The central engine therefore has a capacity sufficient to operate two of the generators when running at its most economical load, while either end engine is proportioned to supply but one generator with power under normal working conditions. The use of the boosters in this plant is incidental, and occurs at periods of light loads only, so that no additional engine capacity over that demanded by the main generators is required for their operation. Under all ordinary running conditions the units of this plant are manipulated as usual, an effort being made to vary with the load the number of engines running, so as to keep those in operation at any one time working as nearly as possible at their rated capacity. In this respect the operation of the plant follows general practice. In a station containing independently-direct-connected units, however, if any piece of the generating machinery gets out of order, it disables the entire unit and thus the commonly accepted principle which underlies the selection of the size and number of units for a direct-connected station is to have in reserve and always ready to be put into immediate service, engine and generator capacity sufficient to take the place of the largest single unit in operation. Thus, with a station containing five generating units of equal size, the station capacity which may be safely relied upon is the combined output of but four of the units, the fifth unit being either held in reserve or undergoing repairs. An additional investment of 25% in station equipment over that actually required by the demands of the service is necessary, therefore, in this case, in order to ensure reliability. One of the advantages of the Arnold system of power-station construction is that the extra reserve unit is not required. Each generator is not rigidly connected to its corresponding engine but is in such a manner that it may be operated by more than one prime mover. Thus the central engine may run either one or all four of the generators as well as the two boosters, while the smaller end engines can reach either or both of two generators and also one booster.



Detail of Magnetic Clutch used in Arnold System of Connecting Engines and Generators in Power Station of the Imperial Electric Light, Heat and Power Co., St. Louis, Mo.

In the method of mounting and connecting the dynamos which makes this flexible arrangement possible each generator armature is mounted on a hollow shaft or quill, which is carried independently in its own bearings. The booster armature is attached to the solid shaft. This shaft is made of forged steel and extends through the hollow generator quills, but without touching them. It is by means of this shaft that any engine can reach the generators not contiguous to it; but under all normal operating conditions, this shaft does not turn, so that this system of connecting involves no more friction and requires no more lubrication than the ordinary arrangement. The coupling on the end of the shaft permits of three combinations: The engine may be directly connected with the quill of the adjacent generator, allowing the interior shaft to remain idle, or the solid shaft may be attached to either the engine flange or to the generator quill. The latter two combinations allow the transfer of power peculiar to this system.

The coupling or clutch is of particular interest, as it is said to be the first magnetic clutch applied upon a large scale to power station work. The accompanying cut shows a cross-section detail of this clutch. One part, B, is bolted to the engine flange, N. A corresponding part, D, is bolted to the generator quill, and this part carries an annular armature, A. Radial arms F, keyed to the solid shaft G. carry an interior armature C. Each coupling is provided with five circular coils of magnet wire O, P, Q, R and S. These coils are electrically connected to contact rings J, K and L, carried on insulating bushes bolted to the hubs of the clutch. Stationary brushes which are connected through a system of switches to the storage battery 'bus bars make it possible to send a current around any coil. The parts of the clutch containing the coils are made of cast-steel of high permeability, so that when a current is sent around any coil, the surrounding metal becomes a magnet and the armature facing the coil is immediately magnetically attracted. The two surfaces of the clutch parts being held in contact by a pressure of at least 80 lbs. per sq. in., it becomes possible to transmit power from one to the other. Thus to connect engine shaft N to generator quill H, a current is sent through coil O in that part of the clutch B attached to the engine shaft. Armature A, which is attached by means of strong studs to that part of the clutch which is securely bolted to the generator quill, is immediately attracted, and overcoming the small resistance of the spring I, the two parts become firmly attached to each other, making it possible to run the generator from the engine. If it is desired to revolve the interior shaft by means of the engine, the current is sent through coils P and Q in parallel, attracting armature C, while if the solid shaft is being turned by the other engine and it is desired to connect the shaft to the generator quill, then the coils R and S are energized and the armature C is attracted in the other direction. The circuits to these coils are all controlled by means of switches on the main switchboard. These switches are so arranged that when the circuit of any coil is broken, the discharge of the extra current is taken up through a carbon resistance, and the insulation of the coil is therefore protected from the liability to puncture. When the current in any coil is discontinued, spiral springs have been provided to overcome the residual magnetism and bring the armature back to its original position.

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*Condensed from a paper presented at the 15th general meeting of the American Institute of Electrical Engineers, Omaha, June 30, 1898.

If both parts of the clutch which are to be attached are stationary, the connection becomes an easy matter, but if one part is revolving, it becomes necessary to put the other part in motion before the current is sent through the coils. This is accomplished by starting the dynamos as motors and bringing them up to speed before closing the magnet coil switch. For this purpose, regular starting-boxes have been installed, one for the boosters and the other for the generators, so that any machine may be thrown into or out of service directly from the switchboard. The result of the whole arrangement is, that a number of combinations between the engines and the generators becomes possible. Under all normal running conditions, the center engine will run its two adjacent generators, and the outside engines will operate the end generators. Each booster may be run when necessary, from either of two engines. The entire line of machinery may be connected together, so that all the engines and generators operate in unison as one large unit, the speeding attachment on the engines making it possible to operate them satisfactorily in this manner.

In case of accident to any generator that particular machine may be stopped without stopping its corresponding engine, and the electrical load will be immediately taken up by the other generators, but without overloading the engines. In case of accident to any engine, the ability of the other engines to carry an overload of 100% may be taken advantage of, if necessary, without overloading any of the generators. Thus the center engine is capable of carrying all four of the generators fully loaded, while the smaller end engines can operate two of the generators, if necessary, in case of a breakdown of the larger engine. The plant may, therefore, operate at period of maximum load, at its full rated capacity, depending entirely upon the advantages of the system of arrangement for a reserve in case of a breakdown to any part of the equipment.

All the variable speed motors operating the auxiliary equipment of the plant are designed to run at two voltages, the maximum being 440 volts, and the other voltage being one-half the maximum. Further speed regulation is obtained by changing the field excitation by means of a small resistance in the field circuits. The use of armature resistance is thus entirely obviated. A switchboard containing the switches and controling apparatus for the pumps and fan motors has been placed conveniently in the boiler-room and another auxiliary board has been placed in the engine-room to control the circulating pump and cooling-tower motors as well as the circuit leading to the crane which spans the engine-room. The use of economically controlled electric motors for running the pumps, fans and other auxiliaries of the plant is expected to result in a considerable saving of fuel.

The storage battery is located in the basement and has a capacity of 2,000 ampere-hours at the normal rate of discharge, but is capable of standing a discharge at the rate of 500-KW. for one hour. The station, therefore, as it now stands, can carry a maximum of 2,000-K-W., three-quarters of which can be taken care of by the generators, and the remaining quarter supplied by the battery. The battery consists of 280 cells, 100 of which are end or regulating cells, by means of which the potential may be regulated, the voltage depending, of course, upon the number of cells in circuit.

No radical departure is claimed for the design of this station. It has been described simply to show the latest solution worked out by conservative engineers of the problem of the generation and distribution of electrical energy. It is thought to be of interest because it presents a combination of the following widely discussed features of modern central station practice: (1) Improved furnaces; (2) Water-tube boilers; (3) Mechanical draft; (4) Fuel economizers; (5) Electrically-driven auxiliaries; (6) Cooling tower condensing system; (7) Arnold system of power station construction; (8) Battery auxiliary; (9) Two-wire distributing system, and (10) 220-volt lamps.

A STEAM ENGINE WITH OSCILLATING PISTON.

The engine illustrated herewith is somewhat of a novelty in steam engine design, and occupies a position midway between the ordinary reciprocating engine and the rotary engine. The cylinder has its axis parallel with that of the flywheel shaft, and in one end is the steam chest. The cylinder proper is divided into two compartments by a partition which is split along the middle to make room for the piston shaft. On this shaft are two pistons or wings which oscillate in the compartments, and on the end of the shaft is an arm carrying the connecting rod, no crosshead or guides being required.

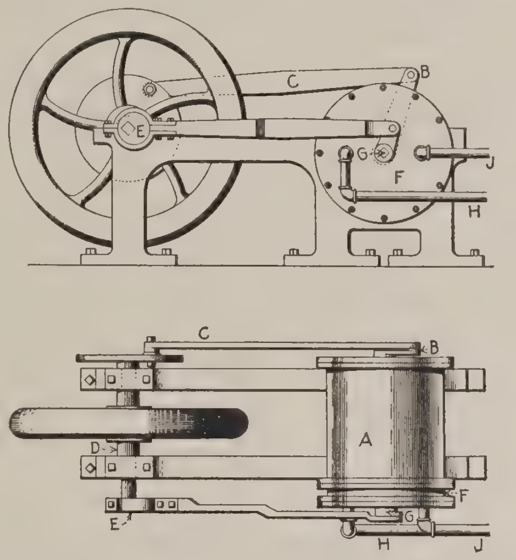

Fig. 1.—Elevation and Plan of Engine with Oscillating Piston.
Benjamin H. Trucks, Inventor.

Fig. 1 is a side elevation and plan of the engine, in which A is the cylinder, B a vertical oscillating arm on the piston shaft, which passes through the axis of the cylinder; C is a connecting rod which is attached to B and drives a crank disk on the flywheel shaft D. On the other end of this latter shaft is an eccentric, E, whose rod drives the oscillating valve in the steam chest F, this valve being carried to the stub shaft G, which is independent of the piston shaft. The steam pipe is shown at H, and the exhaust pipe at J.

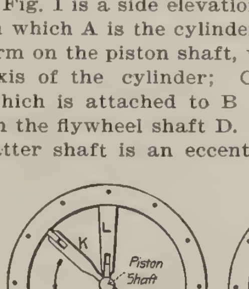

Fig. 2.

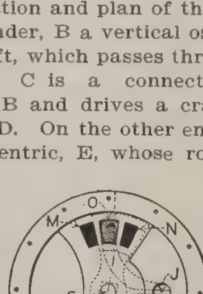

Fig. 3.

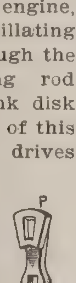

Fig. 4.

Fig. 2.—End Elevation of Cylinder, with Cover Removed.
Fig. 3.—End Elevation of Steam Chest, with Cover Removed.
Fig. 4.—Oscillating Bar Carrying Slide Valves.

its cover removed, showing the reciprocating pis-

Fig. 2 is an end elevation of the cylinder with ton K and the fixed partitions L, the inner ends of which are fitted with packing which bears against the piston shaft. Fig. 3 is an end elevation of the steam chest with its cover removed. In this view, M and M are the steam ports, and N, N the exhaust ports, while O, O are the exhaust passages leading to the exhaust pipe at J. Over these ports move two slide valves, P, P, Fig. 4, carried on the ends of a rocking bar Q, which is mounted on the stub shaft G. These valves have openings through which the exhaust steam from the cylinder passes to the passages O. In Fig. 4 only one of the valves is shown in position, in order to show the corresponding opening in the bar.

This engine is the invention of Mr. Benjamin H. Trucks, of Caldwell, Kan., who has had several built by P. I. Harris, of Wichita, Kan.; the L. P. Lester Machine Shop, at Newton, Kan., and the Ersham Machine Co., of Enterprise, Kan. The smallest, built merely as a working model, is of 2 HP., with cylinder 4 ins. diameter and 3 ins. long, the weight of the machine being only 68 lbs. The largest engine is of 15 HP., with a cylinder 8 ins. diameter and 6 ins. long, the piston area being 30 sq. ins. This engine weighs 750 lbs., and occupies a space only 24 × 44 ins. One of the larger engines is now at work driving the plant of the Enterprise Laundry, at Joplin, Mo., and has been in regular service since Feb. 23, 1897. The advantages claimed for this type of engine include reduction in friction and in number of parts, economy in steam consumption, and small floor space

THE INCREASE IN THE WORLD'S PRINCIPAL NAVIES.

Among the late reports of the Office of Naval Intelligence, in the U. S. Navy Department, is one by Lieut.-Commander W. H. Driggs, U. S. N., on "The Increase in Naval Strength" of England, France, Germany, Russia and Japan. At a time when additions to our own navy are being looked upon with especial favor it is interesting to note what other nations are doing in this direction, and for this reason we make a brief abstract of the paper of Lieut.-Commander Driggs.

England, as always in naval matters, is far in the lead. The budget voted for 1897-98 amounts to about $107,000,000, providing for an expansion in all branches of the navy. The number of officers and men has been increased from 88,850 in 1895 to 100,050 in 1897, including in these figures the coast guard. The total of ships under construction and to be built during the fiscal year of 1897-98 is 108, including 14 battleships, 8 first-class cruisers, 9 second-class cruisers, 10 third-class cruisers and 52 torpedo boat destroyers.

Russia is not only adding to her naval strength but is also actively engaged in opening up harbors and channels for strategical purposes and establishing naval bases in foreign countries. The naval program that was mapped out in 1896 involves an expenditure of $318,000,000, though the exact number of ships contemplated is not specified by Lieut.-Commander Driggs.

France in her budget for 1898 asks for $55,108,000 for naval purposes, allotting nearly $20,000,000 of this for new ships. Her present building program extends over a period of eight years, and involves an expenditure of about $144,300,000. Like Russia, she is providing for better harbors and channels at home, and is creating bases for supply and repair in foreign waters. Admiral Besnard, the French Minister of Marine, calls especial attention to the need of fast cruisers in modern naval warfare, and to emphasize his demand for additional ships of that class in the French navy he presents two tables showing certain naval conditions in May, 1897, as follows:

Available.	England.	Triple alliance.	Russia.	France.
First-class cruisers	24	3	5	8
Second-class cruisers	61	26	7	12
Dispatch boats	50	19	20	13
Torpedo-boats and torpedo-boat destroyers.	51	38	9	13
Total	195	86	41	46
Under construction.				
First-class cruisers	12	10	6	5
Second-class cruisers	6	3	1	7
Dispatch boats	10	5	0	1
Torpedo-boats and torpedo-boat destroyers.	14	1	1	3
Total	42	19	8	16

In addition to the above France had in 1897 10 battleships and 7 armored cruisers under construction, and, counting all classes, she had 65 war ships under construction in that year.

Germany is now putting into execution a naval program laid down in 1873 and deferred until the present time for lack of funds. This program calls for an active fleet of 17 battleships, 8 armored coast-defense ships, 9 large cruisers and 26 smaller cruisers. In addition, she proposes a reserve fleet of 2 battleships, 3 large cruisers and 4 small cruisers. The total proposed and those classed as available by the German government are shown in the following table:

	Total authorized.	Available.
Battleships	19	12
Armored coast defense	8	8
Large cruisers	12	10
Small cruisers	30	23

Germany recognizes the fact that to maintain a modern fleet she must provide for the replacement of old-type ships. To this end she fixes the period of efficiency of battleships and armored coast-defense ships at 25 years, of large cruisers at 20 years and of small cruisers at 15 years; after these periods of service they would have to be replaced by others of the newest type. The personnel of the German navy is to be raised from 18,138, its present strength, to 26,637 in 1904.

Japan has a naval program to be completed in 1906, and during this period she proposes to spend $102,396,546. This program calls for the addition to her navy of the following vessels: Four battleships of 15,000 tons, 4 armored cruisers of 9,500 tons, 3 second-class protected cruisers of 4,800 tons, 2 third-class protected cruisers of 3,200 tons, 3 torpedo gunboats of 1,200 tons, 11 torpedo boat destroyers and 89 torpedo boats. Prior to her war with China Japan only had 18 cruisers ranging from 1,500 to 4,000 tons. When those authorized are completed she will have a navy of 65 ships of war, 11 torpedo boat destroyers and 115 torpedo boats. Japan now has 1,725 officers in her navy exclusive of midshipmen and sub-lieutenants.

In the above lists the total proposed expenditure for naval purposes, according to adopted programs, amounts to $1,001,690,000, all to be expended before 1906 by five nations only.

TEST OF A PIPE DISTRIBUTION SYSTEM.*

By James S. Haring, M. Am. Soc. C. E.†

In testing the distribution system of a water-works recently designed and constructed by the writer, some peculiar facts were developed which have not as yet been satisfactorily explained.

In 1896 a new system of pipes, ranging in size from 12 to 4 ins., and in length about 10½ miles, were constructed. The work of laying the pipes began in May, and was completed in the following December. At the time the work was progressing provision was made for placing hydrants, but they were not then contracted for, and their T-connections were closed by a temporary plug, as were also some dead ends.

The pipe contract was awarded to one of our most reliable pipe companies. The specifications were the usual provisions for a test of 300 lbs. hydraulic pressure per sq.in , and to be sharply rapped with a hammer while under such pressure. No inspector was placed at the foundry, the pipe being taken under the company's guaranty. We had an inspector examine the pipe while being unloaded and again go over the pipe after being hauled to its position on the street; finally, it was inspected by the contractor's men when being laid. The same course was pursued with regard to the manufacture of the valves, each valve being tested at the factory to 300 lbs. internal pressure, the contract for which was also given to one of the largest manufacturers. About 175 valves were used in the mains, and 70 in setting hydrants as supplemental valves.

The contracts for laying the pipe and setting the hydrants had specified that a test of 200 lbs. per sq. in, should be made.

The territory covered was that of a side hill ranging in elevations from 0 to 250 ft., the reservoir being at an elevation of 352 ft. A temporary connection was made between the main leading from the reservoir and the system tested by means of a 2½-in. fire hose connected with a hydrant nozzle.

The test was under the charge of a foreman who had been an inspector on the pipe laying and hydrant setting, a man of more than ordinary intelligence, carefulness, and honesty in the performance of his work, and a man who had also been for a number of years a foreman in one of the largest foundries doing fine metal work, in the East. This inspector not only brought experience, but energy and trustworthiness to bear in the performance of his duties, and when he reached a conclusion it was reliable and could be depended upon.

The pipes were filled with great care; about two weeks were taken to accomplish this so that no hammer or compressed air would occur. Each hydrant was opened and left open to allow the escape of air as it was found the water was rising to near its level, until it ran out of the hydrant; blowoffs were opened and all dirt and accumulations gotten out of the pipes until we were satisfied that every precaution had been taken to make a proper test.

The means of testing were those usually employed, a boiler feed pump set in a galvanized sheet-iron 10-gallon can bolted through the bottom to a plank, the pump connected with an inch galvanized iron pipe and valve by a union to a special hydrant nozzle cap. Water was supplied to the can from a barrel filled from the hydrant before connecting the pump. Attached to the other hydrant nozzle was a test gage registering up to 200 lbs. pressure (this was afterwards changed to a gage registering up to 400 lbs., for the peculiar reason that the contractor who set the hydrants claimed that we were going over 200 lbs. in our test, and were thereby causing the various leaks which appeared in his work, and were violating the terms of his contract by excessive pressures); the sensitiveness of this gage was not very delicate and caused us some annoyance.

The test was begun at the bottom in small sections and from this proceeded slowly over the whole system. There being no service connections, the work was very much simplified. First the reservoir test was made by shutting off all supply; the pressure was noted for a few minutes, when the pump would be applied and a pressure maintained by closing the globe valve from the pump. All defects were sought for and corrected in each section as found.

The very liberal use of valves in the system made it possible to cut off small sections and to locate defective valves, the defect consisting generally of some obstructions under the disk. The writer at the beginning found considerable trouble on one section; the action of the gage convinced him it was not a leak, but must be a defective valve; after manipulating numerous valves, he located the trouble on one immediately at the corner where the test was being made. After digging up the valve and taking off the dome fully a pound of gravel, sand and part of a tin can were found in it.

We were able to make the hydrant test separately because of the supplemental valve with all but two joints, and the hydrant itself separated from its connection. The hydrant was the first test, then the whole to the valve, and finally the pipe section with such enlargement of it as was desired, or found advisable.

As a charge was to be made against the various contractors doing the work of furnishing materials, each was notified of the test to be made and the date when it would begin. Only the contractor who set the hydrants, a local man, responded.

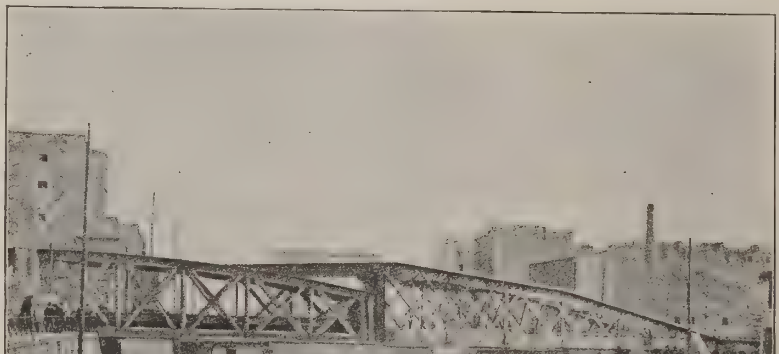

FIG. 1.—THE ERECTION OF A BRIDGE OVER THE NORTH RY., PARIS; VIEW OF OPENING SPANNED BY MAIN AND PILOT TRUSSES.

The test demonstrated only nine minor defects in pipe laying, the cost of repairing which amounted to $89.39. But the pipe demonstrated the peculiarities of the situation, and it in turn was surpassed by the strange defects found in the valves. Three breaks occurred in the 12-in. pipe, two in the 8-in. pipe, and two in the 6-in. pipe, the cost to repair which amounted to $237.49. The fracture in this pipe was, in every instance, shown by the pipe to be inherent foundry defects, cold shorts, honeycombed shrinkage, and foundry imperfections.

After the foundry test, after the care of inspection and every precaution, why should these pipe fail under a 200-lb. pressure test?

Now as regards the valves. The writer required in the valves supplied for the mains the use of sheet rubber gaskets, but in the hydrant valves that provision was not made, and the ordinary oiled paper was used for gaskets. Of the 175 valves used in the mains, 19 were found to be leaking around the packing gland gasket; of the 67 hydrant valves then placed, 13 gaskets were defective, the total cost of making good the defects being $152.33.

What caused these leaks is one of the excuses for bringing this paper to your attention. Our claim is that the general cause was that the gaskets were too thin, that the iron surfaces were compressed together without sufficient elastic material to shut off fully the space between their faces and also that in two instances the follower of the packing gland was too large to enter the casting.

The valve manufacturers made a careful examination of our claims, and disputed their liability for the damage, and they claimed:

(1) That we had not properly conducted the test, having compressed air in the system which had found its way out through the gaskets of the valves as the points of least resistance.

(2) That if the air had not been compressed in the system, it had been in the domes of the valves, thereby causing the gaskets to blow out, and that the air pressure would amount under such conditions to more than 200 lbs.

(3) It was claimed that the packing gland nuts had been tightened up when they were inspected in May, 1896, and that the gaskets had shrunken so that the nuts again needed tightening.

When we produced the gaskets, in each case tagged as to locality, and found none of them showing the least signs of having been blown out, no explanation made by them seemed to account for the cause.

That the leaks were very large from this cause, we demonstrated to the personal examination of a representative of the company who happened to be present when one of the leaks made itself evident.

It is claimed by the makers of these valves that no similar experience has ever come to them in a matter of this kind; of the many thousand of valves sent out by them none have ever been found defective in the two ways discovered in this case. They claim that with their shop practice and system of testing valves, that no such defects could be afterwards found; yet they were, and they are indisputable.

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[*] Abstract of a paper prepared for the Buffalo meeting of the American Water-Works Association, June, 1898. Owing to the inability of the author to be present, the paper was not read, but it was ordered printed in the proceedings.

[†] Engineer of Water Commissioners, Nyack, N. Y.

THE ERECTION OF A BRIDGE OVER THE NORTH RAILWAY IN PARIS.

Owing to increased traffic across the sunken tracks of the Chemin de fer du Nord, in the XVIII. Arrondissement of Paris, the railway company was lately required to construct another bridge for street traffic at this point. The method of erecting, or rather of launching this bridge over the eight or ten tracks of the railway has been described by "Le Genie Civil," and from this description the following abstract is made:

The mean span between the faces of the bridge abutments was 132 ft.; the bridge floor was on a slight grade and the minimum free height above the tracks was 17 ft. The bridge itself was a riveted bow-string truss, 50.84 ft. wide between centers of trusses, and tied together by cross-girders spaced 13.74 ft. apart. The floor was made of longitudinal beams and buckle plates, supporting two footways of 10 ft. each, and the roadway proper 29.52 ft. wide. This floor was paved with wood upon a beton base and the footways were covered with a coating of asphalt ¾-in. thick. The metallic part of the bridge in place weighed 995,720 lbs. and cost erected $47,085, or not quite 5 cts. per lb.

Owing to the traffic upon the tracks beneath, and their peculiar arrangement, it was deemed impracticable to erect this bridge upon the usual timber falseworks; and the engineers of the railway company decided to erect the bridge upon the ground, at one side of the opening, and then to move the whole structure forward to its destined position. As it was a single-span bridge it became necessary to provide the bridge with an advance or pilot truss. This pilot had a total length of 87.94 ft., and it weighed 110,000 lbs. Acting as a concentrated load, this weight centered at a point 36 ft. beyond the point of connection of the two trusses. The extreme forward end of the pilot truss was slightly curved upwards to permit the truss to more easily slide upon the forward rollers. The pilot truss was constructed with a slight grade, designed to compensate for the general deflection during the operation of launching. The two trusses were connected by riveting together the abutting end members and by struts extending back upon and riveted to the upper chords of the bridge proper, as shown in the illustrations; the bottom of the joint between the two bridges was covered by steel plates. The two main trusses of the pilot were firmly united by a system of horizontal and vertical bracing.

The bridge proper was erected in such a position that the pilot truss could be built and attached to it, with the nose of the pilot resting upon rollers on the near abutment. These rollers were 23.58 ins. diameter, made of cast steel, and they were arranged in four groups of six rollers each under each truss, on the launching side of the opening, and one group of four rollers under each truss on the far side of the opening. These rollers rested in pivoted supports of cast steel, carried by balance beams supported in turn by "Belleville" or pivot washers on beams on the ground. All of these rollers were so placed that the lower chord of the bridge was upon a uniform down grade of 63.4 ft. per mile. The actual grade of the bridge in position was 126.7 ft. per mile, or twice this grade; but the reduction was made for the purpose of greater safety in launching.

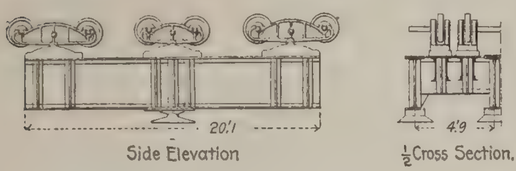

Fig. 2.—Roller Supports Used in Erection of a Bridge.

The bridge was moved forward upon the rollers by two windlasses, placed behind the bridge and each operated by eight men. From the drums of these windlasses two chains passed under the bridge, over pulleys attached to the farther abutment, and then back over two other pulleys attached to the rear of the bridge, with the ends of the chains fixed to the nearest abutment.

After every detail of the proposed operation had been carefully tested, the launch was made in two days, Aug. 23 and 24,. On the first day work was commenced at 9 a. m., and it was stopped, according to the program arranged, as soon as the pilot-truss had entirely cleared the rollers on the near abutment. The launching was resumed at 7 a. m. the next morning, and the truss proper was rolled across the opening by 11 o'clock, without interruption of traffic on the railway or trouble of any kind.

In place for launching the total weight of the bridge was 877,800 lbs., on a length of 143.9 ft. The total length of the pilot truss was 87.94 ft. and it weighed 110,000 lbs. As a result, the uniform distributed load of the main truss was 6,100 lbs. per lin. ft. and that of the pilot truss 1,251 lbs. per lin. ft. The work was done from the plans and under the direction of M. Boreux, Chief Engineer of Public Ways and Lighting, of Paris.

The actual cost of this pilot-truss and its manipulation is not stated in the article in "Le Genie Civil," nor does the author say what was finally done with this expensive and seemingly wasted material. It is safe to say that an American engineer, with a problem of this kind on his hands, would have made use of timber which can be used again. With eight or ten tracks at his disposal, one or more could certainly have been thrown out of service long enough to build a central wooden tower or pier; and this tower could have been utilized as a midway roller support for the pushing out of the counter-weighted main truss. Or, the same tower could be used for erecting two 70-ft. temporary wooden spans, upon which the bridge proper could either have been erected or rolled out complete. If headroom were lacking, the main bridge could have been built above grade and lowered into place upon the abutments.

THE COST OF PRODUCING POWER AT THE LACHINE RAPIDS ELECTRIC POWER PLANT.

The Lachine Rapids power plant, a full description of which was given in our issue of Feb. 18, 1897, has now been in operation about eight months, although all of the turbines and electrical generators have not as yet been installed. This plant, it will be recalled, utilizes a portion of the water power of the Lachine Rapids of the St. Lawrence River about 7 miles above Montreal. The rapids proper are about 5 miles long, with a fall of 30 ft. The Lachine Rapids Hydraulic & Land Co. built a dam about one mile from the foot of the rapids and a dike parallel with the bank and some 5,000 ft. long, which together give the company about 15,000 cu. ft. of water per second with a head of 11 ft.

Taking the plant as it now exists and as it is at present operated, Mr. W. McLea Walbank, managing director of the company, deduces some interesting figures which he presented in a paper read before the National Electric Light Association at its convention held at Chicago in June. The cost of distributing power is not considered since it would be the same no matter how the current was generated, and the figures given consider only the cost of generation and transmission to the sub-stations in Montreal.

The cost of all water rights, dams, wing walls, power houses, hydraulics and electric generating and transmitting machinery installed to the present time amounts to $957,200. This includes a power house, dams, etc., sufficient for the maximum output (about 14,500 HP.), although the present hydraulic machinery and generating apparatus has a capacity of only 4,000 K-W. at the generator switch-board. Allowing a loss of 10% for transmission, the present generator plant can deliver at the sub-station for customers' use 3,600 K-W., and taking the investment at $957,200, this corresponds to a first cost of $263.83 per kilo-watt.

To determine the total cost per kilo-watt an estimate is made as follows:

Interest on $263.83 at 6%, per K-W	$15.95
Depreciation, 5% on $300,000 (taken as the value of that portion of the plant of 3,600 K-W. subject to depreciation), = $15,000, or per K-W	4.17
Operating expenses, including labor, repairs, insurance, etc., for 3,600 K-W., per K-W	2.85
	$22.97

This gives a total cost of $22.97 per K-W. per year for continuous service.

Considering the plant completed and all machinery installed as planned, there will be 72 turbines in operation, and the plant will represent an investment of $1,113,273. At that time the output after deducting all losses will be 13,500 K-W. delivered at the sub-station, and the investment per kilo-watt of such output will be $82.46. As in the former case:

Interest on $82.46 at 6%, per K-W	$4.95
Depreciation at 5% on the increased value of depreciable property but distributed over 13,500 K-W., per K-W	1.68
Operating expenses, also increased but now spread over 13,500 K-W., per K-W	1.51
	$8.14

On this basis the cost per K-W. per year for continuous service will be only a trifle more than one-third of what it is at present.

If the above figures for the cost of power are compared with the cost of steam power at Montreal, where steam coal costs about $3.50 per ton, it will be seen that the company can market its power at a good profit and still make a large saving to its customers over the cost of power or electric current produced by steam.

◆

THE RECLAMATION OF THE SAND-DUNE territory of the Pacific Coast, at Golden Gate Park, near San Francisco, is carried on as follows: The shifting sand is first seeded with sand-grass (Arundo arenaria) and this is allowed to grow for two years; by this time the ground is sufficiently held in place to permit the planting of the Monterey Pine and Cypress, and these trees, in two or three years, complete the reclamation. The entire cost of reclamation does not exceed $50 per acre, and out of the 1,040 acres in the park, 500 acres are now planted with the pines.

◆

A LARGE FLEXIBLE WOVEN SUCTION HOSE, for a centrifugal pump dredge, has been made by George Angus & Co., of Newcastle-on-Tyne, for use in the dredging of sand bars by the Natal government. The pipe is 42 ins. diameter and 10 ft. long, and is made of 1-in. best yacht Manila rope, extra soft laid. To keep the tube in shape iron hoops, 1½ ins. diameter, were woven into the circumference at intervals of less than 1 ft. The same firm has just shipped a similar suction pipe to East London, Cape Colony. This latter pipe is 27 ins. diameter, with 1⅛-in. hoops 30½ ins. apart at the top and 8 ins. at the bottom of the pipe, and the pipe was 9 ft. 8 ins. long and woven on a curve of 10 ft. radius.

◆

MEASUREMENTS OF STREAM FLOW in California in 1897 gave the following main results:

River.	Daily flow, sec.-ft.* Maximum.	Minimum.	Mean.	Total, for year, acre-ft.*
Sacramento[1]	89,100	4,600.0	12,482.0	8,912,617
Stanislaus[2]	10,580	140.0	1,835.0	1,319,333
Tuolumne[3]	14,700	28.0	3,364.0	2,422,827
San Joaquin[4]	18,600	60.0	3,105.0	2,248,979
Kings[5]	22,732	250.0	2,933.0	2,129,964
Kings[6]	18,900	208.0	2,115.0	1,533,288
Kern[7]	5,342	260.0	1,234.0	893,055
Little Rock Creek[8]	308	0.2	25.0	17,979
San Gabriel[9]	1,765	18.0	130.4	93,169
Santa Ana[10]	585	29.0	86.6	61,524

Gaging Stations: [1]Red Bluff, [2]Oakdale, [3]La Grange, [4]Herndon, [5]Red Mountain, [6]Kingsburg, [7]Bakersfield, [8]Palmdale, [9]Azusa, [10]Warm Spring.

*1 sec.-ft. equals 50 California's miner's-inches. 1 acre-ft. is the amount necessary to cover one acre 1 ft. deep, or 43,560 cu. ft.

The measurements were made by the United States Geological Survey, of which Mr. Chas. D. Walcott is director. We are indebted for this information to Mr. J. B. Lippincott, Resident Hydrographer for California, 412 Byrne Building, Los Angeles, Cal.

◆

THE CARR AUTOMATIC MACHINE GUN, invented by Howard Carr, of San Francisco, was lately tested in that city. The gun is fired from a tripod and weighs 20½ lbs. complete. It uses the Krag-Jorgensen cartridge and is fed by a detachable magazine containing 310 cartridges and weighing about 25 lbs. The gun itself is described as "an ordinary Krag-Jorgensen barrel, automatic breech-action, with pistol-grip." In the test noted it was used as a single shot, and then with the continuous fire at the rate of 600 shots per minute. The San Francisco Arms Co. control the patents.

◆

A NEW ENGLISH SERVICE BULLET has been adopted and will be first used in the Egyptian campaign now in progress. This bullet is the same in general form as the Lee-Metford bullet; .303-in. diameter, 1⅕-in. long and weighing 215 grains; it thus fits all the service rifles and machine guns. The case is nickel, with the lead filling the base only and leaving the conical end empty. When this bullet strikes, the conical end burrs and opens backward, lessening the penetration and increasing the shock. Cordite is used for propelling it, and while it is only half the weight of the old Martini-Henry bullet of 410 grains, it has as much energy as the latter with the old service charge of powder. The new bullet is being made at the Woolwich Arsenal at the rate of 2,000,000 rounds per week. If it proves satisfactory in the Khartoum expedition, a permanent stock will be kept on hand at Woolwich.

◆

THE TRANS-SIBERIAN RAILWAY, according to U. S. Consul Smith, of Moscow, has cost, in the five years, 1893 to 1897, inclusive, $188,014,938. In addition to the above, $5,978,663 has been spent for topographical and astronomical work, irrigation, surveys, geological study, agricultural instruments, etc., connected with the development of the country adjacent to the railway.

◆

WESTINGHOUSE AIR-BRAKES, in value ranging from $2,000,000 to $3,000,000, have been ordered by the Russian government for the Manchurian Railway; and there is a prospect of this contract being doubled in the near future, according to U. S. Ambassador Hitchcock, of St. Petersburg.

◆

CUBAN RAILWAYS, says the U. S. Consular Reports, for July, 1898, aggregate about 1,000 miles of main line, not including private branch lines to all important sugar estates. The most important company is the Ferrocarriles Unidos, with four lines connecting Havana with Matanzas, Batabano, Union and Guanajay. The Western Railway extends to Peurto de Golpe, 96 miles from Havana, and 10 miles from Pinar del Rio, the center of the tobacco district. The other lines join the towns of Cardenas and Santa Clara; Mantanzas and Murga and Matanzas and Guareiras; Concha and Cruces; Cienfuegos and Santa Clara; Caibarien and Placetas, Puerto Principe and Nuevitas, and the Guantanamo railway. A line, 8½ miles long, also connects Havana with Marianao. There are four cable lines connecting with Cuba, but only Havana, Cienfuegos and Santiago de Cuba are connected with these lines. The International Ocean Telegraph Co.'s cable runs from Havana to Florida; the Cuban Submarine Co. has a cable connecting Havana with Cienfuegos and Santiago de Cuba; the West Indian & Panama Co.'s cable connects Havana with Santiago de Cuba, Jamaica, Puerto Rico, the

Lesser Antilles, Isthmus of Panama; the Compagnie Francaise connects Havana with Santiago de Cuba, Haiti, Santo Domingo, Venezuela and Brazil.

◆

THE NILGIRI RACK RAILWAY, now being built in India, starts from the Meltapollyam Station, on the Madras Railway. The alinement is nearly straight for 4½ miles to the foot of the hills, at Kulhar Station, with easy curves and a steepest grade of 1 in 40. From Kulhar, which is 1,250 ft. above sea-level, to Coonor, 5,600 ft. elevation, the line rises with a grade of 1 in 12½, with curves as sharp as 328 ft. radius and 70% of the whole line in curve. On this railway there are 35 plate-girder bridges of 60 ft. span and 44 bridges of shorter span; the Burliar bridge has five 60-ft. spans and is 120 ft. above the water in the gorge. Most of these bridges are on curves of 328 ft. radius and on the steepest grade of 1 in 12½. The rack-bars, 10 ft. 2¾ ins. long each, are stamped out of steel. The four tank engines to be used were built by Bezer, Peacock & Co., and weigh 33 tons each, with 13 tons on driving axles, and 10-ft. rigid wheel-base. Each engine will pull 90 tons on the 1 to 40 grade, and 60 tons on the 1 to 12½ grade, and both engines and cars are fitted with powerful brakes. It is proposed to later carry this line over the hills to the port of Calicut, on the west coast of India, and to make connection with the meter-gage railways to the east.

◆

BRAZILIAN MANGANESE ORE has been exported for the last four years. It comes from the district of Miguel Burnier, State of Morias Geraes, about 310 miles from Rio Janeiro. The mines are about 4,000 ft. above sea level, and they are worked by Italian and native labor. In 1897, the entire output of 8,800 tons went to Philadelphia. An analysis of the ore shows an average of 54.7% of metallic manganese, 0.021% sulphurous acid, and 0.077% of phosphoric acid.

◆

A NEW PROCESS OF OBTAINING GREAT HEAT, in metallurgy, is described in "Stahl and Eisen" by Mr. Hans Goldschmidt. The process is based upon the utilization of the high temperature disengaged in the combustion of aluminum. The body to be heated is wrapped in an envelope made of a mixture of aluminum and metallic oxides in a pulverized state. This is then exposed to a temperature sufficient to decompose the oxides and burn the aluminum; and the interior of the packet is very rapidly raised in temperature with results comparable to the work of an electric furnace. The process appears to be especially applicable to the reduction of chrome. On account of the chemical effects resulting, we can substitute for the oxides, or oxidizing bodies, sulphur or sulphureous bodies. The aluminum may also be replaced by magnesium or carbide of calcium.

◆

A MATCH PASTE, free from white phosphorus, and which will light on cloth or other substances, is wanted by the Belgian government, which offers a prize of 50,000 francs to the inventor. The competition is international and is open until Jan 1, 1899. M. Woesti is the President of the Adjudicating Commission, and his address is 2 Rue Laterati, Brussels.

◆

COAL TESTING BY THE RONTGEN RAYS is a new application suggested by H. M. Couriot in a communication to the Paris Academie des Sciences. He states that carbon, in all its forms, is exceedingly transparent to the rays, while silica and silicates are opaque. By placing a lump of coal between a Crookes tube and a fluorescent screen, all the slag and clinker forming parts of the fuel can be detected. In this manner M. Couriot has tested anthracite and bituminous coal, lignite, coke and block fuel. The conglomerate character of the latter fuel is clearly shown; and in coke the particles of iron sulphide show as black spots on the screen. Rough lumps of coal, 1⅛ to 2 ins. thick, may be used, with an exposure of 5 minutes and with a coil having a 10-in. spark.

◆

THE COPPER PRODUCTION of the world for four years, 1894-1897, inclusive, is given in two tables in "The Engineering and Mining Journal" of June 25, from which we extract the following, the figures being tons of 2,240 lbs.

	1894.	1895.	1896.	1897.
World's production	324,859	334,268	381,109	412,050
Production in the U. S.....	163,394	177,881	214,149	227,763
Consumption in the U. S...	84,267	125,619	102,083	126,438

◆

THE VALIDITY OF THE PATENT of C. J. Van Depoele, No. 424,695, April 1, 1890, for improvements in suspended switches and traveling contacts for electric railways, now owned by the General Electric Co., was sustained on June 23, 1898, by the U. S. Circuit Court, Eastern District of New York, and a perpetual injunction was decreed against the defendants. On Jan. 8, 1896, the U. S. Circuit Court of Appeals reversed a decision of the lower court against this patent, and remitted the case to the Circuit Court with instructions in favor of the complainant. The patent covers broadly the switch in overhead wires for electric railways, now in universal use. Two of the sustained claims are as follows:

3. The combination, with an overhead wire for receiving an underneath contact, of a switch-plate attached to the wire in about the same horizontal plane as the wire.
4. The combination of a track having switches, an overhead conductor above the track and having switches, and a car on the track provided with a contact-carrying arm arranged to engage the conductor at a point in rear of the front wheels of the car.

◆

THE GREATEST DANGER of a severe loss by fire in a factory insured in mutual insurance companies, according to the report of the Boston Manufacturers' Mutual Fire Insurance Co. for the month of May, is the possibility that some valve in the automatic sprinkler service will be closed at the time when a fire breaks out. That this danger is not a slight one is shown by the fact that the company's inspectors during six months found 48 instances of sprinkler valves being wholly or partly closed, which ought to have been open. To avoid this source of danger it is recommended that all sprinkler valves should be sealed or strapped open and that each mill manager shall require an inspection and report upon the condition of the valves to be made once a week, such reports to be kept on record for revision by the inspectors of the insurance companies.

◆

HOT-AIR MOTORS are discussed in "Dingler's Polytechniches Journal," for April 10, 1898. In attempts to improve existing machines Messrs. Lombaerde and Lecompte, of Paris, replace the air-compressor by an annular space around the motor cylinder itself. Mr. Korndoerfer, of Bohemia, is striving to maintain tightness and the lubrication of the cylinder at high temperatures. Mr. Ledin, a Swiss, proposes to employ as a motor-fluid a mixture of steam and the products of the combustion of petroleum in a closed vessel. Messrs. Rozer and Mazurier have patented a device for combining a hot-air and explosion motor, in such manner that the escaping gas of the one heats the air in the other motor.

◆

THE COLONIAL POSSESSIONS of European states are given as follows in "Consular Reports" for June:

Country.	Area, sq. miles —(1 = 1,000.)—		Population —(1 = 1,000.)—	
	Motherland.	Colonies.	Motherland	Colonies.
Great Britain	121	16,662	39,825	322,000
France	204	2,505	38 520	44.290
German Empire	209	1,616	53.325	7,450
Portugal	36	810	5.050	10,215
Holland	13	783	4.930	34,210
Spain	198	405	17,300	9,800
Italy	111	242	31,290	195
Denmark*	15	87	2,175	130

*Including Faroe Islands, Iceland and Greenland.

BOOK REVIEWS.

PHYSICAL GEOGRAPHY OF NEW JERSEY.—By Rollin D. Salisbury. With Appendix by Cornelius Clarkson Vermeule. Vol. IV. of the Final Report of the State Geologist. Cloth, 6½ × 10 ins.; pp. 170 + 200; 24 plates, 37 figures in text, large map in tube, and many tables. Address John C. Smock, State Geologist, Trenton, N. J.

This volume contains some of the matter given in the first volume of the present series, "Topography, Magnetism and Climate," which is now out of print. Part I. of the main work is devoted to a detailed description of the topography of the state, and Part II. to the history of the topography. The illustrations are made up of maps, diagrams, profiles and reproductions of photographic views, all well designed to aid in a ready understanding of the text. We have rarely seen a selection of views in a work of this kind which so truly illustrate the text, as distinguished from embellishment. These views do both. The colored relief map is on a scale of one mile to the inch, and is a very creditable piece of work.

The appendix contains a variety of useful information, mostly in statistical form, but conveniently arranged. Among this information may be mentioned bench-marks; elevations of prominent points and topographical features; drainage areas, forested areas and population of stream basins; areas and drainage areas of lakes and ponds and areas of tidal waters; yield of streams; areas of counties and townships; and detailed results of a magnetic survey of the state.

MONOGRAPH UPON RESERVOIRS AND THEIR EFFECTS ON THE FLOODS OF THE MISSISSIPPI SYSTEM.—By James A. Seddon, U. S. Assistant Engineer. Washington, Government Printing Office. Paper; 9 × 6 ins.; pp. 26. Maps and diagrams.

This monograph is the result of long and laborious investigation on the part of the author, and is based upon existing facts, instead of being a deduction from assumed or supposed conditions. For the Upper Mississippi System the period of study covers the years 1880-1885, inclusive; and for these years the stages and discharges of the Mississippi, Missouri and Ohio Rivers have been observed and plotted so as to show the combinations that make up the final floods at Cairo. A similar study covers the floods of the Lower Mississippi, for the years 1882-83-84, 1892-93, and 1897. This gives the stages and discharges at points of maximum outflow and inflow, from Cairo to Vicksburg, and shows the free and restrained outflow and the resulting changes. The map accompanying the flood data indicates the levee lines and distances subject to overflow, and the areas of the several swamp basins. From the material here made available, Mr. Seddon is enabled to, at least, approximately estimate the capacity of reservoir required for a given reduction of any flood; and to do this both for the Upper and Lower Mississippi systems. As to the Upper System, Mr. Seddon concludes that if any head water reservoirs are to be established with the view of reducing flood extremes at Cairo, this must be done wholly in the Ohio River basin; and before any intelligent estimate can be made of the ultimate effect of such reservoirs, the discharge data for this river must be more closely studied and subdivided and traced back to its sources.

The Lower Mississippi has an immense reservoir capacity in its swamp overflow; but these are of little value, as they are, for reducing or controlling flood levels. This lack of value does not arise from any want of capacity to take off water; but from their inability to hold it until after the flood period has passed. The author then suggests a system of cross levees, cutting the natural drainage area into a series of shallow reservoirs, with outlets under control. He discusses the question fully and generally estimates the capacity to be given to such a chain of reservoirs. The detailed location and dimensions he leaves for further consideration.

THE ALASKAN GOLD FIELDS AND THE OPPORTUNITIES THEY OFFER FOR CAPITAL AND LABOR.—By Sam. C. Dunham. Bulletin of the Department of Labor; Carroll D. Wright, Commissioner; No. 16. May, 1898. Washington: Government Printing Office. Paper, 9×6 ins.; pp. 297 to 507. Large map of Alaskan gold fields and smaller maps of particular localities.

To obtain trustworthy information relating to the opportunities for remunerative employment of American labor and capital in the Alaskan gold fields, Mr. Sam. C. Dunham, of the U. S. Department of Labor, was sent out to make an official investigation. He left Washington, D. C., on July 31, 1897, and his report brings matters up to Jan. 8, 1898. He commences his report by a brief account of the discovery of gold in this region; describes the four principal trails leading to the Yukon gold fields, and then presents in the form of a diary, the details, cost and incidents of his trip from Dyea to Dawson. This part of the report is of exceeding value to the would-be gold-seeker; for it tells him what to expect and how much each step towards the Yukon may cost him, in cash and in personal effort. He was exactly one month in reaching his destination; or, from Aug. 23 to Sept. 23, 1897. The separate gold fields are then taken up in detail and illustrated by maps of each. The report is so full of detail that it is impossible to generalize with profit to the reader; but Mr. Dunham freely quotes from and recommends as the best book yet written on the Yukon country, Mr. Wilson's "Guide to the Yukon Gold Fields," published in 1895.

A few facts of general interest may, however, be noted. The mean annual temperature of the Yukon Valley is roughly estimated at 23° F.; with 78° below zero as the greatest cold on record. Open water, even in the coldest weather is found on many of the tributaries of the Yukon, and many springs never freeze over. The annual rainfall in the valley is figured at about 25 ins., with 60 to 70 ins. on the coast. May, June and part of July bring delightful weather, on the lower Yukon; but the rest of the summer is very wet. Timber is abundant; the most valuable and largest tree being the white spruce, which attains a height of 50 to 100 ft., and a diameter of one to two feet. As indicated by annular fiber, this tree attains an enormous age; a tree 8 ins. in diameter often showing rings indicating 600 to 700 years of growth. This slow growth, due to climatic conditions, eliminates any hope of a new timber growth of any consequence when once the present timber supply is exhausted. The other more common trees are the birch, balsam poplar, willows and alders. The first is the only hard wood in the country, and the others are usually soft, rotten and valueless. The Yukon Valley has abundant capacity for producing root crops; but it is not yet known that oats, barley, wheat or rye, can be cultivated. It is highly improbable that this territory will ever become a self-supporting agricultural district; and its chief wealth lies in its fish, furs and gold.

The Yukon River itself is formed by the junction of the Lewes and Pelly rivers, and taking the first as its main source, the river is nearly 2,600 miles long. A number of steamers are now operated on this river, during the navigation season of four to five months, and the head of navigation is at Fort Selkirk, 2,210 miles above the mouth. The fare from St. Michaels, 60 miles across the bay from the Yukon mouth, to Dawson, 2,050 miles up the river, is $90. The up-stream freight, of which there is very little, is figured on a basis of 53 cts. per ton per running hour; and the down-stream freight at 55 cts. These figures mean $150 and $70 per ton respectively, between St. Michaels and Fort Selkirk. On the lower river, or 600 miles above the mouth, driftwood is entirely depended upon for fuel for the steamers, as all standing timber has been cut away by the ice coming down the river. But there is an abundance of good coal, further up, near Tawana, Circle City and Forty Mile. But the interested reader must obtain this report for himself to benefit by the patient work of Mr. Dunham; and the large folding map of the region contained in the report is essential to an intelligent study of the material which he presents.

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BIDS FOR TRANSPORTING THE 25,000 SPANISH prisoners at Santiago de Cuba to Spain were opened in the office of Col. F. J. Hecker, U. S. Volunteers, in the Army Building, New York, July 20, at 11 a. m. The United States Government will deliver the prisoners at Santiago, and it asked proposals for a per capita price for transporting officers and men from Santiago and delivering them on shore at some Spanish port. Cabin accommodations must be provided for the 1,000 officers and the men are to receive the regular U. S. Army ration. Ships must report at Santiago between July 30 and Aug. 10, and payment will be made on satisfactory evidence of the landing of the prisoners in Spain. The following bids were received:

(1) New England Chemical & Supply Co., Boston, Mass., bid $890,000 for the transportation of 1,000 officers and 24,000 enlisted men. Officers to have cabin accommodation; enlisted men to be given steerage quarters. Transportation to be under any other flag than that of the United States.

(2) L. A. Thieme & Co., Philadelphia, Pa., offer to carry 25,000 Spanish soldiers to Spanish soil for $385,000.

(3) James W. Elwell & Co., New York, N. Y., offer the steamship "Meustria," with accommodations for 1,000, at $35 a head for enlisted men and $75 each for officers.

(4) William H. Thompson, New York, N. Y., offers a steamer to carry 150 officers at $90 each, and 1,400 enlisted men at $45 each.

(5) George Osgood Lord, New York, offers to carry 24,000 enlisted men at $37.50 each and 1,000 officers at $72.50 each. Another bid was also received from him which was not considered, owing to its not conforming to the terms of the advertisement, in which the United States was to provide blankets and rations for the prisoners.

(6) Thomas L. St. John bid $37.37 each for officers and $24.87 each for men, including subsistence.

(7) Joint bid from Anchor Line, represented by Henderson Brothers, New York; Cunard Line, represented by Vernon H. Brown & Co., New York; Leyland S. S. Co., represented by Sanderson & Son, New York; Hamburg-American Packet Co., New York; Wilson & Furness-Leyland Line, represented by Sanderson & Son, New York; North German Lloyd S. S. Co., represented by Oelrichs & Co., New York; Royal Mail Steam Packet Co., represented by Sanderson & Son, New York; Robert M. Sloman & Co., represented by Emil Boas, New York, bid as follows: $110 for officers, who are to be given cabin accommodations; $55 for enlisted men, to be carried in the steerage; payment to be made on the number embarked, without regard to whether the vessel reaches port safely or is lost.

(8) C. B. Richards & Co., New York, offer two ships: "Spartan Prince," to carry 40 officers at $55 each, and 800 enlisted men at $25 each.

"Tartar Prince," to carry 50 officers and 1,000 enlisted men at the same rates. A second offer from the same firm tendered its services as agents to arrange for the transportation; this proposition was not considered.

(9) Davis & Huger offered to furnish from one to fifty steamships of foreign build. The offer was not accepted as it did not conform to the terms of the advertisement.

(10) The Tweedie Trading Co. offered bids in triplicate for three ships, with a total carrying capacity of 3,000 men, at a charge of $29 each for enlisted men and $50 each for officers.

(11) R. A. C. Smith, New York, offered to carry enlisted men at $30 each and officers at $60 each on steamers of the Spanish Transatlantic S. S. Co., sailing under the Spanish flag, the United States to guarantee safe conduct. The Washington authorities will award the contract later.

◆

THE LOG OF THE U. S. BATTLESHIP "OREGON," on her now famous run from Puget Sound to Florida, is thus filed in the U. S. Navy Department:

Port.		Record of run.		Average knots per h'r
Left.	Arrived.	knots.	hours.	
Puget Sound, March 6.	San Francisco, March 9	826	72	11.48
San Francisco, March 19.	Callao, April 4	4,112	375	10.96
Callao, April 7.	Tamar, April 16	2,550	214	11.9
Tamar, April 17.	Sandy Point, April 17	131	9	14.6
Sandy Point, April 21.	Rio Janiero, April 30	2,148	221¼	10.16
Rio Janiero, May 5.	Bahia, May 8	749.7	74¼	10.09
Bahia, May 10.	Barbadoes, May 17	2,228	191¼	11.54
Barbadoes, May 19.	Jupiter Inlet. May 24	1,666	141½	11.27

The total distance from Puget Sound, in the Pacific, to Jupiter Inlet, on the Atlantic Coast of Florida, was 14,511 knots, and the ship consumed on this trip 3,909 tons of coal. The total running time was 1,298.25 hours; and the average hourly rate of speed for the entire trip was almost 11.2 knots. According to the above record the coal consumption was almost exactly 3 tons per hour of actual running time, auxiliaries and consumption in port being included, however, in the total.

◆

PROGRESS ON NEW WARSHIPS is reported by Chief Naval Constructor Hichborn, to July 1, as follows: Battleships "Kearsarge," 61% completed; "Kentucky," 61%; "Illinois," 48%; "Alabama," 61%; "Wisconsin," 40%. These five battleships are all to have a maximum contract speed of 16 knots. Of the ten torpedo boats under construction, the "Rowan" and "Mackenzie" report 99% completed; the "Davis," 94%; the "Farragut" and "Fox," 88%; the "Dahlgren," 80%; the "T. A. M. Craven," 60%; the "Stringham," 35%; the "Bailey," 21%; and the "Goldsborough," 10%. The submarine torpedo boat "Plunger," at Baltimore, is within 73% of completion.

◆

THE COMPAGNIE TRANSATLANTIQUE or French Line of steamers, made, on July 3, a contract with the French government for ten years beginning in 1901. After 1901 the company is required to make 52 round trips per year to New York at an average speed of at least 20 knots per hour. The company is now building at St. Nazaire two new steamships which are to have a guaranteed speed of 22 knots per hour, and are to cost about $3,000,000 each. The "La Lorraine" will be ready in 1900, and "La Savoie," three months later. In 1903 and 1905, two more ships, faster still, are to be ready for service.

◆

AN OCEAN LINER LARGER THAN THE "KAISER Wilhelm der Grosse," of the North German Lloyd, is reported to have been ordered by the Hamburg-American Line of the Vulcan Shipbuilding Co., of Stettin, to be completed in 1900. The vessel will be 685 ft. long, 66½ ft. beam and 44 ft. deep. The "Kaiser Wilhelm" is 648 ft. over all, with 66 ft. beam and 43 ft. depth.

◆

THE MORGAN LINE has contracted with the Newport News Shipbuilding and Dry-Dock Co. for three freight steamships, to cost about $2,500,000 in all. These vessels will be built of steel, with single screws, and will generally resemble the "El Rio" and her sister ships now in the government service. They will each measure 5,000 tons gross, be 400 ft. long, 50 ft. beam and 35 ft. deep. They will have three decks, be provided with water-tight bulkheads, have steam heat, electric lights, etc., and triple expansion engines of 4,000 I-HP., with boilers carrying 165 lbs. of steam. The propellers will be 18 ft. diameter and the average speed is to be 17 knots. The Newport News Co. is also building two vessels for the Cromwell Line; and two are being built for the Old Dominion Line at Chester, Pa.; all intended to replace vessels secured by the government.

◆

BIDS FOR TWO FLOATING DOCKS are asked for by the U. S. Navy Department, the cost not to exceed $250,000 for both. Docks ready built are wanted, as there is need for them now in Cuban waters, and two such docks are located in New York and three are in and about New Orleans. The bids for the larger floating docks, provided for in the late naval appropriation bill, will be called for within a couple of weeks.

THE OUTER BREAKWATER LIGHTHOUSE, in New Haven harbor, Conn., will be put under contract on Aug. 1, 1898. This lighthouse will consist of a circular cast-iron caisson foundation 36 and 33 ft. diameter and 58 ft. high, sunk by the pneumatic process and filled with concrete. The depth of water is 28 ft. to M. H. W., and the caisson will be sunk into the sound for 8 ft., and then surrounded by rip-rap, 18 ft. deep. The upper 10½ ft. of the foundation pier will be lined with brick work and forms a cellar, covered by the main-gallery floor supported on brick arches. This will be surmounted by an iron dwelling house, 18 ft. diameter at the base and 45 ft. high to the focal plane. A covered gallery, with a diameter of 38½ ft., will surround the first story of the four in the dwelling portion. This gallery will be accessible from the water by ladders and a spiral iron stairway, inside, leads to the lantern. This light will be located some distance outside the entrance to the harbor, with the focal plane 61 ft. above Mean High Water. Lieut. Col. D. P. Heap, Engineer Corps, U. S. A., Lighthouse Engineer, Third District, Tompkinsville, N. Y., is the engineer in charge.

◆

THE EXTENSION OF THE WEATHER SERVICE to the Caribbean Sea is now before President McKinley in the form of a draft of an order, and an appropriation of $75,000 to be used at his discretion for this purpose. Negotiations are now in progress with other governments interested and whose consent will be necessary in locating stations and providing observers. The scheme contemplates stations on the islands of Trinidad, Curacoa, Martinique, Hayti, the Barbadoes and San Domingo. There are now operating stations at St. Thomas, at Kingston, Jamaica, and at Havana. The Mexican government is also establishing a line of stations along the Mexican Gulf coast to Yucatan, and these are being fitted with instruments adjusted to U. S. standards. With the proposed belt of stations daily weather reports would cover the entire coast line of the Gulf of Mexico and Caribbean Sea for the benefit of the commerce of all nations.

◆

THE EXPORT TRADE OF THE UNITED STATES, for the fiscal year ending June 30, 1898, amounted to $1,231,311,868, an increase of $180,300,000 over the preceding year. The imports for the same year were valued at $616,052,844, a decrease of over $148,600,000 as compared with 1896; the balance of trade in our favor was thus $615,259,024 for the fiscal year. For the month of June, 1898, the exports were valued at $94,808,263, or an increase of over $21,600,000 over the same month of the preceding year. The imports of gold coin and bullion, in the last fiscal year, amounted to $115,173,988, against an export of only $15,324,929.

◆

A PERMANENT EXHIBITION OF MANUFACTURES is proposed for New York city, under the direction of the Merchants' Association of New York, an organization having as its object the fostering of New York city's trade. The scheme contemplates the erection of a suitable building and the placing in it of a large and attractive collection of manufactured articles. It is further contemplated to establish similar exhibitions in a number of European commercial centers. A meeting will be held Oct. 1, details of which will be announced later, to organize a company for this purpose.

◆

THE SCARCITY OF TIN ORE IN THE WORLD is pointed out by Geologist B. G. Skertchley, of Australia, in a published monograph. He shows that while known gold fields cover 1,500,000 sq. miles of the earth's surface, the located tin fields have an area of only 12,500 sq. miles. The seven tin districts of Europe produce about 8,300 tons yearly, with 8,000 tons of this credited to the Cornwall mines. Asia has two tin districts; Hunan, in China, said by some to yield 10,000 to 20,000 tons annually, but proven to yield less than 2,500 tons per year; and the tin mines of the Straits Settlements and adjacent territory, the richest in the world, yielding 58,000 tons yearly. Africa has no known tin mines; North America has no paying mines; South America mines less than 4,000 tons per year, in Bolivia and Peru, and Australia contributes about 6,000 tons a year.

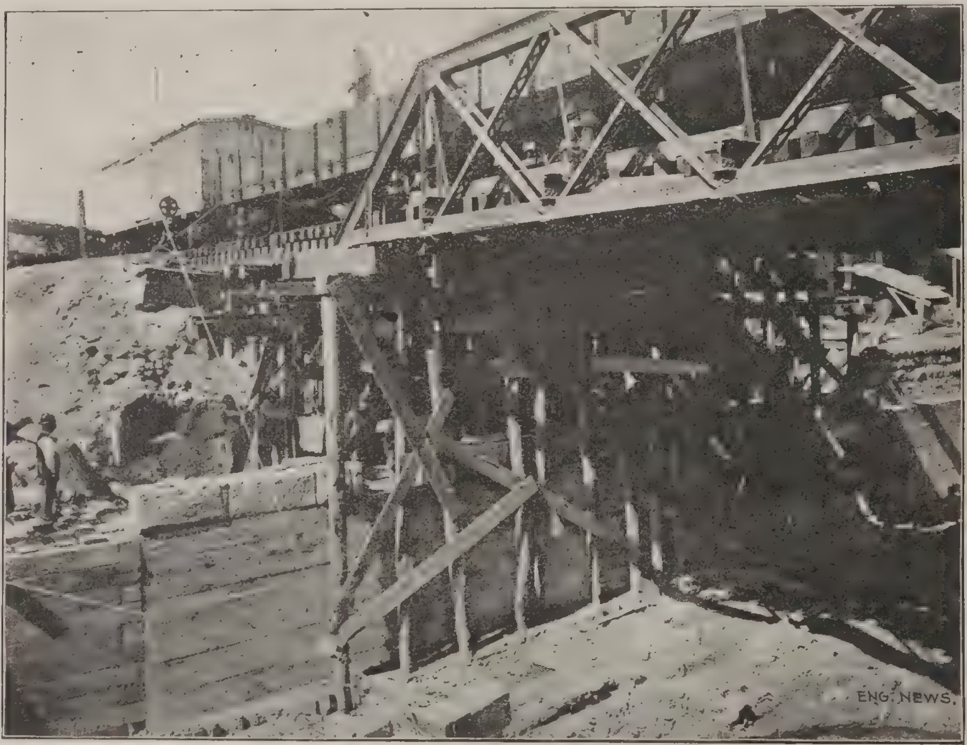
◆

A HAWAIIAN CABLE CONTRACT was signed, on July 2, between the executive council of the Hawaiian government and the Pacific Cable Co., of New York, granting the exclusive right to lay a submarine cable between the United States, Hawaii, Japan and China. The grant also includes the Ladrones and the Philippine Islands, subject to authorization by Congress. The proposed cable would start from San Francisco, and then proceed to the Hawaiian Islands, a distance of 2,097 miles, and thence to Japan and such other islands as shall be later designated. The total distance from San Francisco to Japan would be about 6,500 miles, or, with 16% of slack, about 7,500 miles of cable would be required. The estimated cost of cable and repair ship is $7,500,000. The official messages of the United States are to be transmitted free of cost forever. The officers of the Pacific Cable Co. are: James A. Schrmyser, president; Edmund L. Baylis, vice-president; and these gentlemen, with Rear Admiral John Irwin, J. Pierpont Morgan and J. Kennedy Tod, are the directors of the company.

CONCRETE ABUTMENTS FOR A RAILROAD BRIDGE AT BUFFALO, N. Y.

The rebuilding of the abutments of the three-track bridge of the Buffalo & Niagara Falls branch of the New York Central & Hudson River R. R. across the branch of the Erie Canal in Buffalo, N. Y., known as "Niagara Slip," was made necessary by the recent deepening of the Erie Canal, and the consequent removal of the glacial drift between the original abutments, which were built of stone masonry some thirty years ago, and were founded upon this drift. The rebuilding was done during March and April, 1898, by the Donnelly Contracting Co., of Buffalo, N. Y., and the arrangement of the work and plant present several features of interest. The underlying limestone formation occurred at an average of 10 ft. greater depth; its surface being very irregular and varying 5 ft. or more in the area of the abutments. This was scraped clean to receive the concrete forming the new structures.

The branch of the canal spanned by this bridge connects the Erie Canal proper with Buffalo harbor, and two cofferdams were, therefore, needed to shut off the water. This construction presented difficulties in that the adjacent formation in which the cofferdams must abut was of the most irregular and uncertain character, consisting of drift, lake beach gravel with embedded logs and drift wood, and "made ground" of varied materials. A deposit of 8 ft. of quicksand was encountered and required careful handling to avoid undermining a closely-adjacent brick round-house.



VIEW OF NORTH ABUTMENT OF N. Y. C. & H. R. R. R. THREE-TRACK BRIDGE AT BUFFALO, N. Y., IN PROCESS OF RECONSTRUCTION.

Walter Katte, M. Am. Soc. C. E., Chief Engineer.
Donnelly Contracting Co., Buffalo, N. Y., Contractors.

The bridge is in daily use by 250 or more regular and yard trains of the New York Central, Grand Trunk, Michigan Central, Toronto, Hamilton & Buffalo, and Canadian Pacific railways (three trains having often been seen on the bridge at once), and this service must be maintained without interruption. To permit this, the bridge was supported upon pile bents at either end, and a platform was built beneath the bridge on which were placed the materials, conveyor and mixer for the concrete.

The cofferdams were formed of crib-work 18 ft. wide and 22 ft. high, filled with clay. The crib-work, of 12 × 12-in. square timber, was so designed that, without extra labor in building it, the timber from the dry side of each dam could be taken out intact, and in condition to be used elsewhere. This was effected by using interior vertical posts with horizontal screw bolts, engaging the cross-ties and the face timbers, and with the nuts of the screw bolts exposed. No drift bolts were used in this face of the crib, and no gains were cut in the timbers to receive tie-heads, which came through full size, with the face timbers butting against the tie ends. Wakefield triple-lap and other forms of sheet piling were used to secure the ends of the dams and extend them, and no breaks occurred, though rises of the lake level of 6 ft. or more, caused by the winds down the lake, overflowed the dams twice.

After the area had been pumped dry, the old abutments were taken out, and the excavations for the new ones were made to the bed rock. Upon the irregular surface of this, the abutments were built of concrete for an average height of 18 ft. above rock (to low water line), and of rock-face, massive, stone masonry for 13 ft. above the concrete.

To construct the latter, an overhead track was built lengthwise of each abutment, upon which traveled a truck, from which was suspended a 10-ton Harrington hoist for the blocks of stone, which were thus carried to place and laid in the superstructure. These blocks were first lowered from cars on the bridge overhead by steam derricks, standing on the nearest cofferdam, and thus placed within reach of the truck-hoists.

The total quantities were 835 cu. yds. of concrete and 466 cu. yds. of masonry. The prices were $6.50 per cu. yd. for American Portland cement concrete, and $7.93 per cu. yd. for second-class masonry of rock-face sandstone and backing. The aggregate was $21,000 for the whole work, including building and removing of cofferdams, etc.

The concrete was formed of one part Atlas Portland cement, one part beach sand, and six parts of crushed corniferous limestone and flint, using the total product of the crusher when set at 2-in. opening; the finely-crushed limestone included in this product being equivalent to one part of sand in addition to that already named. These materials were mixed by four or more revolutions of a Ransome rotary mixer, which is so arranged with interior paddles that one revolution is equivalent to four turnings by hand shovels. The mixer was run by a 10-HP. engine, supplied with steam from one of the boilers operating one of the cofferdam pumps.

The crushed limestone and flint were run directly into dump cars at the contractor's crusher, and the cars were then hauled on to the bridge, where their contents were dumped through the floor of the bridge on to the mixer-platform beneath. The plank molds into which the concrete was filled and which confined it to the defined form and dimensions, were composed of smoothly-dressed plank placed with care to have the butts and joints tight to prevent leakage of any surplus water from the concrete. That portion of the forms which came between the pile bents supporting the bridge was braced against these piles, while the molds for the wing-walls were tied together—front and back—by iron tie-rods which were removed as the concrete filling came up to them. As the concrete was to be wholly submerged and out of sight, it was not considered that the face should be specially finished, and therefore the lines of the mold-plank show in the accompanying photograph.

The proportions of materials were here accurately measured in cubical barrows of 2 cu. ft. capacity each, and the concrete was made in batches of 16 cu. ft. every two hours, producing about 90 cu. yds. per day of ten hours. This was conveyed to place and thoroughly rammed in 10-in. layers with 6 × 8-in. wooden rammers. No concrete was made or placed at night, and each morning when work was resumed, a thin grout of clear Portland cement was spread over the top of the last-made concrete, just before placing the fresh concrete upon it. The actual weight of the resulting mass was found to be 159 lbs. per cu. ft. after the test-block of about 1 cu. ft. had been dried for two weeks in a warm room; this being 95% of the weight of the solid rock before crushing.

The work was under the direction of Mr. Walter Katte, M. Am. Soc. C. E., Chief Engineer of the N. Y. C. & H. R. R. R., with Mr. E. F. Van Hoesen, M. Am. Soc. C. E., Division Engineer; Mr. Wm. Pierson Judson, M. Am. Soc. C. E., was the engineer for the contractors.

The accompanying illustration shows the north abutment on April 14th, when the concrete base was completed, and the first course of sandstone superstructure was in progress. When completed and the cofferdams removed, the mean low water level stands about 1 ft. above the top of the concrete.

MARINE WOOD BORERS.

(With full-page plate.)

The destruction wrought by the teredo navalis upon marine constructions in wood is doubtless familiar in a general way to every engineer, but comparatively few are acquainted with the habits of this pest and with the methods by which he accomplishes his destructive work. It is also a fact not generally well known, perhaps, that the navalis is only one species of the teredo, and that the teredo is only one of several forms of wood borers known to naturalists and abounding in sufficient numbers to be a serious menace to marine works constructed of wood. In an interesting paper, by Prof. Charles H. Snow, of New York University, to be presented at the Detroit Convention of the American Society of Civil Engineers next week, the more destructive forms of these marine wood borers are described, with numerous illustrations of the animals themselves and their work. From these illustrations we have selected the engravings published on a full-page plate with this issue, and from the paper itself we abstract the following items of most interest in connection with them. We are indebted to the courtesy of the American Society of Civil Engineers for the use of the cuts.

The four forms of marine wood borers, which are the most numerous, and, consequently, about which the most is known, are: the teredo, the limnoria, the sphaeroma and the chelura. Of these the teredo is the most destructive, and therefore merits the most extended description:

The Teredo.

The teredo is a very ancient form of life, fossil remains having been found in both England and America. Among the ancients it has been mentioned in the writings of Pliny (23-79 A. D.). In modern times it was first observed and studied by the Dutch in 1730, when it threatened the woodwork of the Holland dykes. It has been since this latter date that most of our present knowledge of the teredo has been developed. Up to the present time seven species of teredo have been identified as existing in the United States, one of which is the navalis. This multiplicity of species needs to be remembered, since, owing to the comparatively greater familiarity of engineers with the navalis, the term "teredo navalis" is used indiscriminately by many engineers in speaking not only of the teredo but of all forms of marine wood-borers. The generic name is of course "teredo," which should be used always unless the specific form of teredo is known. These various species of teredo, however, are similar in their principal characteristics, which are shown by Fig. 1.

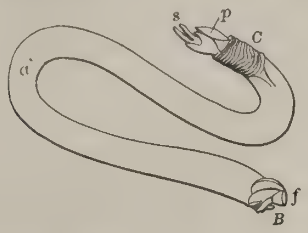


Fig. 1.—Sketch Diagram Showing Distinctive Features of the Teredo.

a, body; C, collar; p, pallets; s, syphons; B, boring shells; f, foot or sucker.

Notwithstanding its worm-like appearance, the animal is a true mollusk. Its principal parts are the body a, the collar C, the pallets p, the siphons s, the boring shells B, the foot or sucker f, and the lining shell. The last is a calcarious substance invariably deposited by the animal upon the newly cut surface of the tunnel which he excavates; and it forms an enameled lining through which he can glide backward and forward as he expands and contracts. The several members and their processes can be considered best separately.

The Body.—The body of the teredo in the young animal is so transparent that some of the interior organs, such as the heart and the ovary, may be observed through it. The heart consists of two auricles and a ventricle. The pulsations, which may be readily counted, are irregular, the rate being about four or five per minute. The blood is a transparent, colorless fluid. Many of the important organs, as the mouth, the palpi, the liver and the foot are inclosed in the boring shell at the further extremity of the animal. The gills are located for the most part at the outside of the shell, and are long and narrow, usually reddish brown in color, and perform the important office of sheltering the eggs and embryo. The nervous system is well developed, and consists of filaments and ganglions connecting the mouth, the branchiae, the foot, the collar and the syphons. The stomach is not distinguished by any peculiarity, but there is a well-developed intestine. The great length of the body is due to the elongation of the syphons or breathing tubes.

The Collar.—The collar extends entirely around the posterior portion of the animal, and fills the place between the body and the circumference of the tunnel. Water cannot pass through the orifice of the tunnel, save as it is controlled by the syphons. The collar contains several well-defined muscles, and these act upon the pallets, which are pulled down over the syphons in such a manner as to close the entrance to the tube when the extremities of the syphons are drawn into the burrow.

The Syphons.—The syphons are the two principal organs, and extend throughout the greater length of the body. One of these tubes conveys the oxygen, water and infusorial food to the vital processes of the animal; the other conveys the exhausted water, the excretions, the debris from the excavation and the eggs to the free water without. The outer structures of the syphons are united while they remain in the body, but signs of divergence are seen as they emerge from between the pallets. They continue united for a little and are then separated into two distinct tubes. These divergent extremities constitute the only part of the animal which can be seen from the outside, and are sometimes mistaken for the entire animal. The longer or incurrent extremity can be pushed out to a distance of 2 ins. or more, while the outcurrent throat remains at about half the distance. The teredo is able to expand or contract these extremities at will and when the conditions are favorable they are extended through the orifice to their full length, and remain stationary or wave slowly backward and forward. When the animal is alarmed the syphons are withdrawn into the tunnel. The siphons are erected by means of a current of blood sent into them from the vessels within. When the water is warm the animal is active and the siphons are extended out full length. They are withdrawn when the water becomes cold, and the teredo is entirely hidden. The extremities of the syphons must always be kept at the orifice of the wood. As the animal grows, the muscular collar and the pallets recede from the entrance, so as to permit the extremities of the syphon to remain there.

The Pallets.—The two shelly plates near the orifice are called pallets, and are connected with the muscles of the collar so that they relax when the syphon extremities pass out between the crescents or horns, which will be seen at the top of the shells, and contract when the syphons are withdrawn. The pallets are then folded over so as to serve as an operculum to protect the soft tubes from enemies.

The Boring Shell.—The boring shell, which is nearly as long as it is broad, presents an irregularly triangular appearance when observed from the side. It may be best seen in Fig. 2. The two halves close tightly at the hinge and at the side opposite the hinge; the open space at the top being toward the main bulk of the animal, and the opening toward the extremity of the tunnel permitting the emergence of the foot or sucker. The shells of young animals are larger in proportion than those of old animals, and when the animal is very young it is for a short time entirely enclosed in the shell.

The Foot.—The foot, which in form resembles a pestle, is a short, stout, muscular organ, broadly truncated or rounded at the end, and so arranged that it can exert a powerful suction upon anything to which it is attached. This cupping action assists the shell in excavating.

The Lining Shell.—This shell follows the tunnel until it finally terminates in a spherical cap. The adult animal occasionally shrinks, and a second cap or partition may be formed as he retreats, the space between the caps remaining unoccupied. The early portion of the tunnel, which was cut by the young animal and is later occupied by the syphon extremities, is below the normal diameter. The lining shell at this point sometimes divides itself into two tubes, each containing one of the syphons. It has been stated that the extremities of the syphons must be kept at the orifice of the wood. The collar and pallets recede as the animal grows larger, thus forming a considerable space between the pallets and the orifice of the tunnel, which is filled with little rings of shell, whose sharp edges serve to protect the entrance. The slender syphons emerging from the pallets pass readily through the spaces at the centers of the rings.

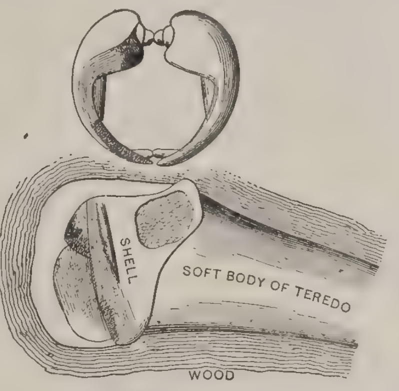


Fig. 2.—Enlarged Sketch of Head of Teredo, Showing Boring Shell.

The teredo can rarely advance for any time in a straight line, being forced to deviate therefrom so as to pass around obstacles, such as cracks, knots or the pre-existing tunnels of its companions. The tunnels may wind in and out and pass so close to one another as to occupy almost the entire content. This fact is well illustrated by Fig. 3.

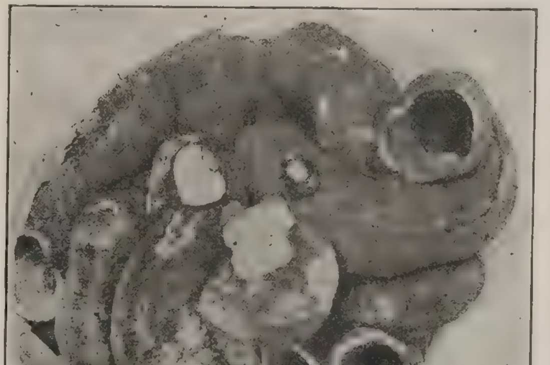


Fig. 3.—View Showing Proximity and Tortuous Nature of Tunnels Made by Teredo.

The thickness of the lining varies with the species. It is sometimes so thin and fragile that it becomes detached by the slightest shock, and is sometimes very thick. The lining presents a surface against which the soft body of the mollusk may press without injury, and also seals the interior of the cell so that the water supply may be better controlled by the syphons.

The teredo rarely crosses a seam or joint in the wood, probably because it fears for the integrity of the lining. Specimens exhibiting the attempt of the teredo to cross a seam show that the shell has been much strengthened at the junction point. When the teredo arrives at maturity, or whenever an insurmountable obstacle is encountered, it seals over the inner extremity of the lining. The growth of the animal, in length. is stopped in either case, and it is entirely surrounded by shell. There is a communication with the outer sea at the two syphon points only, and as the animal continues to live for some time under these conditions it is evident that its sustenance is derived from other sources than the wood.

Vital Processes.—The teredo resembles other bivalve mollusks in that it exists upon infusorial life. This food, together with the necessary amount of oxygen, is drawn in through the longer or incurrent syphon, and flows throughout the length of the animal until it reaches the mouth at the other extremity. The mouth, stomach and intestine are well developed and perform their usual offices. The oxygen is retained by the gills. The return current, beginning at the gills, removes the exhausted water, the excretions and the woody particles. These flow out through the animal and are ejected by the shorter or outcurrent syphon. The teredo does not devour wood; its form is such that dust and other debris have to pass through its body to the point of ejection. Where a teredo is watched for some time, small clouds of very fine dust may at length be observed puffed out from the orifice. The circulation through the syphons is continuous. The teredo may live for a short time out of water. This fact explains its ability to attack wood between high and low water. The specimens which enter wood where it is exposed between the tides do not seem to be greatly hindered in their work.

The Boring Apparatus.—While the animal is still very small, it settles upon the surface of the wood and almost immediately begins to clear away a place in which to burrow. A small pit is made by the edges of the valves of the shell, which come together on pivots shown in Fig. 2. The shells are controlled by powerful muscles acting so as to swing them backward and forward upon the pivots. Only a few of the teeth upon the shell are shown in Fig. 2, and these are exaggerated in size. When the posterior muscle contracts, the shell, with the teeth, is thrown outward and backward and rasps upon the surfaces of the wood. The process is assisted by the foot which emerges through the large blank space between the shells and performs a cupping action.

The Character of the Excavation.—The teredo is very small when it begins to attack the wood, and the hole by which entrance is made, which is the only perforation that appears upon the exterior, is very minute, as shown by Fig. 4. Fig. 5 shows the real interior condition of the same piece of wood. The animal develops very rapidly. The adult diameter is usually attained within 1 or 2 ins. of the surface, and the burrow increases in diameter regularly from the point of entrance to the maximum diameter. The animal grows principally in the direction of length, and therefore it atacks the wood so as to accommodate its quarters to this increase in length. The boring is first carried on across the grain, but ordinarily turns within a short distance and passes in the direction of the grain. This general direction is usually followed, but obstacles are so frequently encountered that the tunnels become exceedingly tortuous, and pass in every conceivable direction.

The teredo usually passes around knots, although quite competent to penetrate knots of oak and other hard woods. Adjoining tunnels are not encroached upon, because these tunnels are completely occupied by live teredos, and more ingenuity would be required to pass through one of them than to avoid it. When cracks exist in the centers of large timbers, they are approached from all sides, but the film is never willingly broken through. It prefers wood that is not surrounded by bark, because of the line of contact between the wood and the bark. When a piece of wood is thoroughly infested, the animals have to pass very close to one another, and the thin film of wood left between the adjacent tunnels is reinforced by the calcareous lining. More than 50% of the weight of the wood may be removed by the teredo, without being greatly evidenced upon the surface. Wood may appear to be quite sound and yet be so weakened that much of it can be crushed by the hand. Failure, therefore, frequently comes suddenly.

Fig. 6 is from a photograph of a log of Panama mahogany, which was cut in the uplands of the isthmus and floated through fresh water to the harbor of Colon, where it remained floating in salt water awaiting shipment. The log was overlooked for one season, and the work of the teredo is thought to have been accomplished in about nine months. The heavy, wet specimen was shipped with others, under the impression that it was sound, but it broke by its own weight after its arrival in New York.

The Size of the Teredo.—The size of the teredo depends upon the species, locality and age, and the absence of obstacles to excavation. Locality has much to do with development. Specimens grow more rapidly and attain larger size where the climate is warm. The teredo continues to grow until it reaches its maximum size, unless an obstacle is encountered. The species navalis may be assumed to average from about ¼ to ⅜-in. in diameter and from about 10 to 15 ins. in length, but specimens of the teredo frequently attain a much greater size. Prof. C. O. Siegerfoos, of Johns Hopkins University, writes that he has measured them up to 4 ft. in length and that the specimens thus measured had not arrived at their full limits. The minimum diameter and length of a boring may be taken as ¼-in. and 5 ins., respectively. The maximum length may be taken at 4 ft. After the teredo has penetrated the wood for a little distance, the diameter remains about constant. Diameters are measured in this portion of the burrow and not at the entrance.

The Range or Field of Work.—The teredo operates throughout a vertical field of considerable depth. This field begins at a point a little above low-water mark, and extends downward until the pressure becomes too great, or the soil at the bottom is encountered. The teredo seems to be able to exist for a little time without submergence, and is therefore able to live above the low-water mark, although exposed daily between the tides. The interior extremity of the tunnel may be higher up than the entrance. The upper limit of the excavated wood cannot be determined by an examination of the orifices at the surface. The lower limit is uncertain and is probably different for different species. It has been assumed by many that the lower limit could be set at about 14 ft. below low water, but recent information, thought to be reliable, indicates that piles have been affected at a depth of from 20 to 25 ft. below that level. The fact that the interior extremity of the burrow is often found below the mud line has given the impression that the field of the animal may extend below this limit, but the outside opening or entrance made by the teredo is never below the soil, although the boring may turn downward for the whole length of the animal. If sediment accumulates around the bottom of the wood so as to cover the syphons, the death of the teredo results.

It is reported that in some harbors the teredos attack at the surface, and in others at the mud line. These differences are partially due to differences in the constituents of the upper and lower layers of water. Where the fresh water of a river meets the heavy water of a sea, the teredo may be almost entirely confined to the lower stratum. The range or field of the teredo is important, because protective processes which could be confined to this field would be more economical than those in common use which are applied to the entire structure.

The Rapidity of the Work.—The rapidity of the work of the toredo depends upon conditions similar to those which govern its size. The evidence upon this subject is not always accompanied by a statement of the conditions under which the results were accomplished, such as the species of toredo, the character of the wood, the season, the climate and the depth of submergence, all of which are points as important as the geographical location of the work. The period in which the teredo accomplishes its work is variable. It may be six weeks or as many years, but rapid work is usually accomplished under the conditions which exist in warm climates. Impure water and cold weather retard its activity, while pure or warm water expedites the work. Maximum probabilities being more important than minimum possibilities, it is safe to assume that a 6-in. boring may be driven in six weeks, and hence, as the animal attacks all sides, a pile 1 ft. thick may be destroyed in that period.

Reproduction and Development.—Mollusks produce their young by means of eggs. Those of the teredo are spherical in shape and greenish yellow in color. The animal is exceedingly prolific; the eggs of a single specimen being probably numbered by the million. The eggs are first deposited in the gill cavity, and are almost at once fertilized. They are free-swimming at the end of three hours, have a well-developed shell before the end of the day, are very hardy, and all seem to be fertilized and to develop.

The embryo passes through several interesting stages before it assumes the character and form of the adult. It is first covered by fine hairs or cilia, which enable it to swim. These are soon lost, and the rudiments of a small bivalve shell appear, which is at first heart-shaped and very small, yet large enough to enclose the entire animal. The portion of the body which protrudes from the shell is fringed with cilia. These, again, constitute swimming organs, and the teredo swims actively until a piece of wood is encountered. The shell has now become rounder, and organs of sight and hearing have been developed. The appearance of these organs marks a climax in the life of the young animal, and it begins to elongate. The locomotive cilia disappear, the eyes are lost, and the mature form is gradually assumed. The life of the larvae is about four weeks, during all of which time they are free swimmers. If the animal has become attached to wood, however, its energies may be expended thereon. The life of a specimen which has not found any wood to attack has not been determined, but is probably quite short.

The extreme life limit of the teredo is unknown, but it is thought that under favorable conditions the animal may live for several years. In the vicinity of New York the processes of reproduction take place for the most part in May. They are not entirely confined to that month, however, but may extend throughout a greater part of the summer. Reproduction in tropical countries is probably extended throughout the entire year. The animal may develop to a very large size, and may possibly attain maturity in a single season.

The Effect of Climate, Temperature or Water.—The teredo navalis thrives best under the influence of heat, but, notwithstanding this fact, it can resist cold to a considerable degree. It is not active when subjected to low temperatures, yet it can endure them. Some species of the teredo have been reported as far north as Eastport, Me., and they exist abundantly under such conditions as obtain at Cape Cod. Destruction is not carried on as continuously or as rapidly in cold climates as in warmer ones, and for this reason maximum results are seen along the South Atlantic and Gulf States and on the Pacific Coast, where the conditions are more favorable, and where reproduction is continued during a longer period.

The purity of the water should be considered in connection with the work of the teredo. Some species inhabit pure sea water; some prefer brackish water, others abound in waters that are muddy, while others again live only in waters that are clear and pure.* The teredo is often present in certain waters, yet absent in the others nearly adjacent. This is usually due to some difference in the water. The xylotrya fimbriata seems to be able to survive the brackish, impure water of the inner New York Harbor, while other species could not live there, though they are present in the nearby outer ocean. The teredo is very active on the North Pacific Coast, yet is absent near the mouth of the Columbia, where the ocean is influenced by the outflow from the river.

The effect of the condition of the water upon the teredo is interesting. The opinion that the periods of unusual prevalence in Holland were in some way connected with a change in the quality of the water was expressed as early as 1733, and since that time has frequently been endorsed by Dutch engineers. Dr. von Baumhauer, Holland Commissioner to the Centennial Exposition, has called attention to the fact that but little rain fell in the years when the teredo was so unusually prevalent, hence the smaller volumes of river water were thought to have permitted larger proportions of salt to reach the coast. This theory is strengthened by the fact that analyses showed a variation in the proportion of salt during dry and rainy seasons.

The Distribution of the Teredo.—The teredo navalis has been identified as existing in the United States between Florida and Cape Cod, and in Europe, from Sweden to Sicily. The teredo norvegica has been found from Cape Cod northward to the coast of Maine. The teredo megotara has been found in floating pine wood at Newport, R. I., and in cedar buoys, etc., at New Bedford, Mass. It has been found south as far as the coast of South Carolina. The teredo dilatata occurs from Massachusetts Bay to South Carolina. The teredo thompsoni has been found at Cape Cod, Mass. The xylophaga dorsalis inhabits the waters of the North Atlantic. The xylotrya fimbriata is found along the Atlantic Coast from Long Island Sound to Florida. It also abounds in the waters of the North Pacific, and is one of the European forms. Different species of the teredo are notably present in such localities as the Bermudas, Jamaica, New Zealand and Australia. The teredo, as a rule, may be generally found in the tropics, and is hardly less numerous in many of the northern waters.

Woods Affected by the Teredo.—All varieties of wood commonly used in construction are subject to attack when exposed to the teredo. Immunity is occasionally claimed for some particular wood, but it will generally be found that the claims have been based upon local conditions and are not fully substantiated.

The following list of partially exempt woods has been compiled by Mr. T. A. Britton from authorities which are said to be reliable:† (Western Australia) jarrah, beefwood and tooart; (Bahama) stopperwood; (Brazil) sicupira, greenheart; (India) malabar teak, sisso, may-tobek; (South America) Santa Maria wood; (Tasmania) blue gum; and (West Indies) lignum vitae. It is not urged that these are entirely exempt, but that they have been exempt for long periods. Very few of them are widely known in construction. It is understood that at Southampton some greenheart piles have failed recently. It may be assumed that the conditions of impregnation or structure necessary to repel the teredo do not exist naturally in such woods as are commonly used in engineering works. It may also be assumed, so far as known at present, that partial or complete immunity, as applied to such woods as are in common use, is a question of locality rather than of variety of wood.

The Limnoria Lignorum.

This small crustacean has several names, as the limnoria terebrans, the gribble and the boring gribble. The limnoria has not been studied for so long a period as the teredo. It was first noticed by Robert Stevenson in 1810, and was examined by Dr. Leach, who one year later pronounced it a new species. It has been investigated since that time by numerous European writers, and, in the United States, it has been studied by Dr. Verrill, of Yale University, and Dr. Sidney I. Smith, of the United States Fish Commission.

The limnoria is gregarious and is found, if at all, in large quantities. It is much smaller than the teredo, but it exists in greater numbers. It has been traced from New York northward to the Bay of Fundy, and large numbers exist in the North Pacific Ocean. It is a very familiar and destructive form of life in Europe. If the destruction accomplished by the limnoria could be estimated it would be found to be surprisingly great.

Descriptive.—The limnoria, Fig. 7, is about as large as a grain of rice. The body is flat, round at each end, and consists of fourteen segments. The sides are nearly straight and are parallel to one another. To each of the seven segments which follow the head is attached a pair of short, stout legs, terminating in claws, the shape of which suggests the small claw of the lobster. The upper surface of the body is covered with small hairs to which more or less dirt usually adheres. The body is grayish in color, and sometimes resembles the color of the wet wood so much that it is difficult to distinguish it. The limnoria can swim, creep backward and forward, as well as jump backward by means of its tail. When touched, it rolls itself into a ball, and in this particular, as well as in general appearance, it resembles the common sow bug.

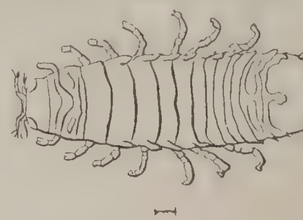


Fig. 7.—Sketch Showing General Appearance of Limnoria or Boring Gribble.

Vital Processes.—The limnoria differs from the teredo in that it is a vegetarian. The teredo is sustained by infusorial life, but the limnoria devours wood. Its tunnel affords both food and shelter.

Boring Apparatus.—The limnoria attacks the wood by means of its mandibles or claws. It prefers wet wood, and succeeds in making a very clean-cut excavation.

Character of the Excavation.—The work of the limnoria differs from that of the teredo in that it works upon the surface of the wood in such a manner as to be clearly seen. The limnoria is similar to the teredo in that its tunnel must communicate directly with the salt water; hence neither of these animals can live in the interior of thick woodwork, such as that of a caisson. The limnoria makes a small, round, parallel-sided tunnel through which it can pass freely back and forth from the sea. The diameter of the entrance of the tunnel is similar to the average diameter. The tunnels are quite short, and are placed very close together, as shown by Fig. 8. They are so numerous that the wood is rapidly reduced to a series of very thin partitions, which soon decay or are washed away by the waves, thus exposing a fresh surface which is at once attacked. Layer after layer is thus rapidly removed, so that the timber is destroyed in a very few years. The limnoria frequently works in conjunction with the teredo, attacking the exterior, while the teredo destroys the interior of the wood, and this combination effects a rapid destruction.

The limnoria attacks both the hard and soft parts of the wood. The hard annual layers have not been avoided in the specimens examined. The limnoria can penetrate knots, but frequently avoids them, so that these hard portions stand out in relief as the timbers waste away. Iron rust is said to cause a somewhat similar effect.

The Range or Field of Work.—The wide range observed between the several species of the teredo does not apply to the limnoria. Its work, as observed in the United States, is generally confined to a limited distance above and below the low-water mark. Where the variations of the tides are extensive, as in the vicinity of the Bay of Fundy, the range of the limnoria is correspondingly great. The United States Fish Commission states that it has been found, although rarely, as deep as 40 to 60 ft.

The Rapidity of the Work.—The limnoria does not work as rapidly as the teredo. The number of individual workers may be taken as a measure of the work they accomplish. The number of tunnels is more important than their depth. Limnoria are almost invariably found in large numbers and destroy a layer from ¼-in. to 1 in. in thickness in a year, the average yearly destruction being probably ½-in. Almost all wood used in marine locations is in the form of piles, which are necessarily exposed upon all sides. Their effective diameter may be reduced at the rate of 1 in. for each season, which result, while not equal to that accomplished by the teredo, is sufficient to cause a great loss.

The Effect of Climate, Temperature and Water.—The limnoria is found where the coldness of the climate prohibits the existence of the teredo. It requires pure sea water, and cannot exist in fresh or impure water, consequently it is not found at the mouths of rivers.

Distribution.—The animals are distributed along the American coast from Florida to Nova Scotia. They exist sparingly in Long Island Sound, but are quite numerous upon the coast of Massachusetts, and are very destructive in the Bay of Fundy. They are very active along the North Pacific coast, and are as much feared in the vicinity of Puget Sound and the Straits of Fuca. They exist also in abundance upon the coast of Great Britain and in other parts of Europe.

Woods Affected.—The limnoria seems willing to attack all varieties of wood commonly used by American constructors, but is said to prefer soft woods. It has been known to attack the gutta percha of submarine telegraph cables. It is said that teak wood is free from attack. Fig. 8 is a life-size photograph of part of a piece of wood from Port Townsend, Wash., showing the work of the limnoria.

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*Percival Wright describes a kind of "ship worm" called Nausitora Dunlopei found in India, 70 miles from the sea, in perfectly fresh water.

†Treatise, "Dry Rot in Timber," p. 223.

Sphaeroma Destructor.

Attention has recently been called to this hitherto undescribed form of life. This animal is interesting in that it is active in comparatively fresh water. It resembles the limnoria, in that it attacks the wood from without, the interior of the wood being unaffected while the exterior is being destroyed. The work of these animals was first noticed upon some of the trestles of the Florida East Coast Railway in the vicinity of St. Johns River in Putnam County, Florida. Specimens of the wood were submitted to the Carbolineum Wood Preserving Co., of New York city, and were referred by them to the Smithsonian Institution at Washington, where they were studied by Miss Harriet Richardson. The animal somewhat resembles the limnoria in appearance, and is dark brown in color. It works between high and low-water marks. These are not tidal levels, but changes due to the wind assisted by the tides. The water appears to be quite fresh and the water hyacinth, which is not commonly found in salt water, flourishes in the vicinity. The distance to the ocean is about 100 miles.

The Chelura Terebrans.

This animal was first noticed at Trieste in 1839, and was next found in some piles in the harbor of Kingston. The chelura was not identified in America until 1875, when two small specimens were discovered by Prof. Sidney I. Smith at Wood's Holl, Mass. No others were observed until August, 1879, when Professor Verrill discovered a number of them in some piles at Provincetown, Mass. The chelura unquestionably belongs to the amphipods, and there is apparently but one species of the genus.

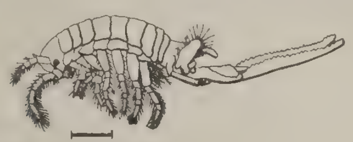

Fig. 9.—Sketch Showing General Appearance of Chelura Terebrans.

Descriptive.—The general appearance of the chelura, Fig. 9, resembles that of the ordinary shrimp, and for this reason is sometimes referred to as the wood shrimp. Its shape differs from that of the limnoria in a very striking degree. The two animals resemble one another only in size. The chelura is a very active little animal, and swims upon its back. It is a jumper, and can project itself to a considerable height when placed upon dry land, and in this respect resembles the sand hopper. The body is semi-translucent, and is thickly spotted or mottled with pink. The animal is distinguished by three pairs of caudal stylets, the last of which are nearly as long as the body. Those of the females or the young animals are not so long.

Vital Processes.—The chelura resembles the limnoria in that it is a vegetarian, and its burrow affords both residence and food. The fact that the chelura devours wood for sustenance is proved by the minutely divided ligneous matter found in the alimentary organs of dissected animals.

Boring Apparatus.—Professor Allman's original study of the chelura is in part yet regarded as authoritative. He states that the chelura attacks the wood and reduces it to minute fragments by means of a kind of file.

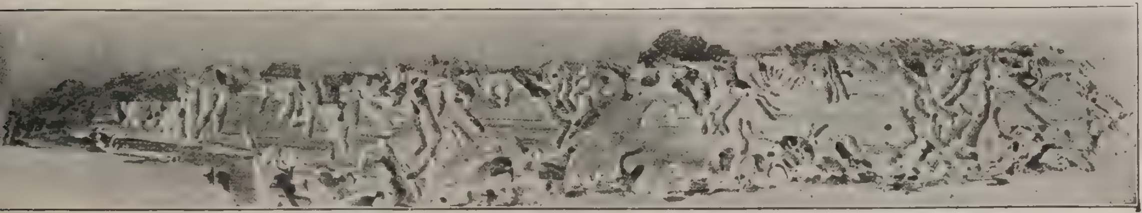

FIG. 10.—APPEARANCE OF TIMBER INFESTED BY CHELURA TEREBRANS.

The Character of the Excavation.—Great difficulty has been experienced in obtaining specimens of the work of the chelura, and those obtained are not sufficient to warrant many generalizations. In many particulars the work of the limnoria and of the chelura bear such a close resemblance, Fig. 10, as to lead to the suspicion that these animals are sometimes confused with one another. The excavations of the chelura are slightly larger than those of the limnoria, but are conducted in much the same manner, as the wood is attacked entirely from without. Numerous punctures are made, and then the weakened layers succumb to the action of the waves, the surface thus exposed being in turn attacked and the wood destroyed in the same manner. It is stated that the excavations of the chelura are more oblique in their direction than those of the limnoria, and this is certainly true of the specimens observed.

The chelura appears to prefer soft wood, and its attack is made as much as possible in the softer annual rings. The work of the chelura differs from that of the limnoria in that the latter attacks the wood at any available point, while the chelura, on the contrary, prefers the softer portions, and avoids the hard wood around knots. Perforations found in such localities may be assumed to be the work of the limnoria.

The Range of Field Work.—The question of range is unsettled. The specimens found at Provincetown were all taken from wood submerged from 8 to 12 ft. below low-water level.

The Distribution of the Chelura.—The chelura was sought many times along the American coast between New Jersey and Nova Scotia, but was not discovered until 1875. It is yet confined, so far as known, to the two original localities, Wood's Holl and Provincetown, both in Massachusetts, but it is more than possible that the animal has escaped observation, and that it is common on the North Atlantic coast. The unskilful eye would readily confound the chelura with the limnoria, although the two animals belong to distinct divisions of the crustaceans. It is quite possible that some of the damage hitherto ascribed to other animals has been accomplished by the chelura.

The chelura has been reported at many places on the coast of Europe, and is mentioned as existing from South Norway to the Adriatic. Attention has been called to the extent of its range. It is said to be an inhabitant of Australia. In Europe a very great amount of destruction is attributed to this species, and efforts have been made to substantiate these points, but have thus far been unsuccessful. It may be that some European results, attributed to this animal, are deserved by the limnoria, as it is probable that some of the work of the limnoria in America should be attributed to the chelura, and it is more than probable that the animals are frequently associated. Efforts to discover particular works affected exclusively by this form of life in Europe have not thus far met with success. The chelura has earned a most unenviable reputation in Europe, but it is not known in which places it exists as a specimen and in which as a pest.

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A COMPLETE THEORY OF IMPULSE WATER WHEELS AND ITS APPLICATION TO THEIR DESIGN.

By R. T. Kingsford.*

The common theory of the impulse water wheel has been given so many times by different authors that the fact that it is only an approximation has been almost entirely lost sight of. It is well known that the speed of the bucket for maximum efficiency is not one-half of the velocity of the jet as the ordinary theory indicates, but from 85 to 95% of the half velocity.

The common theory is correct for the conditions assumed, i. e., a wheel of infinite radius and without friction; conditions that are impossible, and far enough from the facts to make the theory based on them of very little use to the designer and engineer. In a wheel of finite dimensions the bucket does not travel straight before the jet, but cuts through it at an angle of say 20° or 30°, and changes its direction relative to the jet by 70° or 80° before leaving it. It is usually stated also that for maximum hydraulic efficiency the direction of discharge relative to the bucket should be parallel and opposite to that of the jet, while in reality it should be tangential at all times, irrespective of the direction of the jet, for in no other way can the velocity of the bucket neutralize that of the discharging water on the bucket, and the resulting absolute discharge velocity become zero.

For the velocity of discharge to become zero, it is then necessary for the velocity of the water relative to the bucket at the point of discharge to be equal and opposite to the velocity of the discharge portion of the bucket. In practice the discharge velocity can never be quite zero, as the relative direction of discharge must depart from a tangent to the bucket's path, by a small angle of from 5° to 15° in order that the water may leave the wheel without being struck by and exerting back pressure on the succeeding bucket. Referring to Fig. 1, it is clear that the minimum value of this discharge angle, b, may be found from the equation

$$\tan b = \frac{n\ t}{2\ \pi\ R}. \qquad (1)$$

Where t = the combined thickness in feet, of water and bucket, at the point of discharge, as shown in the figure.

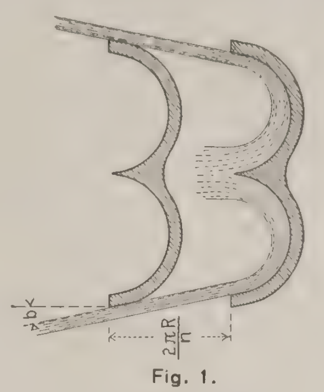

Fig. 1.

n = the number of buckets on the wheel.

R = radius in feet, to the average point of discharge from bucket.

To Find the Speed for Maximum Hydraulic Efficiency.

In Fig, 2, the nozzle T is shown, and four of the buckets or vanes, A F, N P, etc. The centre of the shaft is at M.

Let

H = Head of water available, before nozzle.
P = Pressure per sq. in. equivalent to head H.
V = Spouting velocity of jet in ft. per second = A C in figure.
v = Velocity of bucket for maximum hydraulic efficiency at average point of discharge, in ft. per second = F G in figure.
a = Angle of jet to the path of the average point of water entrance = $\cos^{-1}(p/r)$ = angle D A C in figure.
b = Angle between the direction of discharge relative to the bucket, and the path of bucket at average point of discharge = angle K F J in figure.
c = Average angle of water entrance on bucket = angle D A B in figure.
R = Radius of bucket at average point of discharge, in ft. = F M in figure.
r = Radius of bucket at average point of water entrance in ft. = A M in figure.
p = Perpendicular distance from center of wheel to center of jet in ft.
N_h = Revolutions per minute for maximum hydraulic efficiency.
S_h = Speed ratio for maximum hydraulic efficiency, i. e., ratio of circumferential velocity v of wheel to one-half the spouting velocity of the jet = 2 v/V.
C_f = Retardation or friction factor of water on buckets.
C_v = Retardation or friction factor of water in nozzle.

Referring to the figure, the absolute velocity of discharge F H will be a minimum, and, therefore, the hydraulic efficiency a maximum, when the tangential component F K of the relative discharge velocity F J is exactly neutralized by the velocity F G of the discharge portion of the bucket. The velocity of discharge F J relative to the bucket, is less than the velocity A B of entrance, because of friction between water and buckets, i. e., $F\ J = C_f \cdot A\ B$; also from the right angle triangle J K F, $F\ J = \frac{v}{\cos b}$, therefore,

$$D\ C = A\ B = \frac{v}{C_f \cos b}.$$

Since velocities of rotation vary as the radii, the velocity A D of the entrance portion of the bucket $= \frac{v\ r}{R}$.

Now, from the figure $A\ E = A\ D + D\ E$, or,

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$$V \cos a = \frac{v\,r}{R} + \frac{v}{C_f \cos b} \cos c;$$

which is

$$\frac{\cos c}{\cos b} = \frac{V}{v} C_f \cos a - \frac{r}{R} C_f. \tag{2}$$

From the figure, A C . sin a = D C . sin c, or $(A\,C)^2 \sin^2 a = (D\,C)^2 \sin^2 c$. Substituting A C = V, $D\,C = \frac{v}{C_f \cos b}$, $\sin^2 a = 1 - \cos^2 a$, and $\sin^2 c = 1 - \cos^2 c$, this becomes

$$\frac{\cos^2 c}{\cos^2 b} = \frac{1}{\cos^2 b} - \frac{V^2}{v^2} C_f^2 + \frac{V^2}{v^2} C_f^2 \cos^2 a. \tag{3}$$

Squaring (2) and equating its second member to the second member of (3),

$$\frac{r^2}{R^2} C_f^2 - 2 \frac{Vr}{vR} C_f^2 \cos a = \frac{1}{\cos^2 b} - \frac{V^2}{v^2} C_f^2. \tag{4}$$

To simplify this equation let

$$A = \frac{r}{R},\ B = A \cos a = \frac{p}{R}, \text{ and } C = \frac{1}{C_f \cos b},$$

then (4) becomes

$$\left(\frac{V}{v}\right)^2 - 2\,B \left(\frac{V}{v}\right) = C^2 - A^2,$$

and, solving for V/v, thus gives

$$\frac{V}{v} = B + \sqrt{B^2 + C^2 - A^2}. \tag{5}$$

and, therefore,

$$S_h = \frac{2}{B + \sqrt{B^2 + C^2 - A^2}}. \tag{6}$$

Knowing the speed ratio S_h, the speed of the wheel for maximum hydraulic efficiency N_h may be found from either of the equations,

$$N = \frac{15\,V\,S}{\pi R} = \frac{15\,S\,C_v \sqrt{2gh}}{\pi R} = \frac{183\,S\,C_v \sqrt{P}}{\pi R}$$

Where N = revolutions per minute, corresponding to any speed ratio, S.

To Find the Speed for Maximum Commercial Efficiency.

The effect of bearing friction is to drop the speed for maximum efficiency below that for maximum hydraulic efficiency. This is shown in Fig. 3. O A N C is a curve of HP. and speed of a wheel with frictionless bearings, and is therefore the hydraulic efficiency curve of the wheel. Bearing friction varies directly with the speed, and may therefore be represented by the straight line O J B. By subtracting the ordinates of O J B from those of the curve O A N C, the actual or commercial efficiency curve, O D K, is obtained, having its maximum, D, at a lower speed ratio.

The efficiency curve of a perfect wheel would be a parabola, and if a wheel has enough buckets, the actual curve does not depart from the parabolic form until the speed is beyond the point of maximum efficiency. In the figure, O A B C is a parabola corresponding to the curve O A N C, and this when combined with the line O J B, gives the parabola O D E.

It may be proven from the properties of the parabola, that the ratio of G F to O F is half the ratio of F J to F A, therefore,

$$C_b = \frac{2 - D}{2}. \tag{8}$$

Where, C_b = Ratio of speed for maximum commercial efficiency, to speed for maximum hydraulic efficiency = O G / O F in figure.

D = Ratio of power absorbed by friction at the speed for maximum hydraulic efficiency, to the maximum power that would be developed with frictionless bearings = F J / F A in figure.

Putting S_c = Speed ratio for maximum commercial efficiency = C_b, S_h, equation (6) gives

$$S_c = \frac{2 - D}{B + \sqrt{B^2 + C^2 - A^2}}. \tag{9}$$

Knowing S_c, the revolutions per minute may be found from equation (7).

To Find the Maximum Commercial Efficiency.

The losses in a mounted impulse wheel may be divided into nozzle, bucket, and bearing losses. Referring to Fig. 3, it may be proven from properties of the parabola that the miximum commercial efficiency G D, equals C_b^2 times the maximum hydraulic efficiency F A. Therefore,

$$E_c = C_b^2 E_h \tag{10}$$

In which E_c = Maximum commercial efficiency.

$E_h = C_v^2\ E$ = Maximum hydraulic efficiency.

E = Maximum efficiency of buckets.

The bucket losses may be further divided into losses due to clearance angle at discharge, friction of water or buckets, and irregular actions such as breaking up of the jet by impact, back pressure on buckets, etc. The irregular losses cannot be calculated, but are negligible when the entrance and discharge angles are correct, dividing edges sharp, and curvatures not abrupt. The proportion of power lost in the discharge (see Fig. 2)

$$= \frac{(F\,H)^2}{(A\,C)^2} = \frac{v^2 \tan^2 b}{V^2} \text{ or}$$

$$= \frac{S_h^2 \tan^2 b}{4} \tag{11}$$

The effect of friction between water and bucket is to reduce the velocity of the water, and produce a polygon of forces on the surface of the bucket, the resultant of which is practically perpendicular to the plane of rotation, and, therefore, lost.

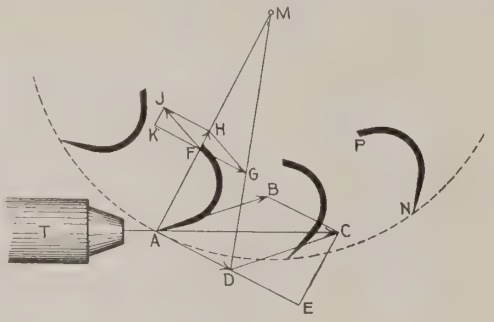

Fig. 2.

The proportion of bucket friction loss

$$= \frac{(A\,B)^2 - (F\,J)^2}{V^2} \text{ (Fig. 2.)}$$

Substituting $A\,B = \frac{F\,J}{C_f}$, and $F\,J = \frac{V\,S_h}{2 \cos b}$, this becomes

$$\frac{S_h^2 (1 - C_f^2)}{4\,C_f^2 \cos^2 b} \tag{12}$$

therefore from (11) and (12) the maximum efficiency of the bucket is

$$E = 1 - \frac{S_h^2 \tan^2 b}{4} - \frac{S_h^2 (1 - C_f^2)}{4\,C_f^2 \cos^2 b} \tag{13}$$

the second term being the loss at discharge and the third that due to bucket friction. The maximum commercial efficiency may now be found from (10) and (13), thus:

$$E_c = C_b^2\ C_v^2\ E \tag{14}$$

To Find the Proper Number of Buckets.

The number of buckets has much to do with the efficiency and regulation of the wheel. If too many, the losses due to the breaking up of the jet, clearance angle, and bucket water friction, will be much increased; and if too few, part of the water will pass through between the buckets without imparting its energy to the wheel. The effect of the latter on the efficiency is shown in Fig. 3 by the falling away of the efficiency curves O A N C and O D K at high speeds.

In Fig. 4, A B is the bottom of the jet, and A and C two adjacent bucket tips. A particle of water having just passed under bucket A, must overtake bucket C, before it reaches B; i. e., for the minimum number of buckets, the time of the jet from A to B equals the time of the bucket from C to B.

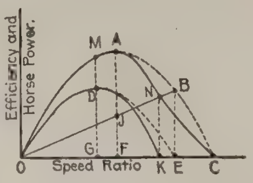

Fig. 3.

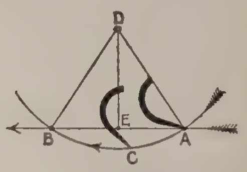

Fig. 4.

Let n_o = Minimum number of buckets allowable.

d = Diameter of jet, in feet.

e = Half the angle subtended by the bottom of the jet = angle E D A in the figure $= \cos^{-1} \frac{2\,p + d}{2\,r_1}$

p = Perpendicular distance in feet from centre of wheel to centre of jet.

r_1 = Radius of bucket in feet at tip, or initial point of water entrance on bucket = D A in figure.

S_b = Speed ratio at which water commences to pass through between buckets. It must not be taken less than S_c.

The time of jet from A to B is

$$\frac{2\,r_1 \sin e}{V} \tag{15}$$

The time of bucket from C to B is

$$\frac{2\,R}{V\,r_1\,S_b} \cdot C\,B \tag{16}$$

and, from the figure, C B = A C B — A C

$$= 2\,\pi\,r_1 \left(\frac{e}{180} - \frac{1}{n_o}\right)$$

Substituting value of C B, equating (15) and (16) and solving for n_o,

$$n_o = \frac{180\,\pi\,R}{\pi\,R\,e - 90\,S_b\,r_1 \sin e} \tag{17}$$

If a wheel is to be used without a governor, S_b should be taken as small as possible, so that the rapid falling off of efficiency at speeds higher than that for maximum efficiency, will tend to prevent racing at light loads.

To Find the Entrance Angle of the Bucket.

In order to prevent loss by the generation of heat, formation of eddies, backwater, etc., the bucket surface at entrance should be parallel to the course of the jet relative to the wheel.

Let c_1 = Angle between entering or initial edge of bucket, and an arc of radius r_1, = angle D A B in Fig. 2.

$a_1 = \cos^{-1} p/r_1$ = angle between center line of jet, and an arc of radius r_1, = angle D A C in Fig. 2.

From the figure, $D\,E \cdot \tan c_1 = A\,C \cdot \sin a_1$, or,

$$\tan c_1 = \frac{A\,C \cdot \sin a_1}{A\,E - A\,D},$$

and substituting $A\,E = V \cos a_1$, and $A\,D = \frac{V\,S_c\,r_1}{2\,R}$, this gives

$$\cot c_1 = \cot a_1 - \frac{S_c\,r_1}{2\,R \sin a_1} \tag{18}$$

Calculations of a Wheel of 32-in. Nominal Diameter.

The following calculations will serve to show the application of the preceding formulae:

The wheel in question is of the tangential type, discharging on the sides; the principal dimensions being, diameter outside of buckets, 35 ins.; radial length of buckets, 4 ins.; diameter of jet, 2 ins., radius to center line of jet, 15¼ ins. These dimensions, in the notation used, give:

$$r_1 = \frac{35}{2 \times 12} = 1.46;$$

$$d = \frac{2}{12} = 0.167;$$

$$p = \frac{15.25}{12} = 1.27.$$

The average radius of entrance will necessarily be between p and r_1, and may be taken as equal to ¾ p + ¼ r_1; i. e.,

$$r = 0.95 + 0.36 = 1.31.$$

The average radius of discharge will be slightly less than p. With type of wheel it may be taken equal to 1.5 p — 0.5 r, or

$$R = 1.9 - 0.65 = 1.25.$$

The value of S_b should be taken to suit the conditions under which the wheel is to run, as previously explained. Ordinarily take

$$S_b = 1.1.$$

Half the angle subtended by the bottom of the jet equals

$$e = \cos^{-1} \frac{2\,p + d}{2\,r_1}, \text{ or,}$$

$$e = \cos^{-1} (0.93) = 21° \, 30'.$$

To find the proper number of buckets use equation (17),

$$n_0 = \frac{180 \times 3.1416 \times 1.25}{3.1416 \times 1.25 \times 21.5 - 90 \times 1.1 \times 1.46 \times 0.366} = 24.$$

The combined thickness, t, of water and bucket at discharge equals $\dfrac{\text{Area of jet}}{2 \times \text{Radial length of bucket}}$ + thickness of bucket and an allowance for irregularity. In this case, make

$$t = ¾\text{-in.} = 0.0625.$$

To find the minimum clearance angle, b. use equation (1).

$$b = \tan^{-1} \frac{24 \times .0625}{2 \times 3.1416 \times 1.25} = 11°.$$

The actual angle of discharge will probably be about 16°. The friction factor of the water on the bucket C_f must be found experimentally. It increases with the extent and roughness of the surface. Assume,

$$C_f = 0.94.$$

To find the speed ratio S_h, for maximum hydraulic efficiency, use equation (6). In this equation,

$$A = \frac{r}{R} = 1.05,\ B = \frac{p}{R} = 1.02,\ C = \frac{1}{C_f \cos b} = 1.11$$

$$S_h = \frac{2}{1.02 + \sqrt{1.04 + 1.23 - 1.1}} = 0.954$$

The proportion of bearing friction, air resistance, etc., must be estimated. Assume D = 0.03. The coefficient C_b may now be found from equxation (8),

$$C_b = \frac{2 - 0.03}{2} = 0.985.$$

The speed ratio, S_c, for maximum commercial efficiency, may be found from equation (9),

$$S_c = C_b \; S_h = 0.94.$$

The friction factor C_v, of the water in the nozzle, increases with the taper angle, being almost unity for a thin flat plate, and for a reamed taper of not less than 25°, it is seldom less than 0.96 or 0.97. Assume

$$C_v = 0.97.$$

The correct speed in revolutions per minute may now be found for any head or pressure from equation (7),

$$N = \frac{183 \times 0.94 \times 0.97}{3.1416 \times 1.25} \sqrt{P} = 42.5 \sqrt{P},$$

The efficiency, E, of the bucket may now be found from equation (13),

$$E = 1 - 0.019 - 0.034 = 0.947.$$

Knowing E, C_b, and C_v, the maximum commercial efficiency may be found from (14),

$$E_c = 0.97 \times 0.94 \times 0.947 = 86\%.$$

To obtain this efficiency, the wheel must be run at the correct speed: i. e., $N = 42.5 \sqrt{P}$, as found above, and the entrance angle of the bucket must be correct.

To get this angle, use equation (18), in which

$$a_1 = \cos^{-1} p/r_1 = 29° \, 30'.$$

Then the correct angle for the entering edge of the bucket is, from (18),

$$c_1 = \cos^{-1} (1.78 - 1.12) = 56° \, 30'.$$

With some wheels the bucket is of such a form that the loss at discharge would be much increased if the angle were made as large as formula (18) indicates, and a compromise has to be made. This is, however, a source of considerable loss and should be avoided by proper designing.

◆

ATMOSPHERIC RESISTANCE TO THE MOTION OF RAILWAY TRAINS.

In a paper with the above title by Prof. W. F. M. Goss, published in the "Proceedings of the Western Railway Club" for April, 1898, there is described a series of experiments on wind resistance of small models of railway cars, from which the author deduces a set of formulas for the air resistance of actual trains of different number of cars at various speeds. The models used were 1-32 the size of an assumed standard box car, or 12 1-16 ins. long, 3⅛ ins. wide and 4½ ins. high. They were placed inside of a smooth air-tight wooden conduit with glass sides, 20 ins. square, 60 ft. long, through which air was blown by means of a fan blower, the velocity of the air current being ascertained by Pitot tube gages. The pressure exerted by the wind in the direction of the axis of the conduit was measured by a very sensitive dynamometer attached to each car. The condition of the cars being at rest and the air in motion was taken as equivalent, so far as the pressure tending to move the cars was concerned, to the natural condition of cars in motion through still air. Numerous observations were made with the number of cars varying from 1 to 25 and with velocities of air from 25 to 105 miles per hour. The actual pressures on the model cars, as registered by the dynamometers, were compared with the theoretical pressures due to the velocity calculated from the formula $P = .0025\ V^2$, in which P = pressure per square foot and V = velocity in miles per hour.*

It was found that when one model only was used the ratio of the force tending to displace the model to the pressure due the velocity was respectively 0.61, 0.54, 0.48, 0.47 and 0.49 for velocities of 25, 41, 73, 88 and 102 miles per hour. For the speeds higher than 25 miles per hour the average ratio approximates 50%. When two models, placed end to end, were used the pressure on the first was about 40% and that on the second about 13%, a total on both of about 53% of the theoretical pressure acting on an area equal to the cross section of a model. For three models the pressures were respectively about 0.40, 0.05 and 0.13 of the theoretical, a total of 58%. For five models the pressures were about 0.39, 0.03, 0.04, 0.04, 0.11, a total of 61%. For ten models the pressure on the first was about 0.39, on the second to the ninth inclusive about 0.039 each, or one-tenth that on the first, and on the tenth about 0.1, making a total of 80% of the theoretical pressure on the cross section of one model. With 25 models the pressures were about the same on the first, last and intermediate models respectively as with ten models, the sum of the pressures for the 25 models being about 1.4 times the theoretical end pressure on a single model. In all cases of trains of more than ten models, however, the pressure on the second model of the train is somewhat less than that upon the third or any other succeeding model except the last.

The relation between the force and the velocity upon the several models of a train may be expressed by the following equations:

For a single model, $A = 0.000116\ V^2$.
For the first model of a train, $A = 0.000097\ V^2$.
For the last model of a train, $A = 0.000025\ V^2$.
For the second model of a train, $A = 0.000008\ V^2$.
For any intermediate model, $A = 0.000010\ V^2$.

In which A = the force in pounds acting on the model in the direction of its length, and V = the velocity of the air current in miles per hour. These equations apply only to models of the particular dimensions used. Equations of a more general character are obtained by reducing the forces acting upon each model to equivalent forces per square foot of area of cross section, as follows:

For the Pitot gage, $P = 0.0025\ V^2$.
For the model alone, $P = 0.0012\ V^2$.
For the first model of a train, $P = 0.001\ V^2$.
For the last model of a train, $P = 0.00026\ V^2$.
For the second model of a train, $P = 0.00008\ V^2$.
For any intermediate model between the second and the last, $P = 0.0001\ V^2$.

The models being 1-32 the size of a 33-ft. box car, the area of surface of an actual car is 32^2 = 1,024 times the surface of a model. The coefficients of V^2 in the above formulae being multiplied by 1,024 the resulting values of P will then represent the atmospheric resistance to the passage of an actual car at the speed of V. The atmospheric resistance of trains of such cars is the sum of the resistances of the several cars, and it may be expressed by the following formula, which is developed from those already given:

$$A = (0.105 + 0.010\ N)\ V^2,$$

in which A = the resistance in pounds, N the number of cars in the train, and V the speed in miles per hour. In a train of cars headed by a locomotive and tender, the locomotive should be regarded as the first car and the tender the second. A passenger car may be considered as equivalent to two freight cars. Taking the freight car as 33 ft. in length, a formula may be constructed in which the length of the train in feet, instead of the number of cars, is a factor.

Prof. Goss concludes his paper by summarizing his several formulae in the convenient forms given below. He says they apply to trains and parts of trains having an area of cross-section equal to that which is common in American practice, with possible errors of from 15 to 20% in individual cases. In the following equations A is the tractive force in pounds necessary to overcome the resistance of the atmosphere, and V the velocity in miles per hour:

a. For a locomotive and tender running alone: $A = 0.13\ V^2$.

b. For a locomotive and tender running at the head of a train: $A = 0.11\ V^2$.

c. For the last car of a train of freight cars: $A = 0.026\ V^2$.

d. For the last car of a train of passenger cars: $A = 0.036\ V^2$.

e. For each intermediate freight car in a train of 33-ft. cars: $A = 0.01\ V^2$.

f. For each intermediate passenger car in a train of 66-ft. cars: $A = 0.02\ V^2$.

g. For a train consisting of locomotive, tender and freight cars: $A = (0.13 + 0.01\ C)\ V^2$, where C is the number of cars in the train.

h. For a train consisting of locomotive, tender and passenger cars: $A = (0.13 + 0.02\ C)\ V^2$.

i. For a train of freight cars following a locomotive, but not including either locomotive or tender, $A = (0.016 + 0.01\ C)\ V^2$.

j. For a train of passenger cars following a locomotive, but not including either locomotive or tender, $A = (0.016 + 0.02\ C)\ V^2$.

k. For a locomotive and any train, either freight or passenger: $A = 0.0003\ (L + 347)\ V^2$, where L is the length of the train in feet.

l. For a train of cars, either passenger or freight, following a locomotive, but not including either locomotive or tender: $A = 0.0003\ (L + 53)\ V^2$, where L is the combined length of the cars composing the train.

---

*[The theoretical pressure due the velocity is $0.005\ V^2$ instead of $0.0025\ V^2$. The theoretical pressure produced by a jet of any fluid on a plane surface at right angles to the jet is equivalent to twice the head which would cause the velocity, or $\frac{2\,v^2}{2\,g}$, v being the velocity in feet per second (see Church's Mechanics, pp. 761, 803). If A = area of the plane in sq. ft., w = weight of 1 cu. ft. of air = 0.0761 at 62° F. and atmospheric pressure, and F = total pressure on the plane. $F = A\,w\,\frac{v^2}{g}$. If A = 1, w = 0.0761, and g = 32.2, $F = 0.00236\ v^2$. If v is taken in miles per hour, $v = 22 \div 15$, $v^2 = 2.15$, and $F = 0.00507\ V^2$. This correction will cause all the figures given by Prof. Goss to express the relation of observed to theoretical pressures to be divided by 2, but it makes no change in his formulas for resistance, which are based on experiment and not on theory.—Ed. Eng. News.]

◆

THE BLUNT DIVIDING ENGINE, built by E. & G. W. Blunt, of New York, in 1851-58, has been secured, along with the business of Mr. F. Eskel, by Kolesch & Co., manufacturers of drawing instruments, of 155 Fulton St., New York. This engine, which was one of the first built in this country, and is still one of the best in use, has a circle 35 ins. diameter, with the circumference divided into 2,160 parts, with six divisions to one degree. The engine was considered so important that an illustrated description of it was published in book-form, in 1858, detailing the methods employed in dividing the circle, cutting the circumferential teeth and in applying it to the division of the circles of surveying and astronomical instruments. The book contains a certificate by the late J. E. Hilgard, of the U. S. Coast Survey, attesting the accuracy of the work.

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We published in our issue of July 7 a report made by Mr. Henry B. Seaman, M. Am. Soc. C. E., on the condition of the various paints applied to the 155th St. viaduct over the tracks of the Manhattan Elevated Ry., in New York city. We accepted and published the report on the strength of Mr. Seaman's reputation, without taking measures to verify its accuracy; but as some severe criticisms of this report have been since presented to us, two members of the editorial staff of this journal visited this structure on July 16 and carefully examined it. As a result of this examination we are obliged to advise our readers that no conclusion whatever as to the relative merits of the various paints under test should be based on Mr. Seaman's report, and we regret having given publicity to it.

To explain more in detail, Mr. Seaman in his report said:

> In making the examination, a careful general scrutiny was given to each girder from the platform below, and each was given a percentage mark, denoting the amount of surface free from rust. These percentages were then carefully compared and reviewed so that they might correctly represent the comparative condition of each girder. When these tests were completed, a thorough inspection was made by climbing through the structure, and the character of rust was denoted for each girder.

In the table accompanying Mr. Seaman's report, the percentages of the surface of each girder free from rust varied from 99% to 25%, and some of these percentages differed by as little as 2% from each other. The editors of this journal who have examined the structure agree in stating that no such accurate estimate as these percentages would indicate is possible by examining these girders from the platforms; and in fact no reliable estimate is possible at all with the girders in their present condition. They have examined the structure from the platforms, and also climbed through it, as did Mr. Seaman. They find practically the entire steel-work covered with a coating of ash, dust, soot, etc., so that any accurate comparison of the conditions of the different paints is impossible. It must be understood that nowhere on the whole viaduct are there patches of deep red rust, such as are found on an iron structure after considerable exposure to the weather, and which stand out plainly against any dark paint. Such rust as is to be found on this structure is for the most part in the form of fine pin points, except where leakage from the floor overhead has spread rusty water on the iron and has discolored it or caused local rusting. To determine accurately the percentage of surface free from rust under these conditions and especially from the platforms 17 ft. below as Mr. Seaman claims to have done, is about as easy as counting the bees in a swarm. We do not mean to say that no differences in the condition of the various paints are discernible. On the contrary, Girders Nos. 3 and 8 are, as Mr. Seaman indicates, in much worse condition than any of the others; at the same time his percentages, 25% and 30%, as the surface of these girders free from rust, would in our opinion be more accurate if stated as 25% covered with rust. We allude to this merely to show that any estimate of the percentage of surface free from rust on the various girders of this viaduct is a matter of rough guess-work under present conditions, and probably no two experts could be found who would guess alike.

The test of paints in progress at this place promises to furnish some interesting and valuable data sometime; but we believe it is too soon yet to make any comparison of the conditions of these various paints that will be worthy of general acceptance by the profession. At least a dozen of these girders show trifling if any difference in their condition, and this is really to be expected, considering that this paint has not been on a year yet and it was applied to an iron surface as clean as the sand-blast could make it.

After the paint has been in service for two years or so, it would be an excellent idea for the committee of the American Society of Civil Engineers, which has in charge the subject of paints for metal work, to make a thorough examination of and report upon the condition of the various paints on this structure. Such a report would carry weight with the profession that could not attach to a report made by any city official or any single engineer, however expert.

◆

Judging from a communication in the Cleveland "Plaindealer," of June 30, one C. C. Merrill, Manager of the Mexican Clay Co., of the City of Mexico, has either been very unfortunate in the selection of his acquaintances; or, he should be at once employed in writing war despatches for Governor General Blanco. This party is making sewer-pipe for the Mexican government under a valuable concession, and, doubtless, for purposes of his own, indulges in fulsome and uncalled-for praise of the strict honesty of the Mexican officials with whom he has to deal. There is no particular harm in this; but he then goes on to draw comparisons between the Mexican and the American engineer, and says that in selling sewer-pipe in the United States, "I never found an American engineer that I could not buy, except he had been bought up by the man ahead of me." As to this statement, Mr. Merrill has either had an exceedingly limited experience as a selling agent; or, what is much more probable, he simply lies. There is no doubt from his own confession but that Mr. Merrill is venal enough, for in his statement he calmly acknowledges offering to a Spanish Chief Engineer terms of "mutual benefit." The mistake he makes is in measuring others by his individual standard.

◆

In the description of the process of liquefying air in use by Mr. Chas. E. Tripler, of New York City, in our issue of April 14, we described the method and apparatus by which a portion of the highly compressed air is made to furnish a refrigerating effect which causes liquefaction of another portion of the air.

An English inventor, Dr. W. Hampson, now claims to be the original inventor of this process of "Self-Intensive Refrigeration," as he terms it. In a paper printed in the "Journal of the Society of Chemical Industry, May 31, 1898, Dr. Hampson explains in detail his method of liquefying air, and gives his reasons for believing himself to be the original inventor of this process of liquefaction of air and other gases.

So far as we have been able to find, neither Dr. Hampson nor Mr. Tripler have taken out American patents on their inventions yet. Mr. Tripler has an English patent (No. 4210 of 1893), which Dr. Hampson alleges is actually a heating apparatus instead of a refrigerating one, and he further claims that Tripler's successful production of liquid air has all been done since the publication of the Hampson system and apparatus in 1895.

Those interested in the subject of liquid air will do well to secure a copy of Dr. Hampson's pamphlet, which is printed by Eyre & Spottiswoode, the well-known London publishers. We presume that the United States patent office will have to sift the question between the two claimants in an interference case.

◆

The vexed question of the improvement of the Chicago River in order to make it navigable for the large steamers now coming into use was brought up for discussion at the meeting of the Western Society of Engineers on June 1. At this meeting a paper was presented by Mr. G. A. M. Liljencranz, U. S. Assistant Engineer, describing the existing obstructions to the navigation of large vessels. A number of plans of awkward locations on the river were exhibited, on which the outline of a large steamer had been plotted, showing graphically the difficulty, and in some cases the impossibility, of such a ship getting through. The general situation and the relation of the Chicago River to the commercial interests of the city have already been fully presented in our columns, and it is only necessary here to state briefly the conditions. The narrow and tortuous channel, which is obstructed by numerous docks, bridges, bridge piers, the roofs of three tunnels, and numerous bends and sharp turns, passes through a business and industrial district, and is traversed by a very large tonnage of shipping in the trade with the freight wharves, grain elevators, coal and lumber yards, etc., which have been established along the stream. At present the river is practically a navigable sewer, the water being black and offensive and the bottom being a soft foul mud which is kept stirred up by the steamers. It is expected that this condition at least will be improved when the drainage canal is completed, but the filthiness and dilapidated condition of the surroundings will remain unless some radical steps are taken for the general improvement of the river. It is not generally known that there is an existing ordinance (passed in 1869), establishing certain dock lines, but this is absolutely a dead letter and docks are built far beyond the prescribed limits, without regard to the requirements of navigation. The drainage board will increase the waterway at some points, in order to secure the necessary amount of flow to the canal, but this will be done by means of covered conduits and will not improve the navigation. For the latter purpose, the U. S. government has undertaken to cut off corners and widen the channel at certain points, but this work will be of limited extent, and is but a temporary expedient. It will remain for the city to undertake the more extensive work of lowering the tunnels, and replacing the center-pier drawbridges with bascule bridges which will neither obstruct the channel nor interfere with the wharfage adjacent to the bridges. With this might and should come a general rectification of the channel and an improvement of the river front.

It certainly seems evident that the city should delay no longer, but at once take the matter in hand, as there is urgent necessity for the adoption of some definite plan for the improvement of the long-neglected river on a bold scale, and not by mere petty improvements which practically leave the general problem untouched. When once such a plan is adopted, the work of carrying it into effect can be done gradually as means will permit. The size of steamers employed in the lake traffic has shown a marked increase within recent years, and the government is now establishing a 21-ft. channel through the lakes between Duluth, Chicago and Buffalo. In recent reports, Major W. L. Marshall, U. S. Engineers, has shown that many of the large vessels whose length and beam enable them to pass through the Chicago River, cannot be given a full load on account of the limitation of draft by the tunnels, and cases are not infrequent where loaded steamers ground in the shallow water over these tunnels.

◆

The return to Spain of the 25,000 prisoners of war lately taken at Santiago seems to be not only the

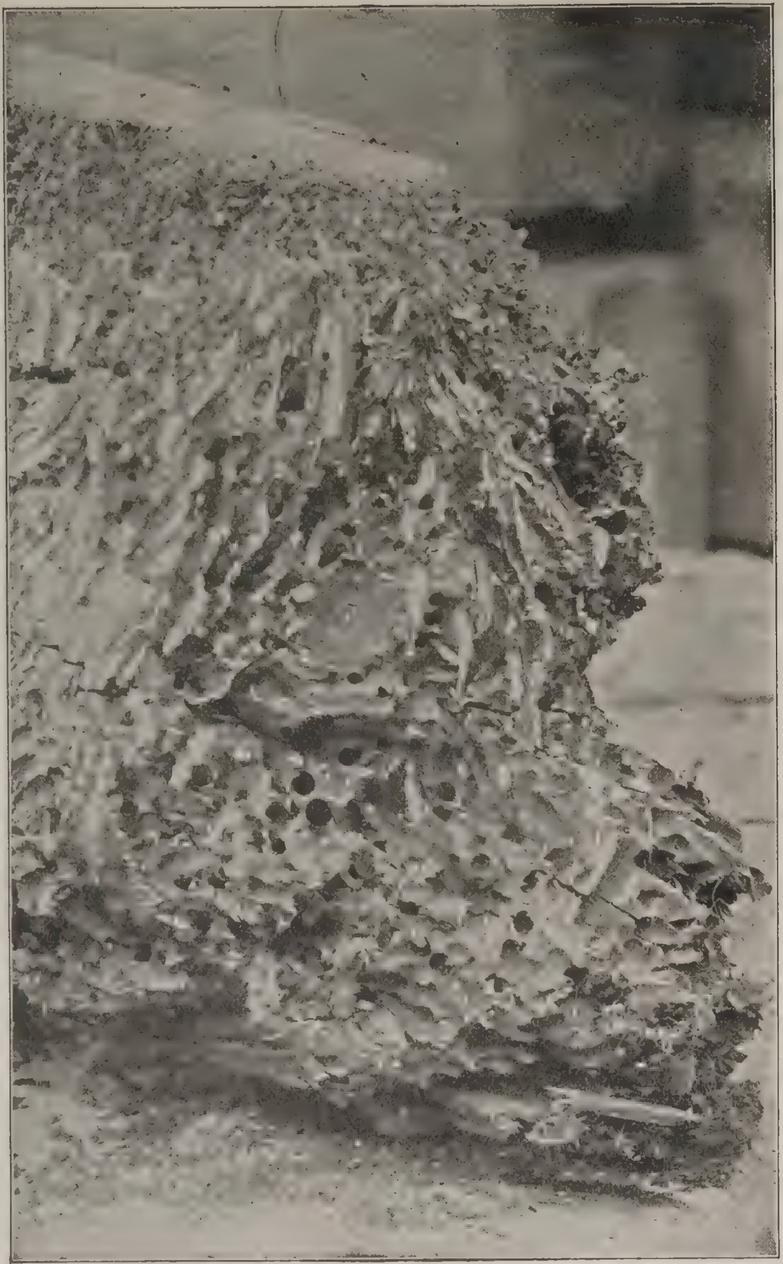

FIG. 6. APPEARANCE OF MAHOGANY TIMBER AFTER NINE MONTHS' WORK BY TEREDO.

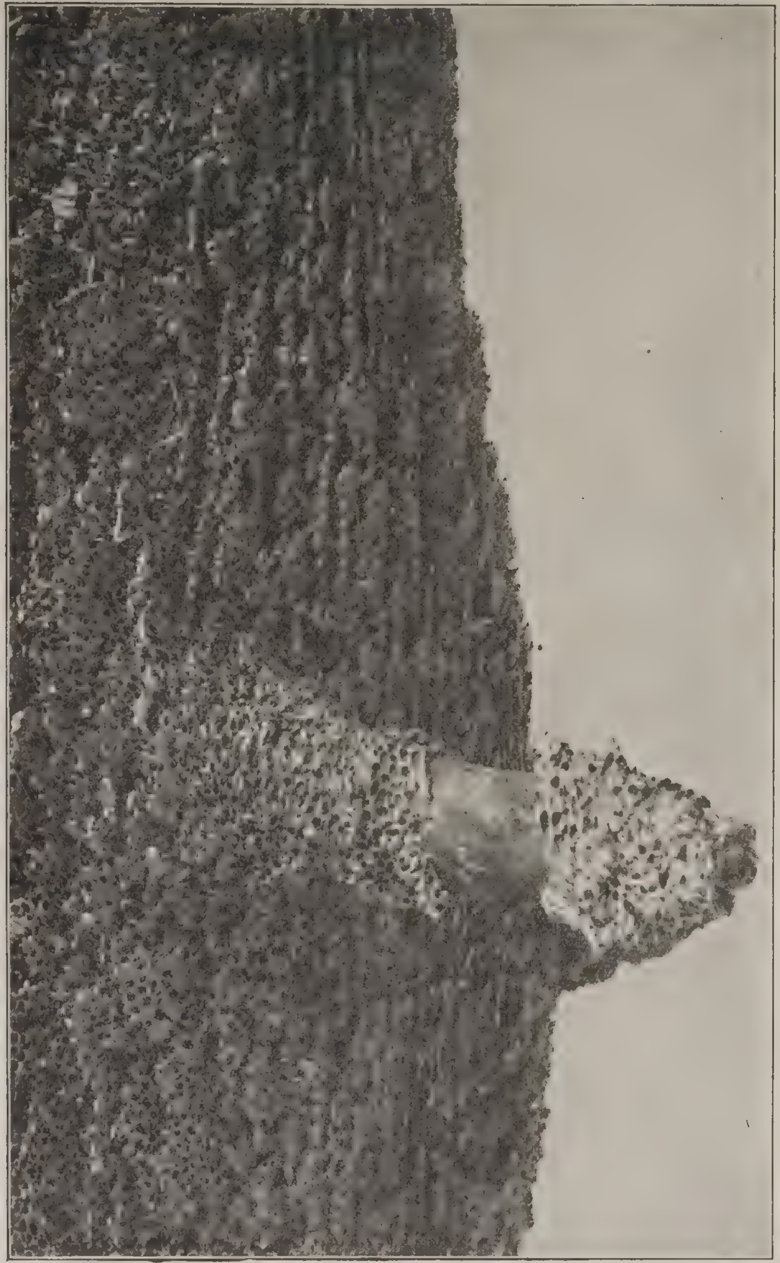

FIG. 8. APPEARANCE OF TIMBER INFESTED BY LIMNORIA.

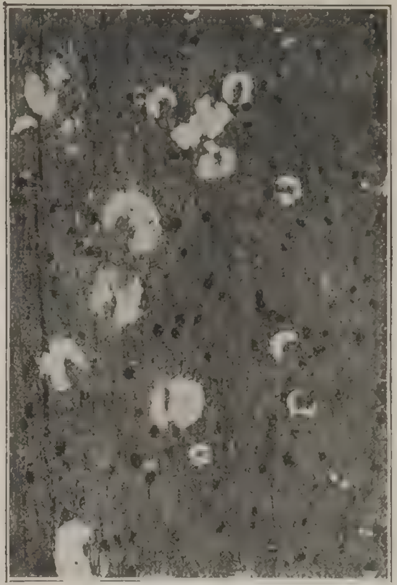

FIG. 4. SURFACE OF TEREDO INFESTED TIMBER SHOWING SMALL SIZE OF INITIAL PERFORATIONS.

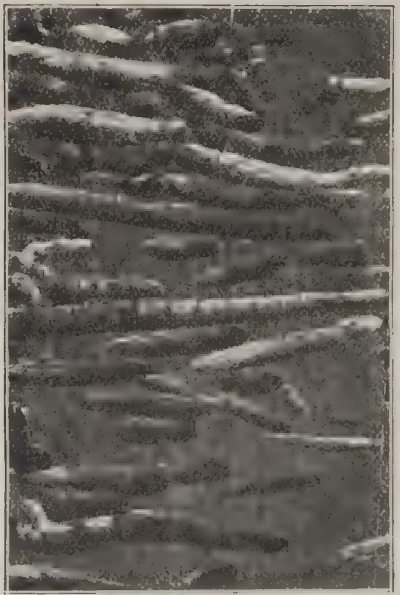

FIG. 5. INTERIOR OF TEREDO INFESTED TIMBER SHOWING ENLARGEMENT OF PERFORATIONS.

MARINE WOOD BORERS.

most economical method of dealing with the problem, but also an eminently wise educational step. These returning prisoners have met the Americans in battle; they have practically witnessed the destruction of Spain's best fleet; they know how our soldiers can fight and our sailors can shoot; and every man of them will be a missionary in Spain, helping vastly to dispel the dense ignorance concerning the United States, which is now one of the greatest obstacles to the restoration of peace. On the other hand, it is an economical plan, because the per capita cost of transferring these prisoners to a Spanish port is small compared with the expense of bringing them from Santiago to the United States, and then feeding and guarding them for an uncertain length of time. There is besides the added risk of importing disease should the prisoners be brought to this country.

◆

In our issue of July 7, in referring to the four Spanish cruisers sunk at the battle of Santiago, we stated that their armor was Harveyized nickel steel. A correspondent asks our authority for this, and we find on more careful investigation that the "Cristobal Colon" had a belt of 6-in. Harveyized armor, whether nickel steel or not we cannot say. The other three vessels had 12-in. side armor, of what material we are not informed, but, judging by the date the vessels were built, it probably was not nickel steel or Harveyized.

◆

THE DEMAND FOR FASTER BATTLESHIPS.

In our issue of June 23 we called attention to the serious blunder which our Navy Department has made in fixing upon a speed of only 15 to 16 knots for the three new battleships for which it is now asking bids. We then showed that every naval power in the world except the United States has increased its standard speed for battleships to from 17 to 19 knots; that there are already at least fifty foreign battleships afloat or under construction which have speeds one to three knots in excess of the speed of any of our battleships; and that for the United States at this time to build new battleships with speeds even lower than the speeds of its battleships now afloat will injure its naval prestige as much as the loss of a battle.

Our prediction that if the American public once understood the significance of this action by the Navy Department, a universal protest would go up, has been amply verified. The presentment of this matter by Engineering News has been copied and commented upon by the principal newspapers in almost every city in the country, and our urgent plea that the Navy Department should revise its action and make plans for our new vessels that will put them at least on an equal footing with those of foreign countries in the matter of speed has been unanimously approved.*

Moreover, the newspapers are ably continuing the agitation for a change in the Department's plans. A number of the leading journals throughout the country have taken hold of the subject in earnest, and by repeated editorial presentations of the subject have awakened a public sentiment which the Navy Dèpartment must sooner or later recognize. Such journals as the "New York Tribune," "Brooklyn Eagle," "Pittsburg Dispatch," "Washington Times," "Minneapolis Journal," "Buffalo Enquirer," "Cincinnati Commercial Tribune," and others of similar standing the country over are urgently demanding that the naval authorities shall change their plans and make the new battleships vessels in which the nation can take just pride.

The only attempt by the Navy Department to justify its decision in any way that has come to our notice, is a Washington dispatch in the "New York Times," of July 8, in which "high naval officials" unnamed are quoted at some length. The substance of this reply we quote verbatim as follows:

> The fixing of a sustained speed of 16 knots an hour for our battleships was made after careful consideration of the question in all its bearings. It is an easy matter to increase the speed of ships, but without sacrificing their offensive and defensive qualities it can only be done by increasing their size.
>
> In consequence of the limited depth of water in most of the harbors on the American coast, it has come to be an unwritten law of naval construction in this country that the draft of the largest of our warships, in their normal condition, shall not exceed 24 ft. Most of the big battleships of European navies draw 27½ ft. Depth is a most important factor in increasing displacement, and as it is limited in this country by the shallowness of our harbors to 24 ft., increased displacement must be sought in either length or breadth or both.
>
> In designing a battleship of more than 12,000 tons displacement with the draft limited to 24 ft., the increased volume, if gained by lengthening, would result in a vessel of too great length for efficiency, increasing the weight of defensive material and reducing her handiness in squadron evolutions. If the beam alone be increased, the vessel would be too wide for many of our docks, and would afford an uneasy and highly unsatisfactory gun platform.
>
> It is further held by many naval authorities to be extremely doubtful whether a higher speed than 16 knots an hour would prove of practical value to a heavy fighting ship. For steaming long distances such a speed could not be used, and no squadron ever manoeuvred or was any naval battle ever fought at as high a rate of speed as that.
>
> A great deal has been said of the superior speed of Admirl Cervera's late squadron, but while those ships were credited with a speed of 20 knots "on paper" they never, from the time they appeared at the Canaries, showed an ability to "get there" at a higher rate of speed than ten knots. The fact that all four of them were overhauled and sunk by our cruiser "Brooklyn" and battleships of far less nominal speed, although the Spaniards had the advantage of a start at full speed, is convincing evidence of the futility of their boasted swiftness.

It is one unfortunate feature of the astonishing naval victories which have been won by the United States fleets in the present war that they tend to beget in the popular mind an over-confidence in the powers of our present naval vessels, and a tendency to overlook the weak points in our national defence. It is natural enough that the non-technical public should take the results at Santiago and Manila as conclusive proof of the efficiency in every respect of our fleets; but it is surprising, indeed, to find such arguments used by "high naval officials."

Further, as a matter of fact, the Santiago battle offers conclusive proof to the veriest tyro in naval strategy of the enormous value of high speed in a fighting vessel. Had the Spanish cruisers been able to reach such speeds as their engine power should have given them, even with their barnacle-laden hulls, the chances are good that they would have got out of range before the American vessels on guard could get under way and stop them. As it was, the fastest of the four, the "Cristobal Colon," did outstrip the other vessels and get entirely away and out of effective range. It was then that the "Brooklyn" and the "Oregon" undertook a stern chase after the fleeing vessel. The former vessel has about the same speed rating as the "Colon," but was not her equal in armor or armament; and in a duel between the two vessels fought with equal skill on both sides, the "Brooklyn" would probably have been worsted. What the result would have been had the two vessels fought alone will never be known, for the "Oregon," running at a 16-knot speed, was able to come to the assistance of the "Brooklyn," and made the defeat of the Spanish vessel sure.

The newspapers are accepting the Santiago battle as clear proof of the value of speed in a battleship, and they are right. For that matter, the statement of the "high naval official" that no battle was ever fought at a greater speed than ten knots is disproved at once by this very conflict. As for other naval battles, it is probably true that few or none have been fought with greater speed than ten knots, simply for the reason that very few naval battles have been fought with modern high-speed naval ships. Everyone familiar with naval warfare, however, knows that numberless actions have been fought with one vessel or fleet making all possible speed to escape and the enemy using every effort to overtake them. These are exactly the emergencies for which high speed in naval vessels is demanded.

The "high naval official" quoted above seems to think that the falling off in speed which Cervera's ships showed, is proof that the speeds of contract trial trips are no index of what a vessel can really do. But because that proved true with the Spanish vessels, it does not follow at all that it is true in the American navy. In fact the "Oregon's" speed in her chase after the "Colon" was very close to that recorded on her trial trip, notwithstanding the more or less foul condition of her hull.

Practically the sole argument that deserves to be considered in the above statement by the naval officials is the claim that the depth of our harbors limits the draft of American battleships to 24 ft., and the width of our dry docks limits their beam. Let us see how much there is to this argument. In the first place, it should be understood that there are only a few harbors on the coast which a 24-ft. draft vessel can enter at low water anyway. The list of ports with a depth of water of 24 ft. or more at low tide on the Atlantic and Gulf coasts is as follows:*

Port.	Depth, mean low tide, ft.
Portland	29
Portsmouth	(Admits any vessel.)
Providence	25
New York	30
Baltimore	27
Norfolk	25
Newport News	25
Yorktown	33
Key West	25½
Tortugas	24
Pensacola	24
New Orleans	26
Sabine Pass	24
Galveston	24

It appears that there are only 14 ports on our Atlantic and Gulf coasts which our present battleships when loaded to 24 ft. draft can enter at low water; but we fail to see that this is a matter of any particular consequence. So long as a battleship can reach the naval stations and dry docks where she is to be equipped and kept in repair, it is a matter of little consequence whether she can enter the other home ports or not. A glance at the above table shows that she can enter nearly as many of the commercial ports drawing 26 ft. as she can drawing 24 ft., anyway.

As for being able to reach the naval stations, battleships of any desired draft can reach the Portsmouth and New York navy yards, and the same is true of the anchorages at Hampton roads and Dry Tortugas. To get up to the berths at the Norfolk yard, some dredging would be necessary for a vessel of 26 ft. draft or more; but if the United States can afford to spend as many million dollars as it proposes to upon new ships, it can afford whatever may be needed to dredge the channels leading to its principal naval stations. For that matter, if our largest battleships can reach the four stations named above we do not see that they need further accommodation.

Let us turn next to the matter of dry dock accommodation. At present we have just three docks on the Atlantic coast which can take in battleships of the dimensions now proposed (excluding the Port Royal and League Island docks, which are inaccessible to our present battleships by reason of shallow water). Congress has just appropriated the funds for five new docks. We know of no reason why these structures should not be made wide enough and deep enough to take in whatever size of battleship the conditions of National defence makes it wise for us to build.

When one really stops to think of it, how absurd seems the declaration, that this country has settled down to a basis of a 24 ft. draft and a 16-knot speed as a permanent limit for its battleships. Other nations may progress as they please, 16 knots is fast enough for us! How long is this standard to last, pray? Are we to continue placidly on that basis, no matter what progress other nations make, until perhaps in some future naval battle the superior speed and manoeuvering power of an enemy's fleet may win them the day?

There have been various conjectures as to the reasons why the Navy Department adopted this low rate of speed for the new vessels. It has been alleged that the three or four great shipbuilding firms who will doubtless take the contracts for them wanted to build duplicates of the vessels of the "Alabama" class now under construction to save the expense of duplicating drawings, patterns, templates, etc., and increase their profits. We do not believe this to be true. Neither do we believe that the Navy officials merely wished to save themselves the trouble of making new designs throughout for these three ships.

We believe the real reason is a sort of ultra conservatism that prefers to follow the beaten path to making any new ventures and prefers to sit comfortably down and rest content with 24 ft. draft and 16-knot speed, rather than to attempt to follow English and Continental naval designers in the vast strides which they have made in the past four or five years.

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*We say unanimously, but in the interest of absolute accuracy, we must record that one Philadelphia newspaper thinks 15 to 16 knots is fast enough.

*This list includes the depth of water up to the wharves in each case. Of course there are harbors of refuge, and places of anchorage all along the coast, as at Key West, Hampton Roads and numerous points all along the North Atlantic coast where vessels of any draft can lie at anchor in more or less shelter.

We have abundant authority for declaring that the American people will not rest content with naval progress of such a sort. The people as a people want no wars; they vastly prefer the arts of peace. They want no huge naval establishment and had rather build schools than battleships and factories than fortresses. At the same time they will cheerfully and gladly contribute all that is necessary to make their national defence impregnable on land and sea; and, thanks to our fortunate position, far less suffices to effect this for us than for any other country. But in these national defences they will brook nothing of a second-rate order. American armor plate is equal to any in the world. American guns are on a par with those of any country. Why should not American battleships be made equal in speed and manoeuvering power to those of any nation? We have given the sole reason which has thus far been put forward, which deserves any credence, that of our shallow harbors, and we have shown that there is actually no serious obstacle in the way of adopting greater draft for our battleships if that is really an essential to their higher speed.

We have no doubt that a large factor in the decision of this matter made by the naval authorities was the fact that it was made at a time when the pressure of other duties was well-nigh insupportable. In the rush of providing for the actual immediate necessities of warfare last May, there was scant time to spare for the solution of any difficult problems in connection with the design of new vessels. But that rush is now past. We are in no serious need of these three new battleships, and do not want or expect to be. With the five vessels now nearing completion, our navy will be as strong in battleships as any nation in the world except England, France and Russia.

It will be vastly better for our national defence to wait a year longer, if necessary, for these three additional vessels, instead of rushing ahead with their construction on lines which every other naval power in the world has discarded as obsolete.

LETTERS TO THE EDITOR.

Springs for Freight Car Trucks.—Correction.

Sir: In the issue of Engineering News of June 23, p. 412, where the standard spring coils, recommended by the committee of the Master Car Builders' Association, are given, is there not an error of some sort? The spring marked "A" does not seem to harmonize with the rest. Perhaps it was 15-16-in. diameter of wire until the compositor got hold of it. I am likely to make some use of these figures and so am particularly interested in correctness. Yours truly,

C. M. Spalding.

Schenectady, N. Y., July 6, 1898.

(The diameter of the wire in spring A should be 15-16-in., the error was made by the compositor, as our correspondent surmises.—Ed.)

A Test of Mechanical Filters at Moscow, Russia.

Sir: After my inspection of American and European filters, I proposed to the Councils of the Municipality of Moscow to undertake experiments with different systems of mechanical filters. Both councils adopted this project, and at the session of June 21 appropriated for the experiments 65,000 rubles (about $32,500). This sum will be sufficient, because necessary pumps and boilers are already at our disposal. The general arrangement of the experiments will be similar to that which I, through the kindness of Mr. Chas. Hermany and Mr. Allen Hazen, have seen in Louisville, Ky., and Pittsburg, Pa.

I consider the matter of great importance, because according to the results of the tests the matter of our future Moscow River water supply (first for 10,000,000 and afterward for 40,000,000 gallons daily) will be settled; and I think that every large city, having a water supply from open sources, ought to undertake such tests, because the results of filtration are apt to be different, according to the conditions of the water to be filtered.

We immediately take steps towards the execution of the ordinance of the Municipality of Moscow, and shall continue the tests for about one year.

I remain very respectfully yours,

Nicholas Simin,

Chief Engineer of Moscow Water-Works.

Moscow, Russia, June 28, 1898.

Cost of Heating a Factory Built of Steel and Glass.

Sir: Our attention has been called to an article published in your issue for July 7, 1898, describing our factory building, and we note your remarks in regard to the cost of heating the same. The power for running our shop is obtained from the local electric light company, so that our boiler is used for heating purposes only. During the past winter, from Nov. 1 to July 1, we burned about 86 tons of coal, costing $3.25 per ton, a total of about $280, and only about half of the fireman's time was chargeable to the care of the boiler and heating plant, so that we feel that $500 would cover the entire cost of heating the building.

In the description which you publish, no mention was made of the fact that the upper portion of all of the windows is double glazed, an air space of ¾-in. being left between the inner and outer panes of glass. The outer pane of glass is, as stated, of corrugated or roughened glass, and the inner pane of ordinary window glass. The lower part of every window is swung on the center instead of every other panel, as stated in your description. The lower sashes are at present single glazed, but are so constructed that another pane of glass can be inserted whenever desired, and it is probable that this will be done before next winter.

It is possible that next winter we may make some tests as to the actual amount of steam required for a given temperature of atmosphere, and will be pleased to send you any data of this kind which we may obtain.

We are pleased with our building and would adopt the same method of construction for any similar buildings which we may erect hereafter.

Yours truly, The Veeder Mfg. Co.,

C. H. Veeder, Pres.

Hartford, Conn., July 11, 1898.

Breakages of Electric Railway Car Axles.

Sir: Enclosed herewith please find an impress of the fractured end of an electric car axle which recently broke in this city. It is remarkable chiefly for showing that some previous action had taken place before the final rupture. That portion of the fracture most completely shaded was as smooth, when first observed after the accident, as if it had been cut with a cold chisel. The blank square spot in the impress is where the head of a key held the gear on the shaft. The rest of the fracture was that of a very fine grained steel and showed no marked peculiarities. A trace of rust was observable about the head of the key but not elsewhere.

In the past five years, five similar accidents have occurred to electric cars in this city. In two of them which came under my notice a similar condition (though not so marked) was shown, i. e., as if partly cut with a chisel. Is the same true of like fractures to seam car axles? Or is it only under the influence of electric power? In each case I have observed, it has been a driving axle which broke.

There were about 100 street cars in use when these accidents occurred; or, to put it another way, about 1% of the cars have had similar breakdowns. This would appear an excessive ratio.

The mileage run by the cars differed; but in all cases the length of run would seem to have been sufficient to have exposed any original inherent defects. It was usually more than 100,000 miles and less than 300,000. In the present case it was the forward axle under an electric dummy used to haul two flats loaded with wood through the city streets to the power house. A 20-HP. T-H. motor was geared to it at the line of fracture. The car ran on two four-wheel trucks, with a motor on each axle. It had run about 125,000 miles at the time of the accident.

Will some one else give information tending to throw light upon this subject? It may lead to some better method of inspecting than the present superficial one, and thereby assure greater freedom than at present from recurrence of such accidents. Yours truly,

A. McL. Hawks.

Tacoma, Wash., July 8, 1898.

(The "impress" which our correspondent sends is an impression on paper made by the broken end of the axle after blackening it with something like printer's ink. The axle was 3½ ins. diameter. The smooth part of the fracture is about 0.4 of the total area, the division between the two parts of the fracture being nearly a straight line. This kind of fracture is not at all unusual in steam car axles; in fact it is the most common way in which any axle breaks. Sometimes the original break runs all around the circumference, making a smooth annular ring half an inch to an inch deep, this fracture being progressive through a long time, say a month or more, and then the final break takes place showing the ordinary steel fractured surface. It appears that the breakages of electric car axles are much more frequent than those of steam car axles. We believe the reason is that they are not made strong enough for the work they have to do. They are subjected to both torsional and transverse strains in reversed directions, to sudden stoppings and startings, and to violent shocks from irregularities of track to a greater degree than the ordinary steam car axle. When the electric railway companies use the same precautions to insure the long life of their axles that the leading steam railways do the average life of the electric railway axle will be greatly increased.—Ed.)

A New Moment Formula for Concentrated and Distributed Loads.

Sir: The communication on "A New Formula for Concentrated and Distributed Loads," in your issue of June 23, illustrates how complicated an extremely simple matter may be made to appear. It is a well-known law of mechanics that the bending moment is maximum or minimum (maximum in the case of a simple beam) where the shear passes through 0. Considering the case assumed, that of a simple beam (1) uniformly loaded for its entire length, and (2) carrying a single concentrated load, it is evident that the shears from (1) and (2) respectively are opposite in character only for the distance from the center of the span to the point of application of the single load. The section of maximum bending moment must lie then somewhere along this distance. Using the notation employed by your correspondent, the following equation follows directly from the law above stated:

$$\frac{P\,a}{s} = \frac{W}{s}\,y_1, \text{ or } y_1 = \frac{P\,a}{W}.$$

As stated by your correspondent, if y_1 is greater than $\frac{l}{2} - a$, the limiting case is indicated and the bending moment is then maximum at P.

Yours truly, E. M.

Philadelphia, Pa., July 1, 1898.

Sir: In your issue of June 23, 1898, there is a communication entitled "A New Moment Formula for Concentrated and Distributed Loads." This is similar to a formula which I have used and for which I submit the following proof, which is shorter than that given by your correspondent, and which it seems to me may be clearer to a part of your readers.

Let w = the uniform load per linear unit;
l = length of span;
P = the concentrated load; and,
a = its distance from the nearer support.

Then the expression for the bending moment at any point at a distance x, greater than a, from the same support is

$$M = \frac{P\,(l-a)\,x}{l} + \frac{w\,l\,x}{2} - P\,(x-a) - \frac{w\,x^2}{2}.$$

Placing

$$\frac{d\,M}{d\,x} = 0,$$

and solving for x, to find position maximum M, we obtain:

$$x = \frac{l}{2} - \frac{P\,a}{w\,l}.$$

To transform this into the form given by Mr. Lepper note that $w\,l = W$ and that $x = \frac{l}{2} - y_1$.

Yours respectfully, Elton D. Walker,

Asst. Prof. Civil Engineering, Union College.

Schenectady, N. Y., June 27, 1898.

Sir: In the issue of June 23, 1898, of Engineering News, is published a letter entitled "A New Moment Formula for Concentrated and Distributed Loads," the author of which thought he had discovered and given to the engineering world a new formula for finding the exact point of maximum bending moment of a beam, supported at both ends and loaded with a uniformly distributed and one concentrated load.

As a matter of fact, a diagram similar to the one given by the writer is found in Hatfield's "Transverse Strains," page 179; where he also deduces the same formula. Hatfield makes his parabola representing the bending moment due to the uniform load above the horizonal line connecting the reactions, and the triangle representing the bending moment due to the concentrated load below said line, while the article by the writer simply reverses this order. Hatfield then proceeds to find the greatest bending moment by drawing a tangent to the parabola and finding the longest line inside the figure formed by the curve of the parabola and the lines of the triangle. Then follows an analytical demonstration to determine the point of maximum bending moment, which I will not burden your readers with, as those who wish may find it on the page of Hatfield cited, but arriving at a conclusion giving the following formula:

$$h = \tfrac{1}{2}\,L + \frac{A\,m}{U},$$

in which L = span; A = concentrated load; m = distance from concentrated load to nearest support; U = uniform load; and h = distance of greatest moment from the most distant support.

This is the same formula as the writer's except that the latter's result gives the distance of the point of maximum bending moment from the center of the span, whereas Hatfield's result gives the distance from the abutment, or the former distance, plus one-half the span.

The edition of Hatfield referred to was published in

1877, and we have been using the formula for years, in fact ever since our engineering department was established. Yours very truly, Dudley McGrath,
Structural Engineer.

Office of Jno. B. Snook & Sons, Architects, 261 Broadway, New York city, June 25, 1898.

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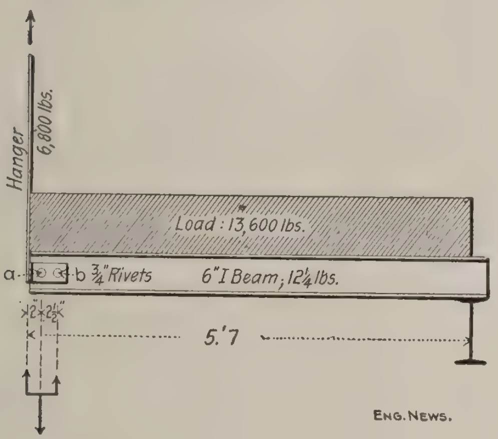
Erroneous Data in Manufacturers' Hand-Books Concerning Structural Beam Connections.

Sir: The issue of a new and enlarged edition of their hand-book by the Cambria Iron Co. has brought to notice the fact that the hand-books issued by the Cambria Iron Co., the Carnegie Steel Co., Ltd.; the A. & P. Roberts Co., and Jones & Laughlins, while excellent in most respects, all contain a table of "minimum spans of I-beams for which the standard connection angles may be safely used with I-beams loaded to their full capacity," which is seriously in error.

This table has been prepared on the assumption that all the bolts or rivets joining the connection angles to the ends of a beam are strained to equal amounts and in the same direction. The fallacy of this assumption was shown in the Engineering News of May 16, 1895, in an article on "Standard Beam Connections." It is due to the authors of the table in question to state that in preparing it they have followed the method in general use. It probably has not occurred to them to question its practical accuracy, and they will doubtless be surprised on investigation to learn how seriously it is in error.

The table indicates in all cases a greater capacity for the connections than they would have under the limits for bearings and shearing on which the table is alleged to be based, the errors being comparatively small for deep beams and very great for shallow ones. As an illustration of one of the cases of great error, the length and load given as corresponding to the standard connection for a 6-in. beam is taken from the Cambria Iron Co.'s hand-book (the books of any of the companies mentioned could be used with substantially the same result), and the maximum bearing stress is analyzed.



As the safe load (as shown in the accompanying cut) is 13,600 lbs., the end reaction is 6,800 lbs., and the load on rivet a is found, by taking moments about the center of rivet b, to be 12,300 lbs., or 71,000 lbs. per sq. in. of bearing surface, as compared with an extreme fiber stress in the beam of 16,000 lbs. per sq. in.

While this analysis shows clearly that the table greatly overstates the capacity of the connection, it is not expected that the result obtained indicates the actual facts with mathematical precision, because no account has been taken in the analysis of the stiffness of the hanger or the clamping effect of the rivets.

In the article in Engineering News above referred to a method for determining the capacity of beam connections is proposed which, while open to criticism, gives much more reliable results than that on which the table is based.
Respectfully, Henry S. Prichard.
Trenton, N. J., May 6, 1896.

(In accordance with our usual practice a proof of Mr. Prichard's letter was sent to the publishers of the different pocket-books mentioned in order that any reply they might desire to make to the criticisms therein might be published in the same issue. With the exception of the Pencoyd Iron Works, whose answer we append below, only one reply was received to our letters, and this firm has not yet sent us any matter for publication. We therefore, publish the matter thus far received without waiting for further replies.—Ed.)

Sir: It is of such importance in steel floor beams and similar structures that the end connections should have as great a carrying capacity as the beam itself, that the criticisms made by Mr. Prichard, under date of May 6, 1898, and more fully in your issue of May 16, 1895, are entitled to careful consideration.

Opportunities occasionally occur in finished structures where it is possible to compare the strengths of the beam and its end connections, and we do not know of any instance where the joints indicated such weakness as Mr. Prichard has suggested. In Vol. XXXVII. of the Transactions of the Am. Soc. C. E., Mr. Julius Baer records the effects on buildings of the St. Louis tornado, and especially notes the persistence of the riveted end connections of beams when the supported beam was entirely destroyed, and remarks: "Any standard floor beam connecting angle is probably of ample strength if subjected to only such treatment as it will receive in a floor." This accords with isolated cases within our own experience.

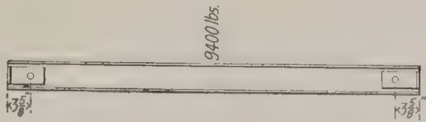


Fig. 1.—Test of the Effect of Friction Between Angle Connections and Web of Beam.

Mr. Prichard probably underestimates two elements of resistance—the frictional resistance, caused by the grip of rivets, and also the partial "fixedness" or continuity due to the rigid attachment of the end angles to their outer supports. Experiments have proved an increased strength of about 10% of a riveted joint over a similar joint held by fitted pins without heads. This refers to rivets 3/4-in. diameter; the gain is less on smaller and more on larger rivets. As the friction is presumably constant, it would probably represent about one-fourth the total working resistance of the joint.

To test the effect of the friction between the angles and web of the beam, a 6-in. I-beam had angles riveted on with a single rivet, as shown in Fig. 1. These were 3/4-in. rivets filling 13-16-in. holes, spaced 3⅝ ins. from the end of angles or midway between the two rivets of the standard joint. Pressure was applied at the middle and it was found to require a load of 9,400 lbs. before any indication of slipping between the parts was observed. This corresponded to a turning moment of 17,000 in.-lbs. due only to friction.

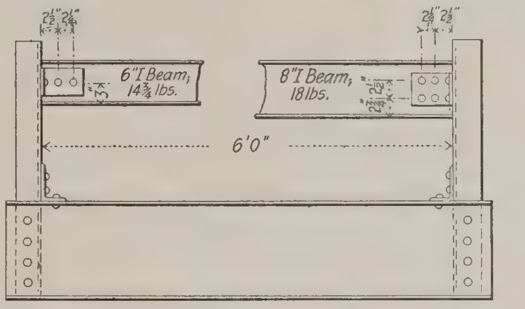


Fig. 2.—Test of Standard Angle Connections.

The following experiments were made on 6-in. and 8-in. I-beams, these small sizes being taken, as the criticism referred to says the "error is very great for shallow beams." The spans were about the minimum recommended by the hand-books. The beams were connected to a stout frame, which represented the usual conditions of end attachments, the attaching angles being the standard of the Pencoyd Iron Works, as shown by Fig. 2. These beams were subjected to pressure at mid-span in the testing machine. No visible effect in either case was discernible at the joint until the elastic limit was much exceeded, when the deflection of the beam caused a yielding of the angles near the root and bending of the exterior flanges around the connecting rivets, as shown in the photographs, Figs. 3 and 4. But when the bending was carried so far that the beams were entirely destroyed, there was still no indication of the slightest yield by slippage or otherwise of the attachment of the angles to the web of the beams.

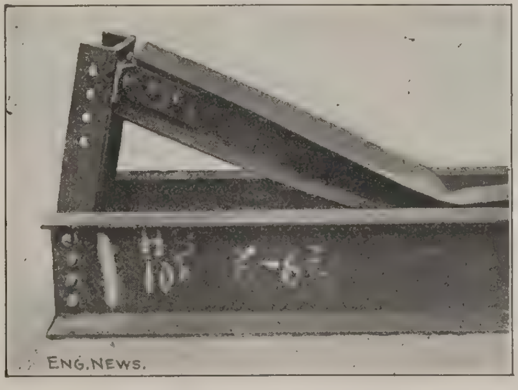


Fig. 3.—Condition of Connecting Angles on 6-in. I-Beam After Failure of Beam.

To demonstrate further the influence of rigidity at the end attachments, two beams of the same section, with the end supported but not rigidly attached, were tested with the angle attachments resting freely upon supports, Fig. 5. The initial deflections on the beams of the same size showed little difference due to the nature of the end supports, and the measurements were not made with sufficient accuracy to establish this difference. As the stresses approached the elactic limit the differences were more marked, and the beam with riveted ends sustained about 20% more load than the similar beam with free ends before any permanent set occurred.

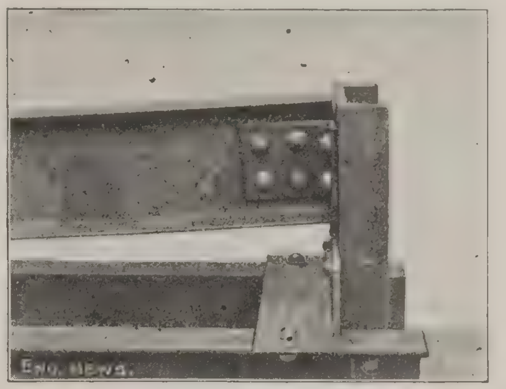


Fig. 4.—Condition of Connecting Angles on 8-in. I-Beam After Failure of Beam.

Table Showing Pressures at Which Permanent Set Began.

Size of beam, ins.	Wgt. per ft. in lbs.	End connections.	Load in lbs.
6	14¾	Free ends.	15,000
6	14¾	Rigid ends.	18,000
8	18	Free ends.	25,000
8	18	Rigid ends.	30,000

In the free end beams, as in those with rigid ends, there was no indication of the least yield between the angles and the web of the beams.

The shearing and frictional resistances act in conjunction, and the strength of the joint is represented by their sum.

The influence of the rigidity of end attachment depends on its extent. If the attachment was sufficiently rigid to render the beam as strong at the ends as in the middle, the moment at the rivets would be as great as at the center of the beam with a concentrated central load. But a connection whose influence was less than aforesaid would only tend to counteract the moments proceeding from the reaction. The influence thus exerted in the case of beams tested had probably one-fourth the effect of fixed ends.

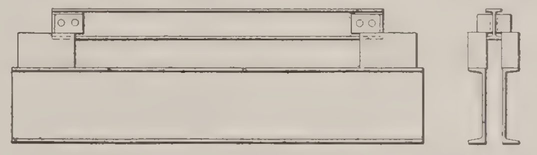


Fig. 5.—Test to Determine the Influence of Rigid End Supports.

A. & P. Roberts Co.,
Per James Christie,
Mechanical Engineer.
Philadelphia, Pa., June 18, 1898.

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OBSTRUCTIVE BRIDGES AND DOCKS IN THE CHICAGO RIVER.*

By G. A. M. Liljencrantz, Mem. W. S. E.

The Chicago River has been and is of enormous value to the commerce of the city, through its large and extensive lake traffic. Its dimensions some 30 years ago were ample for the commerce and traffic of that time, but in recent years almost everything in the city been "kept up with the times"—except the river. To be sure, it has been improved. Miles of docks have been built, periodical dredging has been done, and improved bridges have been built, but the question is: "Has the improvement of the river been kept abreast with other improvements in this great and rapidly growing city?" And another question which, in the writer's mind, is still more serious: "Are existing conditions such as to admit of an improvement of the river that will be commensurate with a metropolis of three or four million inhabitants, as Chicago no doubt will be but a few decades hence?" When studying the conditions we find much cause for discouragement.

Increased depth has been secured to some extent by occasional dredging, but it is again regularly decreased by the unceasing deposits from the numerous sewers emptying into both branches of the river, as well as by constant sweeping and dumping of refuse in various ways into the channel, requiring frequent redredging. But this removable material forms the least serious obstacle in the way of the vertical improvement. Not less than three tunnels cross the river, with their crowns at an elevation which, at the time they were built, allowed sufficient draft for the navigation of that day, but which now form the gravest obstructions to the much larger vessels of deeper draft of the present time.

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*Abstract of a paper presented at the meeting of the Western Society of Engineers on June 1. The abstract is published by permission of the Society, and the paper in full, with the discussion, will be published in the Society's "Journal."

Docks are frequently built with more consideration as to cheapness in first cost than to future needs and are thus made only of strength enough for the existing depth of water, and are accordingly subject to undermining, whenever the channel is considerably deepened. An extensive deepening, even if the obstructive tunnels did not exist, would accordingly involve great expense to individual owners, in addition to the direct improvement by dredging, and to make such improvement practically permanent it will be necessary to dispose of the sewage by a different method from that now employed, or provide for continuous maintenance by dredging.

Let us next look at the difficulties we encounter in planning to widen the channel. Vessels of even the greatest dimensions in use until about 1890, and which still constitute the great part of the lake fleet, easily pass any part of the navigable river, but some of those built within the last few years find it impracticable to enter either of the branches of the river, or, when loaded, to pass the first of the "artificially constructed reefs," the La Salle Street tunnel. The manner in which a long vessel has to move to make this passage possible is illustrated in Fig. 1, showing the river between Clark and Wells Sts., with the tunnel half way between. The available channel is here in the middle of the stream. A vessel 48 ft. beam and 432 ft. long (which is the length of the longest boat now navigating the lakes) represented as coming through the north draw of Clark St. bridge, turning to the deeper channel in the middle, over the tunnel. It is compelled to proceed thence across to the south draw of the bridge at Wells St., because the turn to the north draw of that bridge is practically impossible, for there is only 500 ft. between the two bridges, and the center channel has a depth of 17 ft. at low-water over the restricted width of only 62 ft. on the line of the center piers of the bridges. Center piers and projecting docks obstruct the channel at numerous points. The Chicago & Alton R. R. bridge, north of Archer Ave., is a striking example of how some bridges are constructed without the least regard for the demands of navigation. Too narrow are also the draws of the three bridges in close proximity at Kinzie St., in the north branch of the river, as well as at the Indiana St. bridge. Nothing larger than a tug can pass the east draws of the first named three bridges, which, in fact, had never been dredged until in April of this year. At the Division Street bridge neither draw can be used, nor can those of the North Ave. bridge be used by such large vessels.

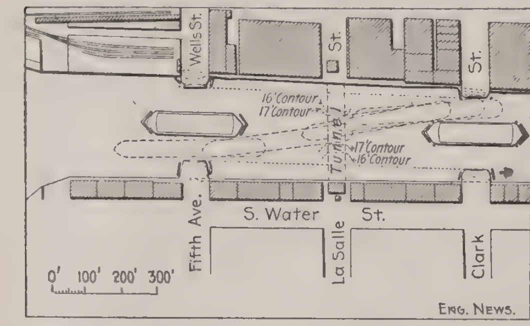

Fig. 1.—Course of a Large Steamer in Crossing the La Salle St. Tunnel; Chicago River.

One of the worst places on the north branch is the sharp bend forming an S-curve at the crossing of the C., M. & St. P. Ry. bridge, south of Clybourn Place, and nothing but the most radical alterations can make this part of the river, or that above, accessible to vessels of the type here represented, and it is therefore thought unnecessary to occupy more time and space in describing the obstructions found above this place, which are generally equally bad, and some perhaps even worse.

The chief reason for the deplorable condition of the river, as regards its many obstructions, I consider to be the total absence of any well defined system of improvement, by way of legally established dock, or channel lines. The owners of water front along the river seem to have built their docks with the sole consideration for their own individual advantage, in such manner as to make as much land as possible, out of what should properly be the channel, apparently in utter disregard of the demands of navigation. Dock lines have been established, to be sure, in detached places, but as far as I have been able to discover, not in conformity to any general system. By an ordinance passed June 11, 1869, or 29 years ago, there were established certain dock lines along a portion of the south branch. Provisions were made in this ordinance for assessments to pay for the condemnation and purchase of land, required to comply with the terms of this document, but nothing further has been done in the matter, and numerous docks have since that time been constructed without the least regard to the dock lines so established, judging by the conditions now existing.

By an act of congress of June 3, 1896, making an appropriation of $50,000 for improving the Chicago River "from its mouth to the stock yards on the south branch and to Belmont Avenue on the north branch as far as may be permitted by existing docks and wharves," the work of improving this river by the United States government was inaugurated.

The only work that could be done, however, in compliance with the wording of the bill, was dredging. Bids were advertised for and received, and contracts let for the execution of this work, which commenced in November, 1896. The project approved by the Secretary of War contemplates the deepening of the channel to 17 ft. below the city datum, the bill providing for dredging to admit passage by vessels drawing 16 ft. of water. The existence of the tunnels would make a greater depth useless.

The work of dredging has been done from the mouth to the stock yards in the south branch, and a part thereof has been redredged, viz.: From the south limits back to Twelfth St., and this work is now nearing completion towards the harbor. In the north branch the work has been done from the junction to Fullerton Ave., and when the northerly limit is reached the whole of that branch will also be redredged.

Up to May 1, 1898, there have been removed from the main and south branches, in round numbers, 540,000 cu. yds. and from the north branch 658,000 cu. yds., or a total of 1,190,000 cu. yds. The sum of $113,000 was appropriated in a later act of congress, for the completion of this part of the river improvement, and authority was by this later act also granted for entering into contracts for work in widening the channel, such work to be limited by the sum provided for that purpose, to-wit: $700,000, including the amount required for the dredging. This work is thus confined to the removal of only the most obstructive of the many protruding dock corners.

The greatest obstruction to navigation are the tunnels and bridges, which are corporate property, and it is questionable whether the government would ever consider the navigation in the river so necessary to the general commerce of the nation to condemn such valuable property, and either to compel the removal of the obstructions caused thereby, at the expense of the owners thereof, as can be done under existing laws, or to undertake the enormous expense of rebuilding or remodeling the structures at the expense of the public treasury.

To decide upon a plan of improvement, which will furnish the greatest relief to navigation, authorized by the bill and at the same time keep the cost within the prescribed limits, a study was made, on the maps, of the various corners and bends in the river to learn to what extent these would interfere with the passage of a vessel of the type described. The vessel was represented by a pasteboard model made to the same scale as the map. In this manner the most obstructive dock corners were selected and improvement of these places recommended, consisting in the removal of a sufficient amount of the protruding land to facilitate the passage of the largest vessel.

Examples of this work are shown in Figs. 2 and 3. At the so-called "Collision Bend," some 700 ft. east of Halsted St. bridge, Fig. 2, 15,965 sq. ft. have already been removed by the Sanitary District and 7,702 sq. ft. are to be removed by the government. The name of this place is a brief but fair intimation of the conditions here. Fig. 3 shows the Illinois Steel Co.'s property, the north part of which forms an obstruction to the passage of vessels through the west draw of Archer Ave. bridge, and is to be removed. The river is furthermore very narrow all along this property and in all 18,790 sq. ft. are to be taken off therefrom. Across the river from the steel company's land is a protruding corner, where 1,693 sq. ft. are to be removed, as shown.

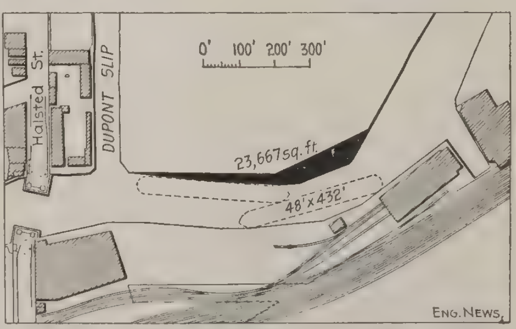

Fig. 2.—Improvement of the Chicago River at "Collision Bend." (U. S. Government Work.)

The whole project contemplates the purchase and removal of 123,100 square feet of land and the construction of 4,790 linear feet of dock, in front of the removed land.

All the principal preliminaries for this work have been completed. All that is needed for commencing active operations is the necessary appropriation; and Congress holds the electric button, a touch upon which will set the wheels of activity in motion.

THE DURABILITY OF MARBLES AND GRANITES.

At the meeting of the Civil Engineers' Club of Cleveland on July 12, Mr. Oliver S. Hubbell read a paper on the above subject, in which he described his investigations as architect for the Wade Memorial Chapel and Receiving Vault. His instructions from his client were to find a building stone which would last for 500 years. We abstract the paper as follows:

The surface of marble soon disintegrates in the climate of Cleveland, and becomes granular as well as discolored. Old tombstones in the city graveyards show this. However, a protective fluid may be used, with which the marble may be saturated, so as to become weather-proof and thoroughly durable. South Dover and Tuckahoe marbles are used in New York city. The Lee marble is largely used in Washington and Philadelphia, but this has a bluish gray tinge. It has certain defects called "shakes," and contains some particles of magnesia, which dissolve in wet weather and leave the surface pock-marked. The Vermont marbles were examined also, in the quarries and in buildings. No old marble was found in New York city that is not more or less discolored and disintegrated. The top surfaces are both rough and dark, while the under sides of projections are in good order. The Vermont quarries are probably the largest marble quarries in the world. These are at Proctor and East Rutland. The buildings of the Quarry Company are built of marble taken at random without selection. They are therefore quite mixed in color, and give a really fine architectural effect. The Rutland marble is easily cut into fine lines and ornamental figures. On the other hand, Georgia marble is hard to cut, and unless great care is used large crystals will break out in cutting.

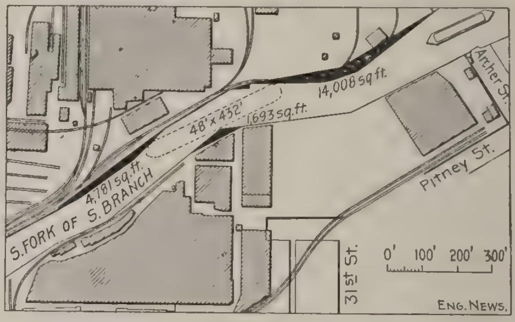

Fig. 3.—Improvement of the Chicago River, near Archer Ave. (U. S. Government Work.)

Granite is refractory and has to be tooled by hard and patient labor. Pneumatic tools have been invented for under cutting, but plain surfaces are generally worked by hand. Granite does not lend itself to fine ornamental lines, and its gray color prevents the best effects of light and shadow.

Of all the granites, the North Jay seems to have the lightest color. Grant's tomb and the new Bowling Green Building, New York, are built of this. It is, however, rather porous and soft, and occasionally discolored by iron. A few defective blocks may spoil the effect of an entire building. Westerly granite is the darkest of all. The Concord granite is used in the Library Building at Washington. It contains some particles of magnesia. The Troy, N. H., granite is light and sound and of good quality. The Halliwell granite was used in building the State Capitol at Albany. Barre has the most prolific quarries in America, but the product is liable to have iron in it, at least in the sap. Small specks of iron hardly detected in the first instance will later dissolve and streak the whole surface. However, it has been used for twenty-five years, and some monuments built of it are still as good as new. The Halliwell granite is the best and most expensive, and is largely used for monumental work. It is homogeneous, all sections presenting the same appearance in whatever direction they are taken.

It was finally decided to use either the Troy or the Barre granite in the Memorial Chapel.

In conclusion Mr. Hubbell stated that although Mr. Wade was recommended by friends to go to New York, or even to Europe, to select his architect, he nevertheless decided that this building should be designed and constructed by Cleveland architects.

The speaker exhibited one sample of white Italian marble, which had been exposed to the Cleveland climate for years, till its surface was black, and it had so far disintegrated that it could be crumbled between the thumb and finger.

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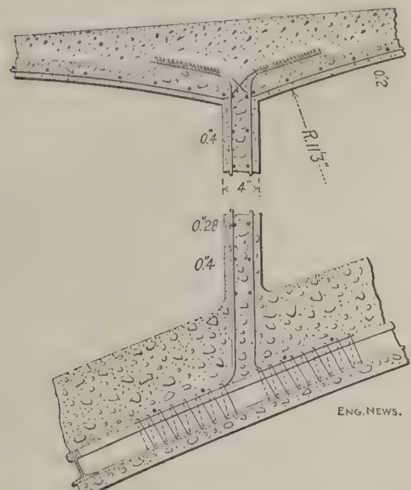
A NOVEL EXAMPLE OF CONCRETE AND METAL BRIDGE CONSTRUCTION.

The accompanying cut illustrates a novel manner of employing concrete and metal in the construction of a foot bridge, which is described in a recent issue of the "Zeitschrift des Oesterreichischen Ingenieur und Architekten Vereins." This bridge serves the purpose of carrying a footpath across a double-track railway in the vicinity of Copenhagen, Denmark, and it has a clear span of 21.85 m. (71.7 ft.), with a rise of 2.58 m. (8.45 ft.). The depth of the arch ring at the crown is 25 cm. (9.8 ins.), and at the springing lines 36 cm. (14.2 ins). The intrados of the arch has a radius of 23.54 m. (77.23 ft.) at the crown which is increased to 26.68 m. (87.53 ft.) at the abutments. The concrete arch is stiffened by five parallel ribs, spaced about 0.75 m. (2.5 ft.) apart; the ribs being bent rails joined together longitudinally and weighing 28 kg. per m. (18.8 lbs. per ft.). The walk across the bridge, which is 3.14 m. (10.3 ft.) wide, is carried by Monier arches 5 cm. (2 ins.) deep, and having spans of 2.24 m. (7.35 ft.) These arches are supported by pillars only 10 cm. (4 ins.) thick, standing upon the main arch ring.



Sketch Showing Method of Employing Concrete and Metal for a Foot Bridge at Copenhagen, Denmark.

The iron net in the Monier arches is made of wires 5 mm. (0.2 in.) thick, spaced 10 cm. (4 ins.) apart. In each of the pillars there are two nets composed of 10 mm. (0.4 ins.) square vertical rods, tied together by 7 mm. (0.275 in.) thick horizontal wires. As shown in the cut, these nets are secured at the feet of the pillars to the iron rails by wire wrapping, while at the top they are connected with the net in the main arch. The proportion of concrete used in the main arch, the small Monier arches, and the pillars, was 1 part Portland cement to 3 parts of gravel. For the abutments and the filling over the small arches the proportions were, 1 part cement, 4 parts sand and 7 parts gravel.

The bridge was built in the spring of 1879, and cost about 8,000 marks, or about $1,900. It is stated by our contemporary that a similar but larger bridge, designed by Mr. Melan, is to be built in Austria. This bridge will have a roadway 6 m. (19.7 ft.) wide for street traffic. The span will be 42 m. (137.8 ft.), with a rise of only 2.85 m. (9.35 ft.). The main arch will be reinforced by lattice girders, and will be hinged both at the center and at the ends.

TWO NEW SAFETY APPLIANCES FOR DERRICK ENGINES.

We illustrate herewith a safety lock and a friction clutch recently applied, by the Lidgerwood Mfg. Co., New York city, to the derrick hoisting engines which it builds. These devices are attached respectively to the foot brake of the boom fall drum and to the hoisting drum and are designed to enable the operator to control the hoisting and boom motions more certainly than with the ordinary appliances. It is claimed that with these attachments the engineman can handle the engine with much more rapidity and with perfect safety to the men below the derrick.

The new engine is substantially the Lidgerwood standard friction drum engine with the addition of the safety lever lock attached to the foot brake of the boom fall drum and the friction lever latch on the hoisting drum. The friction lever latch (Fig. 1) enables the engineman to hold the drum in any desired position, as, for example, when taking up a load with the hoisting fall and desiring to lower the boom at the same time. In such a case the friction is thrown in on the hoisting drum and it is impossible through any slip or inattention for the load to drop, and the operator may give his whole attention to the lowering of the boom. With the safety lever lock (Fig. 2) on the foot brake of the boom fall drum one motion of the foot sets the brake, which cannot be released without throwing the friction in position, and when this is done it automatically releases the foot brake and holds the catch away from the brake till the boom is put in the desired position, when the brake is again set with the foot. By the old method the engineman had to give his attention to the two friction drum levers, two foot brake levers, two ratchets and pawls, and the steam lever, gathering himself into an awkward position in which it was almost impossible for him to follow the load and watch the signal man at the same time. In operating a double drum derrick engine, where the safety appliances have been attached, the engine man stands erect, and in a natural and easy position, and is thus enabled to see every signal whether given from the pit or from the point where the load is dumped, both hands and feet being available for handling the boom while the load is being hoisted.

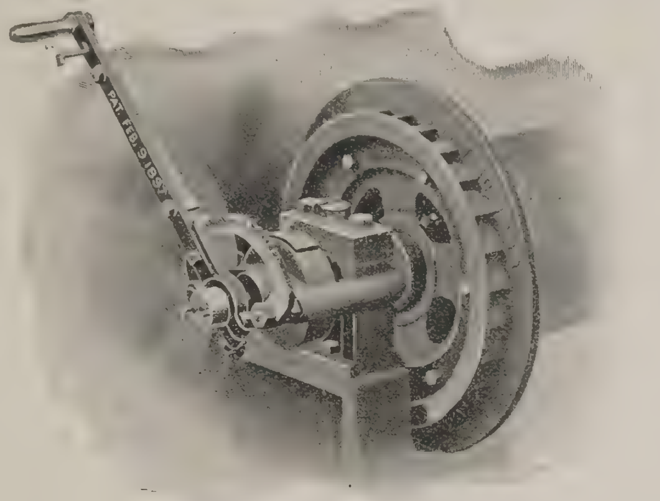


Fig. 1.—Lidgerwood Friction Lever Latch for Hoisting Drum of Derrick Engine.

We are indebted to the Lidgerwood Mfg. Co. for the illustrations and for information from which this description has been prepared.

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THE PNEUMATIC MAIL TUBES across the Brooklyn Bridge are practically completed, and it is expected that a test will be made before the end of the week, although it will be several weeks before the line will be put in continuous operation. It will be remembered that this installation consists of two 8-in. pipes between the New York and Brooklyn post offices, together with the compressors and other auxiliary apparatus.

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THE USE OF DRY PAPER INSULATION for telephone cables in Paris, France, to cheapen the cable investment, has made it necessary to adopt means to keep the paper dry. This is done by closing the ends of the lead-encased cables and forcing air, which has been passed over calcium chloride, through openings in the casing. This pressure is kept at about 45 lbs. per sq. in. and the air besides keeping the paper insulation perfectly dry acts as a safety device since a puncture is at once shown by a drop in the pressure gage.

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THE THIRD AVE. RY. CO., New York city, is about to adopt electricity on its 74 miles of track. At present 29 miles of this are operated by cable, the rest being horse-car lines. So far as possible the old cable conduit will be utilized, and the old 7-in. rails will be taken up and new rails weighing 104 lbs. per yd. will be laid. The new portions will employ the system which is proving so satisfactory on Madison Ave. Current will be supplied from a temporary plant until a large three-phase system can be installed. The power house for this will be at Kingsbridge, from which current will be transmitted to a number of transforming sub-stations.

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THE CONDUIT ELECTRIC SYSTEM is to be adopted by two more of the surface street railways of New York city. On July 20 cars will stop running on Sixth and Eighth Avenues and the roads will be turned over to the contractors. It is expected that by Sept. 15 both lines will be ready for operation by electricity.

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THE STREET RAILWAYS of Baltimore paid the city a total of $69,520 for the quarter ending June 30, 1897. This sum is 9% of the gross receipts of the company and goes to the park fund of the city.

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SEATS FOR ALL PASSENGERS, in elevated or surface street cars and stages within the limits of New York city, is the requirement of a resolution now before the Municipal Assembly and referred to the Law Committee. This ordinance, if passed, would require the transportation company to display a sign when the car is filled, and would impose a penalty of $25 for each offence for taking aboard more passengers than they could seat. No passenger need pay unless a seat were provided. Councilman Christman, in introducing this resolution, said that it was in response to popular demands; but if passed it will be very unpopular with those who have to wait on the sidewalk for a car having empty seats.

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A COMPARISON OF GROSS RECEIPTS for 1896 and 1897 of a number of American street railways is made in the "Street Railway Journal" for July, the figures for which were obtained from the 1898 edition of the "American Street Railway Investments." Of the 175 roads considered 26 had a gross income for 1897 of $1,000,000 or over; 19 earned between $500,000 and $1,000,000; 46 from $100,000 to $500,000; 51 from $50,000 to $100,000, and 33 from $25,000 to $50,000. Four systems, the Union Traction Co., Philadelphia; Manhattan Ry. Co., New York; the Metropolitan Street Ry. Co., New York, and the West End Street Ry. Co., Boston, have incomes ranging from $10,480,646 in the first case to $8,719,032 in the latter. The total income for these 175 companies having net earnings above $25,000 was $113,394,903, which was an increase of 1.9% over 1896.

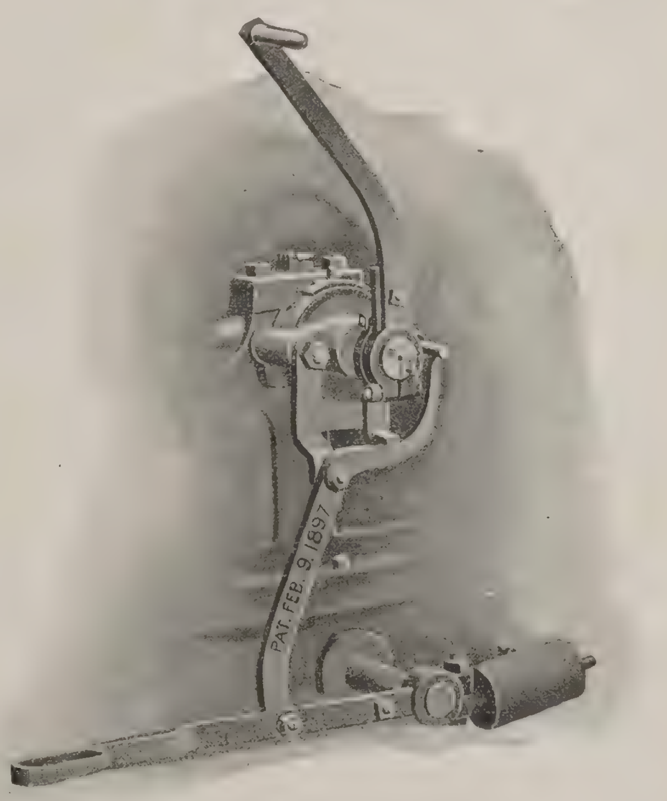

Fig. 2.—Lidgerwood Safety Lever Lock for Foot Brake of Boom Fall Drum of Derrick Engine.

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THE CONTRACTS FOR A MUNICIPAL ELECTRIC lighting plant which were awarded by the Board of Public Works of Grand Rapids, Michigan, on May 12, were vetoed by Mayor Perry on July 6. The reason given for this action is that sufficient consideration had not been given the question; that the engineers designing the plant were regarded by some as inexperienced; that the specifications were so worded that competition was impossible, and that it was estimated the cost would exceed the appropriation from $8,000 to $10,000.

THE COST OF ELECTRIC CURRENT in the case of several street railways which buy the "juice" to operate their lines, was given in a recent issue of the "American Electrician" as follows:

Location of road.	—No. of—		Miles of track.	Price paid.
	Motor cars.	Trailers.		
Georgia	24	9	18	$0.011 per K-W. hour.
Ohio	4	..	3½	$12.50 per mo. per car.
Ohio	5	At times	6	$2.10 per car day (18 hours).
Kentucky	10	"	6	(4) $2, (6) $1.50 per day
Maryland	5	"	..	$12.50 for 5 cars or less, $2 each addit'n'l car.
New York	10	"	6½	$0.015 per car-mile.
Texas	11	"	..	$0.015 per K-W. hour.
Texas	14	2	7½	$3.00 per car per day.
Massachusetts	..	..	..	$0.02125 per car-mile.
Massachusetts	..	..	..	$0.03 per car-mile.
New Hampshire	60	12	20½	$0.03 per K-W. hour.
Pennsylvania	14	..	8	$3.00 per car per day; $2.50 p'r car p'r day.
Pennsylvania	7	..	7	$2.75 per car per day (18 hours).
Vermont	3	..	..	$0.023 per car-mile.
Michigan	5	..	10½	$2 per 18 hrs. each car, $1.85 each ad't'l car.
Michigan	..	..	..	$2.50 per car per day.
Florida	2	..	3	$3.25 per car per day.
Alabama	4	..	7½	$3 per car per day (16 hours).
Nebraska	3	..	1½	$4 to $4.50 per car per day.
Tennessee	2	..	4	$3.00 per car per day (15 hours).

A BOILER EXPLOSION at the National Starch Mfg. Co., Buffalo, N. Y., on July 15, killed 7 persons and injured 35. Both the engineer and fireman were killed and the five tubular boilers were completely destroyed.

THE PRICE OF STEAM COAL IN THE EAST has greatly decreased in the past half dozen years. The following figures show the average New York selling price for the years given:

Year.	Bituminous coal.	Anthracite steam coal.
1892	$2.60	$2.07
1893	2.75	2.53
1894	2.65	2.18
1895	2.25	2.12
1896	2.50	1.93
1897	1.97	1.91
1898	1.75	1.82

THE NEW YORK, WYOMING & WESTERN RAILWAY Co. is a new company incorporated in Pennsylvania to carry anthracite coal from the Wyoming, Scranton, Wilkes-Barre and Lackawanna coal fields to tidewater at or near New York. The detailed plans are not yet made public, but it is reported that the company is to acquire the Lehigh & Hudson Railway, running from Belvidere, N. J., to the Poughkeepsie bridge over the Hudson, and thus gain an entrance into New England. It is to be a coal road only, passengers and other freight than coal being refused; and the rate is to be 60 cts. per ton to tidewater. The estimated cost of the road is $10,000,000, and the officers named are as follows: President, E. V. Sturges; Vice-President, L. A. Waters; Secretary, Thos. E. Jones; Treasurer, Thos. H. Watkins. All of the officers, including directors, are individual coal producers.

ANOTHER DECISION in favor of the Denver Union Water Co. has been rendered in the lower court in the suit of the city of Denver against the company. This time the court holds that the purity and pressure of the supply furnished by the company are up to the standards named in the contract. These standards were a chemical analysis of the supply furnished in 1889 and a hydrant "pressure equivalent, taking the elevation of the surface of the ground into account, to 115 lbs. at the hydrant in front of the Union depot in said city, provided: The city shall not be in default with said company upon any of its agreements." The company did not deny that the stipulated pressure had not been maintained, but urged that the introduction of a gravity system, in which the city acquiesced, and the substitution of larger distributing mains, gave a far more abundant and regular supply, affording better fire protection than could have been given at the contract pressure with the old system. The Judge accepted this view, although his language is a little at fault in using pressure as he did when he said the company "has and does supply a pressure fully as adequate for fire purposes as that provided for under the contract." The only testimony introduced regarding pressure showed that it was but 90 lbs. at the Union Station, instead of 115 lbs. We leave it to our readers to decide whether a contract provision calling definitely for 115 lbs. pressure is satisfied by 90 lbs., simply because the quantity of water available is greater at the lower than at the higher pressure? The previous decision of the court in this Denver case declared that the rates charged by the company were not in excess of the provision of the contract on this point. (See Engineering News, Feb. 24 and March 3, 1898, for editorial discussion.) It is said that the city will appeal the case.

BIDS FOR A NEW GRAVITY WATER SUPPLY for Jersey City will be received on Aug.18. The bids are to be made on the basis of first constructing works of sufficient capacity to deliver 50,000,000 gallons of water daily at the Bergen reservoirs, in Jersey City, at an elevation 210 ft. above mean high tide, through a single pipe line, but the drainage area must have a capacity of 70,000,000 gallons a day. If the city so orders at any time during the contract the capacity of the reservoirs and conduits must be increased to be able to supply 70,000,000 gallons and in case a masonry conduit or tunnel is provided for the original supply it must have a capacity of 70,000,000 gallons, but if this conduit is of steel it may be of 50,000,000 gallons capacity, to be supplemented, if so ordered, by a 30,000,000-gallon steel pipe. The city will buy water by the million gallons, with the option of purchasing the works at the end of 5, 10 or 15 years. Mr. Geo. T. Bouton is Clerk of the Street and Water Board.

A JOINT OUTLET SEWER is proposed in New Jersey for South Orange, Vailsburgh, Irvington, a portion of Newark, and possibly West Orange. It is stated that an engineer will be employed to make a report at an expense not to exceed $1,250. South Orange bought land for sewage disposal by intermittent filtration several years ago, but the land was located in another township, the people of which opposed the plant and secured general legislation prohibiting the location of a sewage disposal plant in any municipality of the state without first securing permission from the authorities of such municipality. The courts upheld the act. Newark has already constructed one outlet sewer jointly with East Orange, after the completion of which that township abandoned its sewage disposal works. The city of Orange, together with Montclair, Bloomfield and Glen Ridge, use a joint outlet sewer discharging into the Passaic River.

MUNICIPAL OWNERSHIP OF THE WATER-WORKS of Des Moines, Ia., is to be voted on at an election to be held Aug. 19. The proposition is to buy the plant of the Des Moines Water-Works Co. for $850,000, this price having been agreed upon by representatives of the bondholders, the city council and the Citizens' Association. If the purchase is made, a long controversy between the city and the company will be ended.

THE THEORY OF THE DIESEL OIL ENGINE, as given by Mr. Diesel, has been criticised in a paper read by E. Capitaine at a meeting of the Verein deutscher Ingenieure, at Frankfort, in April. He also attacks Diesel on the ground of priority of invention. Diesel's patent is dated February, 1892. In May, 1891, Capitaine took out two patents for an engine burning heavy oil injected into compressed air, and in the same year he built an engine, but its development was hindered by want of means. Diesel was fortunate, not only in obtaining pecuniary support, but in obtaining a pressure of 30 atmospheres in his engine, while Capitaine obtained only 15. The compression space in Diesel's engine in only half that in Capitaine's engine, and this, says Capitaine, constitutes the sole difference between the two motors. "The Engineer," which discusses Mr. Capitaine's paper at length, sums up the matter as follows:

> To sum up the matter, the novel points in the Diesel motor are perhaps not so many as its admirers claim for it. To start an explosion engine by compressed air is a method familiar to most engineers, as also to regulate its working by injecting varying quantities of combustible into compressed air, thus varying also the amount of air in excess. But it is scarcely correct to assert, as Capitaine does, that its sole claim to originality consists in diminishing the compresson space of an oil engine. We cannot go into the question of the commercial competition between these well-known inventors. But the fact must not be overlooked that Diesel has produced a practical engine, giving the highest heat efficiency and lowest consumption of combustible yet realized, namely, 0.52 lb. of oil per brake horse-power per hour at full power, with a 20-HP. engine; actual heat turned into work on the brake, 26%; and heat turned into indicated work, 34¾%.

THE KOCH HEAVY-OIL MOTOR-CARRIAGE, lately tested at the Paris motor-car exhibition, is thus described: The motor can be used equally well with crude petroleum, or with distillates like kerosene or naphtha. The two cylinders are placed end to end, with one explosion chamber in the center; the one explosion operating both cylinders. The piston rods are each connected by cranks and connecting rods to the fly-wheel shaft, which is fixed centrally below the cylinders, and the engine is thus exactly balanced. The motor runs at 600 revolutions, develops 6 brake HP. and weighs, with its fly-wheel, about 3½ cwt. Power is transmitted from the motor-shaft to a jack shaft by spur-wheels running in an oil-bath, and from the jack shaft to the rear wheels by the usual chain and sprocket gear. There are three forward speeds, of 5, 10 and 18 miles per hour, and one backward gear. This carriage, carrying four passengers, is said to be capable of mounting 10 to 12% grades with ease. The steering is done with the forward wheels, operated by a standard with a long, single handle.

A BUILDING ON CANTILEVERS, of peculiar design, has lately been erected in Birmingham, England, to utilize a valuable frontage that overhung the tunnel of the Great Western Ry. This tunnel was so near the surface as to forbid the use of girders spanning it, and the house could not be built upon the tunnel masonry. In this emergency Mr. R. Heaton, architect, devised a system of cantilevers to support a three-story warehouse with the front overhanging the tunnel 25 ft. at one end and 4 ft. at the other. The building is 44 ft. deep, and thus only 19 ft. rests upon the ground at the point of greatest overhang. The steel girders which support the building rest upon a pier, with its face 25 ft. from the frontage line; and as the overhang part of the girder in front is longer than the rear portion, a concrete counterweight is suspended from the rear member. The first cantilever, of the six used, supports 270 tons, and carries 160 tons of suspended load. The second cantilever carries the greatest load of 375 tons, and from this point the load decreases with the decrease of the overhang to 4 ft.

BOOK REVIEWS.

HISTORY AND DESCRIPTION OF THE WATER SUPPLY OF BROOKLYN.—Prepared and Printed by Order of the **Commissioner of City Works. I. M. de Varona,** Engineer of Water Supply. Cloth; 12 × 15 ins.; pp. 306, and 81 tables, unpaged; 104 plates, some folding. City Document.

This very handsome volume contains a vast amount of useful and interesting information regarding the water supply of the former city of Brooklyn, now a part of the Greater New York. It is, of course, impracticable to enumerate in detail the contents of the volume, as it includes, as the title states, a "History and Description of the Water Supply of Brooklyn." Many tables, reproductions of photographs, maps, diagrams and other drawings contribute their part to make up a book which does honor to those who prepared and published it, as well as to the city for which it was designed.

The Brooklyn water-works possesses many interesting features. One of these is the large number of driven-well stations, intended originally only as temporary means of supplementing the surface supplies.

The volume contains biographical sketches of the various chief engineers of the works, up to but not including Mr. de Varona, and a good portrait of Mr. Jas. P. Kirkwood, Chief Engineer of the Brooklyn works during their construction. The various rules and regulations of the works are given, including those for the sanitary protection of the water supply. One of the most interesting of the many tables in the book is one giving a detailed statement of the yearly receipts and expenditures of the works. The total cost of construction up to the close of 1895 was $22,102,701 Other valuable tables are rainfall records for Brooklyn and vicinity, and detailed statistics regarding the various pumping plants and their operation. The consumption of water was 12 gallons per capita in 1860; 47 in 1870; 54 in 1880; 67 in 1890; and 75 in 1895. The first figure should not be given much weight, as the works were completed in 1859.

THEORIES DE L'ELECTROLYSE.—**Par Ad. Minet,** Ingenieur-Chimiste, Directeur du Journal L'Electrochimie. Paris: Masson et Cie. Paper; 7½ × 4½ ins.; pp. 175. One of the series of "Encyclopedie Scientifique des Aide-Memoire."

The author takes up the history of electrolysis from 1772, when Paets, of Troostwyk, discovered that he was able to decompose water by means of the current furnished by the great static electric machine at Harlem. But investigators were then studying the mechanical rather than the chemical effects of apparatus of this kind, and Paets's discovery of the electrolytic phenomenon was regarded as of secondary importance. Faraday, later, laid down the broad law, and the investigations of Weber, Mascart, Kohlrausch, Lord Rayleigh and Sedgewick definitely fixed the quantity of electricity necessary for the decomposition of an amount of electrolyte equal to its equivalent expressed in grammes, and according to Becquerel's law. The author broadly defines electrolysis as the phenomenon of decomposition engendered by the passage of an electric current through certain chemical compounds of determined function; and all substances susceptible of being thus decomposed by the current are known as electrolytes. The latter must fill two conditions; they must be conductors of electricity and be sufficiently fluid. The general laws and physical theory of this phenomenon are then discussed at length. The second part deals with the constitution of electrolytes, and the modern chemical theories as here applied; and the next division discusses the electrolytic constants, methods of measuring the resistance and conductivity of electrolytes; effect of saline mixtures; and the electrolytic transport of the ions. The work closes with a very full biography and an excellent table of contents.

ANNUAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 15th general meeting of the Institute was called to order in the Bee Building, Omaha, Neb., on the morning of June 27 by Mr. A. E. Kenneally, the president. Mr. W. W. Bingham, President of the City Council; Mr. G. W. Wattles, President of the Exposition; Mr. E. Rosewater and Col. J. J. Dickey were introduced and made appropriate remarks, to which the president replied and then read his address. The growth of the electrical industry during the last 15 years was traced, and the progress in the industry which, in 1884, involved only $1,000,000, and now over $900,000,000 was interestingly outlined.

Mr. C. P. Steinmetz then read a paper entitled "Dielectric Strength of Air," which was a description of a series of tests of striking distances in air with different forms of terminals and a mathematical discussion of the data obtained. In conclusion Mr. Steinmetz said:

1. At constant voltage and constant wave shape, that is constant ratio between maximum and effective E. M. F., the striking distance is a constant, especially between sharp points, where the tests have been repeated over and over again, and independent of the atmospheric condition, the frequency, etc., to such an extent that the striking distance between needle points offers the most reliable means to determine very high voltages.
2. No physical law has been found to represent satisfactorily all the observations. Some point to the existence of constant dielectric strength of air, analogous to the tensile strength of mechanics. Others point to the existence of a spurious counter E. M. F. of the spark or transition resistance from electrode to air.
3. Constant dielectric strength. Cylinders of 1.11-in. diameter give an average disruptive strength of air of 60 kilovolts per in. Cylinders of .315-in. diameter, an average dielectric strength of 77. Spheres at very small distance point toward the latter value. As a disturbing factor in this case, enters the electrostatic brush discharge, which by a partial breakdown of the air surrounding the electrodes changes and increases the size and decreases the distance of the effective terminals.
4. Counter E. M. F. of the sparks. The tests with sharp points give 22 kilovolts, or 11 kilovolts for a single transition from terminal to air. Spheres give curves pointing to a similar phenomenon. Electric conductors inserted at right angles into or parallel with the discharge, point to the existence of a counter E. M. F. of the same magnitude. The beginning of the electrostatic brush discharge is at a potential of this magnitude also.
5. Potentials of 160,000 volts effective and even up to 170,000 volts have been experimented with. They are probably the highest voltages ever reached by man at ordinary frequencies with alternating currents of considerable power.

Mr. John W. Howell read a paper entitled "Two-Wire Distributing Systems and Lamps at 220 to 240 volts." This paper described the saving in copper resulting from the use of a two-wire system in connection with the higher voltage lamps and recounted some of the troubles encountered in the use of 220-volt. lamps. The statement was made that the future of 200-240-volt systems depended upon the development of a more economical lamp, as all other elements of the system were already provided or could be produced with the means or knowledge now at our command. The third paper, "A Capillary Electrometer for Electrical Measurements," by Mr. Charles F. Burgess, was read by the Secretary. Mr. Burgess' instrument depends upon the change of surface tension of two liquids (preferably mercury and dilute sulphuric acid), which are in contact in a capillary tube. The meniscus which is found at the separating surface moves upon the application of a potential to the liquids. This movement can be measured, as can also the potential producing it, and the instrument is in this way calibrated. The methods of measuring insulation and electromotive force were described.

The afternoon and evening were given up to visits to the Grant Smelting Works and the Union Pacific Shops and the night illumination of the Exposition Grounds.

The morning session of June 28 was devoted to papers, the first of which, entitled "A Modern Central Station," was read by Mr. Geo. A. Damon (Eng. News, July 14, 1898). Dr. Francis B. Crocker followed, reading the Preliminary Report of Committee on Standardization, a committee appointed some time ago to draw up a code to govern the construction of certain electrical apparatus. Such quantities as efficiency, rise of temperature, insulation, regulation, variation and pulsation, rating, classification of voltages and frequencies, etc., are included in this report. The report is a tentative one, and was presented to give members an opportunity to criticize and submit suggestions. The afternoon and evening were devoted to sight-seeing.

The first paper the next morning, June 29, was by Mr. Ernest J. Berg, on "Transmission and Distribution of Power for Railway Service." This was a somewhat mathematical discussion of alternating current systems for railway work with especial reference to generation and transmission, and the available means of regulation from the generating station.

The next paper presented, "Some Phases of the Rapid Transit Problem," by Mr. Albert Armstrong, dealt with train acceleration, train energy and breaking. A number of curves plotted from certain average assumptions were included with accompanying explanations. Mr. D. C. Jackson's paper "The Commutated Curve of a Composite Wound Alternator" was read by title.

The morning of the last day, June 30, was devoted to the following papers: "The Graphic Treatment of Alternating Currents in Branch Circuits," Henry T. Eddy.; "Air Core Distribution," Prof. W. E. Goldsborough, and "High Voltage Power Transmission," Chas F. Scott.

The attendance at the convention was small, as was to be expected by reason of the long distance from the electrical centers of the East. The papers are published in full in the May number of the Society's "Proceedings," which can be obtained from the Secretary, Mr. R. W. Pope, 26 Cortlandt St., New York city.

SUMMER MEETING OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

The first summer meeting of this society was held at the Hotel Irvington, Atlantic City, N. J., July 15. Two sessions were held, one beginning at 2.50 p. m. and the other at 8 o'clock in the evening. The attendance was disappointingly small.

The afternoon session was called to order by President A. R. Wolff, with few appropriate introductory remarks, in which he explained that the summer meeting was intended to be largely of a social nature.

The first paper, "Some Accepted Tests of Ventilation—Are They Reliable?" was read by the author, Mr. T. C. Northcutt. We condense it as follows:

Most of the methods and instruments by which we measure the results of ventilation have come into use within a generation. They are comparatively new and to some extent defective. We are not to abandon methods of testing because they are defective until we have found other methods that are less defective, but I think it important to recognize their shortcomings.

Carbonic Acid Gas Tests.—To discover the degree of impurity of air in occupied rooms it is usual to determine the proportion of carbonic acid gas. The excess of this gas over that which is normal to outside air in a clean locality is taken as showing the degree of impurity. This test is only approximate.

Carbonic acid gas is not the only, nor the worst, poison discharged into the air of an occupied room. An eminent authority states that "a man of average weight throws off through the skin during 24 hours about 18 ozs. of water, 300 grs. of solid matter and 400 grs. of carbonic acid gas." This is nearly 3 lbs. of poisonous matter discharged into the surrounding air by every vigorous adult in each 24 hours. But less than one-third of this is carbonic acid gas. It is well known that the solid matter of excretion in an occupied room is a most deadly poison. We have no accurate means of testing its volume, except by laborious processes in the laboratory not available or practicable for general use. Yet the test for carbonic acid gas in vitiated air is, under carefully guarded circumstances, approximately correct, and, if rightly used, is of great value. This is true because an excess of carbonic acid gas is ordinarily a close companion of all other forms of crowd poison. Its presence indicates the presence of its ally.

Lime Water Test.—This test aims to determine the presence of carbonic acid gas. It does not, except by inference, determine the presence of other forms of crowd poison. It depends upon the fact that carbonic acid gas passed into and through lime water will precipitate the lime in the water, making the water which was at first absolutely clear to be more or less clouded and dense with chalky matter. The amount of carbonic acid gas discharged through the water determines the degree of density.

With the Wolpert Air Tester, for example, you are to determine the volume of carbonic acid gas that is passed through the water by the number of times you have discharged a bulb full of contaminated air through the lime water before the water becomes so dense that a black spot at the bottom is obscured. It is evident that the experimenter may, or may not, exhaust the bulb, or air pump, to the last degree at each filling. He may, or may not, fill the bulb from that limited area of air immediately surrounding his own head, and into which he has just that instant discharged the contents of his own heated lungs. This does not impeach the honesty of the operator. It is simply a question of his knowledge, his skill and precision.

Again, to determine when the black spot can no longer be seen through the lime water is a question of vision, and everyone who has made use of this test knows how difficult it is to be quite sure when the vanishing point is reached. The various lime water tests in popular use are thus defective. But this test is not without great value, and we must continue to use it until something better is known. We should look with some degree of skepticism, however, upon any such test made by the inexperienced.

The Anemometer.—The anemometer is the most useful instrument in determining the results of ventilation. I mean a good anemometer. I have seen some that are no better than an old-fashioned fanning mill. It should be carefully kept in adjustment. Ventilation is, more than anything else, dilution, and so after all the best test of adequate ventilation is the anemometer test. And yet the anemometer, even if a good one, in the hands of an inexperienced or injudicious person, is an unscrupulous liar.

We must continue to use tests which are recognized as in some measure defective. We continue to use them because they are the best known. We must be careful, however, to make these tests with a full knowledge of their shortcomings, and a disposition to carefully watch for every affecting circumstance. In the meantime we will urge inventors to find better instruments for our purpose.

Mr. Jellett, in the discussion, said that his experience demonstrated the approximate nature of tests made with the anemometer. In one case where a delivery of 40,000 cu. ft. per minute was called for in the specifications, his test gave 41,000, while that made by the engineer in charge gave 47,000, and someone else might have obtained 37,000. In the case in question the flue velocities were found to vary considerably, owing to offsets in the flues, and the delivery was altered by the opening or closing of dampers in side flues. Attention was called to the fact that all 3-in. anemomenters seemed to have the same friction coefficient (30) and the reason for this was briefly discussed without arriving at any conclusion.

Mr. Henry C. Meyer, Jr., questioned the accuracy of the author's statement that the carbonic acid gas would rise, and the other exhaled material would settle. It was explained that the separation was only temporary and resulted from a difference of temperature, the CO_2 being hotter than the other products when exhaled.

The Secretary then read Mr. McClellan Davidson's paper, "The Use of Draft Regulators," which was intended to open a topical discussion.

This paper considered in a general way the question of draft regulators for domestic service, stating that any regulator to be of service must be simple, quick to respond to temperature changes, and thoroughly reliable, conditions not completely fulfilled by any regulator in the market as far as his experience went. The best system at present in use employed a thermostatic device, but it was a mistake to claim, as some manufacturers of regulators were doing, that one type was suitable for all purposes, and all systems of heating. With steam heaters the changes were apt to be rapid compared with hot water systems. It was therefore necessary to employ special forms of regulators each suitable for a certain set of conditions.

Others stated that hot water regulators were slow to operate, all closing too slowly and opening too quickly. As an example of the uncertainty of automatic regulators, the case of the operating room of a hospital was mentioned. This room had a large skylight and the sun's passing under a cloud would cause a variation of the room temperature of 5°, notwithstanding the automatic regulator in use.

A paper on "Boiler Furnaces," by Mr. M. C. Huyett, of Detroit, Mich., was read by the secretary. The following is an abstract:

Boiler Furnaces for Steam Power Installations.

The Central High-School Building, Detroit, Mich., has been used two winters. The power plant has four horizontal tubular boilers, aggregating 428 HP. The furnaces were plain grates, hand fired. From September, 1896, to March 1, 1897, 1,093 tons of soft coal were burned, costing $2,892. From March 1 to the end of school term, 190 tons of soft coal were burned at a cost of $536.

The building is in a fine residence part of the city, and complaints of "smoke nuisance," and threats of suits were frequent. The use of anthracite coal was considered favorably and the consulting engineer for the board estimated that 1,000 tons would be required. Proposals were advertised for, and the lowest bid was $4.88 a ton. At the same time proposals were asked for Jackson Hill (Ohio) nut and slack. The lowest bid was $1.69, delivered in the building.

Mechanical furnaces were installed in August, 1897. From September, 1897, to March, 1898, 806 tons Jackson Hill nut and slack were burned at a cost of $1,362.14. The engineer then estimated that 150 tons would complete the school term, at a cost of $253.50. Total $1,615.64.

If the engineer's estimate for the incomplete part of the term proved to be correct, the economy in favor of the mechanical furnaces and cheap bituminous coal would be $1,811.

The known quantity is the two school terms to March 1—$2,891, $1,362 or $1,529 economy.

It is safe to assume that had anthracite been used 1,000 tons would have been required, and fuel cost have been $4,880.

There has not been a single complaint of smoke nuisance whilst burning the 1,000 tons of bituminous nut and slack coal. Almost continuously the chimney top has been absolutely smokeless.

When working a boiler at full duty rating of 100 sq. ft. of heating surface per horse-power with a mechanical furnace 3.16 lbs. Pocahontas R. M. was burned per HP. hour; 3.74 lbs. Jackson nut and slack was burned per HP. hour; 4.4 lbs. Hocking Valey slack was burned per HP. hour; 3.65 lbs. Belmore pea was burned per HP. hour; 4.1 lbs. Cherokee, Kan., slack was burned per HP. hour.

I have test data with slack coal, hand fired, and like coal mechanically fired. The economy favored the mechanical furnace 20%.

Mechanical furnaces require slack or nut and slack, or nut sizes of coal, and with only reasonable attention for some types, and no attention for another type, will consume such sizes of bituminous coal with stack conditions ranging from some smoke—but no smoke nuisance—to absolutely smokeless almost continuously. At no time will chimney gas escape be opaque.

Bituminous slack and screenings coal can be burned so satisfactorily as to not cause a nuisance to occupants of adjoining properties, and with such economy as to fully justify the large money investment required for a modern mechanical furnace plant.

Mr. A. Harvey mentioned the case of the Michigan Central R. R. station at Detroit, Mich., in support of the automatic stoker as against hand firing. In this plant, 1,200 tons of hard coal were formerly required, while with mechanical stoking 1,000 tons of slack were used, thus effecting a saving of about $5,000 a year.

Mr. Jellett called attention to the fact that the economy resulting from the use of mechanical stokers depended upon the locality in which they were employed, the entire question hinging on the relative cost of hard and soft coal, and while stokers made such a fine showing in Detroit, where hard coal cost so much, the saving would be greatly reduced in a place like Philadelphia, where hard coal is cheap.

In opening the evening session, the President announced the following as members of a committee to collect data concerning school-house heating and ventilation in their respective cities: A. E. Kenrick, Boston; Geo. I. Rockwood, Worcester; Ernest Glantzlong, Springfield; Mr. Strangerland, New York; Wm. M. Mackay, Newark; T. C. Northcutt, Syracuse, Rochester, Elmira and Buffalo; H. R. Harvey, Detroit; John Gormly, Philadelphia; B. H. Carpenter, Wilkes Barre, Scranton; Henry Adams, Baltimore and Washington; J. A. Larydon, Pittsburg; H. D. Crane, Cincinnati; D. M. Quay, Chicago; Prof. J. H. Kinealy, St. Louis; Charles T. Tay, San Francisco; David N. Nesbitt, London, England, and A. B. Reck, Copenhagen, Denmark.

The first paper of the evening, "A Suggestion for Determining the Heating Surface of Indirect Radiators," by Mr. H. Eisert, was read by title only, owing to its technical nature, which would require some personal explanation by the author. It will be published in full in the annual proceedings.

A topical discussion, "What is the Best Means of Advancing the Interests of Our Society?" was taken up and considerable time was devoted to considering the objects of the Society, the classes of engineers eligible to membership, and the number of such engineers. Entrance requirements were discussed and the resulting feeling was that everything considered, for a young Society with a high standard for admission, the American Society of Heating and Ventilating Engineers was holding its own.

The fourth topic, "The Consulting Heating and Ventilating Engineer—His Relation to Owner and Contractor," was discussed by Mr. Jellett who quoted from a paper on the same subject read by Mr. Wm. H. Bryan before the meeting of the American Society of Mechanical Engineers, held at Niagara Falls in June (Eng. News, June 2, 1898). He stated that the consulting engineer bore the same relation to the owner that the architect did, and at the same time, like the architect, must have the confidence of the contractor. The duties of a consulting engineer were outlined, and the common practice of accepting bids in which it was quite certain the contractor had made some mistake, afterwards holding him to his contract and thereby making him lose, was condemned. Such action usually resulted in poor work somewhere which would eventually bring the cost up to what should have been allowed.

The consulting heating and ventilating engineer is a recent growth. In most cases he is qualified to do what is claimed by his title. There are, it is true, many equally competent engineers connected with manufacturing firms, but these from this business connection are not in a position to occupy a proper relation to the customer, and hence could not be called consulting engineers.

ANNUAL MEETING OF THE INTERNATIONAL MINING CONGRESS.

The first annual meeting of the Congress was held at Salt Lake City, Utah, on July 6, 7, 8 and 9.

This organization is a result of the gold mining convention which met a year ago in Denver, at which it was decided to extend the scope so as to include all mining and to adopt the more comprehensive name.

At the first session on Wednesday, July 6, there was a rather small attendance. Addresses of welcome were made by the governor of Utah and the mayor of Salt Lake City and were responded to by Col. B. F. Montgomery, of Colorado. The president of the Congress, ex-Gov. Bradford T. Prince, of New Mexico, gave an able address, in which he pointed out that by extending the latitude of the convention to include all mining interests, $750,000,000 in annual product was now represented instead of only $60,000,000 for gold alone.

It was also pointed out that of the five principal metals—gold, silver, copper, lead and iron—the United States today produces more than any other country. Her copper production is greater than that of all the rest of the world. At the afternoon session J. W. Neill, mining engineer of Salt Lake City, read a paper on "Advances in Methods of Concentration." At this session was presented the report of the committee on revision of the Federal mining laws, the most important matter brought before the Congress. The chairman, Chas. J. Moore, mining engineer, of Colorado, presented the majority report and made a strong speech in support of it.

The report was very voluminous, but the principal change recommended in the existing law was the entire annulment of the so-called "apex law" at present applied to lode claims.

By this law the owner of a mining claim is allowed extra lateral rights, that is, he has the right to go beyond the side lines of his claim in following the vein on which he has located. Mr. Moore said in part:

> In the year 1879, only seven years after the passage of the present mining law on May 10, 1872, the evils resulting from its operation had become so great that Congress appointed a public land commission, which investigated most thoroughly the causes of the troubles arising from the present law, and made an exhaustive report. This testimony before this commission showed great evils then existing; and they have grown worse during the 18 years since that commission's report.
>
> To eliminate the "apex-law" would be to return to the common law, which declares that the owner of any portion of the earth's surface is entitled to everything enclosed by vertical lines or planes reaching from his surface boundaries down to the center of the earth, but to nothing outside of them.
>
> By the abolition of the apex law we destroy at once the principal source of the most expensive, harassing and disastrous litigation in our Western States and Territories; but we would compensate those who think they should have possession of every vein throughout its entire depth when its apex is within the surface boundaries of their location, by doubling the size of the maximum location over that of the present law, making it 40 acres instead of 20 acres; and further by expanding the manner of discovery and permitting a location to be taken in any form, thus eliminating all difference between side lines and end lines. The apex law was a legacy from Spain, which we inherited when we acquired the Spanish colony of California, and all the Spanish-American countries except Bolivia have now abandoned it.

Another principle advocated in the report is that of entirely segregating as soon as possible any portion of the public domain upon which a discovery of precious or useful minerals may be made, by requiring the owner of a mining claim to patent his ground within five years from the date of location. Adverse claims are to be adjudicated at the time of location, the original survey of the latter to be now made an official act, and to serve without any subsequent survey as that upon which the patent shall ultimately issue.

In the proposed new law the tunnel-site feature is retained, but its provisions are limited to the ownership of veins not previously covered by surface locations, and are expanded to include the right of possession of the underground places on the beds of ancient rivers, such as are called in California "deep placers."

The discussion of the majority and minority reports of the committee was undertaken at the afternoon session on Thursday, July 7.

The two reports had been printed for distribution among the members, and the minority report was presented by Judge W. B. Heyburn, of Idaho, who made a vigorous speech in its support.

This report recommended the retention of the apex law and of practically the present system of laws, with the abolition of local rules.

The speaker asserted that the "square" claim law (vertical sides) had been in effect in British Columbia since 1891, but that they now desired to change back to the American system. He claimed that the recommendations of the majority report, if enacted into law, would work untold hardship on the prospector who was generally of humble means and who could never begin to comply with the seven notices required, and with the $50 preliminary deposit which the U. S. Surveyor-General required at the time of making the location. He gave examples of the location of certain claims that had laid the foundations of some of the greatest camps in the world, where the locators had barely enough money to pay the recorder's fees. The minority report recommended the establishment of a base line for every ledge as follows:

> The end lines of the first location made upon any ledge shall govern as to the direction of the end lines of all subsequent locations upon the same ledge.

In concluding, Judge Heyburn urged that, though there had arisen many difficult questions in the past in connection with our mining laws, that they had stood the test of a quarter of a century during which they had been interpreted at a cost of millions of dollars, and that it was unwise now to enact any new ones.

Prof. W. S. Keyes, geological expert of California, made an argument for the majority report. Among other things he said:

> I look upon the extra-lateral permission of the law as the chief vice of our present mining code. It has caused more heartaches, more law suits and more rascality and perjury than any dozen laws upon our statute books. On the authority of a former Surveyor-General of Nevada, Mr. S. H. Marlette, there was expended in litigation on the Comstock lode during the years of 1860-'65 inclusive, not less than $9,000,000—one-fifth of the total product of the mines, and, considerably more than was declared in dividends during the same time. Senator William Stewart estimates the cost of litigation carried on by the Chollar and Potosi mining companies, prior to 1866, at $1,300,000, and the expenses of the Ophir-Moscow war at nearly $800,000. The total costs of litigation in the Washoe district up to Jan. 1, 1896, he computes at $10,000,000. As a part of the litigation there sprang up a horde of greedy, conscienceless "standing witnesses," ready, for pay, to swear to anything. Dr. Raymond, in "The Mineral Industry," says: "The full development of the mineral resources of the West will never come to pass until the capital it requires is better protected by definiteness in title and boundaries of mining property. And that cannot be done, in my judgment, by any amendment of the present law, which shall leave in it the present abnormal, irregular, indefinable, precarious, and mischievous extra-lateral right." It is bad enough to be obliged to take the usual mining chances, but when, in addition to this—to use the words of Chief Justice Beatty of California, long on the bench in Nevada—we have the certainty of a law suit, provided the mine proves to be of any value, the outlook for the legitimate miner and investor is far from encouraging.

Professor Keyes then answered the objection that the adoption of the "square" claim would tend to the monopolization of a district by asking why it was that all the other nations of the earth used the system; and why it was that the system was used in all the states to the east that produced the commercial metals.

Among the lawyers, he asserted that the giants at the bar were a unit on the question, and that the "Engineering and Mining Journal,' of 'New York, and the "Mining and Scientific Press," of San Francisco, were both enthusiastically in favor of reform. In closing, he asserted that under the square or surface location no disputes could arise except such as could be determined by a competent surveyor.

The discussion of the reports was not concluded at this session, and it went over until Friday morning, July 8. It was evident that neither report could be approved, and ex-Congressman C. E. Allen, of Utah, offered a resolution as a substitute for both, which was adopted. This simply stated that it is the sense of the Congress that the mineral laws should be so amended as to do away with extra-lateral rights in mining claims, and instructed the President and Secretary to forward to the proper committees and officers at Washington, when Congress convenes in December, copies of the resolution. The main fight against any change in the laws was made by the prospectors.

At the Thursday morning session, Manuel Elquera, secretary of the Peruvian Legation at Washington, and a mining engineer, read an interesting paper on "The Mineral Resources of Peru." Mr. Elquera described the geographical situation and topography of Peru, and explained that of the vast mineral wealth of the country but little is really known. He had traveled a great deal in Peru in the practice of his profession and had journeyed for days at a time through regions where the earth at any place could be taken and washed, and would show particles of gold.

This paper was followed by one entitled "Some Remarks on the Cyanide Process," by Louis Fade, chief chemist and director of the Raessler & Hasdecker Chemical Co., of New York. Among other things the speaker said:

> So-called coarse gold is acted on by cyanide so very slowly that the process is applicable only to ores which contain the metal in a very finely divided state. The selective action of a dilute cyanide solution on gold ores in preference to the sulphides of base metals with which they may be associated, is so wonderful that, from a chemical point of view, we may say that it is possible to extract the gold from all low-grade ores by means of cyanide, with the exception of ores containing copper, zinc and antimony combinations. In these cases the treatment becomes difficult, if not impossible.
>
> On first thought one is inclined to believe that the finer the ore is crushed the better it is for leaching purposes, but this is very often a wrong conclusion. It may be all right for very hard silicious ore, but not for an ore containing, for instance, alumina and magnesia, which are very apt to form slimes when coming in contact with the cyanide solution, and thus render the ore impenetrable. A very good example is the experience of the now world-renowned Mercur mine in Utah. Some six or seven years ago when the process was being developed at the plant of this mine—which, by the way, was the first cyanide extraction plant in this country for the treatment of ore—the managers were advised to grind the ore to about 600-mesh in order to attain the highest possible extraction. The result was the saving of only about 40% of the assay value of the ore. After many attempts and experiments to solve this perplexing problem, it was decided not to crush the ore so fine, on account of its porous nature and its considerable percentage of talc and alumina, which latter rendered the ore difficult of peretration by the cyanide solution. The result was that the coarser the ore was crushed the higher the extraction became, and now it is found that the highest extraction—about 85%—is obtained when the ore is crushed to about ¼-in. cubes.

At Friday morning's session, a paper on the mineral resources of Venezuela was read by Francisco Yanes of that country. Señor Yanes gave an interesting topographical description of that country. He said that notwithstanding mining was still in its incipiency there were 226 mines which furnish 42 different metals. Attention wos called to the rich copper mines of Aroa and El Callao, which have proved astonishingly productive. The richest gold-bearing region is that of Guiana, where the fabulous land of "El Dorado" was located, which attracted so many adventurers to the coast of Guiana in the fifteenth century. There are 62 gold mines in Venezuela, all of which are high-class producers. There are also coal and asphalt mines and petroleum deposits, which have been worked at a profit.

Mr. Yanes was followed by T. W. Gibson, Secretary of the Bureau of Mines and Mining of Ontario, Canada, who, took occasion to preface his talk on the mineral resources of Ontario, by referring most feelingly to the sympathy of Canada for the United States in the present war, and to the close relationship between the two countries.

At the afternoon session on Friday, a paper entitled "Official Geology and its Relation to the Mining Industry," prepared by H. H. Stoeck, editor of "Mines and Minerals," of Scranton, Pa., was read by Prof. Arthur Lakes, of Colorado. The writer told of the first established geological survey—that of North Carolina—begun in 1823, from which the idea developed in different states. The Association of American Geologists was formed in 1840. For years in different states the surveys dragged on, often crippled for want of funds, until after the Civil War. Then came a revival of geological activity until work along this line is done in nearly every state of the Union.

A paper on "Mine Legislation and Mine Inspection in the Anthracite Coal Region of Pennsylvania," was then read by Mr. G. M. Williams, of Pennsylvania.

The speaker told of the beginning of all mine inspection in this country at the anthracite mines; of the opposition of the mine owners at first, and how much benefit it had caused, not only in saving of life and limb, but in the more vigorous health and increased capacity for work of the miners.

At this session Milwaukee was chosen as the place for the next annual meeting, getting about 70% of the vote cast, and Sept. 7 to 10 inclusive, 1899, was fixed as the time.

Mr. Richard H. Terhune, superintendent of the Hanauer smelter, near Salt Lake, read a paper on "Recent Advances in Silver-Lead Smelting," in which he gave the results of numerous experiments he had made.

At Saturday's session a resolution, offered by Prof. S. B. Christy, of California, was adopted, which recommended a liberal increase in appropriations for carrying on the U. S. Geological Survey, and also the co-operation of surveys now carried on by the states independent of the national survey. A vote of thanks to Director Walcott and his assistants was included. A resolution petitioning Congress for the creation of a Department of Mines and Mining, was also passed.

It was decided to establish a headquarters for the Congress at Salt Lake for the coming year, until it becomes time to remove them to Milwaukee to begin the preliminary work for next year. Mr. W. D. Johnson, of Salt Lake, the Secretary-elect, is to be in charge. Col. B. F. Montgomery, of Cripple Creek, Colo., was chosen President for the ensuring year.

The sessions were pleasant and fairly harmonious, notwithstanding the hot weather, which deterred many from sitting through them when there were more attractive resorts outside and at the lake. There were 28 states and 2 foreign countries with delegations in attendance. The greatest attendance at any one time was about 130.

A mineral exhibit was made at a hall near by, at which were shown some of the choicest products of some of the principal mines of Utah, and also some mining machinery.

On Saturday, an excursion was run to Bingham to inspect the Highland Bay (principally copper) mine and others. On Sunday excursions were run to Park City, to Tintic and to Mercur. At the latter place they had the rare privilege of going through the great Golden Gate cyanide mill, illustrated in Engineering News of May 19, 1898.

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THE SPEED PROPOSED FOR THE NEW BATTLEships has been modified by the Navy Department in a notice to shipbuilders dated July 26 as follows:

> The Department will in awarding contracts for the construction of battleships Nos. 10, 11 and 12, under its advertisement of June 7, give preference, other things being equal, to such bids as offer to guarantee the highest rate of speed and greatest coal endurance, the total weights of engines, boilers and coal, and the spaces allowed therefor, to remain as now fixed by the circular defining the chief characteristics of said vessels, and the Department plans and specifications and the vessels to have a steaming radius of not less than 5,432 knots at a speed of 10 knots per hour.

The original circular referred to specified the weight of coal to be carried as 1,200 tons; the weight of engines, boilers and all machinery in the engineer's department at 1,130 tons; the normal displacement at 11,500 tons, with a length over all of 368 ft., and a beam at the water line of 72 ft. Cylindrical single-ended boilers and four-cylinder triple-expansion engines were also specified.

BIDS FOR THE TORPEDO-BOATS AND TORPEDO-boat destroyers, which shipbuilders are now preparing, are not to be opened until Aug. 16, the date having been postponed to give some firms on the Pacific coast more time to prepare their proposals. It is said that thus far there have been comparatively few inquiries for the plans and specifications for these vessels. The high grade of workmanship and material which the government requires has caused several of the contractors to lose on the vessels of this type already built.

THE BRITISH NAVY is to be increased by six new battleships and twelve torpedo-boat destroyers, according to the statement of the First Lord of the Admiralty, Geo. J. Goschen, on July 22. The original naval programme provided for only two additional battleships to be begun this year; but the number was increased on account of information that Russia proposed to build six battleships this year. It is now reported, however, that Russia has greatly reduced its contemplated expenditure for the enlargement of its navy.

THE CONTRACT FOR TRANSPORTING THE SANTIago prisoners back to Spain was awarded by the government to the Campania Transatlantica, at a rate of $55 for officers and $20 for enlisted men. It will be seen that this rate is far below the bid made by a combination of the principal transatlantic steamship lines as given in this column last week. The United States also gains in that its responsibility from an international point of view, and the liability to complications, will be much less than if the prisoners were transported under a neutral flag.

THE "CRISTOBAL COLON" may yet be rescued and become a part of the United States Navy. If she is not it will not be for lack of energy on the part of Lieut. R. P. Hobson, Naval Constructor, U. S. N. The report of the expert of the Merritt Wrecking Co. who examined this vessel was that it would be impossible to float her; but the naval constructor was impressed with the possibility of righting the hull by the use of pneumatic caissons. He made a flying trip to Washington, secured the approval of the Navy Department, and the co-operation of the chief officers of the wrecking company, and a strong effort will be made to save this fine vessel before the hull is broken up by heavy seas.

THE U. S. PROTECTED CRUISER "CHICAGO," after about two years spent in alteration, is very nearly ready for service. The "Chicago" was authorized in 1883 and launched in 1885, and was one of the first of the "new navy." She was then equipped with a twin-screw compound overhead beam engine of 5,084 I. HP., giving her a trial speed of 15.3 knots. Her main battery included four 8-in., eight 6-in. and two 5-in. breech-loading rifles, with a secondary battery of nine 6-pdr. and four 1-pdr. rapid-fire, and two Hotchkiss and two Gatling guns. She was bark-rigged. The "Chicago" is now greatly changed. Her engines are of the twin-screw, slightly inclined triple-expansion type, with 9,000 I. HP., and these are intended to give her a speed of 18 knots. She is fitted with appliances for forced draft, on the closed fire-room system, with smokestacks 80 ft. high for natural draft. The advance in marine engine design, since the "Chicago" was launched, is made evident by the fact that her new engines, though almost twice the power of the original ones, weigh about 135 tons less. The vessel was originally provided with cylindrical externally fired boilers in brick settings, which were obsolete for naval use even when they were designed. These have been removed and in their place have been installed four single-ended Scotch boilers and six Babcock & Wilcox marine boilers. The former will be used for ordinary cruising and the latter only when it is desired to run at higher speeds. In her main battery the four 8-in. guns have been retained, but fourteen 5-in. rapid-fire guns have been substituted for the other breech-loading guns. The secondary battery now has seven 6-pdr. and two 1-pdr. rapid-fire guns, and two Colts' and one field gun. The masts of the ship have been replaced by military tops and her protective deck has been extended. The "Chicago" is 325 ft. long, 48 ft. 2 ins. extreme beam, 19 ft. mean draft, 4,500 tons displacement and 3,042 gross tonnage. She has a complement of 33 officers and 376 men.

THE CUBAN ORE MINES of the Spanish-American Iron Co., at Daiquiri, 19 miles east of Santiago, on whose steel pier and docks were landed most of Gen. Shafter's army, have several contracts on hand for the delivery of ore in Great Britain. For two years the mines were working under the protection of Spanish troops, but just before these troops retreated from Daiquiri they burned the roundhouse and shop of the company. These will be rebuilt and operations will be resumed at once.

THE IRON ORE PRODUCTIONS OF SPAIN in 1897 amounted to 7,468,000 tons, as compared with 6,762,000 tons in 1896. Of this product the Biscayan mines contributed 5,170,000 tons; Santander mined 800,000 tons; Murcia, 470,000 tons; Seville, 330,000 tons, and Almeria, 300,000 tons. Nearly all of this ore is exported, England taking 5,000,000 tons; Germany took 1,000,000 tons; France, 500,000; Belgium, 200,000 tons, and 60,000 tons went to the United States. Spain herself converts but a very small part of this ore; the Spanish production in 1897 only amounted to 297,000 tons of ingots, 63,000 tons of Siemens steel and 134,000 tons of structural iron.

A NEW STEEL PLANT is about to be built at Pullman, Ill., by a company of German capitalists, according to a press dispatch from Chicago. It is said that 20 acres of ground are to be covered with buildings, and that the plant will be one of the largest steel producing works in America. The news is important if true. It will require a very long purse to start a successful steel works. In order to compete with existing works it should have its own ore mines on Lake Superior, its own coal mines and coke ovens, and its own steam vessels and ore and coal docks, all of which means an expenditure of many millions of dollars.

TWO OF THE LARGEST STEEL PLATES ever made were rolled at the South Chicago Works of the Illinois Steel Co., on June 3. They were for the shells of consolidation locomotive boilers. The sheets before shearing measured 128 × 360 ins. and 130½ × 375 ins. Each was sheared into a plate 124 ins. wide, 220 ins. long on one side and 237 ins. on the other. The plate gaged at the four corners 0.577, 0.577, 0.574 and 0.576 ins., and at the ends near the middle 0.640 and 0.623 ins.

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred on July 22 at Dutch Flat, Cal., on the Southern Pacific R. R. The boiler of the locomotive of an eastbound train blew up while the train was standing at the station. The engineer, the fireman and a coal passer were killed and several others were slightly injured.

A WATER-WORKS TANK BURST at Beemer, Neb., on July 13, according to a press dispatch. It is stated that the hoops gave way at the riveted joints, and that the tank fell 25 ft.

A BROKEN SHAFT on the steamer "Friesland," of the Red Star Line, from Antwerp to New York, was repaired in mid-ocean, 1,450 miles from New York, on July 15, in such a manner as to allow the steamer to complete her voyage at seven knots, or about half her usual speed. The shaft was 16 ins. diameter, and a crack was discovered in it running around two-thirds of the circumference and 13 ins. through the shaft, the crack being open ½-in. at the widest point. The break was between the thrust block and the low-pressure crank. The temporary repair was made by a steel clamp and ½-in. wire wrapped tightly around the shaft. The wire was wound like thread on a spool by slowly turning the engine. The low-pressure cylinder was disconnected, and the vessel proceeded at reduced speed, arriving in port three days late.

AN ORDER FOR 500 COMPLETE STREET RAILWAY car equipments, including 1,000 25-HP. motors, 1,000 controllers and 500 trolleys, is reported to have been received by the Walker Co., Cleveland, O., through its Paris agency. The apparatus will be used in Italy, France and Germany.

BIDS FOR A STREET RAILWAY FRANCHISE between Elizabeth and Plainfield, N. J., will be received on Aug. 4 by the Freeholders of Union Co., N. J., at the Court House in Elizabeth. The Freeholders are acting under a law which provides for the widening, strengthening and grading of highways under the control of such bodies, and for the constructions of railways thereon. The estimated cost of widening the streets in question is about $350,000. Messrs. Frank J. Hubbard and J. F. Bauer, of Elizabeth, are the engineers for the county and Mr. S. Rusling Ryno is Clerk of the Freeholders.

ALL ELECTRIC WIRES IN NEW ORLEANS must be placed underground, in accordance with an ordinance passed several months ago. It is said that applications for space in the conduits have been filed by the Edison Electric Light Co., two telegraph and one telephone companies, all foreign corporations, but that no action towards compliance with the ordinance has yet been taken by companies operating under Louisiana charters.

BIDS FOR AN ELECTRIC LIGHTING PLANT are called for by the Shanghai, China, municipal council through F. S. Blackall, of Blackall & Baldwin, 39 and 41 Cortlandt St., New York city. The apparatus will include the two 100-K-W. alternators, direct connected to horizontal medium speed engines, water-tube boilers, switchboard, switches and instruments. Sealed proposals must be sent not later than Aug. 10 to the above address.

THE TRUSTEES OF THE SANITARY DISTRICT OF Chicago have vetoed the scheme of certain private parties to use the water from the drainage canal at its southern terminus for water-power development. They have taken the very proper ground that the water power which the canal will create is the property of the Sanitary District and if it is developed it should be developed for its benefit.

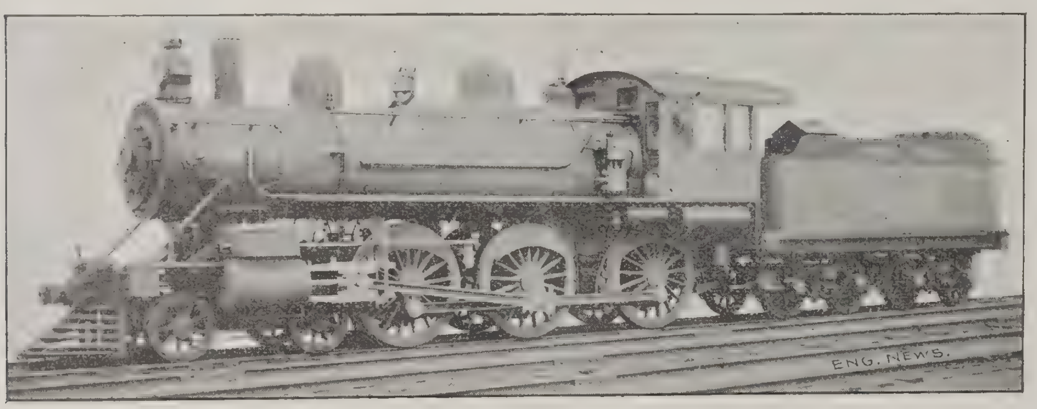
THE FRENCH SOCIETY OF CIVIL ENGINEERS, on June 10 and 11, celebrated the 50th anniversary of its foundation. There was a meeting at the Society House and speeches were made by M. Loreau, the President of the Society, and by the representatives of other societies, and a paper was read on the Alexander III. bridge by M. Alby, the engineer in charge. On June 11 the bridge of Alexander III. was visited, and in the afternoon there was a reception attended by the President of the French Republic and by M. Turrel, the Minister of Public Works, and at this meeting a number of orders were awarded to engineers by President Felix Faure. In the evening there was a brilliant reception with a great number of guests present. On June 13 the ceremonies terminated in a banquet of 500 covers at the Hotel Continental. This society was founded in 1848 and now has about 3,200 members.

THE SEPTIC TANK SYSTEM of sewage treatment was vigorously discussed at the recent meeting of the Incorporated Association of Municipal and County Engineers at Edinburgh, Scotland. Mr. Donald Cameron, City Surveyor of Exeter, and patentee of the system, sent a paper to the meeting which opened up the subject. The paper contained nothing new, but stated that the system was working most satisfactorily at Exeter, where about 65,000 gallons of sewage has been treated daily for 22 months with "no sign of requiring the removal of the deposit" from the tank. The majority of those who took part in the discussion, as reported in "The Surveyor," seemed to consider the system as still in an experimental stage. Several intimated that merely prefixing the word "bacterial" to variations of a well-known and long-practiced system of sewage treatment neither made the variation a new system of treatment nor increased the efficiency of the process. Some objections were urged, also, to the patenting of engineering inventions by engineers.

TEN-WHEEL PASSENGER LOCOMOTIVES; GRAND TRUNK RY.

The Grand Trunk Ry. has recently added to its equipment some large and powerful passenger locomotives of the ten-wheel type, which type of engine is coming to be very generally used for fast and heavy passenger service. A side view of the engine is more striking than the view shown in the accompanying cut, the long boiler being set very high, so that it is entirely above the wheels, which are 6 ft. in diameter. The appearance of the engine is somewhat peculiar, as it is painted black all over (including the boiler jacket), and this sombre color is relieved only by a very little bright work and lettering. All the lettering and striping is in aluminum leaf.

The boiler is of the extended wagon-top pattern, with a wide and shallow firebox dropped low at the front. The main steam dome and the special dome for the whistles and safety valves are mounted on the wagon top, the bell being on the throat sheet and the sandbox on the forward end of the barrel. All the rods are of I-section, and the side rods have solid ends. The engine is fitted with a 9½-in. Westinghouse air pump for the brakes and the air signal. The tender is mounted on two trucks with 43-in. wheels, which is much larger than is common in American practice, as shown in our issue of June 9. Six of these engines were built in April last by the Schenectady Locomotive Works, of Schenectady, N. Y., and we are indebted to the builders for the photograph from which the accompanying cut is prepared. The following is a list of the principal dimensions, given in our standard form:



TEN-WHEEL PASSENGER LOCOMOTIVE; GRAND TRUNK RY.
Schenectady Locomotive Works, Builders.

Ten-Wheel Passenger Locomotives; Grand Trunk Ry.

Running Gear.	
Driving wheels, (6) diameter	6 ft. 0 ins.
Truck wheels, (4) "	3 " 1 "
Tender wheels, (8) "	3 " 7 "
Driving-wheel centers, main	Cast steel.
Others	Steeled cast iron.
Truck and tender wheels	Steel tires.
Drvg. whl. tires secured	Shrinkage and retaining rings.
Engine truck	Swing center.
Journals, driving axles	9½ × 12 ins.
Wheelbase—Driving. 15 ft. 8 ins.; Truck	6 ft. 6 "
Total engine	26 " 11 "
Tender	16 " 6½ "
Engine and tender	53 " 9 "
Truck-pin to c. of lead. driv. wheel	8 " 0 "
Wheels having blind tires	Second pair.
Weight in Working Order.	
On driving wheels	124,990 lbs.
On truck wheels	41,000 "
Engine, total	165,190 "
Water in tank	37,500 "
Coal on tender	20,000 "
Weight of piston and rod	439 "
Weight of crosshead. .346 lbs.; Main rod	711¼"
Weight of front side rod	338 "
Back side rod	263 "
Cylinders.—(2)	20 × 26 ins.
Crosshead and guides	Alligator type.
Connecting rod, length between centers	10 ft. 8¼ ins.
Side rods	Solid ends.
Valve Gear.—Type	Stephenson link.
Ports, steam. .20 × 1⅝ ins.; Ports, exhaust	20 × 3 ins.
Bridges, width	5 "
Bridges, width	1⅜ "
Eccentrics, throw	5 "
Slide valves, balanced; max. travel	5½ "
" " ins. clearance. ⅛ in.; outs. lap.	1 "
" " lead in full forward gear (blind)	1-16 "
" " lead at 6 ins. cut-off, forward	¼ "
Boiler.—Type	Extended wagon top.
Diam. barrel, inside smallest ring	5 ft. 0 11-16 ins.
Dome, diameter	2 " 7½ "
Thickness, barrel plates	21-32 and ¾ in.
Smokebox tube-plate	¾ "
Horizontal seams	Sextuple riveted.
Circumferential seams	Double riveted.
Joints	Butt.
Height from rail to center line	8 ft. 9½ ins.
Length of smokebox, includ. extension	5 " 5 "
Does smokebox arrangement conform to M. M. Assoc rules?	Yes.
Injectors (2)	Hancock inspirator.
Working steam pressure	200 lbs.
Firebox.—Type	Wide, shallow; radial stays.
Length inside. .10 ft. 7 ins.; width inside	3 ft. 4⅛ ins.
Depth at front. . 6 " 4¾ " depth at back	5 " 5 "
Thickness, side plates	5-16 in.
" back plate	⅜ "
" crown plate	⅜ "
" tube plate	½ "
Crown stays . . . . . . .radial; Grate bars	rocking.
Is fire-brick arch used?	Yes.
Stay bolts (drilled), diameter	1 in.
" " pitch	about 3⅞ ins.
Water spaces front and back	4 "
" " sides	3½ "
Tubes.—(Iron), Number	291
Thickness . . . . .No. 12 W. G.; Pitch	2¾ ins.
Diameter, outside	2 "
Length over tube plates	15 ft. 0 "
Heating Surface and Grate Area.	
Heating surface, tubes (exterior area)	2,269.63 sq. ft.
" " firebox	185.85 " "
" " arch tubes	15.15 " "
" " total	2,470.63 " "
Grate area	33.44 " "
Miscellaneous.	
Exhaust nozzle (single), diameter	4¾, 5, 5¼ and 5½ ins.
" " distance below c. line of boiler	1½ "
Smokestack, diameter at top and base	16 "
" height above smokebox	3 ft. 1 in.
" height of top above rail	14 " 7¼ ins.
Capacity of tender tank	4,500 gallons.
Capacity of coal space	20,000 lbs.
Brake fittings, Westinghouse-American, outside equalized.	

* * *

NEW SHIP CANAL ENTRANCE TO THE HARBOR OF DULUTH, MINN.

(With two-page plate.)

The ship canal entrance to the harbor of Duluth, Minn., has been protected for some years past by two parallel piers, about 240 ft. apart and somewhat over 1,200 ft. in length. The increased size of the vessels now used on the lakes and the phenomenal growth of lake commerce have demanded the general improvement of this harbor and its entrance. Plans for the work were prepared some time ago under the supervision of Major Clinton B. Sears, Engineer Corps, U. S. A., in charge of government work on Lake Superior, and work is now in progress.

The harbor of Duluth now consists of the Duluth Canal, the Wisconsin entrance, Superior Bay, Allouez Bay, St. Louis Bay and St. Louis River to the limits of the cities of Duluth and Superior. These bays were once broad expanses of shallow water, averaging from 8 to 9 ft. in depth, except in the channel through them, and the original natural entrance was obstructed by shifting bars with 9 ft. of water. The works carried out by the U. S. government in past years have resulted in giving a good 16-ft. navigation through the natural or Wisconsin entrance; through the artificial Duluth Canal; over the Duluth Basin, of 104 acres; along and parallel to the dock lines of Duluth and Superior, and up the St. Louis River to New Duluth. The channels are well defined and are from 85 to 300 ft. in width. As before stated, however, commerce demanded deeper and wider channels, and a new project was authorized by Congress, on June 3, 1896, providing for the deepening of existing channels to 20 ft., the excavation of a new 20-ft. channel along Minnesota Point dock line, and for a general widening of channels and the creation of turning and anchorage basins 20 ft. deep. The project also includes the widening of the Duluth Canal, and replacing the piers of the Duluth Canal and Wisconsin entrance with substantial structures of timber and monolithic concrete. These plans demand an enormous amount of dredging, and contracts for dredging about 26,000,000 cu. yds. have been let, at an average of a trifle less than 8 cts. per cu. yd., to Williams, Green & Williams, of Duluth, Minn., and to Charles S. Barker, of Superior, Wis. This remarkably low price shows the economic value of the continuous contract system. The original estimate, based upon previous experience with intermittent appropriations, was 15 cts. per cu. yd. That the government is justified in making the expenditures necessary for the improvement of this port is shown by the fact that the lake commerce of Duluth and Superior amounted to over $112,000,000 in the navigation season of 1897; and since the United States took charge of this harbor this commerce has amounted to over $900,000,000.

The present descriptive matter and illustrations relate to the Duluth Canal entrance to Duluth harbor, and the plan given shows the location and general dimensions of the old and the new piers. This is probably the most interesting work included in the new project, from an engineering point of view, though somewhat similar work is to be performed at the Wisconsin entrance.

The contract has been let to King & Steele, for the construction of the substructure of the new south pier of the Duluth ship canal, through Minnesota Point, and a description of the work here proposed will answer practically for the whole improvement. We are indebted to the courtesy of Major Sears for the plans here used, and for the specifications relating to this work. These specifications show that the pier will consist of timber cribs, filled with stone and gravel, and resting upon piles cut off 22 ft. below low water datum. These cribs will be 24 and 36 ft. wide, with the tops extending to within one foot of datum, or low water; they will be built in sections of 50 and 100 ft. and the entire length of the south pier will be 1,722 ft. Resting upon these cribs will be a massive, concrete superstructure, generally 20 ft. wide at the base and extending to a height of 10 ft. above datum. The pierhead in the lake will be 36 ft. wide and 100 ft. long, and the channel face of the cribs will have an armor of 1-in. steel plate, to a depth of 7 ft. below the top, to protect the cribs from injury by vessels.

The character of the bottom material is clean sand, with a bed of gravel overlying the old Minnesota Point, about 13 ft. thick. A trench will first be dredged 26 ft. below datum and for the whole length of the pier, with a width sufficient to prevent any interference with the placing of the cribs. Piles, at least 9 ins. diameter at the small end, will be driven 4 ft. apart, on centers, longitudinally, and 4 and 5 ft. apart across the crib. Both the hammer and water-jet will be used in driving; and the final penetration will be 1 in. under the blow of a 2,000-lb. hammer falling 15 ft. The piles, when cut off, must be at least 17 ft. long, or penetrate the ground to a depth of 13 to 15 ft., thus making the pile about 43 ft. long before driving. A circular saw, mounted on a platform supported by the shoreward piles, will be employed in truly cutting off the piles 22 ft. below datum. The space between the heads of the piles will then be filled to within 6 ins. of the top of the piles with spawls and rock, not exceeding 1 cu. ft. in size, and gravel will be added to fill crevices and level the base to within a couple of inches of the tops of the piles. Protection piers, a pile dike and sheet piling along the trench slopes will be required for the protection of the work during its progress against lake storms, etc.

The pier cribs will be built as shown. The floor will be 8 ins. thick, laid close, with the under side flush; the timbers drift-bolted laterally, and alternate timbers secured by vertical machine bolts, 6 ft. long, passing up into the bulkheads. The channel side of the crib will be a double wall of 12 × 12-in. timbers; drift-bolted vertically, and machine-bolted horizontally. The rear side will be 12 ins. thick, and connecting these two walls will be transverse bulkheads, made of 10 × 12-in. timbers and, 4 ft. between centers, drift-bolted and with alternate sticks dovetailed into both walls. The cribs will be covered by 12 × 12-in. timbers near each side, and by 6 × 12-in. timbers for the remainder. Vertical posts, 10 × 10 ins., and 10 ft. 4 ins. long, will be bolted to the walls and bulkheads, as shown on the plan; and the timber to be used in these cribs will be white oak, for a certain number of courses near the top, and white pine or hemlock for the other parts. The pierhead cribs will be made stronger by the use of more oak, thicker bulkheads, double walls front and rear, and a double thickness of armor plate on the cutwater faces. All of these cribs are to be built in the harbor, towed into position and sunk by filling the pockets with rock and gravel in alternate 6-in. and 12-in. layers, commencing with the pierhead crib in the operation of sinking the piers and working towards the shore.

The pierhead crib, not shown here in detail, terminates in a cutwater having a central angle of 90° and sides about 25 ft. long, with the bulkheads arranged accordingly, and the whole crib strengthened throughout as outlined above. The cutwater will be faced with double 1-in. steel plates, for a height of 7 ft., riveted together and secured to the double timber wall by 1-in. machine-bolts with a counter sunk head in the plates. The under plate will return over the top of the upper timber, for a distance of 9 ins., and be bolted down by a 1-in. drift-bolt 24 ins. long and with counter-sunk head. The plates themselves will be generally about 8 ft. square, though these dimensions vary with positions.

At the ends of the several cribs the end bulkheads are 10 ins. back of the line of the floor, with four outside end-posts, as shown, bolted to the end bulkhead. Two sets of guide-stringers are built into the last two bulkheads, one set near the bottom and the other near the top of the crib. These 12 × 12-in. sticks project 9½ ins. beyond the line of the floor and are so spaced as to abut against the inside faces of the two middle guide posts on the opposing crib and serve as a guide in sinking. Before this space between two cribs is filled with ballast, a 4 × 6-in. timber, 19 ft. long, is run down to cover any space between the outside posts. This stick is secured in position by throwing in ballast against the bottom end and spiking the top. The pockets between the crib will then be completely filled with ballast. It is also specified that the last pocket in the crib is to be only half full of ballast before sinking to obviate any danger from the bulging of the ends before the cribs are in position.

The preliminary plans for the concrete superstructure, as designed by Major Sears, are shown herewith. This concrete work, with the exception of the footing blocks, will be built in place by depositing the concrete in molds forming sections of the full width of the pier and in lengths of 10 to 20 ft. The intention is to make each section as large as can be finished in one working day; and no layer of concrete will be allowed to set before the next is deposited and rammed. Four-sided molds will be used at first for alternate sections, and the intermediate sections will then be built with two-sided molds and a layer of tarred paper separating adjoining sections.

The footing blocks, 5 × 7 ft., and about 3 ft. high, will be molded on shore and then set close on the timber work to form the toe of the superstructure on each side of the crib. The only concrete deposited under water will thus be the limited space at the middle of the pier. American Portland cement will be used for these footing courses and natural cement for the remainder of the work. Beach gravel is abundant at the site of the work, and this will be used in the concrete and materially lessen the cost. A quantity of rubble stone will also be incorporated in the concrete, with suitable spaces between the stone, and the amount of concrete correspondingly lessened.

The steel plates on each crib are to be connected under water, after the cribs are sunk, by the use of straps 24 ins. wide, 8 ft. long and 1 in. thick. These plates will be secured in place by the "patch-bolts" shown. The strap will be punched and counter-sunk at the shop, and the drilling and tapping of the crib plates will be effected when they are in place by pneumatic tools operated by a diver. This arrangement will make a continuous line of well-connected 1-in. steel plates secured to the face of the cribs and reaching 8 ft. below low water datum. With a backing of 24 ins. of wall timber it is believed that these plates will efficiently protect the pier against all damage from ordinary collisions of vessels. In case two adjoining cribs do not exactly aline a special provision is made, as shown, for putting on the connecting straps.

* * *

A TEST OF THE HARDNESS OF CAST IRON.*

By Chas. A. Bauer, M. Am. Soc. M. E., Springfield, O.

Inasmuch as none of the previously known methods for determining the hardness of cast iron had proven to be practical, for a number of reasons, foremost among which was the impossibility of duplicating the results obtained, it became imperative that some method be devised that would be simple and yet reliable, and which would contain none of the objectionable features which are known to exist in other methods.

From the fact that a drill running at a uniform rate of speed and under a constant pressure, the number of revolutions which would be required to drill a given depth would be directly proportionate to the hardness of the material being tested, it was deemed expedient to formulate a method along these lines.

An ordinary drill press was equipped as follows: On the pinion shaft, which raises and lowers the spindle, is attached a disc 12 ins. in diameter, around the periphery of which is placed a light flexible wire cable, on the end of which is suspended a weight which maintains a constant pressure upon the drill. The standard drill is now placed in the chuck. The drill spindle has a revolution counter, and by means of magnets and an armature is controlled by the position of the drill in relation to the table. Adjustments are made so that the revolution counter is thrown into gear after the point of the drill is entirely embedded under the surface of the test piece, and out of gear when the spindle has descended from this point exactly one-half inch.

When the test is to be made the test bar is placed upon the table and the drill is brought down upon its surface; the feed lever is then unlatched. The drill is now rotated at a speed of 250 revolutions per minute, and the hole drilled. The revolution counter is electrically thrown into gear after the drill point is buried beneath the surface, and out of gear when the one-half inch from this point has been reached. The reading of the revolution counter now gives us the exact number of revolutions required to drill the one-half inch, and this we term the degrees of hardness. The more revolutions required, the harder the casting; slight variations in hardness being easily detected.

We have adopted, and would recommend as a standard, a ⅝-in. flat drill having an angle between its cutting edges of 120° and a clearance angle of 10°, running at a speed of about 250 revolutions per minute and having a constant pressure of 160 lbs.

The cutting angle may vary between 115° and 125° without affecting results, but the clearance angle should be 10°. The revolutions of the drill may vary between 240 and 260.

The pressure on the drill should be as near 160 pounds as possible in order to compare with results obtained elsewhere by this method, and should be determined while the drill is in motion. We have placed a small platform scale upon the drill table, then placed the test-piece on this scale and found the pressure to be 160 lbs. while making a test.

After the apparatus has been prepared and standardized, it is well to determine the hardness of a long test piece, which should then be put away and preserved as a standard. Any changes which may then take place can be entirely eliminated and results reduced to the standard by the formula,

$$\text{Degree of hardness} = \frac{Dr}{R},$$

in which D = the degrees of hardness of standard test piece; R = the number of revolutions of drill required to drill that piece under present condtions, and r = the number of revolutions obtained in drilling the piece, the hardness of which we wish to determine.

We make daily tests of our cast iron and mark each piece with its determined degree of hardness, and use any one of them to determine the change in the drill.

We have selected four test bars which represent four grades of hardness. Castings for our purpose should range between that determined for Bars Nos. 2 and 3; No. 1 would be considered too soft, while No. 4 would give us trouble in the machine shop and would surely bring in complaints. We repeated the hardness test on each bar, obtaining three results for each bar. We herewith submit results of these tests:

Bar.	Hardness.		
No. 1	130	128	129
No. 2	150	149	149
No. 3	170	168	167
No. 4	236	232	230

The greatest variation of results occurred in the drilling of the fourth bar, where it was less than 3%. We therefore believe that we have a reliable test and one that will prove of great practical value to all foundrymen.

* * *

A NEW TYPE OF HIGH POTENTIAL INSULATOR.

The insulator shown herewith represents the latest type of a form of insulator developed to meet the requirements of long distance electric transmission. In the early days of low tension and short distances the usual form of glass or porcelain insulators were found quite satisfactory. With increasing pressure it was found that leakage began to be a considerable and dangerous item. This was partially remedied by increasing the number of petticoats, thus increasing the distance over which leakage currents must pass to reach the supporting pin, and at the same time affording more certain drainage during rainy weather. The next difficulty was experienced with puncturing, that is, current piercing the insulation. The natural remedy was to increase the thickness and vary the material. The resulting type of insulator, commonly known as the "Locke," after its inventor, may be described as two insulators, one inside the other, held together by some cementing compound, such as sulphur. The insulator shown represents the latest type intended to obviate the difficulties mentioned. Like the "Locke," it consists of several pieces cemented together, the cementing material, however, being a glaze similar to that used in glazing porcelain ware. In this way the high insulating power of the glaze, which is considerably more than the semi-porous porcelain, is taken advantage of and, as will be seen in Figs. 1 and 2, six layers of glaze and two walls of glaze must be pierced before current can reach the iron pin R. Leakage from the petticoats to the pin is greatly reduced by making the pin also of porcelain. The method of manufacture of this insulator, as described in the patent (No. 601,195, March 22, 1898), is as follows:

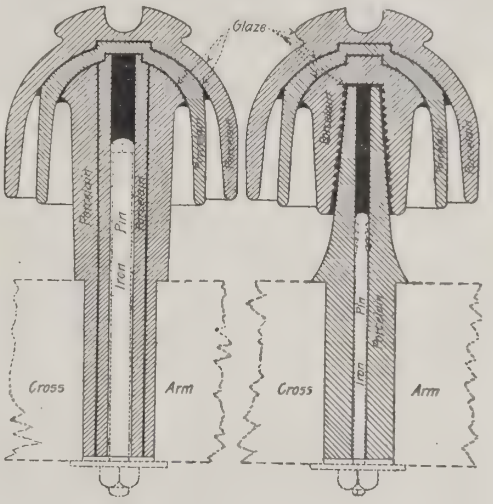


Fig. 1. Fig. 2.

THE BOCH HIGH POTENTIAL INSULATOR.
The R. Thomas & Sons Co., New York City.

The separately molded porcelain parts, after coming from the press, are dried separately, preferably in an oven or kiln, after the usual manner known as "biscuit firing"; when properly dried and ready for the vitrifying-kiln they are each coated with a glazing material, preferably all over, by dipping. The parts are then fitted together and turned upside down, i. e., drip edges up, forming a bowl into which the glazing liquid is poured until the space between the parts, represented by the black lines in the figure, is filled. The collection of parts is next carefully placed in the vitrifying-kiln and subjected to an intense heat, which melts the glaze and forms a solid, practically impenetrable layer or layers of the best kind of insulating material. The extra amount of glazing liquid prevents the formation of air spaces or cracks and fills all spaces resulting from a lack of correct fit or any shrinkage. Factory tests up to 60,000 volts have been made of this insulator with satisfactory results.

The insulators are manufactured, under patents granted to Mr. J. W. Boch, by the R. Thomas & Sons Co., 30 and 41 Cortlandt St., New York city.

* * *

THE COST OF BOILER ROOM LABOR.

A circular has been issued by the Mutual Boiler Insurance Co., 31 Milk St., Boston, Mass., for the information of its members, on "Cost of Boiler Room Labor." It is reprinted from a circular issued by the Steam Users' Association, Sept., 1896. Our readers may remember that the last-named association was organized by Mr. Edward Atkinson, president of the Manufacturers' Mutual Fire Insurance Association, for the purpose of acquiring and distributing among its members information on subjects related to the economy of steam and of fuel. The association had a life of only one year, but its unfinished work has been taken up by the Mutual Boiler Insurance Co., of which Mr. Atkinson is also president and Mr. R. S. Hale, who was the expert of the Steam Users' Association, is Consulting Engineer.

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*Condensed from a paper read at the Cincinnati meeting of the American Foundrymen's Association, June 7-10, 1898.

The circular on "Cost of Boiler Room Labor" is an interesting compilation from statistics furnished by over 100 factories in New England, New York, New Jersey and Pennsylvania, giving particulars of their boiler plants, wages paid to firemen, kind and amount of coal used, etc. The statistics are studied and arranged so as to throw all the light possible on the subject, and some interesting conclusions are drawn from them by Mr. Hale. Some of these conclusions are as follows:

> It takes no more hours of labor to fire a ton of hard coal than of soft coal.
>
> Firemen in hard coal plants receive higher wages by 50 cts. to $1 a week.
>
> The men fire more coal (about 15%) and receive more pay (about 10%) in the plants that run 24 hours a day instead of 10 hours a day.
>
> The cost gradually decreases as the size of the plant increases, becoming, however, nearly stationary at 200 tons per week.
>
> The labor per ton of coal is about 10% less for a steady load than for a variable load.
>
> Handling coal should cost about 1.6 cts. per ton up to five yards, and then about 0.1-ct. per ton per yard for each additional yard.
>
> Wages of firemen and work done per man are about the same in all the states named.
>
> One man (besides night man) can run engine and fire up to about 10 tons per week. One man (besides engineer and night man) can fire up to about 35 tons per week; two men to about 55 tons, and three men to about 80 tons. These figures assume that the night man does all he can of the banking, cleaning and starting. These figures are for average conditions.
>
> Mechanical stokers save 30 to 40% labor in very large plants, 20 to 30% in medium sized plants, and no labor in small plants.

The average figures obtained from 21 Eastern plants, using soft coal and running 10 hours a day are given below:

Plants using tons per week..	100 or over.	200 or over.	500 or over.	All plan's.
Number of plants averaged..	8	2	1	21
Tons coal per man per week.	26	28	33	21.3
Wages of firemen per week..	$10.99	$11.62	$13.25	$10.92
Cts. pr ton, all labor boilr-rm	.42	.42	.40	.52

Effect of Variable Load.

Plants with load..........	Steady.	Varying w'kly or monthly	Varying hourly.
Tons per man per week...	23.6	20.3	23.6
Cts. per ton.............	50	46	61

The lower cost in the plant where the load varies weekly or monthly (such as cotton mills with water power) is explained by the fact that these plants pay the lowest wages.

Effect of Forcing Boilers.

Rate of burning	Quick.	Medium.	Slow.
Sq.ft. grate for 1 ton per wk.	Undr 1.51	1.51 to 3	Over 3
Tons per man per week....	33.8	22.8	20.1
Wages of firemen per week..	$13.25	$11.47	$10.52
Cts. per ton	.40	.50	.54

The decrease in cost per ton as the rate of burning increases is said to be probably because the number of men allowed to a plant is based on the work the boilers might be called on to do, and not on the work they actually do.

Effect of Rate of Wages on Work Done.

Wages, firemen pr w'k.	$10 and under.	$10-$11	$11-$12	$12-$13	Over $13
Tons per man per w'k	22.2	20.3	21.2	20.5	25.3
Cts. per ton.	45	48	55	61	57

These figures do not seem to sustain the oft-repeated paradox that the "highest priced labor is the cheapest labor."

In Mr. Atkinson's introduction to this circular he calls attention to the fact that the average cost of shoveling coal in all the establishments reporting is 48 cts. per ton, while in one establishment the cost is only 26 cts. per ton. He then shows what a fine large sum would be saved to the mill owners if the average of 48 cts. was reduced to 26 cts. in all establishments, and says: "Why should not 26 cts. be the standard or objective point in nine-tenths of the boiler rooms of the factories and workshops where suitable space can be provided?"

We can tell Mr. Atkinson several reasons why. The establishment which averages only 26 cts. per ton as the cost of shoveling coal, burns 1,000 tons a week, runs 24 hours a day, employs 32 men, and pays them only $9.50 per week. It is quixotic for Mr. Atkinson to urge that small concerns employing only one to three firemen can reach any such figure for the cost of boiler-room labor, unless this establishment which shows the lowest cost is being run on an extravagant basis. Furthermore, we may remind Mr. Atkinson that with coal at the price which it is at most New England mills, it doesn't take long for a fireman to throw his wages into the furnace door. If it is attempted to economize by employing cheaper men as firemen or forcing them to shovel more coal than they can handle and fire carefully and economically, the mill treasurer will be apt to find that he has been saving at the spigot. There is plenty of waste going on in many boiler-rooms, but it is not usually in the direction of either too high wages or too little work for the men who attend the furnaces.

A NEW CONTINUOUS RECORDING OR INTEGRATING ENGINE INDICATOR.

The ordinary method of determining the power developed by a steam engine, by means of an indicator, is far from being satisfactory. Indicator cards can be taken only at intervals, and it frequently happens that just before or after the card is taken a change in load occurs, thus making it imperative that a considerable number of cards be taken to secure anything like accurate results. The diagrams thus obtained must be integrated, necessitating a laborious operation with the planimeter. The need, therefore, for some form of instrument which can be readily attached to any steam engine, and which will as readily give accurate measurement of the power developed by that engine, is too well known to be dwelt upon.

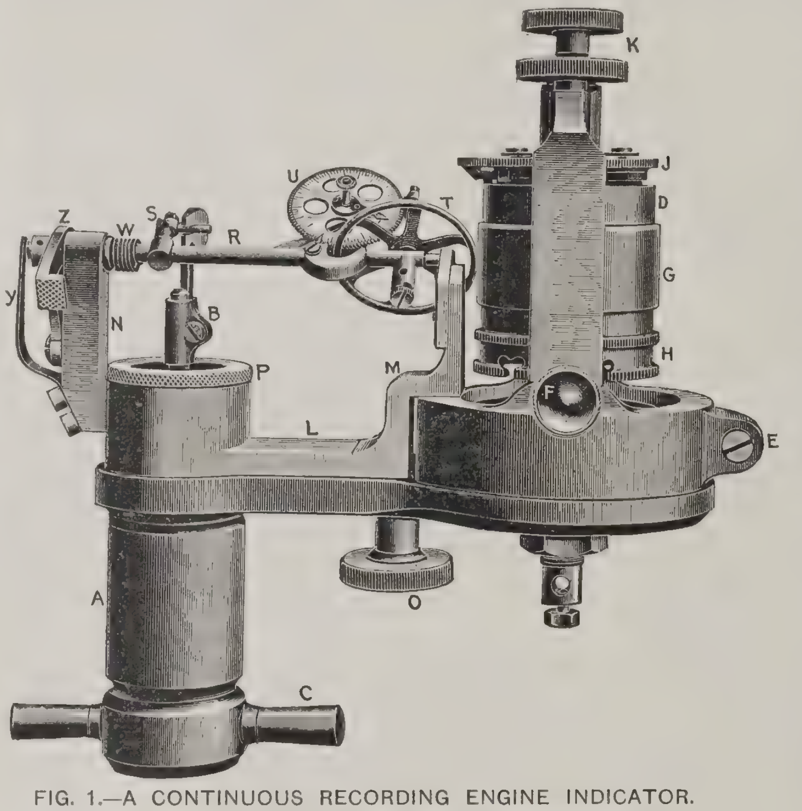

FIG. 1.—A CONTINUOUS RECORDING ENGINE INDICATOR.
W. G. Little, Bexley, Kent, Eng., Maker.

Many efforts have in the past been made to develop such an instrument, usually with small success, owing to the intricacy of the device or the delicacy of its parts. The instrument illustrated herewith is the latest and most successful of such attempts. It is the invention of Messrs. W. G. and C. W. G. Little, of Bexley, Kent, England, the former being at present the manufacturer of the indicator. Fig. 1 gives a fair general idea of its construction, showing also its simplicity. Briefly, the device can be best described by saying that the pencil movement of the ordinary indicator has been replaced by a planimeter wheel, rolling upon the drum as it is moved back and forth by the string attached to the crosshead in the usual way. This wheel is so connected to the indicator piston that as the pressure varies, the plane of the wheel is shifted relative to the axis of the drum.

Considering the parts separately, A is a steam cylinder containing the piston and spring, with the usual attachment screw coupling C and arm B. D is a drum provided with a coil drum, return spring, enclosed in the split case, E; F is a removable stop for the drum, D; G is a metal sleeve slipped on D and capable of being slid up or down, should its surface become worn by the indicator wheel; H is the groove in which the operating string is wound; J K is an ingenious device for measuring the length of the drum movement, and is supported just above the drum. It consists of a central piece upon which are two flat rings, one provided with a graduated scale, and the other with a vernier. By turning the knurled head, K, the inner ring is turned around until the projection on the swinging drum strikes a projection on the lower side of the ring. The other knurled screw is then turned until the drum projection strikes a lug on the vernier at the other end of its travel, when the exact stroke can be read directly on the scale and vernier at J to 0.005-in.

The integrating mechanism is mounted upon a separate frame, L M N, which can be removed from the cylinder by unscrewing the cap P. It consists essentially of a main axle, R, intersecting the axis of the drum, with an offset lever, S, and a planimeter wheel, T, with its axis at right angles to R, and two counting disks, U. The wheel, T, is dished so that the point of contact between it and the drum is always in the center line of R.

The recording device, U, consists of two toothed wheels engaging in a worm on the shaft of the wheel, T. The upper disk has 100 and the lower 99 teeth; the upper counter thus gains one division for each complete revolution of the lower. In this way considerable time may elapse between readings, as the counter can record 10,000 revolutions of the planimeter wheel. Two pointers are used, one on the frame, indicating units and tens of revolutions of the planimeter wheel, and the other on the counter indicating hundreds of revolutions of the counter.

Two styles of instrument are made, one for high speed engines, that is, above 200 revolutions per minute, for which a 1-in. travel is provided; the other for low speeds, with a large drum intended for a 2-in. travel. The drum speed in either case is not supposed to exceed 50 ft. per minute, and may be easily calculated by using the formula, Drum stroke × 2 × revolutions of engine per minute = speed in ft. per minute.

At the end of the shaft, R, is a coilspring, W, which holds the pin of the lever, S, against the bottom face of the crosshead, X, which is attached to the end of the piston rod. Y is a spring bearing on the cone end of R, its duty being to press the planimeter wheel, T, against the drum. Z is a device for applying or withdrawing T to start or stop registering.

To operate the instrument it is screwed onto the indicator stop cock, such as is usually found at the end of the engine cylinder. Some form of reducing motion is attached to the crosshead and the cord is adjusted to obtain the proper swing of the drum. The indicator spring should never be less than 20% above the maximum pressure obtainable at the engine. In starting, both pointers must rest on zero to avoid mistakes in reading. After turning on steam and allowing the instrument to warm up, indications can be taken by throwing the release Z, and noting the time. To stop registering Z is raised and the steam valve closed, the time being again noted. The following formula is then used for calculating the horse-power developed:

$(D^2 \times L \times K \times S) \times B =$ horse-power, in which

$D^2 =$ diameter of cylinder squared.

L = length of stroke of engine piston in ft.

K = constant of instrument =

$$0.000238 = \left(\frac{.7854}{33{,}000} \times 10\right).$$

S = scale of indicator spring.

s = stroke of drum in ins.

B = record on dial of instrument divided by the number of minutes run.

To obtain the mean effective pressure the formula

$$\frac{B}{\text{r. p. m.}} \times \frac{S \times 10}{s} = \text{M. E. P.}$$

is used.

This is based upon the fact that the dial record is always equal to one-tenth the area of a diagram which an ordinary indicator, with the same piston area, spring and a ratio of pencil to piston movement of 6 to 1, would give. To illustrate these formulae, assume an engine in which:

Diameter of piston = 6.5 ins. = D.
Length of stroke in ft. = .833 = L.
Scale of spring = 100 lbs. = S.
Instrument constant = 0.000238 = K.
Stroke of drum in ins. = 1.98 = s.
Record after 10 minutes = 90.

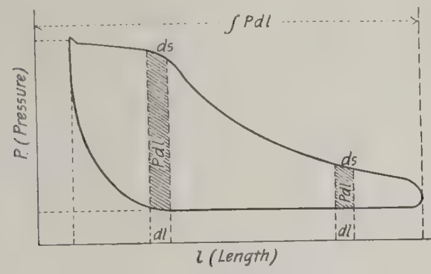

Fig. 2.—Indicator Diagram as a Measure of the Power Developed.

$$B = \frac{90}{10} = 9. \text{ for one minute, and}$$

$$6.5^2 \times .833 \times 0.000238 \times 100 = 0.837.$$

The record upon the dial is $\frac{1}{10}$ of an indicator diagram, $\frac{9}{1.98 \times 10} = 4.54,$ and .837 × 4.54 = 3.799 HP., or the power developed by the end of the engine cylinder to which the indicator was attached.

To determine the M. E. P. the dial is read for one minute, and the speed is taken for a like period. Assuming a speed of 212 revolutions per minute, and a reading of 9 on the dial for the same minute, then

$$\frac{B}{\text{r. p. m.}} = \frac{9}{212} = .0424$$

will be the record per revolution of the engine. The drum stroke is 1.98 ins., therefore, $\frac{.0424}{1.98} = .0214$, gives a value which, if multiplied by 100 (the indicator scale), and 10 (since the record is $\frac{1}{10}$ of the real), we have .0214 × 100 × 10 = 21.4 lbs. as the equivalent pressure which, if allowed to act on each square inch of the piston for the full stroke, would produce the same total effect, hence the M. E. P.

The theory upon which the instrument is based, and a proof of its correctness, may be illustrated by first considering the familiar indicator card such as that shown in Fig. 2. This curve shows the pressure at any instant, and the time through which that pressure is acting. If, instead of the pencil which traced this curve, we should use a roller or wheel, and desire to read directly from the wheel the power developed, it is essential that the circumferential movement produced must represent, either direct or proportionally, the product of the pressure and the distance through which that pressure acts, or again referring to Fig. 2, for the instant (d s), s representing time, the pressure acting is P, and the distance (d l). The power expended during the instant (d s) then will be P d l, and during the full stroke it will be the summation of all these efforts between the limits of the stroke, or

$$\int P\, d\, l.$$

If this movement is direct the dial could read direct; if proportional, a proportional factor must be used to determine the real power. As this instrument is constructed the proportional factor is 0.1.

To show that the circumferential movement obtained is proportional to the actual power, it is convenient to imagine the drum surface developed into a plane, as in Fig. 3. A B represents the direction of the motion of the drum, C D its axis of rotation, E F the plane of the planimeter wheel, G H the axis of the wheel, and O its point of contact with the drum. Suppose O K equal to the small length (d l) of Fig. 2, and O I equal to (d s). If we now move the wheel from O to K in the time (d t) there will be certain amount of slip and a certain amount of true rolling. The sum will be equivalent to sliding the wheel from O to I, and rolling from I to K, during which movement I K would correspond to the circumferential movement. Referring to Fig. 3, I K = O K sin φ, or since $\varphi = \beta$, I K = O K sin β, or d l sin β = distance moved by a point on the rolling surface of the wheel in the time (d t). Sin β or sin $\varphi = \frac{P}{L}$ (see Fig. 4), that is, sin β is proportional to P, or the pressure, and as has been already shown, the wheel movement is directly proportional to d l sin β. Hence, it is proportional to P d l, and also $\int$ P d l.

At first thought it would seem necessary to place the wheel, T (Fig. 1), perpendicular to the lever, S, but experience has shown that this is not the case, and as now constructed this angle is made about 35°, the object being to insure the necessary turning moment of the wheel at all angles apt to be encountered in working the instrument. In a series of careful experiments this angle of lead was also found to act as a compensating device balancing the small slip of the backward and forward motion in a most satisfactory manner.

Some experiments made by Prof. W. C. Unwin in 1895 gave excellent results, which compared very favorably with those obtained at the same time with a standard Crosby indicator. The early form has been improved until the instrument has now reached its present form, as shown in Fig. 1. Its accuracy is well shown in the following data, which represent comparative tests:

The first is a high speed test made at the works of Messrs. Willans & Robinson, Ltd., Rugby, Eng., on Dec. 22, 1897, using a standard Crosby indicator and a Little integrating indicator. Both were attached at the same time to the low pressure cylinder of a large engine running at 350 revolutions per minute on a steady electric load kept constant by adjusting resistance in the circuit:

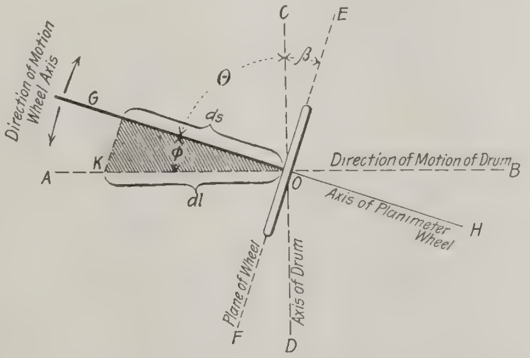

Fig. 3.—Drum Surface Developed into a Plane.

Crosby Indicator.

No.	Diagram, o'clock.	Planimeter. Start.	Planimeter. Stop.	Area.	Length.	Scale.	M. E.P.	Revolutions.
1.	4:12	0.0	0.91	0.91	2.1	50	21.67	350
2.	4:00	.91	1.83	.92	2.1	50	21.91	
3.	3:47	1.83	2.77	.94	2.1	50	22.38	

3) 65.96

21.986

Crosby M. E. P. = 21.986 lbs.

Continuous Indicator.

Time, mins.	Reading, Total.	Reading, For 5 mins.	Reading, Per minute.	Stroke of drum, ins.	Scale.	M.E.P.
5	50.5	50.5	10.1	1.09	80	21.18
10	102.2	51.7	10.34	1.09	80	21.68
15	154.5	52.3	10.46	1.09	80	21.93
20	208.5	54.0	10.8	1.09	80	21.65
25	260.2	51.7	10.34	1.09	80	21.68
30	313.2	53.0	10.6	1.09	80	22.23
35	366.0	52.8	10.56	1.09	80	22.14

·7) 153.49

21.927

Little M. E. P. = 21.927 lbs.

The second test, a slow speed one, was made at Messrs. Vicars, Sons & Maxim's Works, Erith, Eng., on Feb. 25, 1898, using a large simple condensing engine driving shop machinery, and is as follows:

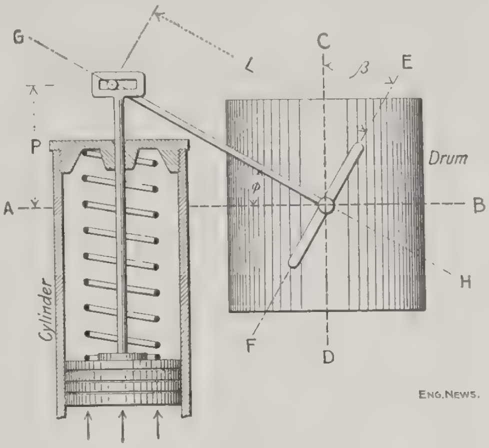

Fig. 4.—Diagram Illustrating Principle of Little's Indicator.

Crosby Indicator.

No.	Diagram, o'clock.	Areas.	Length.	Scale.	M. E. P.
1	3:55	1:74	3.02	50	Average, 28.1215.
2	4:00	1.87	3.00	50	
3	4:05	1.87	3.02	50	
4	4:10	1.70	3.02	50	
5	4:15	1.68	3.02	50	
6	4:20	1.56	3.01	50	
7	4:25	1.61	3.02	50	
8	4:30	1.81	3.02	50	
9	4:35	1.52	3.02	50	
10	4:40	1.62	3.04	50	

10 | 16.98 10 | 30.10

1.698 3.019

Crosby M. E. P. = 28.1215 lbs.

Continuous Indicator.

45 minutes' run: Total reading, 195.6; stroke of drum, 2.95 ins.; 100 spring; reading per minute, 4.3466; revolutions, 52.1.

$$\frac{4.3466 \times 100 \times 10}{2.95 \times 52.1} = 28.27.$$

Little M. E. P. = 28.27 lbs.

The instrument is for sale by W. G. Little, Bexley, Kent, England, the price being £14 10s. (about $72). We are indebted to Mr. Little for the material from which this description was prepared.

* * *

THE ENGINEER AS A USEFUL MEMBER OF SOCIETY.*

It is an all too common characteristic that the engineer is an engineer and nothing more. But this is not the stamp of engineer most needed, and therefore he is not fulfilling his greatest possible usefulness. The type of engineer I am advocating should be as follows: First, successful professionally; second, strong in business; third, influential socially.

Let us consider him along each of these lines. As a professional man he must necessarily be a well-trained man. This training may be the result of education or experience, or both. If he is consistent in his pursuit for it and is mentally endowed for it, he cannot but be strongminded. He must necessarily be a man of great application and concentration in whatever he undertakes. He is and must be honest. He does not hesitate to undertake the most unpromising tasks. He is, in brief, so constituted as to approach engineering tasks with indomitable courage and unfaltering assurance of success. He is cool-headed, slow to express a professional opinion, and, above all, a man who rarely asserts himself on subjects he knows little about. His course of study has been such as to make him essentially a man of clearly defined purpose. He counts not so much the financial as the mental profit in any undertaking. Thus far he is the engineer as he is publicly reputed to be, whether building vast edifices in our cities or opening up to civilization dense wildernesses.

Considering this ideal further, he should, as a business man, thoroughly understand the methods of the business world. He should know how commerce is conducted, the principles of banking, and how enterprises are organized and carried through. If there is any direction in which the average graduate from an engineering school is helpless, it is in that of understanding and being able to apply business principles. He is poorly qualified as a rule, even to the point of being able to protect himself. This partly arises from his concentration upon his preparatory engineering studies, and partly from his belief that engineering and commercial affairs are not in any sense kindred. He therefore enters upon his professional career pursuing purely engineering work. Subsequent opportunity rarely presents itself for him to acquire business experience, for the double reason that business men cannot entrust business affairs to inexperienced hands, and engineers who have attained some degree of professional reputation cannot afford to begin at the bottom of the commercial ladder. Quite too late for him to qualify himself, the average engineer begins to earnestly wish for a wider knowledge of business methods.

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*From an address by W. A. Layman, delivered at the commencement exercises at Rose Polytechnic Institute, June 16, 1898.

The ideal engineer will also play an influential part in social life. By social life I do not mean that existence eked out in so-called society circles. On the contrary, I mean social life in the broadest sense of fellowship with one's fellow men. The engineer so qualified will be interested in the political life of his immediate community, as well as that of the nation. He will study civil and criminal law to that extent which every good citizen is called upon to study it. He will contribute his share to the alleviation of distress, physical and political. He will mingle with his neighbors, studying to add to their comfort in and enjoyment of life. He will be a student of current affairs. He will make some study of literature. He will know what to read, and how to read and how to write. He will not necessarily be pre-eminent in social fields, but will be what is generally termed a well-informed and cultured man.

* * *

EXPERIMENTS UPON THE DURABILITY OF DIFFERENT METAL COATINGS IMMERSED IN SEA WATER.

In 1896 an interesting test was made at the Brooklyn Navy Yard to determine the relative durability of different protective coatings for metal when immersed in sea water. This test was conducted by Edward Smith & Co., of New York, under the personal direction of Prof. A. H. Sabin, Assoc. M. Am. Soc. C. E., of that firm, and with the permission and aid of the Navy Department. Briefly described the test consisted in covering thin plates of steel and aluminum with different protective coatings, placing these plates in cages and sinking the cages in about 6 ft. of water at the Navy Yard. The plates had an area of about 2 sq. ft. on each side and were so placed in the cages that both sides were fully exposed to the action of the water, which at this point is very foul with sewage and the collections of the harbor.

The cages were allowed to remain under water for six months and then were hauled out and an examination made of each. Altogether there were 84 plates. The results of this examination, the nature of the different coatings and other details of the test were published in a paper read before the American Society of Civil Engineers on Nov. 4, 1896, by Prof. Sabin. While this test led to a number of interesting conclusions, it showed the need also of further tests; and accordingly in the summer of 1897 another set of plates were immersed. This second set of plates was removed from the water on July 21, 1898, after an immersion of 13 months, in the presence of a number of engineers and visitors. The accompanying notes of the condition of these plates were taken by one of the editors of this journal, who was present, and examined them upon their removal from the water.

Altogether 133 plates were immersed in this second test. They were placed in six cages. Only two cages and half of a third could be recovered, however, and the accompanying table contains the result of the test of the 72 plates only, which these contained. An attempt will be made to dredge up the remaining plates for examination at some future date. Of the 72 plates recovered, twelve were plates which had undergone the 1896 tests and which were immersed a second time. These twelve plates were, therefore, immersed for 19 months altogether. The remaining 60 plates were new when immersed, and, as already stated, were under water for 13 months.

The different coatings with which the plates were covered are described in the table, and with a brief explanation these descriptions will be clear to nearly everyone. The ordinary oil and resin varnishes are made by compounding certain fossil resins with various proportions of refined linseed oil, and the essential differences in varnishes are due chiefly to the kinds of resin used and the proportion of oil. For convenience it is customary to assume 100 lbs. of resin as a unit. A 20-Kauri varnish, therefore, means a varnish resulting from compounding 20 gallons of oil with 100 lbs. of Kauri resin. A similar terminology is adopted for varnishes made of Zanzibar or Manila resin. Where the coating is described as "air dried" it is meant that is was allowed to dry onto the plate at ordinary temperature, and where it is described as "baked" it is meant that a heat of 215° to 240° F. was employed to bake the coating onto the plate.

In examining the plates they were simply removed from the cages, washed to remove the slime and loose marine growths, and inspected while wet. Only a few moments were given to the examination of each plate as it is intended to examine them more carefully when they have thoroughly dried. Until the results of this final study are collated it is, perhaps, best not to pass opinion upon the comparative behavior of the different coatings in detail. One or two broad conclusions, however, seem to follow from the facts given. It is pretty plain; (1) that whatever pigment is used, a more durable coating for marine work results if varnish is used as the vehicle than if oil is used; (2) that a varnish coating or a pigment and varnish coating seems to endure sea water better when baked on than when merely air dried on; (3) that white zinc is probably acted upon as little as any pigment which was used in the test, and (4) that enamel coatings baked on at high temperatures are apparently the most durable of any.

TABLE SHOWING RESULTS OF TESTS OF PROTECTIVE COATINGS APPLIED TO STEEL AND ALUMINUM PLATES IMMERSED FOR 13 MONTHS* IN SEA WATER AT BROOKLYN NAVY YARD.

No. of plate.	Character of vehicle.	Character of pigment.	Preparation.	Condition of plate and coating.
			Aluminum	Plates.
151	20 Kauri varnish	None.	Air dried.	Edges blistered; no considerable corrosion.
152	30 " "	"	"	Covering one-half gone; much corrosion.
153	40 " "	"	"	Covering mostly gone; badly corroded.
154	I X L No. 2 varnish......	"	"	Covering half gone; not badly corroded.
155	Spar varnish	"	"	Covering mostly soft; some corrosion, not deep.
156	Spar varnish	"	"	Somewhat more corroded than plate 155.
157	"Durable metal coating".	"	"	Hard; no corrosion; 20% blistered at edges.
158	"Pipe coating" baked	....	....	Good condition.
159	"Pipe coating" baked	....	....	Good condition.
160	30 Kauri varnish	White zinc.	Air dried.	Quite hard; top, good condition; bottom, blistered.
161	40 " "	"	"	Good condition.
162	30 Zanzibar varnish	"	"	Excellent condition; no corrosion; no blisters.
163	Spar varnish	"	"	Several large blisters; not deeply corroded.
164	20 Kauri varnish	None.	"	Covering three-fourths gone; badly corroded.
165	30 " "	"	"	Covering badly destroyed; much corrosion.
166	40 " "	"	"	Covering considerably blistered; not much corrosion.
167	I X L No. 2 varnish......	"	"	Covering considerably blistered; somewhat corroded.
168	Spar varnish	"	"	Coating soft; some blisters; not badly corroded.
169	"Durable metal coating"..	"	....	Hard; considerably blistered; very little corrosion.
170	30 Kauri varnish	White zinc.	Air dried.	Hard; few blisters; some corrosion.
171	40 " "	"	"	Considerably blistered and corroded.
172	30 Zanzibar varnish	"	"	Hard; no corrosion; no blisters.
173	Spar varnish	"	"	Hard; no corrosion.
174	Pipe coating baked	....	....	Good condition; no corrosion; no blisters.
175	Pipe coating baked	....	....	Good condition.
...	Mitchell's	White enamel.	....	Excellent condition.
			Steel Plates.	
251	40 Kauri varnish	Ultramarine blue.	Air dried.	Many small blisters; little corrosion.
252	Raw oil	"	"	Coating practically gone; uniformly corroded.
253	20 Kauri varnish	Graphite.	"	Blistered slightly; very little corrosion.
254	30 " "	"	"	Few small blisters; no corrosion.
255	40 " "	"	"	Many small blisters; no corrosion.
256	Raw oil	"	"	Coating destroyed.
257	20 Kauri varnish	Keystone.	"	Many pin-head blisters, but generally good.
258	30 " "	"	"	Pin head blisters; no corrosion.
259	40 Kauri varnish	"	"	Pin head blisters; no corrosion.
260	Raw oil	"	"	Coating destroyed; badly corroded.
261	20 Kauri varnish	Red iron oxide.	"	Blistered some; not badly corroded.
262	30 " "	"	"	Many small blisters; some corrosion.
263	40 " "	"	"	Many pin-head blisters; some corrosion.
264	Raw oil	"	"	Coating practically destroyed; badly rusted.
265	" "	Red lead.	"	" mostly gone; considerable corrosion.
267	" "	Prince's metallic.	"	" practically destroyed; badly rusted.
268	" "	Purple oxide.	"	" practically destroyed; badly rusted.
269	Eureka paint	....	"	" badly destroyed; badly rusted.
270	Detroit graphite paint.....	....	"	" destroyed; badly corroded.
272	Bowles' paint.	....	"	Good condition; few blisters.
273	Rahtjens paint	....	"	Coating badly gone; considerable corrosion; few barnacles.
274	McInnis paint	....	"	Very good condition; no barnacles.
275	International Holtzapfel..	....	"	Coat'g badly gone; considerably corroded; sm'l barnacles.
277	Red lead and white zinc ..	....	"	Soft, gone in spots; corroded on edges.
278	Red lead and white zinc ..	....	"	Soft, gone in spots; corroded on edges.
281	20 Kauri varnish	None.	"	Discolored on edges by rust; not deeply rusted.
282	30 " "	"	"	Small blisters; not deeply corroded.
283	40 " "	"	"	Pin-head blisters; not deeply corroded.
284	30 manila varnish	"	"	Numerous small blisters; not deeply corroded.
285	30 Zanzibar varnish	"	"	Many pin-head blisters; little corrosion.
286	Spar varnish	"	"	Badly destroyed; considerable corrosion.
287	I X L No. 2 varnish	"	"	Many pin-head blisters; not much corrosion.
288	Raw oil	"	"	Coating destroyed; badly corroded.
289	Durable metal coating ...	....	"	Many small blisters; little corrosion.
			Steel Plates Reimmersed after 1896 Test.	
1	20 Kauri varnish	Flake white.	Air dried.	Rusted on edges; discolored; good condition otherwise.
2	20 " "	"	Baked.	Rusted on edges; discolored; good condition otherwise.
16	20 manila varnish	White zinc.	"	Some blisters; one side considerably corroded.
18	8 " "	Flake white.	"	Hard; pretty good condition.
20	30 Zanzibar varnish	White zinc.	"	No blisters; no corrosion.
22	20 Zanzibar varnish	"	"	Few blisters; some corrosion; hard.
35	Sabin Process pipe coating enamel........		....	Some corrosion on one edge; otherwise good condition.
			Aluminum Plates Reimmersed after 1896 Test.	
113	Sabin Process pipe coating enamel........		....	Two small blisters; otherwise good condition.
104	White zinc ground in varnish, one side baked.........			Three or four small blisters; otherwise good condition.
122	White zinc ground in varnish, one side baked.........			Three or four small blisters; otherwise good condition.
105	Chromium oxide ground in varnish, one side baked....			Few small blisters; generally excellent condition.
124	Spar varnish, one side baked			Two or three small blisters; no considerable corrosion.

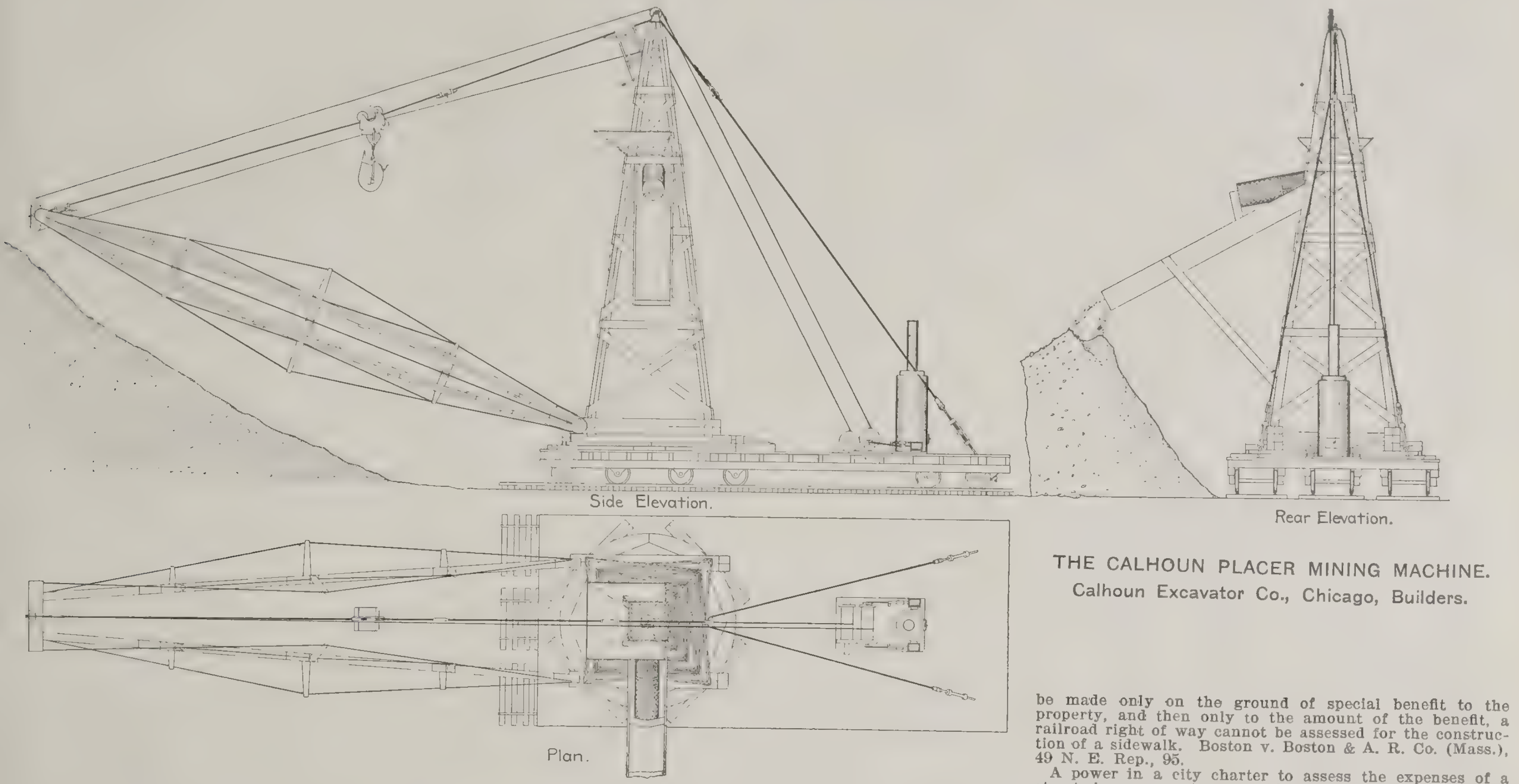
*The twelve plates from the 1896 test were immersed six months longer than the others, or nineteen months altogether.

* * *

THE CALHOUN PLACER MINING MACHINE.

The cheap and simple apparatus for placer mining and gravel washing, which is shown in the accompanying cut, is an adaptation to this particular work of the Calhoun excavating machine, which was illustrated and described in detail in our issue of April 15, 1897.

The machine is entirely self-contained, and consists of a tower, boom, hoisting plant and washing plant, all mounted on a large platform car running on three sets of tracks. The tower rests on a pivoted turntable, so that the boom can be swung to either side and make a cut sufficiently wide for the progress of the machine. At the rear of the car are placed the hoisting engine, pumps, etc. Near the front end of the car is the frame tower, about 50 ft. high, over the top of which pass the running, hauling and tail ropes. In this tower is a hopper, discharging into a revolving screen placed over an inclined chute. This chute has two floors, the upper one carrying the coarser material, which passes through the end of the screen, while the lower one forms the riffle box for retaining the gold carried down with the finer gravel, which passes through the meshes of the screen. The lower floor can be made of sufficient width to admit of several partitions, thus giving a greater surface of riffles. A pump supplies a continuous stream of water to the hopper and the riffle box, and the debris is delivered clear of the cut and out of the way of the machine.



THE CALHOUN PLACER MINING MACHINE.

Calhoun Excavator Co., Chicago, Builders.

From the front side of the bottom of the tower extends a double boom about 70 ft. long, composed of two trussed members connected at their outer ends by a transverse timber, to which is attached the running rope, and on which are the sheaves for the tail rope. The running rope passes over the tower and has at its rear end a sheave, through which passes the back-stay cable, whose ends are attached by turnbuckles to anchors at the rear corners of the car. This arrangement permits of adjusting the slope or angle of the boom. The tail rope passes from the rear drum of the hoisting engine over the top of the tower, down to the end of the boom and back to the carriage, to which its end is attached. The hauling rope is also attached to the carriage, and passes under a sheave in the bail of the bucket, over a guide sheave in the carriage and back through the top of the tower to the front drum of the engine.

In the illustration the carriage is shown on its trip up with a loaded bucket. On reaching the tower the bucket is reversed and emptied by the tripping device, and is then started downward by the tail rope. When it reaches the detaching device on the hauling rope (which is placed just over the toe of the slope), the bucket is released from the carriage and drops vertically to the ground, where it automatically takes position for loading as it is pulled up the slope. Meanwhile, the carriage is pulled on down the running rope and is automatically locked by a latch at the end of the boom until the loaded bucket is again in place and locked to the carriage, when the catch is released. With proper handling, the bucket can make one trip per minute.

The machine may be built of wood, and has been designed for strength and durability under hard work and rough usage. Buckets of ½, 1 or 1½ cu. yds. capacity may be used. It is manufactured by the Calhoun Excavator Co., 628 Unity Building, Chicago, Ill., and further information will be furnished by the manufacturers on application. The California Wire Works, of San Francisco, Cal., have the agency of the Calhoun excavator for the Pacific Coast states, and will furnish information to interested parties in that territory.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Damage for Trolley Poles.

The poles and wires of an electric railway are an additional burden upon the street, not contemplated in the original dedication, made by a plat filed in accordance with law, and the abutting lot owners are entitled to whatever damages their property has sustained by reason of such location, especially where they interfere with his ingress and egress from his lots. Jayne v. Omaha St. Ry. Co. (Neb.), 74 N. W. Rep., 67.

Liability on Acceptance of Defective Work.

A contractor is entitled to recover from the other party who accepts the work and receives the benefit from it, although there was not a strict compliance with the special contract under which it was done, the contract price less such sum as will fully compensate the other party for the imperfections of the work or insufficiency of the materials. Smith v. Packard, 27 Southeastern Rep. 586.

Liability to Repair Pavement.

A contractor cannot avoid effect of provisions of his contract that he shall keep the pavements in good repair for a certain number of years, without cost or expense to the city, and that he shall assume the risk of damage to the work which may be occasioned by the caving in of the street, or from any other cause whatever, upon the ground that the caving rendering the repairs necessary was the result of the negligence of the city in filling such excavations before he did his work, and of which he had no notice. Warren-Scharf Pav. Co. v. St. Paul, 72 N. W. Rep. 711.

Railroads and Street Assessments.

Since assessments, under the laws of Massachusetts, can be made only on the ground of special benefit to the property, and then only to the amount of the benefit, a railroad right of way cannot be assessed for the construction of a sidewalk. Boston v. Boston & A. R. Co. (Mass.), 49 N. E. Rep., 95.

A power in a city charter to assess the expenses of a street improvement upon "lots and parcels of land" deemed benefited by the improvement confers no authority to assess on the tracks, ties, or franchises of a street railroad company. Conway v. Rochester, 49 N. Y. Supp. Rep., 489.

Liability for Flow from City Drains.

A municipal corporation which has increased the flow of water in a certain direction is only bound to exercise reasonable care in providing means for carrying off the surplus; it is not an insurer against unprecedented floods or cloud bursts. Keithsburg v. Simpson (Ill.), 70 Ill. App. Ct. Rep., 467.

A village by connecting its sewers, etc., with private drains, and draining the surface water of streets and sewers into same, becomes responsible for damage done by polluted water passing through them, to the same extent as it had originally connected such private drains, and is liable for the whole of the damage. Kewaunee v. Ladd, 68 Ill. App. Ct. Rep., 154.

WEATHER TABLE FOR JUNE, 1898. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Degrees Fahrenheit.)				Wind.			Precipitation. Inches and hundredths.		
						Velocity in miles per hour.		Direction at time of max. velocity.			
		Average.	Max.	Min.	Range.	Average	Max.		Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt........	62.4	86	36	50	7.6	36	SW	2.28	0.60	14
	Portland, Me.........	61.3	89	45	44	6.9	24	S	3.98	1.13	15
	New York City.......	68.9	89	53	36	10.9	40	SW	1.28	0.30	9
	Pittsburg, Pa....	73.8	92	55	37	5 7	48	NW	3 98	1.35	10
	Chicago, Ill....	68.8	90	52	38	15.3	50	SW	5.30	2.50	10
	Omaha, Neb.	73.9	95	55	40	7.6	28	SE	5.16	2.94	10
	St. Paul, Minn.	68.2	93	49	44	7.3	36	NW	2.71	0.90	12
	Duluth, Minn........	57.0	88	38	50	8.9	32	NE	3.52	0.97	12
	Bismarck, N. Dak....	64.4	95	40	55	10.7	40	NW	1.21	0.50	7
	Average............	66.5	91	47	44	9.0	37	——	3.27	1.24	11
Southern Cities.	Washington, D. C....	73.5	97	53	44	5.6	30	NW	1.33	0.80	5
	Louisville, Ky........	77 4	94	58	36	7.0	45	S	5.00	2.35	7
	St Louis, Mo.........	77 8	92	61	31	7.7	37	SW	3.85.	1.59	9
	Savannah, Ga........	80 4	97	65	32	7.5	28	W	4.58	1.64	8
	Kansas City, Mo.	76 0	93	63	30	7.2	30	NW	6.05	1.73	14
	Jacksonville, Fla	81.4	96	64	32	7.6	36	SW	2.13	0.85	8
	Chattanooga, Tenn..	78.1	97	59	38	5.8	40	SW	4.05	1.88	9
	New Orleans, La.....	81.0	91	70	21	6.6	34	SE	3.79	1.18	11
	Memphis, Tenn.......	79.6	92	65	27	7.7	52	W	2.76	.89	12
	Palestine, Tex.	78.6	93	64	29	5.7	28	S	5.50	1.81	18
	Average............	78.4	94	62	32	6.8	36	——	3.90	1.47	10
Western Cities.	Helena, Mont........	58.5	88	37	51	7.5	36	SW	3.52	1.14	14
	Port Angeles, Wash..	54.9	74	42	32	7.8	24	NW	1.24	0 43	10
	San Francisco, Cal ..	59 0	89	49	40	13.1	40	W	0.19	0.18	2
	Salt Lake City, Utah.	67.1	96	33	63	6.6	37	NW	1.45	0 90	6
	Santa Fe, N. Mex....	64.2	91	41	50	6.1	30	SE	1.53	0.70	8
	Denver, Colo.........	67 0	98	41	57	7.7	41	S	0.94	0.33	8
	Yuma, Ariz	——	——	—	——	——	——	——	——	——	——
	Average............	61.8	89	40	49	7.8	35	——	1.48	0.61	8

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Our readers who may be searching for amusement in these midsummer days, cannot do better than turn back to our issue of May 12, in which we reprinted the comments of "The Engineer," of London, on "Spain's Armored Cruisers." With the results of the Santiago engagement fresh in mind, it is highly entertaining to read the following:

> We find, therefore, that to all intents and purposes the Spanish "Vizcaya" class are battleships of the second class. * * * * The "Cristobal Colon" could and no doubt will "lie in the line" if there is a naval action; she is proof against every sort of shell. Except her and the "Pedro d'Aragon," now building, which carry 10-in. guns, all the Spanish armored cruisers carry a couple of 11-in. guns; very good pieces, able to penetrate all the armor on the American battleship's guns.
>
> The American armored cruisers are quite different; they are really armored cruisers. Their belts, instead of being 12-in. steel, as in the "Vizcaya's," are of 3-in. steel only; their big guns are only of 8-in. caliber. Now, an 8-in. projectile is quite useless against the belts of the "Vizcaya's," or against their barbettes, and in engaging such ships shell fire alone could be depended on to do anything. Of course, shell fire is the staple attack, but the "Brooklyn" and "New York" can do nothing against the Spaniards, with their comparatively feeble 8-in. shell, that the Spaniards cannot do against them with a far more powerful gun. It is rank heresy, maybe, but we cannot but hold that there is a tendency to unduly glorify the small quick-fire gun or the medium-sized 8-in. The chances of hitting are, of course, greater with the smaller weapon, both from its extra rapidity and its extra numerical quantity; but when the big shot does hit its effect will be, of course, far greater.

The latest news from Santiago is that the wrecks of the Spanish cruisers show eight 4-in., twenty 5-in., ten 8-in. and only two 12 or 13-in. shot holes above their present water lines. In view of this record "The Engineer" will probably modify its opinion as to the effectiveness of the 5-in. and 8-in. guns on the American vessels. The fitness of the "Colon" to "lie in the line" seems to be proved, but it is in line with the other wrecks on the Cuban coast and not in the line of battle.

◆

The issue of "The Engineer" of July 8, contains some very unique comments upon the Santiago battle; its information has evidently been gathered from highly inaccurate sources, and its criticism is correspondingly wide of the mark. It betrays the most astonishment that the American vessels were so promptly got under way, when the Spanish cruisers appeared. "It is difficult to believe," it says, "that the American ships could have remained under full steam habitually, yet it is clear that they were so when the Spanish fleet came out. * * * * We must conclude, that if, as they say, they were taken by surprise, they were fortunate enough to have steam up for some other purpose."

Our contemporary is evidently a long way from comprehending the way they do things in the American navy. Upon the fleet before Santiago was placed the responsibility of preventing the escape of Cervera's cruisers. These were assumed to be ships of speed enough to escape from any of our battleships and power enough to defeat any of our other vessels. The sequel showed, indeed, that neither of these assumptions were true; and there were, of course, many reports before the battle as to the defective condition of the machinery and hulls of the Spanish vessels. The American commanders, however, would have been derelict in their duty had they allowed such reports to influence their action. Their business was to keep at all times sufficient vessels at the harbor entrance and ready for instant action to fight and destroy Cervera's fleet should it issue forth. To lie with fires banked and steam down, as the Spanish fleet did at Manila, would have been crass stupidity. It is safe to say that in all the weeks our vessels mounted guard off Santiago, there was never a time when furnace fires were not kept bright enough to keep up steam in the boilers, so that the ships could get under way at a moment's notice.

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Other conjectures of "The Engineer" are hardly less amusing; but it caps the climax at the close with the following:

> The American fire was sufficiently well aimed to tell, while the whole of the Spanish fire seems to have been wasted. Even the Chinese at Yalu produced much greater effect with their unsuitable solid steel shot than the Spanish guns on this occasion. This suggests a ghastly possibility. Did the Spanish fire blank, owing to the absence of projectiles? Some shot they doubtless had; even the splashes prove this, but they may have been very few.

We have heard much from various sources as to the inefficiency of the Spanish navy; but "The Engineer's" conjecture that Cervera's fleet came across the Atlantic to take part in the war with its magazines chiefly supplied with blank cartridges is a little beyond belief. "The Engineer," we may remark, is in a chronic state of worry over shortness of ammunition. It is sure that Dewey's squadron has not enough left to bombard Manila with, and it has presented figures to prove that the American vessels at Santiago ought to have used up all their ammunition in fifteen minutes. But it apparently forgets that Cervera's vessels had never been in action at all until they came out of Santiago Bay to try and make their escape. If they ever had any ammunition, they had it then; and if they had nothing but blank cartridges they would have never taken the trouble to fire their guns.

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Since the above was in type, "The Engineer," of July 15 has come to hand, in which we find further comments on the Santiago battle and more preposterous delusions as to the facts. Our contemporary still cherishes the idea that the American fleet maintained its blockade of Santiago with banked fires, and says it has now heard that "it had been apparent to the American ships that the Spanish ships were getting up steam and, consequently, they did the same." It then proceeds to draw with great gravity, as one of the lessons taught by the war, the following:

> To make a dash through a superior fleet, it is desirable to secure the lead in getting up steam.

Our contemporary's misinformation is by no means confined to this point, however. It is in a state of profound astonishment as to the "total disproportion in the effect of the American guns to that of the Spanish." In attempting to explain this, it seizes on a rumor that some of the principal guns had been removed from the Spanish ships, and declares that "this is too awful to call for comment."

From the same trustworthy informant, we presume, it has heard that the torpedoes on the Spanish vessels "seems to have lain on deck and formed mines for the enemy's shells to explode." On the basis of such cock-and-bull stories as these our contemporary adds the following gems to its list of "lessons taught by the war":

> A ship loses in fighting power if she omits to take her principal guns on board.
>
> Shots that only strike the water and make splashes produce no real effect on an enemy unless he is strangely nervous, consequently even quick fire is no use unless well directed.
>
> Torpedoes should not be left about exposed under a hot fire.

These and other "lessons" of similar profundity our contemporary propounds with the gravity befitting an original discoverer of great truths. It is to be hoped that the folly of "only striking the water and making splashes in the hope of producing an effect upon the enemy" will be appreciated in future by all naval commanders. To quote again our highly entertaining contemporary:

> Nay, apparently, had they fired a quantity of blank cartridges which made a thick smoke they would have done the Americans nearly as much harm as they did and perhaps made it more difficult to deliver a well-aimed fire at them.

After this we can only congratulate ourselves that the author of these novel naval tactics was not in command of the Spanish fleet.

◆

The New York Canal traffic thus far this season has fallen far below even the low record of last year. The total to July 16 is but 5,453,000 bushels, against 7,238,000 bushels in the same time last year. The poor showing is ascribed to the numerous breaks in the canal, which have delayed the boats, and to the opening of the canals a week later than usual. On the other hand, the total grain receipts at New York since May 1 have been more than 7,000,000 bushels larger than last year; and the elevator pool at Buffalo, which has for so many years been denounced as the chief enemy of the canals, has been broken. Instead of the old standard rate of ⅞-ct. per bushel for elevating grain at Buffalo, the rate this year has dropped as low as ⅛-ct. The railways, however, also have the benefit of the lower elevator charge, and it is said that they are now transferring grain from Lake steamers to cars at Buffalo in some cases without charge. Another notable fact is that nearly all the canal grain traffic has been in corn and oats. Only 16,000 bushels of wheat have been shipped by canal up to date this season, while the railways have brought to New York nearly 17,000,000 bushels. Apparently, in the rapid fluctuations of the market the slightly cheaper rate on the canal has cut no figure in comparison with the greater dispatch of the railway. The grain shipper had rather pay two or three cents more a bushel than run the risk of a drop in price of three or four times that amount. In view of the fact that since the canals opened the railways have carried seven-eighths of the grain traffic, and that the total amount of grain coming to New York has increased at the same time that the canal traffic has fallen off, those who urge the maintenance of the canals as essential to New York's supremacy in the export trade may find it necessary to revise their opinions.

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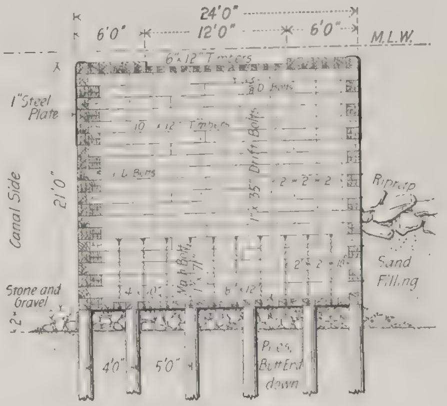
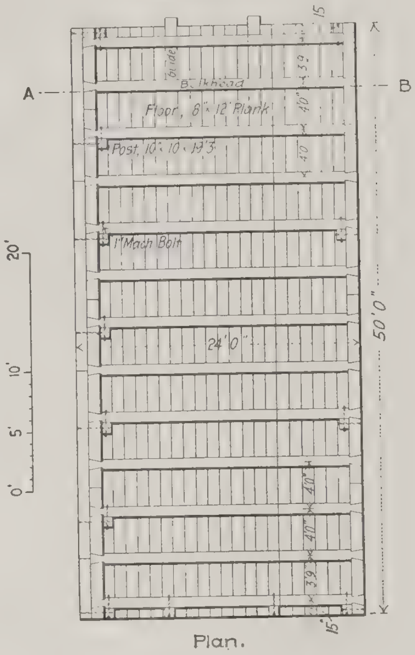
A test of the Ellithorpe air cushion for elevators was made in the new Empire Building, Broadway and Rector St., New York city, on July 18. The building is 20 stories high. The air cushion is formed by making that portion of the elevator shaft from the basement to the level of the third floor an enclosed well, with sides of riveted steel plates and steel doors which are enclosed in strong frames in such a manner as to prevent their being blown out by the air pressure which would be developed by the sudden descent of a car. The test was made by suspending by a short rope from the bottom of the regular elevator car, another car, an old one, weighing about 2,000 lbs. This was raised to the top of the shaft, the rope was cut and it fell. On the floor of the old elevator were arranged a dozen eggs, four glasses of water, and the globe of an incandescent lamp, with the idea, says a press report of the test, that if they passed through the ordeal a man could safely do so. A preliminary test was made by dropping the car from the 10th story. The eggs and the lamp globe remained unbroken, and only a few drops of water were spilled. Then the test was made by dropping the car from the 20th story. The report states that its velocity when it passed the third

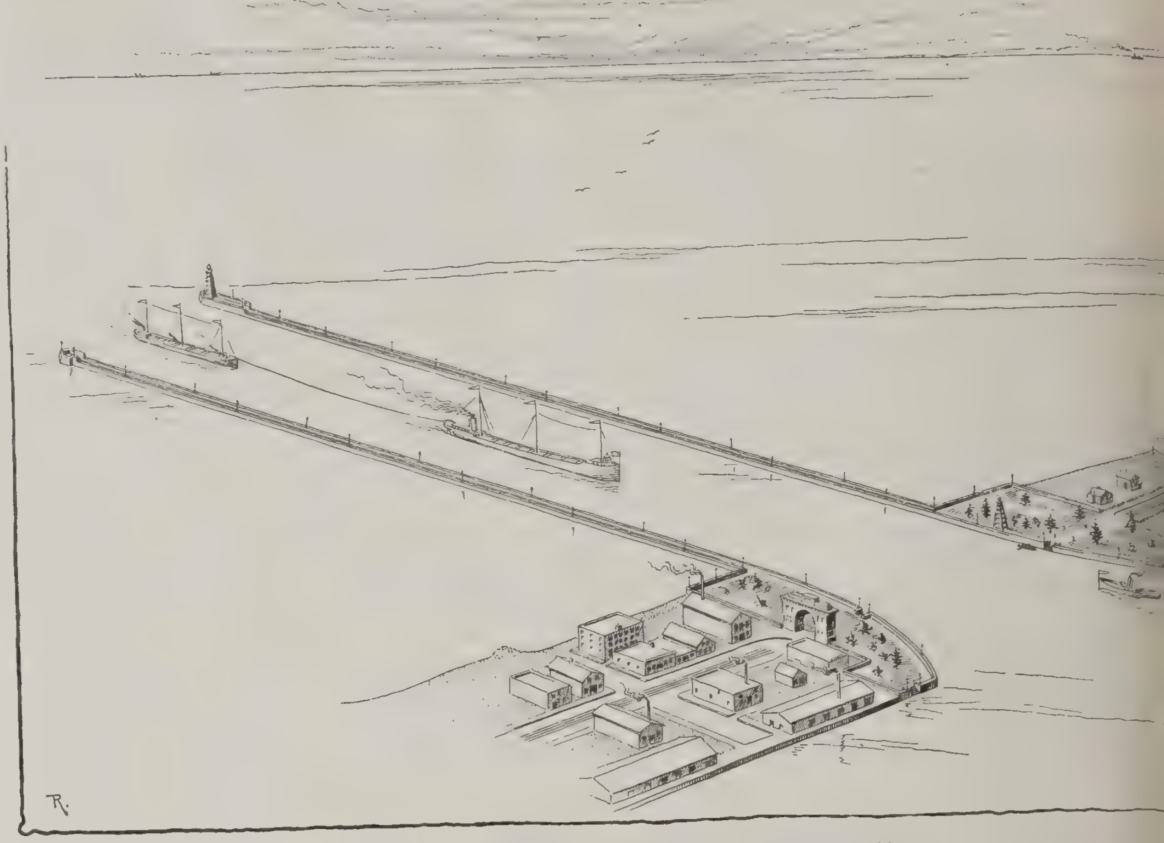


Cross Section A-B.

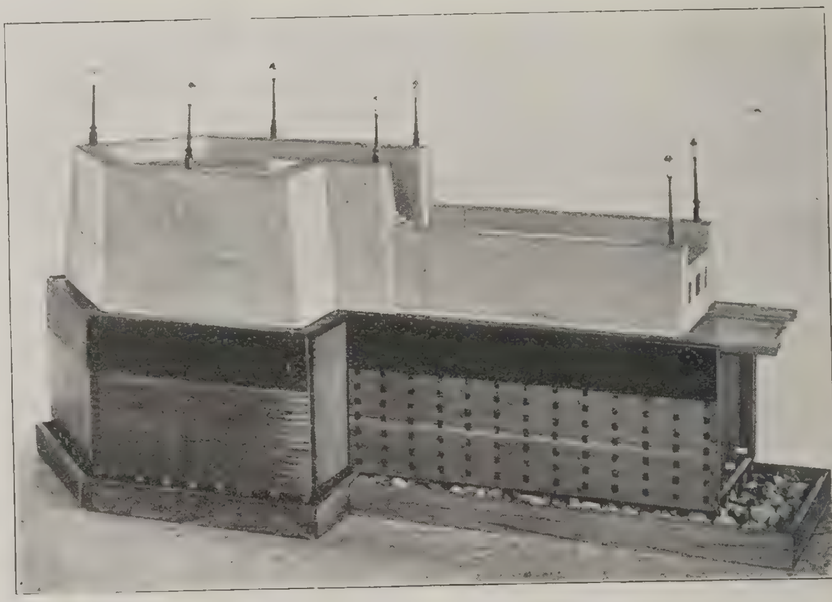


Plan.

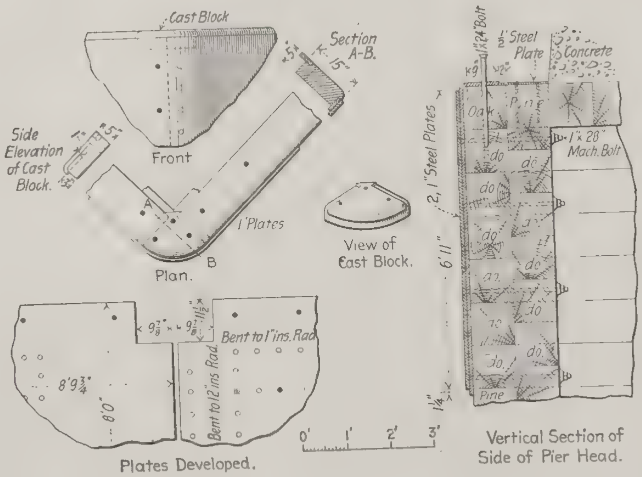
CRIB DETAILS OF MAIN-PIER.



PERSPECTIVE VIEW OF SHIP-CANAL.



MODEL OF PIER-HEAD AND CRIB.

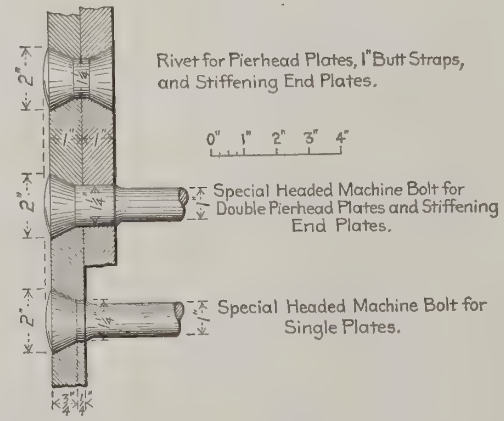


Plan.

Plates Developed.

Vertical Section of Side of Pier Head.

ARRANGEMENT OF PLATES ON PIER-HEAD.

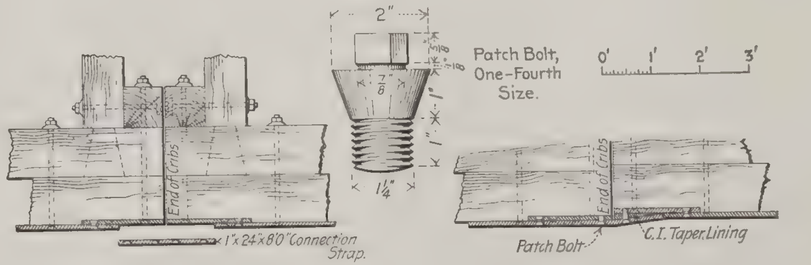


Rivet for Pierhead Plates, 1" Butt Straps, and Stiffening End Plates.

Special Headed Machine Bolt for Double Pierhead Plates and Stiffening End Plates.

Special Headed Machine Bolt for Single Plates.

TYPICAL RIVETS AND BOLTS FOR FASTENING PLATES.

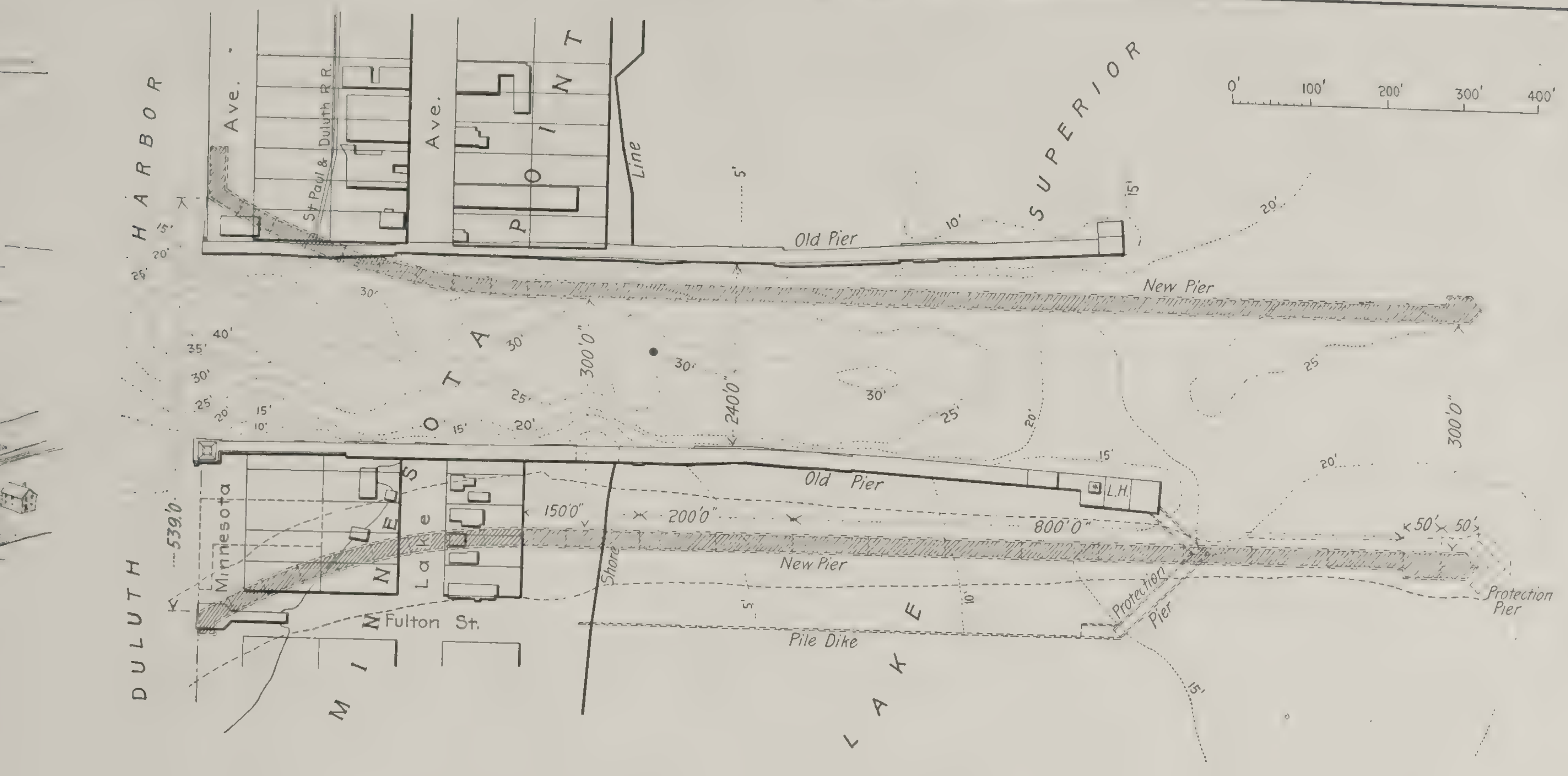


Patch Bolt, One-Fourth Size.

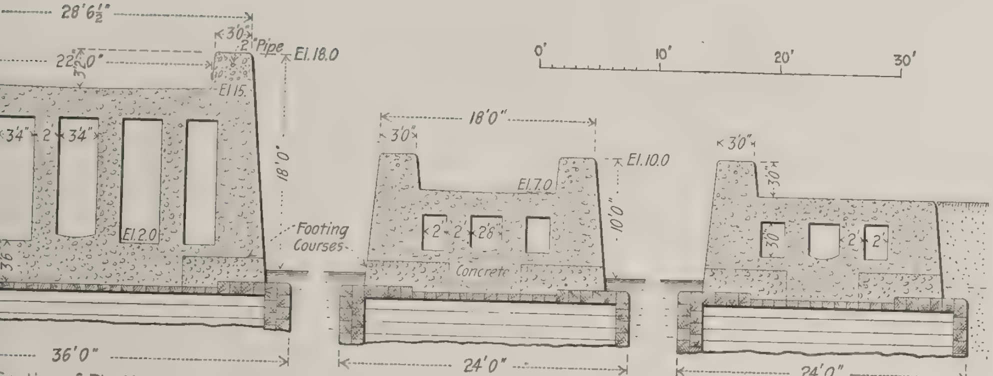
Cribs of Equal Width.

Cribs of Differing Widths.

METHOD OF JOINING CRIBS BY CONNECTING STRAPS.



MAP, SHOWING OLD AND NEW PIERS.

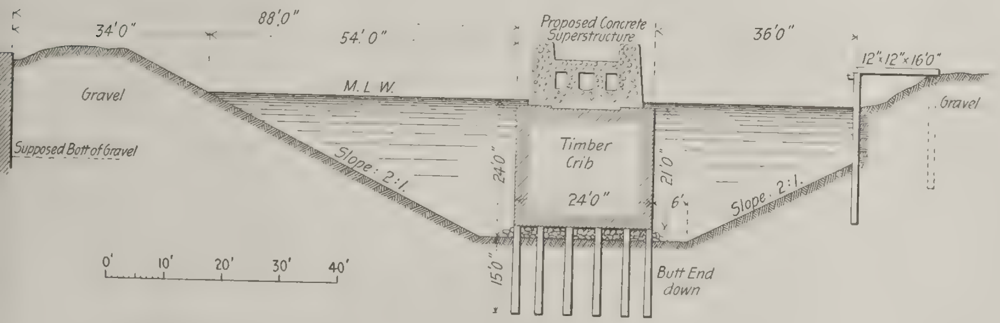


Section of Pier Head.

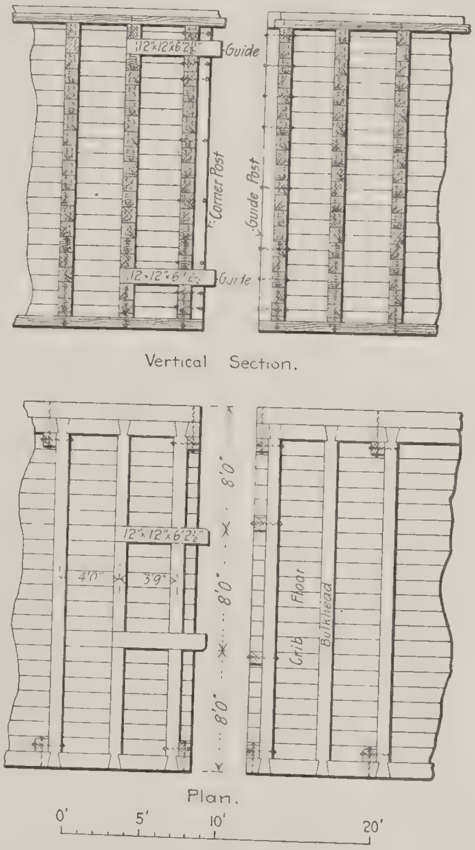
Section of Pier.

Section of Pier and Retaining Wall.

TYPICAL CROSS-SECTIONS OF PIER SUPERSTRUCTURE.



CROSS-SECTION THROUGH MINNESOTA POINT.



METHOD OF JOINING CRIBS.

NEW SHIP CANAL ENTRANCE
TO
HARBOR OF DULUTH, MINN.

Major Clinton B. Sears, Corps of Engineers, U. S. A., Chief Engineer.
J. H. Darling, U. S. Assistant Engineer in Charge.

[illegible]
[illegible]
[illegible]

floor was 126 ft. per second, nearly 1½ miles a minute. This corresponds to a free fall of 250 ft. It also says that the second test was considered just as satisfactory as the first, "although the frail woodwork at the back of the car was wrenched out of place, the eggs remained unbroken." Nothing is said about the glasses of water and the incandescent lamp in this test.

The idea that if an egg could pass through this "ordeal" a man could, appears to us a little doubtful. Consider a man weighing 160 lbs. standing on the floor of an elevator car falling at the rate of 126 ft. per second, which would be its speed at the end of a free fall of 250 ft. The energy of the descending man would be 160 × 250 = 40,000 ft.-lbs., and this amount of energy would have to be absorbed before he could be brought to rest. Suppose his speed were checked at a perfectly uniform rate so that he would come to rest at the end of a further descent of 50 ft. If the man remained in an upright position the pressure he would bring on the floor of the car, and the reaction of the car on the soles of his feet would be 40,000 ÷ 50 = 800 lbs. That is, during the whole time during which the descent of 50 ft. lasted, the man would practically weigh 800 lbs. If during a portion of this time the rate of reduction of speed should be greater, the pressure of the man on the floor of the car would also be much greater. The chances are that the man would not remain in a vertical position. He would be likely to bend his knees with such suddenness as to fracture his knee-caps, and if his weight were then taken on his hands his arms would be broken, or if not he would experience a probably fatal concussion of the brain or of the spine. It may be said that all this is theory, however, and the practical test shows that the eggs were not crushed. But why should they be? We have made a little experiment with eggs, and here are the results: Three eggs weighed together 5½ oz. They were put on a small plate, and another plate was placed above them, making a platform on which was piled a weight of 13 lbs. before the eggs were crushed. That is, an egg subjected to a crushing force between two plates resists a pressure equal to about 38 times its own weight.

When a falling elevator car is gradually checked by an air cushion, the effect upon an egg in the car is to increase its pressure upon its support, just as in the case of the man. But the rough test which we have cited above seems to indicate that the egg could be subjected to a retarding force equal to 38 times its own weight before its shell would crush. A 150-lb. man under such a force would have a pressure of no less than 5,700 lbs. on the soles of his shoes, if he could continue to stand erect, which would be, of course, impossible.

Of course we are supposing in each case the retarding force to be applied without shock, for a very trifling shock would crush the egg, while the man has elasticity enough in his anatomy to absorb without injury the shock from a free fall of several feet. When it comes to a fall of ten or twenty stories the air cushion test simply proves that eggs are stronger than they are generally supposed to be, but it proves nothing, so far as we can see, as to what would happen to a man in an elevator car under the same conditions of fall.

* * *

THE VALUE OF HIGH SHORT-TIME TENSILE STRENGTH TESTS FOR HYDRAULIC CEMENTS.

Quite a large number of cement specifications published recently have challenged comment on account of the enormous tensile strengths which they require both natural and Portland cements to develop in one, seven and twenty-eight day tests. In certain instances which have come to our notice the tensile strength requirements of the specification ran as high as 175 lbs., 500 lbs. and 600 lbs. for Portland cement at these respective ages, or from 30 per cent. to 40 per cent. higher than engineers usually require for the same classes of work. Figures for natural cement when compared run much the same way.

It is a legitimate question, we think, whether such very high tensile strength requirements are desirable. Certainly the question may be raised whether in the ordinary run of engineering work there is any good reason for such differences in practice as the figures just quoted show. It must be either that too low requirements are being demanded by engineers generally, or else that in these exceptional cases a value is being set on very high short time tests which is largely fictitious, and it should be determined which case is really the true one. The necessity for making such an investigation is increased by the fact that these high-test specifications have been made the subject of such extended mention in engineering papers and elsewhere that they are being accepted without question by many persons as being a generally recognized improvement in engineering practice. Time may, indeed, show this to be the case, but at present their position in this respect is not unassailable, and it may be beneficial to some of our readers who have not studied the question to point out the possible objections to these very high short time cement tests.

The first thought that comes to one is that we have the irrefutable evidence of hundreds of structures built with mortars and concretes made from the low strength cements and hydraulic limes of a half century ago that such cements in most cases retain their durability and develop strengths which are adequate to all demands. The rock-like consistency and hardness of some of this early cement work has indeed often been the subject of special remark by engineers who have had occasion to examine it. Most of these cements probably would not have withstood the short time tensile test demanded of natural rock cements today, and they certainly would have failed to give even approximately the high strengths demanded of Portland cement at early ages by the figures just quoted. It may be argued, of course, that if these low strength cements have proved so efficient, the high strength cements of to-day will be proportionately better, but this is not necessarily a correct deduction, as will be shown a little further on.

Meanwhile it may be pointed out that apparently the opinion is exceptional, rather than general among engineers that such very high short time strengths are desirable. The current American and European specifications for Portland cement which are published elsewhere in this issue bring out this fact very clearly, as a brief glance at the accompanying summary of the more detailed figures will show:

	Tensile strength in lbs. per sq. in.				
	Neat cement.			3 sand 1 cement.	
Specifications.	1 day.	7 days.	28 days.	7 days.	28 days.
European governm't.	None.	347	528	119	204
U. S. government..	114	394	536	129	199
91 misc, American.	134	384	528	118	189
General average ...	124	375	531	122	197
Philadelphia, Pa. ...	175	500	600	170	240

To emphasize the difference between average practice, as shown by these figures, and the exceptionally high test requirements referred to, the figures of tensile strength required of Portland cement in public works in the city of Philadelphia, Pa., are appended to the table in shape for direct comparison. As we have previously stated, these requirements are the most severe of which we know. Even the specifications for the U. S. Government lighthouse work are not higher, and there, if in any class of engineering work, it would seem that great strengths at early ages might reasonably be demanded of the cements which are used.

The figures in the table can be compared by each person for himself. All that it is necessary to remark here is that the superior advantages of the highest at least of these short time tensile strength requirements for cements are not recognized by the actual practice of engineers who have in charge the most important works in which cements are employed. The inference is at least fair, then, that such high strengths at early ages are of doubtful value in practical construction. Leaving the question of prevailing practice out of the argument, however, let us inquire what the advantages of unusual strengths at early ages are likely to be in the light of the duties which cement is ordinarily called upon to perform.

It is fair to say, we think, that nothing like the full ultimate strength of a cement is required at such early ages as one week or even four weeks in by far the greater number of places where this material is used. In lighthouse work, or in breakwaters, jetties and similar marine constructions exposed to the fury of the waves, it may be desirable for the masonry to develop its full strength at a very early age, but in the majority of engineering works this is not true. The quality which the engineer really wants most is that the cement shall develop a fair strength in one week or in four weeks and shall gradually increase this strength and maintain it as long as the structure may be called upon to endure. In other words, the whole matter simmers down to the question of durability.

The inquiry then comes up whether cements which show unusual strengths at early ages are any more durable than others. Cement literature, so far as we know, contains nothing to show that they are. There are several things, however, which tend to show the contrary. It is very commonly remarked by those who have made long tests of Portland cements that those cements which showed exceptionably great strengths at early ages were far more likely to become brittle with age than those which tested lower at first. This is exactly what we should expect from our knowledge of rock crystalization. In rocks it is well known that the more rapid the hardening the more imperfect and uneven in shape, size and texture are the crystals until they finally disappear altogether and the material comes out glass instead of stone.

Unfortunately, exact figures are largely lacking upon this feature of the hardening of cements, but some suggestive tests which bear indirectly upon it were published by Mr. R. E. Middleton, M. Inst. C. E., in London "Engineering," of April 6, 1888, which are worth quoting in lack of more comprehensive proof. Mr. Middleton's figures are as follows:

No. of test.	Age, days.	Strength, lbs.	Age, days.	Strength, lbs.	Age, days.	Strength, lbs.	P. c. gain or loss.
1.	7	258	942	440	1,325	550	+ 113
2.	7	320	900	635	1,283	577	+ 75
3.	7	371	982	560	1,365	599	+ 61
4.	7	419	1,040	435	1,423	492	+ 18
5.	7	479	1,088	542	1,471	551	+ 15
6.	7	534	858	545	1,241	526	— 1.5

These figures apparently show that cements which test from 250 lbs. to 350 lbs. in seven days increase in strength more and retain their strength better than do cements which test from 400 lbs. to 600 lbs. at the same age. It would be manifestly improper to conclude from these figures alone that the same result would always follow, but they are rather significant when taken in connection with other evidence.

But even supposing that cements which show a strength of from 500 lbs. to 600 lbs. in seven-day tests do not deteriorate in any way, what particular advantage follows their employment? The case is evidently not like the case where structural steel, for example, is the material employed. If by some new metallurgical process we increase the efficiency of a steel bar to do work we at once reap a direct gain in the reduction in size and weight of the members which we must put into our structures. It is not so in using a cement which tests 50 lbs. or 100 lbs. more than others. The conditions of its employment in the great majority of engineering works are such that very little if any reduction is possible in the amount of material which must be used whatever its strength may be.

There is another phase of the matter also which may be enlarged upon in this connection. It costs more for the manufacturers to produce a cement which will test 500 lbs. in seven days than it does to produce one which will test 300 lbs. at that age. Unless a proportionate advantage is gained by reducing the quantity and weight of the cement employed or by an increase in its durability, in using the high-testing material, therefore, this extra cost is a waste of money. Furthermore, as many cements cannot be made to develop such great strength by normal means, manufacturers, in order to meet the high test requirements demanded, use adulterants, which are always useless and may be exceedingly detrimental to the final strength and durability of the cement. So common had this practice of adulteration become in Germany a few years ago that both the manufacturers and the government authorities were compelled to adopt stringent measures to put a stop to it. We have here evidence that the demand for very high tensile strengths at early ages, while intended to guarantee an especially good material, really results in an inferior one being put on the market.

These, then, are some of the reasons why we may, perhaps, conclude that the excessively high tensile strength requirements which some specifications contain are not warranted by the advantages which the cement that meets them offers for practical engineering work. Lacking conclusive proof that cements which are very strong at early ages are not more durable than those which test lower, this is probably all that we are justified in concluding. There is great need for definite experimental information upon this point in the shape of a series of long time tests of various cements having very low, very high and medium strengths in short time tests. Such tests if sufficiently comprehensive would do very much to settle the question which we have briefly discussed here, and some of our cement laboratories would perform a valuable service to engineers in carrying them out. Unless such enormous strengths as 500 lbs. or 600 lbs. in seven days give correspondingly greater durability and strength, when the cement has been in place for years, they place a useless expense upon both makers and users of cement and should be abandoned in drawing cement specifications for the ordinary run of engineering work at least.

In conclusion we should not be understood as trying to discourage any legitimate attempt upon the part of engineers to secure better qualities of hydraulic cements. We do think, however, that there is a tendency evident in many instances to place too high a value upon tensile strength as the criterion by which a cement should stand or fall as a proper structural material to be used in engineering works, and that this tendency is leading some engineers to make mistakes in formulating their cement specifications. If the same effort which has been expended by engineers and manufacturers to increase the tensile strength of cements at early ages had been expended in developing their reliability and durability the benefit would have been much greater.

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LETTERS TO THE EDITOR.

The Patents on the Diesel Motor.

Sir: In your issue of July 21 you give a short abstract of a paper read by Mr. E. Capitaine at Frankfort, attacking the Diesel patent. Having given Mr. Capitaine's statement, you will, no doubt, in fairness, give also Mr. Diesel's reply.

Mr. Diesel advises us that Mr. Capitaine's paper was read in Frankfort on the 20th of April, and consisted mainly of statements and data, which Capitaine had submitted in his suit before the Imperial German Patent Court. In this he moved to annul or largely restrict the Diesel master patent. On the very next day, April 21, 1898, the court, after a review of all this testimony, denied his motion, upheld the Diesel patent and condemned Capitaine to pay the costs. An official copy of this action of the Imperial German Patent Court is on file here and will be gladly shown to any one sufficiently interested in the matter.

Very truly yours,
Diesel Motor Co., of America,
E. D. Meier, Engineer-in-Chief.
11 Broadway, New York, July 25, 1898.

◆

Frog Angles and Crossing Frogs.

Sir: I desire to present some discussion upon the letters on frog angles and crossing frog formulas, published in your issue of June 16. The two points I wish to cover, are, 1st, the useless multiplication of formulas when the case is already fully covered by the standard formulas given for right angled or oblique triangles; and, 2d, I wish to challenge the idea that it is possible to construct a desirable crossing by measuring any part of an old one that is ready to be renewed.

I would like first to call your attention to what seems to me to be the unnecessary complication of the formulas given in Mr. R. S. Ball's method. Would it not be much plainer to say that all cases where a curved track crosses a straight one, with the angle of intersection and the radius of curvature given, can be reduced to a simple case of right-angled triangle, which does not need any other formula than those already given in any pocket manual. Thus, taking the accompanying diagram, the basic factor is the triangle E, F, G, of which G is the point of intersection, F is the center of curvature, and E the point where a line from the center of curvature strikes the center line of the straight track at right angles thereto. You thus have a right-angle triangle with the hypothenuse and one of the acute angles given from which

$F E = r \cos \theta$, adding $\frac{1}{2} g = Fe_1$, substracting the same $= Fe$.

$F A$ and $F C = r - \frac{1}{2} g_1$.

$F B$ and $F C = r + \frac{1}{2} g_1$.

Then, with those two side of the respective triangles given we have

$$\cos A = \frac{Fe_1}{F A};\ \cos B = \frac{Fe_1}{F B};\ \cos C = \frac{Fe}{F C};\ \cos D\ \frac{Fe}{F D}.$$

The actual work will be the looking up of four logarithms, the finding of their differences as indicated, and then searching in the tables for four angles.

Then for the sides,

$$\left.\begin{array}{l} e_1 A = Fe_1 \tan. A \\ e_1 B = Fe_1 \tan. B \end{array}\right\} A B = e_1 B - e_1 A.$$

$$\left.\begin{array}{l} e C = Fe \tan. C \\ e D = Fe \tan. D \end{array}\right\} C D = e D - e C.$$

Angle $A F C = C - A$, of which the tabular arc × $F A =$ side $A C$.

Angle $B F D = D - B$, of which the tabular arc × $F B =$ side $B D$.

This seems to be much more desirable than a long formula that simply amounts to the same thing.

Mr. Wm. Wallace Christie gives methods of solving crossing problems, which seem to me to be specially open to the criticism of starting with an unnecessarily erroneous basis.

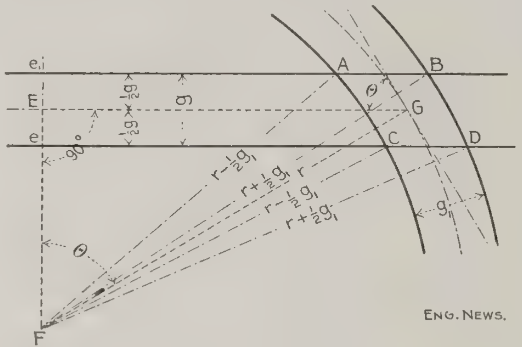

Diagram of Frog Angles.

My experience leads me to believe that it is utterly impossible to secure satisfactory data in the way he describes, namely, by measuring the diagonal of an old crossing and getting the curvature by ordinates. I can hardly conceive of a case where it would be impossible to run out the curves and get the correct angle of intersection, and the better result would most certainly pay for the cost of sending out two men to secure such data, in fact the case would be a rare one where it would cost much (if any) more to get the correct angle than to get the meager information he uses.

Having got the angles of intersection, his Case 1 then becomes the simple solution of right-angled triangles which I have already described, and his Case 2 becomes the solution of a series of oblique triangles whose common side is the line joining the centers of the two curves, the other sides being respectively R and $R_1 \pm \frac{1}{2}$ the gage, according to the point sought. Any formulas that might be needed are surely to be found in the standard formulas given in any of the pocket manuals for these two classes of triangles.

Yours truly,
E. D. Wileman,
Lake Shore & Michigan Southern Ry.
Toledo, O., June 25, 1898.

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The Report on the Condition of the Paints on the 155th Street Viaduct, New York City.

Sir: Your editorial of July 21 upon the report on the condition of paints on the 155th St. viaduct shows a lack of ability to grasp either the scope of the report or the character of the tests which is deplorable. Even while you quote from the report the statement that these percentages were carefully reviewed, "so that they might correctly represent the comparative condition of each girder," your criticism is based upon the fact that they do not represent absolute values. Does any intelligent engineer ever make a railroad profile to the natural scale? Yet the elevations are directly comparative.

The purpose in describing in such detail the method of examination was to enable any engineer to make his own deductions; and it was not expected that a test of six months' duration would be considered final or conclusive. You suggest the advisability of waiting two years before forming any conclusions. You seem to be unaware that this structure is liable to be repainted at any time, since the original invitation of May, 1897, from the Department of Public Works, made reference to "painting the vialuct next year." It is to be hoped that this repainting may be deferred, but we have no assurance that such will be the case. Although the test is of such short duration, there are two facts which are as definite now as they ever will be:

1. A number of the paints have failed absolutely to protect the metal from sulphur gases.

2. The carbon and graphite paints prove generally efficient for this purpose.

You suggest that "it would be an excellent idea for the Committee of the American Society of Civil Engineers, which has in charge the subject of paints on metal work, to make a thorough examination and report." Would it not be a still better idea first to appoint such a committee, as none exists at the present time? Furthermore, there is no probability that a committee of the Am. Soc. C. E. could ever make such a report. Neither red lead nor iron oxide in pure linseed oil have been tested here, yet these two paints have long been in general favor as a protection for iron. All the paints used in this test were patented compounds.

Your criticism of my method of giving percentages may be left to the individual judgment of your readers. If a girder 69 ft. long and 9 ft. deep cannot receive a general inspection from a point 12 ft. distant, the results sought are not such as should be desired in a report of this character. You may find difficulty in counting the rust pimples on a girder, but for the purpose of a report of progress you may select several points of view, each equally advantageous for every girder, make a separate list of percentages from each standpoint, and by computing the averages obtain results which are fairly accurate and truly comparative. While it may be true that no two engineers would give exactly the same percentages, it is also true that engineers following this method of procedure would not differ materially on the comparative condition of these paints.

Your editorial quoted the paragraph describing the method of procedure. Why not quote the next paragraph as follows:

> After completing the examination and recording the results, the kinds of paints used for each girder with the number of coats and comparative rapidity of drying were obtained from Mr. M. E. Evans, C. E., under whose direct supervision the girders were cleaned and the various paints applied.

This is the key to the whole report. The stipulation with which I undertook this examination, was that I should have no previous knowledge of the different kinds of paints on the several girders. Did your examining editors take the same precaution?

I regret that any of your advertisers should have been injured by your publication of the report.

Yours truly, Henry B. Seaman.
40 Wall St., New York city, July 25, 1898.

(Mr. Seaman's statement in his original report was that the figures he gave represented the percentage of the surface of each girder which was free from rust. We took this to mean that they were intended to represent absolute values; but the first paragraph of the above letter seems to contradict this.

We were in error in supposing that the committee of the Am. Soc. C. E. on "Paints for Metal Work" had already been appointed. A resolution favoring the appointment of such a committee was adopted at the annual meeting last January, and was referred to the Board of Direction in accordance with the Constitution. The Board will report its action on the matter, we suppose, to the meeting at Detroit this week.—Ed.)

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Gould's "Arithmetic of the Steam Engine."

Sir: I have just read your review of my little book, "Arithmetic of the Steam Engine," in the June 2 number of Engineering News, having missed many numbers during my absence at army headquarters in the South. Since you therein charge me with several errors and inaccuracies I presume that you will allow me to attempt to clear myself of these charges.

Let me first say I am glad that one of the charges which you make against my book is its brevity, because I consider that to be one of its chief merits. It would fail utterly of its purpose if it were not brief. But to turn to the more serious faults which you allege against it.

You say my assertion that the quantity of heat contained in a body is "its temperature into its weight into its specifit heat," is incorrect because it does not apply to superheated steam. I think this criticism is hardly fair, especially since I state, in the chapter on steam, what the quantity of heat contained in steam is.

You next take exception to my statement that, per Porter's tables, the sensible heat of steam is always a little higher than its temperature. Seeing that Porter's tables are conveniently bound up for reference in the back of the book, I can only express my surprise that you did not verify the correctness of my assertion by glancing at the figures in columns two and three of these tables.

You then say, referring to another of my statements, that you see, for the first time, horse power defined as the engineering unit of virtual velocity. Very good. But is not the definition correct, all the same?

Referring to my remarks on momentum, which I can assure you were not hastily penned, you object to the clause which says "Momentum represents the stored or acquired energy of weight acting through time," on the ground that it might be construed to show that a body at rest could acquire energy by acting through time. I reply: Scarcely, for I had just defined momentum as "quantity of motion," and explained that the momentum of a body moving with a certain velocity is equal to its weight into the time during which it would have to fall under the influence of gravity in order to acquire that velocity. The paragraph should be read in its entirety. If, in the formula which I give for momentum, velocity is made equal to zero, as occurs when a body is at rest, then the resulting momentum of that body becomes also equal to zero, as it should. To prove that I am wrong you then give the example of a 10,000-ton ship acted upon by a weight of 1 lb. for a period of 100 seconds. To which I reply that your data neither suffice for the use of the formula which I give nor conform to my definition of momentum as quantity of motion, and therefore your example proves nothing.

Your final remarks on my observations upon vis viva do not seem to call for any reply because I do not find that they seriously challenge my assertions.

I cannot agree with you that I should have done better had I used the words of Rankine and of Clark instead of my own. I grant you that their words are infinitely better than mine, but I do not think I would have been justified in rehashing them in a volume purporting to be written by myself.

I cannot but regret that you have conceived it to be your duty to search only for defects in my little volume. I think if you had read the book more dispassionately you would have detected some of the merits which other competent authorities have found it to possess.

Very faithfully yours, E. Sherman Gould.

Yonkers, N. Y., July 14, 1898.

(We give space with pleasure to Mr. Gould's defence of his book, but must reply to one or two of his statements. We find the term "sensible heat" in a column of the steam tables in the back of the book, said to be taken from Porter. We have not Porter's book at hand to refer to, but it also has made a slip if it uses the term "sensible heat" in this way, for the thing signified is not "sensible heat," but the total heat (above 0° F.), measured in B. T. U. in 1 lb. of water of the temperature given. The term "sensible heat" we take to mean heat that is perceptible by the senses, to give it any other or arbitrary significance appears to us a misuse of language, but it may be that Mr. Gould is not the one originally responsible for this.

"The engineering unit of virtual velocities is the horse-power." Is this a correct definition? We think not. As stated by Mr. Gould, the equation of virtual velocities obtains when $P V = P_1 V_1$, in which P and P_1 are the weights of two bodies, and V, V_1 their respective velocities. According to Coxe's Weisbach, p. 209: "If a system of forces which act in a plane have a motion of translation, then the work done by the resultant is equal to the sum of the work done by the components," and this statement is given as the "principle of virtual velocities." Rankine's Applied Mechanics, p. 479, defined the "principle" as "the name given to the application of the principle of conservation of energy to the determination of the conditions of equilibrium amongst the forces applied to any connected system of points." We fail to find in these definitions any suggestion that there is such a thing as a "unit of virtual velocity," still less that a horse-power, which is the unit of rate of work, or the foot-pounds of work done in a minute divided by 33,000 can be such a unit.

"Momentum is weight into time." Mr. Gould satisfactorily explains what he means by this expression, and we now understand that the momentum of a ship moving at the rate of 1 mile an hour is equal to its weight multiplied by the time during which it would have to fall under the influence of gravity in order to acquire that velocity; but it would have been better, it seems to us, to give the term momentum the usual definition, the product of mass, or weight $\div$ g, into velocity. His statement that, momentum represents stored energy, however, is still inaccurate, for momentum is $m v$ and energy is $\frac{1}{2} m v^2$.—Ed.).

Notes and Queries.

Heating Surface per Horse Power (Correction).—In the abstract of Mr. M. C. Huyette's paper on "Boiler Furnaces for Steam Power Installation," on p. 47 of our issue of July 21, 100 sq. ft. of heating surface per horse power is a misprint for 10 sq. ft.

F. M. T. asks our authority for the depths of harbors of the United States given in our editorial of July 21, p. 41.

We compiled the table from "Bulletin No. 36, U. S. Coast and Geodetic Survey. Table of Depths of Channels and Harbors, Coasts of the United States," issued in 1897.

A YEAR'S PROGRESS IN ENGINEERING.*

It was formerly the duty of the President to give a summary of the progress in engineering during the preceding year. This duty does not now exist, but, inasmuch as a number of my predecessors have selected other subjects for their annual addresses, I have thought it proper to return to the old practice, although the engineering field has now become so large that a short paper can give but a very incomplete sketch of the subject.

Railway Construction.

The mileage of railways built in the United States in 1897 (2,108 miles) is not extensive. It hardly varies from the mileage built in 1896 or 1895, is a little lower than that of 1894, and far below that of 1890 to 1892, and earlier years. Of the separate states, California leads with 221 miles. Canada returns 395 miles, and Mexico 367 miles. In Canada the Canadian Pacific Ry. has done a vast amount of work in converting temporary into permanent work, and in reducing the grades in the Rocky Mountains; and improved transportation facilities for the grain trade have been inaugurated by the construction of the Ottawa & Parry Sound Ry. extension to Parry Sound on Lake Huron.

In the last fiscal year 714 miles of Indian railroads were opened, and the total mileage now is nearly the same as that of the United Kingdom. In Japan the progress is marked. In March, 1897, the passenger traffic was reported to be 21.2%, and the freight traffic 15.1% larger than during the previous fiscal year, and further development on a larger scale is contemplated and partly begun. In China, while at present there are only 300 miles of railway, additional lines, involving a much larger development, are now projected, under the auspices of several European nations. The great Trans-Siberian Ry. is advancing steadily toward its eastern terminus. In Africa the Congo Ry., from Matadi to Stanley Falls, constructed by Belgian engineers with Belgian capital, is expected to be opened before the end of this summer, and the Bulawayo Ry., in South Africa, was opened a few months ago. Even in Abyssinia a line from the coast to the interior of the country is projected.

Improvements in Railway Operation.

In the United States, while the actual amount of construction has not been large, the general tendency has been toward an increase of speed and safety, which has been attained by the introduction or improvement of such devices as heavier rails, the air brake, the interlocking system of signals and the strengthening of cars. The block system of signals is now so common that it is difficult to realize at the time of the World's Fair, in 1893, only one line of railway in the United States was fully provided with it.

The equipment in general is being perfected, heavier locomotives are being built, and the compound locomotive is being slowly introduced with promise of success. Efforts are especially being made to secure uniformity in mechanical devices. The result of the labors of a committee of this Society has had much to do with the introduction of uniform rail sections, and you will be called upon here to decide whether a similar committee shall be appointed for the study of a uniform type for rail joints. Notable progress toward the abolition of grade crossings has been made, in and near a number of cities.

In recent years extensive and more commodious terminal and union stations have been built in large cities; a conspicuous instance is the Southern Union Station now being built for a part of the railway system which terminates in Boston.

Street Railways and Electric Locomotives.

Within a few years the development of cable and electric railways has been phenomenal in the United States and all over the world. The advent of the trolley car has revolutionized travel, and affected the movement of population in the neighborhood of large centers. In some instances, electric traction has begun to compete with local steam railways, and the cheap fares made possible by its economical installation have placed travel for business or for pleasure within the reach of the poorest. Compressed air has also come to the front; as an instance of it, compound air motors for certain lines of street cars in New York city are now contracted for.

Among the successful examples of electric propulsion may be mentioned the Baltimore Belt Line of the Baltimore & Ohio Railroad; the electric high-speed suburban service about Cleveland, including six different lines and covering long distances, and many others in various parts of the country; the Chicago elevated railways; the proposed systems of rapid transit in New York and Boston; the Boston & Nantasket branch of the New York, New Haven & Hartford R. R.; the third-rail electric system between Berlin and Hartford, Conn. We may note here that the question of rendering the third rail innocuous after the passage of each train is apparently solved.

In England the Metropolitan Ry. Co. and the Metropolitan District Ry. Co. have already acquired the necessary parliamentary rights to adopt electricity as their motive power, and are said to be waiting until the new Central London Ry., the greatest electrical enterprise in England, shall have been in operation. In France, the proposed new terminal of the Orleans Ry., consisting of 2½ miles of underground railroad in the heart of the city of Paris, is an important enterprise.

Canals.

One of the most important questions in the United States is that of the connection between the Great Lakes and the Atlantic. A United States commission is now at work on a report as to the best plan to be recommended. Opinions differ materially as to the advisability of building from the Lakes to the Atlantic a deep ship waterway or one of smaller dimensions. In the meantime the state of New York is at work increasing the depth of the Erie Canal to 8 ft.

At Sault Ste. Marie, in 1897, the traffic of the ship canal amounted to 18,954,000 tons, a tonnage much larger than that of the Suez Canal. The Montreal, Ottawa & Georgian Bay Ship Canal, by way of Georgian Bay and the Ottawa River, which, it is said, will save 1,100 miles between Chicago and Liverpool, should be mentioned.

The recent naval operations connected with the present war with Spain have revived the question of the American Isthmian canals. The feasibility and cost of the Nicaragua Canal are now being investigated by a United States Commission. The report of a previous commission concluded that the canal is feasible, but at an estimated cost higher than was reported by the original promoters of the enterprise. In the meantime, the new Panama Canal Co. is at work on the Isthmus, and is now making a further engineering study of that work, with a view of deciding whether the undertaking can be profitably pushed through. If the report is favorable, an effort is to be made to find the necessary capital for the completion of the canal. In both cases it appears that construction was begun without sufficient data, and that the most serious engineering question to be solved is the proper and safe disposition of the freshets caused by the great rainfalls of the wet season. The necessary investigations are now being made.

In France, the proposed canal from the Atlantic to the Mediterranean has been finally abandoned as too costly. It is reported that the Suez Canal is to be deepened. In Russia, a ship canal, to join the Baltic and Black Seas, is to be begun next spring. Of the 1,080 miles, the reported length of the canal, 875 miles are to be in canalized rivers, leaving only 125 miles to be excavated. In Italy, the regulation of the Tiber River is nearly completed. This is an important work, the total cost being estimated at $21,000,000.

The following statistical figures as to the cost of large canals in various parts of the world are thought to come from a reliable source:

Name.	Length, miles.	Years building.	Total rock & earth, cu. yds.	Cost.
Suez	66	9	80,000,000	$100,000,000
Corinth	3.7	12	15,220,000	15,000,000
North Sea	61.5	8	....	37,440,000
Chicago	40.6	5	40,000,000	25,300,000
Manchester	35.5	6	53,500,000	77,000,000

Bridges.

In the construction of bridges, the last few years have seen a further development in the designs of structures for large spans. The United States government has required the building of such bridges, up to 1,000 ft. span, over the Ohio, Mississippi and other rivers. The necessities of the traffic of New York city have given renewed impetus to the designing of suspension bridges of unprecedented span, and have caused the introduction of novel details, made practicable by recent improvements in the manufacture of steel. The perfection of the methods for erecting long and high-span trusses has also rendered these operations much more satisfactory as to cost, and as to the important element of the time necessary to carry them out. The recent reconstruction of the Niagara Falls Bridge is a conspicuous instance of the best modern engineering in that field, and the new East River Bridge will probably be the prototype of others.

The various designs for a much larger suspension bridge over the Hudson River are familiar to you, and have carried the possibilities of bridge building much beyond long-accepted limits. The famous Victoria Bridge, justly considered at the time of its construction a bold and novel undertaking, has outlived its usefulness, and is being replaced by a modern steel structure of 20,000 tons (with 24 spans of 254 ft., and one of 350 ft.), which will be far lighter and cheaper, although of greater strength, than the original bridge.

There has been a tendency in recent years to return to the construction of stone arch bridges, wherever local conditions as to cost of foundation and length of span have justified the generally larger outlay necessitated by this class of more permanent structures. In this connection, the recent introduction of the three-hinged masonry arch must be noted. The Melan arch, of which many examples have been presented in recent years, has pushed to the front the principle of the mixed construction of masonry and metal. Although, owing to the changes of form produced by varying temperatures and by the internal movements due to the behavior of masonry before it is entirely set, there may remain some doubt as to the perfect homogeneity of this class of construction; success has, undoubtedly, been achieved in many cases, but time alone can give final sanction to the wide adoption of structures of this class. The arch bridge at Topeka, Kan., said to be the largest of that description, costing $150,000, and containing only 140 tons of steel, is a conspicuous instance of this method of construction.

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*Slightly condensed from the address of President Alphonse Fteley at the Detroit meeting of the American Society of Civil Engineers.

High Buildings.

When the modern high building of skeleton steel with masonry walls was first introduced for business purposes, some doubts existed as to its permanency. Many new problems as to the stability and fire-resisting properties of such buildings presented themselves, but the complicated questions of their equipment, including untried methods of carrying passengers, and of supplying water, sewerage, heating, ventilation, etc., appear to have been solved satisfactorily. High buildings have been erected on various kinds of foundations. In many cases solid rock has been reached at great depths, and compressed air has been resorted to in the building of the main supports; in others, the weight has been so distributed over uniformly yielding materials as not to tax them beyond practical limits. Frequently, where the resistance of the ground was not uniform, the adaptation of various parts of the structure to the weight to be supported at each place taxed to the utmost the ingenuity of the builders. In certain cases, mechanical devices have been introduced for the purpose of meeting possible irregular settlements. The distribution of weight on yielding foundations has often been accomplished by clusters of steel beams imbedded in concrete. At times, when the foundations of proposed structures extended below the lowest point of the foundation walls of neighboring buildings, it was necessary to support the latter, and at the same time not to interfere with the operations of construction, generally conducted on restricted areas; this result was accomplished by the introduction of novel and ingenious devices. The necessity for reducing the weight of buildings has resulted in the reduction of the masonry part to a minimum by the adoption of floors which possess lightness and strength as well as fireproof qualities. The rapidity and ease with which these extensive buildings are erected without extraordinary impediment to travel in crowded streets is remarkable.

The future of the high building, with its many parts out of reach, and without possibility of examination and maintenance, is now difficult to predict. Several modern fireproof buildings have stood well the test of fire, but no great conflagration has occurred to show what the results of such a contingency would be. In a recent earthquake on the Pacific Coast, modern high buildings are reported not to have suffered.

Outside of constructive possibilities, however, other questions which may have an important bearing on the future of high structures present themselves: Their influence on real estate values, on the growing accumulation of population in the business districts, and on the problems of water-works and sewerage. Should the erection of high buildings extend more and more, the sanitary condition of the people passing a part of their life in districts thus built up would become a serious question, and one which should be taken in hand by the proper authorities. The height of these buildings is now, in many cases, too great, and if this style of construction is to go on it is most probable that it will be limited everywhere by law, as has been done in several cities.

Harbor Improvement.

The constantly increasing size and draft of large vessels for commercial and military purposes make it necessary in many cases to deepen harbors, and also enhance the cost of docks, dry-docks, and of all structures connected with river and harbor works, the size of which depends upon the depth of adjacent waters. For the purpose of facilitating navigation in rivers and harbors, great improvements have been made in dredging apparatus, the capabilities of which have rendered possible excavations which would have otherwise required too much expenditure of time and money. In this country the dredging operations on the Mississippi River have reached an unexpected development and success.

The great docks of Duluth and Superior, recently built to accommodate the large grain crops of the two Dakotas and part of Iowa and a great amount of iron ore, coal and other products, the new Liverpool docks and the recent dock improvements of Dunkerque and Calais, are examples of modern designs in that line. In this connection may be mentioned the new breakwater, 20,000 ft. long, under construction by the Government at Buffalo, which is the largest on record.

Public Water Supplies.

The number of places in the United States now possessing a public water supply, whether under public or private ownership, is nearly 4,000; but, while systems of works increase in number and importance, it would seem that we lack in this country the faculty of properly regulating them as regards the quantities to be furnished. In large cities, with some exceptions, the per capita consumption is increasing, and in several of them the amount consumed attains absolutely inordinate proportions, although, in some of them, every gallon of it has to be pumped. The old cry that water in our communities should be as free as air is heard from people, who from their intelligence and business habits should know better, and the taxpayer does not stop to think of the result of extravagance in water consumption. More water means more and larger pipes, more capacious reservoirs, more pumping stations, and, in many cases, new sources of supply, with the attendant large outlays necessary to procure them. It also means increased risks in some cases, as in New York, it becomes a problem to locate water pipes properly in already crowded streets. That there is a large waste of water is admitted by all, but the means of checking it are not generally applied. Objections are raised as to a more extended system of making consumers pay for the amount of water actually consumed, and clumsy and inaccurate methods of estimating the amount and value of the water used are resorted to, which not only would not be tolerated for the sale of other commodities, but would be considered absolutely ridiculous.

The consequences of excessive consumption of water are ominous. Take the case of New York: In 1890 its new aqueduct was put into service, the consumption then being 110,000,000 gallons per day. After nearly eight years, the average for 1897 was 230,000,000 gallons per day, a per capita rate of about 115 gallons. At this rate the new system of water supply begun over ten years ago and constructed at a very large cost will soon be insufficient in a dry year, and new sources will have to be developed at a much greater cost.

The large cities of this country, which, located on the sea coast, have no fresh water within easy reach, have generally taken too great risks in the matter of their water supply, and it is to be wondered at that no harm has resulted from this policy; those especially where the density of the population is great should have more than one system of water supply, and it is to be hoped that this view of the subject may be adopted.

Water Purification.

With the advance of sanitary science the need of purer water has been felt, and efforts have been made in many directions to improve public water supplies. Where they are obtained by impounding river waters in storage reservoirs formed by damming the streams, great inconvenience has been felt from offensive tastes and odors, generally produced by the development of microscopic vegetation. Efforts have been made to improve the gathering grounds and the reservoirs, and in a number of cases, especially in and about Boston, the soil, down to the underlying sand and gravel, has been removed at a large expense, to the great benefit of the impounded waters. In cases where the same inconveniences have been experienced in underground waters pumped into reservoirs exposed to the light, a notable improvement has been produced by covering the reservoirs.

Much attention has been given in late years to the study of filtration processes. Thirty years ago, an eminent member of this Society and one of its late Past-Presidents, prepared, for the benefit of the St. Louis Water-Works, a report on "Water Filtration," which, for many years, was the most valued text-book on the subject. It was then thought, and it was so maintained for many years, that hardly any chemical action took place in the filtering of water, and that the main function of the filter was to retain the particles suspended in the water, very little action taking place on matters contained in solution. Little was known of the influence of filters on bacterial life. Within recent years, however, especially through the efforts of the Massachusetts State Board of Health in conducting at the experimental station at Lawrence its well-known series of experiments, results have been obtained which have revolutionized the theory of water filtering. Radical chemical and biological changes have been found to take place in the operation of filtering, and bacterial life has been recognized as the most potent instrument for the conversion of organic matters into mineral compounds, while it operates at the same time as an agent of almost complete self-destruction, provided, of course, that the construction of the filters, the selection of the filtering materials used and the subsequent care of the apparatus are such as to properly carry out the results indicated by the laboratory experiments.

A number of different materials have been recommended and used as filtering media with varying success; the most extensively used have been sand and gravel. Sand filters have been in use in Europe for many years, long before the full measure of their usefulness was known, and the modern applications of the system have been highly instructive. We all recollect the striking results of the differences in mortality in Altona and Hamburg during the recent epidemic of cholera, when the first-named city, with a water supply polluted by sewage, but filtered, showed only sporadic cases, while in Hamburg the water supply, less polluted, but not filtered, was recognized as the cause of the heavy mortality recorded. No large systems of what may be called gravity sand filters exist in America, but important communities have been recently and are now making extensive experiments with a view to building some, and in one instance at least, in Albany, a system of filters on a large scale is now under construction.

In mechanical filters, in which various filtering substances, mainly sand, are used, coagulants are generally used to eliminate a large portion of the organic and other matters contained in the water, and sufficient pressure is applied to force the water through the filtering medium so as to cause a flow of water larger than through gravity filters, per unit of area. They have been used for years and have recently been so perfected as to be reported by their inventors as capable of successfully competing with gravity filters in cost and in efficiency. Two very important series of experiments have been made by large cities to investigate the merits of the mechanical filter. Further developments and added experience will evidently be needed to decide the question. From reports made by capable experts in behalf of communities in search of advice for the purpose of constructing filtering apparatus, it appears that the choice between the two systems, in many cases, must be determined by local circumstances, depending mainly on the cost of the filtering materials and on the quality of the water.

The public appears to realize now, more than ever, the desirability, if not the absolute necessity, of procuring purer water, and the close connection between pure water and improved public health is better understood by public bodies. From an economical standpoint alone, when considering the commercial value of each human life, the saving effected by diminishing the mortality would represent a large capital.

Water Pipes.

Construction has been favored by the decreasing price of iron and steel. The price of cast-iron pipes, especially, has never been so low as it is at present. Steel riveted pipes, for the conveyance of water from the source of supply to the point of consumption, in recent years have been introduced more liberally in the East. For long distances, with large diameters, under heavy water pressure, especially when few connections have to be used on the way, these pipes are as much superior to cast-iron pipes as the steel substitute is to the old cast-iron tension member of a bridge, and it is not doubted that they will be ultimately used to the exclusion of others, but, unfortunately, although similar pipes made of wrought iron have been successfully used for years on the Pacific coast, and elsewhere, it cannot be said that the coatings used to preserve the metal from oxidation are entirely satisfactory. The rivets used for fastening the pipes and the lapping joints impede the flow to a certain extent, and a pipe has been devised, the fastenings of which are entirely outside and provide the pipe with a smooth bore. The great improvement in steel-welded pipes of large diameter will also remedy that defect to a large extent. An order is reported of several thousand tons of welded pipes to be made of Siemens-Martin mild steel, 24 ft. long and 42 ins. in diameter, for the Birmingham Water-Works. The possibilities of steel pipes are well illustrated by the proposition to convey a much-needed supply of water, of 5,000,000 gallons per day, to a mining district of Western Australia, by means of a pipe 30 ins. in diameter and 328 miles long.

Dams and Reservoirs.

The construction of water-works and of irrigation works has rendered necessary, in recent years, the erection of many dams for the impounding of water, a number of them being of great height. Few new principles of construction have been introduced, but improved methods for the building operations have been resorted to, thereby reducing the ultimate cost and the time necessary for the completion of the structures.

The solid stone masonry section on the general plan originally introduced by the French engineers, has been accepted in many places; the general practice now being to use large stones with the necessary filling of spawls instead of the uniform small-stone masonry, formerly adopted and even recently recommended by eminent engineers. Elsewhere, concrete masonry has been adopted, this course being generally indicated by local circumstances, such as the high cost of, or even the lack of, stone in the vicinity. In recent instances of concrete dams slight vertical cracks have developed which have been less frequently found, if at all, in well-built stone masonry, owing probably to the more thorough bonding of the mass by means of the interlocking of heavy stones. In the western part of the United States rock-filled dams have been built, the imperviousness of the structure being procured by the construction of core-walls, by the building of a timber lining on the up-stream side or by other devices. The earth dam continues to be universally used; parts of India and of the United States showing recent instances of this mode of construction for high dams, mostly with the aid of puddle, or masonry and concrete core-walls. A peculiar core, formed of thin sheet iron, used in connection with a recent rock-filled dam in California is worthy of notice, if not of imitation.

It is to be regretted that theoretical calculations cannot be accurately applied to the computations of the stability of dams. The distribution of strains through such masses is not well known; moreover, the diversity of the materials used; the unavoidable lack of uniformity in the labor employed, the different times of the year in which the work is performed under varying temperatures, are all elements which cannot be accurately analyzed, although they can be provided for by the introduction of the too often necessary margin of safety. Experience must here come to the rescue of the designers, and dictate the necessary precautions to be used in accordance with known precedents. Especially is this true of the designing of earth dams, for which, in almost every instance, a careful study must be made of the particular materials at hand for construction.

The uncertainties just alluded to have been eliminated in the design of a dam of moderate size, the building of which has been recently reported. It is formed of steel columns and struts reposing directly on the bottom of the valley, the up-stream side being formed of steel plates rendered water tight by the application of a bituminous coating. It is possible that in many instances the cost of such a design would be too high for practical purposes, and some of its features may not be unobjectionable, but it is noteworthy.

Many dams of importance have been recently constructed or are in process of construction or of preparation. The Periar dam, in the Province of Madras, 173 ft. high, was completed in 1893, under exceptional difficulties, for irrigation purposes. The dam built for the water-works of the City of Remscheid, Germany, was also recently erected. In the masonry dam of La Tache, in France, the old French practice of using such small stones only as two men could carry has been continued, although convenient quarries were at hand. The new Croton Dam for the water-works of New York, to be of masonry and earth work, a structure of great height and involving the laying of over 600,000 cu. yds. of masonry, is well advanced.

In the states of California and Arizona especially a large number of dams, mostly for irrigation purposes, have been recently completed or are being erected. The Upper and Lower Otay dams, one of them provided with a thin steel core, are important in size. Several masonry dams in Arizona, of great height, may be mentioned; one of them to be 250 ft. high above foundation, and to form a reservoir of the enormous capacity of 1,020,000 acre-feet. La Mesa dam, in California, was built with materials transported and deposited in place by flowing water, by the process known to miners as "ground sluicing." Another, to be 130 ft. high, is expected to be built by the same method. The Louisa Needle Dam, built for the regulation of the Big Sandy River, Ky., recently completed, is remarkable from the fact that it sustains a head of water which considerably exceeds that supported by any other dam of the trestle or wicket type yet constructed.

As the needs of water supply and irrigation call for higher dams, the reservoirs formed thereby are obviously increasing in size, and figures are now being reached as to reservoir capacities, which recall the size of the great ancient reservoirs, the knowledge of whose existence has been transmitted to us by tradition, if not by history. The idea of the restoration of the great compensating reservoirs of the Nile, spoken of some time ago, does not appear to be any longer entertained, but the erection of two dams across the river, with a proposed storage of 266,000 million gallons, for the purpose of regulating its flow, is now being seriously contemplated, if not already started. The system of compensating reservoirs for the Mississippi Basin is well under way.

Sanitary Engineering.

The construction of sewers keeps pace with the general development of municipal engineering; the second part of the metropolitan system of sewers for Boston and the neighboring cities and towns has been practically completed; the great Drainage Canal of Chicago is approaching completion, and, in connection with it, intercepting sewers of large diameter are being built under peculiar difficulties; many other systems of sewers are in process of construction or in preparation.

The question of the disposal of the sewage from cities and towns, in view of preventing the pollution of streams, is especially occupying the attention of municipal engineers. Many reports recently made on the subject have attracted the attention of the profession, and in several states commissions have been appointed for the purpose of studying this problem in reference to the welfare of adjacent and neighboring communities. Those who are studying these questions, however, are much hampered by the lack of proper laws, and, in many cases, special legislation must be procured. A commission has been recently appointed in the state of Connecticut for the above-mentioned purpose, and the state of New Jersey is now attempting to procure the necessary legislation in order to properly define the rights and duties of the various communities interested in the purification of the Passaic River, now much polluted by sewage.

The practical applications of the various systems of disposal of sewage are comparatively few in this country, although new works of that description, on the principle of irrigation, filtration and chemical precipitation, have been inaugurated within the last few years. The chemical precipitation system of London, with its production and disposal of 2,000,000 tons of sludge in 1897, remains the largest exponent of that class of work.

Paris completed in 1895, by means of the Acheres Aqueduct and Park, a large addition to its irrigation system which disposes to-day of one-half of the total flow of the sewers of the city, and Berlin has so added to its irrigation fields that their total area is 20% larger than that of the city.

Much attention is being given in many directions to the disposal or utilization of the waste of large cities. Cremation processes appear to be looked upon with increased favor as being the more economical; great advance has been made in that direction in Hamburg and Berlin. It would seem that the greater amount of coal wasted in this country should make this process more successful. Reduction processes of various kinds have met abroad with a moderate degree of success. Several important plants have been and are being built in the United States; they have not been an entire success so far, and may be said to have hardly passed the experimental period.

Tunnel Construction.

The construction of recent tunnels for railroads, waterworks, sewers and other purposes shows marked progress. Tunnels are driven at a more moderate cost, in less time, and difficulties are surmounted with greater ease. In crowded streets, underground building operations, at times very near the street surface, have taken place with least injury to buildings and without interruption to traffic or danger and inconvenience to citizens. Parts of the London Metropolitan Railroad, the underground railroad under the Boulevard St. Michel in Paris, and the partly completed subway of Boston, are conspicuous instances of tunnel operations conducted in accordance with the most recent methods. By similar means, one of the main French railroad lines is to transfer its terminus from the outskirts of Paris to its most central part. The proposed underground Rapid Transit system of New York city may soon give another illustration of the possibility of building conveniently and rapidly through crowded streets. With the perfected driving shield, the use of compressed air, and the methods of excavation recently used, few difficulties would appear to be insurmountable.

The project of the Simplon tunnel through the Alps is coming to the front again, and although not yet fully financed, construction is soon expected to start. It is 15 miles long, and, notwithstanding its great length, is expected to require one-fourth the time devoted to the construction of the Mont Cenis Tunnel, and to cost one-half as much.

With the advent of electric propulsion, the necessity for thorough ventilation in tunnels used for urban transportation does not appear to be considered so important as formerly. It is to be hoped that efforts are to be made to so renew the air in tunnels as to reduce to a minimum, when required, the atmospheric differences between the inside and the outside; the changes experienced in some of the existing structures being sufficient to materially affect public health.

Application of Electricity.

The science of electricity has advanced by such strides that its evolution, it may be said, brings every day new surprises, and that its application to engineering purposes requires the attention of specially trained men. A few words have already been said of the adaptation of electricity to traction. There is, indeed, hardly a branch of engineering in which it cannot be introduced with success.

Its extensive application to the treatment of metals forms the subject of the recent annual address of the President of the Institution of Electrical Engineers of England, and its use in mining operations is being gradually extended. Its universal introduction for the production of power covers a field the limits of which it would be difficult to define. The substitution of individual electric motors in the place of shafting and pulleys is gaining ground, and the improvement thus accomplished has been so important as to already cause a marked movement toward a radical modification in the construction of mills, which can in this way be built more economically and with better conditions as to light and ventilation. On the other hand, flexible transmission by cable (except for traction purposes) is steadily losing ground.

A new impetus has been given to the development of water power plants, which, prior to the introduction of electricity on so large a scale, had lost much of their importance. England, France, Germany and Italy present interesting instances of these modern establishments, and you have heard of some of the largest enterprises in this country and Canada where immense power is now, or is to be, transmitted to great distances.

Engineering Researches.

It is gratifying to state that in many a branch of engineering, experimental researches have been recently made, and are being conducted, and that data of great value are being accumulated. The Massachusetts State Board of Health is continuing its remarkable series of experiments, which have already contributed so much to the development of sanitary science; tests of materials of all kinds have been extended and systematized, and much is expected from the experiments conducted by the American Section of the International Association for testing materials. Mechanical tests of American timber have been made, and are being continued by the Forestry Division of the United States Department of Agriculture, which have already contributed to the subject of timber physics many new facts and experimental knowledge of great value.

Tests have also been recently conducted which throw much additional light on the composition and resistance of fireproof floors and of the bearing power of those in which concrete and steel are united.

In hydraulic engineering we may mention the extensive gaging of streams conducted under the direction of the United States Geological Survey; the continued painstaking experiments of M. Bazin on the flow of water in open channels; experiments made to ascertain the loss of water from reservoirs by seepage and evaporation; extensive tests on the percolating capacity of certain sands and gravels, made by the Engineering Department of the Metropolitan Water Board of Massachusetts; and a number of interesting gagings to determine the flowing capacity of long pipes for the conveyance of water, one important instance of which is to be presented to you at this meeting.

When summing up the conclusions of such experiments the results obtained are frequently represented by algebraic formulae, which are apt to be interpreted as being of a general character, while they give the facts between certain limits which are not always sufficiently defined in the accounts given of the experimental work. Formulae, correct between certain limits, may be grossly erroneous when applied outside of them. To avoid this objection, sometimes a serious one, the custom should be encouraged of publishing, at the same time as the deduced formulae, diagrams of the results obtained, and at the same time the limits beyond which the given experiments do not apply.

The Professional Standing of the Engineer.

We may well ask ourselves whether our profession is recognized by the general public as it should be. The mission we have to fulfil is in no way inferior to that of the other professions. On the engineer depends often the integrity of the capital invested by those who repose their confidence in him, and on the soundness of his designs frequently depends human life, and yet, when the learned professions are enumerated, the engineer is often passed by. This is probably due to the comparative youth of our profession in this country. A generation ago the scope of its usefulness was very much more limited, but the field is being extended at such an increasing rate, and the money invested in engineering enterprises of all kinds is correspondingly so much greater, that our profession is steadily gaining in importance and standing. It is obvious that we can all contribute to that result by our individual professional efforts in our respective fields.

As our work extends, we cannot but feel the need of increased knowledge. In that respect we have much better facilities than our predecessors, as, through professional papers published by engineering societies, and through the engineering press, we can keep abreast of the times, and the educational facilities are much greater. The yearly addition, to the profession, of students who are graduated from engineering schools, favors the dissemination of technical knowledge in many directions, as, owing to their large number they may not all be able to procure purely engineering positions, but must find new openings in the industrial world and in other channels, thereby carrying professional knowledge where it will be found of great value.

While we review the field covered by our profession, it is gratifying to notice that the names of members of this Society constantly occur to us as having had an important part in the advancement of all branches of engineering and in the erection of the most important works executed in America. Moreover, through our foreign members and a few of our American brethren, our Society is by no means a stranger to the engineering practice of the rest of the world. This is as it should be, and as it was foreseen by the founders of the American Society of Civil Engineers; and, owing to its increasing importance, membership in its body will logically become more desirable.

The number of members of all classes is now 2,119, not including over forty applicants now before the Board of Direction. This is a large gain since the beginning of the present year.

When following in the steps of our predecessors in the field, the Institution of Civil Engineers and the Society of Civil Engineers of France, we decided to provide new headquarters for ourselves, the time was very opportune. Convenient as our former building had been, it had become insufficient for our requirements, and greater delay would have caused great inconvenience and detriment. The experience of nearly one year fully justifies the action taken. Our new house has added not a little to the standing and dignity of our body, and the advantage gained amply compensates the increased outlay necessary for its maintenance, a burden that our Society, in its sound financial condition, can well sustain. We have entered a new era of successful life, and, in conclusion, allow me to express the wish that the increasing importance of our profession be the sure omen of the continued prosperity of the American Society of Civil Engineers.

COMPARISON OF RECENT SPECIFICATIONS FOR FINENESS AND TENSILE STRENGTH OF CEMENTS..

In our issue of April 28 we published in tabular form the principal requirements in the specifications for cement formulated by the officers of the Corps of Engineers, U. S. A., for the works in their charge. A similar comparison of the principal requirements for fineness of grinding and tensile strength, embracing both Portland and natural cements and both European and American practice in railway, municipal, bridge and other private work as well as government work, has been brought to our attention by Mr. R. W. Lesley, Vice-President of the American Cement Co., of Philadelphia, Pa., and is abstracted here to supplement the information already given in

TABLE I.—Showing Requirements for Fineness of Grinding and Tensile Strength of Portland Cement in Specifications for Various Classes of Work in the United States.

Specification.	Per cent. passing		Lbs. per sq. in.						
			Neat cement			Mortar, 2 to 1.		Mortar, 3 to 1.	
	2,500 sieve.	10,000 sieve.	24 hrs.	7 days.	28 days.	7 days.	28 days.	7 days.	28 days.
U. S. government engineers	95½	84	131	402	547	150	200	119	189
U. S. lighthouse engineers	95	..	..	383	600	175	250	85	..
U. S. engineers, Navy Department	90*	97†	..	462	..	..	..	..	..
District of Columbia	95	85	..	387	500	125	200	116	166
Average of nine cities.	97	89	161	388	538	158	200	134	201
" six railways	95½	80	115	319	483	123	175	108	150
" six bridges	97	88	119	347	487	142	250	132	200
" three aqueducts	..	80	110	333	400	125	200	132	225§

*6,400 mesh sieve. †3,600 mesh sieve. §One only.

the previous article. This information was collected and compiled by Mr. Lesley himself from authentic sources, and has been published in a pamphlet entitled, "A Summary of Recent Cement Specifications."

The first thing of interest which may be noted in this summary is the close agreement for Portland cement between the averages of the government specifications published in our issue of April 28 and the averages of the government specifications of the leading European countries, including Russia, Belgium, Germany, Switzerland, France, England and Norway, and also 91 miscellaneous specifications for Portland cement taken from a variety of American sources outside of government work. This fact is shown by the accompanying table, compiled from the more detailed figures:

Specification	P. c. passing sieve of		Tensile strength, lbs. per sq. in.				
			Neat cement			3 sand, 1 cem'nt	
	2,500 mesh.	10,000 mesh.	1 day.	7 days.	28 days.	7 days.	28 days.
European govmt	92	(a)	None.	347	528	119	204
U. S. government.	..	..	144	394	536	129	199
91 miscellaneous..	96	85	134	384	528	118	189

(a) 88% required to pass a 5,800 mesh sieve.

A somewhat more detailed summary of the same figures, except that European specifications are excluded, is made in Table I. This table shows quite clearly the variety of sources from which the detailed figures come and also enables a comparison of the practice of American engineers for different kinds of work. Another fact to be particularly noted is the generally moderate requirements for tensile strength, in the 1 and 7 day tests especially.

Turning now to the detailed figures for natural cements we find the following to be the average requirements for fineness of grinding:

Specification.	Per cent. passing 2,500 sieve.	6,400 sieve.	10,000 sieve.
U.S.Engrs. in 24 works	91	85	72.5
District of Columbia...	92.5	..	80
Average of 8 cities*...	93	..	81
" 2 railways.	95	..	..
" 2 bridges..	95	..	..
" total 38 spec.	92	85	79

*62½% is required to pass a 40,000 sieve.

The requirements for tensile strength of natural cements average as follows:

Specification	Lbs. per sq. in.				
	Neat cement.			2 to 1 mortar.	
	1 day.	7 days.	28 days.	7 days.	28 days.
29 government w'ks	38	102	164	*34.5	77
Dist. of Columbia..	75	100	150	50	75
Ten cities	70	134	237	†68	200
Four railways.....	64	105	163	§47	80
3 aqueducts, etc....	60	117	200	‡65	..
Two bridges	55	87.5	185	‡35	70
Average of 51 spec.	63	109	178	‖44	86

*Average of 10 works. †Average of 3 cities. §Average of 3 railways. ‡One structure only. ‖Average of 19 specifications.

There seems to be a wider margin of difference in practice in the use of natural cements, than in the case of Portland cement; but as the cases noted are practically all modern works, we must charge the wide differences of requirement to controlling local conditions.

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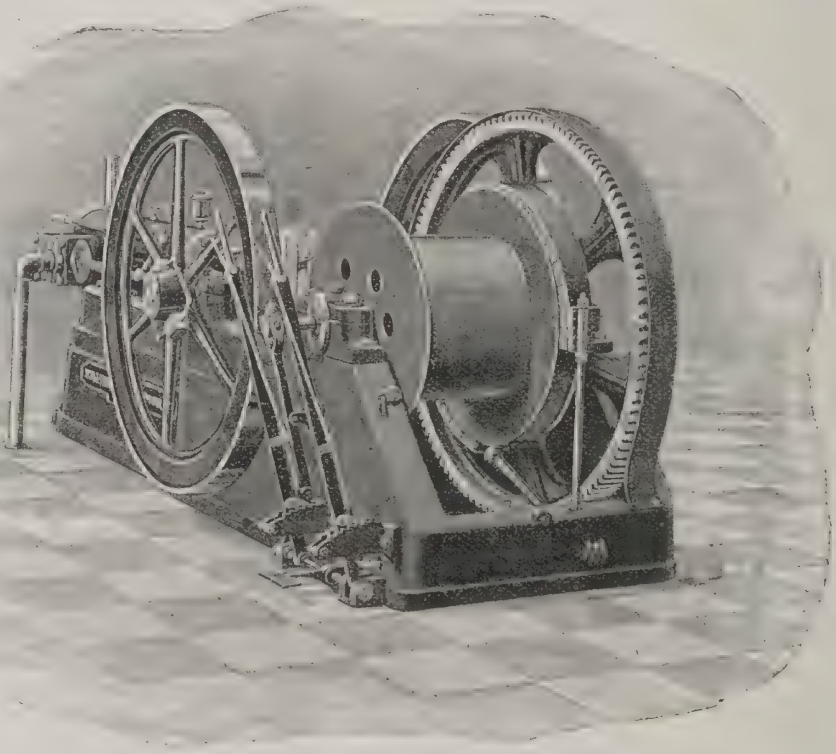
A GASOLINE HOISTING ENGINE.

The accompanying illustration represents a simple and compact gasoline geared hoisting engine, which has recently been placed on the market, in which the entire plant is mounted on one bed-plate. The horizontal cylinder of the gas engine is at the end, the crank shaft and flywheel are at the middle, and the hoisting drum is at the other end.

The drum is loose on the shaft, to which a large gear wheel is keyed, and is gripped to or released from this gear by means of a friction clutch of special form, having a conical surface of wood, which fits a corresponding metal surface in the center of the drum. The clutch is moved along the shaft by means of a vertical hand lever at the side of the engine frame. The foot of the lever, just above the quadrant, is connected to the foot of a rocker arm or lever, to whose upper end is attached the rod of the clutch. This arrangement is shown in the cut, the clutch lever being the one nearest to the flywheel. A special advantage claimed for this clutch is that its action gives no end thrust on the drum shaft bearings. For lowering a load the clutch is released, and the drum is controlled by a hand brake on the end of the drum, this brake being operated by the other vertical hand lever shown in the cut. Both levers have latches engaging with notch quadrants, and are thus locked in whatever position they are set. If desired, the levers can be placed near the head of the mine shaft or level, and connected to the engine by rods or other suitable connections, so that the attendant can see to the dumping of the bucket.


COMBINED GASOLINE ENGINE AND HOISTING PLANT.
Fairbanks, Morse & Co., Manufacturers, Chicago, Ill.

The gearing is well supported, the spur wheel having an outside bearing, while the pinion has an extra bearing between it and the flywheel. Cut gears are used, and the engine and drum shafts have bearings of phosphor-bronze and anti-friction metal respectively. The engine is kept turning over all the time during working hours at its lowest practicable speed, and to hoist, the attendant depresses the pedal near the hand levers, and thus operates a speed changing device by which the speed is at once increased. Gas, gasoline or distillate may be used as fuel, and the cylinder charge is exploded by an electric igniter. A hand starting device is used, which has a small vertical air pump, much like a bicycle tire pump. This sprays a charge into the cylinder, and the charge is then exploded by a hand igniter. With this device one man can start the largest engine.

These hoisting plants are made in six sizes, ranging from 6 HP. to 44 HP., capable of hoisting loads of 1,150 to 6,000 lbs. respectively. They are among the gas engine specialties of Fairbanks, Morse & Co., of Chicago, to whom we are indebted for information respecting them.

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ROCK-FILL DAMS IN CALIFORNIA.

A valuable contribution to the 18th Annual Report of the U. S. Geological Survey is a comprehensive paper upon "Reservoirs for Irrigation," written by Mr. James D. Schuyler, M. Am. Soc. C. E. The paper has also been published in a much more convenient form as a separate report. Several of the dams described by Mr. Schuyler have already been illustrated in this journal; but there is an especial interest in the type of rock-fill dams successfully constructed in various parts of the Pacific coast territory to meet existing conditions.

One of the largest of these rock-fill dams, and the first built in California for irrigation purposes, is in the Escondido irrigation district, San Diego Co., and has been in service since 1895, in the irrigation of about 2,000 acres of land. This district is in a valley surrounded by mountains, and the dam is located on the Von Segern branch of San Elijo Creek, at an elevation of 1,300 ft. above sea level and 650 ft. above the town of Escondido. The immediate tributary water-shed covers only about eight square miles; and as this is not sufficient to fill the reservoir with its run-off, the main supply is brought by a conduit from the San Luis Rey River. The conduit taps this river at an altitude of 1,600 ft., and it has a capacity of 28 second-feet and is 15.6 miles long. Of this distance, 67,287 ft. are in ditch, 14,142 ft. in flume and 806 ft. in tunnel. The intake tunnel, 356 ft. long through solid granite, heads in the river 3 ft. below low water level, and its lower end is excavated below grade so as to form a settling basin, in which sand accumulates at the rate of 1,000 cu. ft. daily and is sluiced back into the river. The upper 8,000 ft. of conduit is a wooden flume, supported on the slopes of a rugged canyon, with a general width of 4 ft. and depth of 3 ft. The ditch is 5 ft. wide on the bottom, with side slopes of 1 on 1, and the minimum depth is 3 ft. The total cost of this conduit was $116,328, or $1.29 per foot for construction and engineering, besides 12 cts. per foot for right of way, commissions, etc. This conduit, when running to its full capacity, can fill the reservoir in 60 days, while the drainage area immediately at the dam sometimes yields enough to fill it without this auxiliary.

The general formation is granitic, and at the site of the dam bed-rock was found about 4 ft. below the bed of the creek and nearly level across the canyon. The top soil was carefully removed over the entire base of the dam and construction was commenced immediately upon the bed-rock, which was of the character of disintegrated granite, having harder bowlders scattered through it.

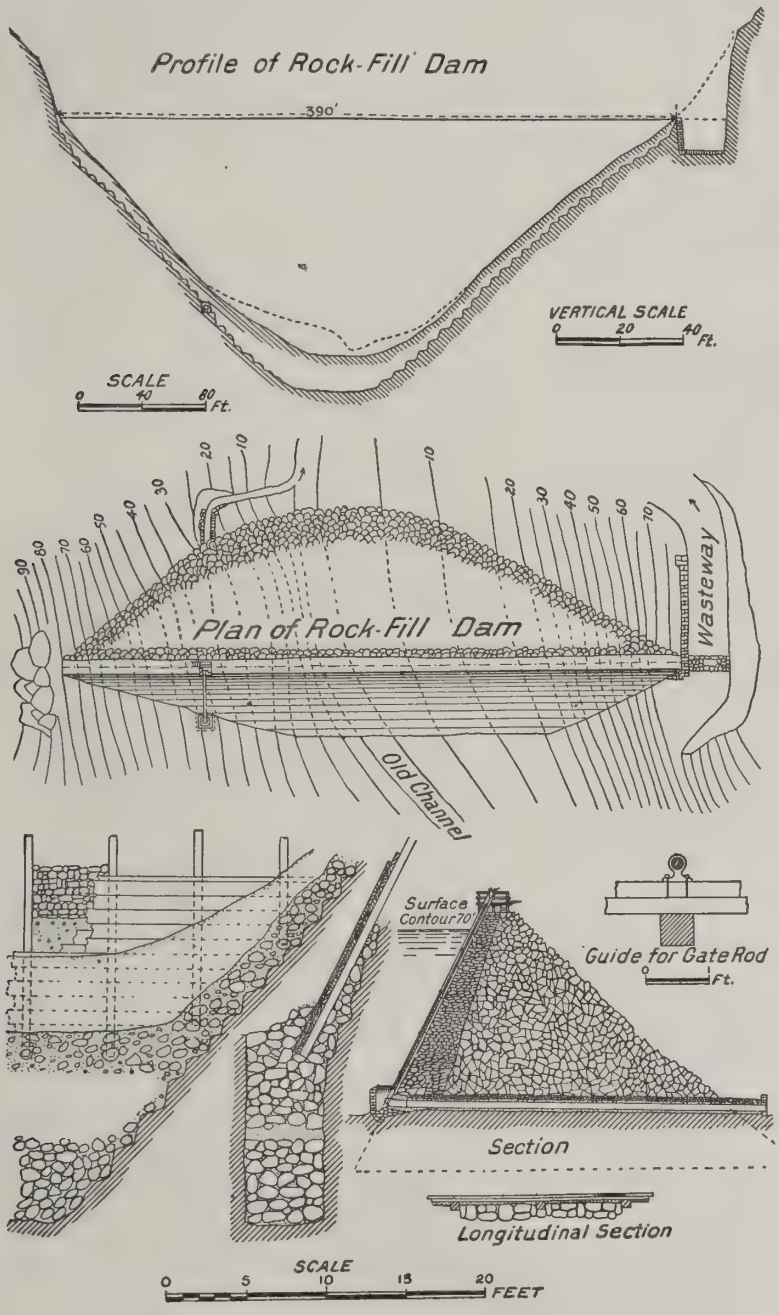
The dam was of the ordinary type of loose rock-fill dam, with plank facing; a type which has given good service in northern California for many years, but is usually regarded as being a somewhat temporary device owing to the perishable nature of the wooden skin depended upon for tightness. The Escondido dam is 76 ft. high, 380 ft. long on top, 100 ft. long on the bottom, and it has a base width of 140 ft. and a top width of 10 ft. A spillway was excavated in the solid rock at the north end, with a width of 25 ft. and its bottom on the 70 ft. contour, or 6 ft. below the top of the dam. This is left open and unobstructed. The slopes of the dam are 1 on ½ on the water face, and on the back 1 on 1 for half the height, with the lower half flattened to 1 on 1¼. After the foundations were stripped a trench was excavated at the upper toe of the dam, from 3 to 12 ft. deep, and this was filled with rubble masonry, 5 ft. thick, laid in Portland cement, to connect the plank facing with the canyon walls.

This dam contained 37,159 cu. yds. of rock, of which 6,000 cu. yds. were hand-laid in courses of dry rubble on the face, in a wall 15 ft. thick at the bottom and 5 ft. at the top. The remainder of the dam was in the form of loose, angular granite blocks, up to 4 tons in weight, dumped from cars and handled to some extent with derricks. No small quarry spalls or earth were used, and the result was a clean rock-fill which has only settled 3 ins. since final completion. A trestle was carried across the canyon, and the posts of this trestle were left buried in the embankment; a modern system of cable-way transport would have been cheaper, more rapid and better. As the hand-laid face wall was carried up, redwood timbers, 6 × 6 ins. and spaced 5 ft. 4 ins. apart on centers, were embedded to a depth of 4 ins. vertically in the masonry. To these timbers the planks were spiked, and as each row was put in place concrete was rammed into the 2-in. space between the plank and the wall, so as to give a full bearing to the plank. On the lower third of the dam the planks were 3 ins. thick; on the middle third, 2 ins., and on the upper third they were 1½ ins. thick and double throughout. Joints were broken, horizontally and vertically, as much as possible, and the jointe were calked and smeared with hot asphaltum.

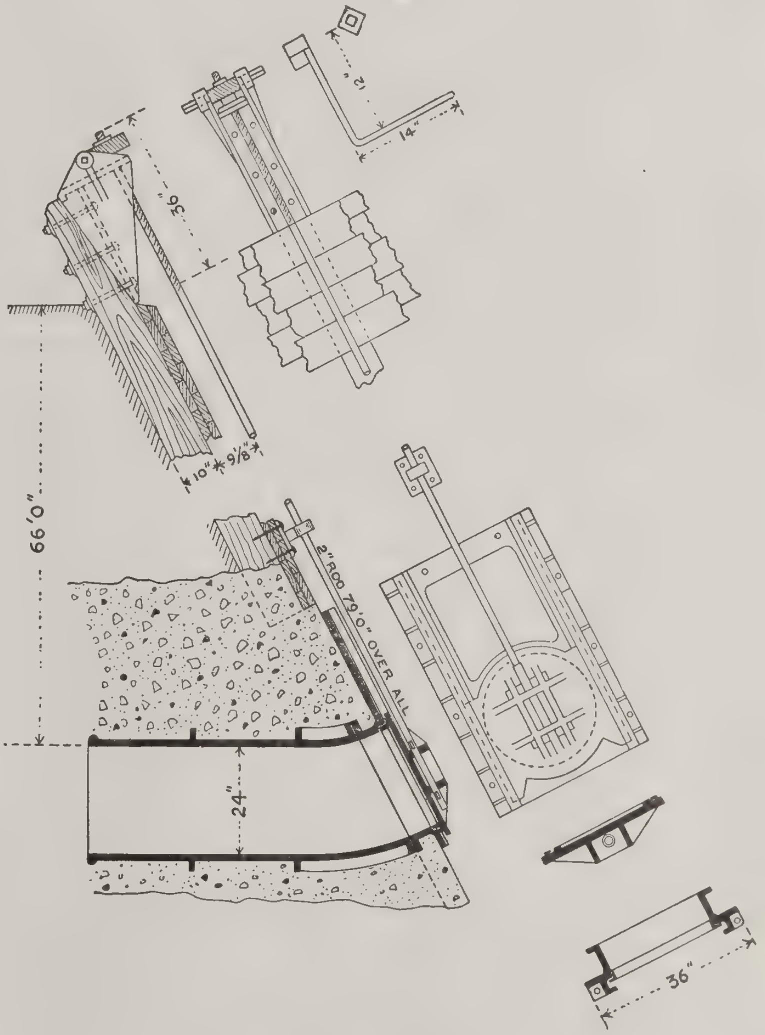
Springs were developed in the foundation excavation to the extent of 3 to 4 miner's inches constant flow. These were led by pipes to the outer toe; but when filled to the 57 ft. level, the maximum leakage was found to be 8 miner's inches, exclusive of the springs. This leakage remained quite constant, and it is doubtful whether it is due to percolation under the dam, through the disintegrated granite or to leakage through the joints in the plank facing. In any event, it is entirely harmless, though the loss of 100,000 gallons of water per day is an annoying one when it is needed for storage. The facing plank has been carried 3 ft. above the stone fill, as a wave protection, so that the ultimate crest is 9 ft. above the floor of the spillway. The outlet was originally designed to be controlled by a tower, and the foundation was laid at the upper toe of the dam on the south side; but the plan was changed; a grating was placed over the base of the tower a few feet above the gate covering the outlet; and the gate was set on an incline and controlled by a 2-in. rod leading up the incline to a worm-gear located above the crest of the dam. The outlet pipe is 24 ins. diameter, and is made of ordinary vitrified sewer pipe, laid in a trench and imbedded in concrete to a depth of 12 ins.

The total cost of this dam, under the contract, was $86,946.21, or $27.82 per acre-foot of reservoir capacity up to the floor of the spillway. The land for the reservoir site cost in addition $23,112, including clearing, and the total cost was $110,059, or $38.41 per acre-foot. The contract prices were unusually high for such work, and were as follows: Per cubic yard, earth excavation, 30 cts.; rock excavation, $1.10; rock-fill, $1.50; dry-stone masonry, $3.75; rubble masonry in cement, $8.00; concrete, $14.00; and lumber, $50 per M feet. It is the first rock-fill dam built in California for irrigation purposes; the older dams of this type having been used exclusively in mining operations.

Other dams of this general type, under construction or built, are the Lower Otay rock-fill-steel-core dam, described in our issue of March 10, 1898; the Morena dam on Cottonwood Creek, about 50 miles from San Diego; Upper Otay reservoir; Chatsworth Park, in San Fernando Valley, Cal.; and the Pecos Valley dam. The Morena dam is to be 160 ft. high and is expected to carry 150 ft. of water. It will contain 256,000 cu. yds. of stone. The outlet will be at the 30-ft. contour and consists of a tunnel, 6 × 6 ft. and 600 ft. long, cut in the solid rock, and in this tunnel will be two 24-in. and one 12-in. steel pipes, imbedded in concrete. These will connect inside with a steel intake inclined well or pipe, 36 ins. diameter, running up the side of the canyon at the toe of the slope of the dam, and fitted with 36-in. stops at every 30 ft. in height. These stops will be controlled by rods passing up the slope to the top. The dam is being built by a company under contract to deliver to the city of San Diego 12,960,000 gallons of water daily at a point four miles from the city. Mr. Schuyler says that the constructors seem to consider the services of an engineer superfluous, and there is practically no engineering



PLANS AND PROFILES OF ESCONDIDO DAM.



DETAILS OF GATE OF ESCONDIDO DAM.

supervision. The City Engineer of San Diego alleges that extraordinary negligence has been shown in laying the toe wall, which is said to have been built up 112.5 ft. high in 18 days!

At the Upper Otay reservoir the foundations were laid at the time of Mr. Schuyler's report, and while the canyon at the bottom is only 20 ft. wide, in porphyry rock, the dam may be built to a height of 100 or 120 ft. The Chatsworth Park dam succeeds two earthen dams previously carried away, and the new dam is quoted by Mr. Schuyler as an example of "how not to do it." This rock-fill dam is 41.3 ft. high above the creek bed, 100 ft. long on the bottom, and 159 ft. on top. It is 10 ft. wide on top, and slopes at an angle of 60°, or 1 on .057, on each side, giving a base of 60 ft. The water face is covered with Portland cement concrete, 8 to 16 ins. thick. The rock used for the fill is a soft sandstone, dumped in place without selection; and as everything loosened in the quarry was put into the fill, the proportion of earth and sand is very large. The angle of repose of the mass is thus flatter than that of rock alone, and flatter than the slopes proposed by the plans. The specifications were carelessly carried out, and the dam leaked considerably with 10 ft. of water behind it, and three-fourths of the lower face wall slid off two weeks after the contractor had "finished" his work. The work was done by contract for $9,000, partly payable in land. The company failed, and the dam is being reconstructed by building a dry hand-laid slope wall on the lower face, 4 ft. thick, and covering this with a masonry wall 6 ft. thick. The mortar used is half lime and half cement to three parts sand, and it will have an outer coat of 6 ins. of concrete. But all this is on the lower face of the dam.

The Pecos Valley rock-fill dams, near the town of Eddy, New Mexico, were built for storage reservoirs in 1889-90 and 1893. They differ from the others in using earth alone as a facing to stop leakage. The lower dam, built first, was 48 ft. high and 1,380 ft. long; the water slope of the rock-fill was 1 on 1½; width of rock base, 106 ft.; crown, 10 ft. wide. The earthen facing also had a crown width of 10 ft. and a slope of 1 on 3, covered with a pitching of loose stone for wave protection. This dam was ruptured in 1893 by a flood-wave in excess of the spillway capacity; a breach being made 300 ft. wide. It was immediately repaired and built 3 ft. higher, at a cost of $86,000, and the spillway capacity was increased to 33,000 second-feet, with the water 7 ft. below the top of the dam. The upper dam, built in 1893, was built in a similar manner, except that the rock-fill was made 14 ft. wide at top, and the earth fill only 6 ft. wide; the slopes remaining the same. The face of the rock-fill, against which the earth rests, was a hand-laid wall, 2 ft. thick, on a slope of 1 on ½. It required 102,400 cu. yds. of rock, 103,600 cu. yds. of earth, 3,800 cu. yds. dry retaining wall and 6,200 cu. yds. of rip-rap. It is said to have cost $170,000 complete. This dam is 52 ft. high, 1,686 ft. long, 20 ft. wide on top, and 280 ft. wide on the base. In 1895, when visited by Mr. Schuyler, it showed no signs of leakage or settlement, though the reservoir was more than half full.

BOOK REVIEWS.

UNSERE HOCHSCHULEN UND DIE AUFORDERUNGEN DES ZWANZCGSTEN JAHRHUNDERTS.—Von A. Riedler, Konigl, Geheimen Regierungerath und Professor. Berlin, 1898. A. Seydel. Paper; 10½ × 7½ ins.; pp. 120.

In this work on "German Universities and the Demands of the 20th Century," Prof. Riedler discusses the present state of German universities and technical colleges, and raises the question whether these institutions for highest education will be able to fulfill the national tasks of the future. He claims that engineering work is the pioneer of natural science and one of the principal features of modern culture. The author develops a scheme of reform of the German universities, recommending the uniting of the existing kinds of universities and completing the old universities by technical departments, embracing the whole of technical science. He hopes that this reform will result in a much more effective scientific and technical instruction, and besides will lead to a higher social appreciation of engineers and architects than now is the rule in Germany. In case the union proposed by him cannot be brought about, the author advocates a reform of the German technical colleges, aiming at thorough economical and general scientific education, but fights energetically against the attempt to join some one or other single branch of technical science to the old universities, because it would undoubtedly perish in such isolation.

FRANCHISES AND TAXATION IN CHICAGO.—Ninth Biennial Report of the Bureau of Labor Statistics of Illinois. Secretary, Geo. A. Schilling, Springfield, Ill. Chief Special Agent, Prof. E. W. Bemis (now of), Manhattan, Kan. Paper; 5½ × 8½ ins.; pp. 320; many tables. Address the Secretary.

This volume contains some very interesting studies of the street railway, gas and telephone companies of Chicago. By showing in detail the over-capitalization of the various companies, the prices charged by them for their services and the compensation, when any is rendered, paid the city for their franchises, the report paints a dark picture. If the figures presented are reliable, and they give evidence of having been prepared with care, although many of them are of necessity only estimates, then the people of Chicago are paying enormous tribute to the conpanies named.

The accounts of some of the financial transactions of these companies read like fairy tales, especially those relating to Mr. Chas. T. Yerkes, who is here shown as a modern rival of Midas.

The section on taxation shows the ridiculously low assessed valuation of Chicago property, a fact also brought out in the discussion of franchises. The chapters on gas and street railways were prepared by Prof. Bemis, whose monograph entitled "Municipal Ownership of Gas in the United States" is recognized as a creditable work. The report is to be welcomed as another addition to the scanty information available regarding the operations of street railway and other natural monopolies in our great cities.

ELASTICITAET U FESTIGKEIT.—By Prof. C. Bach, K. Wurtt. Baudirector; Professor of Mechanical Engineering at the Royal Technical High School, Stuttgart. Third edition, revised and greatly enlarged. Julius Springer, Berlin. 8vo.; pp. 570; numerous illustrations; 18 gelatine plates and many tables. $4.

This is the third and much enlarged edition of Professor Bach's admirable and practical book on the Elasticity and Resistance of the most important structural materials. The author deems it advisable to initiate his readers into the methods used in the practical solution of the problems treated of in the book in order that they may form their own opinions based on actual conditions. The student thus becomes impressed with the fact that he is not dealing with a field which has already been largely threshed out, as is commonly assumed, but is, on the contrary, only in an active state of development. He points out that numerous able mathematicians have advanced formulae more rapidly than their practical knowledge of concrete material seemed to justify, because they neglected the physical aspect, and, therefore, their solutions, otherwise correct, do not always solve practical problems.

In this edition, which is even more fully illustrated than the second, and in which no pains have been spared in typography, will be found many additions relating to the actual work of carrying out the author's investigations.

Among these may be mentioned the much discussed problems of compression of short specimens, flexure of columns and resistance of flat and flanged cast-iron and steel plates and heads. Professor Bach's work in this direction is unique, as he is the first to solve these problems correctly and demonstrate his conclusions by actual tests. It is to be regretted that this valuable work has not yet been translated into English. We can heartily recommend it to any American engineers who read German.

WEALTH AND PROGRESS OF NEW SOUTH WALES, 1896-97.—By T. A. Coghlan, Government Statistician. Tenth issue. Sydney: Government Printer. Boards: 8¾ × 5½ ins.; pp. 1,028.

Mr. Coghlan here gives an interesting historical sketch of Australia, commencing in 1503, but carried out in considerable detail from the actual founding of the English colony at Botany Bay in 1788. The succeeding parts are similar in outline to previous issues, dealing with the area, physical configuration, climate, geology, fauna and flora, of New South Wales. Following this we have the detail of the government, commerce, industries, population, vital statistics, instruction, etc. Under the head of railways we find the history of their development from 1846, to the operation of 2,639 miles of road in 1897. Of this total 2,476 miles are single track, and the average cost per mile is put down at $60,660, in a total expenditure for railways of $160,122,690. For the year ending June 30, 1897, the gross revenue from the government railways of New South Wales was $15,073,710, an increase of $971,625 over the preceding year. The working expenses were $8,006,090, and the net earnings were thus 46.8% of the total earnings. It is interesting to note that while the home government maintains a fleet of ten warships on the Australian station, all the colonies entered into an agreement for ten years with the British government, in 1887, to pay a subsidy towards the maintenance of an Australian auxiliary squadron. This annual subvention amounts, for the whole of Australasia, to $455,000 for maintenance and $175,000 for interest on cost of construction at a 5% rate. The resultant fleet entered Port Jackson in 1891, and consisted of five fast cruisers, of 2,575 tons displacement each, and two torpedo gunboats, of 735 tons; of these, three cruisers and one gunboat are always kept in commission, while the others are held in reserve in Australian ports. But the Australian government has no voice in the management of these vessels or any control over their movements; but this force is always exclusive of the regular fleet maintained in Australian waters, and the British government replaces any vessel lost.

THE RELATIONS BETWEEN CITIES AND TOWNS AND STREET RAILWAY COMPANIES IN MASSACHUSETTS. Report of Special Committee consisting of Chas. F. Adams, of Lincoln; Wm. W. Crapo, of New Bedford, and Elihu B. Hayes, of Lynn; Walter S. Allen, New Bedford, Secretary. Paper; 6 × 9 ins.; pp. 296. Address one of those named above.

In our issue of April 7, 1898, we noticed the advance pages of the body of this report and commented editorially on the bill submitted by the committee to the legislature for establishing the future relations between street railway companies and municipalities. The full report, now before us, contains nearly 250 pages of appendices giving a large amount of valuable information on the subject under discussion. In the first appendix the secretary reviews in detail the history and present status of street railways in Massachusetts. Next there are given brief "Abstracts of the Statutes of the Various States in Relation to Franchises and Methods of Taxation of Street Railways." Then follows a general description of the street railway systems and franchises of 14 American and 22 European cities, this information apparently having been largely obtained by the commission at first hand. An abstract of a paper entitled a "Statement in Relation to Municipal Ownership and Operation of Street Railways in England," by Robt. P. Porter, forms still another appendix, besides which there are others quoting from previous Massachusetts reports bearing on the subject and showing how the law proposed by the commission would affect the revenue from street railways now received by the municipalities and what the various railway companies would have to pay as commutation for relief from the burdens of paving and snow removal now imposed upon them.

The paper by Mr. Porter is designed to show how the advocates of municipal ownership have misinterpreted English experience in this line. One of his chief arguments is that American capitalists would have done better in these English cities and towns than the municipalities themselves have done. There are certainly good reasons for making the comparison, instead, between public and private ownership in England, and then applying the conclusions to the probable results from public and private ownership in America. We have been very forward in our street railway development under private ownership, but England seems to have been backward in this matter under both private and public ownership. Mr. Porter has omitted at least one factor entering into the present condition of street railway development in England, whether under public or private ownership. He compares the street railway mileage and population of a number of American and English cities, but states the areas of neither; certainly area is an important factor in the case. Nor does he bring out the fact that whereas the capitalization of both public and private street railways in England are closely in accord with their actual cost, many of our American street railway companies are capitalized for many times their legitimate cost, so that under municipal ownership here much lower fares might prevail than are charged by the companies. English conservatism, in some instances, has saved and will continue to save vast sums which American capitalists have recklessly spent in more or less foolish experiments both in adopting new railway methods and making unwarranted extensions. The American plan is to charge all these expenditures to the capital account, instead of to profit and loss, and attempt to earn dividends on them. In other words, the public is called upon to bear the penalty of all the blunders or miscalculations of managers of private railways and often, but not always, has to do so. English managers of private railway companies do not have so much freedom in this respect, which partly explains their conservatism. In Massachusetts, also, the street railway companies are under the wholesome supervision of the State Railway Commissioners, but in most or all of our other American commonwealths these corporations manipulate their capital accounts about as they please.

It is not enough to show, as Mr. Porter attempts to do, that the mileage charges of American street railways are as low or lower than those on the municipal systems of England. The real question at issue is, how do prices in England compare under private and municipal ownership, and how would they compare here?

We do not doubt but that Mr. Porter is entirely right in some of his criticisms of American claims for municipal ownership abroad, and we are glad to say that he appears to have taken great pains to ascertain the facts bearing on the subject. But in interpreting these facts and applying them to American conditions we think he shows himself quite as much a partisan of private ownership as those he is criticising have been partisans of municipal ownership.

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THE PROPOSED STORAGE DAM AND RESERVOIR for the water-works system of Columbus, O., has been reported on by Mr. Jas. D. Schuyler, M. Am. Soc. C. E., of Los Angeles, Cal., who spent some time in Columbus for that purpose. Mr. Schuyler approves the general plan proposed by Mr. Julian Griggs, Chief Engineer of Public Improvements of Columbus, but recommends that the concrete dam be 52 instead of 30 ft. high, and that instead of an overflow dam a spillway be provided. A dam 52 ft. high would impound 5,681,000,000 gallons of water and flood nearly 500 acres, forming a long, narrow reservoir, very favorable to sedimentation. Mr. Schuyler also recommends that the curvature of the dam be increased by diminishing the radius from 1,910 to 800 ft., or less.

◆

THE LITIGATION OVER UNDERGROUND WATER supply, brought by Walter R. Smith against the former city of Brooklyn, N. Y., has again been decided in favor of the plaintiff. The plaintiff alleged that an artificial pond, from which he obtained ice, had been dried up by the driven wells sunk by the city a few years ago. The facts in the case, together with its course in the courts were given in an editorial on "Riparian Rights in Underground Waters," in our issue of Aug. 19, 1897. The present decision was made by the Appellate Division of the Supreme Court of the State of New York, and affirms an award of $1,800 damages to Mr. Smith, made in a jury trial.

◆

THE SECOND TRIAL OF THE SUIT of Joseph H. Smith et al vs. Salt Lake City, Utah, has been completed, and the decision of the referee was rendered July 14. This was a suit brought by the bondsmen of Dubois & Williams, the original contractors for the Parley's canyon conduit for supplying Salt Lake City with water. (See Engineering News, Oct. 22, 1896.) The bondsmen completed the work at a loss, and soon thereafter filed an action against the city to recover $97,000. They alleged in their complaint that the city changed the route of the conduit after the original contract was entered into, thus requiring the use of much more material than would otherwise have been needed. The trial was had before the same referee as in June, 1893, and the city won on every point. As that was in territorial days, the case came up before Judge Hallett of the Federal Court at Denver, who last winter granted a new trial, being of the opinion that it was to be assumed that a route had been established before the contractors bid upon the work, and if so that the contractors were entitled to extra pay. The case has been very strongly contested by the city, and at the second trial a number of the leading engineers and contractors of the state were employed, who inspected the completed work very thoroughly and who showed that the contractors did not lose the large amount of money claimed, and that one route would have been as expensive as the other. However, by the late decision, the referee awarded the plaintiffs $10,044, together with interest at 8%, from Feb. 4, 1892 (the date of the completion of the work), making a total of $15,245, and also the costs of the several hearings, about $3,000 more. The referee's report will have to again go to Judge Hallett, and it is likely that a bitter contest over its confirmation will be made, as neither side is satisfied with it.

THE EFFECTIVENESS OF AUTOMATIC SPRINKLERS was well shown in a recent fire in a storehouse at the Atlantic White Lead Works in Brooklyn. Only a portion of the building was protected by sprinklers. The fire originated on the second floor, about 30 ft. from the protected portion, and extended through all of the unprotected part of both the second and third floors, but was completely checked at the point where the sprinklers were located, the stock, plumber's materials packed in hay, being wet thoroughly. The loss would have been insignificant if the whole building had been protected.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Aug. 1 on the Central of Georgia Ry., at Fort McPherson, Ga., in which a train carrying troops for the Camp at Lithia Springs was run into by a freight train. No soldiers were hurt, but two railway employees were killed and three injured.

◆

EXCESSIVE EXPANSION OF THE BROOKLYN Bridge by the extreme heat of July 29, coupled with a blockade of trolley cars covering practically the entire suspended span, resulted in a slight buckling of the bottom chords of four of the six stiffening trusses. The damage done was unimportant in itself, and is chiefly interesting for the lessons which it teaches respecting certain features of the construction and the need of a more rigid regulation of the electric railway traffic. In our next issue we hope to give fuller details of the accident.

◆

THE REPORT ON THE "BOURGOGNE" DISASTER, made by the Court of Inquiry held at Halifax, N. S., exonerates the Captain and crew of the sailing vessel "Cromartyshire" from all blame for the collision. Concerning the course on which the French steamer was sailing at the time of the collision, Capt. W. H. Smith, of the Royal Naval Reserve, who was the Government's special commissioner in the investigation, said:

> It appears to me that "La Bourgogne," as a mail steamship starting from New York, was not in the position at the time of the collision as indicated by the steam lanes upon the pilot chart of the North Atlantic, where the steamship routes are laid down, and in the note upon the chart it is stated: "The principal transatlantic steamship companies have adopted these routes, and sailing vessels are requested to avoid them as much as possible."
>
> It also appears to me that it is highly desirable that the rule of following the steam lanes should be made binding on all steamships navigating the Atlantic, when plying between New York and European ports.
>
> "It is of much importance to all concerned that steamers carrying a large number of passengers between New York and European ports should, if practicable, traverse the Atlantic upon such safe courses that in all probability would take them clear of the most dangerous locality, and, if possible, steamers should especially avoid that portion where fogs are frequently known to exist and may be encountered at any time, more particularly during the summer months under certain conditions of weather and direction of wind.
>
> "I am of the opinion that it is desirable that new lane routes should be selected for fast passenger steamers to and from American ports. These routes should be established by law and adopted by the governments of the various localities.
>
> "The route I propose is as follows: Leaving New York, a course direct from Sandy Hook to longitude 70° west, in latitude 40° north, and follow that parallel of latitude until longitude 47° west is reached, then each ship could pursue the great circle course, either to Fastnet Rock Lighthouse, coast of Ireland, or the Scilly Islands, as the case might be. On the westerly or outward passage, steamers should go 30 miles to the northward of this route. Upon such a route, probably, no fog or icebergs would be encountered, and only an occasional derelict, which could be seen by a good lookout."

◆

FIREPROOF WOOD IN THE NEW WARSHIPS is advocated by Chief Naval Constructor Hichborn; but is opposed by the other three members of the Naval Construction Board, and the matter is referred to Secretary Long for final decision. The burning of the Spanish ships at Santiago has called renewed attention to the danger resulting from combustibles on board war vessels. On the other hand the fireproofing chemicals used in treating the wood are said to cause corrosion wherever it comes in contact with iron, and if the wood is exposed to moisture the chemicals may become leached out and the wood may lose its fireproof character. A later report states that the Secretary has approved Constructor Hichborn's report, and that all wood used in the new vessels will be fireproofed.

◆

A BURGLAR-PROOF VAULT OF ARMOR PLATE is being constructed by the Carnegie Steel Co. for the Union Trust Co., of Pittsburg. The interior of the safe, or vault, is to be 18½ × 16½ ft. by 9½ ft. high. Eleven plates of face-hardened, reforged nickel steel armor plate are to be used, aggregating 396,750 lbs. The size and location of these plates are described as follows: The front plate will measure 234 × 114 × 8 ins., and will weight 46,150 lbs. It will be reinforced by a rolled steel plate 222 × 102 × 6½ ins., weighing 38,200 lbs. The door will be circular, 87 ins. diameter, 8½ ins. thick, and will weigh 15,400 lbs. It will also be reinforced, but with a cast-steel plate, 86 ins. diameter, 3 ins. thick in the center and 6 ins. thick on the edges, weighing 7,500 lbs. The back plate will be 234 × 114 × 6 ins., 45,000 lbs., two side plates, 208 × 110 × 6 ins., 39,000 lbs. each; two top plates, 226½ × 106 × 6 ins., 41,000 lbs. each; two bottom plates, 234 × 106 × 6 ins., 42,250 lbs. each. The vault is to be constructed under the Hollar-Kennedy patent. No bolts are to be used, the plates being dovetailed together. The flanges of the plates are wedged snugly in undercut grooves of corresponding shape cut in the connecting plates, thus preventing movement in any direction. The vault will have a foundation of heavy masonry. The door will be ground to an air and gas-tight joint and will be secured by 27 heavy radial bolts. The mechanism for actuating the bolts will be checked by three time locks.

◆

A STAND OF COLORS, costing approximately $500, will be presented by The Engineers' Club of New York city to the first of the three regiments of Volunteer Engineers, authorized by Congress and now in camp at Peekskill, N. Y. It is also proposed to purchase a searchlight outfit for the first regiment, and The Engineers' Club has undertaken the work of raising the amount necessary, about $3,000. Subscriptions should be sent to Mr. S. W. Baldwin, Treasurer, care of The Engineers' Club, 374 Fifth Ave., New York city.

◆

EXPORTS OF MANUFACTURED GOODS from the United States for the fiscal year ending June 30 were the largest ever recorded, amounting to $288,871,449, or nearly 12 million dollars more than in any preceding year, more than double the exports of such goods a decade ago, and almost three times as much as in 1880. It is interesting to note that exports of bicycles amounted to $6,846,529, against less than two million dollars in the preceding year. The Bureau of Statistics of the Treasury Department has issued an interesting summary, showing the exports of the principal lines of manufactured goods in the last fiscal year and in the year ending June 30, 1888. We reprint it as follows, and would call especial attention to the growth in the exports of manufactures of iron, steel and copper.

	Year ending June 30.	
	1898.	1888.
Articles exported.	Value.	Value.
Starch	$1,850,353	$202,932
Flax, hemp and jute manufactures	2,557,465	1,391,216
Instruments for scientific purposes	2,770,803	714,514
Cars, carriages, etc.	3,424,419	2,243,756
Fertilizers	4,359,834	1,255,028
Tobacco, manufactures of	4,818,493	3,578,457
Paper, and manufactures of	5,494,564	1,078,561
Paraffine and paraffine wax	6,030,292	2,163,242
Cycles, and parts of	6,846,529	......
Agricultural implements	7,609,732	2,645,187
Chemicals, drugs, dyes & medicines	9,441,763	5,633,972
Cotton, manufactures of	17,024,092	13,013,189
Leather, and manufactures of	21,113,640	9,583,411
Copper, and manufactures of	32,180,872	3,812,798
Mineral oil, refined	51,782,316	47,042,109
Iron and steel, manufactures of	70,367,527	17,763,034

In view of the interest just now felt in our trade with the Orient, it may be remarked that Japan bought 53 million gallons of our mineral oils and China 44 million gallons.

◆

AMERICAN INTEREST IN THE PARIS EXHIBITION of 1900, it is hoped, will now be stimulated by the appointment of Mr. Ferdinand W. Peck as Commissioner-General for the United States. Mr. Peck was chairman of the Finance Committee of the Chicago exhibition, and was a member of the preliminary commission which was sent to Paris over a year ago. The business manager on Mr. Peck's staff will be Mr. Paul Blackman, who was Chief of Concessions of the Chicago exhibition. A permanent office of the Commission will shortly be opened in New York city, and several departments will be created, including those of agriculture, transportation, electricity, fine arts, machinery, American inventions, and mines and mining. The head of the last named department will be Mr. J. F. V. Skiff, who was the chief of the similar department in the Chicago exhibition.

◆

THE PNEUMATIC MAIL TUBE SYSTEM connecting the Brooklyn and New York General Post Offices was opened Aug. 1 before about 200 persons. The first carrier made the round trip from Brooklyn and back in six minutes and two seconds. The cost of the plant was about $60,000, and the government is to pay a rental of $14,000 per year to the New York Newspaper and Transportation Co. for carrying first-class matter.

◆

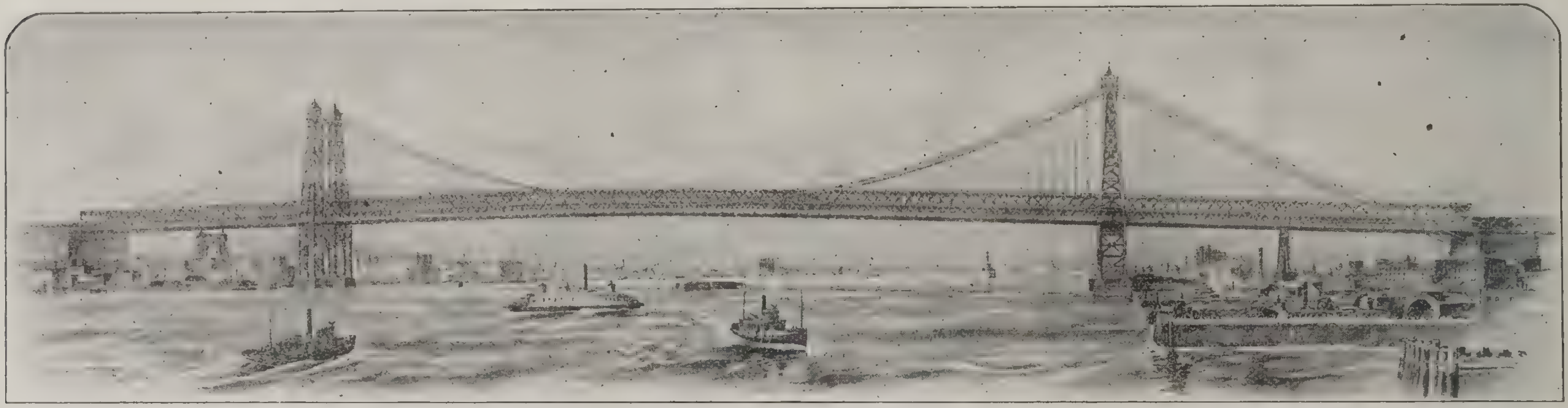
LIGNITE is being used for fuel by the Houston & Texas Central Ry. For switching engines it is used alone, with improved draft appliances and the diamond stack, but for road engines it is mixed with equal parts of coal. The results of the use of lignite are given by Mr. S. R. Tuggle, Superintendent of motive power of the road, in a paper read before the Texas Railway Club. He says that besides the saving in cost, due to the shorter haul, large beds of the lignite being near the main line of the road, there has been a saving in repairs of flues, stay-bolts and fire-boxes.

THE NEW EAST RIVER BRIDGE, NEW YORK CITY.

We show herewith a perspective view of the New East River Bridge, now under construction between New York and Brooklyn, which we have had engraved from a water-color drawing made for the New East River Bridge Commission by Mr. C. W. Reinhardt, Chief Draftsman of Engineering News. Details of the tower foundations, anchorages, end spans and towers proper of this bridge were published in our issues of May 27 and Sept. 9, 1897, and Feb. 17, 1898, and only a few of the leading dimensions of the completed structure will be given here. These are as follows:

	Feet.
Length between terminals	7,200
Width. out to out	118
Minimum height at pier-head lines	117
Minimum height at center of span	135
Height of masonry in tower foundations above mean high water	20
Height of center of cables at top of towers above mean high water	335
Width of carriageways, each	18
Width of two footwalks, each	12
Width of four trolley-car tracks, c. to c.	10
Width of two elevated railway tracks, c. to c.	12
Distance apart of stiffening trusses, c. to c.	72

The towers above the masonry and the entire suspended structure, except the flooring, will be of steel. The four suspension cables will each be 17½ ins. in diameter.



PERSPECTIVE VIEW OF THE NEW EAST RIVER BRIDGE BETWEEN NEW YORK AND BROOKLYN.
L. L. Buck, M. Am. Soc. C. E., Chief Engineer.

As most of our readers will remember, Mr. L. L. Buck, M. Am. Soc. C. E., is Engineer in Chief of the new bridge, and Mr. O. F. Nichols, M. Am. Soc. C. E., is his principal assistant. Work is now in progress upon the tower foundations and the anchorages, and bids have been received for constructing the towers and end spans, but contracts have not been awarded.

* * *

THE MACHINERY OF THE NEW TORPEDO BOATS AND TORPEDO-BOAT DESTROYERS.

The machinery of the 12 new torpedo boats and 16 torpedo-boat destroyers is described as follows in the official circular to bidders, issued by the Navy Department. The bids for these vessels are to be opened on Aug. 23:

Torpedo Boat.

The propelling engines will be of the vertical four-cylinder, direct-acting, triple-expansion type, each with cylinders 14, 22 and 25¼ ins. diameter and 18 ins. stroke. The indicated horse-power of the propelling engines will be about 3,000 when the engines are making about 350 revs. per min. The propelling engines will be placed in separate water-tight compartments, with the high pressure cylinders forward and the low pressure cylinders aft.

The main engines will be balanced in an approved manner. The main valves will be piston valves, one for each h-p. cylinder, operated by the Stephenson link motion. Each main piston will have one piston rod, with a crosshead working in a slipper guide.

The framing of the engines will consist of vertical forged-steel columns, stayed by forged and cast-steel ties and braces. The engine bedplates will be of cast steel, supported on forged steel keelson plates built in the vessel.

The crank shafts will be made in one section and will be hollow. The shafts, piston rods, connecting rods, valve rods, eccentric rods, and working parts generally, will be forged of nickel steel.

There will be two condensers made entirely of composition and sheet brass. Each will have a cooling surface of about 1,240 sq. ft., measured on the outside of the tubes, the water passing through the tubes. For each main engine there will be one double-acting air pump, driven from the main engine shaft. The circulating pumps will be of the centrifugal type, one for each condenser.

The propellers will be right and left, of manganese bronze or approved equivalent metal.

There will be three water-tube boilers constructed for a working pressure of 250 lbs. per sq. in. Two of these boilers will be placed in a water-tight compartment forward of the engines and the other one will be placed in a water-tight compartment abaft the engines. The total grate surface will be at least 137 sq. ft. and the total heating surface at least 7,544 sq. ft. There will be three smoke pipes, one for each boiler.

There will be two main feed pumps, one in the forward fire room and the other in the after engine room. These pumps will each have a capacity of 147 gallons per minute at a piston speed of 100 ft. per minute. There will be one auxiliary feed pump, located in the forward engine room. The capacity of this pump will be 147 gallons per minute at a speed of 100 ft. per minute. There will be one fire and bilge pump in the after engine room, having a capacity of 147 gallons per minute at a speed of 100 ft. per minute.

There will be two blowers in the forward and one in the after fire room. There will two evaporators and one distiller, and such other auxiliary or supplementary machinery, tools, instruments, or apparatus as are described in the detailed specifications or shown in the drawings.

The weight of all the machinery and boilers, including auxiliaries and radiators and water in the boilers, condensers and pipes, and such stores and spare parts as may be carried on board when fully equipped must not exceed 79.745 tons.

Torpedo-Boat Destroyers.

The propelling engines will be alike, and each will be placed in a separate water-tight compartment. These engines will be of the vertical four-cylinder, direct-acting, triple-expansion type, each with cylinders 20½, 32 and 38 ins. diameter and 22 ins. stroke. The indicated horse-power of propelling engines will be about 8,000 when the engines are making 327 revs. per min., the steam pressure at the engines being 250 lbs. per sq. in. above atmosphere. The order of cylinders will be as follows, beginning forward: For the starboard engine, second low-pressure, intermediate, high and first low-pressure; for the port engine, first low-pressure, high, intermediate, second low-pressure. The cranks will be at 90°, the high and first low-pressure cranks being opposite, as also the intermediate and second low-pressure, the second pair being at right angles with the first pair. The weights of the pistons will be such as to make the weights of reciprocating parts the same for all cylinders, the weights of the air-pump pistons and moving parts actuating them being taken into consideration. Any other system of balancing, which the contractors may wish to use, will be considered by the Bureau of Steam Engineering. The balancing of rotating weights of main engines by counterweights on the crank webs is left optional with contractors.

The main valves will be worked by means of Stephenson double-bar links. All the main valves will be piston valves, double-ported for steam, there being one for each high-pressure, two for each intermediate-pressure, and two for each low-pressure cylinder.

Each main piston will have one piston rod, with a crosshead working in a slipper guide. The framing of the engines will consist of vertical forged-steel columns, well stayed by diagonal braces. The engine bedplates will consist of a separate steel casting for each bearing, all supported upon and bolted to two fore-and-aft plates, which latter are supported by and form part of the engine keelsons, carefully and strongly worked into the framing of the vessel. The crank shafts will be made in two sections and will be hollow.

The shafts, piston rods, connecting rods and working parts generally, will be forged of high-grade steel.

There will be two condensers, made entirely of composition and sheet brass. Each will have a cooling surface of about 3,470 sq. ft., measured on the outside of the tubes, the water passing through the tubes. For each propelling engine there will be two double-acting vertical air pumps driven from the high and intermediate pressure crossheads. The circulating pumps will be of the centrifugal type, one for each condenser. The propellers will be right and left, of manganese bronze or approved equivalent metal.

There will be four water tube boilers, constructed for a working pressure of 300 lbs. per sq. in. Two of these boilers will be placed in a water-tight compartment forward of the engines, and the others will be placed in a water-tight compartment aft of the engines. The boilers in the after boiler compartment and the after boiler in the forward compartment will be alike, each containing about 80.5 sq. ft. of grate surface; the forward boiler will not be as wide as the others, and will contain about 73.5 sq. ft. of grate surface, the length of grates not exceeding 7 ft. in all the boilers. The total grate surface will be at least 315 sq. ft. and the total heating surface at least 17,768 sq. ft. There will be four smoke pipes, one for each boiler.

There will be four main feed pumps, each of a rated capacity of about 150 gallons per minute. They will be located, one in each engine room, and one in each fire room. All these pumps will draw from the feed tanks and from the reserve water tanks, as specified elsewhere, and will deliver into the main feed pipe. The main feed pumps located in engine rooms will deliver into both the main and the auxiliary feed systems. The main feed pump in the after engine room will draw from the reserve water tanks through a separate pipe. Both main feed pumps in engine rooms will draw from the air-pump channel ways.

There will be two auxiliary feed pumps, one in each fire room, of the same capacity as the main feed pumps. They will draw from the feed tanks, the reserve water tanks, and the sea, and discharge into the auxiliary feed pipe, into the fire main, and the ash ejectors. There will be in each engine room a fire and bilge pump. These pumps will draw from the bilge, through the auxiliary drain, and from the sea, and deliver overboard and in the fire main. There will be two blowers in each fire room.

The water level in each boiler will be controlled by an approved feed regulator.

There will be two evaporators and one distiller, and other auxiliary or supplementary machinery, tools, instruments, or apparatus as described in the detailed specifications.

The weight of all the machinery and boilers, including auxiliaries and heaters and water in the boilers, condensers, pipes, and feed tanks, and such stores and spare parts as may be carried on board when fully equipped will not exceed 190 tons.

* * *

THE "BOOTJACK" SIGNALS OF THE LAKE SHORE AND MICHIGAN SOUTHERN RY.

In the early use of railway signals and signaling little or no attempt was made at uniformity, and each road used such forms of targets, arms, etc., as it deemed best. As the art of signaling has improved and its use has become more general, however, the advantages incident to uniformity in signals and rules have become more generally recognized, and at the present day the semaphore form of signal is almost universally considered as the standard form, although the use of disks is still continued in certain automatic signals. Even in England a few examples of obsolete forms of signals are still to be seen; and in this country, where the introduction of signaling on a large scale is of comparatively recent date, there are still in use a number of special and peculiar signals which have been introduced by individual roads and are still continued in service.

An example of these is the "bootjack" signal, which is a feature of the Lake Shore & Michigan Southern Ry., and the general form of which is shown in Fig. 1. The signal has two arms at right angles to one another, both arms being in one piece, which is pivoted at the heel, a small counterweight at the heel balancing the arms and facilitating the working of the signal, besides returning it always to the "danger" position should the operating mechanism be broken. On the spindle of the signal is keyed a cogwheel, whose teeth engage with a rack on a vertical rod, to the lower end of which is attached a lamp. This lamp slides up and down in a box fitted with four or six lenses on one or both sides, according as the signal has four or six positions, and governs train movement in one or both directions. For six-position signals, two lamps are usually employed, placed side by side and moved together, showing two lights for each position of the arm. The signal is the invention of Mr. Wm. Gravit, Master Carpenter of the Lake Shore & Michigan Southern Ry., and has been in use since about 1881. It is used entirely on the main line, and to some extent on the branches, for block or train-order signaling, and is also used at junctions and for governing switch movements.

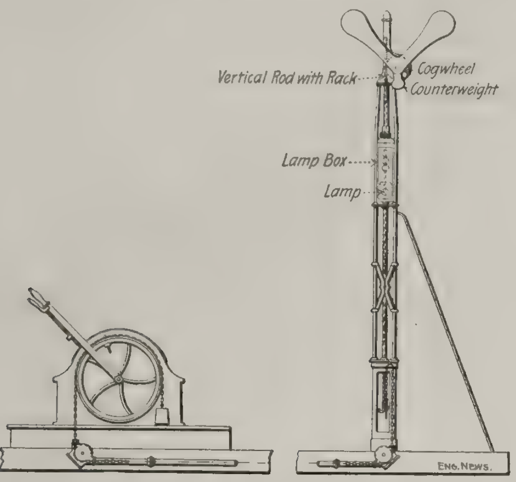


Fig. 1.—Bootjack Signal on the Lake Shore & Michigan Southern Ry. (Danger Position.)

In governing the movement of trains the signal has four positions: (1) Both arms pointing upward in V shape, both tracks blocked; (2) one arm horizontal and pointing south (and the other hanging down), south track blocked; (3) one arm horizontal and pointing north (and the other hanging down), north track blocked; (4) both arms pointing downward like an inverted V, both tracks clear. For these indications only two colors are used, white and red. At crossings and junctions, however, two additional positions are used, with the arm forming a horizontal V on one or other side of the post. For these signals there are six lenses, one above the other, but in most of the six-position signals there are two lamps placed side by side and moving together, showing two lights of the same or different colors for each position of the arm. For these signals white, red, and green lenses are used. The arms are invariably painted red on both sides.

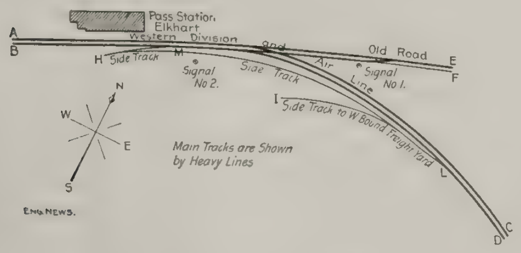


Fig. 2.—Plan of Junction at Elkhart, Ind.; L. S. & M. S. Ry. (Showing Signals).

The arrangement and indications of the signal will be clearly understood from Figs. 2 to 5. In Fig. 2 is shown a plan of the junction of the single track Old Road, with the double track Air Line and Western Division at Elkhart, Ind. The junction of these three divisions is opposite the station building, and train movements are governed by two "bootjack" signals and a single-arm block signal at the west end of the yard, 2,300 ft. west of the station. The sidetrack, I, leads from the Air Line into the westbound freight yard. The sidetrack, H, connects with both the Air Line and the Old Road. Eastbound freight is passed from H to to the Air Line either at M or around the sidetrack to L. Signal No. 1 is for switching movements only, and is a six-position double-lamp signal. Signal No. 2 refers to eastbound trains only, and its two lamps show in one direction only. The positions and lights of these two signals for their several indications are shown in Fig. 3. Westbound trains are controlled by the single-arm signal above mentioned, passenger trains from the station to this signal being given clearance cards through the yard.

Fig. 4 is a plan of the junction of the Jackson Branch and Monroe Branch with the main line of the Old Road at Lenawee Junction, Mich. Two signals are used, one of which is a "bootjack" with a single lamp showing a light in each direction, and the other is a pivoted red arm or target with two red lamps suspended from it. The positions and indications of these two signals are shown in Fig. 5.

These signals appear to be somewhat complicated and confusing in their indications, although we are informed that no complaints in these respects have been made by the operating department. Nevertheless the use of odd and peculiar signals is not to be recommended in these days, the advantages of uniformity having been so well established, nor is it good practice to attempt to make one signal give so many indications. When some more modern system of block signaling is introduced on the Lake Shore & Michigan Southern Ry. it is to be hoped that it will conform to the accepted standards, for reasons which have been editorially discussed in our issues of Jan. 20 and May 12.

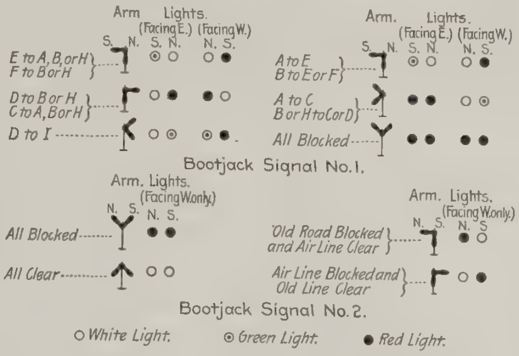


Fig. 3.—Positions and Colors of Four-Position and Six-Position Bootjack Signals at Elkhart.

It may be noted that on this road there is no signal engineer in charge of either the interlocking plants or the block or train-order signals, the latter being under the telegraph and operating departments. This anomalous condition of affairs is not by any means confined to the L. S. & M. S. Ry., however, as shown in a paper by Mr. W. H. Elliott, in our issue of Jan. 20; but in view of the rapid growth of signaling and block working on important lines it is most desirable that all work of this kind should be concentrated under the charge and supervision of one head in one department.

* * *

THE FAIRMOUNT PARK ARCH BRIDGE, PHILADELPHIA.

(With two-page plate.)

In our issue of July 2, 1896, we published the accepted design made by the Phoenix Bridge Co., for the new bridge to be built by the Fairmount Park Transportation Co., over the Schuylkill River, Fairmount Park, Philadelpia. This structure is now completed and in service, and on our double-page plate this week we present some of the more important metal work details and other interesting structural features of the work. It may be recalled to mind in this connection, also, that shortly after the design for this bridge was accepted there arose some discussion as to its fitness, which was given quite fully in Engineering News of Aug. 13, 1896. A study of the details shown here is made of somewhat more interest by reading this discussion in the same connection.

The general design of the Fairmount Park bridge is shown by Fig. 1. It consists of four 208 ft. stiff braced arches flanked on one end by two 70-ft. and one 85-ft. lattice spans, and at the other end by two 70-ft. and one 40-ft. spans. The total length of the bridge, excluding the embankment approaches, is thus 1,097 ft. Two electric railway tracks, a carriage-way and a foot-walk cross the bridge, the total width of 79 ft. 3 ins. being divided between them, as shown by the transverse section of the floor, Fig. 2. A special feature of the design which may be noted here is the method adopted for taking care of the grade to make it the least noticeable. This method consisted in making each arch of increasing depth as called for by the grade, but keeping the distance between the upper and lower chords at the center of the arch in each case the same. Had the arches been kept alike and the distances between the chords made to correspond to the grade, it was considered by the designers that the effect would not have been so good; as the change in grade between two arches would have been emphasized by this changing distance between the chords.

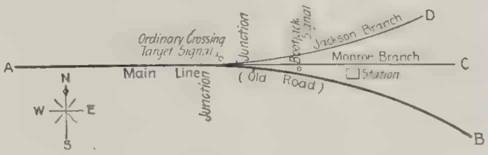


Fig. 4.—Plan of Lenawee Junction, Mich., L. S. & M. S. Ry. (Showing Signals).

The metalwork was proportioned for the following requirements:

(1) The floor beams and stringers are to carry a loading of 100 lbs. per sq. ft. over all parts of the sidewalk and driveway or a 20-ton load on a wheelbase of 9 ft. on any part of the driveway; and for 1,000 lbs. per lin. ft. of the railway tracks, or an electric car weighing 25 tons loaded followed by another car weighing 20 tons loaded, on a total wheelbase of 78 ft.

(2) The trusses are to carry the full area of the sidewalk and driveway over the whole span loaded with 80 lbs. per sq. ft., and 1,000 lbs. per lin. ft. over each railway track. The dead load was assumed to be 7,800 lbs. per lin. ft.

The strains induced by this loading are shown for one of the main arch ribs by Fig. 3, which also shows the panel arrangement, web system and end bearing construction in a general way.

Taking up one of the main arches more in detail, it will be seen that it is composed of three parallel ribs spaced 28 ft. apart c. to c. A stiff lateral system braces the ribs together in the plane of the bottom chord. The top chords are braced laterally only by the floor system, which, as will be seen later on, is an unusually stiff one. The web and chord connections are all riveted rigidly; with pins at center and ends. Fig. 4 shows the principal details of the center connection and one adjacent panel, and Fig. 5 similar details of one end bearing and the three adjacent panels. These drawings explain themselves.

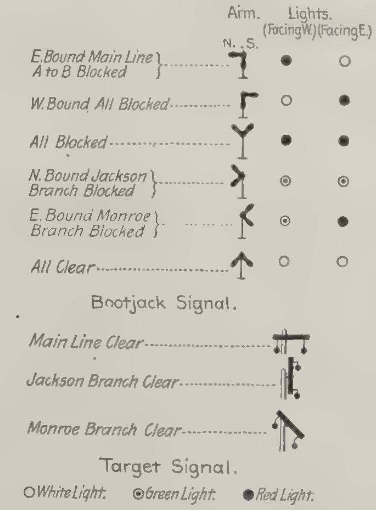


Fig. 5.—Positions and Colors of Bootjack and Target Signals at Lenawee Junction.

It will be noticed from Fig. 3 that the ends of the arch ribs are carried by steel shoes and bearing plates. The bearing plates of 1½-in. wrought steel were anchored to the masonry first and the location of the steel shoe castings fixed on the plates after all the piers were finished. The holes for the anchor bolts connecting the shoe castings to the bearing plates were drilled by template after the exact location of the respective shoes had been determined. This construction proved to be very efficient, not the slightest movement being noticed in swinging off the arches.

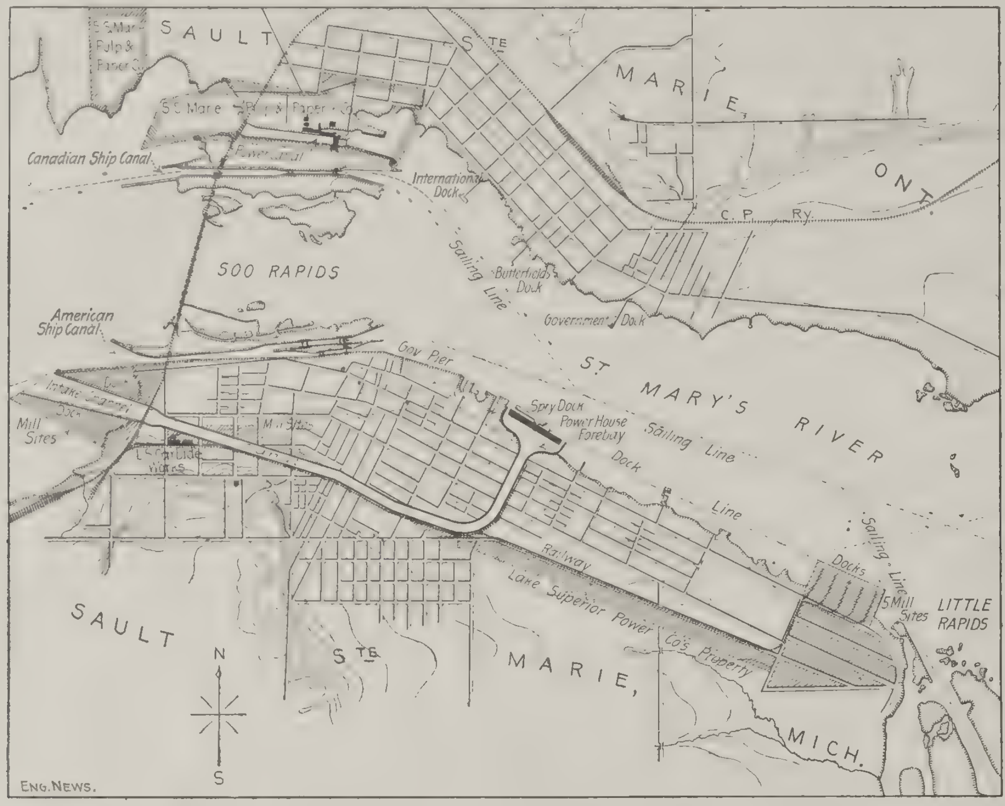


FIG. 1.—MAP SHOWING WATER POWER PLANTS OF THE LAKE SUPERIOR POWER CO., AT ST. MARY'S FALLS, MICHIGAN.

H. von Schon, Sault Ste. Marie, Mich., Chief Engineer.

The floor construction is shown clearly by Fig. 2. It will be noticed that the roadway and sidewalk have buckle plate floors with concrete filling, making a very stiff lateral bracing. The portion carrying the electric railway tracks has the ordinary floor beam, stringer and cross tie construction of railway bridges, but between each pair of the main floor beams, shown by Fig. 2, there is introduced an intermediate beam covering just the width of the railway tracks.

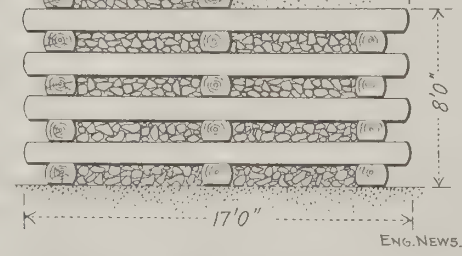


Fig. 2.—Retaining Cribwork for Banks of Intake Channel in Earth.

The method of erecting the bridge by falseworks is clearly shown by Figs. 6 and 7. These two engravings, made from photographs taken May 7 and May 18, respectively, also indicate the rapidity of erection. In about one month's time the three main spans were erected nearly complete, including the floor system and trolley tracks. Concerning the plan of erection, it will be noticed from Fig. 6 that the lower chords of the arches were first connected complete on the falseworks, including the bracing, and then the web members and upper chords were put in place panel by panel. This plan was found to be quicker and better, and was much easier on the falseworks, than the plan of erecting the bridge by putting in place a complete panel at a time, proceeding from one end to the other. It practically eliminated any pushing of the falsework due to loading one side first.

As an example of careful shop work, as well as for its rapid erection, this bridge is worthy of notice. Each arch is different, including all members, and although the metal work was not assembled in the shop before shipment the foreman of erection states that every joint and detail came together perfectly and without the least trouble.

In the foregoing, attention has been called very briefly only to the principal constructional features of this bridge, but a great many minor details of interest are shown by the drawings. For the matter from which this description and the illustrations have been prepared we are indebted to the Phoenix Bridge Co., Phoenixville, Pa., Mr. John Sterling Deans, M. Am. Soc. C. E., Chief Engineer.

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WATER POWER DEVELOPMENT BY THE LAKE SUPERIOR POWER CO., AT ST. MARY'S FALLS, MICH.

The possibility of utilizing the 18-ft. fall in the St. Mary's River at Sault Ste. Marie, Mich., for developing water power has long been recognized, and various different attempts have been made in the past to organize and carry out a broad plan of utilization. None of these plans reached a very advanced stage on the American side of the falls until recently, but on the Canadian side a large amount of work has been done during the past three years. The work of water power development on the Canadian side was first taken up, we believe, by the town of Sault Ste. Marie, Ontario. The town was, however, unable to raise the money necessary to carry the work to conclusion, and some four years ago it disposed of its interests to the Lake Superior Power Co., composed of a syndicate of Eastern capitalists, headed by the following officers: President, E. V. Douglas, Philadelphia, Pa.; Vice-President, F. H. Clergue, Bangor, Me.; and Treasurer, W. P. Douglas, Philadelphia, Pa. The company's headquarters are at 1420 Chestnut St., Philadelphia, Pa.

At about the same time, 1894, the same company secured the rights for water power development on the American side, but it first began the actual work of construction on the Canadian side. Here it completed a canal about 2,000 ft. long, 125 ft. wide, and 14 ft. deep, with all the necessary constructions for developing 20,000 HP. To use this power, two 40-grinder pulp mills were erected, one being completed in the fall of 1896, and the other during the following summer of 1897. The location of these mills, the canal and the other property of the company on the Canada side is shown by the map, Fig. 1, and this work will not be referred to again here.

On the American side of the river the work had, of course, been progressing in securing property and developing plans for the proposed improvement, but it was not until the present year that actual construction was begun. In fact the work might have been delayed still longer had it not been for the development of the calcium carbide industry. In 1896, Mr. Geo. O. Knapp, of Chicago, Ill., with the co-operation of the Lake Superior Power Co., erected at Sault Ste. Marie, Mich., the Lake Superior Carbide Works, for the manufacture of calcium carbide. This finally led to the organization of the Union Carbide Co., which controls the manufacture of calcium carbide over a large portion of the United States, and this company proposes to concentrate the manufacture of its commodity at Sault Ste. Marie. At the very outset, the company will require some 20,000-HP. (electrical) for its new works, and this power the Lake Superior Power Co. has contracted to supply. The remaining power to be developed will be largely consumed, it is expected, in the electrical reduction and concentration of the various copper and nickel ores in which the country to the north of the "Soo" is so rich. With this brief explanation, attention may be given to the plan proper for developing the water power of the St. Mary's River on the American side of the falls.

The St. Mary's River, as most of our readers know, is the outlet for the waters of Lake Superior into Lake Huron, the mean discharge at the rapids being about 90,000 cu. ft. per second. The mean elevation of Lake Superior is 601½ ft., while that of the river below is 582 ft., making a fall of 19½ ft. in a distance of about 3,500 ft. The general scope of the Lake Superior Power Co.'s project is to divert such a portion of the discharge over the most direct and economical route as will yield 40,000 HP. at the turbine shaft. To accomplish this it will excavate a canal through the village of Sault Ste. Marie, Mich., along the route shown by Fig. 1, and at its lower end erect a power house with the necessary turbines and electrical generators.

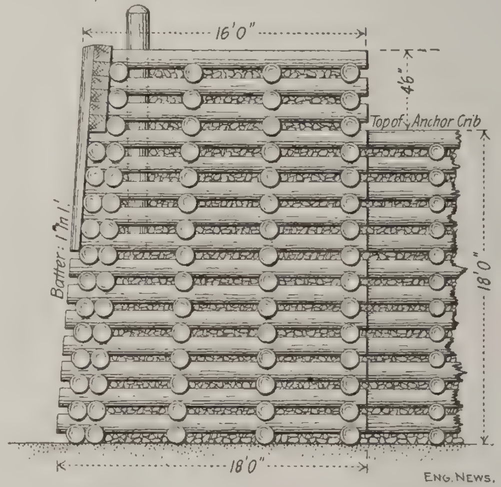


Fig. 3.—Bulkhead Wharf Construction at Entrance of Intake Channel.

Canal.

Location.—The right of way secured for the canal was primarily the location selected some ten years ago by one of the early companies organized to develop the water power of the river. In a measure, this early location, or a portion of it, is the logical one. The present canal location, therefore, follows the old location for about 6,000 ft., then curves to the north to an outlet. The old location continued nearly straight ahead, as shown by the dotted lines bounding the company's property, to an outlet some two miles or more below the falls. Fig. 1 shows clearly the present location.

The general location having been selected the next step was to determine the necessary dimensions of the canal. It was found that for about 3,000 ft., beginning at the west end, Potsdam sandstone came to the surface, and thence for the remaining distance the formation was sand, gravel, clay and boulders in undefined and irregular deposits, the sand, however, largely predominating. For nearly two-thirds of its length, therefore, the material penetrated by the canal would not endure undisturbed a velocity greater than 3 ft. per second. Such a flow would require a sectional area in the canal prism of about 10,000 sq. ft. or a width of canal of from 450 ft. to 500 ft. This width was out of the question. The land adjacent to the canal location had become settled and built upon, and the real or imaginary value fixed upon it by its owners, prohibited any thought of requiring much of it for right of way. The only solution was to narrow the canal and so protect its banks as to permit of a velocity of flow approximating that which could be safely maintained in the rock cut. This velocity was set at 7½ ft. per second.

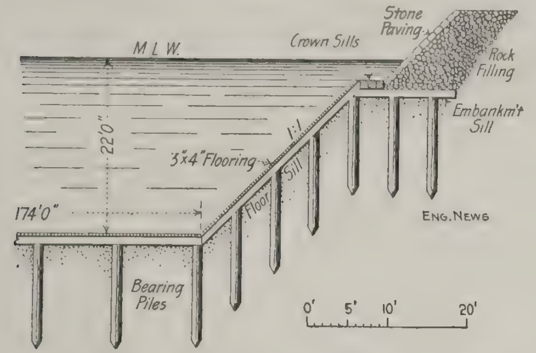


Fig. 4.—Revetment for Canal Prism in Earth.

The canal capacity was based upon the final development of 40,000 HP. on the shaft of turbines yielding 80% efficiency with seven-eighths water. The volumes of water required to be diverted to attain this result was $\frac{504{,}473}{Vh}$, in which V is the velocity of 7½ ft. and h is the effective head, which was found to be 16.2 ft., or a volume of 4,200 cu. ft. per second. Adopting an excess of area of 5% and the coefficient of friction, n, of 0.02, this made the necessary rectangular section in rock 200 × 22 ft. For earth, adopting an excess of area of 2½% and a coefficient of friction of 0.015, with side slopes of 1 on 1, the necessary section was 22 ft. deep, 174 ft. wide on the bottom, and 218 ft. wide at the top. These sections were, therefore, adopted for the main part of the canal; there being a widening at the head to form an intake and another at the foot to make a forebay.

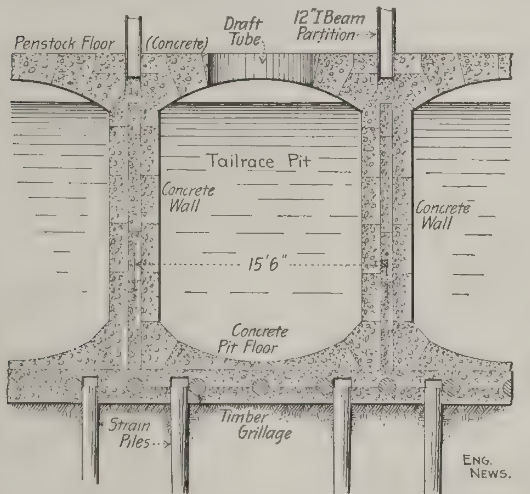


Fig. 6.—Cross Section of Tailrace Pit.

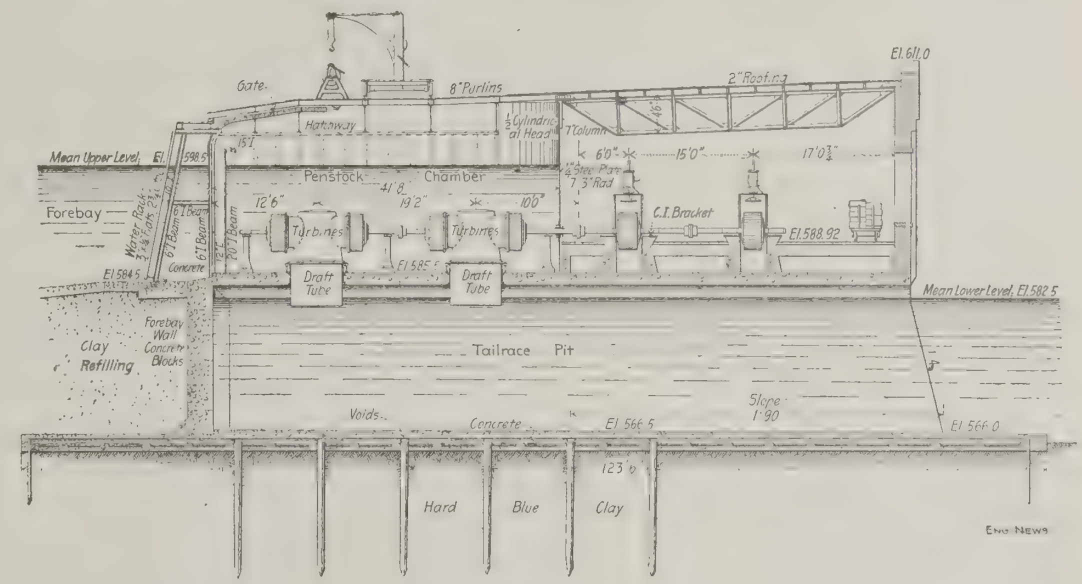


FIG. 5.—TRANSVERSE SECTION OF POWER-HOUSE THROUGH PENSTOCK AND TAILRACE PIT.

The intake is 2,400 ft. long and leads through a shallow bay to the navigable channel in the St. Mary's River. Here the prism is gradually widened to 500 ft., the sides being cribwork. The forebay at the terminal of the canal is about 1,400 ft. wide and is closed by the power house, as shown by Fig. 1.

For purposes of construction the work is divided into the Intake Section, Canal Sections I., II. and III., the Forebay and the Power House. The description of the work will follow the same order of division.

Intake.—The intake section extends from the harbor line on the west, east to the river shore, traversing Ashmun Bay, a shallow sheet of water generally from 3 ft. to 5 ft. deep. This section is about 2,400 ft. long, its eastern section being mostly in sandstone rock and the western section in sand, gravel and boulders. The rock portion is to be cofferdammed, and a rectangular channel 200 × 22 ft. is to be excavated dry. The western portion is to be gradually widened to 500 ft. at the entrance and dredged to a depth of 18 ft. The sides of the dredged channel are to be retained by log timber cribs with stone paved earth embankments, except near the western terminal, where bulkhead wharves 600 ft. long will be built.

The general construction of the retaining cribs is shown by Fig. 2, and is described more in detail in the specifications as follows:

The material is to be of hemlock, tamarack or Norway pine logs, faced on two sides to uniform thickness of 12 ins., laid in alternate longitudinal and transverse courses upon each other in crib form. The bottom course of the structure is a longitudinal of 12-in. timbers 30 ft. long, laid 7 ft. centers and is to rest on the channel bed in a horizontal plane, being 18 ft. below the datum plane. Upon it are laid transverse timbers 12 ins. thick and 17 ft. long, 7 ft. centers. The construction continues upward in this manner to a height of 8 ft. from the bottom, where it narrows, the upper four longitudinal courses consisting of only two rows of 12-in. timbers, the transverse timbers being 10 ft. long. The longitudinals in front and rear row are laid with butt joints and in center row pass by 7 ft. All timbers at crossings are spiked with ¾-in. × 20-in. drift bolts and all joints and laps are bolted every 2 ft. This construction terminates with a longitudinal course consisting of three 12-in. timbers laid close to the face of the crib, with top surface 16 ft. from bottom or 2 ft. below water surface, serving as heel sills for the stone paved bank, rising from this elevation to a height of 5 ft. above water surface on a slope of 1 on 1. The bottom transverse course in each alternate crib bay is floored with closely laid 12-in. logs, each spiked at crossing to each longitudinal timber with one ⅞-in. × 20-in. drift bolt. The cribwork is to be filled with stone ballast selected from rock excavation, no piece exceeding 1 cu. ft., and with chips and gravel to fill the voids between larger stones; and the back of the structure is to be filled with similar material to a height of 5 ft. above water surface. All this filling is to be in layers. The front slope of the filled space above the cribwork is to be paved with selected stones at least 12 ins. deep, set on edge by hand, close to each other, and so fitted that they will form a solid close-jointed pavement, resting at the foot against the toe log and being capped with larger flag stones all firmly imbedded into the bank.

The general construction of the bulkhead wharves is shown by Fig. 3, and is described in detail by the specifications as follows:

The bottom course of the structure rests on the channel bed in a horizontal plane, 18 ft. below datum plane, and is composed of four longitudinal 12-in. log timbers 30 ft. long, laid 5 ft. centers. Upon it are laid the transverse courses of 12-in. log timbers 18 ft. long and 7.5 ft. centers. The timbers in these two bottom courses are gained into each other at crossings 3 ins., so that the top surface of the transverse timbers is 1 ft. 9 ins. above foundation of structure. This construction continues upward except that all upper longitudinal timbers are 9 ins. thick, and that at crossings the transverse timbers only are gained for 1½ ins. The length of longitudinals is uniformly 30 ft. and they are laid butt to butt in front and rear rows, joints and splices are spiked with similar drift bolts set bolted to longitudinals; and they pass by 7.5 ft. in the two inner rows, being bolted to each other. Transverse timbers are of varying lengths as the construction goes upward, which is due to the face batter. All timber crossings are spiked with ¾-in. drift bolts 20 ins. long, and all joints and splices are spiked with similar drift bolts set from opposite sides and at intervals of 2 ft. This construction continues upward to 4 ft. 6 ins. above upper level, with the exception that the front row of longitudinals above water surface is of square-sawed white pine facing timbers.

The bottom facing timbers are 12 × 12 ins. × 26.5 ft., laid with 4-ft. scarf joints on bevel face to follow face batter and upon them are laid four courses of 10 × 12-in. × 30 ft. 8 ins. or 40 ft. long on 12-in. faces with butt joints. The cap facing timber is of 12 × 12 ins. × 34 ft. or 40 ft. long laid with 4-ft. half lap joints. All scarf and lap joints are tied by two 1 × 14-in. drift bolts; and facing timbers are secured to each other by ⅞-in. drift bolts of sufficient length to set through 2½ timbers, driven every 4 ft. The front ends of the transverse timbers above water surface are to be dovetailed into the square facing timbers, the dovetails to be not less than 6 ins. deep by 8 ins. wide, neatly cut, leaving square cut sawed shoulders on the ties and to fit up well against the facing timbers. The dovetailed ends are secured to the facing timbers, each with one ¾-in. round-pointed drift bolt, 16 ins. long. Half-round oak fenders are placed on each side of the exposed ends of the crossties, the top of fenders being flush with top of bulkhead. Mooring posts are placed in bulkhead every 50 ft. A close log floor is laid in each alternate crib bay upon the second longitudinal course from the bottom.

Five anchor cribs 20 ft. long (transversely), 22.5 ft. wide (longitudinally) and rising to water surface, are placed in rear of the main bulkhead. Their construction is the same as that of the main bulkhead, consisting of alternate longitudinal and transverse log timber courses. There are four longitudinals, 5-ft. centers, 24.5 ft. long, and four transverse timbers running through from front face of main bulkhead to rear of anchor crib in one length. These courses are laid and joined in the same manner as described for the main bulkhead and are all floored on the second longitudinal course as described for alternate bays in the main structure; two anchor piles are to be set in each unfloored bulkhead bay against the rear longitudinals, and stone ballast is to be placed in the entire bulkhead structure.

The work of excavation proper in the intake section calls for brief mention only. As stated, the western portion is dredging. The eastern portion inside the cofferdam is dry excavation in rock, overlayed by sand, gravel and boulders. There will be about 115,000 cu. yds. of solid rock and 152,000 cu. yds. of other material in this dry excavation. In rock the sides of the prism are to be cut with channelling machines.

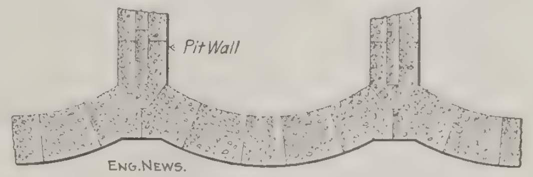


Fig. 7.—Horizontal Section Through Forebay Wall.

Canal Sections I., II. and III.—This portion of the work consists of the following excavation:

Section.	Dimensions of prism, ft.	Length, ft.	Not rock, cu. yds.	Rock, cu. yds.
I.	200 × 22	2,900	23,000	532,000
II.	22 × 174 and 218	2,900	710,000	......
III.	22 × 174 and 218	3,100	780,000	......
Total		8,900	1,513,000	532,000
Grand total of excavation				2,045,000

Besides excavation, this work comprises the necessary constructions for retaining the banks. In the rock portion this consists in constructing a retaining wall 3½ ft. wide at the bottom, and 2½ ft. wide at the top, where the top of the natural rock falls below the requisite height of the canal banks, and in remedial construction to be applied to the canal sides where the rock formation is found to be faulty. It is estimated that there will not be more than 350 cu. yds. of retaining wall.

The protection of the earth prism will consist of a timber revetment on the bottom and sides, constructed as shown by Fig. 4. The bearing piles are driven in rows spaced 5 ft. apart, and running transversely across the canal, and they carry log timber sills faced to a uniform width of 12 ins. and drift bolted to each pile. The space between sills is filled with puddle. On top of the sills is laid a floor of 3 × 4-in. timbers. The other details of construction are sufficiently explained by the drawing, Fig. 4.

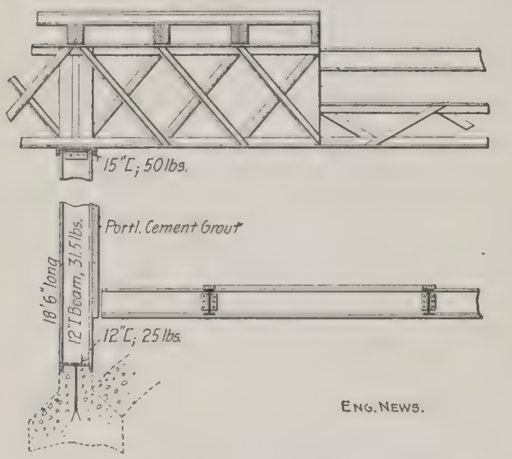


Fig. 8.—Part Longitudinal Section Showing Penstock Construction.

Forebay.—The forebay consists of the gradual expansion of the channel at the termination of Section III. by similar curves east and west to a width of about 1,400 ft. The length varies from 150 ft. to 300 ft. The power house closes the front of the forebay. The whole area of the forebay will be inclosed by triple-lap sheet piling, and its banks will be riveted in a manner similar to the earth sections of the canal proper. The amount of excavation called for, including that for the power house foundations, is 235,000 cu. yds. of mill waste, sand, gravel and clay.

Power House.

Foundations.—The foundation area of the power house is about 1,367 ft. × 125 ft., and the foundation consists of a timber grillage placed upon a bed of stiff clay and resting upon piles. A row of triple lap sheet piling surrounds the grillage, which is also filled and covered with concrete to a depth of 6 ins. above the tops of the log caps. This construction is shown in a general way by Fig. 5, which is a transverse section of the power house through the center of the penstock and of the tailrace pit underneath it. This section also shows the arrangement of the turbines and dynamo coupled to a single horizontal shaft, and it may be stated here that there are 85 of these units in the power house.

Tailrace Pits.—Upon the timber grillage foundation are erected the pit walls 3 ft. thick and 15½ ft. apart c. to c. These walls extend for 96 ft. transversely across the foundation grillage. At the bottom between the walls are sprung inverted arches forming the pit floors, and at the top is the roof, which is a series of circular arches with spans of 12½ ft., rises of 2 ft. and a thickness at the crowns of 1½ ft. This roof has circular openings lined with steel collars for the turbine discharge, and covers only 43 ft. of the pit length, or the length of the penstock chambers. The inner ends of the tailrace pits are closed by an arched forebay wall 18 ft. high. In this manner the tailrace pits are entirely enclosed except at their outer ends, where the water is discharged. Fig. 6 is a transverse section of one of the tailrace pits showing the wall, floor and roof construction just described, and Fig. 7 is a horizontal section of a small portion of the arched forebay wall closing the inner ends of the pits.

The construction of the pit walls, forebay wall and pit roof is of Portland cement concrete blocks laid in cement mortar, and that of the pit floors is monolithic Portland cement concrete. Altogether about 28,500 cu. yds. of concrete are required in the work, of which 23,739 cu. yds. will be in 14,400 blocks. The use of so much concrete block masonry in rather trying positions makes the specifications for the cement employed of more than usual interest, and their principal requirements are abstracted here:

The inspection of the cement will be in 100-barrel lots. Ordinarily cement will be taken for testing purposes from 10 barrels out of each 100 lot, selected at random, and the failure of any of this cement to come up to all the requirements will be considered sufficient cause to reject the lot of 100 barrels of which the faulty cement is a part. The inspection tests to which the cement is to be subjected will be made as follows:

(1.) To determine the time of initial setting cement will be mixed for three minutes with about 30% of water so as to make a stiff paste and then spread upon a glass plate to a thickness of about 1½ ins. Whenever this cement paste resists a slight pressure exerted by a finger nail it will be considered to have taken the initial test.

(2.) To determine the constancy of volume mixed neat cement will be made into wedge-shaped pats about 3 ins. on a side, ½-in. thick at back and tapering to a feather edge. This pat will be kept in a box protected from draft or sun and covered by a wet cloth for 24 hours and then laid in water of ordinary temperature where it will be kept and examined for a period of 28 days.

(3.) To determine the fineness the cement will be sifted through a No. 100 sieve; that is, 100 holes per lin. in.

(4.) To determine the tensile strength 20 briquettes of the cement lot to be tested, 10 of neat cement and 10 of three parts of standard Point Aux Pins sand, will be made and tested in accordance with the methods approved by the American Society of Civil Engineers as far as they relate to the preparing, preserving and breaking of the briquettes.

The requirements to be fulfilled by the cement in order to be accepted for this construction, as evidenced by the results of the inspection tests, are:

(1.) That the time of initial set is not less than one hour.

(2.) That the cement pats made for the constant volume test, exhibit no warping, cracking or other unsoundness after being in air or water of ordinary temperature for 28 days.

(3.) That the cement is of such fineness that at least 90% will pass a No. 100 sieve.

(4.) That the minimum tensile strength per sq. in. as per average of ten neat cement briquettes after 28 days of age (1 day in air and 27 in water) shall be 700 lbs., and of the three parts of sand briquettes of the same age and exposure, 300 lbs.

In regard to the manufacture of the concrete blocks the specifications are as follows:

The filling of the molds is to be done in molding sheds as close to the point where the concrete is mixed as practicable. The molds may be of any construction the contractor selects, provided they are of the true forms and dimensions required for the blocks and that they are lined with sheet iron on the inside. They may be bottomless provided they are placed upon sufficiently heavy and smooth platforms. Before the concrete is deposited in the molds each part of the mold which will come in contact with the concrete is to be thoroughly cleaned and covered with a thin coat of a good grade of machine oil. The molding of any one block must not be interrupted but is to be completed as rapidly as practicable without any intermission in the depositing and compacting of the concrete. The exposed surfaces of the block are to be molded out of the finer material contained in the concrete mass and this is to be compacted by special steel-shod oaken rammers having a face of ½-in. × 5 ins. The filling is to be carried slightly over the top surface of the mold and a cover sufficiently heavy is to be forced upon the top so that the surface becomes perfectly leveled off and smoothed. A cement label in accordance with the engineer's directions is to be inserted in the top of each block upon its completion. The sides of the mold may be removed 48 hours after the block is molded but no sooner, and the block is to remain upon the molding platform at least 15 days, during which time it must be shaded from sunlight, kept wet by sprinkling, and protected against freezing temperature. After this period blocks may be removed to storage where they may be piled provided they rest on 2-in. planks and they are to be protected from weather and temperature below 36° F. for 15 days more. Blocks which have attained an age of 30 days and are accepted by the engineer may be laid in the structure for which they are designed.

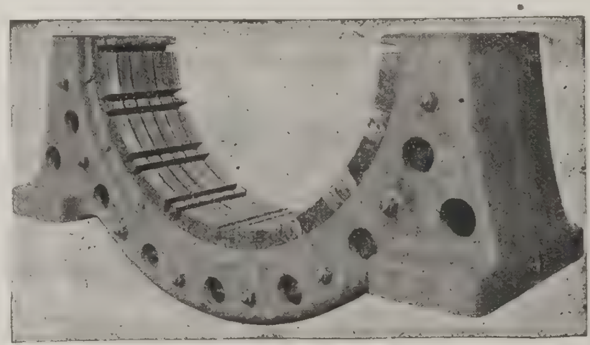


Fig. 10.—Lower Half of Stationary Armature for Single-Phase Alternating Current Generator.

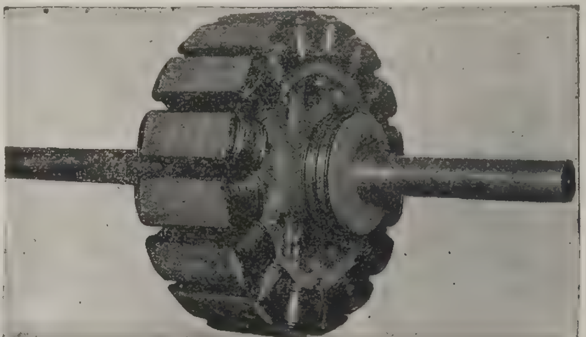


Fig. 11.—Rotating Field for 375 K-W. Alternating Current Generator, Built by the Walker Co., Cleveland, O.

The laying of the concrete blocks will be in all respects governed by such rules and methods as are usually adopted in laying first-class ashlar masonry.

Penstock.—The penstocks are located directly over the rear ends of the tailrace pits, as shown by Fig. 5, and consist of a floor, which is also the roof of the tailrace pit below, partition walls, cylindrical steel bulkheads closing the inner ends, and a trussed roof. Fig. 8 shows the partition wall, floor and roof construction, and Fig. 9 shows the bulkhead construction. It will be noted that the partition walls consist of a framing of I-beam posts with channel sills and caps filled with Portland cement grout. This filling will be done between timber forms having a clear inside width of 1 ft. 5 ins.

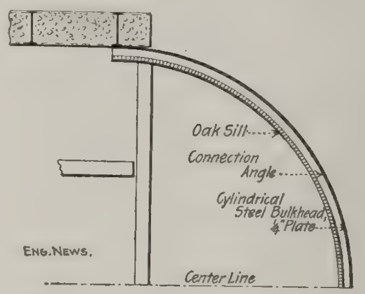


Fig. 9.—Horizontal Section Through Penstock Bulkhead.

The bulkhead is semicircular and is fastened to the walls and floor, as shown by Fig. 9. It is 14 ft. 6 ins. in diameter, and is made of ¼-in. steel plates connected by double riveted lap joints. The ends of the penstocks opposite the bulkheads are open into the forebay. Five of the penstocks are also arranged for spillways, and have a discharge capacity equal to the full amount of the water diverted by the canal.

Each penstock is closed by a rolling gate of the construction indicated by Fig. 5, and has a water rack to prevent the access of drift. A movable headgate of the wicker dam type will also be erected at the terminal of the canal proper, its superstructure being a highway bridge.

Mill.—The mill proper occupies the front portion of the power house, and contains the electric generators. The two pairs of turbines in each penstock have a capacity of 500 HP. at 250 revolutions. These are mounted on a single horizontal shaft, to which the 375-K-W. slow motion dynamo is also attached.

These generators, which are to be built by the Walker Co., Cleveland, O., operate at 200 volts and 60 cycles per second when running at 240 revolutions per minute. Ten exciters of 100 HP. each will be installed, and these will be belted to the turbines in such manner that each exciter can be operated by either of two turbines. The generators have stationary armatures, as shown in Fig. 10, with an interior revolving field magnet, which is a massive cast-iron split hub provided with steel ring tires, to which are bolted the 30 outwardly projecting laminated pole pieces. These are wound with a flat copper ribbon conductor, wound edge on, and insulated with shellacked paper. The winding is placed upon a suitable spool which is slipped on the pole piece and securely clamped when the pole piece is bolted down. These bobbins are connected in series, the ends running to the two rings, seen in Fig. 11, which permit the exciting current to reach the coils while the field is revolving. The armature consists of a large ring built up of sheet iron stampings, notched to form slots for the armature coils. These sheets are clamped together in semi-circular cast-iron side pieces, which are hollowed for ventilation, and the two halves are finally bolted together. The armature coils are wound on forms and carefully insulated, being afterwards slipped into slots, clamped into place and connected up. The current will be used in the carbide furnaces, consisting of 6 furnaces in multiple on four machines, and as only four furnaces out of the six will be in use at any one time, each furnace will take the full output of a machine, or about 1,800 amperes at 200 volts.

The mill house proper is built of sandstone masonry, with a steel truss roof and steel interior framing. Fig 5 shows this construction in a general way.

In conclusion it may be interesting to some of our readers to give the total amounts of the different kinds of work and material which will be required in constructing the plant. They are as follows:

Excavation:	
Solid rock, cu. yds.	650,000
Other material, cu. yds.	2,200,000
Log timber, ft., b. m.	15,000,000
Squared timber, ft., b. m.	7,000,000
Structural steel, tons	2,400
Bolts and spikes, tons	300
Portland cement, barrels	70,000
Sandstone masonry, cu. yds.	40,000
Sand, cu. yds.	25,000
Brokenstone, cu. yds.	60,000
Turbines	320
Dynamos	80

According to the present plans, all work of construction is to be completed in two years. All the plans and specifications of the work have been prepared under the direction of Mr. H. von Schon, Chief Engineer, Lake Superior Power Co., Sault Ste. Marie, Mich. We are indebted to Mr. von Schon for the information from which this description has been prepared, and also to "The American Electrician" for Figs. 10 and 11 and the material from which the description of the electrical apparatus was prepared.

* * *

THE WALKER CONDUIT ELECTRIC STREET RAILWAY SYSTEM.

The satisfactory working of the Metropolitan conduit electric railway in Washington, D. C., and the Lenox Avenue line in New York city, marked a new era in city street railway construction. The system thus practically tested has undoubtedly come to stay, because it meets the engineering requirements and also embodies the one feature long desired by municipal authorities, namely, freedom from any overhead construction.

The two roads just mentioned have now been in operation about three years, and their continued success is a final answer to the stock statement that conduit roads cannot be made to operate successfully or economically. As a result, we may expect to see many city street railway companies following the example of the Capital Traction Co., of Washington, or the Metropolitan, of New York, and either of their own accord, or under compulsion by city authorities, change their lines from horse, cable or overhead trolley to the conduit system.

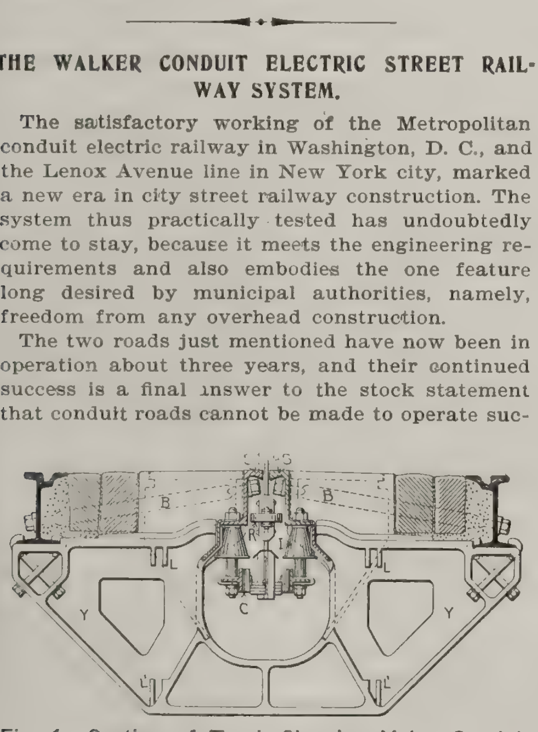


Fig. 1.—Section of Track Showing Yoke, Conduit Insulators and Plough

Anticipating this demand, likely to occur in the near future, the Walker Co., of Cleveland, O., has developed a conduit system embodying the successful features of the present systems and introducing such new ideas as experience has made expedient.

To the casual observer the conduit of this system appears the same as those first mentioned; substantial cast-iron yokes spaced about 5 ft. apart support deep girder rails and the usual slot rails. Inside the conduit are two T-shaped conductor rails, about 6 ins. apart and 14 ins. below the street surface, while every 15 ft. are the familiar cast-iron hand-hole lids.

Fig. 1 represents a section of track using the Walker conduit construction. The yokes, Y, are cast with large broad steps, but are light in weight, owing to the method of distributing the metal, the webs being cast thin, but deep. They are all of the same pattern, thus preventing any delay during construction work which would result from waiting for special yokes. Suitable steps are provided at the ends for supporting the rails, which are securely locked into place by hook bolts, as seen in the figure. The slot rails, S, S, are bolted to the yokes in the usual way and are braced by the flat tie rods, B, B. The insulators, I, I, Fig. 2, consist of an outer bell-shaped malleable iron shell and a straight steel shank threaded at the lower end and held in the bell by an insulating material, said to be superior to porcelain on account of its elasticity. This is formed around the knob of the rod and shoulder of the bell by pressure. These insulators are bolted to the foot of the slot rails a little to one side of every third yoke, that is, 15 ft. apart, and a cast-iron hand-hole frame, Fig. 3, is bolted to the slot rail and the yoke in the proper position to afford access to the insulator. To the lower end of these insulators the conductor rails, C, C, are bolted, the bolts passing through the web of the conductor, thus avoiding the long cast-iron offset heretofore used. These T-rails are 3 × 2½ ins., and have a cross section of about 250,000 circular miles. They weigh 18 lbs. per yd. and are rolled in 30-ft. lengths, thus bringing a joint at every third hand-hole, where two No. 0000 copper bonds are employed. The line is divided into insulated sections, varying from 500 to 800 ft. in length, which are connected together by a system of switches placed in suitable manholes under or at the side of the track, so arranged that any trouble can be easily located and confined to a short section of the line. Taps are taken off from the feeders at frequent intervals, and these are also controlled by switches.

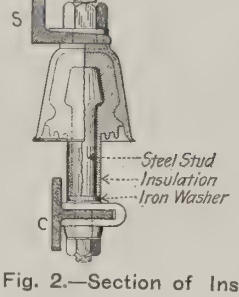


Fig. 2.—Section of Insulator for Supporting Conductor Rails.

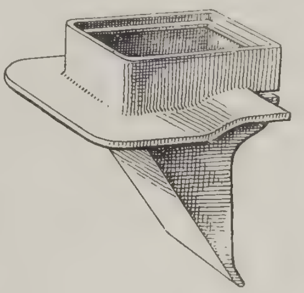
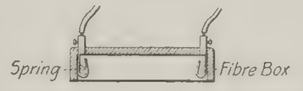


Fig. 3.—Cast Iron Handhole for Access to Insulators.

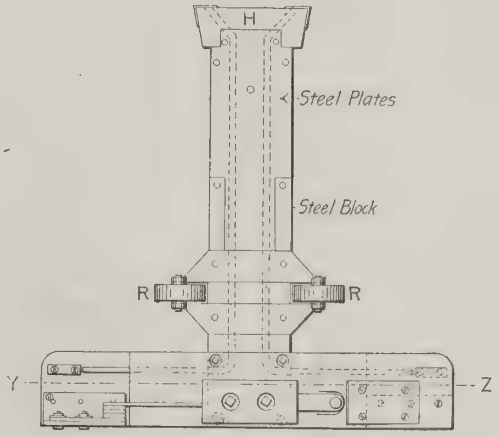
Construction work is facilitated by the lugs, L, L, cast on the yokes, into which boards are slipped to form a backing for the concrete of the conduit. In this way just the proper thickness of material is maintained with no waste. To prevent any possibility of the breaking-in of the concrete forming the arch at the top of the conduit, steel plates, shaped in rolling so as to hang on the foot of the slot rail and rest upon suitable lugs cast upon the yokes, are employed. The finished conduit is 16 ins. wide and 24 ins. deep from the upper surface of the slot rail to the bottom.

The plough employed, shown in Fig. 2, differs only in details from that used on the systems now in operation. It consists of two ¼-in. steel plates, bolted together, at the lower end of which are bolted two pieces of wood about 18 × 6 ins. by about ⅞-in. thick. The cast-iron contact shoes are mounted upon springs, as shown, and are connected through copper fuses to the leads, which run up in grooves between the steel plates to contact strips on an insulating block, H, at the top. Just where the hanger would wear against the sides of the slot tempered steel pieces are inserted. A few inches below this, two rollers are strongly mounted upon the hanger, their purpose being to bear against the foot of the slot rail, as seen in Fig. 1, and thus prevent any great strain on the conductor rails in rounding curves, or should the car run on a switch or off the track. To attach the plough to the car, a cast-iron clamp bar is bolted to the steel plates previously mentioned. This is proportioned so as to have ample strength under ordinary working conditions, but will break from any undue strain and permit the plough to drop free of the car. To facilitate this, connection from the car to the plough is made through a box, J, provided with contact springs which press against the strips on H. If the plough drops or it is desired to break connection the box is slipped off.

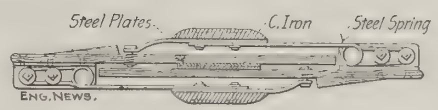
Comparing the section given in Fig. 1 with the section of the conduit roads now in use (Eng. News, Feb. 24, 1898, Fig. 4), several differences will be observed. The first, and possibly the most important, is the substitution of a molded compound in the insulator in place of porcelain, thus considerably reducing the size. The second, resulting from the reduction of size, admits of the insulator being bolted to the foot of the slot rail, thus saving the boring of one hole and the use of two bolts for each insulator, and lastly, as the insulators are now close together, the cast-iron offset is dispensed with, thus effecting a saving to that amount. The insulator stud is bolted directly to the web of the conductor rail, practically at its center of gravity, and consequently the strain on the insulator is simply the dead weight of the conductor rail, except when a car is passing. At such times there is a side strain due to the pressure of the plough springs.



Section of Box.



Side Elevation.



Section Y-Z.

Fig. 4.—Walker Plough and Details of Construction.

* * *

A WATER TANK AT DALLAS, TEX., is reported as having failed on Aug. 1, fatally injuring a man engaged in finishing it. The tank was to be used for private fire protection and was on a tower 65 ft. high. It had a capacity of about 30,000 gallons and had just been filled.

◆

ELECTRIC LOCOMOTIVES for operating the mountain divisions of the Central Pacific Ry. are said to be under consideration. It is believed that sufficient water power can be obtained from the mountain streams in the vicinity of the line to generate the current, and it is proposed to operate the road in this way from Sacramento east across the Sierra Nevadas to Verdi, Nev., a distance of 144 miles. While the above is only newspaper rumor, the high price of coal on the Central Pacific makes the story one which is not at all improbable.

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ADVERTISING RATES: 20 *cents per line. Want notices, special rates, see page* 18. *Rates for standing advertisements sent on request. Changes in standing advertisements must be received by Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.*

We noted in our last issue the issue of a supplementary circular by the Navy Department announcing that in considering bids for the three new battleships, preference would be given to designs promising the highest speed, in connection with good steaming radius. Apparently the Navy officials have come to feel, however, that this plan will not give the new vessels such speed as they should have to keep the country abreast of foreign nations, and according to Washington dispatches of Aug. 1, Secretary Long has proposed to the Board of Construction that the present call for bids should be withdrawn, and entirely new designs should be prepared which will give the ships greater speed.

It is said that the Board itself is now in favor of this, and that the new vessels will be designed for a minimum speed of 18 knots instead of 15 as at present, will be copper sheathed, and will have a displacement of about 13,000 tons. The cost will be somewhat increased; but it is hoped that Congress will consent to an increased appropriation when it reassembles.

If this plan is carried into effect, the country will have renewed reason for its confidence in Secretary Long as the most able head that the Navy Department has had in many years.

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The accuracy of the shop work habitually turned out by some of the better bridge shops of this country is sometimes, it seems to us, not so fully appreciated by engineers as it might be. As an instance of such careful workmanship we may call attention to the three-span steel arch bridge across the Schuylkill River, in Fairmount Park, Philadelphia, Pa., which is quite fully described elsewhere in this issue. The fact that in a structure of this magnitude where each arch differed in all its members, and without any previous assembling of the different parts, every joint and detail was found to fit perfectly upon erection speaks marvels for the perfectness of the shop management and machine work of the modern bridge shop, and it should not fail to receive full recognition. This is, however, by no means an isolated example. Among several which we now call to mind may be mentioned the new 840-ft. steel arch which is being built at Niagara Falls, N. Y., to replace the old footway suspension bridge just below the cataract. The closure of this arch, which took place on April 17, was a notable illustration of careful planning and shop work on the part of the builder, as well as the engineer.

As stated in Engineering News of Feb. 10, 1898, the two halves of the Niagara arch were erected simultaneously from the opposite shores, each half-arch being held back to its adjacent shore by a system of temporary anchor rods attached to alternate panel points of the arch rib until the final connection at the center ensured the stability of the structure by itself. The top anchor rods, that is, those reaching to the panel points nearest the center or crown of the arch, were made strong enough to hold the entire weight of the bridge with the other anchor rods removed, and it was calculated in designing the center connection of the arch ribs that with the weight carried by these top anchor rods alone there would be an opening at the center between the ends of opposite ribs of 2½ ins., at normal temperature. As a matter of fact the amount of this opening proved to be 2¾ ins., with a temperature of 60° F., when the closure was made. Fully as accurate results were obtained in other respects. The arch being of the two-hinge type, with the top chord under a compressive strain, the ends of the top chord were of course the first to close, to be followed by the closing of the arch ribs proper as the strain in the top chord changed from tension to compression under the load. It is plain that if the top chords were thus allowed to close first there might be some difficulty in getting the arch rib to close, and, further, there would be much uncertainty whether the proper apportioning of the strains between the top chord and the arch rib had been secured.

To avoid all this, the builders decided to insure the arch ribs meeting first by the simple means of cutting off the top chords and then, after the ribs had been connected, to force apart the opening in the top chord and insert a cast-steel shim just long enough to replace the metal previously cut off. The various dimensions and pressures involved in this process of closing were carefully calculated at the bridge works before erection and were outlined in a letter of instructions to the company's engineer in charge of erection as follows:

> Each top chord has been made 3 ins. shorter than the figured theoretical length. This would leave in the structure if under no strain whatever, an opening of 6 ins. After the anchor bars have been relieved of all strain and the ribs and their bracing are carried as a three-hinged arch, with a pin at the lower center, this distance ought to be shortened, at an average temperature, by 2¼ ins., leaving a 3¾-in. opening. The weight of the anchor bars which will be carried by the arch will probably increase this opening somewhat. Every rise in temperature of 10° F. will increase the space by 0.2-in. and vice versa. To change the three-hinged arch to the two-hinged arch, the opening at the center ought to be forced back again 2¼ ins., giving a total opening of 6 ins., as intended in the drawings. To do this it will take 370,000 lbs. on one rib, at the average temperature. For every rise in temperature of 10° above the average this strain ought to be reduced by 34,000 lbs. on one rib, which amount corresponds to 0.2 ins. mentioned above. We expect thus, if a pressure is applied, which makes the proper allowance for the temperature, that we will be able to close up the top chords of our arch by planing down 6½ ins. permanent cast-steel shims to 6 ins. or to the amount corresponding to what the top chords have been kept short.

When the closure was made on April 17, the arch ribs came together within ¼-in. of the calculated distance, as stated above. The opening between the ends of the top chords at 60° F., was exactly 3¾ ins., and the pressure registered by the hydraulic jacks in forcing this opening apart the full 6 ins., was 370,000 lbs. for each chord. The lateral adjustment was easily made with crowbars. In other words, the results were almost exactly what they were figured to be. When it is remembered that the accuracy of closure depended, first, upon the accuracy of the calculation and design of the entire steel work; second, upon the exactness with which the bearing shoes or skewbacks were placed, and, third, upon the perfection of the shop work, these results are indeed wonderful. We are not forgetful of the fact that in structures of this immense size and importance the builders doubtless exert themselves particularly, to secure phenomenal results in such particulars as those just described; but nevertheless the combined cunning and efficiency of men and tools which produce these results is an element which does not disappear in the every-day work turned out by them. Where so much important work is left to the honesty and ability of the bridge manufacturer, as is habitually done in this country, this is a matter of no small gratification.

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The exact function of bacterial analyses of public water supplies is becoming better understood as time passes and experience accumulates. Unfortunately, many engineers, the majority of doctors, and nearly all laymen still hold mistaken ideas on the subject. We have frequently urged that the isolation of any specific disease germ from the other bacteria in water is a task so difficult and uncertain as to render the attempt practically worthless to the water-works manager. The best bacteriologists freely admit this now, it being a general rule that the higher a bacteriologist stands in his profession the less pretension he makes to being able to differentiate the typhoid bacillus. Thus, Prof. Percy F. Frankland, who has, perhaps, done more than any other man in England to make known and appreciated the value of bacterial examinations of water and the bacterial efficiency of filtration, says

> it is becoming daily more evident that the recognition of specific bacteria is a matter of much greater difficulty than was at first supposed, and the bacteria which are associated with typhoid and cholera are amongst those which offer the greatest obstacles to complete identification.

This quotation is from a paper on "The Chemical and Bacterial Examination of Water," read by Prof. Frankland before the recent meeting of the British Association of Water-Works Engineers. In studying the character of water supplies it is very true, as Prof. Frankland says, in concluding his paper, that

> it is not only necessary that a particular sample of it submitted to an expert shall be free from danger, but that it shall be derived from a source which is capable of continuously yielding, year in, year out, a safe and wholesome product, and in order to secure this end he will have to make use of all the independent evidence which is available: (1) That which is obtained from careful inspection of the source; (2) that which can be furnished by chemical analysis; and (3) that which is afforded by the bacteriological examination of the water. And the special value of the bacteriological evidence will consist in the power possessed by this method of examination alone of revealing whether and to what extent any purification processes, natural or artificial, are able to remove disease-producing bacteria, should they at any time be present, from the water.

We do not intend to belittle the work of the bacteriologist. His services are valuable in studying natural waters and invaluable in determining the efficiency of filter plants which treat polluted water. Single analyses, of any kind, are of comparatively little use, while bacterial analyses of filtrates should not only be made frequently, but samples from each bed should be examined in order to determine whether each unit of a plant is doing its work properly. A fully equipped and well-manned bacterial laboratory is a desirable, if not necessary, adjunct of every filtration plant, and for certain waters a chemical and microscopical laboratory should also be in service. Where water is not purified, one or all of these laboratories can also be maintained to great advantage, but should be supplemental, in most cases, with frequent and searching sanitary inspections of the drainage area from which the water is derived. This latter work, as Prof. Wm. T. Sedgwick recently pointed out, would be a proper and profitable field for young engineering graduates.

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THE POSITION OF UNITED STATES ASSISTANT ENGINEERS.

As most of our readers know, the work of the United States Government on its fortifications for coast defence and on the improvement of its navigable rivers and harbors is under the charge of the officers of the Corps of Engineers of the Army. This corps is made up of those graduates of the West Point Military Academy who stand highest in their classes at graduation; and while it might be thought that special aptitude in engineering studies might be a better basis of choice than the mere attainment of a high standard according to the West Point marking system, it must be confessed that the plan of selection has worked admirably in practice.

The total membership of the corps is now, we

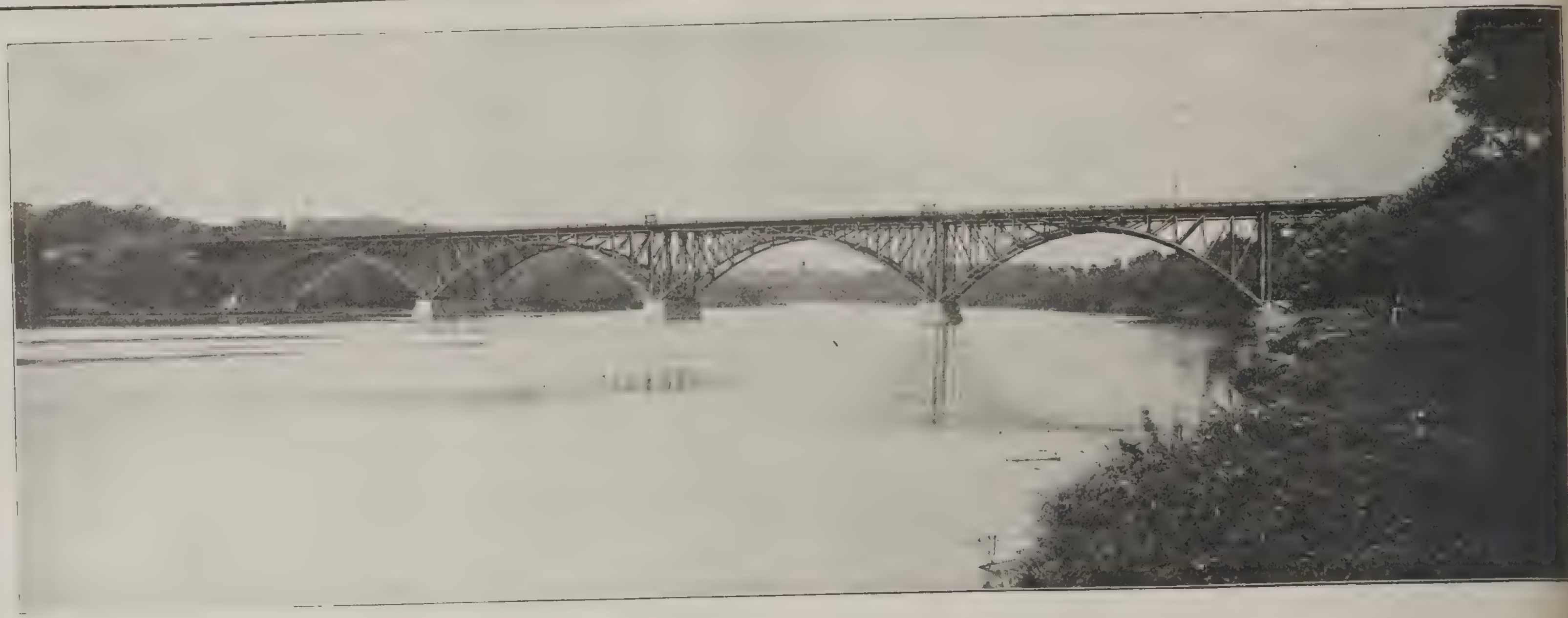


FIG. 1. GENERAL VIEW.

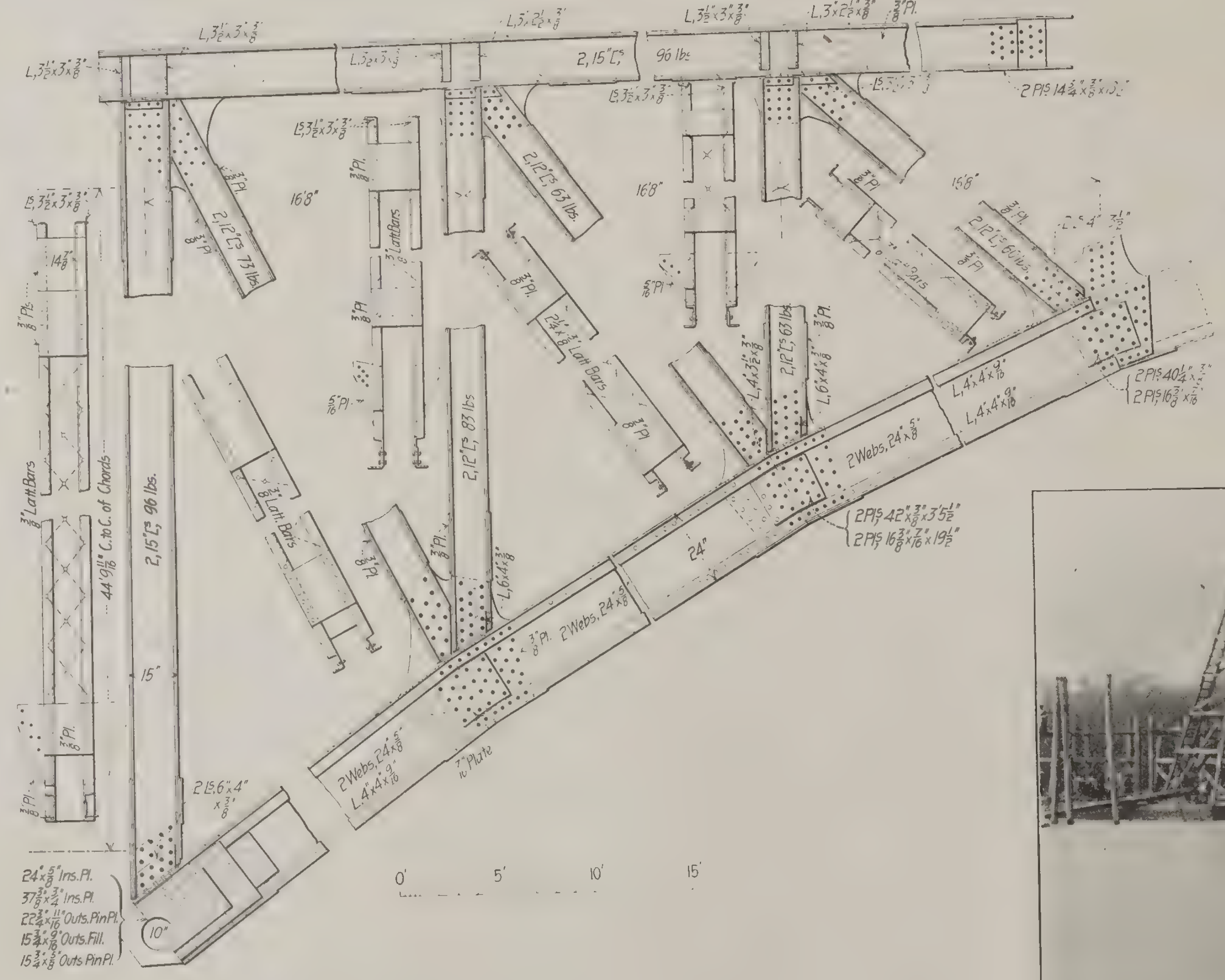


FIG. 5. END BEARING AND WEB DETAILS OF ARCH RIB.

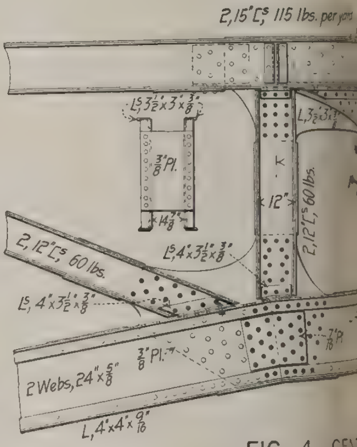


FIG. 4. CE

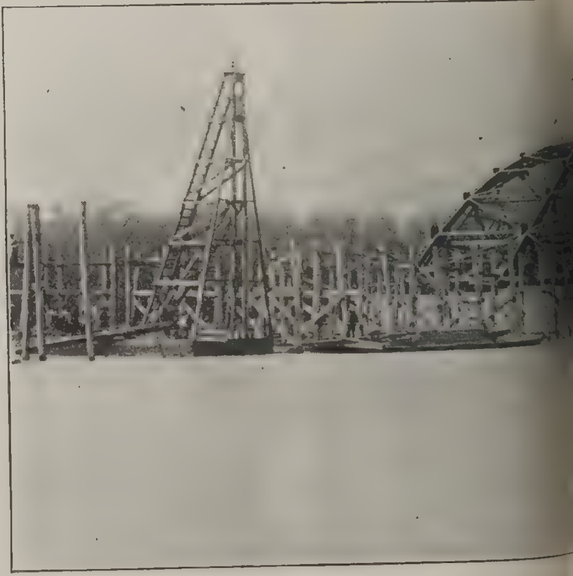


FIG. 6. VIEW SHOWING MANNER O
BEFORE PLAC

STEEL ARCH BRIDGE OVER SCHUYLKILL

Built by the Fairmount Park Transportation Co.

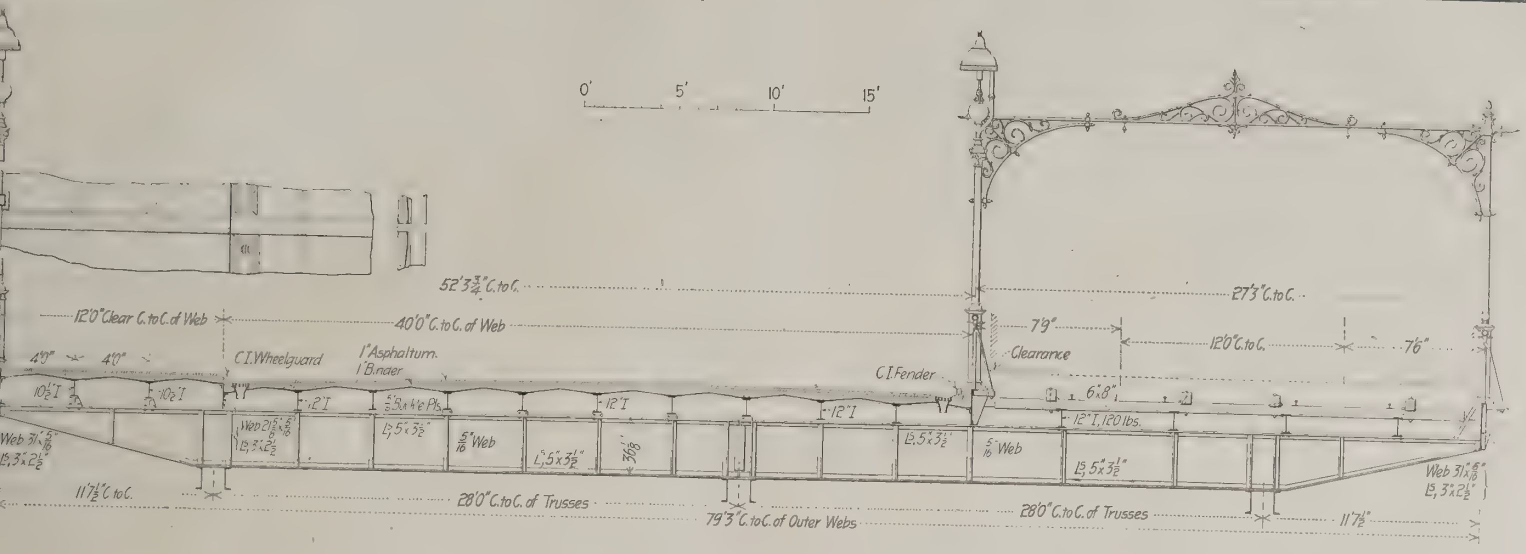
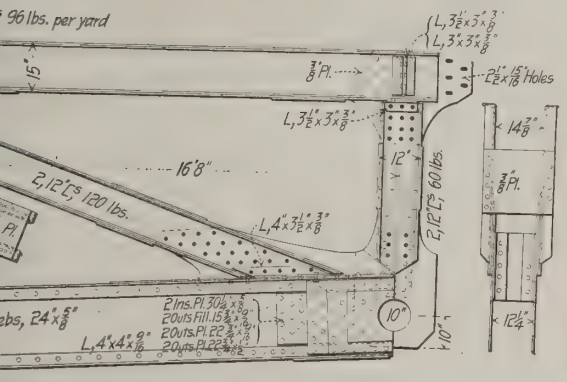


FIG. 2. TRANSVERSE SECTION SHOWING FLOOR CONSTRUCTION.



ETAILS FOR ARCH RIB.

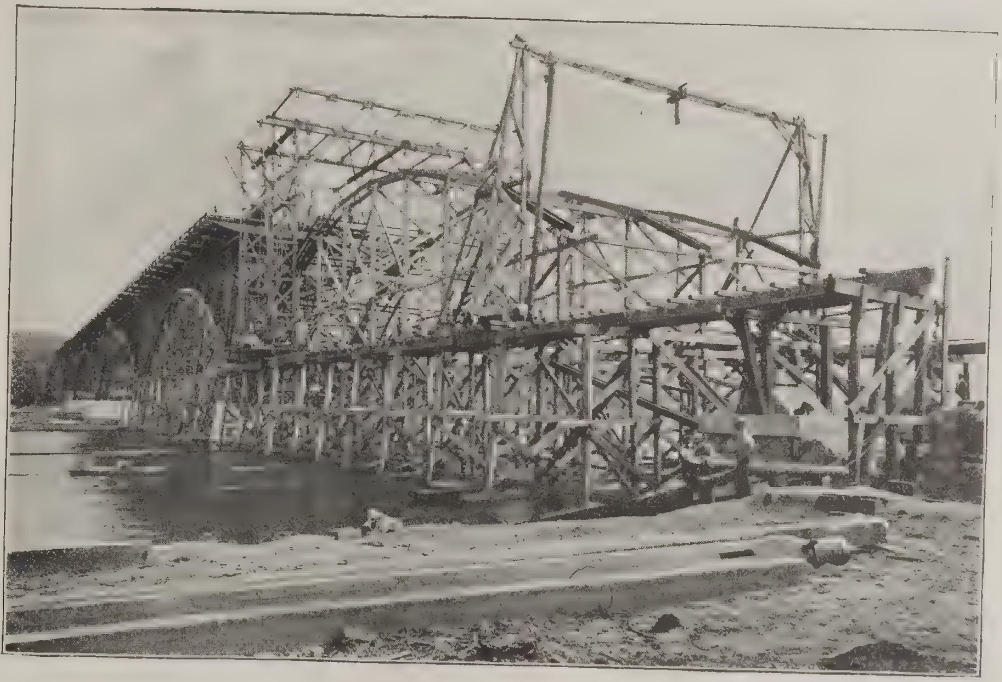
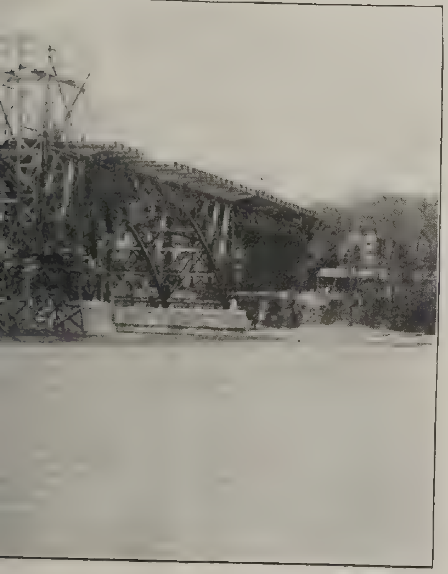


FIG. 7. VIEW SHOWING CONSTRUCTION OF FALSEWORK AND TRAVELERS.



OWER CHORDS COMPLETE
M.

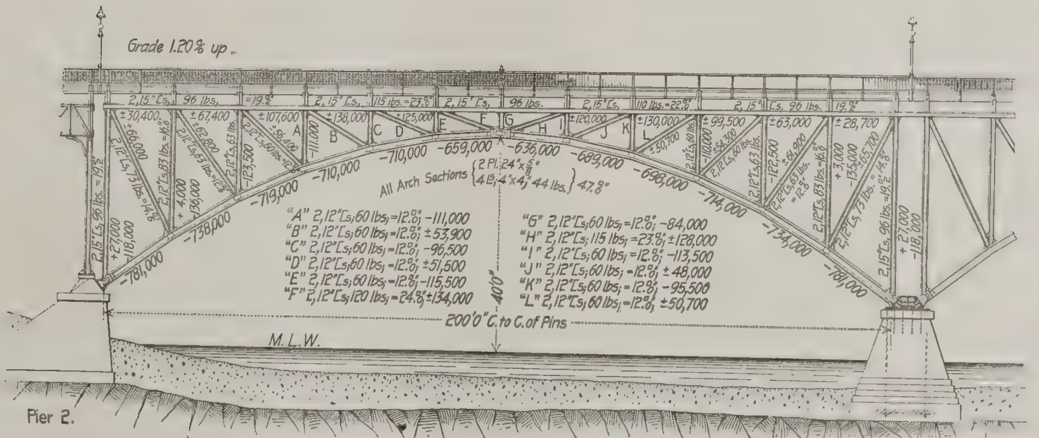

Grade 1.20% up
2,15" [s, 96 lbs. = 19.8"
2,15" [s, 115 lbs. = 23.8"
2,15" [s, 96 lbs.
2,15" [s, 110 lbs. = 22.8"
2,15" [s, 90 lbs. 19.8"
±30,400
±67,400
±107,600
±138,000
±125,000
±120,000
±130,000
±99,500
±63,000
±28,700
±56,400
-111,000
-123,500
±50,700
-110,000
±54,300
-122,500
A
B
C
D
E
F
G
H
I
J
K
L
-719,000
-710,000
-710,000
-659,000
-636,000
-689,000
-698,000
-714,000
-734,000
-738,000
-781,000
-781,000
All Arch Sections {2 Pl. 24"x⅝", 4 L^s, 4"x4", 44 lbs.} 47.8"
"A" 2,12" [s, 60 lbs, = 12.0"; -111,000
"B" 2,12" [s, 60 lbs, = 12.0"; ±53,900
"C" 2,12" [s, 60 lbs, = 12.0"; -96,500
"D" 2,12" [s, 60 lbs, = 12.0"; ±51,500
"E" 2,12" [s, 60 lbs, = 12.0"; -115,500
"F" 2,12" [s, 120 lbs, = 24.0"; ±134,000
"G" 2,12" [s, 60 lbs, = 12.0"; -84,000
"H" 2,12" [s, 115 lbs, = 23.0"; ±128,000
"I" 2,12" [s, 60 lbs, = 12.0"; -113,500
"J" 2,12" [s, 60 lbs, = 12.0"; ±48,000
"K" 2,12" [s, 60 lbs, = 12.0"; -95,500
"L" 2,12" [s, 60 lbs, = 12.0"; ±50,700
40'0"
200'0" C. to C. of Pins
M.L.W.
Pier 2.
Pier 3.

FIG. 3. ELEVATION SHOWING STRAINS AND COMPOSITION OF ARCH MEMBERS.

MOUNT PARK, PHILADELPHIA, PA.

Designed and Erected by the Phœnix Bridge Co., Phœnixville, Pa.

believe, about 115; including the officers of every grade, and by a recent law it is to be increased to 127. It is manifest, however, that this number of engineers is wholly inadequate to perform the engineering work required in connection with the expenditure of the many million dollars which are laid out by the Government each year, on rivers, harbors and fortifications, and in carrying out other work such as that of the lighthouse board, which is entrusted to the Corps of Engineers. The officers in charge, therefore, have power to hire draftsmen, clerks, transitmen and various other assistants upon the works under their charge. Those entrusted with the most responsible work are given the title, U. S. Assistant Engineer. The number of such Assistant Engineers employed by the Government during the last fiscal year was about 180.

The subordinate title and inadequate pay of these assistant engineers have long been a source of serious complaint, and many years ago there was considerable agitation on the part of some of the local engineering societies in the West looking toward a reorganization of the system of conducting Government works. This agitation came to nothing, however, one reason being that the reforms proposed involved such radical changes as to arouse opposition, and the position of the United States Assistant Engineers remains what it has been for many years past.

The present time seems to us an opportune one to consider the position of these engineers and see what can and ought to be done to better it. It is by no means unlikely that the next half-dozen years may see the undertaking by the Government of public works of great magnitude, demanding for their most successful design and execution the highest grade of engineering ability. Engineers as a body must recognize the great desirability that the Government should secure such ability, and accord to those who furnish it such credit as they may deserve, and a monetary compensation that will serve as some standard in fixing the value of the highest class of engineering work in this country.

Under the present system we think every fair-minded man must concede that the Government falls far short of doing this. The pay of the 180 assistant engineers varies from $125 to $300 per month. They are hired and discharged as the work requires, and a large proportion of them are employed only a small part of the year. The highest salary named is paid to a very few of the men. We find only 68 with salaries of $200 or over, and only 13 with salaries of $250 or over. When the temporary character of the employment and the difficult and important nature of the work is considered, we contend that these salaries are inadequate in many cases for the high-class of professional ability that is needed.

It may be said that these engineers are not obliged to accept Government situations. If the compensation is inadequate, they can seek work in other fields; but such a comment betrays want of knowledge of the real state of affairs. A large proportion of these assistant engineers, if they are to perform the tasks assigned them as they ought, must devote years to study and practice in the special field of river and harbor engineering. The engineer who masters this science and becomes a thorough expert in this branch of the profession has absolutely no prospect of employment in this country except in the Government service; and the utmost that he can hope for in the Government service is employment of uncertain duration from month to month, at a compensation of at most $200 or $300 per month. Because an engineer accepts such pay does not prove that it is adequate. He may well prefer it to the alternative of seeking a subordinate position in some other branch of the profession, where his expert knowledge, so hardly acquired, would be of little or no value; but the fact that the Government has no competition in the employment of engineers on works for the improvement of navigation ought not to be taken advantage of to cut down their pay.

The fact is that when the temporary character of the employment is taken into account, there are, we believe, not a few clerks in the U. S. Engineer offices who are better paid, on the whole, than the assistant engineers. Indeed, for employees of the lower grades, such as clerks, stenographers, ordinary draftsmen, etc., the United States pays rather better wages than private employers, while its professional employees very generally receive much less.

Closely connected with the matter of rates of pay is the matter of title and position. No matter what ability a civilian engineer engaged on river and harbor work may possess; no matter how great a work he may design, his title is that of "Assistant Engineer," and his position is a subordinate one. The public so recognizes it; and until this is remedied, it will be of little use to agitate for an increased rate of payment. Members of Congress will say with truth that $200 to $300 per month is ample compensation for an "Assistant Engineer."

Various plans have been proposed for reorganizing our system of public works with a view to a more equitable treatment of the engineers employed upon them; but the great trouble with most of these plans has been that they involved changes altogether too radical. It has been proposed, for example, to take the control of these works entirely out of the hands of the officers of the Corps of Engineers. We are very sure that a strong protest would go up against any change of this sort, from whatever source it might come.

Among the officers of this corps are some of the ablest and most competent engineers that the country possesses. They are a set of picked men of thorough education and experience, and they have carried out the great works entrusted to their charge, involving the expenditure of hundreds of millions, with a faithful devotion to duty, a strict honesty, and an entire freedom from political intrigues, which are a lasting honor to them and to the profession to which they belong.

It may be said that if the officers of the Engineer Corps are able engineers, what is the need for engineers under them in other than subordinate positions? We will try to make clear why there is such a need. Out of a total number of officers in the Corps of Engineers, there are approximately 5 colonels, 12 lieutenant-colonels, 25 majors and 30 captains, or let us say in round numbers, about 75 men who are of sufficient age and experience to take responsible charge of large works.* The lieutenants and second lieutenants which form the remainder of the corps act as assistants to the officers of higher rank in the corps, instructors at West Point and Willet's Point, and in general occupy such positions as will fit them for places of greater responsibility at a later date. It will, of course, be understood that West Point cannot turn out full-fledged engineers any more than the civilian schools of engineering. In fact, the West Pointer at graduation may be less advanced than his civilian brother; for he has had to spend much of his four years' course on purely military studies.

These 75 men, more or less, have to supervise the expenditure of all the sums appropriated for river and harbor improvements, for the construction and repair of lighthouses, and for fortifications, a total of from $25,000,000 to $40,000,000 per annum. Besides this they have to report on a great variety of projected works, and on obstructions to navigable waters, to serve on boards and commissions, and as delegates to foreign countries,, military attaches, etc., to conduct the municipal engineering work of the city of Washington and supervise its public buildings and parks, and to perform various other incidental duties.

Another fact must be taken into consideration. Not every one of these seventy-five or more officers has sufficient engineering ability to handle efficiently large and difficult engineering problems. They have, it is true, professional training and experience; but in the making of a really great engineer we must always allow Nature some part. If one were to pick from the best civilian engineering schools, 75 students at their graduation, and attempt to make engineers of them all, it would be strange, indeed, if more than 50 per cent. proved to have ability enough to reach a Chief Engineership solely on their own merits. There is no reason why we should expect to find a greater proportion of prizes in selecting engineers from the graduating class at West Point; in fact there may be less reason, for the boy of 16 to 18 who starts for West Point seldom does so with the desire or expectation of becoming an engineer.

As a matter of fact, we find that the officers of the Corps of Engineers vary greatly in their professional ability. Many of them are indeed engineers of the highest rank. On the works carried out under their charge, when the demand on their time permits, they originate the design, take the responsibility of deciding all matters in which technical questions are involved, and are in actual fact the Chief Engineers of the work.

Another class of officers are frankly aware of their inability to handle intricate technical problems. They are the executive heads of the works under their charge; but all matters of a technical or professional character they turn over to their assistants. It must be said, too, that nearly all the officers of the corps are being compelled more and more to follow this course, no matter what their engineering abilities may be, through the multiplicity of the duties heaped upon them. There are, all told, but 24 hours in the day and 365 days in the year; and it needs but an examination of the amount of work which some of the engineer officers have laid upon them to realize that it is a physical impossibility that any one man can perform even a small part of the responsible engineering work which must be done in the course of a year.

The reform that we would advocate, therefore, is merely a frank recognition of the existing state of affairs. An officer in the Corps of Engineers is still the executive head of the works under his charge, and the people want him to continue the executive head; but he is no longer the Chief Engineer, and from the nature of things he seldom can be. The position he occupies and ought to occupy corresponds to that of the Commissioners in charge of large public works of states or cities, or the General Manager of a railway corporation. The laws and the regulations of his corps should be so amended as to recognize this, and also to provide for the employment of actual Chief Engineers on works of importance, exactly as the Commission in charge of building an important bridge, dam or aqueduct selects a Chief Engineer. It goes without saying that such a chief, entrusted with the responsibilities that would naturally attend such a position, would be entitled to a salary proportionate to his responsibilities.

But, it may be said, would not this increase the annual expense to the Government for engineering work? Probably it would, but the trifling amount which would be thus expended, would, we believe, be far more than offset by the saving that would be made in the total cost of the work done.

There are two tasks which ought to be performed by an engineer in the design of any engineering work. One, and the easiest one, is to make the work sound enough and stable enough to meet all demands upon it. Little more is required for this than to follow past precedents. The second and more difficult task is to see how the work can be built or made at the smallest expenditure; and it is here that a wide range of knowledge, inventive genius and familiarity with the latest improvements in materials and processes come chiefly into play.

An engineer who is crowded with work is often obliged to omit the second of these tasks. We doubt not many an officer of the Engineer Corps can call to mind work done under his direction, which he could have carried out at much less expense had he been given time to make all the needful preliminary studies.

We are not arguing, therefore, merely for an increase of salary to a class of engineers who amply deserve it. We are arguing for actual economy in the carrying out of our public works. Let the Government, instead of trying to see how little engineering work it can get along with in carrying out its river and harbor works, empower its engineer officers to employ such engineering talent as the importance of their work justifies, and see that their works are designed for economical as well as stable construction.

A word may now be given to some of the other schemes which have been proposed by those who have sought to benefit the assistant engineers. One proposition has been that the Government should adopt the Continental system of carrying on its public works, should place them under the control of civilians alone, and should create an established corps with life appointments, a regular system of grading and promotion, and pensions after retirement. No such scheme could have the ghost of a chance of adoption in this country. It would not only meet with intense public opposition, but it would make no provision whatever for varying the force to suit the work to be done. There is really no reason why the Government should not do as states, cities and private corporations do; engage professional services when the work in hand requires them, and dispense with them when they are no longer needed.

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*The new law will increase to nearly 90 the total number of engineer officers of a rank above that of lieutenant; but the law cannot bestow upon the young lieutenants who will be promoted to fill these new positions experience and mature knowledge. That is a matter in which time is an essential factor.

Again, it has been proposed that the Government should simply confine its engineer officers to purely military works and turn over to civil engineers all works of navigation improvement. Every friend of honest government would raise his voice against such a proposition as this. Experience, some of it very recent, has fully shown the danger of making professional appointments dependent on political pulls. The engineer officers now in charge of Government works hold life positions; they are dependent on no party boss for his backing, and their professional honor and integrity is everywhere conceded. To turn over their work to men who would probably depend upon congressional recommendation for their places, would be far from a benefit to the engineering profession.

Some assistant engineers have suggested that their position might be changed to correspond to that of the naval civil engineer corps, and they ask for a similar basis of relative rank, etc.; but they have a mistaken idea of the actual status of that corps. The Civil Engineer Corps of the U. S. Navy now contains only 15 officers, ranking from a Commodore, when Chief of Bureau, down to Lieutenants of the Junior grade. Excepting in numbers and in method of original appointment to the lower grades, this corps holds the same position in the Navy that the Engineer Corps holds in the Army; and, like the Engineer Corps, it also has full authority to temporarily employ civilian engineers when the needs of the service require it, and to discharge them when the demand has passed. It is true, that in the Navy, the original appointments are made from civil life; but their number is limited by law, and the pay is by no means high. They have a permanent position and a relative rank; but to apply the same methods to the admission of the U. S. Assistants into the Engineer Corps of the Army, would simply mean the permanent increase of the number of this corps to unnecessary limits.

We see no chance whatever that any of the three plans we have outlined and criticised can possibly be successful. On the other hand the moderate measure of reform which we have proposed is, we believe, entirely practicable, and might be brought about if the profession at large were to take hold of it. The assistant engineers themselves can do little; for agitation on their part will be set down to mere desire for greater perquisites. The officers of the Corps of Engineers can hardly take a prominent part in such a reform, without transgressing the rules that govern their corps. It rests with the engineering profession at large, through its organized bodies, to take up the matter and urge it to a solution.

A great deal is being said concerning the need for a higher standing for the engineering profession, and various large schemes are being discussed to better it. It seems to us wise to undertake the smaller tasks first. If the engineering profession can bring about a just recognition and compensation for the civilian engineers employed in responsible positions on the Government's great works of river and harbor improvement, it will do a great deal to raise and dignify the standing of the profession in the eyes of the public.

LETTERS TO THE EDITOR.

The Paints on the 155th St. Viaduct, New York City

Sir: I desire to offer some criticisms upon the tests of the paints used upon the 155th St. viaduct, New York, as presented by Mr. Henry B. Seaman, in your issue of July 17.

It is very unfortunate that under "kind of paint" he does not state what each paint is composed of. If he had so stated, one could judge better of the value of the pigment part of the paints.

Acording to the list, Nos. 2, 4, 13 and 14 are practically the same, although they represent the product of different manufacturers, and without doubt each has a different percentage of graphite in the pigment. Any one purchasing graphite paint under such a title does not know how much silica or clay or other things and how little or how much pure graphite there may be in it.

No. 1 does not state whether red or white lead was used, and if the result turns out as suggested in the memorandum marked 1, notwithstanding its large percentage of freedom from rust, it has proven itself to be no good for further protection and should be condemned.

One must not suppose that No. 3 means straight red lead and linseed oil, although that impression will prevail to a great extent. It is doubtful if there is much or any of this pigment in this paint marked "antoxide," which is a trade name of the manufacturer for this particular paint. Absolutely pure red lead and linseed oil makes a better record in such tests.

No. 5, the paint showing the largest percentage, was used with three coats, which gives a decided advantage over a paint which has only two coats used, and probably the proportion of durability would be as 3 to 2. Therefore, No. 12 with two coats only would, it is safe to assume, show up with three coats equally as well as or better than No. 5 "Nobrac" (which is carbon spelled backwards and is a trade name), if placed in the same position where it caught the direct effect of the sulphur fumes from the locomotives.

The result of these tests as they appear in your issue of July 7 will be very misleading to the average reader. In order to make a report complete and valuable, a knowledge of the constituent parts of the paint is essential; and if any salesman or agent or manufacturer refuses to give that when demanded, his paint should not be countenanced for a moment. Respectfully, W. B. Parker.

Chicago, Ill., July 11, 1898.

(Mr. Seaman's report was criticised in some other respects in our issue of July 21.—Ed.)

◆

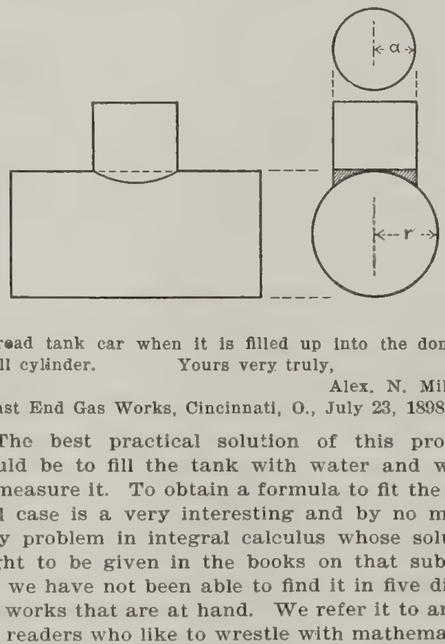
A Problem in Solid Geometry.

Sir: You will favor me greatly by publishing a formula (with its derivation) for the volume included between two cylinders of different diameters whose axes intersect at right angles.

The problem comes up in computing the contents of a railroad tank car when it is filled up into the dome or small cylinder. Yours very truly,

Alex. N. Miller.

East End Gas Works, Cincinnati, O., July 23, 1898.



(The best practical solution of this problem would be to fill the tank with water and weigh or measure it. To obtain a formula to fit the general case is a very interesting and by no means easy problem in integral calculus whose solution ought to be given in the books on that subject; but we have not been able to find it in five different works that are at hand. We refer it to any of our readers who like to wrestle with mathematical puzzles in August.—Ed.)

◆

Power of Windmills.

Sir: There having lately come under my notice, in the Kansas University "Quarterly" for April of last year, an article by Mr. Murphy,* in which he gives the results of a number of tests made by him for the determination of the power developed by wind-engines; and as these tests were carefully made on wheels of a number of different makes and on wheels of different sizes of the same make, all under regular service conditions as they performed their every-day work, and cannot but be of real value, I thought that a comparison of these results of actual practice with the results obtained by the simple little formula which I sent you some two** or three years ago might prove of interest to some of your readers, as it shows that this formula is a sufficient guide for the determination of the size of wheel required for any given amount of work.

The formula which I then proposed was

$$HP. = .0001\ D^3,$$

where HP. is the net horse power developed with an air current of 16 miles per hour, and D is the diameter of the wheel in feet.

From Table I. of the article above referred to, after throwing out the results obtained from the tests on the "Jumbo" and the "Fairbanks" wheels, as these results show only one-tenth the power which wheels of their size should develop, and those of the "Ideal," which are not at all consistent one with another (the 14-ft. wheel giving only about one-third the power of the 12-ft. wheel and one 8-ft. wheel giving three times the power of the other), and arranging the remaining results in the order of the size of the wheels, we form the first four columns of the following table. The fifth column is the average for each size wheel of the values given in the fourth column, and the sixth column gives the horse power for each size wheel as given by the formula $HP. = .0001\ D^3$.

Mill number.	Name of Wind-Engine.	Diam. in ft.	Actual horse power with wind blowing 16 miles per hour.	Aver. horse power of wheels of same diam.	Horse power as given by $HP. = .0001\ D^3$.
9	Aermotor	16	0.433	0.433	0.410
3	Aermotor	12	0.207	....	....
7	Aermotor	12	0.221	....	....
2	Mogul	12	0.260	....	....
13	Aermotor	12	0.171	0.184	0.173
17	Gem	12	0.149	....	....
19	Gem	12	0.162	....	....
21	Halliday	12	0.121	....	....
15	Gem	10	0.082	....	....
16	Halliday	10	0.103	0.093	0.100
5	Aermotor	8	0.072	....	....
6	Gem	8	0.042	0.057	0.051

From this table it will be seen how close the results given by the formula agree with the average results obtained in practice.

In case one is dealing with a strictly high-class wheel, as the Aermoter, it would be better to add another term to the formula, making it

$$HP. = .002\ D + .0001\ D^3.$$

Taking mills Nos. 9, 3, 7, 13 and 5, all Aermoters, from the table above given, we would have:

Diameter of wheel in ft.	Average HP. from tests.	HP. from formula, $HP. = .002\ D + .0001\ D^3$.
16	0.433	0.442
12	0.200	0.197
8	0.072	0.067
or, in round numbers,		
16	0.43	0.44
12	0.20	0.20
8	0.07	0.07

which leaves little to be desired.

Respectfully yours, M. Fargusson.

Southport, N. C., July 22, 1898.

◆

The Moduli of Elasticity of Cast Iron.

Sir: Can you give me, or, if not, where could I obtain, reliable information, based upon tests, by which to determine the modulii of elasticity of average American cast iron for compression and for tension? Many text-books of engineering state that in cast-iron beams under transverse strain, loaded in the usual manner, the neutral axis is situated some distance above the center of gravity of the section, owing to the difference between the compressive and tensile strength of the material; however, they give only one modulus of elasticity. Now, it can easily be proven. theoretically, that the position of the neutral axis is dependent upon the two modulii of elasticity and their difference, and is entirely independent of the ultimate compressive or tensile strength of the material.

Aside from a scientific standpoint, this question may be of interest to engineers, although cast iron is now so little used to resist transverse strain. In many cases, however, reliable formulae for calculating the resistance of irregular cast-iron sections would be useful; e. g., for columns eccentrically loaded, bases, brackets, etc. Similar reasoning is applicable to stone or concrete sections, as, e. g., footings. Very respectfully, F. Carl Pollmar.

Newberry Building, Detroit, Mich., July 19, 1898.

(Wood's "Resistance of Materials" gives a record of a tensile test of American cast iron made by Capt. Rodman, in 1857, which shows that the modulus of elasticity decreased from 27,000,000 at 3,000 lbs. per sq. in. to 18,000,000 at 14,000 lbs., and to 10,000,000 at 24,000 lbs. In Kent's "Mechanical Engineers' Pocket Book," p. 314, there is given the record of another test showing a decrease of the modulus from 25,000,000 at 1,000 lbs. per sq. in. to 12,500,000 at 8,000 lbs., the piece breaking at 23,285 lbs. per sq. in. Wood gives the record of a compression test made by Rodman, of a cylinder 10 ins. long, in which the modulus increased from 11,000,000 to 14,500,000, with an increase of the stress from 1,000 to 15,000 lbs. per sq. in., while a test by Hodgkinson on a bar 10 ft. long showed a decrease in the modulus from 13,000,000 to 11,000,000 for an increase in the stress from 2,000 to 33,000 lbs. per sq. in. The modulus of elasticity of cast iron appears to be extremely irregular, both in tension and in compression, depending, no doubt, upon the quality of the iron, but in tension it always decreases shortly after the beginning of the test, showing no definite elastic limit. Johnson's "Materials of Construction" says the modulus of elasticity in cast iron varies from 10,000,000 to 30,000,000, and that it is approximately the same in tension, in compression, and in cross-bending. Any attempt to construct a formula for strength of cast iron on the basis of its moduli of elasticity in tension and compression, we think, would be a waste of time. Concerning formulas for strength of cast-iron columns and brackets, see Engineering News of Jan. 13 and 20 and June 30, 1898.—Ed.)

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*Mr. Murphy's experiments were described in our issue of Aug. 19, 1897.—Ed.

**Eng. News, Nov. 14, 1895.

MASSACHUSETTS EXPERIMENTS ON THE PURIFICATION OF FRESH, STALE AND SEPTIC SEWAGE.

By H. W. Clark.[*]

For the past ten years, systematic investigations in regard to methods of sewage purification have been carried on by the State Board of Health, of Massachusetts, at the Lawrence Experiment Station, which was established largely for that purpose. Many of these investigations can be properly classed under the head of experiments upon purification by intermittent filtration, and many modifications of intermittent filtration have been studied. Moreover, all these studies have been carried on, not with the idea of obtaining results only, but of making clear the essential principles by which the purification of sewage can be effected. It seems to be an opportune time to say this, and to present a brief review of a portion of the work of the station during its first eight or nine years of operation, and also of the results of some investigations recently made, on account of the considerable quantity of literature recently published in regard to the results obtained by the so-called septic tank system and bacterial filters of England.

Papers, dealing with the septic tank and bacterial filter methods, have been presented, once or twice recently, to engineering and chemical societies by American engineers and chemists, as something entirely new in sewage purification, apparently overlooking a large amount of data published in the reports of the Board, bearing upon the principles of these methods; that is, the chemical and bacterial actions by which purification is effected by them.

Sewage, as ordinarily understood, is that volume of filth flowing in our sewers, consisting of the wastes from houses, stores and in some cases, streets, together with the water used in washing these wastes into the sewers; sometimes this volume of sewage is largely augmented by the addition of waste liquors from manufacturing industries.

Let us consider, for a moment, the composition of domestic sewage; that is, sewage free or almost free from manufacturing wastes. It is evident that, with a given population, the strength of the sewage produced, or, in other words, the degree of pollution of the water flowing in the sewers varies inversely as the volume of water used by that population. It is generally much more dilute in American than in European cities and towns, owing largely to the extravagant water consumption of the average American municipality. It is a difficult matter to state what is a represenative sewage, but, taking the Massachusetts cities and towns from which the State Board of Health obtains samples of sewage for analysis, the average sewage of these towns and cities analyzes about as follows, in parts per 100,000:

Total solids, 45 parts; loss on ignition, 20 parts; free ammonia, 2 parts; albuminoid ammonia, 0.55 of a part; chlorine, 5.5 parts; oxygen consumed from permanganate, 3 parts.

Of course, during a portion of the 24 hours in almost any of these cities and towns, a sewage is flowing much stronger than that indicated by this average, but in all of them a considerable amount of ground water enters the sewers at all times of the day, and during the night the sewage is much weaker than during the day-time, being in some places largely this ground water.

In 1888 the Lawrence sewage pumped at the Experiment Station contained 1.55 parts of free ammonia, and 0.69 of a part albuminoid ammonia, making its total nitrogen contents 2.4 parts. During 1897, however, the average free ammonia in the sewage pumped was 4 parts, and the average albuminoid ammonia 0.83 of a part, making the total nitrogen contents 4.62 parts; an increase of about 95% in the amount of unoxidized nitrogen present in the sewage. Now, while the strength of the sewage pumped at the Station had doubled, its composition in regard to the arrangement of its nitrogen and carbon contents had also changed very materially; and in regard to this change in composition, which has been many times referred to in the reports, I wish to present a few facts.

It is evident that, when the mixture of water and organic matters of all kinds, such as are found in sewage, has just occurred, and little chance or time has been given for mechanical, chemical and bacterial actions to take place, we must have a liquid flowing in the sewers containing organic matter quite different in its general composition from the same matter in this liquid after opportunity and time have been given for these various actions. The fresh sewage, that is, the sewage just as it enters the sewers from houses or streets, contains free oxygen and generally nitrates and nitrites. As it flows along the sewer, the organic matters are decomposed in the presence of this free oxygen and the oxygen of the nitrates and nitrites, largely by the bacteria present, and the composition of these organic matters is radically altered by these actions, the crude matters being changed to simpler forms, probably in the following way:

The bacteria first attack the carbon, and, in the presence of free oxygen, convert it to carbon dioxide; the nitrogen and hydrogen set free unite to form ammonia, and this joins with the carbon dioxide, forming ammonium carbonate; thus, the free ammonia, so-called, of the sewage increases quite rapidly for a time, while the crude, organic matters decrease. For instance, analyses of samples of sewage from different localities in the State of Massachusetts show the following results upon this point; these analyses having been presented in the reports of the Board for 1894 and 1895:

Samples collected at the Worcester Lunatic Hospital, from the sewer at a point a few hundred feet from the buildings, and a few minutes after the mixture of water and organic bodies has taken place, show only 17% of the total nitrogen of the sewage to be present in the form of free ammonia. Samples from Marlborough, collected at a point, to reach which all the sewage must flow at least four miles, show 56% of the nitrogen present to be in the form of free ammonia. Samples from Framingham, taken at a point, to reach which all the sewage must flow about two miles, show 49% of the nitrogen present to be in the form of free ammonia. Samples taken from a manhole in the Lawrence St. sewer at Lawrence show from 30 to 36% of the nitrogen present in this sewer to be in the form of free ammonia; and samples of practically the same sewage, collected at the Experiment Station, after it had been 24 hours longer on its journey from a point near this manhole through the pipe to the Station, show about 60% of the nitrogen present to be in the form of free ammonia. Reversing these figures, it will be seen that the fresh sewage, taken directly from the Lawrence St. sewer, has about 60% of its nitrogen present in the form of crude organic nitrogen; while the stale sewage, collected at the Experiment Station, has on an average about 40% of its total nitrogen in the organic form.

Investigations in regard to this change have been made at the Station, and published in the reports of the State Board of Health from time to time. For example, upon p. 461 of the report for 1894, the following experiment is given:

A gallon bottle was filled with fresh sewage taken directly from the manhole in the Lawrence St. sewer previously mentioned, and analyzed as soon as possible after collection. Subsequent analyses were made every two or three hours during the first two days of the bottle's standing in the laboratory, and once a day thereafter for a period of six days. The results showed that, upon standing 24 hours, the free ammonia increased about 100%, and the dissolved oxygen and nitrates and nitrites disappeared; the dissolved oxygen being present at the time of collection in an amount equal to about 57% of that necessary for saturation of water at the temperature of this sample of sewage when collected. The total organic nitrogen decreased 50% within 24 hours, and 67% during the entire experiment. The insoluble organic nitrogen decreased about 60% during the first 24 hours, and 80% during the entire experiment. The amount of oxygen consumed from permanganate decreased 50% during the entire experiment, caused by the formation of carbon dioxide. This bottle of sewage stood upon the table in the laboratory, and so was exposed to light, and frequent removal of the stopper allowed the access of air; therefore, it was not under the same conditions as the sewage held in the septic tank at Exeter, England. On the other hand, the bottle was shaken each time before a sample was taken from it for analysis, thus getting an amount of sludge proportionate to the volume of sewage taken for analysis; whereas, the sewage from the septic tank is drawn from a point midway on this tank, and only a small amount of sludge is obtained with a sample of the tank effluent. This experiment and its results were spoken of in the report for 1894, as an illustration of the initial step in the purification of organic matter by bacterial action.

In a discussion of the composition of sewage and the permanency of filters in the report of the Board for 1895, it was stated that, if the sewage is stale when reaching the place of disposal, the organic matter in suspension is finely divided by the comparatively long continued mechanical, chemical and bacterial actions through which it has passed, and a much larger percentage of the organic matter will readily pass into the interstices of the filtering material than will be the case with fresh sewage, and that the surface of filters will not become clogged by the crude organic matters of the sewage so readily as they will when fresh sewage is being applied. Also, it was stated that the organic matter in the stale sewage has apparently been worked over to such an extent during its slow passage through the pipe from the sewer to the Station, that not only has it lost a certain proportion of its sludge, but the remainder is of a nature more easily attacked by the bacteria in the filter than is the fresh organic matter. These statements and the investigations giving rise to them were made because it was evident that the experimental filters in operation at the Station, while receiving with the sewage applied to them a greater amount of organic matter than during earlier years, were producing better results than was the case two or three years previous to this, and also were not storing much of the matter applied.

To demonstrate further the better work of a filter receiving stale sewage than one receiving fresh sewage, an experiment was made in 1896, and published in the report of the Board for that year; two small filters being started, one receiving the stale sewage pumped at the Station, and the other, fresh sewage collected from a manhole in the Lawrence Street sewer. The total nitrogen in the fresh sewage was 4.35, and in the stale sewage, 4.23 parts per 100,000. Only 27% of the nitrogen in the stale sewage was organic nitrogen, the rest being in the form of free ammonia, while the fresh sewage contained 60% of its total nitrogen contents in the organic form, the remainder, or 40%, being in the form of free ammonia. The oxygen consumed from permanganate by the fresh sewage was about 2½ times that consumed by the stale sewage. After six months' operation of these filters, the one which received the fresh sewage had stored 26% of the applied nitrogen, while the one receiving stale sewage had stored but 12%, this latter filter being operated without disturbance of its surface, while, owing to the crude sludge applied with the fresh sewage, the surface of the filter receiving it had to be raked several times during the period of operation.

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[*] Chemist of the State Board of Health of Massachusetts, Department of Water Supply and Sewerage, Lawrence, Mass.

On account of these and other investigations at the Station, we have long known that the volume of sewage which a given area of filter bed will successfully care for and render pure varies not only according to the strength of the sewage applied, but also according to the composition of the sewage, as I have explained it; that is, the arrangement of its carbon and nitrogen contents, whether in the soluble or insoluble form. Such sewage as that collected from the sewer of the Worcester State Lunatic Hospital contains comparatively little organic matter in solution, and the organic matter in suspension is not finely divided; it is, therefore, evident that when such sewage is applied to a filter, there will be strained out and left upon the surface of this filter a large amount of crude organic matter to be slowly acted upon by the air and bacteria; that is, if the sewage runs directly to this area. If, however, it passes through properly arranged screens and sedimentation basins, a large proportion of this crude insoluble matter can be removed from it before it passes to this filter. Then we have to purify by filtration a body of liquid containing perhaps only a small proportion of its original organic pollution; but we shall also have a large body of sludge, so-called, to be in some way disposed of.

On the other hand, a sewage similar to that now and for several years past pumped at the Lawrence Experiment Station, or pumped to the beds at Marlborough, can be called in distinction from the fresh Asylum sewage, a stale sewage; that is, one in which the crude organic matter has been worked over by chemical and bacterial actions, resulting not only in a change of the form in which this matter is present, but also in the loss of a portion of the primary amount, this loss occurring as has been explained.

To purify sewage, we separate from a large volume of liquid the relatively small amounts of organic and mineral matters contained in this liquid.

Intermittent filtration is a bacterial and oxidizing process of purification by means of which the organic matter present in the sewage is removed, both by change into gaseous forms and escape into the air, and change to the inorganic form, and passing away as harmless mineral salts in solution in the effluent of the filter. We have seen how the organic matter, by a process of decomposition, that is, by the action of a certain class of bacteria working in the presence of oxygen, is gradually changed to free ammonia. It is this free ammonia that the nitrifying and oxidizing bacteria present in the filter change to nitric acid, which joins with some such base as potassium or sodium present in the sewage, to form nitrates which, as stated, come through in solution in the effluent. This action is the main one upon which the purification of sewage by intermittent filtration depends, and all care of an intermittent filter is a constant aim to so handle it that everything will be favorable for this action to take place and continue vigorous.

We have seen the different form in which the carbon and nitrogen present in the sewage may reach the filter's surface, according as the sewage to be disposed of is fresh or stale, and it is evident that the amount of work to be done in the filters by the bacteria present varies greatly, owing to this fact. That is, if the sewage is as fresh as the Worcester Asylum sewage, a much larger amount of work and a greater change in organic matter has to be accomplished in the filter before the sewage is purified than has to be done if stale sewage, which has been long enough in the sewer for the beginning of the bacterial actions to take place, is applied to the filter.

The question now being agitated is whether the breaking up of the organic matters cannot be better effected by holding the sewage in a tank without access of air, and thus aid the growth of that class of bacteria which can live without air, than with free access of air and action on the filter's surface, and within the filter by the bacteria acting in the presence of air.

I will present here a few examples of what can be accomplished by the filtration of sewage without preliminary forced putrefaction. For periods varying from eight to ten years, we have had in operation at the Station seven large experimental filters, 1-200 of an acre in area, and containing sands or gravelly soils common to New England. These filters have been operated at rates of from 20,000 to 120,000 gallons per acre daily, and daily analyses made of the sewage applied to the filters and the effluents from them. We have also kept watch of the condition of the filtering material, in order to learn definite facts in regard to the storage of organic matter in this material, as the maintenance of an equilibrium between the organic matter applied to the filter and that lost by being nitrified and changed to the inorganic form, or passing away into air in the form of carbon or nitrogen gases, is necessary, in order to insure the permanency of a filter; that is, the permanency of the whole depth of the filter body, not making allowance for any removal of clogged sand from the filter's surface.

It is a fact that there was, for some years after the filters were started, an increasing accumulation of sludge or organic matter stored in these filters. The reason for this is not, perhaps, entirely clear. Fresh sewage, so-called, was being applied during the first years of operation, instead of the stale sewage subsequently applied; but the stale sewage contains more sludge than the fresh sewage did, owing to the increased strength of all the sewage flowing in the sewer and pumped to the Station. On the other hand, we have taken better care of the upper portion of each filter bed for the past five or six years; that is, the surface of each filter has, during these years, been disturbed by occasional raking, and has been spaded over to a depth of 6 ins. each spring and fall. One of the filters, however, when clogging began, had been treated in this way with apparently little effect in aiding the removal of the stored organic matter, or in producing better filtration results.

It seems probable, taking everything into consideration, that, besides the improvement of all the filters of late years, caused by increased care of the upper portion of them, the stored organic matter was, during the clogging period, being slowly worked over by the millions of bacteria present, until, finally, small portions of it arrived at a condition in which it was easily attacked by the nitrifying and other bacteria present in the filter, and with the usual results. When this time was reached, each daily addition of indigestible matter, which had to remain in the filter and be worked over for a long period, was offset by the daily amount which had been worked over for this long period and was being removed as nitrates in the effluent.

Analyses of the sand during this period of clogging showed the presence of a large amount of fatty matters. Now, however, although the sewage applied contains fully as much fat as was present during the first years of operation, it does not seem to accumulate in the filters. Whether we have cultivated in the filters a species of bacteria now capable of disposing of this fat readily, or whether the more prolonged actions of the bacteria in the sewer and sewer pipes, caused by the longer stay of the sewage in these places, have broken the fats and fatty matters into simpler forms, more easily handled by the bacteria present in the filter, we cannot state. The latter theory seems the more probable one.

It is worth mentioning here that we have in one of the towns of the state two experimental filters in operation, receiving tannery sewage containing a very large amount of fat. Tannery sewage is, of course, of considerable age and in an advanced state of putrefaction when allowed to run to waste from the tannery, and the fatty matters present do not clog the filters, but pass through into the effluent.

Quoting from our reports, I have given experiments showing the change in the composition of sewage with increased age; showing also the loss of crude organic matter taking place as sewage grows older; and showing the greater ease with which intermittent sand filters can dispose of stale sewage than fresh sewage. These facts are now being taken advantage of by the so-called septic tank system, first in operation in Exeter, England. This is an air-tight tank into which the sewage passes, and is retained for a time in order to allow the bacteria of decomposition and putrefaction to break up the organic matters into simpler forms, and thus reduce the insoluble matter, or sludge, by causing a considerable portion of the carbon and nitrogen to be so changed that it is either in solution in the sewage, or will pass away from it in the form of gas. As I have said, I have given data showing that the actions by which this process is made successful have been thoroughly understood by us for a considerable time, and the fact that sewage would lose a certain percentage of crude organic matter when held in a body has certainly been known. Anyone who has ever had any experience with, or noted the changes taking place in an ordinary cesspool, must have had their attention drawn to this fact. We had not, however, ever considered that these actions could be utilized as now proposed by the septic tank system.

We have, however, studied the method to some extent during the past few months with very interesting results. The sewage remains in our tank 24 to 36 hours, and is drawn from a faucet midway between the top and bottom of the side of the tank, as at Exeter. Thus we avoid drawing out the sediment from the bottom of the tank, and the fat and fatty matters which accumulate upon the surface of the sewage. The sewage, after its stay in the tank, is, when drawn from it, of an exceedingly offensive odor, quite highly colored, but clear for sewage, and containing a relatively small amount of matters in suspension. The free ammonia has increased slightly, and the total albuminoid ammonia has decreased about 50%, and the organic matters indicated by the determination of oxygen consumed from permanganate also about 50 per cent. Of course, no nitrification takes place within the tank, and we have found that all the nitrifying and oxidizing bacteria, that is, those bacteria depending upon the presence of oxygen for their life and functional activities, are destroyed while the sewage is passing through the tank. When entering, the sewage contains nearly 4,000,000 bacteria per cu. cm., and when drawn out about 250,000 bacteria per cu. cm., a reduction of 95%.

The following analyses show (1) the composition of the fresh sewage taken from the manhole at the Lawrence St. sewer; (2) the composition of the stale sewage as it is pumped at the Station, which enters the septic tank; and (3) the composition of the sewage drawn from this septic tank:

(Parts per 100,000.)

	Ammonia		Nitrogenas		Oxygen consumed.	Bacteria, per cu. cm.
	Free.	Alb.	Nitrates.	Nitrites.		
From sewer	2.60	1,18	0.10	0.0210	8.50	1,950,000
Station sewage..	4.50	1.05	0.00	0.0000	4.80	3,800,000
Septic sewage ..	5.50	0.55	0.00	0.0000	2.50	250,0 0

We see by the three analyses the following changes: A regular decrease in the albuminoid ammonia, with the necessary increase in the free ammonia resulting from this, and a regular decrease in the amount of oxygen consumed from permanganate. The sewage taken from the manhole at the sewer has little odor, and that not at all offensive. As pumped at the Station, the odor is only slightly increased; but as drawn from the septic tank, the odor is very offensive; that is to say, we have had changes, produced by the bacteria working upon the organic matter present, something as follows:

These organic bodies are compounds of carbon, hydrogen, nitrogen and oxygen. The first action is the formation of carbon dioxide, free ammonia —which joins with this carbon dioxide—water, and probably nitrous oxide. The next action which takes place in the septic tank is the further breaking up of these bodies, without the presence of free oxygen, and the formation of ill-smelling gases; that is, the organic matter has been well broken up and is well on the way to its reduction—if I may call it so—to its lowest terms by the bacteria acting during the time in which the sewage has been held in a body.

The septic sewage is applied to two filters, one an ordinary intermittent filter containing 5 ft. in depth of sand of an effective size of 0.23 mm., a sand very favorable for effective and satisfactory purification by intermittent filtration. The rate of operation of this first filter up to the present time has been 100,000 gallons per acre daily. Nitrification was very slow in starting in this filter, much slower than would have been the case with a filter receiving sewage in a less advanced state of putrefaction, and containing the large number of bacteria present in the sewage as it is pumped to the Station, and before entering the septic tank. Even at the present time, after four months' operation, although nitrification is quite active within this filter, averaging about 2½ parts nitrates in the effluent during the past few weeks, still the effluent is very turbid and ill-smelling. If the ordinary sewage pumped at the Station had been applied at an equal rate during these four months of operation, we should certainly be obtaining an effluent at the present time, clear, practically colorless, with little turbidity and no odor.

The reason for the comparatively poor result obtained so far by the intermittent filtration of this septic sewage is undoubtedly due to a number of facts, the principal one being that, although the nitrifying bacteria have finally become established within the filter, yet each application of sewage, passing down through the filter, has set free from it the gases generated in the septic tank and retained in solution in the sewage until this time, these gases being inimical to the life of the bacteria in the filter, which are of an entirely different class from those growing in the septic tank. The gases also rapidly exhaust the air in the filter; the filter effluent containing no dissolved oxygen in distinction from the effluent from filters receiving ordinary sewage. It can be said also that, while the filter shows no signs of clogging, and the sewage disappears quite readily from its surface, still the turbidity and disagreeable odor of the effluent seem to be increasing at the present time, rather than decreasing.

The second filter receiving this septic sewage is a bacterial filter, so-called, containing 5 ft. in depth of small pieces of coke. Before describing the action of this filter, I wish to make a few statements in regard to bacterial filters. Of course, all properly constructed filters are bacterial filters. Lately, however, this name has been given to a class constructed and operated in a somewhat novel way. The first bacterial filter in operation at Lawrence was started early in 1894, and contained 5 ft. in depth of gravel. Since then, others have been started, of cinders, coke, etc. The method of operation and the reason for naming them as they have been is as follows:

They are all filters of comparatively coarse material, having a large percentage of open space, and the sewage is applied in such quantity that this entire open space is filled daily, or even several times daily, the idea being that, as the sewage is drawn off, this open space becomes filled again with air, and hence the organisms work through the entire depth of the filter, instead of working in the upper layers only.

A bacterial filter receiving septic sewage was put in operation nearly four months ago at a rate of 800,000 gallons per acre daily. At this rate the sewage passing through it has had removed from it a very large percentage of its organic matter. No nitrifaction, however, has started within this filter, and reasoning from previous results it would seem probable that a considerable percentage of the organic matter removed from the sewage by the filter is being stored within it at the present time. I say, this seems probable, reasoning from results obtained with fresher sewage. It may not be so, however. We have found that in intermittent filtration fully 30%, on an average, of the nitrogen in the applied sewage escapes into the air in the gaseous form, and it is very possible that a much greater percentage is lost in this manner from the bacterial filter receiving septic sewage with its organic matter well on the way towards its reduction to its lowest terms, as has been explained.

We have, moreover, in this filter evidently a class of bacteria which carry on the purifying action begun in the septic tank still further, even although the nitrifying organism is not present, and as a result the effluent of the filter, although containing a large amount of free ammonia and an amount of albuminoid ammonia considerably above the average amount usually present in the effluents of our intermittent filters receiving ordinary sewage, is odorless and remains so indefinitely, and is only slightly turbid: That is, the ill-smelling hydrogen gases have either been destroyed or have passed away from the sewage during its stay in the filter, and the organic matter remaining in the effluent has apparently reached a state where no further putrefying actions can take place. This effluent is of a very good appearance as far as color and turbidity are concerned, being much better in this respect than the effluent of the intermittent sand filter receiving septic sewage and operating at only one-eighth the rate of this bacterial filter. Analyses of these effluents are as follows:

(Parts per 100,000.)

	Ammonia.		Nitrates.	Nitrites.	Oxygen consumed.	Bacteria, per cu. cm.
	Free.	Alb.				
Effluent of bacterial filter …	4.30	0.17	0.00	0.0025	0.75	55,000
Effluent of intermittent filter…	1.75	0.13	2.60	0.2600	1.08	140,000

The aerated gravel filters described in our Reports also gave an end result in regard to producing an odorless effluent similar to this. On p. 469 of the report of 1895, the following statement was made:

> Comparing the resulting liquids after the treatment of sewage by various methods of removing sludge, it is noticeable that the organic matter in the liquids, after rapid filtration combined with aeration, is of a different character from the organic matter in the sewage resulting from the other sludge removing processes; that is to say, even when the organic matter as shown by the albuminoid ammonia is present in these effluents in as great quantities as in sewage after chemical precipitation or straining through coke, it has passed through such chemical and biological changes that it develops offensive odors very slowly on standing.

Bacterial investigations are, of course, being made, and the organisms so far isolated from the effluent of the septic tank show greater development at a temperature of 65° F. than at either a lower or a higher temperature.

In conclusion, it can be said that the septic tank process is one of much interest to anyone studying sewage purification, but there are two drawbacks: First, the fact that a large body of septic sewage must be exceedingly offensive and cause a nuisance where the same volume of fresher sewage would not cause a nuisance; and second, the construction of a reservoir of sufficient storage capacity to hold a large volume of sewage—that is, one day's flow from a municipality of average size—would be quite an expense. It seems probable to me, however, that a much smaller tank can be used in proportion to the volume of sewage flowing than is used at Exeter, and for this reason: A sewage of ordinary age, that is, one which has traveled for any great distance in the sewers, will, when it reaches its point of disposal, be practically free from dissolved oxygen, all having been used up by the bacteria and organic matter before reaching this point. Now, if such sewage runs into a properly built septic tank, no air will be carried in with it, and the length of time which it remains within the tank need be only long enough to allow a complete precipitation of the insoluble matters, and the accumulation, to some extent, of the fats upon the surface of the sewage. These matters can remain in the tank for an indefinite time; and, being acted upon by the bacteria of decomposition and putrefaction, will be slowly changed to the soluble form, and pass away to a large extent, perhaps, in the effluent of the tank. Thus, the sludge, the difficult factor in sewage purification, may perhaps be disposed of, and the sewage, staying a shorter time within the tank, will not have such an offensive odor, and will not make the disposal area so great a nuisance. The process has not been on trial long enough as yet, however, to determine accurately what percentage of the total volume of sludge can be gotten rid of in this way.

A COMPARISON OF BRITISH AND AMERICAN NAVAL VESSELS.

The following comparison by an English naval expert of the vessels, guns and armor in the British and United States navies, we find in the New York "Tribune," credited to the London "Mail." It appears to be a very fair and unprejudiced statement, and is, so far as we are aware, in accordance with the actual facts. The British navy is certainly in advance of all others in the world in its use of the wire-wound gun, which, by permitting higher pressures, larger powder charges and longer barrels, sends its projectiles home with a force which ordinary built-up guns of the same caliber cannot equal. The critic's remarks respecting the speed of battleships are also noteworthy:

American guns are not, I take it, so good as ours. The 60-ton weapon is a fine and powerful gun and has stood the strain of prolonged firing, but it is not better than the British 67-ton gun and is inferior, both in rapidity of fire and penetration through armor, to our 46-ton wire weapon. There can be little doubt that our 6-in. and 4.7-in. weapons of the quick-fire type are ahead of anything now manufactured in the United States. The British-built "New Orleans" is pronounced by American naval officers in the West Indies the best cruiser of her size in the United States Navy. Her guns have excited particular admiration, owing to their simplicity, accuracy and rapidity of fire.

When we turn from guns to projectiles and armor we are upon less certain ground. Two years ago the American Carpenter and Wheeler-Sterling shells were better than anything made in England. It is possible that to-day they are ahead of our projectiles, though with the very great attention given to this point by British manufacturers recently, it is not altogether likely. Our Hadfield projectiles are, I believe, among the very best. Still, the American Navy is probably at this present minute supplied with better armor-piercing projectiles than the British Navy, for the reason that the United States did undoubtedly get ahead of us.

In the matter of armor-plates England fell behind because, for some reason or other, the Admiralty in our earlier Harveyized plates did not use nickel. The Americans adopted a nickel steel, which has performed wonderfully in trials. But here again, I am glad to say, we have advanced greatly. The Krupp gas-hardening process, which has been adopted by our three great armor-making firms, when applied to nickel-steel plates, such as we now use, gives splendid results. The firm of Vickers has particularly distinguished itself for the armor which it has turned out in the last few months. Nor are Brown and Cammell behind their enterprising rivals.

The point in which American ships excel ours is in battery. It is well known that, ton for ton, the United States warship is beaten in armament only by the new ships now constructing for Germany, a young and audacious Power. Taking two new ships, British and American, these are the armaments:

"Canopus" (British).	"Alabama" (American).
Four 12-in.	Four 13-in.
Twelve 6-in.	Fourteen 6-in.
Ten 12-pdrs.	Seventeen 6-pdrs.
Six 3-pdrs.	Six 1-pdr.
Eight Maxims.	Four Maxims.
Four torpedo tubes.	Four torpedo tubes.

The American ship has a much heavier battery. Though, as has been said above, the British 12-in. gun shoots harder than the American 13-in., the projectile of the American gun is 400 lbs. heavier than that of our gun. Probably with crews of equal efficiency the American ship would win on guns alone, if her weapons were of the most recent type. She has two more 6-in. quick-firers, and the 6-in. gun is a very formidable and useful weapon.

In the matter of ammunition the British ship is better supplied for her heavy guns. She is no better supplied with 6-in. shells. And it must be remembered that she is 1,400 tons larger.

In armor the difference is most striking. These are the facts, set forth side by side to afford a contrast:

British.	American.
Side—Belt, 250 ft. by 18 ft. and 6 ins. thick.	Belt, 220 ft. by 7½ ft., from 16½ to 9½ ins. thick. Above this a belt 140 ft. long by 8 ft. broad, 5½ ins. thick. Above this another tier of armor, 140 ft. long by 7 ft. 6 ins. broad, 5½ ins. thick.
Heavy guns — Barbettes, 10-in.; shields, 6-in., sloped.	Barbettes and turrets, 15 to 17 ins.
6-in. guns — 6-in. casemates.	5½ ins.
Protective deck—Two, one 1-in., the other 2½-in.	One, 2¾ to 4 ins.
Armor on ram — 2 ins., a broad belt, covering the ship forward.	4 ins., a narrow belt.

It will be seen that the American ship is, beyond question, better protected than the British vessel. In the American the armor virtually sheathes the whole vessel amidships. In the British ship the armor is only a patch

—though a large patch. Moreover, there is no thick armor on the water-line, as we find in the American.

In speed and coal supply the British "Canopus" has a great advantage. Our ship is nominally good for 18¾ knots, and carries 1,900 tons of coal. The American is 2¾ knots slower, and carries 1,200 tons of coal. In practice the difference of speed should be about two knots. Great importance is attached in this country to speed, and very rightly. We must always force the fighting if war comes, and our ships must be able to catch their enemies. They are none too fast, as matters stand, for France has smaller-battle ships than the "Canopus," now nearly ready for sea, with engines as powerful as hers.

It would be wise from our point of view to class the "Canopuses" as armored cruisers of the finest type. Then, perhaps, we should hear less of the superiority, in actual fighting points, of such ships as the "Alabama."

Turning to our cruisers, it does appear that the Americans are ahead of us. The "Brooklyn," for example, is much more heavily armed than the "Powerful" of about her own date; is very nearly as fast, and in coal endurance is equal to the British. Our smaller cruisers are enormously below the Americans of their own size in armament. I have always held with our American friend that in war the object should be to kill your enemy as quickly as possible, before he kills you. The more guns you can carry the more likely you are to hit the enemy and to kill his men.

It is said: "Oh, but we carry so much more amunition." No doubt we do, but the question is this, Would it not be wiser to copy other Powers, and translate this ammunition into guns? I notice that the newest Russian cruisers, of the size of our "Hermes," carry one more 6-in. gun, and have 180 rounds of ammunition per gun, against our ship's 200. Yet the Russian ship will steam 23 knots, natural draught, and ours only 20½.

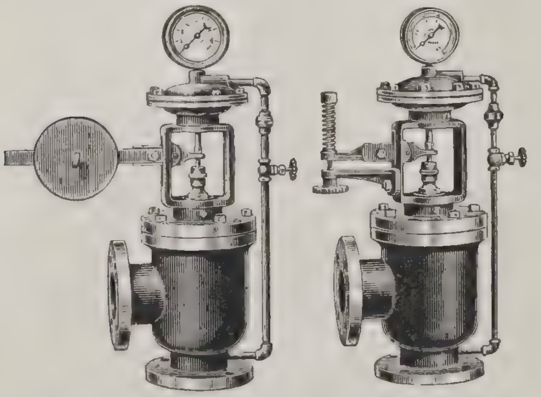
Take the "Olympia" as another example. She is just about the size of our "Eclipse." But she is 1½ knots faster; carries 300 tons more coal; has 4-in. armor on her big guns; a deck much thicker than the "Eclipse's," and a battery out of all proportion more powerful. Here are the figures:

Eclipse."	"Olympia."
Five 6-in. quick-firers.	Four 8-in.
Six 4.7 in. quick-firers.	Ten 5-in. quick-firers.
Eight 12-pdrs.	Fourteen 6-pdrs.
Eleven small.	Ten small.
Three torpedo tubes.	Six torpedo tubes.

Summing up, then, we may pronounce our battleships in important respects better than the American, our guns much better, our projectiles as good, our armor as good, and our cruisers much worse.

NEW STYLES OF REDUCING VALVE.

The accompanying cuts show two styles of reducing valves recently put on the market by the Fisher Governor Co., of Marshalltown, Iowa, who are also manufacturers of the well-known Fisher steam pump governor. A standard gage is furnished with each valve, so that the low pressure can always be seen. The one with weight and lever is especially adapted for extremely low pressures, and it will hold the lower pressure uniform even when the boiler pressure increases, or a greater part of the radiation is cut off. The style with spring attachment is more especially adapted for steamboat work. The valve and seats of these reducing valves are made of phosphor bronze.



New Styles of Reducing Valves.
Manufactured by the Fisher Governor Co., Marshalltown, Iowa.

ELECTRIC WELDING OF STREET RAILWAY RAILS.

In June, 1893, the Johnson Company, of Johnstown, Pa., which had been for nearly a year previously experimenting with the electric welding of rails, began welding the rails of the West End Street Railway of Boston, Mass. The apparent success then attained encouraged other roads to try the new method, and in a short time about 50 miles of track had been welded by this method in Boston, Cleveland, Johnstown, Brooklyn, St. Louis, and Detroit.

The approach of winter and with it cold weather caused the rail to contract and resulted in the breaking of many of the joints, usually just to one side of the weld showing that the breaks were the result of a weakening of the steel consequent upon the intense heat produced by the electric current. The experiments conducted at that time determined quite conclusively that a strength of 100,000 lbs. for a 6-in, rail, or thereabouts, was ample to resist the tension resulting from the annual change of temperature. 200,000 lbs. was therefore assumed as a necessary joint strength. A series of tests made on short sections demonstrated that welded joints could be made capable of standing considerably more than this figure. As a result of the failure of electric welding in Boston and elsewhere, the Johnson Co. refrained from a general introduction of its system and began a series of careful experiments to see if it were possible to produce the weld with its desirable features and still not destroy the structure of the adjacent steel. The solution was found to be very simple, and consists in putting the material at the weld under great pressure just after the weld is made and the current cut off and holding this pressure while the steel cools. In this way, the steel is prevented from crystalizing and losing its elasticity at the point next the weld. The company, after further experiments to thoroughly test this discovery, is again in the market.

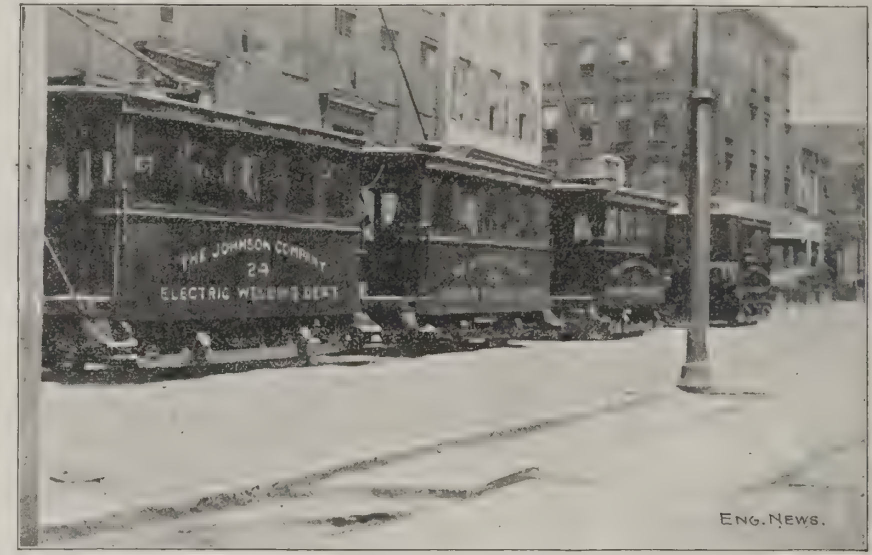


FIG. 1.—THE ELECTRIC RAIL WELDING EQUIPMENT OF THE JOHNSON CO., JOHNSTOWN, PA., NOW OPERATING IN BROOKLYN, N. Y.

At present one of its equipments is in Brooklyn, engaged in welding about 45,000 ft. of double track on the Nassau Electric R. R. The welding equipment is composed of four cars, as shown in Fig. 1, containing the various electrical machinery instruments, sand blast, water tanks, regulators, etc. This train is transported about the country on flat cars, which land it as near the point where work is to be done as possible. The cars are then run onto the street railway lines and as each car is equipped with its own trolley and motors they are propelled by their own power to the desired position.

The car to the left in Fig. 1, contains a booster built by the Crocker-Wheeler Electric Co., of Ampere, N. J. This car complete weighs 28,000 lbs. The booster is a 125-HP. 500-volt, 200-ampere direct current electric motor directly connected to a 70-K-W. dynamo wound for 420 amperes at 175 volts at a speed of 750 revolutions per minute. Current for operating the booster motor is taken from the trolley wire by an ordinary trolley pole on top of the car and the altered current is carried through flexible cables to the next car where the rotary converter is placed.

In the converter car are the instruments for indicating line and booster voltage and currents in the various circuits as well as resistances for regulating the output. The rotary converter is a 4-pole machine, built by the Thomson Electric Welding Co., of Lynn, Mass. This machine has one armature provided with a commutator on one end and collector rings at the other. It runs 500 revolutions per minute, taking current on the direct current side from the booster circuit and converting it into alternating current at 300 volts. The alternating current is taken from two collector rings and passes by flexible cables to the next car, in which is found the main switch, the relative coil for current regulation, the massive welding transformer and clamp and the mechanism for moving this. Here also are the pumps, tanks, etc., necessary for cooling the jaws of the clamp.

The welder is nothing more nor less than a large transformer, mounted upon a bail which swings from a heavy arm or crane arranged to be raised or lowered or swung from side to side by means of screws driven by a small electric motor taking current from the trolley. The transformer core is laminated soft iron wound with two primary coils for 300 volts alternating current and about 260 amperes, and insulated with oil. The secondary consists of one turn, which is only completed when welding, furnishes from 30,000 to 50,000 amperes at from 2 to 4 volts. This secondary is made up of the two casings or cast metal jackets, which surround the primary coils. The contact blocks forming the jaws of the welder are

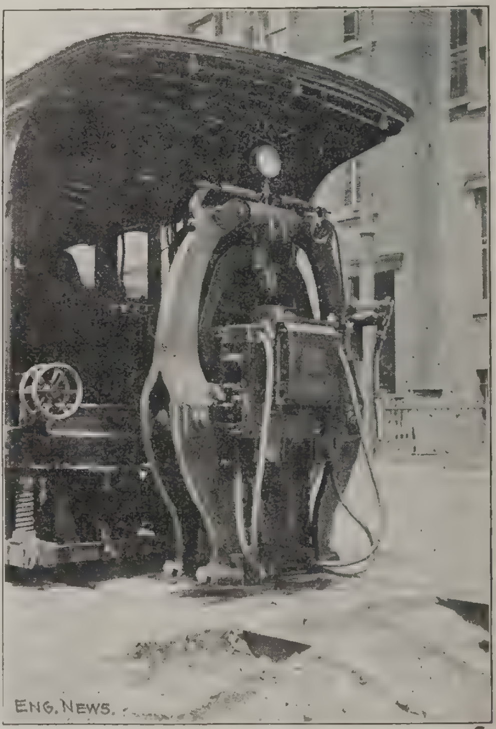


Fig. 2.—The Thomson Electric Rail-Welder.
Thomson Electric Welding Co., Lynn, Mass., Makers.

hollow and are connected with a small pump which keeps water circulating through the blocks close to the weld and thus prevents their overheating. To obviate carrying a large quantity of water it is cooled by a form of air cooler placed on top of the car, seen in Fig. 1. This is a shallow round galvanized iron tank provided with two bottoms, between which is arranged a spiral strip forming a winding passage at the center of which air is admitted from a small rotary blower. The upper bottom is full of fine holes, and the water above this is prevented from leaking through by the air which forces its way up through the holes, producing a cooling of about 10 or 20° F., as it passes out through the water.

The amount of current applied at the weld is regulated in two ways; directly, by adjusting the pressure of the jaws; indirectly, by varying the field resistance of the booster. A reactive coil is also placed in series with the primary of the welding transformer. This, however, is only used to prevent excessive sparking at the switch terminals when the circuit is broken. It consists of a simple solenoid in which is suspended a core composed of a bundle of soft iron wire.

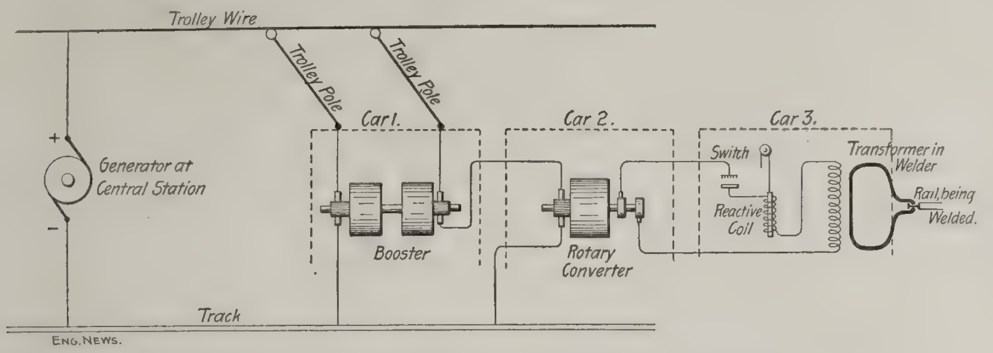


FIG. 3.—DIAGRAM OF CONNECTIONS AND APPARATUS EMPLOYED FOR ELECTRIC RAIL-WELDING.

The manner of applying the clamping to the rails is quite clearly shown in Fig. 2, in which it will be noticed that two heavy steel levers are pivoted beyond their centers and are connected at their upper ends by a double-acting hydraulic jack. A small hand pump, mounted upon one of the levers, suffices to produce any desired pressure in the jack which is referred through the levers to the joint.

Farther forward, in Fig. 1, and always in advance of the welding train just described, is the sand blast car containing a sand blast outfit, made by B. C. and R. A. Tilghmann, 126 S. 11th St., Philadelphia, Pa., an emery wheel, electric heaters to dry the sand, an electric motor and a belted air compressor. This car is cut away at the rear and is provided with canvas curtains which permit the joints to be cleaned previous to welding without scattering the sand and annoying passers by. The operator wears a helmet and cape, covering his head and shoulders.

In operation, the cars are run out at night, so as to interfere as little as possible with the schedule, and the sand blast is put to work clearing the rail joints already exposed by removing the paving for a space of about 2 × 2 ft. Shims of sawed rail sections are next wedged into place between the ends of the rails. The welding train is then moved forward until the welder hangs over the center of the joint. Two steel splice bars, 1 × 3 ins. by about 19 ins. (Fig. 4), are next clamped into place, so that the central strip (a) of each bar covers the junction of the rails. The pressure on the jaws is run up to 7-10 ton, or about 1,400 lbs., by the hand pump, current is turned on and the metal is watched until it welds. The current is broken and the pressure is increased to about 35 tons, under which the joint is kept until it is cooled. The jaws are then loosened and the car moved back just enough to put the jaws over the portion (b) at one end. This kite-shaped raised portion is produced by stamping the bars at the factory, so that a depression is formed on one side and the projection on the other. Into the depression on the back is fitted a flat steel stamping. Its purpose is to ensure an even bearing of the clamp blocks. The second weld is next made and cooled under pressure as before, and then the weld on the opposite end of the splice bar. At the end of about 15 minutes (during which current was on for about 6 minutes) the rail joint is complete and ready for use.

The amount of excavation required at the joint is small, considerably less than with the various forms of so-called cast welds. It is claimed that joints made by the welding process meet all the requirements of strength, give a certain amount of flexibility, an amount about equal to that of the rail itself, and afford an electrical bond far superior to any other form of joint.

Regarding the cost, an approximate idea can be obtained by figuring backward. There are three welds, per joint, current being on about 2 minutes per weld, a total of 6 minutes, during which close to 100 K-W. will be necessary to operate the welder and various auxiliary apparatus. This is 1-10 of 100 K-W. hours, or 10 K-W. hours per joint. The dollars and cents of this will depend upon the particular road where the welding is in progress, being more or less according to local circumstances and the efficiency of the plant. In any case, five or six men are necessary to operate the train as described and this force will average about 18 or 20 joints in 7 hours or between 2½ and 3 joints per working hour. With 30-ft. rails double track there would be about 700 joints per mile, which would mean 233 hours or about 24 days of 10 hours each per mile. To this must be added about 30 cts. per joint for cost of splice bars and other pieces used. Such a joint made in the usual way with fish plates and bolts would cost about $1.80 for material, exclusive of copper bonds and all labor. Cast joints, that is, those in which from 50 to 120 lbs. of cast iron is poured about the rail ends, vary in cost from $2.00 to $3.00 per joint.

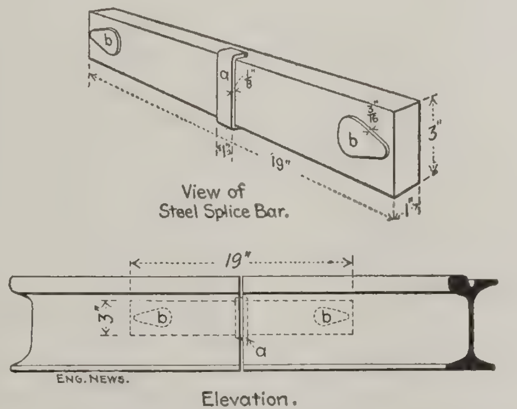


Fig. 4.—Steel Splice Bar Used, Showing Welding Points and Position of Splice with Reference to the Rails.

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THE SMOKE NUISANCE in the railway tunnel in St. Louis is creating some agitation in that city, and efforts are being made, by the newspapers and by business men's organizations, to have an ordinance passed to secure its abatement. The "Star" is carrying on a "crusade" in favor of the ordinance, which is to compel the Terminal Railroad Association "to rid the tunnel of its blackness, foulness and disease-breeding germs by methods of illumination and ventilation." That the St. Louis tunnel is black and its atmosphere so thick with smoke as to be unbreathable every traveler who has passed through it knows, but that it contains any germs, disease breeding or other, is doubtful. Sulphur fumigation is an effective method of killing germs, and the tunnel is well fumigated every time a train passes through it.

◆

THE HUDSON RIVER TUNNEL bondholders, through their trustees, the Farmers' Loan & Trust Co., of New York, and Mr. J. H. B. Kendall, of London, England, have made application to the New Jersey Court of Chancery for an order to sell the property in view of foreclosure proceedings on the mortgage of $4,000,000. It is expected that the order will be granted, when, it is stated, it is the intention of the bondholders to reorganize the enterprise and complete the tunnel. The status of the tunnel work was given quite fully in our issue of Nov. 25, 1807.

◆

ANOTHER LONDON UNDERGROUND RAILWAY is under consideration, and as the company, known as the Great Northern & City Ry. Co., is capitalized at $8,000,000 and includes a number of prominent railway men, it is quite likely the road will be constructed. The plan is to excavate two 16-ft. tunnels three miles long, connecting the Finsbury Park Station of the Great Northern Ry. and Moorgate St. in the city proper. The regular steam suburban trains will be hauled through the tunnel by electric locomotives, making the trip in 12 minutes.

◆

A ROYAL COMMISSION ON SEWAGE TREATMENT and disposal was recently appointed in England and is now holding meetings. The London "Surveyor" deprecates the fact that the press is excluded from the sittings.

◆

TELEPHONE SUBSCRIBERS IN RUSSIA NUMBER 21,590, of which 11,171 are supplied by the Bell Company, the remainder by the government. The company has 15 exchanges in 11 districts, including St. Petersburg, Moscow, Warsaw, Odessa, etc. The government has 80 exchanges in 67 districts, requiring 2,875 miles of lines and 15,130 miles of conductors against 848 miles of company lines and 15,580 miles of conductors. The charges are: 5.7d (12 cts.) for three minutes; 11.4d. (23 cts.) for the use of trunk lines up to 33 miles and 1s. 7d. (48 cts.) for distances of about 65 miles.

◆

AN ACETYLENE GAS PLANT has been installed in New Milford, Conn., for public lighting purposes. The holder has a capacity of 300 cu. ft. There are four generators, each holding 150 lbs. of carbide. The connections are such that water is permitted to gradually flow into one generator until the carbide is consumed, when it is automatically switched to the next generator, and thus the pressure and supply are maintained.

◆

THE "GOLD FROM SEA WATER" ENTERPRISE of the Electrolytic Marine Salts Co., of North Lubec, Me., has suspended operations and the "inventor" of the process and manager of the company, "Rev. " P. F. Jernegan, has absconded after having received $338,000 of the "profits," which were derived not from sea-water but from the stockholders. He sailed for Europe under an assumed name after having converted about $100,000 cash into government bonds in New York city, and his arrival at Havre on his way to Paris has been reported by cable. Steps have been taken to have him shadowed by detectives in France until papers can be sent charging him with embezzlement, on which his extradition may be secured. It is said that about $300,000 out of the $10,000,000 capital stock of the company was subscribed for in Newburyport, Mass., by bank directors and leading business men, who were led to subscribe through their confidence in the judgment of Mr. A. P. Sawyer, a local capitalist, and Mr. W. R. Usher, a large shoe manufacturer of that city, both of whom were directors in the company. One report says that $2,400,000 of the stock has been sold at par, that 45% of the money received went to the promoters, 20% to the "financial agents," and the remaining 35% into working capital, some of which was expended in the construction of the works at North Lubec, upon which 600 men have been engaged. The New York "Herald" of July 31 gives an interesting account of the preliminary experiments of the "inventor," near Providence, R. I., by which he obtained his first contributions of capital. It appears that a small shed was built at the extremity of a long slender wharf projecting from the shore of Narragansett Bay, and through a hole in the floor there was lowered by means of a windlass a large box containing a pan of mercury. An electric battery supplied by the "inventor" was applied during a whole night in the presence of some capitalists from Middletown, Conn., who had brought with them the mercury. The next morning the mercury was lifted from the water and given to a chemist who assayed it, and found in it $4.50 of gold, and thereupon the capitalists, much pleased, paid the first installment on their investment. The deception in the experiment, according to the detective, consisted in a diver's proceeding under water during the night to the box, pouring out the mercury, and substituting for it another lot of mercury containing gold. Upon this basis was floated the $10,000,000 company. Its success in obtaining gold at North Lubec was attested by its sending frequently to the New York Assay office "gold bricks" containing each about $2,000 of gold, and the exhibition of similar bricks at the company's office in Boston. The "gold from sea-water" scheme thus appears to have been one of the most gigantic swindles of recent years. It was similar in many respects to the Electric Sugar Refining swindle in New York city in 1884, by which many prominent business men, including even sugar refiners, were victimized. One of the operators in that scheme was convicted and sentenced to nine and a-half years' imprisonment. It is to be hoped that a like fate will meet the Rev. Jernegan and his accomplices.

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ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The thirtieth annual convention was held at Detroit, Mich., July 26 to 29, the headquarters being at the house of the Fellowcraft Club, the use of which was kindly tendered by its Board of Governors. A special train was run from New York, over the Lehigh Valley and Wabash railways, and special accommodations were provided by the Wabash R. R. for members from Chicago and St. Louis. There was a large attendance, both of members and guests.

The opening session was called to order about 10 a. m., July 26, Mr. A. Fteley, President of the Society, being in the chair. In consequence of the absence of the Mayor, Rev. Dr. Arnold, of Detroit, delivered the address of welcome, which was responded to by Mr. Fteley. The President's annual address was then read by the Secretary, an abstract of which we gave last week.

After the reading of the address, chairmen of the district committees to select members of the nominating committee were appointed by the chair. It was then suggested that the discussion of the proposed amendments to the constitution should be taken up, but on motion of Mr. Geo. S. Morison it was voted to defer this until the time set for it upon the program. The meeting then adjourned.

The afternoon session was devoted to a discussion of the paper by Messrs. Charles D. Marx, Charles B. Wing and Leander M. Hopkins, on "Experiments on the Flow of Water in the 6-Foot Steel and Wood Pipe Line of the Pioneer Electric Co., at Ogden, Utah." Mr. Henry Goldmark gave a brief synopsis of the general points of the paper, after which some written discussions were read by the Secretary, in which doubts were expressed as to the accuracy of the results of the experiments, in view of the conditions under which they were made. Mr. Kuichling also expressed somewhat similar views. Mr. John C. Trautwine, Jr., who was a member of the committee of the Franklin Institute, appointed to report upon the Venturi meter, thought the investigations made by these authors as to this meter are particularly valuable, especially as there is some doubt as to whether the piezometer measurements should be made at the top of the pipe or at the middle of the pipe. Experiments made at Philadelphia showed that the loss of head is less with this meter than with any other, but the loss increases as the square of the velocity. A 20-in. Venturi meter was placed on a certain supply main, and when several fire engines were pumping from this main to extinguish a fire they could not get enough water until the meter was cut out and the water sent through the by-pass.

At 3:30 p. m. the meeting adjourned, and the party boarded a number of electric cars provided by the Detroit Electric Ry. Co. for a ride about the city. The cars first went out on Woodward Ave., which is a handsome residence thoroughfare, and then along Jefferson Ave. to the water-works pumping station, where a short time was spent in examining the plant and in getting a photograph of the party. During this trip the width of the streets, their cleanliness, and the excellence of the pavement (mainly asphalt and brick) attracted considerable attention, especially from those interested in municipal work.

In the evening there was a steamer excursion on the Detroit River and St. Clair Lake, by courtesy of the Detroit, Belle Isle & Windsor Ferry Co. A band was provided, and dancing was indulged in on the upper deck.

The morning session on July 27 was called to order about 10:15 a. m. The first paper taken up was on "The Determination of the Safe Working Stress for Railway Bridges of Iron and Steel," by Mr. G. Herbert Stone. There was no discussion, nor were the written discussions presented, the President considering that the subject was too mathematical to be considered in the limited time that could be devoted to it. The Secretary then read a synopsis of Mr. Charles H. Snow's paper on "Marine Wood-Borers," an abstract of which was given in our issue of July 21. In the discussion it was stated that at San Francisco the teredo now attacks timbers which were formerly almost free from their attacks. Creosoting was considered one of the best protective methods, as it prevents decay as well as the attacks of borers, etc., but it is not universally reliable, as the oil will penetrate the softer rather than the harder parts of the wood, leaving the latter liable to attack. Mr. Harrod referred to the use of sewer tile slipped over the piles, the annular space being filled with sand, while Mr. Robert Moore described a process consisting of wrapping the pile with cloth treated with a certain mineral cement. One member thought that metal piles will be the most practicable solution of the question, especially in view of the low cost of iron and steel. The discussion began to drift towards methods of protecting piles, but the President ruled that this was not in order, and limited the discussion to the subject of the borers themselves. Mr. Wegmann said that while the limnoria is found in Boston harbor, the teredo is only rarely found, and is killed off by the severe winter cold. Cape Cod appears to be about as far north as the latter will reach.

The long and detailed paper by Mr. J. A. Ockerson on "Dredges and Dredging on the Mississippi River" was next taken up, the discussion being opened by Mr. Harrod. Work on the channels, he said, must be commenced as soon as the river has fallen to about mid-stage, and will allow of the surveys being made. The use of dikes and training works would necessitate extensive preparations at a multitude of places, as well as large gangs of men and extensive plant to put in these works. One of the new dredges will be self-propelling, thus avoiding the trouble and expense of a tender. It is desirable to keep the delivery pipes as short as possible, as a pipe 1,000 ft. long will deliver 25 or 30% less than a pipe 500 ft. long. As the dredged channels are usually diagonal to the current he advocated depositing the dredged material on the downstream side of the cut or channel.

Prof. L. M. Haupt referred to the use of portable jetties or dams, which are used mainly on the crest of bars, and consist of steel panels, with mats, secured to piling. Jetties or training walls to increase the scour through channel could be made in the way suggested by Mr. Harrod. The portable dams have been used with success in water 10 ft. deep and over. They cost about $3 per lin. ft., and 250 ft. can be built in a day. Another member thought the paper should have given credit to Mr. A. B. Bowers for the development of the hydraulic dredging system, and still another considered that the tables of the results of tests were unsatisfactory, the tests of different dredges having been made under such different conditions that the results could not properly be compared.

The next paper was on "The Reservoir System of the Great Lakes of the St. Lawrence Basin; Its Relation to the Problem of Improving the Navigation of These Bodies of Water and Their Connecting Channels," by Capt. Hiram M. Chittenden, U. S. Engineer Corps. An abstract of this was read by Mr. James A. Seddon, the author of an appendix to the paper, giving "A Mathematical Analysis of the Influence of Reservoirs Upon Stream Flow." The author of the paper thought that it would be best not to attempt to modify the oscillations in the lake levels, and that if such modification should be attempted it could best be done by some form of movable dam rather than by a fixed submerged weir, at the outlet of Lake Erie.

The discussion brought out considerable opposition to the statements and suggestions of the paper, and Prof. J. B. Johnson considered that the acceptance of its conclusions would mean stopping all further improvement. Mr. Rafter thought the position taken in regard to the question of rainfall in the Great Lakes was incorrect, and presented a somewhat lengthy discussion on this point. Mr. George Y. Wisner and Mr. Lewis M. Haupt also took part in the discussion and presented views adverse to those of the author.

At the afternoon session, the district committees presented nominations for members of the committee to nominate officers for 1899, and the nominations were confirmed as follows:

District No. 1.—Henry G. Prout, New York city.
District No. 2.—J. W. Ellis, Woonsocket, R. I.
District No. 3.—Emil Kuichling, Rochester, N. Y.
District No. 4.—Lewis M. Haupt, Philadelphia, Pa.
District No. 5.—Prof. Ira O. Baker, Champaign, Ill.
District No. 6.—N. W. Eayrs, St. Louis, Mo.
District No. 7.—Andrew Rosewater, Omaha, Neb.

The next subject was the selection of the place for the next annual meeting, and the membership at large seemed to have taken even less interest than usual in the matter, the letter ballot having resulted in only 56 votes. Washington and Atlantic City received the highest number of votes, the number being five in each case. Then followed the usual amusing and mildly acrimonious discussion on the subject. Mr. George S. Morison suggested that the convention be held at some point in the extreme South in April, 1899, but after a good deal of desultory talk this motion was defeated by a vote of 68 to 28, the larger vote being in favor of leaving the matter to the Board of Direction without any suggestion from the meeting. Possibly the discomfort due to the heat which prevailed in the convention hall had some influence in this, the very idea of going South suggesting more heat. Prof. Fuertes favored Ithaca and Cornell University, and a motion by Mr. B. M. Harrod was carried, to the effect that the convention should be held at some place where the entire party can be accommodated in one hotel.

An amendment to the constitution was also carried, and without discussion. This amendment does away with the office of Auditor, and puts the work of that office upon the Secretary and the Finance Committee, thus saving the Society the sum of $1,000 per year.

The question of submitting the appointment of committees on "rail joints" and "paints and painting" to a letter ballot was then taken up, but the discussion turned largely on the powers of the meeting and the Board of Direction as to modifying the terms of the original resolutions adopted calling for the appointment of such committees. Apart from this, Mr. Don J. Whittemore deprecated the work of committees, on the ground that the Society ought not to undertake work of this kind, which, he believed, should be done by individuals for themselves. Mr. Berg and Mr. Seaman, however, expressed the opinion that investigations by committees are among the important purposes of the Society and that a committee can get information and do work which no individual can or will do. Mr. Morison did not approve taking up the entire broad subject of rail joints, but thought a committee ought to be appointed to prepare standard sections for angle bars to fit the so-called "Am. Soc. C. E." standard sections of rails. The vote was 9 against to 46 in favor of submitting the question to letter ballot.

The subject of paints and painting, however, was considered to be of a somewhat different character, the great objection appearing to be that the inquiry would inevitably run foul of patents and manufacturers, and it was eventually decided that this proposed investigation should be dropped, and not submitted to letter ballot.

This concluded the business proceedings and the meeting then adjourned.

On Thursday, July 29, a large party left the Brush St. Station at 9.15 a. m., on a special train for Port Huron, provided by the Grand Trunk Ry. At Port Huron the party boarded a train of new gondola cars fitted with seats, which train was then run through the St. Clair tunnel to the Canadian side, and then back again. The train was pushed through in each direction, so as to have no trouble or discomfort from the smoke and gases from the engine. It is interesting to note that the huge tunnel engines, having ten driving wheels, are no longer fitted with side tanks, but have large tenders, as is the practice with ordinary road engines.

The Grand Trunk Ry. train then carried the party to the St. Clair River, where the steamer "Pleasure" was in waiting, and lunch was served as soon as the party was on board. The steamer started about 12.30 p. m., and after a very delightful trip down the St. Clair River and lake and the Detroit River, reached Detroit about 5 p. m.

The final session was called to order about 10 a. m., July 29, when the paper by Mr. D. A. Molitor on "Three-Hinged Masonry Arches, with Special Reference to Long Spans," was taken up. Mr. Goldmark, who opened the discussion, referred to the theoretical advantages of the three-hinged arch, but considered that it would have greater deflection than a solid masonry arch, and that therefore it would be inferior to the latter for railway bridges. Furthermore, as the arch masonry is but a small percentage of the total masonry in the structure, the slight saving in material by the use of a three-hinged arch is of but little importance. M. W. G. Berg took a similar view, and thought that the advantages of this type of arch would probably be more balanced by the increased difficulty and labor of design and construction.

Prof. J. B. Johnson, however, thought that a distinction should be drawn between difficult and uncertain computations, and thought while those for a three-hinged arch may be difficult those for a solid arch are very uncertain in results. If the principle is correct, the cost of making the necessary computations will be as nothing compared with the saving in cost of the structure.

After this, a series of resolutions of thanks to local authorities, transportation companies, etc., was adopted, and the convention then adjourned.

In the afternoon a party went down to Wyandotte on a parlor car of the electric railway to visit the shipbuilding yard of the Detroit Dry Dock Co., where the iron freight steamer "Troy," for the New York Central R. R., is now being completed.

In the evening a reception was held at the Detroit Club, and was a very sociable and enjoyable occasion.

The meeting was eminently successful, the only drawback being that the party was distributed among several hotels, so that there was less opportunity for general sociability and the making of acquaintances than when the entire party is accommodated under one roof. This led to the adoption of a resolution, as already noted, to the effect that the next convention should be held at some place where all the members and their guests can be accommodated in one hotel. The attendance was exceptionally large, there having been about 230 members and 300 guests present. With the exception of one or two very hot days, the weather was exceedingly pleasant. The Society was most hospitably entertained, and all the excursions were enjoyable and were managed without a hitch. As to the business part of the proceedings, perhaps the less said the better; most of the papers were presented in a perfunctory way, considering their value and importance, and the discussions were in too many cases brief and unimportant. It is possible that at some future day the Society will boldly omit technical papers and discussions entirely from its summer meetings.

ENGINEERING NEWS AND AMERICAN RAILWAY JOURNAL.

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THE POLLUTION OF THE PASSAIC RIVER is to be studied anew by a third commission. The eight members of this commission have just been appointed by Mr. Foster M. Voorhees, Acting Governor of New Jersey, under an act passed by the state legislature of 1897, providing for a state commission to consider the subject of the pollution of the rivers and streams of New Jersey. While the act is general in character, the popular conception of it seems to be that it is intended to be applied to the Passais River only, and all of the eight commissioners reside in cities or towns affected by the Passaic River problem. The commisioners are to receive not over $1,000 per year for their services, and may expend $25,000 in their work, subject to the approval of the governor of the state. The expenses of the commission are to be apportioned among the communities benefited. The members of the commission are as follows: Messrs. Wm. T. Hunt, Editor of the Newark "Sunday Call," and H. C. H. Herold, President of the Newark Board of Health; Chas. W. Fuller, City Attorney of Bayonne; Jas. A. Exton, M. D., of Arlington; Wm. Kent, M. Am. Soc. M. E., Associate Editor of Engineering News, of Passaic; Elias J. Marsh, M. D., and John Hinchliffe, Mayor, of Paterson; and Chas. F. Harrington, of Bergen Co.

◆

MUNICIPAL OWNERSHIP OF WATER-WORKS continues to make rapid headway. On July 31 the plant of the Duluth Gas & Water Co. was formally transferred to the city of Duluth, thus ending the long struggle described in our issues of Dec. 16, 1897, Jan. 20 and May 5, 1898. At Des Moines, Ia., the people vote on Aug. 29 on buying the plant of the Des Moines Water-Works Co., formal agreements for the purchase having been made between the officials of the city and company. The Great Falls Water-Works Co., of Great Falls, Mont., has just accepted the city's offer of $375,000 for its plant. Several other places have recently changed to or voted for municipal ownership, while Indianapolis, Denver, Los Angeles, Pasadena, Cal., Cripple Creek, Col., Fulton, N. Y., and many other places, big and little, have the subject under discussion.

◆

WORK ON THE MASSENA CANAL, says the Watertown, N. Y., "Standard," is rapidly progressing. Seven steam shovels are at work on the ridge near the St. Lawrence, and two of these Vulcan shovels have a capacity of 1,000 to 1,500 cu. yds. per day of 10 hours. Cableways are being put up for Vivian scrapers and for transporting material, the latter is a 2½-in. steel cable stretched from two towers across the Grasse River, and capable of carrying a 10-ton bucket.

◆

HIGHER SPEED IN NEW BATTLESHIPS was decided upon on Aug. 9 by the Naval Board of Construction. But the board opposed making new designs for these ships, and recommended that bids be opened on Sept. 1, as originally proposed. This action is taken in the hope that the builders will submit plans and bids for faster ships, and the Cramps and the Newport News shipyard have already promised to send in such bids. Engineer-in-Chief Melville dissents from the recommendation of the board, and sends in plans of engines for speeds of 17 and 18 knots; but for the latter speed he wants 600 tons additional displacement if the 1,200 ton coal capacity and 6,300 knot steaming radius are to be preserved. The inherent danger in increasing speed without proper increase in displacement will be a crowding of machinery and a continuance of unsufferable heat conditions in the fire and engine rooms.

◆

THE TORPEDO BOAT "MACKENZIE," built at Hillman's shipyard in Philadelphia, on Aug. 5, made 23 knots on its builder's trial trip. The contract speed was 20 knots. But a boiler tube blew out on her return trip and four men were seriously burned. On the same day the torpedo boat destroyer "Farragut," a 30-knot boat, made a preliminary trial at San Francisco. She was built at the Union Iron Works, and with 3,000-HP. developed out of her 5,800-HP. contract power, she made 26 knots.

◆

THE COST OF LARGE CALIBER AMMUNITION, in the present war is very great. A 13-in. gun, firing a projectile weighing 1,100 lbs., consumes 550 lbs. of brown prismatic powder, costing from 30 to 33 cts. per pound. At the lower price the powder for a single discharge costs $165. The common 13-in. shell is said to cost $116.63; but the armor-piercing projectile costs $418. To these items musts be added cartridge-bags, primers, freight, etc., amounting to about $15; or, $296.63 for the shell discharge, and $588 for the discharge of an armor-piercing projectile. As the 13-in. gun can be discharged about 25 times in an hour, the work of one gun for an hour may cost the government about $15,000. The 8-in. gun costs about $65 for each shot; the 5-in. rapid-fire costs $33; the 6-in. brech-loading shot costs about $40, $14 being for the powder; and each round of a Hotchkiss 6-pdr. gun is estimated to cost $5.70, and a 1-pdr., $1.12. Whitehead torpedoes cost $2,500 each, and a Howell torpedo, $2,200.

◆

ONE FLOATING DOCK, instead of two, will be purchased by Commodore Endicott, Chief of the Bureau of Yards and Docks, for immediate use in Southern waters. This order was issued since peace representations were made, and negotiations have been concluded for towing the Perth Amboy dock, of 2,300 tons capacity, to Key West.

◆

A COALING STATION WILL BE ESTABLISHED by the Navy Department at the U. S. Naval Station, New London, Conn., and bids have been asked for the work. The specifications call for the erection of coal pockets or sheds with a capacity for about 10,000 tons of bituminous coal on a basis of 45 cu. ft. per ton. The plans contemplate the receipt of coal by rail over an extension now being built through the station, and also by water, suitable coal handling and conveying apparatus being provided for rapidly unloading or loading vessels or lighters. Only the most approved and substantial methods and construction will be used.

◆

GREAT ACTIVITY IN SHIPBUILDING is expected to follow the end of the present war. As a result of the number of vessels impressed into the government service, many steamers are now being built to replace them. Wm. Cramp & Son are building a steel twin-screw steamship, 360 ft. long, for the New York and Cuban Mail Steamship Co., and four steel steamships, each 280 ft. long, for the American Mail Steamship Co. At Chester, Pa., two steel steamships, each 260 ft. long, are being built for the Old Dominion Line; Harlan & Hollingsworth, of Wilmington, Del., is constructing a 274-ft. steel steamer for the Merchants' and Miners' Transportation Co., of Baltimore; and at Newport News, three new Morgan liners, two new Cromwell liners and two new Pacific Mail steamships are on the ways.

◆

THE THREE 2,500 HP. GENERATORS and steam engines constructed by the Westinghouse Electric & Mfg. Co., of Pittsburg, Pa., for the Metropolitan Electric Supply Co., of London, England, were inspected on July 30 by a large number of engineers. Each of these machines include a marine-type, vertical-cross compound engine of 2,500 HP. and a direct connected 2,000-HP. 500-volt two-phase generator, with a revolving armature. The engines are capable of operating at speeds between 116 and 145 revolutions per minute.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Aug. 8 on the New York, New Haven & Hartford R. R., at Canton Junction, Mass. A special mail express, composed of four cars, jumped the track while running at a high rate of speed, owing to the breaking of a bolt in the cross beam of a siding switch. Three postal clerks were killed and seven were injured.

◆

THE HAMBURG-AMERICAN LINER, "Fuerst Bismarck," has made a new record, from New York to Cherbourg, of 6 d. 13 h. 50 m. This beats her previous best record by about one hour. The "Bismarck" held the Southampton eastward record for four years. It was taken from her in September, 1897, by the "St. Louis," which made the trip in 6d. 10h. 14m., and the Southampton record is now held by the "Kaiser Wilhelm der Grosse," at 5 d. 17 h. 8 m., made in November, 1897.

AMERICAN EXHIBITORS at the Paris Exposition will, if present indications continue, make a creditable showing. Already applications have been received from over 600, and the 150,000 sq. ft. allotted to the United States will undoubtedly prove too small, and a request will be made for a total of 500,000 sq. ft. So far, ten electrical companies alone have asked for 75,000 sq. ft. The prominence given to the United States by the present war has had its effect abroad, and it is expected that little trouble will be experienced in obtaining the extra space.

◆

ARMOR-PLATE BANK-VAULTS are being built by the Carnegie Co. for the Union Trust Co., of Pittsburg, and the Philadelphia Saving Fund Society. The steel vault of the Union Trust Co. will be built of single 6-in. plates. with an 8-in. plate, weighing 46,150 lbs. and 234 × 114 ins., in the front. This front plate will be reinforced by a rolled steel plate 6½ in. thick and weighing 38,200 lbs. The door will be circular, 86 in. diameter and 3 ins. thick at center, and 6 ins. thick on the edges, ground to a gas-tight fit. The clear space within the vault will be 18½ × 16½ ft. and 9½ ft. high. No bolts are used in joining the plates, as the work is machined out and dovetailed so as to form a solid box resting on a masonry foundation. This is said to be the first use of solid armor-plate for this purpose as a substitute for the usual laminated steel construction.

◆

THE PHILADELPHIA STORM OF AUG. 3 eclipsed all previous records. The rainfall record was 5.48 in. in 1 h. 50 m., and a boy and horse were killed by lightning. A man was drowned in a cellar in a sudden and enormous inrush of water from the street.

◆

A STEEL VERTICAL LIFT BRIDGE, with steel towers 213 ft. high, has been built by French engineers, at Bizerte, Tunis, over the entrance to Lake Bizerte. The span is not noted, but the bridge is lifted by cables and pulleys, by a 6-HP. engine, in 40 seconds.

◆

ALUMINUM HORSESHOES have been tested in the Russian cavalry and seem to prove satisfactory. It is reported that they wear out less rapidly and are less affected by mud and moisture than the ordinary shoe. The difference in weight is 2½ oz. per shoe.

◆

A TELEGRAPH LINE FROM CAIRO to Cape Town, in Africa, is talked of, with Mr. Cecil Rhodes as chief promoter. The proposed route would be from Fort Salisbury to the Zambezi, near Tete; thence to Zomba and along the west coast of Lake Nyassa to Karonga and Lake Tanganyika. At the latter point it would be necessary to lay a cable to the head of the lake; or, obtain the permission of Germany or the Congo State to run an overland line through that territory. A telegraph line is now said to extend as far north as Lake Tanganyika; and from Cairo south it almost reaches the site of old Khartoum, or the junction of the Nile and the Atbara.

◆

THE CONSERVATOIRE DES ARTS ET METIERS, on June 24, celebrated the centennial of its installation in the old priory of Saint-Martin des Champs, in Paris. Descartes is credited with first conceiving the idea of a museum of models for the use of artisans; but the French Convention ,on Oct. 11, 1794, realized this idea by a decree then issued; and on June 10, 1798, the Conservatoire was definitely organized and installed in its present building. The decree called for the collection of machines, models, tools, designs, and books of all kinds relating to the arts and manufactures, and the construction and uses of these machines, tools, etc., were also to be made plain. Free lectures are given here upon the application of science to the industrial arts, upon mechanics, chemistry, industrial economy, descriptive geometry, industrial legislation, agriculture, etc. Original research is here conducted under the ablest men obtainable, and the scientific library now numbers 40,000 volumes. The building itself is a beautiful structure of the 11th, 12th and 13th centuries.

◆

THE FRANKLIN TUNNEL, now under construction on the Valley Railway terminating on the Bay of San Francisco, will be 5,600 ft. long. Work was commenced on the approaches in December, 1897, under the Engineer, Mr. A. S. Riffle. This tunnel, named after Franklin canyon close by, is 22 miles from Point Richmond, the terminus of the Valley Railway, and the road now being built will connect at Stockton with the present line of the Valley road. This road will require five tunnels through the Coast Range of mountains, one at Point Richmond, 825 ft.; a curved tunnel of 1,100 ft. at Pinole, and two others of 1,300 ft. and 300 ft., besides the Franklin tunnel. The contractors for the latter work are Folev Bros. & Muir, of St. Paul, Minn., and the estimated cost is about $400,000. The work is being pushed from both ends, at the present rate of 6 ft. daily on the eastern end and 8 to 12 ft. daily at the west. The tunnel lies about 400 ft. below the summit of the ridge pierced.

COVERED STORAGE ROOM FOR RAW MATERIAL; YOUNGSTOWN BRIDGE CO.

The advantages to be gained in the cheapness and comfort of handling and in the ease of marking and laying out the various rolled shapes used in bridge work has led a few bridge companies to build covered storage yards for their raw material. In the accompanying view such a covered space, forming a part of the main truss shop of the Youngstown Bridge Co., of Youngstown, O., is shown quite clearly, with the assorted piles of angles, Z-bars and other shapes fully protected from the rain and snow. The view also shows some features of the overhead trolley construction and the heating arrangements for these shops, which, as we have previously noted, were entirely rebuilt last winter. The advantages to be gained by so fully protecting the material from the weather are not confined to economy in labor and time in handling the material at the bridge shop. Recent investigations have shown that the durability of paint is very materially increased by having the metal free from corrosion and perfectly clean when the paint is applied. These conditions are much more likely to prevail if the material is protected from the weather from the first, than if the manufacturer is depended upon to clean thoroughly in the rush of work all metal work to which paint is applied before shipment.

INTERIOR OF MAIN TRUSS SHOP OF THE YOUNGSTOWN BRIDGE CO., SHOWING RAW MATERIAL STORED UNDER COVER.

THE NEW WATER-WORKS INTAKE TUNNEL FOR CLEVELAND, OHIO.

(With single-page plate.)

The longest water-works intake tunnel yet attempted in the world, so far as we know, is now being constructed at Cleveland, O., beneath Lake Erie. It will be 26,000 ft. in length, 9 ft. in diameter, in the clear, have an estimated daily capacity of 170,000,000 gallons, and will terminate at an intake crib in water 49 ft. deep, located as shown by Fig. 1. On June 17, 1898, when a member of the editorial staff of this journal visited the work, the shore shaft and one temporary lake shaft had been sunk and about 8,500 ft. of tunnel had been driven, besides which the second temporary shaft was down about 98 ft. below the water level and the permanent steel intake crib had been launched and was being finished preparatory to being towed to and sunk in place. This article, however, describes the work up to July 31, as noted further on.

Thus far the work has progressed without more than the minor incidents to be expected on all such jobs, with the exception of two explosions in the tunnel and the encountering of bad material in the shaft of temporary crib No. 2, as described further on. Mr. M. W. Kingsley, M. Am. Soc. C. E., Superintendent of the Water-Works, is the chief engineer of the work, and Mr. C. F. Schulz is first assistant engineer.

Before proceeding to describe the new tunnel and accessories a few words may be said regarding the old works and the report recommending the improvements now in progress.

The Original Tunnels and the Expert's Report.

The present water supply of Cleveland is taken from the lake at a point 6,006 ft. from the shore, although the tunnels are somewhat longer, through two intake tunnels, as shown on the map, Fig. 1. The first tunnel built was 5 ft. in diameter and 6,662 ft. long. Later this tunnel was extended for 2,580 ft., from the shore to the pump wells, the diameter being 5½ ft. and 6 ft. About 1890 a second tunnel was completed, leading from the old intake crib to the main pumping station. The diameter of this tunnel is 7 ft. and its length is 9,200 ft., including the shore end.*

The combined capacity of the two old tunnels is placed by Mr. Kingsley as at least 120,000,000 gallons, at all stages of the lake. By lowering the pumps and the conduits connecting with them it is expected that 150,000,000 gallons per day can be drawn through these tunnels, even after they are extended as a single tunnel of large diameter, as recommended in the report mentioned below.

Early in 1896 a commission composed of Messrs. Rudolph Hering, G. H. Benzenberg and Desmond FitzGerald, Ms. Am. Soc. C. E., reported on improvements in the water supply and sewerage systems of Cleveland. They recommended that water should be drawn from a new intake crib about four miles from the shore, through an extension of the present tunnel; that intercepting sewers should be built to convey the sewage some ten miles, measured along the shore, from the water-works intake; and that a flushing tunnel be built to dilute the water of the Cuyahoga River. This report was approved, except in some details, by Messrs. M. E. Rawson, Chief City Engineer, and M. W. Kingsley, M. Am. Soc. C. E., Superintendent of the Water-Works. Mr. Kingsley advised the construction of an independent tunnel from the proposed intake to a new pumping station on the opposite side of the city, as is being done. Instead of a submerged intake crib, as recommended by the commission, the projecting structure shown by the accompanying drawings is to be used. The intercepting sewer, it may be added, is now well under way, but the flushing tunnel has not been started, which delay accords with the suggestions of both Mr. Hering and Mr. Kingsley.

The Shore Shaft.

The work of driving and lining the tunnel is to be carried on finally from four shafts, a shore and inlet shaft, respectively, and two temporary shafts, thus giving six headings. The shore shaft was completed Dec. 18, 1896. Its dimensions and general character are shown by Fig. 2. It was sunk some 60 ft. by the use of a cast-iron shoe and ordinary excavation, the shoe having a cutting edge and the curb being loaded as found necessary. Steel cylinders of ¼-in. plate were riveted on the shoe and then on each other as it sank, and a brick wall built up inside the cylinder, as shown. After the shaft had been carried down as far as was deemed practicable by this means, a pilot shaft about 6 ft. sq., lined with heavy oak sheathing, was sunk to the level of the bottom of the sump. This shaft was then enlarged by sections and the brick lining put in from the bottom upwards until some 10 or 12 ft. from the cast-iron shoe. The weight of the curbing caused it to sink down, bending all supports placed under it, until it rested on the lower wall. The two walls not coinciding perfectly, the latter was rebuilt, after an air lock had been placed in the upper section. The location of the two temporary cribs is shown in Fig. 1. The cribs are very solidly built of timber, in pentagonal form, having outer sides 54 ft. in length. The first course consists of 12 × 12-in. timber framing, upon which is a solid floor of two courses of 12 × 12-in. timbers, with 3 × 12-in. plank, laid flatwise and calked, between them. All four courses are of pine, drift-bolted vertically and horizontally, besides which many screw bolts were used. The outer and inner walls of the crib and an intermediate wall are of hemlock timbers for 40 ft. above the pine bottom just described, and of pine for the next 16 ft., or to the floor line, the timbers being of 12 × 12-in. stuff. Vertical drift-bolting is used freely in these walls and proper bracing is also employed. A plan of the crib at the floor line and a cross section of the superstructure are shown by Fig. 3. The corners of the cribs for a distance of 14 ft. below the floor line are protected by ¼-in. steel plates and there is a 3-ft. band of the same material around the cribs at the water line to protect the cribs from the action of moving ice. The construction of the cribs was begun on shore and finished inside the breakwater after launching them.

The Temporary Cribs and Shafts.

The temporary shafts are 8 ft. in diameter inside and are in 43 ft. of water. Ouly the one nearest the shore has yet been completed. For about 25 ft. above the top of the ring of the tunnel the shaft is lined with 12½ ins. of brick. Next comes a cast-iron cylinder with a 1¾-in. shell and inside flanged and bolted joints, lined with 4 ins. of brick. The upper 9 ft. of the shaft is of steel. This shaft was sunk in much the same way as the shore shaft, the shell having the flange on its lowest section omitted to form a cutting edge'

Difficulties at Temporary Shaft No. 2.

At the second temporary crib the sinking of the shaft has met with delays, which can be best described by quoting from a letter to this journal written by Mr. Schulz, First Assistant Engineer, which brings the account down to July 31:

> Work proper on this shaft was begun on Jan. 14, 1898, and by Jan. 25 eight cylinders were bolted together, making the total length of the shaft 72 ft., 18 ft. of which had been forced into the lake bottom, the upper 8 or 9 ft. being sand, while below that was soft blue clay. The ninth cylinder was then added, having first been converted into an air lock by bolting to the end flanges heads or diaphragms having a door each and made of steel plates stiffened with channel irons. The shaft was then ready to have an air pressure applied to complete the lower part under pressure. Before this the water had been pumped out and the shaft found to be perfectly dry.
>
> The work was now delayed, because the air compressor for this crib had not arrived, and after it did arrive (on

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*A detailed description of the Cleveland water-works from their start to the close of 1877, including the construction of the first tunnel, was published in Engineering News for April 26, May 3 and 10. and June 14, 1879. Subsequent articles on various phases of these works were published in our issues of April 23, 1881; March 19, 1892; April 5, 1894; and Feb. 20, 1896, the latter being an abstract of an expert's report on the new supply.

Feb. 3) the ice in the lake prevented its being taken out until Feb. 11, when it was set up and connected with the shaft ready to put on the pressure. Digging was resumed in the shaft Feb. 18. During this time, i. e., from Jan. 25 to Feb. 18, or 23 days, this shaft, in order to prevent its settling further, had been held in timber clamps, which were secured to the wall enclosing the well of the crib. There had been a strong movement of ice in the lake at different times from Feb. 1 to 10, which shook and jarred the crib considerably, and the shaft being held in the clamps, this shaking and jarring was communicated to it, so that it worked down into the clay bottom about 3¾ ft. farther. It, however, remained perfectly dry during all this time.

On Feb. 21, the cast-iron shaft, now 81 ft. long, was in its proper position and embedded for 25 ft. in the lake bottom, with 3 ft. excavated below the cutting edge, ready for the masons to build the brick lining, consisting of three rings of brickwork, making a wall 12½ ins. thick. The air pressure was now put on, 18 lbs. per sq. in. being maintained, and the masons were sent in at 11 p. m. About an hour later a little water was observed to be trickling in through what seemed to be a vein of sand about 6 ft. wide and a few inches thick. The flow of water gradually increased, so that by 2 a. m. there were about 18 ins. of water in the shaft and the men were compelled to quit work. As no provision had been made for taking care of or pumping out any water, the shaft slowly filled up, there being 11½ ft. of water in it at 8 a. m., although the air pressure had been increased to 25 lbs.

The contractors decided to order two more cylinders and to force the shaft 18 ft. farther into the clay before again attempting to put in any brickwork. While these were being made, the air pressure was let off from the shaft, and the water in the shaft then rose to the lake level, indicating that the water had forced its way down on the outside of the shaft, or through some cracks in the clay extending from the bottom of the shaft to the bottom of the lake.

The tenth cylinder was delivered on March 10 and put in position on the following day. The water was then removed from the shaft and excavating commenced. It was found that the clay, also some sand and gravel, extended up in the shaft to about 9 ft. above the cutting edge. The shaft settled about 4 ft. on the second day after resuming operations. On the following day the eleventh cylinder was bolted on, making a total length of shaft of 99 ft. Excavating was then continued, the material being soft clay. Subsequently two cracks were discovered in the cast-iron cylinders, one in the second cylinder and one in the third cylinder from below. Both cracks were immediately under the top flange of these cylinders and extended a little more than one-fourth way around. The water now came in quite fast through these cracks, and also around sides of cylinders from below, which finally compelled the men to leave the shaft and allow it to fill again with water. The work was delayed on two other occasions, first by gas and water bursting up from below, and again by water coming in under the cutting edge of the shaft. Both times the shaft was allowed to fill up with water.

Permission was finally given the contractor to add a third extra cylinder, making twelve in all, or 108 ft. total, and to drive the shaft a few feet deeper than was originally planned in order to get into better ground for driving the tunnel. (The invert of the tunnel here was to have been 105 ft. below datum.—Ed.) In order to secure the cracked cylinders the top flange of the first and the bottom flange of the fourth cylinder were connected by rods about 18 ft. long, passing through the flanges of the two cracked cylinders and drawn up tight with nuts on both ends. The cracks were also calked with lead and a brick wall 8 ins. thick built inside the two cracked cylinders, the brickwork being laid in Portland cement mortar and thoroughly grouted. While this work was being done 40 lbs. pressure were maintained in the shaft. After this work had been completed and the clay again dug out to the cutting edge, on July 20, the air was allowed to exhaust from the shaft in order to sink it farther down, settling it 4 ins. in about one hour and then stopping. Air pressure was then again applied, the water pumped out and excavating continued until 3 ft. below the cutting edge had been taken out, when the air was again let off, the shaft sinking 21 ins. this time, but filling with water in a few hours.

After the water had been removed an examination showed that another cylinder had been cracked during this operation, being the sixth one from below; the crack being in the same relative position with the others. This is now being calked and secured by rods. This shaft is now, July 31, 108 ft. long and extends from 12 ft. above lake level, or 10 ft. above city datum line, to 52 ft. below the bottom of the lake.

It is our opinion that the most trouble has been caused by the leakage through the cracks in the cylinders, rather than by water following down outside the shaft and coming in under the cutting edge; and we were at first inclined to the belief that these cracks were due to the heavy strains produced in the shaft while it was held in the clamps and the crib was jarred and shaken by the moving ice. Against this theory, however, is the fact that the shaft was perfectly dry during all the time that work was suspended and for four days after it was resumed, and that the cracks themselves were not discovered until about 26 days later. This third crack occurring during the operation of forcing the shaft down indicates that the cause is to be sought in the ground through which it is being sunk.

When the tunnel is completed it will be arched over at the two temporary shafts. The shafts will then be filled with puddled clay to a depth of 20 ft. and for the remaining depth to the lake bottom with earth. All obstructions to navigation to a depth of 35 ft. below the water line will then be removed.

The Steel Intake Crib.

The permanent steel crib has an outside diameter of 100 ft. and a central well 50 ft. in diameter. A section of the crib is shown by Fig. 4, and two views of it under construction by Figs. 5 and 6. It has an octagonal pine timber bottom, 4½ ft. thick, the lower course being a frame and the three upper ones being solid, all the timber being 12 × 12 ins., except the outer ones, which are 12 × 18 ins. Radial partitions divide the crib into 24 water-tight bulkheads. The rings and partitions are of ⅜-in. steel plates, in 6-ft. courses, reinforced by angles at the joints and also at intervals along the radial plates. The rings are bolted to the timber bottom and also braced against it, triangular-shaped plates with angles bolted to their longer sides serving as braces. In each compartment and course there is one strut between bulkheads, and one tie piece between braces, all of angle iron, the struts being formed of two channels bolted together and to vertical gusset plates inserted at the top of each vertical joint in the bulkheads, four angles being used at these joints. All joints are riveted. The twelve inlet ports are designed to admit water to the shaft and tunnel at eight times the rated capacity of the latter, allowing a velocity of 4 ft. per sec. through the tunnel.

The metal work of the crib is painted with three coats of lead and oil, the first and third coats being of red lead and the second of white lead. Analyses of the lead were made from time to time to make sure that only pure lead was being furnished.

The timber bottom of the steel crib was constructed on land and the steel work started there after which the structure was launched to the breakwater and work continued until it was ready to be towed to and sunk in place. Fig. 5 shows the crib at the breakwater and Fig. 6 shows it in place.

The intake shaft will be about 10 ft. in diameter. As proposed, the first 18 ft. of the shaft, above the top of the tunnel lining, will be lined with a 16¾-in. brick wall. For the next 60 ft. the lining will be of 2-in. cast-iron cylinders, each 10 ft. in length, 4 ins. of brick being built inside this cylinder and carried on to the top of the shaft through the upper 30 ft. of steel cylinders. All the metal sections have inside flanged and bolted joints.

The Lake Tunnel.

The tunnel, as already stated, is 9 ft. in diameter in the clear, and is lined with three courses of shale brick, laid in mortar composed of one part of natural hydraulic cement and two parts clean sharp lake sand.

The grade line of the tunnel was designed to start at an elevation of 105 ft. below city datum at the shore shaft and also at the two temporary shafts, and to start at an elevation of 109 ft. below city datum at the inlet shaft. The tunnel is being built with a very slight up grade from each shaft so as to cause any water that may be encountered to flow towards the shafts. There will be three summits in the tunnel, not exceeding 2 ft. high each, which will be at the points where the different headings will meet. It is calculated that the air which will be entrapped at these summits will be absorbed by the water, as it will be under a pressure of about 43 lbs. when the tunnel is full of water.

Compressed air under an average pressure of about 20 lbs. is being used in building the tunnel, the locks being placed as already stated above in describing the shafts, except that the lock near the shore shaft has been moved out about 3,700 ft. beneath the lake. This lock is of boiler iron, 5½ × 17 ft., built into brickwork. The two locks at the next shaft are of greater length than the first one, so as to admit three instead of two construction cars. They are built of brick, with steel diaphragms, bolted together. The air supply is 4 ins. in diameter. The tunnel beyond the lock is ventilated by taking the air required for locking in and out through a 2½-in. pipe leading from the face of the work to the lock. A special air lock (of 6-in. wrought-iron pipe) is used to send rails, pipe and similar supplies into the portion of the tunnel under pressure, thus diminishing the waste of air caused by operating the large lock. The tunnel is lighted by incandescent lamps. The cars for sending in supplies and hauling out the excavated material are drawn by mules.

The tunnel excavation has been carried on by the ordinary methods employed for such work, except for a few feet at the scene of the accident. The material encountered has been mainly a stiff blue clay, in layers of ½-in. to some 6 or 8 ins. thick, with very thin layers of quicksand between them.

Accidents in the Tunnel.

Occasionally small pockets of gas were found, but the gas gave no trouble until, on May 11, a large amount of gas was encountered which gave rise to an explosion, from the effects of which eight men died subsequently. A mass of clay fell into the heading in advance of the brickwork, completely filling it for a length of 17 ft., the lining having been carried to a point 6,281 ft. from the shore shaft. At this point there was some 50 ft. of clay above the excavation. The cave-in extended up 20 ft., leaving about 30 ft. of solid material between its top and the lake bottom. The contractor requested permission to change the course of the tunnel, but this being denied work was resumed on June 13. The fallen material being loose, it was decided to hold it in place, while inserting the lining, by means of a steel cylinder. This was built up to the diameter of the outside of the brickwork with 18 × 24 × ¼-in. steel plates, bent to shape, with 3 × 3-in. angles riveted on each edge by means of ⅝-in. rivets, 3 ins. c. to c. The angles of the adjoining plates were fastened together with ⅝-in. machine bolts, five in each longitudinal and six in each circumferential joint, making 102 bolts in each ring of 17 segments. When the writer visited the tunnel this work was well under way and it was expected that twelve rings, or a length of 18 ft., would suffice to pass through the fallen material. Under date of July 31 Mr. Schulz sent us the following additional information regarding this break in the tunnel, as well as a description of a second break, which occurred on July 11, or just two months later:

> Eighteen feet of steel plate did pass through the fallen material and work was then carried forward in the usual way, except that shorter drifts were made, as the clay was quite poor, containing a large mixture of dry quicksand. Since the explosion on May 11, the contractors had changed their method of ventilation so as not to depend altogether on locking through the air-lock for exhausting the air from the face, but had extended a branch of the exhaust pipe through the air-lock, which was constantly blowing off air, and it was thought that this would prevent any re-occurrence of any accident from gas explosion. On July 11, however, while the masons were at work, another explosion occurred, which killed eleven men, or every one at the face of the work, the only men escaping being a mule driver and the locktender, who were both at the air-lock about 2,850 feet from where the explosion occurred. The tunnel had been completed to 6,541 ft., or 260 ft. beyond the point where the first explosion occurred. What caused it is not known; the electric lights were not extinguished, except for a distance of 700 ft. back from the face, the wires being torn down and the lamps broken in this part. The tunnel was not injured in any way, although a brick bulkhead 4¾ ft. thick, built across the tunnel at 6,200 ft. from the shore shaft, or 340 ft. from the face of the work, was completely demolished, the whole mass being hurled about 120 ft., carrying floor and tracks before it for this distance. A temporary bulkhead has been built in the tunnel at the face and work stopped for the present.

Instrumental Work in Locating the Tunnel and Cribs.

The following description of this part of the work was prepared for this journal by Mr. Schulz:

To reproduce the direction of the line in the tunnel as established on the surface, two plumb lines were suspended in the shore shaft, lined in with the transit on top, the bobs being steadied in oil, and the line was then produced in the tunnel by a transit set up about 50 ft. from these two lines and ranged in until the three points were in perfect alinement. The line was then marked by files on iron hooks, driven into the roof of the tunnel every 100 ft. The shaft not being vertical, the two plumb lines could only be placed about 2½ ft. apart. As this gave too short a base line by which to build the tunnel for any great distance, a 6-in. tube was driven from the surface down through the roof of the tunnel at a point 65 ft. from the shaft. The operation of plumbing down and producing the line in the tunnel was then repeated at three different times, with one plumb line in the shaft and one in the tube, giving a base line 65 ft. long. As the transit work interferes considerably with the transportation of spoil and material, the line was then very satisfactorily produced as the work progressed, for 400 or 500 feet, by stretching a fine line, 200 ft. long, always using the last two hooks as a range, and then checking the work with the transit. The grade of each section built is given with a straight edge and carpenter's level, and checked with the instrument once a week, or every 90 or 100 ft.

The intake protection crib is located 18,040 ft. from the breakwater light, bearing N. 32¼° W. This point was selected as complying with the recommendations of the sanitary commission to place the intake west of the river, and as not being too far west to make it impracticable to build the tunnel to a pumping station three miles east of the river. After this point had been determined, the line of tunnel was marked on the grounds of the proposed pumping station by a series of stakes. A base line, 3,800 ft. long, was then measured on the U. S. breakwater, west of the river, which runs parallel with the lake shore at a distance of about 3,000 ft. from it.

The positions of prominent points, such as the center of the old intake crib, center of Detroit St., school house, steam exhaust pipe of Society for Savings Building, breakwater light and center of shaft No. 1 (shore shaft) were then established, by triangulations, from this base line, to be used in determining the proposed positions of the different cribs by means of angles observed with a sextant.

In placing the two temporary cribs more attention was paid to locating their centers exactly on the line of the tunnel, so as to make it possible to build the tunnel in a straight line, than to have them any exact distance out from shore.

To determine the right location of the first temporary crib, which was to be 11,600 ft. distant from shaft No. 1, pound stakes, i. e., stakes about 65 ft. long used by fishermen, were driven in the lake on the line of the tunnel; one 100 and one 200 ft. from the proposed center of the crib. To determine the location of the first stake a fisherman's pound stake driver, equipped with a steam hammer and its own motive power, was run over the proposed line of tunnel as nearly as could be judged, and the position located approximately with a sextant, an anchor with buoy attached being thrown overboard the moment that the two objects, subtending the angle at which the sextant had been set, coincided. Four anchors, each about 300 ft. from this buoy and at right angles to each other, were then dropped and the stake driver was then, by means of lines attached to these anchors, hauled back and forth in the vicinity of the buoy until it was brought into the exact position as nearly as could be determined with the sextant. A stake was then driven and checked by an observer on shore stationed with a transit on the line of the tunnel, as previously marked, and who could plainly see the stake after it was driven and the driver removed to one side.

It was found that the stake was 0° 4′ 25″ south of the tunnel line, this angle corresponding to a distance of 16.5 feet; a second stake was then driven 16.5 ft. north of the first stake, and again checked with the transit on shore and found to be exactly on the line of the tunnel. A third stake was then driven on the line of tunnel at a distance of 100 ft. from the second stake, in order to have a range for the location of the crib in case it should be impossible (which proved to be the case) to see the shore when the crib was being placed in position.

The second temporary crib was located in the same way. After these cribs were sunk and built up their exact position was also determined; to be used as a basis in placing the intake protection crib.

Before the intake crib was taken out another base line was measured on the railroad right of way, on the east side of the river, commencing at the intersection of this line with the tunnel line and going westward 3,636.94 ft. By means of this base line the positions of the first and second temporary cribs and the old intake crib were determined independently of the west side base line and found to agree very closely, i. e., the distance from shaft No. 1 to center of crib No. 1, by the west side base line, was 11,613.1 ft.; by the east side base line it was 11,611.8.

As the distance determined with the east side base line was obtained more directly, this was adopted as being the more correct one and was used in calculating the angle for the proper location of the intake crib.

To determine this angle the distance from the old intake crib to temporary crib No. 2 was calculated, as well as the proposed distance, on the line of the tunnel, from crib No. 2 to the intake crib, and the included angle being known, the proposed angle at the new intake crib between crib No. 2 and the old intake crib was then determined. Before this crib was taken out three stakes were driven on the line of the tunnel, the same as for the temporary cribs. Four ship's anchors for hauling and holding the crib in exact position were then placed in the lake, two being placed parallel to the line of tunnel and two perpendicular to this line, at the proposed center of shaft in this crib; each anchor was about 350 ft. distant from this point.

The crib was taken out early in the morning on July 1, and was sunk by 10.20 a. m. The crib was controlled by five lines, two leading from one anchor to opposite sides of the crib so that it could be swung around as well as hauled back and forth, the object being to have the landing point directly towards shore. After the crib was secured to the anchors the lines were hove taut to hold it in position so that the proposed center of the shaft to be sunk from this crib should be exactly on the line of the tunnel and also the right distance away, this distance being determined and controlled by constant observations made with the sextant, stationed over this point.

The 24 4-in. gates to the compartments were then opened, care being taken to have the crib go down in a level position. When within about a foot of the bottom the crib began to surge to the southwest a little and touched bottom before it could be brought back to line, so that the proposed center of shaft was afterwards found to be 19 ins. south of the tunnel line. This point can, however, be shifted somewhat, so that this divergence is of no consequence practically. The crib was also found to be 8 ins. out of level in 100 ft. (its diameter), which accounts for 5 ins. of this 19 ins. divergence. Up to July 27 about 12,000 tons of stone had been thrown into the crib, and about 1,500 tons of large rip-rap stone had been placed around it.

After the crib had been filled with stone to its full height of ten courses, or 60 ft., as now built up, and when about 6,000 tons of rip-rap have been placed around it, it will be leveled by means of the eleventh course. A parapet 7 ft. high will then be added and a house 44½ ft. sq. be built in the center of the crib. It will probably be the middle or end of September before this will be accomplished.

Quantities and Contractors.

The estimated quantities in the steel and wooden cribs were as follows:

	Crib.	
	Steel.	Wooden.
Pine timber, ft. B. M.	284,319	404,166
Hemlock timber	......	480,000
Oak timber	1,120	8,774
Pine lumber, rough, ft. B. M.	20,696	19,800
Pine lumber, planed and matched	11,600	15,500
Steel plates, angle beams, etc., lbs.	*2,861,288	......
Cast iron, lbs.	17,610	......
Drift bolts, lbs	14,314	54,695
Spikes	952	......
Screw bolts	11,426	14,250
Concrete, cu. yds	785	......
Stone filling, cords	2,640	1,390
Rip-rap, tons	3,000	5,500

*Including machine bolts.

The tunnel and four shafts will contain the following estimated quantities: Excavation, 95,515 cu. yds.; brick, 15,785,000; steel, 91,400 lbs.; cast iron, 549,000 lbs.

All the work was let to Cleveland contractors, as follows: Steel crib, the Van Dorn Iron Works, for $137,393; wooden crib No. 1, L. P. & J. A Smith, $50,000; wooden crib No. 2, T. H. Garland, $44,445; tunnel and shafts, W. J. Gawne, $524,190; total, $756,038. Mr. J. J. McReynolds has been associated with Mr. Gawne in the tunnel work and the Schailer & Schniglau Co., of Chicago, are carrying on the work from the two temporary cribs, including both shafts and the tunnel work extending therefrom, but the city recognizes Mr. Gawne only as connected with it.

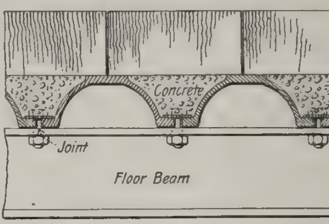
Up to July 22 progress at the three tunnel headings had been made as follows: 6,541 ft. had been completed from the shore shaft westerly; 1,392 ft. from temporary crib No. 1, easterly; and 1,429 ft. from the same crib westerly; making a total of 9,362 ft.

We are indebted to Mr. Kingsley for information and blue prints used in preparing this article, and also to the several contractors for courtesies extended to our representative. We are also indebted to both Mr. Kingsley and Mr. Schulz for a revision and several important additions to the article, especially with a view of noting changes and progress made since our representative visited the work. The additions by Mr. Schulz are properly accredited to him wherever inserted.

WOOD BLOCK PAVEMENT ON THE SUSPENSION BRIDGE OF AVIGNON, FRANCE.

M. Armand describes in the "Annales des Ponts et Chaussees," for the first quarter of 1898, the repaving with wooden blocks of the suspension bridge over the Rhone, at Avignon. This bridge is 743 ft. long, in three spans, and was built in 1843, and rebuilt and stiffened in 1887-89. The floor, however, was still made of wood, with transverse planks laid on longitudinal stringers; and with the extensive use of the bridge and the dryness of the climate this floor was constantly under repair, to the great annoyance of passengers over it.

It was determined to take advantage of the more rigid structure by laying a pavement of wooden blocks; but a solid foundation was requisite for this purpose, and the vibration of the bridge was liable to disintegrate concrete as ordinarily laid. At first, a floor of steel plates riveted to iron cross I-beams was suggested, and on this were to be laid the wooden blocks, imbedded in bitumen and the joints filled with cement. This type of pavement would have cost about $7.27 per sq. yd.; as based upon 38 francs per 100 kilos. for steel, and 14 francs per sq. meter for the wood pavement. But it was found difficult to put down this floor without interrupting the traffic, and for this and for other reasons a new plan was adopted in November, 1897, which permitted the use of beton.



Part Cross-Section of Floor of Avignon Suspension Bridge.

Stamped steel troughs were used, weighing 25 lbs. to the yard, and these were laid parallel to the axis of the bridge and bolted to the transverse floor beams, which were ordinary I-beams. A thin iron strip laid in the bottom of the trough formed by the meeting of two of the shapes tightly closed the space between them and served to hold the heads of the bolts. The cross-beams were spaced 4 ft. apart on centers. The space between the troughs was now filled with beton to the level of the top; upon this foundation were laid wooden blocks 8 ins. deep, with bitumen poured in the joints to a certain height and the joint then finished with cement mortar. This pavement was covered with fine gravel and opened to traffic 48 hours after its completion. The whole work was completed between Oct. 18 and Nov. 14, 1897.

The advantages gained are—the very considerable decrease in the cost of maintenance, the increased comfort to users of the bridge, and the removal of the danger of fire. The total cost of replacing the floor was $3,192; but the annual repair account was formerly $1,200, and the repairs to the present floor, including a fund to replace pavement when worn out, should not exceed $900 per annum.

STANDARD METHODS OF TESTING PAVING BRICK.*

By Arthur N. Talbot, M. Am. Soc. C. E.†

The extensive use of brick for street paving purposes in our interior cities has made the adoption of standard methods of testing paving brick a matter of interest alike to engineers and manufacturers. The present diversity of practice does not permit an accurate understanding of the requirements of any set of specifications.

To make a durable pavement, brick must have, to the requisite degree, toughness and hardness, strength, and imperviability to liquids. Acceptable methods of testing paving brick must be easy and convenient to make and must give similar results when repeated, and the apparatus must be easily and cheaply duplicated anywhere. Such tests must determine the qualities of the brick, must distinguish soft from hard, and brittle from tough, and must do justice to both large and small brick.

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*Slightly condensed from "The Technograph," of the University of Illinois.

†Professor of Municipal and Sanitary Engineering, University of Illinois.

The test commonly used to determine toughness and hardness is known as the rattler test, or impact and abrasion test. Abrasion machines are unsatisfactory, because they do not include a test of the impact effect. The rattler test gives the impact and abrasion effect, but there is such a great variation in size of rattler, in speed and duration of test, and in the amount and kind of foundry shot used that the adoption of a uniform method and uniform conditions becomes a matter of great importance.

Two societies have had under consideration for three or four years the matter of standard tests of paving brick—the Illinois Society of Engineers and Surveyors and the National Brick Manufacturers' Association. The committee of the National Brick Manufacturers' Association, known as the Commission on Paving Brick Tests, made a very comprehensive set of tests and secured a large amount of valuable data.* Their work is certainly a valuable contribution to engineering literature. A recommendation of the Commission, adopted by the Association, was that the rattler test be made the principal test, and that it be made without foundry shot; i. e., with a charge of brick alone. Among the specifications adopted are the following: That the standard rattler shall be 28 ins. in diameter and 20 ins., long, but that machines having diameters between 26 and 30 ins. and lengths from 18 to 24 ins. may be used; that the cross section of the barrel shall be a regular polygon of from 12 to 16 sides; that the shaft shall not extend through the chamber; that the charge shall consist of a number of brick of one kind nearest equal in bulk to 15% of the bulk of the rattling chamber; that the per cent. of loss of weight be determined for 1,800 revolutions at a speed of 30 revs. per min.; and that the average of two distinct and complete tests made on separate charges of brick shall be used as the official result.

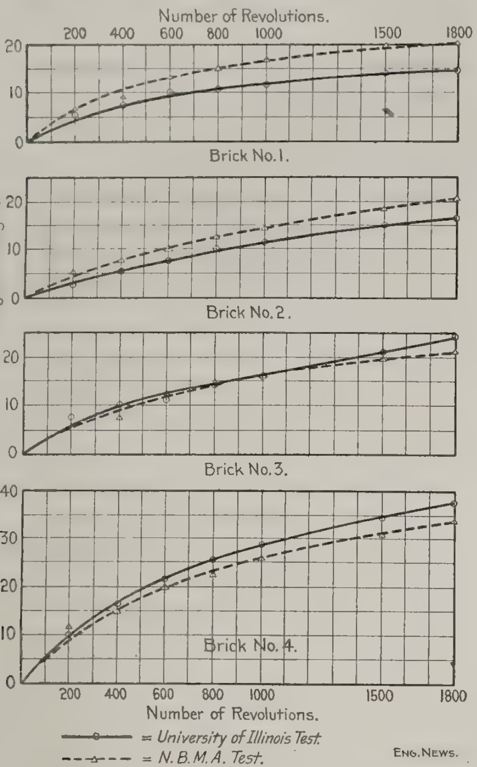

Fig. 1.—Rattler Losses of Paving Brick; Comparison of Results by Standard Methods of the University of Illinois and the National Brick Makers' Association.

By Prof. Arthur N. Talbot, Champaign, Ill.

The efforts of the Illinois Society of Engineers and Surveyors have been to secure the adoption of some standard form and amount of foundry shot which may easily be exactly duplicated and which will give the proper relation between the impact and the abrasion effect, in place of the miscellaneous foundry scrap so commonly used. Favorable consideration has been given to the shot used by the writer in the Laboratory of Applied Mechanics of the University of Illinois, in tests made for the Department of Public Works of Chicago, and known as the University of Illinois standard. This standard shot consists of cast-iron blocks of two sizes, a larger size, 2½ × 3⅛ × 5¼ ins., with edges rounded to ½-in. radius, weighing about 8 lbs. each, and a smaller size, 1 × 1½ × 2½ ins., with rounded edges, weighing about 1 lb. each. After experimenting with various mixtures, a mixture of even parts of large and small blocks was chosen. A large proportion of 8-lb. shot gives too great impact action and a smaller proportion gives too little. From 7 to 10% of the volume of the rattling chamber may be occupied by the shot. For the 24 × 36-in. rattler, 150 lbs. of 8-lb. shot and 150 lbs. of 1-lb. shot makes a good charge.

An advantage in the use of the iron mixture is that a few bricks or several may be tested without affecting the conditions materially. Thus, for the charge and size of rattler above mentioned, from 5 to 14 bricks may be tested at one time and the percentage of loss will remain nearly constant. This method easily distinguishes soft and brittle brick, and is fair to large as well as to small brick. The writer is of the opinion that the use of a standard amount of a standard form of cast-iron shot such as that used in the tests at the University of Illinois and mixed in such proportions as to give a proper relation between the impact and the abrasion action offers the best method of making the rattler test on the score of convenience, fairness, ease of securing standard material, detection of soft brick and measurement of toughness and ability to stand both impact and abrasion. The National Brick Manufacturers' Association Commission abandoned the use of cast-iron shot on the ground that the impact effect exceeded the abrasion effect; that the wear and tear on the rattler was prohibitory; and that the results did not give a good characteristic curve. It is to be regretted that this decision was reached on such a meager data and that a second form of foundry shot was not used. With the shot herein described, the abrasion effect is sufficiently marked, the wear on the machine is not excessive, and the characteristic curves are regular and uniform, as shown by the curves illustrated in this article.

However, the general adoption of a uniform method of testing paving brick is of such importance to engineers and manufacturers that the particular method selected is not essential, provided it fulfils the requirement of uniformity, fairness and thoroughness. If the National Brick Manufacturers' Association standard is satisfactory in these respects, the writer is quite willing to aid in securing its general adoption. The objections made to this method are that it requires a large number of brick for the test, too many to detect lack of uniformity if averages be taken; that a slight decrease in the number of brick below the number required to make 15% of the volume will seriously affect the results of the test; and that the method will not sufficiently distinguish soft and brittle brick. The last objection, if found to be true, would show a serious defect in the method.

To find whether the rattler test of the National Brick Manufacturers' Association does sufficiently distinguish differences in texture of brick known to be different in character, and also to compare the results of this method with those obtained with the standard cast-iron shot of the University of Illinois, a series of tests was made in the Laboratory of Applied Mechanics.

Four kinds of brick were used. Brick No. 1 was a repressed shale paver, 2½ × 3⅞ × 8⅛ ins., selected from the product of one of the best known manufactories, and an excellent brick. Brick No. 2 was also a repressed shale paver of excellent qualities, 2⅞ × 3⅞ × 9¼ ins. Brick No. 3 was a surface clay brick, well burned and a good article, 2⅛ × 3⅝ × 7⅝ ins. It may be said, however, that its structure, appearance and wear, and also its life in pavement under ordinary conditions, go to show that it is inferior to Bricks Nos. 1 and 2. Brick No. 4 may be ranked as a high-grade sewer brick or building brick, 2⅛ × 3⅞ × 7¾ ins. All were selected by the makers, and as the individual bricks were weighed during the tests, their uniformity is known from the data collected. The absorption test gave the following amounts in 48 hours, only rattled brick being used for the test: Brick No. 1, 0.5%; Brick No. 2, 2.2%; Brick No. 3, 3%; Brick No. 4, 4.7%.

The rattler used was the 24 × 36-in. rattler of the Laboratory of Applied Mechanics of the University of Illinois. A movable partition allowed this to be shortened to 18 ins. Although this diameter is 2 ins. less than the minimum allowed by the Manufacturers' recommendation, the variation will not affect the comparison in this discussion.

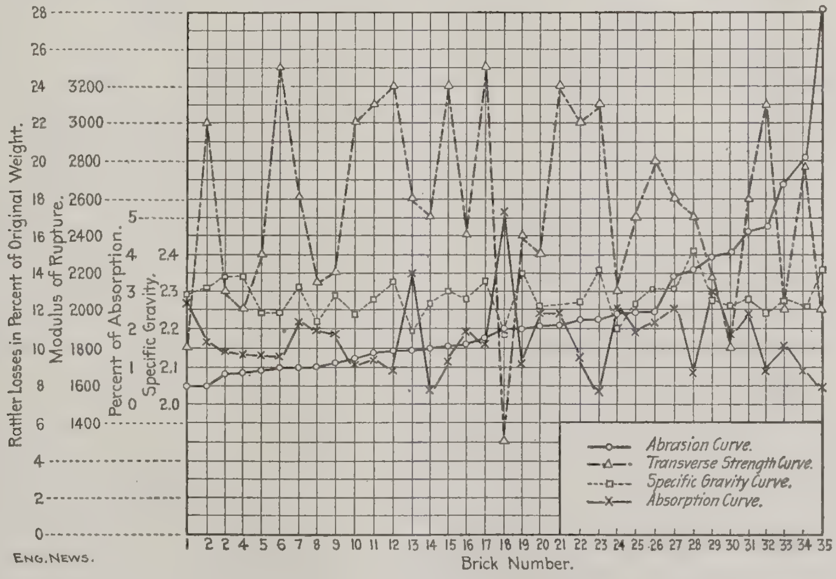

FIG. 3.—RESULTS OF TESTS OF 35 MAKES OF PAVING BRICKS.

Each make of brick was tested by the Manufacturers' test; i. e., without foundry shot and with a charge of brick equal in volume to 15% of the volume of the rattler. Experiments were made both with the full length rattler and with a length of 18 ins. The speed was about 30 revs. per min.

Each make of brick was also tested with the form of shot known as the University of Illinois standard cast-iron blocks. For the full rattler, 150 lbs. of the large and 150 lbs. of the small shot were used, and for the 18-in. length, one half of this amount. The speed was about 20 revs. per min. Twelve bricks were used in the full rattler and six in the half length.

The brick were weighed at the end of 200, 400, 600, 800, 1,000, 1,500 and 1,800 revolutions. The results have been plotted and are shown in the diagram, Fig. 1, the abscissas representing the number of revolutions and the ordinates the per cent. of loss in terms of the original weight. It will be noted that the curves, now generally called characteristic curves, are quite similar, and that the Manufacturers' curve is above the Illinois curve in Brick No. 1 and Brick No. 2, crosses it in Brick No. 3, and is below it in Brick No. 4. To make a comparison of the two methods, the diagram shown in Fig. 2 was constructed. The loss of Brick No. 1 was taken as unity, and the losses of the others were expressed in terms of this and plotted as shown.

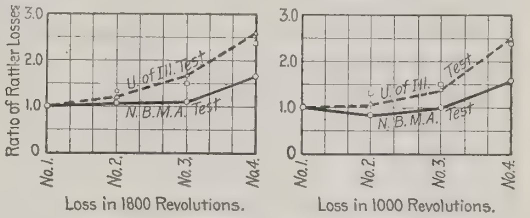

Fig. 2.—Ratio of Rattler Losses to Loss of Brick No. 1 Compared with Ratio of Reciprocals of the Moduli of Rupture.

The ratios of the reciprocals of the moduli of rupture of the different makes to that of Brick No. 1 are shown by the points enclosed in squares.

Two things may be seen from Fig. 2: (1) The Manufacturers' test makes Brick No. 3 as good as No. 1 and No. 2, when, as has been stated, it is manifestly inferior. (2) The loss in Brick No. 4, which is unfit for pavement, is much less distinctly marked in the Manufacturers' test than in the Illinois test.

If these conclusions are borne out with other makes of brick, the Manufacturers' test has serious defects. It does not sufficiently distinguish between hard and tough brick and soft and brittle brick. A satisfactory method of testing paving brick must show the difference between bricks of the nature of No. 1 and No. 2, and such as No. 3, and will make a more marked distinction between bricks like No. 4 and hard and tough bricks.

The ratios of the reciprocals of the moduli of rupture of the different makes to that of Brick No. 1 are shown in Fig. 2 by the points enclosed in squares. It will be seen that these ratios increase much as the ratios of rattler loss by the Illinois standard. The values of the moduli of rupture were the averages of five brick, and there was no great variation in individual cases.

The tests described above were verified partly by repetition and partly by comparison with results obtained with the same brick heretofore, and it is thought they are representative of the makes of brick used. It may be added that in the Manufacturers' test, a charge of soft brick soon broke, and thereafter the loss was much lighter. In general, the impact effect of the test was insufficient to test the toughness of the brick. The results are quite different from those anticipated by the writer.

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*See Eng. News, May 6, 1897, for a very full abstract of this report, with editorial comments.—Ed.

While the tests described are not extensive enough to warrant rejecting the standard method of the National Brick Manufacturers' Association, they show that the method should not be adopted without further investigation. It is hoped that engineers having opportunities to make such tests will contribute to the general knowledge of the subject. If these results shall prove to be representative, the method of using a charge of brick alone cannot properly be adopted as a standard by engineers.

The recommendation of the National Brick Manufacturers' Association abandoning the absorption test and not recommending the cross-bending test will not be acceptable to engineers. It is true that the limit of absorption has frequently been placed too low, that overburned brick are as bad as underburned, and that uniformity of brick is more important than low absorption. With a moderately low limit, as 3 or 4%, and a definite time of say 48 hours, brick which pass the rattler requirement but which have high absorptive qualities would be cut out. The cross-bending test adds another precaution. The results are indicative of shearing and crushing strength—qualities which are necessary in a pavement having heavy traffic. It takes the place of the crushing test, which is difficult to make.

As a matter of interest on the topic of tests of paving brick, the diagram, Fig. 3, is presented. The data are from tests made in the Laboratory of Applied Mechanics of the University of Illinois, on thirty-five makes of paving brick from Ohio, Indiana, Illinois, Iowa and Missouri. They are plotted in the order of loss by the rattler test, the different properties of the same brick being shown on the same vertical line. These may be said to be picked brick, and among them are the best paving brick of the country. It will be seen that while there is a considerable variation in the modulus of rupture, in a general way the value decreases as the rattler loss increases.

THE SIMS-DUDLEY PNEUMATIC GUN.

The present war is affording an excellent opportunity to test in actual service the many new forms of weapons which have been brought forward during recent years. Some of these types are proving very successful; one in particular, the Sims-Dudley pneumatic gun, owing to its adoption by the Cuban insurgents, previous to the declaration of war, and later by the Rough Riders, has received considerable notice in the daily press. Generally it is spoken of as a dynamite gun, but it is really a pneumatic or compressed air gun throwing shells filled with high explosives.

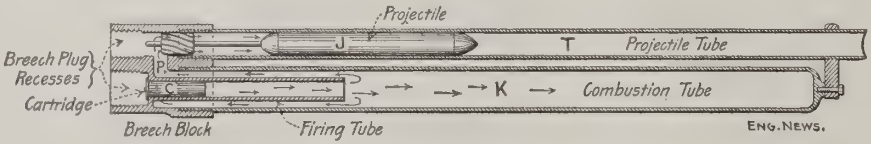

FIG. 2.—DIAGRAM ILLUSTRATING THE PRINCIPLE OF THE SIMS-DUDLEY PNEUMATIC GUN.

The accompanying cut, Fig. 1, represents the gun in its latest form, such as is now in use in Cuba. In Fig. 1 it is shown ready for firing. The extreme simplicity of the gun is apparent and is largely responsible for the good work it has already done. The upper or projectile tube is made of a combination metal having a tensile strength of about 75,000 lbs. per sq. in. and is about 14 ft. long, with a smooth bore about 2½ ins. in diameter. Just below is what is termed the combustion or firing tube, which is a strong steel tube 7 ft. long and 4½ ins. in diameter. The breech block is a steel casting into which the projectile and firing tubes are screwed. It has a suitable passage connecting the tubes and a swinging back upon which are mounted two segmental screw breech closing blocks. These are swung into place and locked by turning a lever much the same as with ordinary breech-loading ordnance. The tubes are mounted upon trunnions with a seator and hand wheel for elevating. The limber is built of sheet steel and angles, thus making a light and strong mounting.

The principle upon which the gun operates is to start the projectile without shock and to increase its velocity through the whole length of its passage through the long tube. This permits the use of shells containing high explosives. To fire the gun the breech block is unlocked by turning the hand lever, the cartridge, really a large blank shell, resembling a shot-gun shell, but about 6 or 7 ins. long, and containing 7 to 9 oz. of smokeless powder, is thrust into the shell chamber of the lower tube, Fig. 2. The projectile seen lying on the ground in Fig. 1 is then placed in the projectile tube, the breech closed and locked, and the gun is ready to be sighted and fired, which is done by pulling a lanyard in the ordinary way. This permits the firing pin, previously drawn back, to fly forward under the action of a spring and strike the fulminate cap of the cartridge. The large volume of gas immediately issuing from the cartridge C, Fig. 2, fills the combustion tube K, compressing the air contained. This air, now under considerable pressure, at once rushes through the passage in the breech block P and forces the projectile J out of the tube T. The powder charge is proportioned so that the pressure produced is sufficient to give the projectile a velocity which will insure an effective range while producing little noise or smoke. As the gun is at present constructed, the range varies from 2,600 to 3,600 yds.

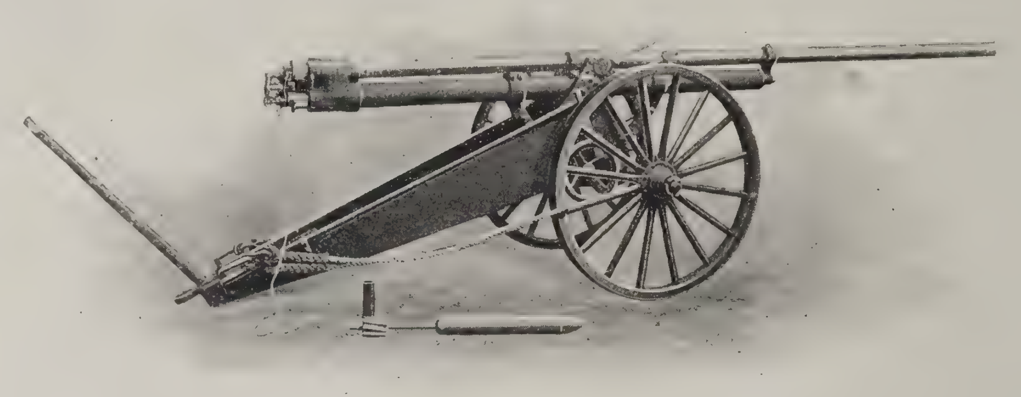

FIG. 1.—SIMS-DUDLEY PNEUMATIC GUN READY FOR USE, SHOWING PROJECTILE AND CARTRIDGE.

Sims-Dudley Defense Co., Makers, New York, N. Y.

The projectile, Fig. 3, is simply a light casing containing the explosive gelatine and the mechanical fuse, and is provided with an aluminum spiral on an extension at the rear end, which produces the rotation necessary to keep the projectile in a straight course. The main portion C, Fig. 3, is a thin brass tube 2½ ins. in diameter, containing the explosive charge, which so far has been what is known as Nobel's gelatine, a tough jelly-like mass containing nitro-glycerine and nitro-cotton, a mixture that does not explode as easily as dynamite but produces a much more destructive explosion; H is a conical brass head containing the time fuse which can be arranged to explode the charge after any given interval. This fuse ignites the fulminate of mercury in M, which explodes a small amount of gun-cotton in the metal case G, and the explosion of this sets off the main charge. To prevent accidental explosion in the gun or during transportation, the fuse head H is provided with a small wind vane and a screw, not shown in the illustration, which confines the firing device. After the projectile has left the gun, this vane whirls around, loosens the screw and falls off before it has traveled more than 200 ft. The complete projectile is 36 ins. long and weights when loaded 11½ lbs., the casing weighing 7½ lbs. and the charge 4 lbs.

It is possible, with a squad of about six men, to continually operate the gun at the rate of about five shots per minute, or 20 lbs. of the highest form of explosive known could thus be thrown each minute into the ranks of an advancing enemy without being seen or heard. The effect of the heavy explosions, each of which would be fully as destructive as a 6-in. shell can be imagined. The destructive effect of the explosive gelatine used is several times as great as that of the powder ordinarily used in shells, to fire which requires heavy artillery. In fact, such shells can only be used in siege operations, owing to the difficulty in transporting guns and ammunition.

The following table gives some further data in connection with these penumatic guns:

Dimensions, Weights, Range, Etc., of the 2½-in. Caliber Gun.

		Type of gun. Three-tube, light.	Type of gun. Two-tube, heavy.
Cartridge.			
Length		3 ins.	6 to 7 ins.
Amount of smokeless powder		3½ ozs.	7 " 9 ozs.
Gun.			
Weight	Gun alone	250 lbs.	480 lbs.
	Heaviest piece	150 "	310 "
	Carriage, complete	450 "	564 "
	Carriage wheels	120 "	150 "
	Gun complete, on carriage	700 "	1,044 "
	Naval mount	400 "	400 "
	Gun complete, on naval mount	650 "	880 "
Length	Projectile tube in gun	9 ft.	13½ ft.
	Gun,* on carriage, over all	12 "	16 "
	Gun,* naval m'nt, " "	10 "	14 "
Range of gun in yds.		1,750	2,600†

*Gun complete. †2,600 to 3,600 yds.

TRANSFORMER LOSSES AND THEIR DETERMINATION.*

By Frederick Bedell, M. Am. Inst. E. E.†

The condition very nearly attained in the operation of a transformer is the transference of power from the primary to the secondary without loss, a raising or lowering of the voltage in the ratio of the secondary turns (S_2) to the primary turns (S_1), and a corresponding decrease or increase in the current in the ratio of S_1 to S_2. As an example, let $S_1 = 10\ S_2$ in a 20-K-W. transformer. The condition nearly attained is

Primary watts = 20,000 Secondary watts = 20,000
" volts = 1,000 " volts = 100
" amperes = 20 " amperes = 200

In reality we have in the secondary an amount less than the above, as 19,200 watts, 98 volts, 196 amperes.

We accordingly have the following losses:

Lost watts; lost volts; lost amperes. The first determines the efficiency; the second, the regulation; the third, determines the magnetizing current.

The lost watts are due to hysteresis, eddy currents, and copper losses both primary and secondary.

The lost volts are due to copper drop (which is proportional to copper loss) and reactance drop due to magnetic leakage.

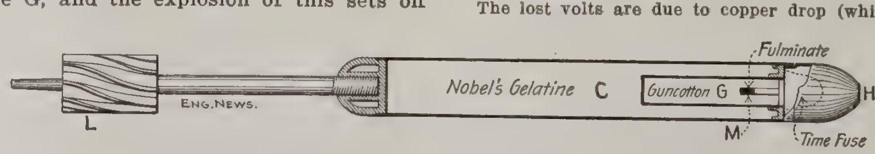

FIG. 3.—DIAGRAM SECTION OF EXPLOSIVE PROJECTILE.

The lost amperes (magnetizing current) consists of two components, $I\mu$ the exciting component which takes no power, and an energy component I_h at right angles to it.

The hysteresis loss in watts is

$$\text{Vol. } \eta\ n\ B^{1.6}\ 10^{-7};$$

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*Read before the Electrical Society, Cornell University, Ithaca, N. Y., May 4, 1898, and printed in the Sibley Journal of Engineering.

†Assistant Professor of Physics, Cornell University, Ithaca, N. Y.

where the volume is in cu. cms., n is the number of cycles per second, and B the number of C. G. S. lines per sq. cm. The hysteresis coefficient η varies with the grade of iron, being about 0.002 for good iron. This and the following formula are due to Steinmetz.

The eddy current loss in watts is

$$\text{Vol. } \gamma \, (d\ n\ B)^2\ 10^{-21};$$

where d is the thickness of laminations expressed in mils. The eddy current coefficent γ is the conductance of the iron (the reciprocal of the resistance in ohms per cu. cm.) and is about equal to 10^5. In this case, eddy loss in watts equals

$$\text{Vol. } (d\ n\ B)^2\ 10^{-16}.$$

It is not possible to calculate the eddy current loss with a high degree of accuracy; this, however, is not essential inasmuch as it is but a small part of the total loss.

If R_1 I_1 and E_1 are the resistance the current and the electromotive force of the primary, and R_2 I_2 and E_2 the resistance, current and electromotive force of the secondary, the copper drop in per cent. is

$$\frac{R_1\ I_1}{E_1} + \frac{R_2\ I_2}{E_2}.$$

In lighting transformers of the best makes this constitutes almost all the voltage drop, the reactance drop being comparatively ineffective.

The two components of the magnetizing current are

$$\text{Power component, } I_h = \text{watts core loss} \div E_1.$$

$$\text{Exciting component, } I\mu = .707\ \frac{10}{4\ \pi}\ \frac{B\ l}{S_1 \mu}.$$

Here l is the length of the magnetc circuit in cms.; μ is the permeability and has a value of about 2,000. The total magnetizing current is

$$I_0 = \sqrt{I_h^2 + I\mu^2}.$$

The formulæ given above may be used for calculating the lost watts, volts and amperes.

In transformer testing, the magnetizing current and the core loss (including both hysteresis and eddy currents) are found by ammeter and wattmeter measurements made on the low potential coil at normal voltage, the high potential coil being on open circuit.

Measurements with wattmeter and voltmeter on the high potential coil with normal current, the low potential coil being short-circuited, give directly the copper loss and impedance drop. The copper loss divided by the current gives copper drop. The reactance drop is

$$\sqrt{(\text{impedance drop})^2 - (\text{copper drop})^2}.$$

If we let x be per cent. reactance drop and $i\mu$ per cent. exciting current, we have for lighting transformers:

$$\text{Effective reactance drop} = 100 - \sqrt{10{,}000 - x^2 - 2\ x\ i\ \mu}.$$

The total drip or "regulation" is the sum of the copper drop and the effective reactance drop.

For power transformers, if $\cos \theta$ represents the power factor of the load:

$$\text{Effective reactance drop} = 100 - \sqrt{10{,}000 - x^2 - 200\ x \sin \theta}.$$

To determine the eddy current loss in watts, the core loss must be measured at two frequencies. Let W′ be total core loss at normal voltage E′, and frequency n′. At a lower frequency n″ and a lower voltage

$$E'' = \frac{n''}{n'}\ E',$$

let the core loss be W″. We may compute the watts eddy current loss at the highest frequency (n′) and normal voltage by the formula

$$\text{Watts eddy currents} = \frac{W' - \dfrac{n'}{n''}\ W''}{I - \dfrac{n''}{n'}}.$$

If the electromotive-force wave at the two frequencies is essentially different, this may be taken into account as follows: Let the form factor (f) be the ratio (see Bedell's "The Principles of the Transformer," p. 312 et seq.) of the average to the virtual value. (For a sine wave this is .9). The core loss W″ at the lower frequency is to be measured at a voltage

$$E'' = \frac{n''\ f'}{n'\ f''}\ E'.$$

The eddy current loss in watts at the higher frequency n′ and normal voltage is

$$\frac{\dfrac{n''}{n'}\ W' - W''}{\dfrac{n''}{n'} - \left\{\dfrac{E''}{E'}\right\}^2}$$

This formula is exact; neglecting the difference in shape of the electromotive force-waves (i. e., assuming f′ = f″), this reduces to the formula first given.

The efficiencies may be computed quickly and accurately by the following table (devised as a time-saver), in which c_2 is the copper loss at full load expressed as per cent. of output, h_2 is core loss as per cent. of full load output, and t is time:

Fraction of load.	Losses as per cent. of output. Copper.	Core.	Total, t.	$\frac{t^2}{100}$	Efficiency.
5/4	5/4 c_2 = ...	4/5 h_2 = ...	....	....	....
1	c_2 = ...	h_2 = ...	....	....	....
¾	¾ c_2 = ...	4/3 h_2 = ...	....	....	....
½	½ c_2 = ...	2 h_2 = ...	....	....	....
¼	¼ c_2 = ...	4 h_2 = ...	....	....	....
1/10	1/10 c_2 = ...	10 h_2 = ...	....	....	....

$$\text{Efficiency} = 100 + \frac{t^2}{100} - t.$$

The all-day efficiency, assuming that the transformer is on full load for x hours each day and idle the remainder of the time, is

$$\text{All day efficiency} = \frac{100}{100 + c_2 + \dfrac{24}{x}\ h_2}.$$

This method for computing efficiency, and also the formula for the experimental determination of eddy current losses and for effective reactance drop in lighting and power transformers are here given for the first time.

(The following example, also by Dr. Bedell, will illustrate the use of the foregoing.—Ed.)

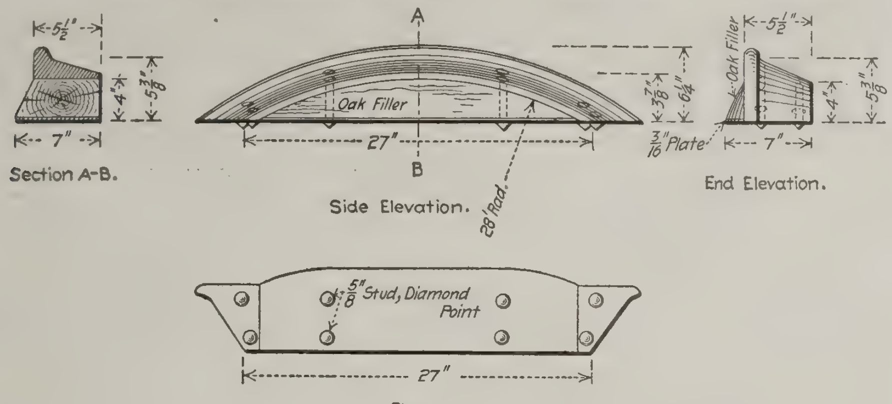
2-K-W. transformer. Copper loss = 48 watts. Core loss = 30 watts.

$$c_2 = 2.4. \quad h_2 = 1.5.$$

Fraction of load.	Losses as per cent. of output. Copper.	Core.	Total, t.	$\frac{t^2}{100}$	Efficiency.
5/4	5/4 c_2 = 3.0	4/5 h_2 = 1.2	4.2	0.18	95.98
1	c_2 = 2.4	h_2 = 1.5	3.9	.15	96.25
¾	¾ c_2 = 1.8	4/3 h_2 = 2.0	3.8	.14	96.34
½	½ c_2 = 1.2	2 h_2 = 3.0	4.2	.18	95.98
¼	¼ c_2 = .6	4 h_2 = 6.0	6.6	.44	93.84
1/10	1/10 c_2 = .24	10 h_2 = 15.	15.24	2.32	87.08

$$\text{Efficiency} = 100 + \frac{t^2}{100} - t.$$

$$\text{All-day efficiency} = \frac{100}{100 + c_2 + 4.8\ h_2} = 91.24.$$



THE "BURLINGTON" CAR AND ENGINE REPLACER.
Henry Miller, Asst. Supt., C., B. & K. C. Ry., Inventor.

A NEW RERAILING DEVICE.

Car replacers or wrecking frogs, for replacing derailed car and engine wheels upon the track, form a somewhat important feature of the minor part of railway equipment, and a great variety of these devices are in use. The accompanying illustration represents the replacer which has been adopted as the standard rerailing device of the Burlington railway system, the special feature of which is that it is very simple in design and is made from scrap at the railway shops.

It consists mainly of a segment of the discarded tire of a locomotive driving wheel, the tread being beveled and the flange turned down to some extent. The space under this piece of tire is filled in with a wooden block, the bottom of which is protected by an iron plate 7 ins. wide, made of 3-16-in. scrap tank iron. The plate, block and tire are secured together by eight ⅝-in. steel rivets, which have countersunk heads in the tire, and diamond points projecting ¾-in. below the plate. These points act as spurs to prevent the replacer from slipping when in use. The smaller size is 27 ins. long, 5⅜ ins. high over the tread, and 6¼ ins. over the flange. The larger size is 32 ins. long, and 6⅜ to 7¼ ins. high.

This device is styled the "Burlington" replacer, and is the invention of Mr. Henry Miller, of Hannibal, Mo., who is Assistant Superintendent of the St. L., K. & N. W. R. R., and the C., B. & K. C. Ry. (Burlington system). We are indebted to Mr. Miller for a blue print and description of this rerailer.

A BELGIAN GAS-LEAK DETECTOR.

U. S. Consul Morris, of Ghent, describes a method in use in that city for detecting gas-leaks, which he describes as follows in the "Consular Reports," for June, 1898:

> The outfit consist of a large hand drill or auger, several hollow tubes or pipes of the requisite length, a few corks fitted with quills through the center, a bottle of or-palladium, and a few bits of white paper. The tubes must be long enough to enter the ground to a point about 15 to 20 ins. above the main and to project above the street pavement a sufficient distance for observation, say 3 to 4 ft. They may be iron, such as common interior gas pipe, or, better still, brass, which is lighter to carry and more convenient to handle.
>
> Several paving blocks are first removed for a space of about two yards immediately over the gas main, and holes are bored in the soil with the drill, care being taken to thoroughly loosen the earth and extract as much as possible. In each of these holes a piece of the hollow piping is planted. It should not be rammed down too deep, so as to be too near or below the gas main, or to become clogged with dirt. On the upper exposed end one of the corks is placed, with the quill in the center, running up and down parallel to the pipe. A small piece of the white paper is dipped in the or-palladium and pushed into the open quill. Twenty or thirty such detectors are put in position at one time. If a leak exists within, say, two yards of any of them, the effect of the escaping gas will be evident upon the paper, rendered sensitive by the reagent, and it will at once turn black. The effect of the action of the gas upon the detector first placed in position will be evident before the last one of a row of 20 is set up. It is a common sight to see two or three men in the streets of Ghent making experiments in this manner for the detection of leaks. Indeed, the gas company causes regular tests to be made in turn in all the streets of the city. The loss by leakage is now said not to exceed more than 3%.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Steam Rollers Not a Street Obstruction.

A steam roller, while being properly used in repairing a street, is not such an obstruction or defect in the street as will render the city liable for injuries inflicted by a horse frightened by such machine. Lane v. City of Lewiston (Me.), 39 Atlantic Rep., 999.

Electric Light Plant Not a Public Necessity.

Under the laws of North Carolina prohibiting municipalities from contracting debts or laying taxes, except for necessary expenses, unless by a majority vote of the qualified voters, such city having general powers only, cannot issue bonds for the erection of an electric light plant for lighting its streets, as such plant is not a "necessary expense," without legislative authority to submit the proposition to the voters and a ratification by a majority of such voters. Mayo v. Town of Washington (N. C.), 29 Southeastern Rep., 343.

Freight Rates and State Laws.

A state enactment, or regulations made under authority thereof, establishing rates of transportation by the railroad, that will not admit of the carrier earning such compensation as, under all the circumstances, is just to it and to the public, would deprive such carrier of its property without due process of law, and deny to it the equal protection of the laws, and would therefore be repugnant to the Constitution of the United States. Smyth v. Ames (Sup. Ct. U. S.), 18 S. C. Rep., 418.

When Objections to Improvements are Too Late.

After street improvements are completed, a landowner cannot object to assessments for the same on the ground that the contract was let to one whose bid was slightly more than that of another; although the law requires the contract to be let to the "best bidder." City of Bloomington v. Phelps (Ind.), 49 Northeastern Rep., 581.

Liability for Making Gas Connections.

Where a gas company insisted upon making all gas connections, between house mains and pipes, and assumed that duty, it was bound to exercise due care in performing it. A provision on the back of an application to furnish one with gas, exempting the company from damages from an explosion from the use of gas has no application where the explosion was caused by the imperfect closing of the gas main by the employees of the company when no gas was being used in the house. Bastian v. Keystone Gas Co. (N. Y.), 50 N. Y. Supp. Rep., 537.

Contractor Bound by Certificate.

Under a contract providing for compensation at a fixed price per cubic yard of earth moved, the amount due to be certified by the general manager of the railroad company month by month, such certificate is conclusive, in the absence of fraud, mistake or gross carelessness, to prevent the contractor after completing the work from asserting a claim for extra compensation for alleged overhauls. Breyman v. Ann Arbor R. Co. (U. S. Cir. Ct.), 85 Federal Rep., 579.

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It seems that, after all, Spain has given unwilling, but very convincing testimony as to the manner in which the battleship "Maine" was destroyed in Havana harbor. At the time of that catastrophe Spanish officials loudly insisted that the cause was an internal explosion of one or more magazines, the result of "carelessness and a notorious lack of discipline on the American ships." But the board of officers appointed to report upon the result of our gun-fire upon the ships of Admiral Cervera, sunk in the Santiago fight, incidentally find a valuable object lesson in the appearance of these ships that has a direct bearing upon the destruction of the "Maine." Three of the four Spanish warships were blown up by their own magazines, and one of them had every magazine exploded, with all its torpedoes in addition. But as compared with the wreck of the "Maine," there was no upheaval of the keel and little bulging of the plates except in the immediate vicinity of the point of impact; the effect of the explosion was nearly always upward, the protective deck was sometimes lifted, but, except for the springing of a few plates, the hulls were intact. In other words, the evidence gathered from the wrecks of these Spanish warships, that in armor and guns were practically superior to the "Maine," conclusively shows that the latter ship was sunk by an external explosion, however brought about.

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Another most valuable object lesson afforded by these ships is the terribly destructive effect of the smaller projectiles of the secondary batteries, as handled by American sailors. The fight started at a range of 6,000 yds., and narrowed down to about 1,000 yds. at the closest point. But one ship, the "Infanta Maria Theresa," was struck by 12-in. or 13-in. shot, and only two of these landed on the ill-fated warship. The "Christobal Colon," which kept out of range most of the time, was struck six times by 8, 6 and 5-in. projectiles; the "Vizcaya," with 10 and 12-in. armor, was hit with larger projectiles fourteen times, and by 6-pdrs. eleven times; the "Infanta Maria Theresa," as before mentioned, was pierced twice by 12 or 13-in. shot, and by one 8-in. shell; but the "Almirante Oquendo," of the same class as the last two, was hit four times by 8-in. shell, three times by 4-in. and twice by 6-in. projectiles, and 42 times by 6-pdrs. But in all cases, except the "Colon," it was the fire of the secondary batteries that wrought the greatest havoc and practically destroyed them. By this fire the decks were swept and men were driven from the guns; the explosion of shells fired the ships, and on the "Theresa" cut the water-mains, so that the fire could not be extinguished. The structure above the armor belts was torn into shreds; and though it cannot now be definitely determined whether fire on board or shells exploded the torpedoes, and some of the magazines, it is evident that the deadly rain of small shells kept the Spaniards from working their guns or from taking measures to preserve themselves and their ships from fire. The moral of this sea-fight is that modern ships and modern guns are only really formidable when the men that handle the ships and guns are not only brave, but also skilled in the use of these war-tools. What would happen when the antagonists are equally balanced in these qualities can better be guessed at than described.

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Three of the Spanish warships were practically destroyed by fire started by the explosion of American shells, and the wisdom of reducing to a minimum the woodwork aboard our vessels and fireproofing that which must be used becomes apparent. Eight of the gunboats authorized in 1893 and 1895, were fitted with wood made fireproof by a simple and satisfactory process, which consisted in withdrawing all sap and moisture from the wood, in a vacuum, and then filling the pores with phosphate of ammonia. Wood so treated will only char and will not shrink, but objection was made that such wood was heavier, and not quite as strong as untreated wood, and that it was difficult to work and had a tendency to absorb and retain moisture. It was also complained that paint did not stick to it very well and the contained chemicals had a corrosive effect upon metal in contact, and spoiled the clothes of officers contained in drawers made of it. These are serious charges, and in January of this year a board of naval officers, convened for the purpose of reporting upon fireproof wood, voted in favor of discontinuing its use. But Naval Constructor Hichborn, who made a minority report in favor of wood thus treated, says that the greater number of these charges are false. Fireproofed wood is used in many of the costly large buildings now being erected, and there is little trouble in working or painting it; and for ships' use, especially in decks, its non-shrinking qualities are invaluable. Its increased weight is of comparatively little importance, and the additional cost adds but a few thousands of dollars to the millions invested in a battleship. The terrible experience in the Santiago fight, added to the almost forgotten destruction by fire of the Chinese ships in the Yalu River combat, have brought about a decided revision of the finding of the late board, in this connection, and the order has already gone out so to protect at least the wooden decks of the new battleships. The lesson taught at Santiago is that fire and smoke will drive the bravest men from their guns and make impossible any efficient defense against hostile attack. In other words, if modern ships and guns are to be successfully employed against modern gun-fire, it is of the greatest importance that all internal fittings be made fireproof. If there are any valid objections against present processes of fireproofing Yankee inventive skill should eliminate them.

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THE INVESTIGATION OF THE NEW YORK STATE CANALS.

The report of the Commission appointed by Gov. Frank S. Black to investigate the work done upon the New York State canals under the $9,000,000 appropriation, which is abstracted elsewhere in this issue, is a document which does credit to its authors. The predictions that the Commission would present a "white-washing" report, for the sake of the political and commercial interests involved, have not been fulfilled. The arraignment by the Commission of those responsible for the loss of over a million dollars to the State of New York is temperate and judicial in its tone, but the facts are set forth with a fearless straightforwardness that is most convincing.

Let us briefly sum up the story of the New York canal improvement, as it is told in the Commission's report:

The State Engineer's estimate of its cost given to the Constitutional Convention in 1894 was $11,573,000, and was "little more than a guess." This was cut down to $9,000,000 by the advocates of canal improvement, apparently for no better reason than the fear that this was as large a sum as the people of the state could be induced to approve by a popular vote. It was hoped that by omitting all work not absolutely necessary, this sum might suffice. When it came to making plans and specifications, however, there seems to have been absolutely no attempt to "cut the cast according to the cloth." The plans were made exactly as if an unlimited sum were available, and works were planned and carried out which had nothing whatever to do with the deepening of the canals.

The sums expended thus far may be divided as follows:

Advertising for proposals		$92,321
Superintendent's Inspectors	$178,969	
Engineering	812,000	
Total for engineering and inspection..		$990,969
Paid to and due contractors		7,937,903

Of these amounts, the Commission finds that at least $80,000 was improperly expended for advertising. The inspection carried on under the Superintendent of Public Works appears to have been needlessly extravagant; $41,514 was paid to the force of inspectors during the ceven months of open navigation in 1897, when work on the contracts was practically at a standstill. During the present year $98,922 has been paid to inspectors appointed without civil service examinations, and apparently for other reasons than their ability and fitness.

Of the engineering expenses, $272,000 was for preliminary surveys, on the basis of which the estimates and bidding sheets were made up and contracts were let, and this work the Commission finds to have been necessary. The survey did not accomplish, however, what it should have. No study was bestowed on special conditions, and the contracts were let without provision for meeting these conditions. Contract 4 on the Middle Division (the Jordan level) is an example. The contract price, according to the engineer's estimate, was $154,471; but up to May 1, 1898, it had cost $581,879.

Of the $272,000 for preliminary surveys named above, $50,391 is for plans for a pneumatic lift lock at Lockport, and special improvements at Cohoes, which were unwarranted and improper.

Turning now to the total of $7,937,903 represented by work done on the contracts, the Commission finds that not less than $1,000,000 has been improperly expended. The contractors have benefited through the improper classification of earth as rock; through the making of unbalanced bids for work, through unwarranted payments for material overhauled, in which case embankment price was added to excavation price. "More than half of the total amount of cost of embankment was improperly paid for material overhauled and wasted"; and finally, through allowances for "extra work." Up to June 1, the engineers had returned $824,821 as extra work; but the actual quantity is much greater. Besides the above, it is stated that $30,810 was spent in Syracuse, on work which had nothing to do with canal deepening, and elaborate plans ware made for expending $100,000 to benefit the milling interests at Lockport.

As one reads the instances of extravagance and illegal expenditure set forth in detail in the Commission's report, the conclusion is inevitable that their estimate of $1,000,000 as the amount which the contractors have received in excess of their just dues, is a conservative figure. When the unnecessary expenditures on advertising, engineering and inspection are also taken into account, it seems probable that the total sum of which the state has been robbed will reach a million and a-half or more, or about one-sixth of the total amount which the taxpayers of the state borrowed for the purpose of deepening the canals. The most hardened defender of the old-time maxim that "to the victor belongs the spoils," must agree that so great a proportion of "pickings and stealings" cannot be justified.

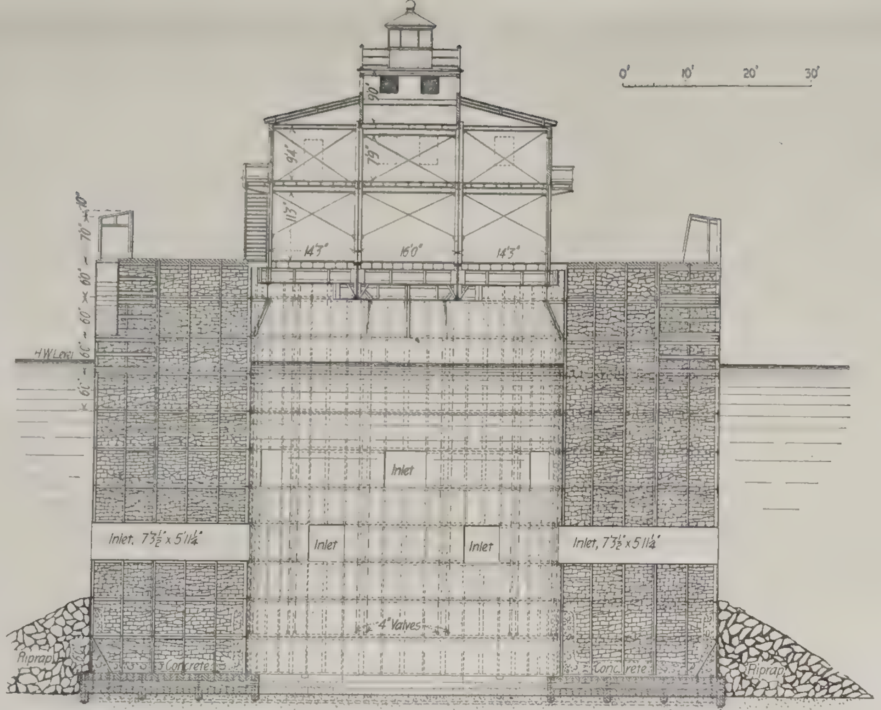
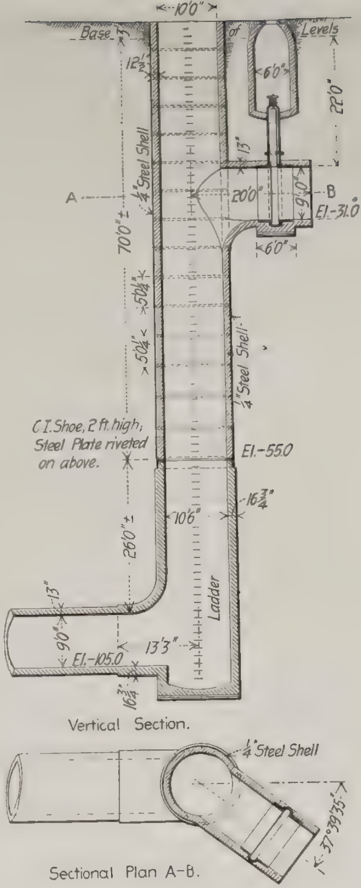


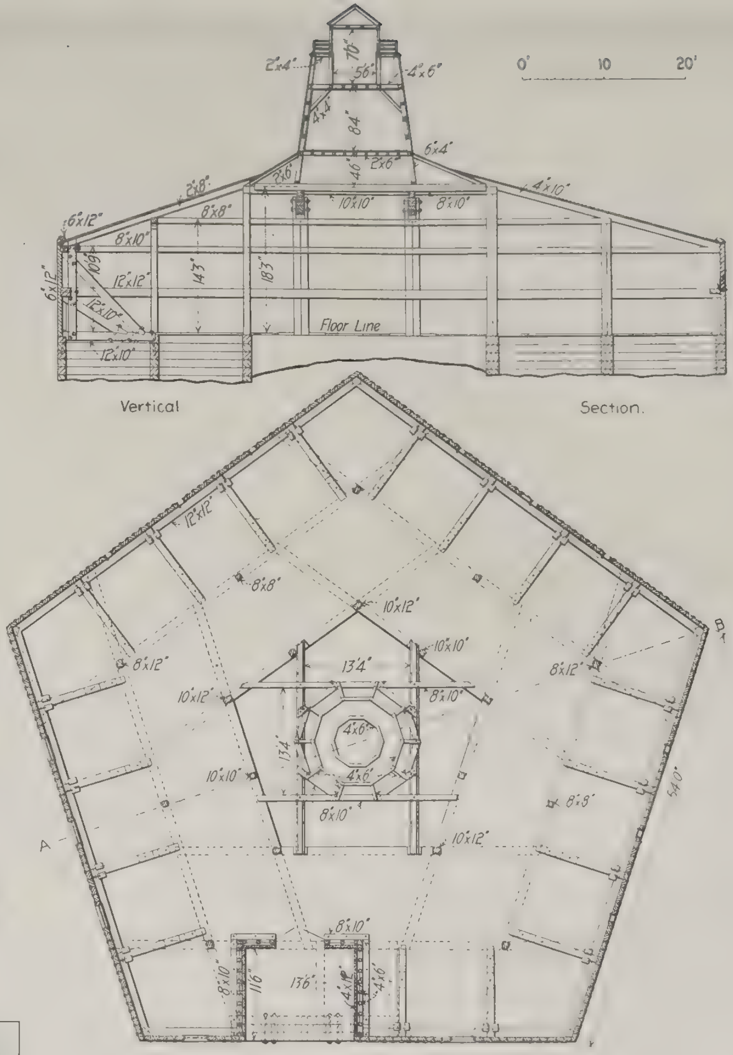
FIG. 4. SECTION OF STEEL INTAKE CRIB.



Vertical Section.

Sectional Plan A-B.

FIG. 2. SHORE SHAFT FOR NEW LAKE TUNNEL.



Vertical Section.

Horizontal Section

FIG. 3. SUPERSTRUCTURE OF TEMPORARY CRIBS.

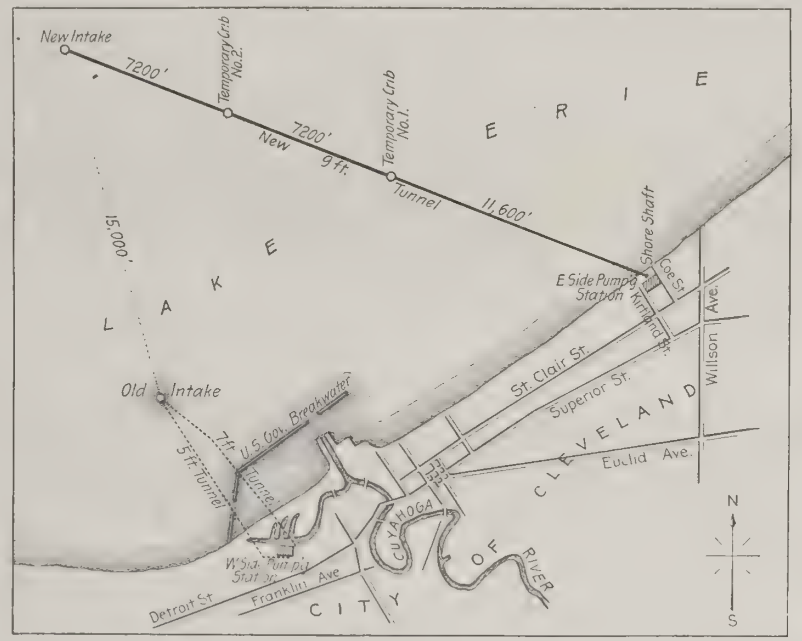


FIG. 1. MAP SHOWING LOCATION OF OLD AND NEW TUNNELS.

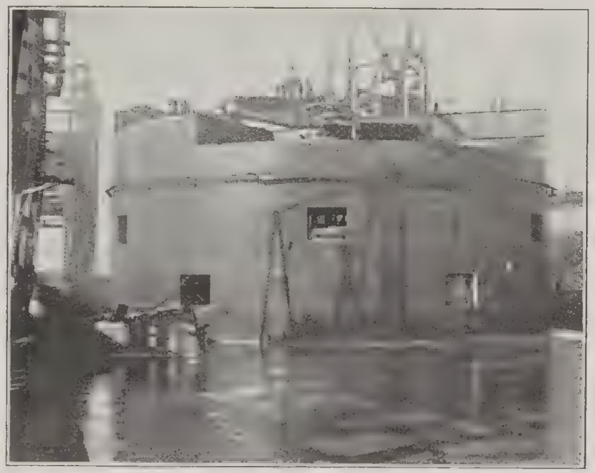


FIG. 5. STEEL INTAKE CRIB, APRIL 26, 1898; FIRST EIGHT COURSES COMPLETED.

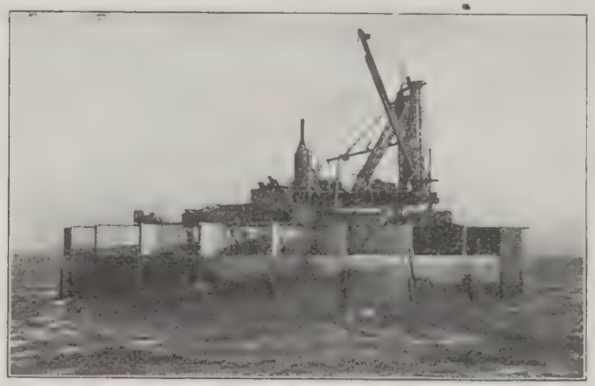


FIG. 6. STEEL INTAKE CRIB IN PLACE, JULY 9, 1898.

NEW WATER-WORKS INTAKE TUNNEL, CLEVELAND, O.

M. W. Kingsley, M. Am. Soc. C. E., Superintendent.

UNIVERSITY OF ILLINOIS

The action of the Governor in calling upon the legal authorities to take steps for the immediate prosecution of those responsible for the misappropriation of public funds and the misuse of public trusts deserves the warm approbation of all good citizens. It is just such corruption of public office for private gain as this investigation has laid bare that has brought the once great Spanish nation to the depths of humiliation and defeat. The American people must effectually punish such exhibitions of official corruption and malfeasance as the Canal Commission has uncovered, if they would preserve their own nation from a decay and degeneration similar to that which has eaten out the vitality of Spain.

We have it on excellent authority that one of the men who was seeking to reap a rich harvest from the canal fund, but who found the way blocked by an honest and incorruptible public official of high rank, swore with a great oath that he would give five thousand dollars to get this faithful guardian of the public treasury into the North Woods; and would guarantee that he would never be seen again alive. Surely, when matters have come to this pass it is time the people of the state should arouse themselves to the dangers that menace their government. No political influence, no considerations of personal favor should stand in the way of the detection, conviction and punishment of those who have robbed the state or been false to their trust.

We have thus far heartily commended the Commission's report; but when we turn to its recommendations as to the future work upon the canals, we are obliged to take issue with it. While the Commission was made up of non-partisans from a political standpoint, it was made up of men who are without exception known as "canal men," and it advises the completion of the canal improvement with no question whatever as to whether the work will be worth what it will cost in the benefit of commerce. Instead, the Commission brings forward the well-worn old fallacy that because the canals in the days of their prosperity paid into the state treasury a large amount above their cost, the state should not hesitate to pay out for their improvement the whole of this surplus. Not one of the able business men composing the Commission conducts his private business on such a principle. If a machine becomes obsolete in type, no longer able to produce goods in competition with newer and more modern devices, it never pays to make extensive repairs upon it, unless it appears that after these repairs are made, it will be able to compete with other machines and return to the owner a profit on the amount spent.

The conviction is growing upon all intelligent students of transportation economics that all such barge canals as those of New York state are obsolete machines; and that no such small improvement as that which the state has now undertaken can restore to them their traffic and prevent their abandonment in the early future. The Commission estimates that $15,616,000 additional will be needed to complete the deepening of the canals to the extent contemplated by the law of 1895; but how is that fund to be obtained? The people of New York who were assured three years ago that $9,000,000 would do a certain piece of work are now told, after they have furnished this sum, that about two and one-half times as much will be required! Are they likely to throw good money after bad? Because they have borrowed nine millions, and dropped one or two of them into dishonest pockets and the rest into the mud of the canals, is no sign that they will consent to borrow fifteen or sixteen millions more to meet a similar fate.

Further, for more than two years to come, there is no way in which New York can obtain further sums for canal improvement, except by direct appropriation by the legislature from funds in the treasury. It is now too late to submit a proposal for the issue of bonds to popular approval at the election next November. In November, 1899, certain constitutional amendments have to be voted upon and no bond proposal can be submitted to the people. Thus it will not be before November, 1900, that any proposition to issue further bonds for canal improvements can be submitted to the people. But by that time the falling off in canal traffic is likely to reach such proportions that the dullest cannot fail to comprehend that the day of the old barge canal is past.

Freight cars of 60,000 to 100,000 lbs. capacity hauled by modern powerful locomotives, are cheaper and more efficient machines for handling freight.

By 1900, moreover, the project for deep waterways from the Great Lakes to the Atlantic, on which the United States is now spending nearly a half-million in preliminary surveys, will probably have taken such shape that we shall at least know something of the cost of such new avenues for traffic, and whether their construction would be a paying venture. It goes without saying that if any such work is to be carried out, all money expended on permantnt improvements on the Erie Canal is practically thrown away. It may be said with truth that the chances are very small that the Government will undertake so vast a work as a ship canal from the Lakes to tidewater promises to be. The possibility, however, is bound to have more or less influence on public opinion; and there is also the possibility that in place of the ship canal the Government may take up the more modest, but much more promising project for a barge canal of large size over the Erie Canal route.

Taking all these conditions into consideration, the chances that the people of New York can be persuaded to approve the expenditure of some $16,000,000 more upon the canal deepening seems to us extremely remote. We are aware that the influences which favor the canal appropriations are very strong. The political leaders of both parties see large opportunities in them for strengthening whichever party happens to be in power. The commercial interests favor the canals, from force of habit. It has so long been dinned into people's ears that the canals are an essential factor in the commercial prominence of New York, Buffalo and the cities along the line of the canals throughout the state, that people have come to accept it without question. Time, however, will change all these influences. The politicians are likely, in the next two years, to learn more of the real temper of the people concerning the canal improvements. Those who defend the commercial importance of the canals are becoming wiser as the canal commerce dwindles, and New York's cities continue to flourish and grow. It seems to us very unlikely, therefore, that the recommendation of the Commission for the further improvement of New York's canals will ever be carried out.

LETTERS TO THE EDITOR.

Temperature and Sensible Heat.

Sir: As your editor who wrote the answer to Mr. Gould's letter in to-day's issue seems to be a little hazy on the generally accepted meaning of sensible heat, it might be well for him to look the matter up in standard works on thermodynamics. He can find the term as used by Rontgen in Du Bois's translation of his Thermodynamics, ed. 1880, bottom p. 379; and its relation to the temperature in the equation at the top of page 376. L. F. R.

Philadelphia, Pa., July 28, 1898.

(The writer of the review of Mr. Gould's book does not admit that he is hazy on the meaning of the term "sensible heat," but confesses that he is somewhat surprised to find the extent to which the inaccuracy of using this term to mean "heat of the liquid" has crept into the literature of thermodynamics. It is a good example of the too common practice of scientific writers to take a term from the ordinary language of the people and give to it a new and restricted meaning. Mr. Gould's book, p. 9, says "Temperature and sensible heat are generally considered as synonymous terms." Why should they not be? "Sensible" means perceptible by the senses, and heat that is perceptible by the senses is what is commonly called temperature. The temperature of water at the boiling point is 212° F. This is its sensible heat. The heat units in 1 lb., measured above 0°, are 212.9 B. T. U. The 0.9 B. T. U. excess of this "heat of the liquid" above the figure representing the temperature is not "sensible," and therefore it is inaccurate to call the 212.9 B. T. U. sensible heat. Heat of the liquid is a much better name for it. —Ed.)

Spacing Stiffeners in Plate Girders.

Sir: I notice in your issues of May 19, June 9 and July 7 letters on the subject of "Spacing Stiffeners in Plate Girders," and an allusion to my paper read before the American Society of Civil Engineers in 1885, on "Specifications for Iron Bridges." History repeats itself, and Mr. Beach seems to have worked out the problem on much the same lines as I did myself. So far as the question of I-beams or girders without stiffeners is concerned, there appears to be no dispute.

When I went to Altoona on the Pennsylvania R. R. in 1860, fresh from the Rensselaer Polytechnic Institute, I found in use on that road plate girder bridges, 50 and 60 ft. long, or longer, and 4 to 5 ft. deep, having only 3-16-in. webs, with vertical stiffeners of cast iron, placed on each side and bolted together through the web by three bolts, these being the only connection. The stiffeners hugged well up under the flanges of the girder and were spaced at intervals equal the depth of the girder, more or less. These bridges were, without question, the best and stiffest type of structure on the road, were considered in every way the most reliable, and were carrying with safety any load that could, with the then existing rolling stock, be placed upon them. Some of them may be still in use on branch roads.

When, however, I came to design such structures and applied Rankine's rule for vertical web, "considering that the shearing stress at the neutral axis is equivalent to a pull and a thrust of equal intensity, inclined opposite ways at 45°, and that the vertical web tends to give way by bucking under the thrust," I found to my surprise that these bridges ought to have been utter failures, and, according to Rankine, should have doubled up and departed this life.

The matter gave me considerable study, in the course of which I made a model of a girder with a thin paper web, something similar to the one I send you, only larger, and I found at once that the web did not resist by compression and give way by buckling, but by tension. I made diagonal slits in the web, as you see in this model, converging downwards towards the center. These being in the line of tension did not affect the strength in any way, as you may see by placing this model on supports at the ends, with the proper flange, as marked, up, and applying a heavy weight. When, however, I reversed the girder, with the other flange up, making these slits or cuts converge upward towards the center and placing the web in a condition that it could not resist by tension, the absolute weakness of the girder was at once apparent, and if much load were placed on it, it would break down, the web buckling up under compression. It was upon this practical solution of the problem that I formed my theory of the computation of web and stiffeners, which I stated in my paper, and which for thin webs I still maintain. If one will only give the matter a few moments thought and develop the plate girder from the open truss by increasing certain members to an infinite number, the result ought to be self-evident.

If there are no stiffeners, Rankine's rule holds good and the case is one of a lattice girder with an infinite number of lattice pieces forming a continuous web. Stiffeners in girders could, of course, be placed inclined instead of vertical, except for practical convenience in construction.

The increased thickness of web adopted in later years has not been due to theory but entirely to practical considerations, principally that of deterioration and rusting of the metal in thin sheets from the action of the coal-smoke of engines, and also to increase the bearing surface for rivets. Webs riveted in between angles have, of course, a great resistance merely from the hold which the angles have on them like the jaws of a vise, and in the early days there was not as much attention paid to the bearing surface of rivets as now. Shearing was the only matter considered. In those early days, also, engines burned wood, and coal-smoke with its sulphur fumes did not exist in any quantity.

When one comes to the use of a thick web and proposes to use it for all it is worth, the problem naturally becomes more complicated. A certain portion may be included in the flanges of the girder and often is by those economically inclined; perhaps a portion with the stiffeners; and then, if thick enough, it may also resist by compression as well as by tension, approximating to a girder without stiffeners. For my own part, I would prefer to make my calculations on the theory I have indicated, and having obtained the minimum dimensions for parts, then increase them as practical considerations from my experience, questions of wear and tear, etc., would make advisable.

Yours very truly,
Jos. M. Wilson, M. Am. Soc. C E.

Philadelphia, Pa., July 19, 1898.

(The general appearance of the model sent by Mr. Wilson is shown quite clearly in the accompanying engravings made from photographs taken in the office of Engineering News. These photographs show the model girder loaded in the two ways suggested by Mr. Wilson. Fig. 1 is a view of the model placed with the slits in the web converging downward and loaded with a block of type metal, weighing 1¼ lbs. It will be noticed that the slits are drawn tight and that the web between each pair of stiffeners is tight and smooth. With the same load placed on the opposite flange of the model; that is, with the slits converging upward, the appearance is as shown by Fig. 2. In this view it will be seen that the slits are sprung apart and that the web is buckled between the stiffeners its entire length. The action of the girder with the two methods of loading described corresponds to the description given in Mr. Wilson's letter, and is a remarkably graphic and convincing proof of his statements.—Ed.)

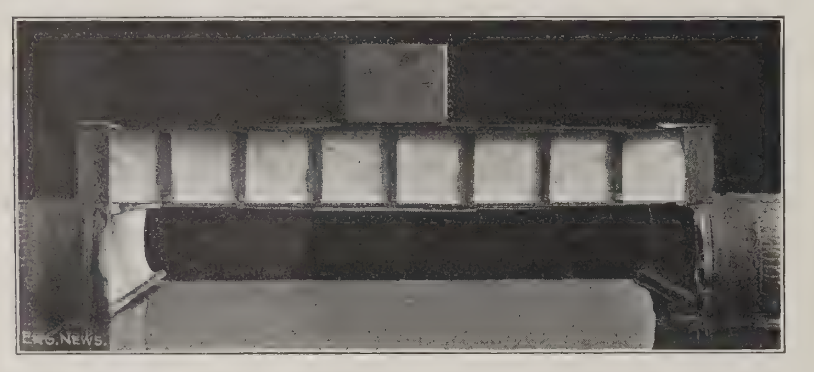


FIG. 1.—VIEW SHOWING EFFECT OF 1½-LB. WEIGHT ON MODEL GIRDER WITH SLITS IN WEB IN THE LINES OF TENSION.

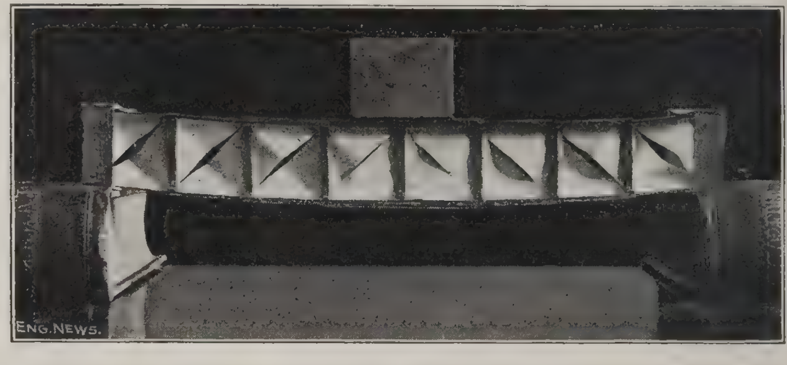


FIG. 2.—VIEW SHOWING EFFECT OF 1½-LB. WEIGHT ON MODEL GIRDER WITH SLITS IN WEB CONTRARY TO THE LINES OF TENSION.

Sir: Permit me to make a few, somewhat belated, comments on a communication in your issue of July 7th. "Practical Bridge Builder" is pleased to take me to task for what he considers a violation of the ethics of criticism, in my failing to point out more explicitly wherein a previous correspondent has erred in his so-called "theory" for the spacing of stiffeners, but, instead, contenting myself by calling attention to a few easily accessible references on the subject.

While I quite agree with this second writer in that, generally speaking, "the burden of proof rests upon the critic," I must submit, that the critic, in this instance, is none other than the original author, on whose side he has seen fit to arraign himself. From what the former terms a "theory;" but what must be regarded a conjecture, pure and simple, unless proved otherwise; he has ventured to draw conclusions, utterly at variance with certain incontrovertible principles of mechanics, without adducing a single argument in their support. It requires but little familiarity with the subject to recognize that each and every one of his six conclusions is untenable. But until something tangible is presented in their support, it is not worth the time or space to enter upon a detailed discussion to prove that the assumed analogy between a plate girder and a Pratt truss cannot possibly exist.

Unless "Practical Bridge Builder" can himself offer something more substantial in behalf of the Pratt truss "theory," than the account of his observations on the behavior of the web at the end of a certain plate girder, his views, too, will fail to impress sensibly on a thoughtful reader. What he has cited in that connection would go equally far towards proving a plate girder bridge similar to a Fink truss, a Bollman truss, or in fact any number of equally remarkable analogies. As a critic of what is generally regarded as sound theory, let him take to heart his own counsel.

Though seemingly superfluous, it may not be amiss to state that, before attempting to prove the analogy of a plate girder to any other form of construction, it is incumbent upon the critic—whether theorist or self-styled "practical" man—either to submit a formal refutation of the generally accepted theory of the distribution of stress in web plates, or to show that his own theory is merely an extension of the same. Nothing less than this can reasonably be expected to carry conviction, or is, in fact, deserving of serious consideration.

Passing over certain inaccuracies in my critics reference to my former communication, which are patent to anyone, I have only to defend myself against the carelessly thrown out charge, that in my reference to the spacing indicated in the sketch accompanying the original communication, I have presumed to state, or even to intimate, that your correspondent's guess was wrong, because slightly different from my own. That what I did write does not admit of this absurd construction will be shown to any reader who can recognize the broad distinction between a matter of empiricism (in the sense of experience, not experiment), and a matter of guess.

To sum up, experience in the case of hundreds, probably thousands of girders, has shown that if the stiffeners are placed at intervals not exceeding the unsupported depth (inside of flange angles) of the web, security against buckling is assured, provided that the bearing requirements of flange rivets are fully met. Toward the ends of a girder, the intervals are frequently reduced in a purely arbitrary fashion. That this is not necessary is attested by the record of the numerous girders designed after Cooper's specifications, which embody no such requirement. It goes without saying, that for girders of very great depth, the rule named must be modified in the case of thin webs, according to individual judgment, to ensure their better alinement. The proper size of stiffeners can be computed only at the supports. The sizes of the intermediate ones are absolutely beyond the reach of theory.

With apologies for trespassing on your space to this extent, in a matter that can have but little interest to the general reader, I am

Very respectfully, E. M.

Philadelphia, Pa., July 23, 1898.

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Notes of an Engineer in Colorado.

Sir: The readers of Engineering News may be interested in a brief description of what the writer saw in a recent trip through the principal towns of Colorado. I entered the state from the north, traveling over the Union Pacific Ry. to Denver, thence over the Denver & Rio Grande standard-gage line to Grand Junction, and from there over the Rio Grande Western through Utah to my home at Salt Lake City.

From Cheyenne, Wyo., southward for about 40 miles there is no industry or agriculture but stock raising. Between Pierce and Eaton the first irrigated lands are reached, and thence all the way to Denver one has an ocular demonstration of the benefits of irrigation.

Greeley, 54 miles from Cheyenne and 52 miles from Denver, was the birthplace of the art of irrigation for the English-speaking people of Colorado. The town was laid out in 1870 by a colony under the fostering care of Horace Greeley. With but little experience in farming, and none in irrigation, these colonists went to work with a will, and, despite many failures at first, they have succeeded in establishing a colony that is pointed to as a model by many that are interested in irrigation. The Cache a La Poudre River, a fine stream from the mountains, runs through the town, and supplies most of the irrigation canals.

I took a run from Greeley up to Ft. Collins, 25 miles to the northwest. Besides being in a rich farming section this town is the site of the State Agricultural College. I met here Prof. L. G. Carpenter, professor of civil and irrigation engineering, and was shown what his department was doing in instructing, not only the students, but the public at large, through the experimental work at the Agricultural Experimental Station.

Prof. Carpenter has been stationed at the college for ten years, and his researches and writings have caused him to become well known abroad as well as in this country, wherever an interest is taken in irrigation. For the 300 to 350 students per year coming to the Agricultural College, there are four courses of four years each open. The only degree given for any of the courses is that of Bachelor of Science, though special degrees are given for post-graduate work. Over one-half of all the graduates are from the engineering course. Male students in all the courses devote one-third of their sophomore year to surveying, with field practice in compass and level work. Naturally a large amount of time in the civil engineering course is given to irrigation.

The civil engineering department has a building to itself. On the first floor are the office and library of the professor of engineering, the drafting room and also a room for carrying on the work of the irrigation engineering section of the Agricultural Experimental Station. This station is intimately connected with and under the same governing board as the college. In the basement are the physical and hydraulic laboratories. The hydraulic laboratory has tanks and a set of suspended scales, weighing to 5,000 lbs., for ascertaining very closely the amount of water flowing through orifices and over weirs.

The Department has Colorado, Lallie and Fteley current meters, the latter with an electrical recording attachment, and also a long-distance, electrical, self-recording water-level instrument, made by Richard Freres of Paris, by which the change in elevation of a water surface miles away in the mountains is recorded at the station.

As meteorology is an important factor in irrigation, instruction in this is given also, and a complete set of instruments, many of them imported, is in daily use. This includes self-recording thermometers, barometers, psychrometers, anemometers, pluviometers, actinometers, statoscope, soil thermometers, evaporation tanks, etc.

The Mechanical Engineering Department of the college has a large two-story building of its own, which is completely equipped for instruction and for manual training.

Denver.—This city has one of the best systems of street railways in the country, considering the great extent of territory covered. The total value of all the lines is about $4,000,000. The Denver City Railway Co. was the pioneer in street car matters, and its first horse car lines were built over 20 years ago. In 1889 most of the main lines were changed to the cable system. This was just before electric roads were proved to be a commercial success, and many hundreds of thousands of dollars in first cost, as well as excessive expenses in operation, could have been saved if electrical propulsion had been perfected a year or two earlier. The company has 30 miles of cable tracks (15 miles of double tracks) operated by six different cables running out of its power house at 18th and Lawrence Sts. The longest of these cables is the West Laramie, 32,000 ft. long. The plant at the power house has about 1,600 HP., while about 85 cars are run and 350 men employed. Though much inferior to the electric lines in economy and service, the cable line plant here represents a high type of engineering skill. More miles of cable railway are probably operated from this power station than any other single one in the world. A brief account of the plant and tests of its efficiency by the constructing engineer was given in Engineering News of Aug. 17, 1893, p. 130.

The company's system was sold under foreclosure after the panic of 1893-4 for $500,000. Something like $3,000,000 had been invested in it. An application to the city council for a franchise allowing the cable system to be changed to electrical has been made, but has not yet been acted upon. The Providence girder rail, 6 ins. high and 56 lbs. to the yard, was used in the cable road for convenience in paving, and it will be difficult to use it again if the cable yokes are taken up, as the base is so narrow that the outside jaw of the yoke is relied on to brace it. Even if the present track is used, the heavy electric cars of the present day (weighing two or three times as much as the cable cars) will be likely to test the girder rail very severely.

The company also owns the West End Electric Road, having 10 miles of track, 10 cars, a power house of 1,000 HP., and employing about 30 men. This is about the only standard-gage street railway in Denver—the others being 3½-ft. gage. The company also operates 4¾ miles of its old-time horse lines. On the cable road the cars run 11,000 car miles daily, on the electric 1,000, and on the horse track 175. The total number of passengers carried during 1897, including the transfers, was 9,000,000, and the car mileage was 2,000,000 miles.

The Denver Consolidated Tramway Co., now much the largest of the street railway companies, is an interesting example of the results of energy and good management. The Denver Tramway Co. was organized in 1888 to build a cable railway system. Franchises were secured and construction proceeded with that year, notwithstanding the vigorous opposition of the pioneer company, which had before had a monopoly of street railway privileges. All the money was furnished by local capitalists.

The cable system included 18 miles of track, costing about $40,000 per mile. The company soon decided that electric roads were the best, and all the additions have been of that system. In 1893 the 18 miles of cable line were converted into electric road, the cable conduit, etc., being left in. It is stated that about $25,000 per mile would have been saved if electrical propulsion had been so perfected as to allow of it at the start. The power house was built at the corner of Broadway and Colfax Ave., the center of the system and in the then resident district, and was a large building with handsome exterior. Cotton ropes were used in the place of cog gearing, on account of the objections to noise in this locality. The building has been abandoned, and the machinery used for other purposes where possible. The system as now consolidated includes 58½ miles of track in double track, 36 miles of single track and 4½ miles of sidings, etc., or 99 miles in all. It operates about 75 cars daily, and 18,000,000 passengers were carried in the first 10 months of 1897. It is found that there is a saving of about 6 cts. per car mile over the cable road, notwithstanding the great increase in the size of the cars, and as to freedom from stoppage, flexibility under very great variations of traffic and general convenience, the electric roads are found to be decidedly the best.

The old cable cars weighed 6,500 lbs., and carried 40 passengers; the new electric cars with motors weigh 16,000 lbs., and hold 100. Both the General Electric and the Westinghouse systems of electricity and motors are used, the latter ranging from 10 to 35 HP. The company has lately begun tearing up its old cable tracks to replace them with rails on ties. In forming the cable conduit the bottom part only was made of concrete, the sides being of plank stretching from yoke to yoke. On account of this, which was looked on as a penny-wise method at the time, the loss will be much less than if the entire conduit had been of concrete, as in the Denver City and other cable roads. The boards are considerably rotted, but still serviceable at the end of ten years. The yokes are broken off in pieces by sledge-hammers and used as old iron, the part imbedded in the concrete being allowed to remain. In the new track in the paving districts "T" rails 6 ins. high and weighing 72 lbs. are used. 30-ft. lengths rolled at Pueblo were first used, but more lately 62-ft. lengths, coming from the Johnson Co., Lorain, O., have been used. About five miles of the track had been replaced with heavy rails up to May of this year. Creosoted ties, 6 x 8 x 6, coming from the Michigan Pipe Works, at Bay City, Mich., and costing 94 cts. each, delivered, are used. The Servis tie-plate has also been adopted. The old cable road rails are only 35 lbs. weight. In the paving district all street car companies have to pave between the rails and for 2 ft. each side. This company spent about $80,000 in 1897 on such work, much of it re-paving.

In addition to the roads named, the Colfax Electric Railway has 11 miles of single track (east of the city limits); the Denver, Lakewood & Golden Ry. Co. has nearly 4 miles of electric road in the city, and the 34th Ave. line has 1½ miles of track, which are operated in one direction by horse-power and on the return by gravity—carrying the horse. There are altogether about 155 miles of street railway track in the city and suburbs.

In good weather nearly all of Denver's streets are in good condition, but before paving began in 1890 the business streets were miserable in very wet weather. There have been over 14 miles of pavement laid, all but about 16% being asphalt. The sandstone paving is confined to the down-town district.

Denver's sewer system has also nearly all been built since 1890, and is now quite complete, containing 224 miles of sewers.

Denver has become a very important manufacturing center during the past few years, and as the cost of living is now as low as in the East, one of the most important factors in the relative cost of manufacturing in the West is thus eliminated. Iron works, and especially works for the manufacture of machinery used in mining, milling and smelting, have a very extensive trade in the mountain regions. The manufacturing district lies principally along the Platte River, for a distance of about 9 miles. The Omaha & Grant, the Globe and the Boston & Colorado smelters, all at the north end of this district, give employment to nearly 1,500 men. In this locality are also the great Jersey shops of the Union Pacific Ry. Co, leased on May 1 to the Union Pacific, Denver & Gulf. Besides its own work, the U. P., D. & G. does a great deal of custom work at these shops, including much for the Union Pacific.

At present only about 230 men are employed in the machine and engine shops and 150 in the car building department here. The track for a heavy electric crane was provided in constructing the machine shop, but this was never put in (thus saving about $5,000), and instead airlifts of about two tons capacity are used. These prove to be more rapid and to make a great saving of time in handling all small pieces. A 15-HP. Thompson-Houston motor is used for operating the transfer table, and by having call signals provided for the operator at one corner of the building he is not required to be at the table all day, but gets in three or four hours' work at a lathe.

The roundhouse was formerly lighted by electricity, but it was found that the stationary lights were not at all suited for inspecting the parts of an engine, and if carried around for this purpose many were broken. They were taken out and the regular engineer's oil lamp is now used, with 8 large oil bracket lamps placed around the walls for general lighting. By this means $300 per month is saved, two electric light dynamos and an engine being left idle. The omission of the overhead crane left room at one end of the overhead tramway to fit up a tool room.

Three steel viaducts connect the main part of the city with that west of the So. Platte River, crossing over the numerous railroad tracks along the river bottoms. Two of these, on 16th St. and on West Larimer St., were built by the Denver City Cable Ry. Co. The first of these is about 3,000 ft. long, the last considerably more. The 14th St. viaduct, now being built by the city, will be about 3,500 ft. long.

In the engineering profession I found that business had been extremely quiet for several years past—beginning with the panic of 1893—but that it has lately been picking up. Many engineers who had their own offices during the better days gave them up, and either attempted working on a salary or else moved to other parts of the state or the country.

Prices of living, merchandise, etc., have come down in Denver the past few years, until it now more nearly resembles an Eastern city than any other in the West; and with penny papers and other evidences of Yankee economy it must make the old-timer who returns here feel somewhat pensive when he remembers the scorn with which anything less than 10 to 25 cts. was formerly regarded.

All municipal improvements in Denver are built under charge of the Board of Public Works, the engineering staff making the surveys, as well as plans for new structures. The duties of the city engineer's office are mostly confined to street and lot lines and grades.

The state engineer's office is a very important one in Colorado, having control not only of irrigation, but of many state public works. Mr. John E. Fields is the present incumbent. For the administration of the irrigation laws, the state is divided into six natural drainage divisions, each in charge of a superintendent, and these into 69 districts, each in charge of a commissioner. All the streams of the state used for irrigation are regularly gaged. There are many volunteer observers of gages, but some are paid about $5 per month. The state engineer's department carries this along in conjunction with the hydrographic department of the U. S. Geological Survey, the former paying the salaries and the latter the expenses. One deputy is in the field all the time, making the rounds of the principal gaging stations about once a month. The last legislature made no appropriation for public works such as have been constructed under supervision of this department, but it is likely that the next one will provide for further expenditures. W. P. H.

Salt Lake City, Utah, July 1, 1898.

THE NEW YORK STATE CANAL INQUIRY.

In March last Gov. Black appointed a special commission to investigate and report upon the work already done in enlarging and improving the Erie, Champlain and Oswego canals, in the State of New York, under the provisions of Chapter 79 of the Laws of 1895; whether the contracts were properly made and whether the money paid out was properly expended; the proportion of work done and that still to be done; and the amount of money in excess of the appropriation of $9,000,000 still required to complete the proposed enlargement and improvement. The commission submitted its report to the Governor on July 30, and though the detailed evidence is not yet accessible a brief summary of the report proper is here given.

The commission secured the services of Mr. Abel E. Blackmar, of New York, as counsel, and appointed Mr. Edward P. North, Vice-President American Society of Civil Engineers, as consulting engineer, and Mr. Lyman E. Cooley, of Chicago, as advisory engineer. The report commences with a brief sketch of the Erie canal system and makes the following statement of the actual condition of the work on the several canals at the present date:

Location.		Work, miles.		
		Completed.	Incomplete.	Not contracted.
Erie Canal	Eastern Division..	26.56	27.99	51.687
	Middle Division ..	23.18	73.61	None.
	Western Division..	3.45	112.40	31.81
	Total	53.19	214.00	83.497
Champlain Canal		5.886	24.03	36.11
Oswego Canal		6.63	6.73	24.11
Grand total		65.706	244.76	141.017

The commission notes that it is impossible to give the exact condition of the work done under these contracts, though its engineers report that the quality of the work performed is generally good and is an improvement upon that usually done upon our canals. As to the features of the work, the conditions as they developed were most unfavorable, and required a high degree of skill and moral strength to meet them; the pressure for haste resulted in demoralized and disorganized execution, and influences hereditary in canal work had to be combatted. As a general thing the contract prices were reasonable and as low as could be expected; there was actual competition between the bidders, and in a great many of the contracts there is nothing to condemn. The actual amount of money expended for the enlargement and improvement of the canals to July 28, 1898, was as follows:

Disinfectants	$6,684.93
Advertising	92,320.70
Inspectors	178,969.43
Engineering expenses	812,000.00
Paid to contractors	7,106,722.77
Continuing work on suspended contract No. 3	35,555.19
Total	$8,233,253.02

Under the law of 1895 not less than 10% of the amount due the contractor is to be retained by the state until the completion of the work, and including unpaid drafts amounting to $35,092.37, the apparent free balance out of the $9,000,000 appropriated is only $25,556.25. The item of disinfectants refers to the treatment of certain sewage-contaminated material excavated in the City of Buffalo.

In regard to advertising, the report states that the total amount thus expended upon the first 32 contracts was $74,978.50, an average of $2,343.08 for each contract. No attention was paid to the amount involved in the contract, and in one case the cost of advertising was 23% of the engineer's estimate of the total cost of the work, while in another case this cost was as low as one-third of one per cent. of the engineer's estimate. In later advertisements the superintendent's requirements were omitted and several contracts were grouped in one advertisement with the result that 49 contracts were advertised for $17,342.20, or an average of $353.92 each. The commission concludes from the evidence submitted that an average expenditure of $150 each would have properly advertised these contracts, and that $80,170.70 was improperly expended in this direction.

The report shows that while $38,532.80 was paid to inspectors during the season of closed navigation, and when work was being done, the sum of $41,514.19 was expended in paying these officials during the season of open navigation when work on the contracts had substantially ceased. The commission is of the opinion that a portion of the expense of maintaining this force of inspectors during the open season was useless, and therefore improper.

As no sufficient data existed in the engineer's office for the making of the estimates, maps, plans and specifications required by law, an expensive preliminary survey was absolutely necessary, and the commission deemed this expenditure requisite and proper. But a sum amounting to $49,391.32 was charged to these surveys and actually paid to experts for plans, etc., of lift locks at Lockport and Cohoes. While the employment of skilled and special engineering assistance is deemed generally proper, in such cases, the commission finds that the improvement contemplated by them was unauthorized and could not be legally made under Chapter 19 of the Laws of 1895, and this large expense was therefore improper. It was also deemed unnecessary to obtain complete working plans of three separate devices before choosing between them. The nature of the work required a large expenditure for engineerig services; but the complexity of the specifications, say engineers North and Cooley, has unnecessarily increased this cost.

For the purpose of making the contracts the canal was divided into contract sections, varying in length from .67 to 22.07 miles. The contractor bid upon the quantities estimated by the engineers, and upon the specifications, maps and plans accompanying the quantity sheets. In comparing bids these quantities were multiplied by the prices submitted, and the lowest total obtained the contract. If the quantity sheet does not represent with reasonable accuracy the actual amount of work to be done; or if the specifications admit of uncertainty of classification between the several items; or if the plans are indefinite, or made in the alternative; this method affords an opportunity for excessive final cost, unbalanced bids, improper classification and other abuses. The commission finds that, notwithstanding the large amount expended on the preliminary surveys, the quantity sheets, plans and specifications lack accuracy and definiteness. So far, the actual cost of the work let has exceeded the contract price by 9.84%; and the total cost of the work for which contracts have been let, including the estimated cost of those incomplete, will exceed the contract price by 69.08%. As early as July, 1896, it was evident to the State Engineer and to the Superintendent of Public Works that the cost of the work, as shown by the notes and measurements of the engineers, would far exceed $9,000,000. An attempt was then made to reduce the estimates by cutting out everything that did not seem to them to be absolutely necessary to obtain the result primarily aimed at in the statute. But this mutilation of the quantity sheets did not render the work unnecessary, and as the improvement progressed much of the work cut out reappears in an increase of quantities over the preliminary estimates. For example, the slope wall estimated for and bid upon amounted to 543,779 cu. yds.; while up to May 1, 1898, 425,916 cu. yds. of such wall had been built and it was then estimated that 432,839 cu. yds. more would be required to complete these contracts. The preliminary estimate of vertical wall was 106,353 cu. yds.; on June 1, 1898, 168,735 cu. yds. of this wall had been built, and the revised estimate called for 110,326 cu. yds. to complete the contracts.

The value of the preliminary estimates was also greatly impaired by the fact that they were made without reference to the specifications, and were in fact made before there were any specifications. The assistant engineers classified and defined rock and earth as each saw fit in making the original soundings and estimates, and the quantity sheets were prepared accordingly. When the specifications were afterwards made these terms, rock and earth, were given a technical and arbitrary meaning, and no revision of quantities was or could be made owing to lack of sufficient data. The specifications classed as rock, hard-pan which "could not be plowed," and the meaning of the term "embankment" was also changed in the specifications after the computation of quantities in the preliminary surveys. The following table shows a comparison of quantities as shown on the bidding sheets with the quantities of work actually performed:

	Cu. yds.
Rock in quantity sheets	550,183
Allowed to contractors to May 1, 1898.	740,068
Estimated amount to be excavated, May 1.......	253,501
Embankment in quantity sheets	729,374
Allowed to contractors to May 1	1,167,849
Estimated amount remaining, May 1.	615,145

This disparity is partly due to improper classification; and another source of error was inexcusable carelessness in omitting quantities actually returned and inserting a nominal small quantity of 70 or 100 cu. yds. into the bidding sheets; in another case 5,000 cu. yds., estimated, was set down as 500 cu. yds. The report deals at length with the discrepancies in excavation, which showed an excess of from 10.77 to 35.09% over the preliminary estimates. On contracts in the cities of Utica and Syracuse the improvement was made by both lowering the bottom and raising the banks, and here the preliminary estimates were 1,532,370 cu. yds., while the work actually done and that estimated to complete calls for 2,171,724 cu. yds., an increase of 41.72%. On these contracts the material was procured from outside the prism, during the navigation season, and before there was any excavation from the canal. All this material was taken from borrow pits and paid for as excavation; and that hauled over 1,000 ft. was paid for as embankment in addition. The reason given for this course was that the material in the prism was an unknown quantity; could not be used in winter as it was frozen, and the silt could not be separated from the harder material. The commission disagrees with this position and believes that the course pursued was a wasteful departure from the original intent of the contract and specifications which called for the use of proper excavated material upon the banks. On some sections there were extravagant returns made for mucking, or removing all vegetable matter to the depth of 6 ins. on the outside slopes of embankments.

The earth and rock classification, as before mentioned, was very faulty, both for the reasons already given and because the specifications confided this classification to the three resident engineers, who in this case had supervision over about 152 miles of canal. Personal examination in all cases was absolutely impossible, and anything like accurate work would have required more engineers. The average of all accepted bids for dry excavation of earth was 28.8 cts. per cu. yd.; the average for all accepted bids for dry excavation of rock was $1.42 per cu. yd. The report then takes up the three divisions separately, and by individual cases shows a great uncertainty and frequent and arbitrary reclassification of earth and rock. Space available forbids going into this interesting detail, and the same may be said for the detail of the embankment returns.

Under the head of extra, or additional work, we find that to June 1, 1898, work valued at $824,820.88 was done under special agreement, outside of the contracts, showing the insufficiency of the preliminary investigation. A large amount of this work was not contemplated by either party and was thus not within the contract itself. Some of this extra work, though admitted as useful and necessary, was paid for as excavation, slope wall, etc., under the contract prices, and only swells the quantities under the contract and does not appear in the work done by special agreement. "Extra work" was also largely done from force account with 10% added for profit to the contractor; and many claims exist for work done without special directions. Other work was performed which was not properly part of the improvement prescribed by law, and in some cases a free gift of material belonging to the state was improperly made to the contractors. In concluding their report the commission expresses the opinion that not less than $1,000,000 in all was improperly expended in the manner here pointed out.

In its estimate of total cost of the work, done and to be done, the commission submits the following statement:

Expended on contracts (approximately).....	$7,867,924.36
To be expended to complete contracts	4,731,600.00
Total	$12,599,524.36
Estimated for work to be let	8,900,000.00
Total cost of completed work	$21,499,524.36

In other words, 36.6% only of the entire work is finished. The $13,651,000 estimated to complete the work does not include engineering, and 10% should be added thereto. This estimate does include, however, the pneumatic locks at Cohoes and Lockport, the change of line at Newark and the improvement at Little Falls. But the commission does not recommend the pneumatic lifts at Lockport and Cohoes, and if the locks at these points are left as at present, the estimate would be decreased by $2,100,000. The engineers, Messrs. North and Cooley, with the approval of the commission, recommend certain changes in the location of the canal, which, if sanctioned by the legislature, would further diminish the estimated cost of completion.

It is only just to the State Engineer's Department to say that the estimates of 1896, based upon the preliminary surveys, put the cost of the improvement at at least $13,500,000, not including engineering, advertising or inspection. This estimate was improperly cut down to $9,000,000 to meet seeming demands, and upon this revision the work was let. As the work progressed it became evident that the official estimate was too small and another was made amounting to about $16,000,000. The State Superintendent of Public Works also committed the grievous error of letting contracts after it was apparent that the money remaining available was totally insufficient to complete these contracts. This has left long stretches of the canal in an incomplete condition and has involved the state in serious questions of liability to contractors.

The commission finds that the force allowed the State Engineer is not adequate to the performance of all the duties of his department. The State Engineer himself is a member of various boards and has many duties to perform outside of canal improvement. The present dual system in the management of canal affairs is also objectionable and is inherently vicious. It throws the responsibility upon two departments, those of the State Engineer and Surveyor and the Superintendent of Public Works, which have separate functions to perform, but are so interwoven as to make it extremely difficult to fix responsibility in case of negligence or wrongdoing. The commission recommends that the authority and responsibility be vested in one department, and that either the Superintendent of Public Works be given power to maintain a sufficient engineering force and take all the responsibility; or, that the State Engineer be intrusted with the business management of the canals and the entire responsibility of maintenance, repair and improvement. The last suggestion would involve the abolition of the Department of Public Works; and the first would duplicate the engineering force to a great extent and largely increase the cost. In any event, before further work is done there should be a more accurate study of the conditions, a revision of the specifications and the preparation of adequate quantity sheets for all work still to be performed. In conclusion, the commission recommends the continuation of the improvement on the lines contemplated to final completion, with such changes as have been suggested and that may be sanctioned by the legislature.

The entire cost of Erie canal system, up to 1895, is $102,345,123. The state has received from these canals, up to 1882, when tolls were abolished, $134,648,900; and these canals have thus much more than repaid the entire cost of construction, maintenance and repairs, up to Oct. 1, 1885. The report is dated at Albany, N. Y., on July 30, 1898, and is signed by the following commissioners: George Clinton, Chairman; Franklin Edson, Secretary; Smith M. Weed, Darwin R. James, Frank Brainard, A. Foster Higgins and William McEchron, Commissioners.

SEISMIC AND OCEANIC NOISES.

In the April issue of the "Monthly Weather Review," Mr. Samuel W. Kain, of the Natural History Society of St. John, N. B., and others, write of the mysterious "booming" noises often heard at sea and near the coasts. These sounds seem to be frequent off the coast of Nova Scotia; they resemble the distant boom of cannon, and they alarm and drive away schools of fish. Sometimes, as at Gannet Rock light-house, the sound is as sharp as the report of a 24-pdr. cannon, fired 40 yds. from the building, accompanied by a shaking of the ground. The same noises are frequently reported from the Bay of Fundy.

Mr. Kain says that while these sounds have generally been attributed to some form of earth disturbance, and are thus termed seismic noises, it is by no means certain that they may not often have an entirely different origin. The salt water drum-fish (Pogonias Chromis) is common on the Atlantic coast, and a large drum-fish will give out a sound that may be heard a long distance. As the sound is refracted into a nearly horizontal direction on its emergence from a level water surface, it may seem to come from a great distance, when it is really near at hand or under the vessel. There may be other fish of great size that can give forth louder sounds, and this may account for their variety. On the other hand, Mr. Kain believes that some of these oceanic noises defy all attempts at rational explanation.

Prof. Alexander Agassiz says that the large drum-fish atttains a length of more than 4 ft., but he cannot satisfactorily explain how the "drumming" is produced. Cuvier observes that it may depend on the air-bladder, though this has no direct communication with the open air; De Kay supposes it "to be occasioned by strong compression of the expanded phraryngeal teeth upon each other." Prof. Agassiz, from frequent examinations of the structure of the fish, is fairly satisfied that it is made in the air-bladder itself; that the vibrations are produced by the air being forced by strong muscular contractions through a narrow opening, from one large cavity—the air-bladder—to another cavity, that of the lateral horn. The sound itself, says Dr. Mitchell, most resembles the tap of a drum, and it is so loud that when many of the fish are gathered together it can be heard "several hundred yards from the water."

Prof. Wm. F. Ganong, of Northampton, Mass., writes to Mr. Kain and says that he cannot accept the drum-fish theory. He has heard the sounds from hills one-quarter mile from the sea, and they were too great in volume to be made by any number of fish. Mr. Kain is inclined to conclude that these sounds originate from different sources; some undoubtedly come from drum-fish; others are due to the heavy thud of breakers on cliffs; others to the cracking of rocks in ledges, such as light-houses frequently stand upon, and others still are occasionally due to genuine earthquakes occurring at the bottom of near oceans. In the latter connection it is well to remember that there are eight or ten well-defined regions on the North American continent within each of which there is a so-called center of seismic disturbance. There is no reason why similar centers should not exist under the ocean; and the great solitary waves occasionally reported by vessels sailing between Newfoundland and New York may sometimes be due to earthquake shock, as similar waves in the Pacific are known to have been caused by earth disturbance.

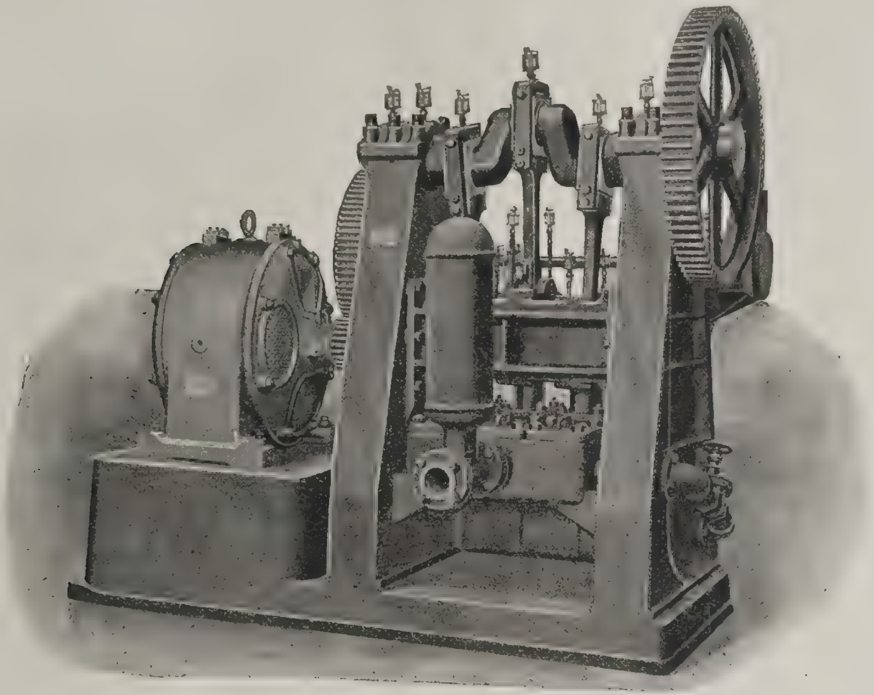


FIG. 1.—A WESTINGHOUSE THREE-PHASE MOTOR GEARED TO A GOULDS TRIPLEX PUMP.

AN ELECTRIC MOTOR FOR NARROW GAGE RAILWAYS.

We illustrate in the accompanying cut a new type of electric motor designed for narrow gage railway service with a minimum gage of one metre (39¼ ins.). In outward appearance this new motor resembles the motors for standard gage. It is built by the General Electric Co., of Schenectady, N. Y., for comparatively heavy service, such as is encountered in city and suburban traffic where the load carried at times is considerable and the speed moderate. The motor is designed for 500 volts and other regular electric railway conditions, and is rated at 37 HP. on a basis of a maximum temperature rise not exceeding 75° C. in the winding of field or armature after a full load run of one hour, provided the temperature of the surrounding air does not exceed 25° C. It weighs alone 1,865 lbs., and together with gear and gear case 2,150 lbs.

The magnet frame is cast in two parts, each containing two pole pieces bolted on from the outside. The upper half also has heavy lugs which are fitted with bearings for the car axle, upon which the motor rests, and other small lugs to which is bolted the suspension bar. The armature bearings are also bolted to this part of the frame. The bottom half can be lowered and the armature, commutator and bearing exposed for examination or repair.

The armature bearings are lined with 3-16-in. Babbitt metal swaged and bored to size. On the commutator end the bearing is 2⅝ × 6 5-16-ins., and the pinion end 3 × 7⅞-ins. All bearings are amply lubricated, are easily accessible and are designed to keep oil and grease away from armature and fields. The four wire-wound field coils surrounding the pole pieces are insulated with asbestos, are carefully wrapped with tape and cloth for insulation and protection, and are tested when in place with 5,000 volts alternating current between coil and field frame. The armature core is 14½ ins. in diameter and 6½ ins. in breadth, with 33 slots. The winding is "barrel-type," there being 3 coils in each slot. These are insulated and taped to form one coil for convenience in repairs. The coils are held in place in the slots by tinned steel wire wound around and soldered so as to form bands. The coil terminals are brought down and soldered directly to commutator segments. The commutator is 10 ins. in diameter and has 99 hard-drawn copper segments 4⅜ ins. long with a wearing depth of 1 in. The best grades of mica is used in its construction, and when completed it is tested with 5,000 volts between segments and shell and 500 volts between segments.

The brush-holders are mounted upon a block of treated wood attached to the upper part of the field frame, and are readily accessible by removing the hand-hole plate seen in the upper right-hand portion of Fig. 1.

AN ELECTRICAL PUMPING EQUIPMENT.

The illustration given herewith represents a combination electric pumping outfit, consisting of a type "C" three-phase induction motor built by the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., and a vertical "Triplex" mining pump constructed by the Goulds Manufacturing Co., 16 Murray St., New York city. Such equipments are intended for use where the source of power is somewhat remote from the pump, and the pump here illustrated is designed for high pressures and has a capacity of from 60 to 150 gallons per minute to an elevation as high as 1,400 ft.

The motor is of the well-known "Tesla" type, and is built for circuits using 7,200, 3,600 or 3,000 alternations per second. It consists of a stationary part, known as the primary, permanently connected to the transmission circuits, which may be of any length, and a rotating secondary which is entirely disconnected from the primary, and consists of a series of thin steel disks, or laminae, mounted upon a suitable cast-iron spider. The disks have all around their outside square slots, and into these are slipped insulated copper bars which are connected at their ends to heavy copper rings. The revolving part is as solid and as free from liability to accident as an ordinary pulley wheel. This type of motor is especially remarkable in its simplicity. It possesses no commutator brushes, or collector rings and, consequently, requires very little attention. In addition it has a high commercial efficiency, a high power factor, and close speed regulation.

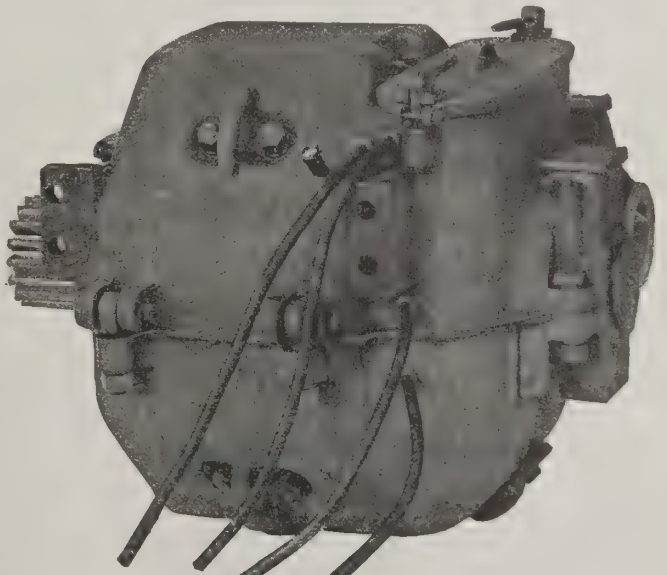
Starting up is accomplished by means of a double throw switch mounted upon a cast-iron case containing two auto-converters. These converters are connected across the circuit and are constructed to deliver a low electro-motive force to the motor. After starting the switch is thrown over and the motor is thus put directly on the main circuit. The starter may be some distance from the motor, for instance in mine pumping, it may be placed in the engine-room and the pump anywhere in the mine.

STATISTICS OF COMMERCE ON THE GREAT LAKES.

The Bureau of Statistics, of the U. S. Treasury Department, has issued an exceedingly interesting report upon the growth of traffic on the Great Lakes. It is practically the first comprehensive investigation of this subject since 1889, and the figures here gathered by Mr. George G. Tunell, of Chicago, are correspondingly valuable. For most useful purposes the report itself must be studied in all its detail, but some general figures are here given to illustrate this phenomenal growth in traffic, and to explain some of the reasons for it.

The astonishing development of the iron mines of the Lake Superior region, during the last 15 years, is very largely responsible for the enormous growth of traffic through the St. Mary's Falls Canal, and, in fact, throughout the Lake system. This development practically commenced in 1880, with but 677,073 tons of ore moved out of Lake Superior in the season; in 1895 the shipment of ore amounted to over 8,000,000 tons, or about one-half of the total of 16,806,781 tons passing the canal in that season. In 1897 the movement of ore exceeded all previous records and amounted to 10,633,715 net tons, with lumber, grain, flour and coal forming the other main items in an aggregate trade of 17,619,933 net tons.

These traffic statistics bring out a number of facts concerning the character of lake transportation. In the first place, this trade is exceedingly simple, consisting of but few commodities, and these are mainly crude products; at the time of the last census, iron ore, coal and lumber made up 75.73% of the tonnage of the lakes, and grain and mill products contributed 16.15% of the remaining 24.27%. The other elements of growth are the excessively rapid handling of freight, due to its simple character, the constantly increasing size of vessels, improved methods of supplying fuel to vessels, etc. Local traffic on the lakes is comparatively insignificant, nearly the whole commerce moving from one end of the system to the other; and a conspicuous feature is great preponderance of east-bound over west-bound freight. In 1890 the total east-bound commerce through the Detroit River in American vessels



A 37-HP. ELECTRIC MOTOR FOR NARROW GAGE RAILWAYS.

was 15,670,156 net tons, as compared with a westbound trade of 6,080,757 net tons; and this difference is more apparent still in the St. Mary's Canal.

The average registered tonnage of vessels has been constantly increasing; in 1870 the average tonnage of vessels passing the St. Mary's Canal was about 375 tons; in 1880 it was about 495 tons; in 1890, 800 tons, and in 1896 it was 926 tons. This statement, however, does not give a fair idea of the actual growth in the tonnage of vessels, as that of sailing vessels is about the same, and the tonnage of steamers shows no remarkable change until 1887. In 1886, the average gross tonnage of steamers was 269 tons; in 1891 it was 759 tons, and in 1897 it was 1,437 tons; or an increase of 534% in average tonnage in 12 years. The latest steamer building, for the Bessemer Steamship Co., is 475 ft. long over all, 50 ft. beam, and 29 ft. deep, and she will carry 6,500 to 6,750 gross tons on a mean draft of 17 ft. Mr. Tunell compares these dimensions with the two largest ocean steamers afloat, as follows:

	Bessemer steamer, ft.	"Kaiser Wilhelm der Grosse," ft.	"Oceanic," ft.
Length over all	475	648	704
Length on keel	455	...	685
Beam	50	66	68
Depth	29	43	46

In the matter of depth of hull, the shallowness of the lakes is responsible for the above disparity.

Steam is very rapidly supplanting sails on the Great Lakes; in 1864 there were 624 steamers, aggregating 144,117 gross tons, and 1,855 sailing vessels, of 293,978 gross tons. In 1897 the sailing vessels aggregated 334,104 gross tons; while there were 1,775 steamers aggregating 977,235 tons, and 101 barges of a total of 60,783 tons. In other words, while the number of vessels has changed but little since 1864—2,543 against 2,869—their total tonnage has increased from 438,095 to 1,372,122 gross tons.

In regard to freight rates, the tendency has been steadily downward. This is shown in a general summary of results, from 1887 to 1896, inclusive, which is condensed as follows:

General Summary of Freight Business from 1887 to 1896, Inclusive.

Season.	Total, ton-mile.	Total cost, transportation.	Cost per ton-mile, mills.	Average distance carried, miles.	Value of craft— American.	Value of craft— Canadian.	Carried by Canadian vessels, %.
1887............	4,458,544,804	$10,075,153	2.3	811.4	$17,684,550	$2,089,400	7.0
1890............	7,207,299,415	9,472,215	1.3	797.2	27,857,700	1,777,800	3.5
1895............	12,502,548,892	14,238,758	1.14	830.0	40,858,800	2,037,000	3.75
1896............	13,582,641,886	13,511,615	.99	836.4	43,006,200	2,135,300	4.0

The total estimated value of freight passing through the St. Mary's Canal alone has increased from $79,031,757 in 1887, to $195,146,842 in 1896. In this time the bulk of freight passing the same waterway rose from 5,494,649 net tons to 16,239,061 in 1896, and to 18,982,755 net tons in 1897.

The report enters largely into the flour and grain traffic; but while this is very important, the iron ore industry, as affecting lake transportation, is more generally interesting. The enormous amount of ore annually transported first arrests attention. In the navigation season of 1897, 10,633,715 net tons, out of a total of 18,982,755 tons passing through the St. Mary's Canal, were iron ore; and for the same year the total shipments of iron ore by lake from all the lake ports aggregated 13,681,522 tons. This means that approximately two-thirds of all the iron ore consumed by the blast furnaces of the country passes over the waters of the lakes in its way from the mines to the furnaces. The excellent quality of the Lake Superior ore and the cheapness of its extraction has made this change in the sources of iron ore supply in 15 years. In mining, the steam shovel is largely used to dig it and load it onto cars. During one day, in 1896, three steam shovels, working 14 hours each, dug and raised 10,700 gross tons, or 428 car loads of ore, from the Oliver mine, of the Mesabi range. Cars holding 25 tons each are being continually loaded from the ore-bed at the rate of 2½ minutes per car; and the largest shovel has loaded as much as 5,825 tons, or 233 cars, in 10 hours. This shovel weighs 90 tons, has a hoisting capacity of 200 HP., and is equipped with a 2½-cu. yd dipper and loads 5 to 6 tons at each swing. The estimated average cost of loading ore into the cars from the bed of the mine is considerably less than 5 cts. per ton. The cost of stripping the mine averages about the same; so that the aggregate cost of mining may be placed at less than 10 cts. per gross ton.

The cars used are especially designed for this ore traffic, and the expensive terminals are solely planned with a view to cheap handling of the ore. At some of these shipping ports the docks are built as high as 57.6 ft. above the water; and the ore-trains run upon them, dump the ore into pockets holding from 65 to 186 tons each, and from these pockets iron chutes lead directly to the holds of the vessels brought alongside the dock. Very little manual labor is required in this loading; though the ore has to be trimmed in the hold of the vessel at a cost of 2½ cts. per ton. The ore-receiving docks are similarly equipped with labor-saving devices. The chief item is the cost of shoveling the ore in the holds of vessels into the buckets; this charge amounts to 9 cts. per ton, and to this is added a dock charge of 5 cts., making 14 cts. per gross ton for the total expense of discharging iron ore. This ore, once in the buckets, is raised from the hold, carried back 350 ft. on the dock, and dumped, at a total cost of from 1 to 1½ cts. per ton, including labor, depreciation of plant, interest and fuel. Most of the ore is now loaded directly into cars and carried to furnaces located from 60 to 475 miles from the Lake Erie ports.

These improved loading and receiving docks are also partially responsible for the low transportation rates on the lakes; for instead of a vessel losing days in taking on and discharging cargo, this work is now done in a few hours. With the finely comminuted ores of the Mesabi ranges, which do not run so rapidly down the chutes as the hard and lumpy ores, 2,500 tons of ore can be put aboard a vessel in 70 minutes. At Two Harbors, 3,028 tons of hard ore were loaded in 70 minutes; and vessels frequently load and depart with a cargo of 3,500 to 4,000 tons within two hours of the time they reach port. With the appliances now in use for unloading, at the best docks, the largest vessels are unloaded in from 12 to 14 hours. At the new dock at Conneaut, O., to be operated in connection with the Bessemer Steamship Co. and the Pittsburg, Bessemer & Lake Erie Ry., it is expected that the largest vessels will be regularly unloaded in 10 hours; and it is hoped that in all but special cases this time will be reduced to 7 hours. The new plant is equipped with 12 "legs," one over each hatch in the vessel; and with all legs at work the capacity of the plant will be 900 to 1,000 tons per hour; or 7 hours for unloading a 6,000-ton ship. Owing to this perfection of transportation facilities, during the navigation season of 1896, large quantities of ore were carried from the head of Lake Superior to the lower lake ports, a distance of 889 miles, for 60 cts. per gross ton, or the equivalent of a ton-mile charge of only 0.67 mill. This low rate was even reduced to 50 cts. per ton, for some weeks in 1897, or a ton-mile rate of 0.56 mill. During the early spring of 1895, red hematite ore of Bessemer quality was delivered at Cleveland for $2.80 per ton; in the summer and autumn of 1896, the price of this ore varied from $4.00 to $4.25, and in 1897 it was as low as $2.00 to $2.50. The influence of low rates is shown by the fact that if the lake rate per ton-mile were 3 mills, which may be taken as the lowest rate that a railway could afford, the transportation charge from Duluth to Cleveland would be $2.54 per ton, or more than the traffic could bear. A table of the ore-shipping docks on the Great Lakes shows that the length of dock, in one case, is as much as 2,304 ft., with a width of 52 ft.; this dock, that of the Duluth, Missabi & Northern Railway, at Duluth, is 53 ft. 8½ ins. above the water, has 384 pockets, and an ore capacity of 57,600 tons. There are 21 of these docks on Lakes Superior and Michigan.

The coal traffic on the Lakes is important as furnishing the great bulk of the west-bound traffic; about 9,000,000 tons being shipped from the ports of Lakes Erie and Ontario in 1896. This trade from Buffalo, in 1873, amounted to only 570,443 tons, while that port shipped 2,400,068 tons of anthracite coal in 1896. The bituminous coal comes mainly from Cleveland, nearly 2,000,000 tons being shipped from that port in 1896. The chief western distributing points are Chicago, Milwaukee, Duluth and Superior, in the order named, but with Chicago handling two-thirds of the total. As with iron-ore, the handling of coal made necessary the development of facilities. The anthracite coal is usually loaded from pockets, and 5,127 net tons of this coal were lately put aboard the "Zenith City," at Buffalo, in 4 hours. In the loading of soft coal, however, very great innovations have been made. Until recently soft coal was shoveled, at a great cost, from cars to buckets, and then swung onto the ships by derricks; the loading is now done at the best docks by car-dumping machines, one of which, at Cleveland, loaded into a ship 5,176 tons of coal in 10 h. 30 m., at a total cost of $13, or ¼ ct. per ton. Coal is now generally unloaded by the self-filling clam-shell, or grab-bucket. In the best type a speed of three trips per minute is guaranteed, with an average load of one gross ton; it is also guaranteed that the total cost of removing cargo and delivering it in the yard shall not exceed 5 cts. per ton for the entire cargo. At one of the Milwaukee yards, two vessels, whose cargoes aggregated 7,776 tons, commenced discharging at 8 a. m. and were ready to leave at 8 p. m. For handling soft coal, a special form of "grate" has been devised. Coal rates are exceedingly low, owing to the scarcity of west-bound freight. The average of daily rates for 1896 was 24 cts. per net ton, from Buffalo to Duluth, or about ¼ mill per ton-mile.

Owing to the enormous drafts made during half a century upon the forests of Michigan, Wisconsin and Minnesota, the once seemingly inexhaustible timber supply of these regions is failing, and the lumber business on the lakes is waning. The lake shipment of lumber, from Saginaw River points alone, has steadily fallen from nearly 660 million feet, in 1885, to less than 90 million feet in 1897.

ANNUAL CONVENTION OF THE LEAGUE OF AMERICAN MUNICIPALITIES.

The second annual meeting of this association was held at Detroit, Mich., Aug. 1 to 4, and there was a very large attendance. The association is composed of cities, as corporations, which send numerous delegates and representatives. The attendance, therefore, included mayors, aldermen, public officers and a certain proportion of "politicians." In all, about 1,500 delegates were present, and the meetings were well attended. Owing to some hitch in the arrangements and the fact that the printed programs omitted to say where the meetings were to be held, the morning session of Aug. 1 was practically omitted, and the first regular session was called to order about 2.30 p. m. by the President, Mr. John MacVicar, Mayor of Des Moines, Ia.

Rev. C. L. Arnold opened the proceedings with prayer, after which the report of the Secretary was presented. In this it was stated that most of the work of the year had been in the direction of increasing the membership, and that in spite of certain interested antagonism, 72 cities are now members of the league. One of the most important departments is the bureau of information, which has issued three bulletins and answered 300 special enquiries, while a library of several hundred volumes has been collected. The report stated that, contrary to the requirements of the constitution, the Secretary had expended a large proportion of the receipts, without formal sanction, but that this had been necessary under the conditions. The receipts were $2,280, of which $590 was turned over to the Treasurer. The report of the Treasurer was then presented, and showed receipts of $590 and expenditures of $586.

Hon. H. S. Pingree, Governor of the State of Michigan, then delivered a short address of welcome, in which he pointed out that one of the most difficult and most important problems in municipal government is that of inducing the so-called "best citizens" to be something more than fault finders. He also favored trips by city officials to inspect the work and methods of other cities, and in this he is no doubt right, provided that these trips are not the mere junketing outings of aldermanic bodies and others which are somewhat too common, and are simply a means of wasting city funds.

The subject of "Garbage Disposal" was then opened by Mr. F. A. Walker, President of the Council of Trenton,

N. J., who prefaced his paper by the remark that it had purposely been made short, as he thought the best results of the convention would be obtained by an extensive discussion rather than by the presentation of the experience or opinions of one individual. He referred to the two systems of disposal by incineration and reduction, his own experience having been with the former, for the benefit of public health. At Trenton, a contractor is paid $6,000 per year for collecting and destroying the garbage (exclusive of night soil), the material being taken to a Dixon crematory, which has been in use for 2⅓ years, and has only cost $50 for repairs. It costs 30 cts. per ton for cremation alone. Night soil is carried five or six miles out by small contractors, who deal directly with the householders, while another contractor takes dead animals to a soap factory. Whatever system is used, should, in his opinion, be owned and operated by the city, as it is a matter of public necessity, and the collection should also be done by the city and not by contractors.

Mr. C. A. Collier, Mayor of Atlanta, Ga., said that all garbage, night soil, decayed fruit and vegetables, dead animals, etc., etc., is destroyed in a Dixon crematory four miles from the city. While this is thorough in operation, it is an expensive system, but nevertheless the city is quite satisfied, feeling justified in spending the money on behalf of the public health. The population is about 100,000, and the sanitary department expends $140,000 per year, which is considered money well spent.

Mr. F. B. Farnsworth, Mayor of New Haven, Conn., said that his city had an old-fashioned system of disposal which is not uncommon in the smaller cities. It lets contracts for the collection of garbage to men who have tracts of land and raise hogs, and what is not eaten by the hogs serves to fertilize the ground. The garbage includes nothing but kitchen refuse. He thought this system to be "good enough." The great trouble is to get the collecting properly done, as good men will not stay at this sort of work. At Worcester, Mass., a similar system is in force, but is under the supervision of the Superintendent of the Poor Farm, all the wagons, horses, etc., being owned by the city. One man is hired for each team, and with him goes one of the inmates. The garbage is utilized on the farm, as manure and food for hogs.

Mr. L. P. Whelan, Chairman of Council of Richmond, Ind., said the system of collecting by contract was not satisfactory, and this work had, therefore, been put in charge of the Health Officer. Garbage, night soil and refuse of every kind is carted to an Engle crematory near the river bank, in the middle of the city, natural gas being used for fuel. He did not think it well to insist upon the use of metal cans, as in winter the stuff freezes in the cans, which are damaged by the men breaking it loose for dumping.

Mr. Smith, of Moline, Ill., stated that in that city the collection of garbage is done under the supervision of the City Marshal. Mr. Hart, of New Orleans, referred to the trouble over the garbage contracts in that city, which has been fully described in Engineering News.

Mr. W. C. Maybury, Mayor of Detroit, said that his city has made a three-year contract at $50,000 a year, for collecting the garbage and delivering it on cars, which carry it out 15 or 20 miles to a reduction plant. It has happened that the contractors have done their work faithfully and well, but in view of the probabilities of carelessness and the evil results to public health which might attend such carelessness, he thought the city ought to do the garbage collecting. He argued that this formed an important part of the city's work in performing its duty to the health of its citizens, and that the responsibility should not be shifted to a contractor.

The meeting then adjourned, and the members proceeded to view an exhibition of throwing fire streams from a water tower and from the fire-boat on the river.

In the evening Mr. James A. Lavery, of Poughkeepsie, President of the Labor Federation of the State of New York, delivered an address on "The Relation of Municipalities to Organized Labor."

On Tuesday morning, Aug. 2, there was a reception by the Board of Education at the new Central High School, after which the regular meeting was held, the first subject taken up being "Administration by Boards, Single-Headed Commissions or Council Committees." Mr. W. E. Young, Mayor of Akron, O., favored the second plan, with one man at the head of each department, for water supply, fire protection, charity, etc. Mr. F. V. Evans, Mayor of Birmingham, Ala., strongly approved of the third plan, taking the view that the people's representatives should themselves attend to the affairs of their municipal government, and not delegate their authority or responsibility to boards or commissions.

An address on "Municipal Liberty, or Local Self-Government," was then delivered by Prof. Frank Parsons, of the University of Kansas. He did not approve of municipal affairs being so much under the control of the state legislatures, but thought each city ought to be allowed to govern itself without such general regulation. The comprehensive scheme of government suggested by him included municipal ownership of municipal industries, the initiative and referendum, and woman suffrage.

The afternoon session was opened by a discussion on "The Regulation of Saloons," in which most of the speakers presented liberal ideas, and denounced many of the present systems of restrictive regulation. The subject of "Street Paving" was then taken up, and Mr. R. J. Saltsman, Mayor of Erie, Pa., stated that asphalt and brick are now mainly used, on a concrete foundation, which is found to be superior to rolled gravel. The cost of asphalt is now $1.83 per sq. yd., with a five years' guarantee. Tramps are put to work cleaning the streets. Prof. Bemis, of the Kansas Agricultural College, gave an address on municipal ownership for electric lighting plants, and presented arguments and figures in favor of this system.

In the evening there was an entertainment at Belle Isle Park.

At the morning meeting on Aug 3 there was a large attendance, and the first subject taken up was "The Remuneration to Cities for Franchise Rights In, Over and Under Public Streets and Alleys." There was but little discussion, however. One of the speakers spoke strongly in regard to the point that improvement in municipal affairs can be secured only by citizens taking an active part in such affairs and not leaving them to politicians, who are financially interested.

The subject of "Public Water Supplies" was then opened by an address by Mr. James K. McGuire, Mayor of Syracuse, N. Y. This address described the growth of the present water supply system of that city, which is taken from Lake Skaneateles and flows by gravity to the city. Under corporate ownership, the distribution system was extended only on those streets where a remunerative return was assured, but very much better results have been obtained during the eight years of municipal ownership. Credit was given to Mr. Wm. R. Hill, M. Am. Soc. C. E., Chief Engineer, for his work in connection with this system, and for the introduction of day labor and the eight-hour day, which systems have been in use since Jan. 1, 1896. Mr. George Hillyer, President of the Water Board of Atlanta, Ga., then described the water-works of that city, where the water is forced up 500 ft. from the Chattahoochee River to a reservoir holding 30 days' supply, or 185,000,000 gallons. He strongly advocated the use of reservoirs of 20 to 40 days' capacity, especially where the water has to be filtered, as it facilitates the work of filtration. The most important part of his address was that in relation to the use of meters, the adoption of this system having reduced the fuel consumption and the pumpage to an enormous extent, and the pressure is now sufficient for fire purposes. The city is paid for about 57% of the amount consumed, and the maximum water rate is 10 cts. per 1,000 gallons. The consumer pays for the meter, and the city puts it in and keeps it in order. He favored mechanical filtration, as used at Atlanta.

Mr. M. H. Levagood, Mayor of Elyria, O., then exhibited a sample of the water supply of Painesville, O. There is a sand beach on the lake, kept clean by the wash of the waves, and in this a trench 800 ft. long was dug and filed with clean, sharp sand. The water percolates into this trench and flows through it to a cistern or tank, from which is drawn the supply for 7,400 people. The system has been in use for some years, and has cost practically nothing for repairs.

After the roll-call by cities the meeting adjourned. In the afternoon there was a boat ride on the river.

The morning session of Aug. 4 was devoted to a consideration of "Municipal Ownership of Public Service Industries," all the speakers favoring such ownership. Mr. Samuel F. Jones, Mayor of Toledo, O., read an address in which he referred to the various enterprises conducted by the city of Glascow, and pointed out that while people at large are patriotic enough to sacrifice position, health and life in time of war, they are lacking in that peace patriotism which would lead them to some self-sacrifice in the interests of their cities and their fellow-citizens. Mr. F. G. Pierce, Mayor of Marshalltown, Ia., and Mr. J. A. Johnson, of Fargo, N. Dak., also delivered addresses, taking the same general view.

In the course of the lengthy and animated discussion, one member asked how cities could acquire enterprises for which franchises have already been granted, without enormous expenses, which must be met by special taxation, general taxation or bonds. In answer to this, a delegate from Elwood, Ind., said that as the water company in that city did not give good service and could not be induced to sell out, the city built its own plant, and with such successful results that it is now arranging to build an electric lighting plant, raising the money by a tax of 8 cts. per $100. Prof. Parsons, of Kansas, said that at Springfield, Ill., a local lighting company was found which charged $150 per arc lamp. Of this amount, $60 is for the cost of lighting, and the balance is for interest, etc., and a sinking fund, so that in a few years, when the original investment has been paid, the plant will revert to the city without any further change.

Mr. Greene, formerly Mayor of Binghamton, N. Y., said that it should be borne in mind that a water or lighting company is in a legitimate business, and should be dealt with fairly and on a business basis, not as a criminal. He thought that even municipal ownership would be a failure without the civil service system and the exclusion of party politics. He thought every municipality should report to the state legislature, and after some further discussion a resolution was adopted in favor of such a plan, with a uniform system of accounting, while the resolution also provided that corporations conducting municipal enterprises should be required to report in a similar way. Prof. Bemis thought that a state legislature ought to have power to authorize a municipality to exceed its limit of debt, provided that the issue of bonds is for an existing plant as an asset, but in such case the charges must be sufficient to pay the interest and also form a sinking fund. Such a system is already in force in Massachusetts.

The afternoon session differed materially from the previous part of the meeting, the "politician" element being more in evidence, and the character of the proceedings somewhat resembling those of a ward meeting. The first business was the presentation of a report by the auditing committee, censuring the Secretary somewhat sharply for unbusinesslike methods and for not complying with the requirements of the constitution in regard to the conduct of the financial affairs. After a long and hot discussion this report was adopted, as were certain amendments to the constitution, by which the powers of the secretary are materially curtailed.

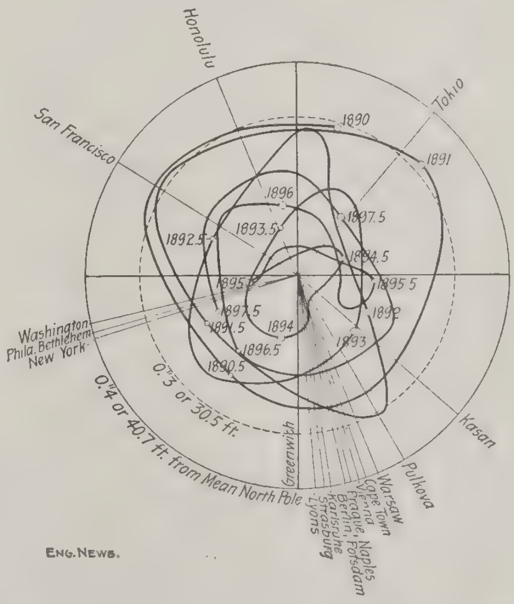
The election of officers resulted as follows: President, Samuel L. Black, Mayor of Columbus, O.; Vice-President, W. C. Maybury, Mayor of Detroit, Mich.; Treasurer, M. Taylor, Mayor of Bridgeport, Conn.; Secretary, B. F. Gilkison, New York city. It was also voted that the next meeting should be held at Syracuse, N. Y.

The exhibitors were few, and comprised the following firms: Dixon Garbage Crematory Co., Toledo, O.; Seagrave & Co., Columbus, O. (fire ladders and trucks); U. S. Voting Machine Co., Jamestown, N. Y.; International Street Sweeping Machine Co., Dayton, O.; Welsbach Light Co., New York, N. Y.; and the Atlas Cement Co., New York. The DeCarlie automatic compressed air catchbasin cleaner was also exhibited.

BOOK REVIEWS.

BERICHT UEBER DEN STAND DER ERFORSCHUNG DER BREITENVARIATION. (Report on the Status of the Investigations Concerning Variation of Latitude.)—By Th. Albrecht. Berlin: Georg Reimer. 1898. Quarto; pp. 36; 1 plate.

This report is one of the valuable publications of the International Geodetic Association, an association which has done much good work during the past twenty years in unifying the methods of geodesy and perfecting our knowledge regarding the shape and size of the earth. Dr. Albrecht here gives the results of the measurements on latitude variation made at twenty observatories in different parts of the world, determines their relative precision, and combines them so as to deduce a curve showing the motion of the north pole of the earth's axis from Jan. 1, 1890, to July 1, 1897. In the following figure this curve is shown, 90.0 being the point for Jan. 1, 1890, while 90.5 is the point for July 1, 1890, and so on. The center of the figure is the mean position of the north pole for the 7½ years under consideration. In 1890 the pole made about seven-eighths of a circuit around its mean position; in 1891, but little more than three-fourths of a circuit, while in 1892 nearly the entire revolution was effected. The two circles drawn at 0.3 and 0.4 seconds of latitude from the mean pole give the scale of the figure, the radii of these circles being 30.5 and 40.7 ft., respectively. It should be noted that the north pole, which may be defined as the north end of the earth's axis, does not really move, since the axis remains parallel to itself throughout the year, but it is the earth which moves with respect to the axis; it is more convenient, however, to speak of the pole as in motion and the figure shows its path relative to the earth surface.



Positions of the North Pole, Jan., 1890, to July, 1897.

The practical consequence of this strange phenomenon is to cause a continual variation in the observed latitudes of all points of the earth's surface, for latitude expresses the angular distance from a point to the equator, and of course the equator moves with the pole, the plane of the equator being always perpendicular to the axis. For example, suppose that a certain point in our office had the latitude 40° 42′ 58.93″ on Jan. 1, 1891; if observations had been taken throughout the year it would have been found that this slowly decreased until in August it became about 40° 42′ 58.41″, and that an increase then followed until at the beginning of 1892 the observed latitude became about 40° 42′ 58.67″. It is thus seen that decimals of a second in astronomical latitudes do not have the precision which was formerly attributed to them.

The lines radiating from the center of the figure show the directions to the cities whose observatories furnished the data for deriving the curve. Of course, all these directions are south. The large number of observatories taking part in the work indicates the importance of the subject to astronomers and geodesists. The observations at Honolulu were conducted simultaneously by the International Association and by the U. S. Coast and Geodetic Survey from June, 1891, to July, 1892; simultaneously others were made by the Naval Observatory at Washington and by the Coast Survey at Rockville, Md. Those at New York were made at the observatory of Columbia University in 1893 and 1894. The most extensive series made in the United States is that conducted by Prof. C. L. Doolittle at the observatory of Lehigh University, in Bethlehem, Pa., which covers nearly four years. All these observations of latitude are made by the zenith telescope method. The curve given in the figure is the most probable one, derived by Dr. Albrecht from a discussion of all the records, and its degree of precision may be inferred from his conclusion that the probable error of location of a point of the curve is about 0.03″ of arc, which corresponds closely to 3 ft. in distance.

Dr. Albrecht does not discuss the theory of the motion of the pole or give the equation of its path. We understand, however, that this has been done through the analysis of Prof. Chandler, of Harvard University. It is established that the pole makes a circuit around a certain center in 428 days, and that this center at the same time makes a circuit around the mean position in 365 days. The combined effect of these two motions is to cause the period of rotation to vary between 422 and 434 days and the distance of the actual from the mean pole to range from 16 to 36 ft. Whether this theory explains fully the curious path of the pole in 1895, when the motion appears to be reversed in direction, we are unable to state.

THEORY AND CALCULATION OF CANTILEVER BRIDGES.—By R. M. Wilcox, Ph. B., Instructor in Civil Engineering, Lehigh University. New York: D. Van Nostrand Co. Pasteboard; 3¾ × 9 ins.; pp. 108; illustrated; 50 cts.

This volume is published to replace the original No. 25, "Theory and Calculation of Continuous Bridges," by Prof. Mansfield Merriman, of "Van Nostrand's Science Series." The change of name and scope of the volume was considered advisable from the fact that the continuous girder has gone entirely out of use, except for swing bridges, and the cantilever bridge has taken its place. The book is divided into three chapters, the first of which is a brief history of cantilever bridge building, with short references to the larger structures of this type constructed in Europe and America. Chapter II. treats of the theory of the cantilever and the calculation of of strains under the conditions of loading common in highway structures, and Chapter III. is devoted to a similar consideration of railway cantilever bridges. The book is clearly written and provides a very handy little treatise on the subject which it covers.

HOW TO BUILD FIREPROOF AND SLOW-BURNING.—By Francis C. Moore, President of the Continental Fire Insurance Co. Author of "How to Build a House, etc." Continental Print, New York. Pamph.; 5¼ × 8¼ ins.; pp. 74, + 20. 10 cts.

Mr. Moore is the representative of the New York Board of Fire Underwriters, on the Board of Examiners of the Building Department of New York city. His pamphlet contains many interesting and valuable hints in regard to fireproof and slow-burning construction, together with a considerable number of statements which are based on insufficient information and are calculated to do harm rather than good. We commented editorially in our issue of June 30 on Mr. Moore's defence of cast-iron columns, and need only say here that he continues to advocate them in this book. He also betrays his well-known prejudices against concrete floor constructions, steel rivets, which he declares "are dangerous and should never be used, unless of a very superior quality," and curtain walls. He seems to think that the curtain wall as ordinarily used with steel skeleton construction is not thick enough to confine the heat in case fire occurs and prevent the ignition of adjacent buildings; but he gives no facts in support of this view, and we believe he would find it difficult to do so.

When Mr. Moore turns to matters more strictly in the field of fire protection, however, he lays down some sound principles, and his little book may be profitably studied by any engineer who will be careful to distinguish what is really sound and valuable from that which is based on prejudice and misinformation. Some of his suggestions, such as that of a glass floor for dynamo rooms, are novel and interesting.

WORKINGMEN'S INSURANCE.—By William Franklin Willoughby, United States Department of Labor. New York: Thomas Y. Crowell & Co. Cloth; 5½ × 8 ins.; pp. 386; tables; $1.75.

That this book might prove of great practical interest and value to some of our readers will be evident when it is stated that acording to its author workingmen's insurance abroad has developed very largely from the unsatisfactory working of laws relating to employers' liability. Such laws have proved inadequate for modern industrial conditions, both in the opinion of many employers of labor, of the laborers, and of legislators. Mr. Willoughby describes clearly and concisely what has been accomplished in the way of workingmen's insurance both in European countries and the United States. Both voluntary and compulsory insurance have been tried abroad, the former most notably in Germany. Some of the countries which neither make insurance compulsory nor provide it by governmental agencies have done much in the way of regulating private voluntary insurance. In the United States most of the attempts at workingmen's insurance described by the author are railway relief associations. Some space is also given to trade associations. The kinds of insurance described in this book are accident, sickness, old age and invalidity, and to a less extent life insurance proper. A few pages are devoted to insurance against lack of employment. One of the best chapters in the book is a critical discussion of the whole subject presented in the form of conclusions. Strange to say, the volume is without an index, a serious omission.

PROGRESS IN TIMBER PHYSICS.—Influence of Size on Test Results, and Distribution of Moisture. Circular No. 18, U. S. Department of Agriculture, Division of Forestry. B. E. Fernow, Chief of Division. Paper; 11½ × 9¼ ins.; pp. 20; diagrams.

This circular gives the detailed results of experiments conducted by Prof. J. B. Johnson, of Washington University, and Mr. S. T. Neely, C. E., under the heads indicated in the title. The most important conclusions may be stated briefly as follows:

1. A difference in strength values derived from a few specimens of the same kind of wood, up to 10% for coniferous wood and to 15% for hard woods, cannot be considered a difference of practical importance; such differences cannot be relied upon as furnishing a criterion of the quality of the material. 2. The size of the test piece does not in itself influence strength values (except in compression endwise when the size is less than a cube). 3. Small test pieces judiciously selected furnish a better statement of average values of a species than tests on large beams and columns in small numbers. 4. A large series of tests on small pieces will give practically the same result as such a series on large beams and columns, hence there is no need of finding a coefficient with which to relate the results of the former to construction members. 5. The influence of moisture on strength appears even greater than the former tests and statements from this division have indicated. The most important discovery of all, worked out by Mr. S. T. Neely, may be stated as follows: The strength of beams at elastic limit is equal to the strength of the material in compression, and the strength of beams at rupture can, it appears, be directly calculated from the compression strength; the relation of compression strength to the breaking load of a beam is capable of mathematical expression.

PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—Forty-sixth Meeting, held at Detroit, Mich., August, 1897. Published by the Permanent Secretary. Salem, Mass. 8vo.; paper; 80, 499.

This volume contains, in addition to a list of officers, members and fellows, the Constitution of the Association, very brief abstracts of some of the scientific papers read at the Detroit meeting, and titles of the others, the addresses of the several vice-presidents of the Association before their respective sections, and the address of the retiring president, Dr. Theodore Gill. The latter was a memorial address on the life and work of Edward Drinker Cope, the distinguished naturalist, who had been elected to preside at the Detroit meeting, but who died a few months before. The titles of the addresses of the vice-presidents before the several sections are as follows: Section A—Mathematics and Astronomy. W. W. Beaman: "A Chapter in the History of Mathematics." Section B—Physics. Carl Barus: "Long-Range Temperature and Pressure Variables in Physics." Section C—Chemistry. William P. Mason: "Expert Testimony." Section D—Mechanical Science and Engineering. John Galbraith: "The Groundwork of Dynamics." Section E—Geology and Geography. I. C. White: "The Pittsburg Coal Bed." Section F—Zoology. L. O. Howard: "The Spread of Land Species by the Agency of Man; with Especial Reference to Insects." Section G—Botany. George F. Atkinson: "Experimental Morphology." Section H—Authropology. W. J. McGee: "The Science of Humanity." Section I—Social and Economic Science. Richard T. Colburn: "Improvident Civilization."

It may be of interest to note the relative space given in this volume to the proceedings of the several sections, as follows: A—Mathematics and Astronomy, 62 pages. B—Physics, 30 pages. C—Chemistry, 27 pages. D—Mechanical Science and Engineering, 25 pages. E—Geology and Geography, 24 pages. F—Zoology, 38 pages. G—Botany, 44 pages. H—Authropology, 102 pages. I—Social and Economic Science, 68 pages. Some of the statistics of the Association are also instructive. Its jubilee of the 50th anniversary will be held in Boston this year. The membership in 1897 was 1,610, the lowest figure since 1880. In 1883 the membership was 2,033, and from that date until 1896 it fluctuated between 2,054 (in 1891) and 1,802 (in 1896). The attendance at the Detroit meeting was 283, the lowest figure since 1879, when it was 256. There is abundant evidence in these figures that the Association is not filling the place that it should. In fact, for many years it has shown symptoms of decay. One cause, no doubt, is the wretched system of publication of its proceedings, of which this volume is one of the worst examples. Few of the addresses, which occupy the greater bulk of the volume, are of any permanent importance, and the rest of the book is scarcely worth garret-room. The society is about entering on a new regime, however. It has organized a committee on "Policy of the Association," which is expected to devise ways and means not only of preventing the death of the Association, but of infusing into it new life and making it creditable to American science and scientific men.

THE MINERAL INDUSTRY.—Its Statistics, Technology and Trade in the United States and Other Countries to the End of 1897.—Edited by Richard P. Rothwell, Editor of the "Engineering and Mining Journal." Vol. VI., supplementing volumes I. to V. The Scientific Publishing Co., New York and London. 8vo.; cloth; pp. 903; $5.

The sixth annual volume of "Mineral Industry" is a worthy companion of its five predecessors. It resembles them in being a most extensive collection of the statistics of about 100 different mineral substances, with brief statements concerning the location of their principal sources of supply, the history, the business prospects and the mineral and metallurgical development of each branch of the industry. It contains also a great number of articles on special subjects related to the mining industry, written by specialists in these subjects. We give the titles and the names of the writers of some of the principal writers below:

"Calcium Carbide and Acetylene," by Alfred H. Cowles; "The Manufacture of Hydraulic Cement in the United States," by Frederick H. Lewis; "Progress in Electro-Chemistry in 1897," by H. Borns; "Clay Ballast—Its Methods of Manufacture and Cost," by H. Foster Bain; "The By-Product Coke Oven," by W. H. Blauvelt; "Cyaniding Telluride Ores," by Philip Argall; "Gold Mining in South Africa,' by E. D. Chester; "The Quicksilver Industry of Italy," by Vincente Spirek; "The Rare Elements," by L. M. Dennis; "Slate," by H. L. J. Warren; "Tunnel Rights Under the United States Mining Law," by R. W. Raymond; "Progress in Ore Dressing in 1897," by Robert H. Richards; "Fatal Accidents in Coal Mining in the United States and Canada," by Frederick L. Hoffman.

The volume contains a very complete index, containing, it is said, over 16,000 titles. We are informed that "Mineral Industry" was recently awarded a gold medal by the French De La Societe D'Encouragement Pour L'Industrie Nationale in testimony of the service which it is considered to have rendered in the promotion of industry in France.

DIRECTORY TO THE IRON AND STEEL WORKS OF THE UNITED STATES.—Embracing a Full List of all the Blast Furnaces, Rolling Mills, Steel Works, Rail Mills, Structural Mills, Plate and Sheet Mills, Tinplate Works, Steel-Casting Works, Wire-Rod and Wire Mills, Cut-Nail Works, Wire-Nail and Horse-Nail Works, Bolt, Nut and Rivet Works, Chain Works, Stamping Works, Bridgebuilding and Shipbuilding Works, Car-Axle, Car-Wheel and Carbuilding Works, Locomotive Works, Malleable Iron Works, Tube Works, Pipe Works, and Forges and Bloomaries. To which is added a complete list of the Iron and Steel Works of Canada and Mexico. 14th edition; corrected to April 1, 1898. The American Iron and Steel Association, 261 So. 4th St., Philadelphia. Cloth; 8vo.; pp. 380; $7.

The Directory of Iron and Steel Works is published every two years. The present edition is much larger and more complete than any of the earlier editions. The long sub-title above gives a general idea of its contents. The names and location of the works are given, arranged by geographical districts and alphabetically, followed usually by a description of their character, capacity and products, with the names of the principal officers. The iron and steel works of the country have a splendid organization for collecting statistical information, and the present directory is a credit both to Mr. Swank, the secretary and general manager of the Association, and to the whole American iron trade. We notice that two of the steel works, the Midvale and the Black Diamond, following their custom of previous years, have declined to furnish any information for the directory. Their action is odd, to say the least.

REGULARIZATION DU MOUVEMENT DANS LES MACHINES.—Par L. Lecornu. Ingenieur en Chef des Mines. (Encyclopedie Scientifique des Aide Memoire.) Gauthier-Villars et Fils, Paris. Paper; 4½ × 7½ ins.; pp. 217; 3 francs.

The theory of regulators of movement in machines, or governors, as they are usually called in English, is one of unusual difficulty to students. The present work may clear up some of the difficulties for those who can read French and who enjoy wrestling with equations in calculus. It is divided into two parts. The first treats of the theory of governors with indirect action, and is borrowed from the work of M. Leaute and put in accessible form. The second, or governors with direct action, is drawn from a memoir of M. Lecornu, for which he received the Fourveyron prize of the Academie of Sciences in 1895. The theory of governors, interesting in itself, leads to conclusions of practical value, for from it are formulated rules which should be followed by builders of machines in order to insure them a regular speed.

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AND
AMERICAN RAILWAY JOURNAL.

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THE TRIP OF THE BATTLESHIP "OREGON," from Puget Sound to Key West, is described from a steam engineer's point of view in a letter written by First Assistant Engineer C. N. Offley, U. S. N., in charge of the starboard engine-room of the "Oregon." From this interesting letter, as published in the New York "Sun," we learn of the extreme watchfulness with which all the machinery of this ship was overhauled and cared for on the memorable trip. He gives a summary of the runs and coal consumption, which supplements a table already published by the Navy Department. In the following record the time while entering and leaving port is eliminated, the run commencing when the ship was fairly under way; the coal record does not include that used while in port, but does include coal consumed for all purposes while at sea:

From	To	Distance, knots.	Time, hrs.	Speed, knts pr hr.	Coal, tons.	Knots per ton coal.
Bremerton	San Francisco.	827.7	72	11.49	221.0	3.74
San Francisco	Callao	4,076.5	371	10.99	962.0	4.24
Callao	Port Tamar	2,529.9	212	11.93	785.0	3.22
Port Tamar	Sandy Point	132.0	9	14.55	66.0	2.00
Sandy Point	Rio de Janeiro.	2,247.7	223	10.08	657.0	3.42
Rio de Janeiro	Bahia	700.0	*	*	288.0	....
Bahia	Barbadoes	2,229.0	193	11.55	620.0	3.59
Barbadoes	Jupiter	1,683.9	142	11.86	478.5	3.3
Jupiter	Key West	280.0	27	10.37	77.9	3.6
Total		14,706.7			4,155.4	

*Speeds variable; data unreliable.

◆

THE TEMPERATURE OF WARSHIPS, at least in the fireroom, is usually something abnormal, and the "Cincinnati," an armored cruiser, has registered as high as 205°F. under forced draft. In both this ship and the "Raleigh," now with Admiral Dewey, this terrific fireroom heat is charged to reduced boiler space, under English rules, which crowded machinery of a high nominal power into a small space. When these ships were built the Engineering Department demanded room to install the boilers properly, but as 15 ft. would thus have been added to the 300 ft. fixed for the ship's length, the request was refused. It is pointed out that the specifications for the new battleships tempt builders to utilize the space provided by crowding into it high-power machinery, which will lead to like results. This is another incentive for reopening the whole question of design for these new ships; and late experience in tropical regions should in itself tend to a more decided regard for the health and comfort of the men in the fireroom. This part of the ship should be made at least endurable for the men whose services are too often overlooked in counting up our heroes.

◆

THE ABSENCE OF HEAVY GUNS on the "Christobal Colon" in the Santiago fight is explained as follows by "La Tribuna di Roma:" The Spanish authorities refused to accept the two 254 mm. (about 10-in.) guns built at the Armstrong works at Pozzuoli for this ship, alleging defects in the sighting appliances. These were to have been replaced by two 9.6-in. Hontoria guns, but for some reasons which the Spanish naval authorities can alone explain, the "Colon" was sent to Cuban waters with guns of only about 5-in. caliber.

◆

AN INCREASE IN THE CIVIL ENGINEER CORPS, U. S. N., is asked for by Commodore Endicott, Chief of the Bureau of Yards and Docks. At the present time this corps numbers 15 officers in all grades, and of this number, Mr. R. E. Peary is on leave in connection with his Arctic work. Messrs. A. G. Menocal and U. S. G. White are suspended from duty, and one or more others are on sick leave. This reduction in the active list especially embarrasses the service at this time, and the Chief of Bureau asks that the corps be permanently enlarged to 20 officers. As at present constituted, this corps includes one officer with relative rank of Captain, U. S. N.; two with the relative rank of Commander, one of whom, Mr. M. T. Endicott, is now Chief of Bureau, and ranks as a Commodore; three officers ranking as Lieut.-Commanders; four ranking with Lieutenants, and six ranking relatively with Lieutenants of the junior grade.

◆

THE PLANS FOR RAISING the "Christobal Colon" are progressing under Naval Constructor Hobson. He has lately been experimenting with large rubber bags, or collapseable caissons. It is proposed that each of these shall have a lifting capacity of ten tons, and that they shall be lashed in place and inflated when sunk. The experiments being made at New York are to determine the strength and power of the bags and the efficiency of the air-valves.

◆

HIGHER SPEEDS IN THE NEW BATTLESHIPS, "Maine," "Missouri" and "Ohio," are promised by at least five prospective bidders, in communications to Secretary of the Navy Long. These shipbuilders include the Cramps, of Philadelphia, the Newport News Co., the Union Iron Works, of San Francisco, John A. Dialogue & Co., of Camden, N. J., and the Harlan & Hollingsworth Co., of Wilmington, Del. These firms propose to submit their own designs for hull and machinery, subject to the approval of Chief Naval Constructor Hichborn and Engineer in Chief Mellville. They provide that should these plans be satisfactory and speed greater than 16 knots be assured, the contract will be made with the successful firm.

◆

A CLOUD-BURST occurred on Aug. 13 about 20 miles from Rogersville, Tenn., in which 17 persons were killed and several others injured.

◆

A RAILWAY ACCIDENT near Genoa, Italy, in which 9 persons were killed and 40 seriously injured, is reported to have occurred on Aug. 11. A heavy freight train drawn by three engines became stalled on a steep grade in the Glori Tunnel. The tunnel soon filled with gases from the engines, which asphyxiated the engine drivers and firemen, leaving the train to run backward and crash into a passenger train standing at the entrance of the tunnel.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Aug. 10 near Pennington, Va., on the Louisville & Nashville R. R., as the result of a landslide. Three coaches rolled down a 60-ft. embankment, injuring about 20 persons, one or two quite seriously.

◆

CHINESE RAILWAY AFFAIRS appear to be making some progress. A line is now under construction from Peking to Pao-ting-fu, 90 miles, and we learn that a Belgian company has closed an agreement with Director-General Sheng for the construction of a line from Pao-ting-fu to Hankow, a distance of about 600 miles. The railway from Shanghai to Woosung, 9½ miles, is expected to be opened for traffic about the end of August.

◆

THE PARIS EXHIBITION OF 1900 will have a very large representation from the United States, and thus far the space allotted to the various departments is given as follows by Mr. Ferdinand W. Peck, Commissioner-General for the United States:

	sq. ft.
Agriculture and food products	20,000
Army and navy	3,300
Chemical industries	5,160
Education, instruments, practical sciences and arts	11,470
Fine arts	(not yet known)
Forestry, hunting and fisheries	3,300
Heating apparatus	4,500
Horticulture	(not yet known)
Machinery and electricity	50,000
Manufactures	25,000
Mines and mining	7,700
Textiles	13,000
Transportation and civil engineering	20,000
Total	163,430

◆

THE FIRST AMERICAN LOCOMOTIVE for England has just been finished by the Baldwin Locomotive Works. It is a double-ender, intended to run between Barnstaple and Lynton, the latter place being a sea resort about 15 miles from Barnstaple.

◆

THE LARGEST FREIGHT TRAIN EVER HAULED left Altoona, Pa., on the Pennsylvania R. R., bound for Columbia, Pa., on Aug. 9. The train was made up of 130 coal cars and was 3,877 ft., or only a little less than ¾ of a mile long, and weighed, exclusive of engine and tender, 5,212 tons, of which 3,693 tons was coal. Engine No. 872, belonging to Giant 45 class, which weighs 118 tons, and is considered to be the largest in the world, hauled the train. The 132 miles from Altoona to Harrisburgh were covered in 12 hours; in other words, the train made an average speed of 11 miles per hour.

◆

TRACK ELEVATION IN CHICAGO has been carried on vigorously during the past two or three years, but at the end of 1897 less than half the work called for by existing ordinances had been completed. The following is an extract from the annual report of Mr. John O'Neill, Superintendent of Track Elevation:

Total track elevation provided for by ordinances	45.7 miles.
Total track elevation completed Dec. 31, 1897	19.0 miles.
Total track elevation to be effected	26.7 miles.
Total grade crossings abolished by ordinances	243
Total grade crossings eliminated Dec. 31, 1897	86
Total grade crossings to be eliminated	157
Cost of work provided for by ordinances	$16,130,000
Cost of work executed, Dec. 31, 1897	$6,050,000
Cost of work yet to be done	$10,080,000

During the present year considerable work has been done by the Chicago, Milwaukee & St. Paul Ry., the Pennsylvania Lines, and by the Atchison, Topeka & Santa Fe Ry. at the complicated 16th St. crossing (Eng. News, July 14, 1898). The following is a list of the track elevation ordinances passed up to the end of 1897:

May 3, 1892—Illinois Central R. R., 47th St. to 71st St.; 3 miles; 13 crossings; $2,000,000. Completed.

July 9, 1894—Chicago, Rock Island & Pacific Ry. and Lake Shore & Michigan Southern Ry., from 16th St. to 69th St. and 67th St. respectively; 8½ miles; 41 crossings; $3,000,000. Nearly completed.

Feb. 18, 1895—Chicago & Northwestern Ry. (Galena Division); Sacramento Ave. to 46th St.; 2½ miles; 6 crossings; $400,000. Completed.

March 30, 1896—Chicago & Northwestern Ry. (Milwaukee Division); Wrightwood Ave. to Rosehill cemetery; 4½ miles; 20 crossings; $900,000. Completed. (Wisconsin Division); Armitage Ave. to N. 44th Ave.; 4½ miles; 48 crossings; $1,000,000. Work done in 1898.

July 27, 1896—Pittsburg, Fort Wayne & Chicago Ry.; 55th St. to 67th St.; 2 miles; 13 crossings; $750,000. Work partly done.

Jan. 18, 1897—Pittsburg, Fort Wayne & Chicago Ry.; State St. to Laurence Ave.; 1 mile; 2 crossings; $150,000.—Lake Shore & Michigan Southern Ry.; 61st St. to Laurence Ave.; 2 miles; 2 crossings; $1,000,000. Work partly done.—Chicago & Northwestren Ry.; Rockwell St., from Kinzie St. to Ogden Ave.; 2 miles; 19 crossings; $1,000,000. Completed.

May 17, 1897—St. Charles Air Line at 16th St.; 3 miles; 8 crossings; $2,000,000. Work in progress.

Dec. 2, 1897—Chicago & Northwestern Ry. (Milwaukee Division); Chicago Ave. to Diversey Ave. and Wood St.; 3 miles; 27 crossings; $1,200,000.—Chicago, Milwaukee & St. Paul Ry. (over the C. & N. W. Ry.); Chicago River bridge to Paulina St.; 0.5 mile; 3 crossings; $100,000.—C. M. & St. P. Ry.; Irving Park Boulevard; 6 miles.—C., M. & St. P. Ry. (Pacific Junction Branch); 0.6 mile.

◆

A NEW WIRE ROD MILL of the most modern type is about to be built by Mr. William Garrett for King, Gilbert & Warner, at Columbus, O. The mill will use a 5-in. square billet, which is taken from the billet mill, after being sheared into lengths, to a heating furnace, where it is given a light wash heat, and then is delivered direct into the rod train. A letter from Mr. Garrett to the "Iron Trade Review" gives the reasons for locating the mill in Columbus, which is interesting in showing how the minor economies are being considered in modern steel works. We quote from it as follows:

> In the past, Messrs. King. Gilbert & Warner have shipped the major part of their production to wire rod mills in Cleveland, in the shape of 4-in. billets, which, after being rolled into rods, have been reshipped through Columbus, to a large wire mill in Cincinnati. Owing to the keen competition in 4-in. billets, this see-sawing in the transfer of freight could not be tolerated. The freight on the billets from Columbus to Cleveland is 65 cts. per ton, and the freight on rods from Cleveland to Cincinnati is $1.20 a ton, making $1.85 per ton. Had the wire rods been manufactured at Columbus, the freight from Columbus to Cincinnati, 55 cts. per ton, would be the only expenditure for transportation, showing a clear saving of $1.30 per ton in freight. There is a further saving of about 50 cts. per ton in the manufacture of wire rods, when taking the hot billet, which is rolled from the initial heat of the ingot, and rolling this billet before it is cold into wire rods, making a saving of $1.80 per ton in favor of making wire rods in Columbus.
>
> It may be said there are already too many wire rod mills in this country, which can now produce far more than we can at present consume. True; but are they correctly located to avoid this duplication of freight charges, and in such position relative to the steel mills as to take advantage of the initial heat of the ingot?
>
> The day is not far distant when no firm that makes pig iron can afford to let it leave the works until it has taken advantage of the initial heat of the metal in every stage of manufacture, to put it into a marketable shape, which is entirely feasible in the case of merchant steel and wire rods.

◆

THE POWER PLANT of the Hudson River Power Transmission Co. was started up on Aug. 9. This plant, it will be remembered, is situated about 18 miles from Schenectady, N. Y., and includes a concrete dam 2,000 ft. long and 18 ft. high, and a power-house which will eventually contain 28 250-HP. turbines driving 7 750-K-W. three-phase General Electric generators. At present only 5 generators are in place, and the current from these is transmitted to Schenectady, where it is used to operate a portion of the machinery of the General Electric Works.

ORNAMENTAL BRIDGES FOR LAKE PARK, MILWAUKEE, WIS.

We illustrate herewith a number of park bridges designed by Mr. Oscar Sanne, as Consulting Engineer for the Park Commissioners of Milwaukee, Wis., and erected in Lake Park of that city during the last few years. In designing these bridges Mr. Sanne was instructed to provide designs which should fulfil not only all engineering requirements, but should also be artistically worthy of the sites the bridges were to occupy. The several views of the completed structures which we publish will enable each reader to judge for himself in what measure Mr. Sanne has succeeded in securing these results. The photographs from which these views have been engraved were furnished us by Mr. Sanne, and from a paper read by the same gentleman at the meeting on July 6 of the Western Society of Engineers, we abstract the following brief description of the different structures.

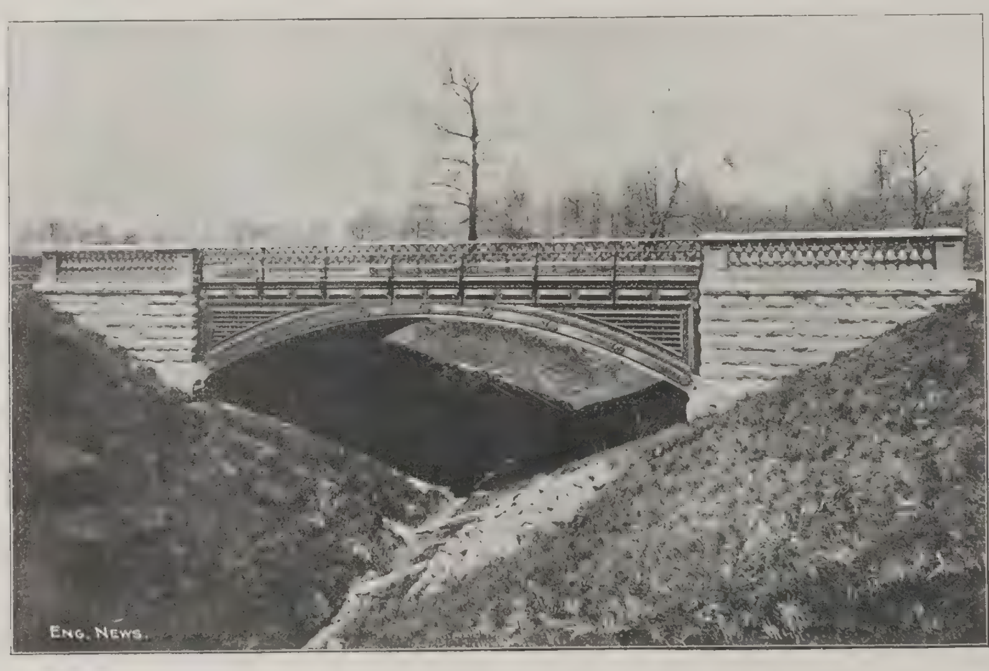

FIG. 2.—VIEW OF 50-FT. STEEL ARCH HIGHWAY BRIDGE, LAKE PARK, MILWAUKEE, WIS.

Fig. 1 is a side elevation of the smallest of the several structures, it being intended for pedestrians only. This bridge is composed of two 30-ft. and one 50-ft. plate girder deck spans. The girders are 30 ins. back to back of angles. This depth was considered the most effective one with regard to graceful appearance. The girders are placed 12 ft. 9 ins. c. to c., leaving a walk of 12 ft. clear width between railings. The bridge is supported by two bents of ornamental cast iron columns well braced. The abutments are of limestone masonry, with a hand railing of terra cotta on top of the coping. The cost of this structure was as follows:

Masonry and terra cotta railing	$1,398.45
Iron work	1,274.00
Total	$2,672.45

The second bridge shown (Fig. 2) is a 50-ft. steel arch, which carries the park driveway over a very picturesque ravine. It is composed of six 50-ft. steel arch ribs, with the front ribs shielded from view by a cast-iron ornamental cover. The four inner ribs are each composed of four 3 × 3½ × ⅜-in. angles, and one 18 ft. × 5-16-in. web plate, and the two outer ribs of four 3 × 3½ × 5-16-in. angles, and one 18 ft. × ¼-in. web plate. The ribs were calculated and constructed as arches with two hinges, and were figured for a live load of 100 lbs. per sq. ft. plus the dead load. The floor was figured for the same uniform live load, and in addition for a ten-ton road roller.

The roadway is 26 ft. wide resting on a floor support of I-beams and buckle plates; the roadway itself being composed of about 6 ins. of concrete, on top of which are laid 5-in. asphalt paving blocks. The sidewalks are 7 ft. wide, resting on I-beams, and are made of ⅜-in. cast-iron plates with diamond facing. The abutments are U-shaped, with very heavy buttresses for each arched rib. A terra cotta hand-railing is placed on the top of the coping. The cost of this bridge was as follows:

Masonry and terra cotta	$5,786.00
Iron work	4,265.65
Roadway floor and sidewalk	769.83
Total	$10,821.48

The third bridge, shown by Fig. 3, is a 35-ft. brick arch, which also spans a ravine. The ornamental parts of this arch were made of terra cotta, as well as the face stones of the arch proper. The arch is built of five rings of the best sewer brick, laid in Milwaukee cement. The faces of the spandrel and wing walls were laid with a very handsome brownish face brick. The sidewalks, 6 ft. wide, are made of concrete, and the roadway, 26 ft. wide, of macadam. An ornamental hand-railing of terra cotta surmounts the structure. The total cost of this bridge, which was let in one contract, was $10,449.

Bridges four and five were twin structures, and their general appearance is shown by Fig. 4. These bridges form the main entrance to Lake Park, and are located in the neighborhood of the most desirable and finest residence property in the city of Milwaukee. It was, therefore, natural that these structures should receive great care and attention in their design. After a careful investigation of the peculiarities of the location, with due consideration of economy and utility, it was decided that the most satisfactory solution of the problem would be the adoption of an arch bridge, with open spandrels, so as to obstruct the view over the lake as little as possible.

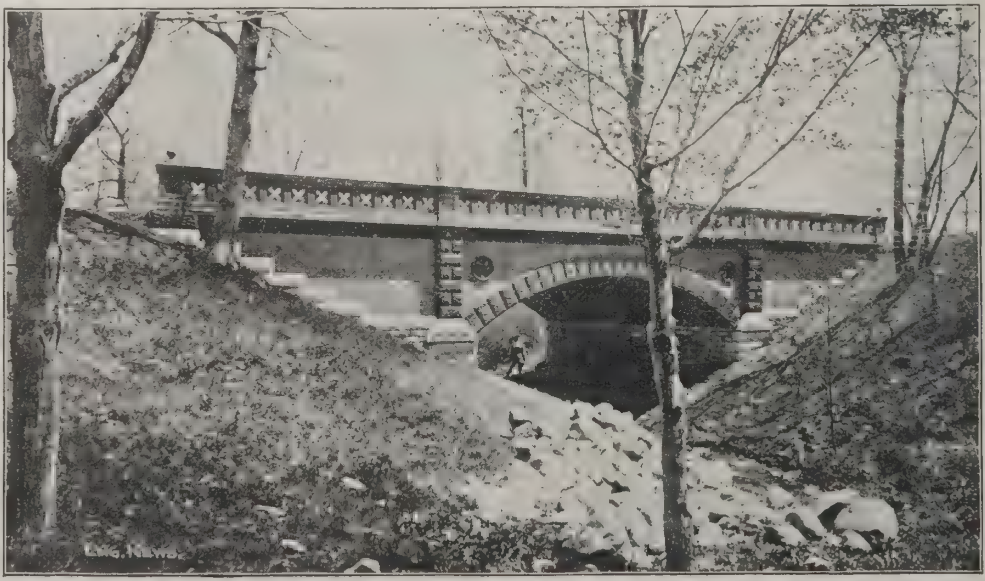

FIG. 3.—VIEW OF 35-FT. BRICK ARCH HIGHWAY BRIDGE, LAKE PARK, MILWAUKEE, WIS.

These bridges were started in September, 1896, but owing to some difficulty in getting the proper stones, the work was badly delayed and the stonework was not finished until the beginning of October, 1897. The foundations offered no particular difficulties, as the bottom consisted of a very solid clay ground upon which the footings could be laid directly. To get a better distribution of the load, however, a layer of 2 ins. of sand was put under the footing course. The allowed pressure at the ground was 2½ tons per sq. ft. The foundation course consisted of selected stones not less than 12 ins. thick, and the masonry above the foundation and below the surface of the ground was rubble. Above the surface of the ground ashlar masonry with rubble backing was used. Stretchers were not less than 18 ins. thick, and each course above the skewback was of the same thickness of 16 ins. Below the skewback the stones varied from 16 to 17 ins. in thickness. Practically all the stones had to be cut stones with 1 in. chisel draft. The walls were provided with weepholes well-filled with broken stones for the purpose of drainage, and the filling behind the walls was cinders.

The bridges were calculated as two-hinged arches for a uniform load of 100 lbs. per sq. ft. plus the dead load. The floor proper was designed to carry a concentrated load produced by a steam roller weighing about 16 tons. In the calculation of these arches the effect of temperatures was also considered. Neither lateral nor sway rods were used, but ⅜-in. gusset plates and cross struts were placed at each panel point. The posts were bolted to cast-iron shoes. The floor of the roadway and sidewalks is carried by I-beams, upon which rest buckle plates ¼-in. thick. The roadway was made of 4 ins. of the best Trinidad asphalt resting on a 4-in. layer of concrete. The sidewalks are of Atlas cement concrete.

The hand-railing is of steel and cast iron. Due allowance was made in this railing for contraction and expansion by putting the ends of the railing into a pocket chiseled into the stone railing for this purpose. The abutments were finished by a cornice 2 ft. deep, and on top of this was put a plain railing. These two parts were originally designed for terra cotta, but as the cornice and railing could be obtained in Bedford sandstone for about the same price as the lowest terra cotta bid, it was concluded to use the sandstone. On the top of the half octagon of the hand-railing is placed an ornamental lamp-post with five lights. The bridges are further ornamented by sculptured stone lions resting on heavy pedestals. The costs of these bridges were as follows:

Masonry, four abutments complete up to cornice	$14,977.64
Iron work, bridges proper, including iron hand-railing, buckled plates, lamp posts and guard rails	16,075.00
Stone railing and cornice	3,712.00
Asphalt floor for roadway, $2.50 per sq. yd.	1,177.56
Cement sidewalks, 14 cts. per sq. ft.	491.87
Electric and gas fixtures	138.90
Total	$36,572.97

THE WEST SUPERIOR COAL STORAGE PLANT OF THE LEHIGH VALLEY COAL CO.

By William R. Davis.[*]

(With two-page plate.)

A coal storage plant having several structural features of novelty and interest was built at West Superior, Wis., by the Lehigh Valley Coal Co., in the Fall and Winter of 1894-95. The plant consists of two steel buildings for anthracite, each 246 ft. in diameter, and 100 ft. high, and each with a capacity of 50,000 tons; a bituminous floor, with a capacity of 45,000 tons, and retail pockets for the local trade, Fig. 1. Bituminous coal cannot be piled to a greater height than 30 ft. in this plant—a precaution against spontaneous combustion—and is the only coal not stored under cover.

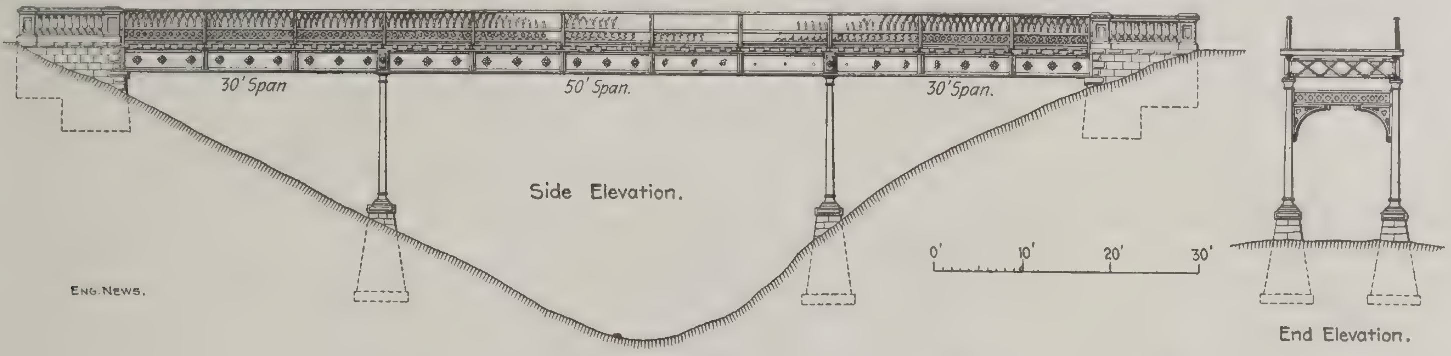

FIG. 1.—ORNAMENTAL PLATE GIRDER FOOT BRIDGE, LAKE PARK, MILWAUKEE, WIS.

The plant is located on Tower Bay Slip and through the local belt line railway has perfect shipping facilities. The wharf front consists of piling and cribwork. The original marshy ground on which the plant is built was filled in with sand, which was unloaded from scows by means of sand dredges. All foundations are supported on piles.

All coal is unloaded, put in storage and reloaded by machinery. Fig. 2 shows a sectional elevation of the anthracite plant. Coal from the company's mines in Pennsylvania, and loaded on boats at Buffalo, is delivered at the wharf in the open season from May to December. It is unloaded by automatic clam shell shovels of 2,000 lbs. capacity, furnished by the W. S. Bogle Co., of Chicago, and similar in most respects to those used in New York city. The towers carrying these shovels are of steel, 120 ft. high, and travel the full length of the wharf for use with either the anthracite or bituminous portions of the plant. The clam shell discharges into a hopper from whence the coal descends by gravity to the lower part of the ascending or trimmer trough. From this point it is handled by the Dodge system of endless chain conveyors. The trimmer trough has a movable bottom. Coal is first discharged through the open bottom at a point about 20 ft. inside the building, and the steel ribbon in the bottom is pulled ahead from time to time so that the coal will never fall more than a few inches.

The use of a steel roof compelled a novel departure in the form of the reloader. As usually constructed a single reloader lies between two piles of coal and operates into either at pleasure. In this plant the reloaders are pivoted at the center of each building (Fig. 3), and all coal is withdrawn through a cast-iron tunnel, below the floor. When the building is filled with coal the reloader is buried and lies directly over the axis of the tunnel. It is, of course, impossible to operate it then. The first coal, therefore, is removed through chutes suitably spaced along either side of the reloader, leading into the tunnel, after which the reloader is left uncovered and removes all that remains in the building. The coal discharged by either spouts or reloader into the tunnel is carried by a continuous chain conveyor extending along the tunnel and up an incline where it is passed through revolving screens into the pockets and loaded into the cars. The tunnel, which has an inside diameter of 7 ft., was cast with a body ⅞-in. thick, and ends 1¼ ins. thick. This has proved to be too light. It cracked in several places under full load, which is eccentric on account of an interior partition parallel and close to the axis of the tunnel. The cracks were patched and the tunnel braced immediately afterwards, however, and it has since given satisfactory results.

The Bogle Shovels have shown the following average capacity in anthracite for three shovels on a fair-sized cargo, from beginning to end of operation, viz.: For egg, 135 tons per hour; for stove, 165 tons per hour, and for chestnut, 185 tons per hour. The capacity of the anthracite plant has proved equal to that of the shovels. Each building can handle 185 tons per hour either into or out of storage when pushed.

The machinery for the entire plant, except that for the Bogle towers and the stationary engines, was furnished by the Link Belt Engineering Co., of Philadelphia, and the Link Belt Machinery Co., of Chicago, according to the designs of the Dodge Coal Storage Co., of Philadelphia, with Mr. Chas. Piez as chief engineer. The structural steel work was furnished by the Allentown Rolling Mills, of Allentown, Pa., with Mr. Frederick S. Guerber as chief engineer. The writer of this article was engaged on the design and was engineer of erection of the structural work. The erection of structural work and machinery was done by the Barnet & Record Co., of Minneapolis, Minn. The photographs by which this description is illustrated were taken by Mr. John A. Telner, Engineer of Erection for the Dodge Coal Storage Co.

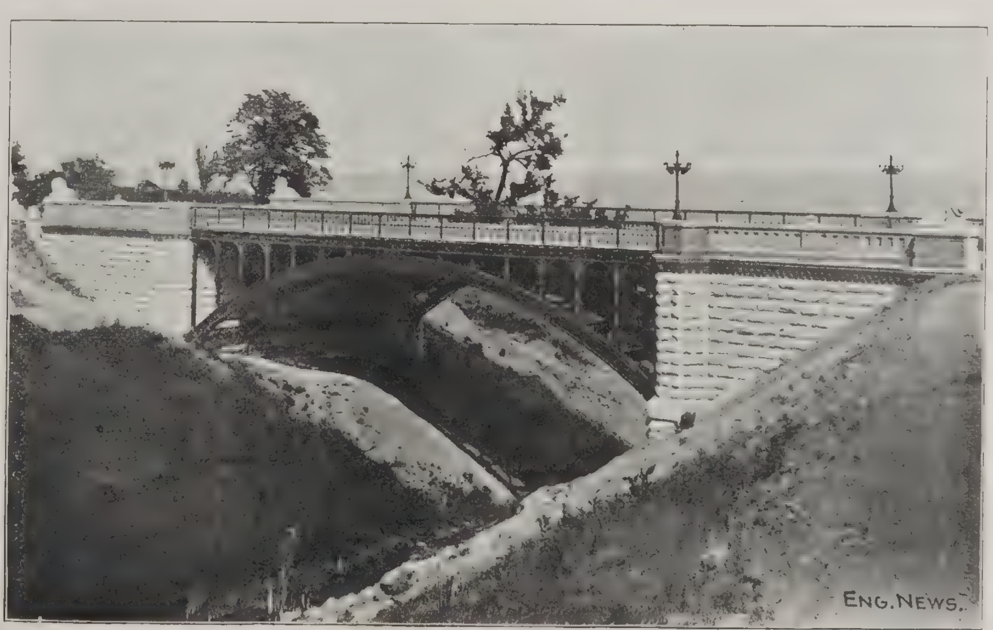

FIG. 4.—VIEW OF 87-FT. STEEL ARCH HIGHWAY BRIDGE, LAKE PARK, MILWAUKEE, WIS.
Oscar Sanne, Milwaukee, Wis., Designing Engineer.

Each building consists of 24 riveted trusses meeting at the center, which carry purlins covered with standard No. 22 corrugated iron. One truss, called the trimmer truss, and its opposite are made heavier and wider to carry the trimming conveyor and machinery, Fig. 4. The outer trusses were figured by graphic methods for the usual snow and wind loads under the different conditions of loading. It was required to design for safety with a view to rigid economy. To avoid the ambiguity attaching to the stresses when a central ring to which the trusses are riveted is used and secure a true three-hinged arch. There was designed a connection, believed to be novel and certainly original, which is shown by Fig. 5. It will be seen that the trusses are erected in four groups of six each. They are all alike until near the top pin, when a special "neck" brings the pins of each group to a level of its own. The plan in Fig. 6 shows how the two center trusses are straight and how the ends of the side trusses are bent. At the bend, cast-iron bearing blocks are used, as shown by the section in Fig. 6 to transmit the horizontal thrust from one side truss to the opposite one. The tongues and grooves are provided to prevent the possibility of undue distortion under excessive eccentric wind loads, and are used merely as an extra precaution.

Fig. 6 shows the working drawings of one group of necks. The others are similarly constructed. Separate pins are used for each pair of trusses, making three pins for each group, except the upper group, which contains the special trimmer trusses. In this case the truss narrows down to come on its bearing pin, but a stiffening member passes over the side trusses and down to two additional pins concentric with the other three (see Fig. 3), serving only to give added lateral stability to these trusses which were the first to be erected. The vertical space between the several groups was made as small as was consistent with freedom of erection. The thrust of the trusses is taken up by rods meeting in a heavy ring which lies outside the mouth of the tunnel and below the reloader.

In storage plants, as previously built in the east on the Dodge system, the coal had been heaped in piles which were perfect cones. In this plant, it was desired to save the outer space where the depth was small by using a retaining wall, as shown in Fig. 1, an arrangement which very much reduced the cost of the buildings.

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[*] 1455 Washington Ave., New York, N. Y.

Mr. James M. Dodge, President of the Dodge Coal Storage Co., proposed the method here described, and has patented it.

The wall consists of special corrugated iron, No. 16, or 1-16-in. in thickness, with a pitch of 5 ins., and corrugations 1 in. deep, manufactured by the Cincinnati Corrugating Co., of Piqua, Ohio. This is supported by 4-in. 7-lb. steel beams spaced 2 ft. 11 ins. apart between centers, and each anchored by two ¾-in. diameter rods, which are fastened to a steel plate 36 ins. × ¼-in., standing vertically in a solid ring, fully spliced with lap joints, and with a radius about 20 ft. less than that of the wall. The construction is fully shown by Figs. 7 and 8. The pressure on the wall was assumed to be that given by Trautwine (p. 686, art. 6; p. 689, Rem. 4). The following table is compiled by the Link Belt Engineering Co., from Trautwine's formulas, which are in reality those of Coulomb. The figures are based on 27° for the angle of repose, the true figure for large piles, and 52.1 lbs. per. cu. ft. for the weight of coal in smaller sizes. The writer does not wish to be understood as indorsing the theoretical correctness of the formulas:

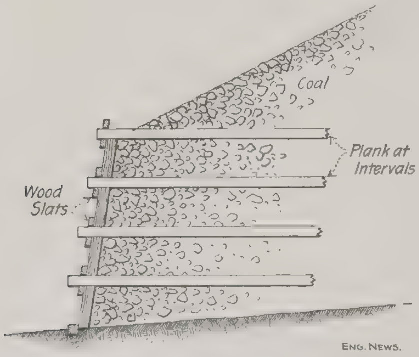


Fig. 10.—Sketch Showing Ordinary Method of Piling Coal.

Table Showing Pressure of Different Depths of Coal on Horizontal and Inclined Surfaces.

	Horizontal surface. Pressure		Sloping surface. Pressure.	
Depth, (d) in ft.	Total.	On lowest ft.	Total.	On lowest ft.
1	9.78	9.78	14.22	14.22
2	39.12	29.34	56.88	42.66
3	88.02	48.90	127.98	71.10
4	156.48	68.46	227.52	99.54
5	244.50	88.02	355.50	127.98
6	352.08	107.58	511.92	156.42
7	479.22	127.14	696.78	184.86
8	625.92	146.70	910.08	213.30
9	793.18	166.26	1,151.82	241.74
10	978.00	185.82	1,422.00	270.18
11	1,183.38	205.38	1,720.62	298.62
12	1,408.32	224.94	2,047.68	327.06
13	1,652.82	244.50	2,403.18	355.50
14	1,916.88	264.06	2,787.12	383.94
15	2,200.50	283.62	3,199.50	412.38
16	2,503.68	303.18	3,640.32	440.82
17	2,826.42	322.74	4,109.56	469.26
18	3,168.72	342.30	4,607.28	497.70
19	3,530.58	361.86	5,133.42	526.14
20	3,912.00	381.42	5,688.00	554.58

Note.—Surface horizontal: Total pressure for depth (d) = 9.78 d^2; pressure on lowest foot = 9.78 (2d — 1). Surface sloping, at angle of repose: Total pressure for depth (d) = 14.22 d^2; pressure on lowest foot = 14.22 (2d — 1).

The anchor rods were so spaced as to give nearly equal moments at the points of attachment and between. The working stresses were assumed to be 16,000 lbs. per sq. in. for both coal and wind loads. The horizontal wind pressure was assumed to be 30 lbs. per sq. ft. The only connection of the wall with the trusses was at the top of the beams, which merely rested against the strut at the hip, to take the wind reaction. It was thus intended to make it impossible that any of the coal pressure should be carried into the trusses, a precaution so that a failure of the wall might not involve a more serious failure. When storing coal, the band is first imbedded before any pressure comes on the wall, and, as shown in Fig. 1, the anchor band is well within the conical portion of the pile which gives no pressure to the wall. The reader will notice the similarity between this method and that long in use in which the wall is built of planks anchored by other planks running back into the face of the pile, as shown in Fig. 10. When the anchor band was erected it swung lightly upon the ¾-in. anchor rods without other support. To avoid undue strains from the weight of the coal, legs were provided about 8 ft. apart resting upon steel plates on a wooden sill, pivoted to swing clear for the reloader. This wall and the rest of the structural work has been entirely satisfactory, and no weak points have developed after three winters' service.

THE SHEARING STRENGTH OF RIVET STEEL.*

Five years ago the use of steel for rivets in high-grade boilers, stand-pipes and structures was considered doubtful practice by many engineers, and wrought iron rivets were used long after wrought iron plates had been displaced by steel. Steel rivet material of that day was unreliable and lacked the toughness and uniformity which is essential for standing the abuse of ordinary riveting operations. Improvements in manufacture have produced a steel rivet bar, which for toughness, uniformity and reliability, in fact for everything except the range of temperature allowable in riveting, is the equal of the best iron rivet.

Present practice in designing joints uses values of the shearing strength of steel based upon experiments made several years ago. The data frequently quoted are from experiments made in England by Prof. A. B. W. Kennedy in 1885. The shearing strength of these steels varied from 67 to 83% of the tensile strength. From these and other tests on the earlier structural steels, the ratio of the shearing strength of rivet steel to its tensile strength has been assumed to be 80%, and the ratio of this shearing strength to the tensile strength of the plate used in the joint, 75 to 83%.

As a contribution to the knowledge of this subject, the results of a series of tests made in the Laboratory of Applied Mechanics of the University of Illinois are presented. The tests first described were made by the different class divisions as regular laboratory work, and the later tests directly by Mr. C. V. Seastone, assistant in the Laboratory of Applied Mechanics. Three sizes of four varieties of rivet material were used, and tests were made both for single shear and double shear.

Four varieties of material were tested: 1. The Victor boiler rivet steel, manufactured by the Champion Rivet Co. of Cleveland, Ohio; 2. Best Boiler rivet steel, manufactured by Sternbergh & Son, Reading, Pa.; 3. Structural rivet steel (said to be Bessemer steel), manufactured by Sternbergh & Son; and 4. Best rivet iron, manufactured by Sternbergh & Son. Three sizes of each of these makes were used, ½, ¾ and 1-in. diameter. The rivet rod fitted the holes in the apparatus so accurately that it was not found necessary to turn the rods down.

The determination of the phosphorous and sulphur of the rivet material made by Prof. S. W. Parr resulted as follows:

	Per cent.	
	Phosphorous.	Sulphur.
Victor steel	0.025	0.043
Best boiler steel	0.011	0.031
Structural rivet steel	0.041	0.053
Wrought iron	0.058	0.000

The accompanying cut shows sections of the apparatus used for making the shearing tests. The apparatus for single shear, shown at a, consisted of two bars with accurately drilled holes through which the test pieces passed. A bolt through the slotted holes above the test piece and one through the holes below it, held the bars firmly so that the shearing planes remained together. Tests showed that the friction between these plates was small. The length of the bars (28 ins.) reduced the eccentricity of the pull to a very small amount.

TABLE I.—Comparison of Shearing and Tensile Strengths of Rivet Material.

	Tension.				Single shear.		Double shear.	
Diameter.	Ultimate strength, lbs.	Elastic limit, lbs., per sq. in.	Elongation in 8-in., %.	Reduction of area, %.	Ultimate strength, lbs., per sq. in.	Ratio of shear to tension, %.	Ultimate strength, lbs., per sq. in.	Ratio of shear to tension, %.
Victor Boiler Rivet Steel.								
½-in.	48,100	31,000	33	76	38,400	80.0	37,700	78.4
¾-in.	49,930	31,000	34	55	37,900	75.7	37,550	75.3
1-in.	47,350	31,150	37	65	34,500	73.3	34,700	73.3
Best Boiler Rivet Steel.								
½-in.	48,700	35,300	33	62	38,550	79.1	39,250	80.6
¾-in.	47,000	28,650	36	68	36,200	77.0	36,300	77.2
1-in.	49,330	30,600	32	70	36,100	73.2	36,200	73.4
Structural Rivet Steel.								
½-in.	55,400	37,700	26	70	43,400	78.3	42,100	76.0
¾-in.	55,900	37,350	29	64	41,700	74.6	41,900	74.9
1-in.	53,600	35,500	29	71	38,000	70.9	38,600	72.0
Wrought Iron.								
½-in.	49,600	37,750	25	46	40,200	81.5	38,200	79.5
¾-in.	50,200	31,200	38	48	38,600	77.0	39,100	79.8
1-in.	48,400	32,000	33	52	35,200	72.8	36,400	75.2

The apparatus for double shear, shown at b, consisted of two middle bars ⅝-in. thick and an upper and a lower bar each 1 in. thick. The upper bar was fastened to the two middle bars with a 1½-in. bolt, and the test pieces passed through accurately drilled holes in the middle and lower bars. A bolt through a slotted hole in the middle and lower bars held them firmly together. The bolts and the stiffness of the middle bars prevented any bulging or buckling of the bars during the process of shearing.

The bars were tool steel of 80,000 lbs. tensile strength. The upper and lower bars were placed in the grips of the 200,000-lb. Olsen testing machine and tension applied. Little perceptible distortion took place in the test holes of the apparatus. The usual tension tests of the rivet material were also made. The steel rods were bent cold flat on themselves without showing flaws, and a 1-in. Victor steel rod was tied in a close knot by cold bending.

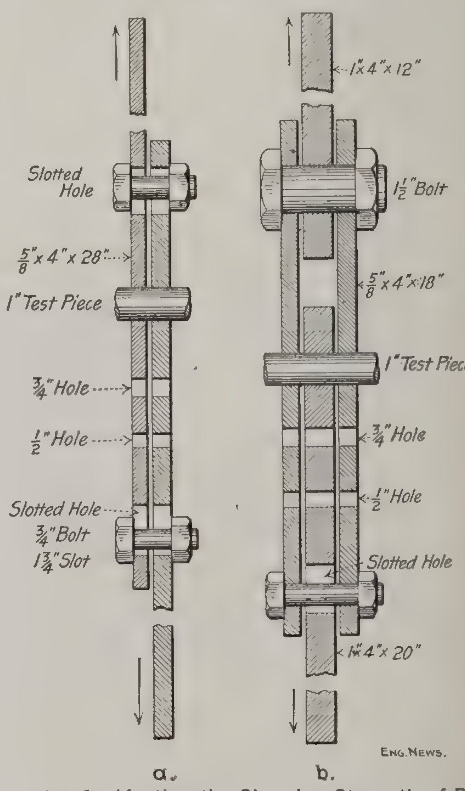
The sheared pieces are specially noticeable for the indentation which takes place after the elastic limit is reached. The shoulder or indentation was as much as 10% of the diameter, and increased with the diameter of the test piece. The bending action was slight and was scarcely noticeable on the compressed side. An examination of the pieces during and after the tests showed that this method of testing largely eliminates the flexural effect upon the rivet and hence is not subject to the criticism sometimes made upon shearing tests.

The average of the results of the tests are given in Table I.

It would be interesting to know why the ratios for the small rivets are higher than those for the large. If bending entered into the results, the smaller rivets would have the smaller ratios. The table shows that the tensile strengths of the several sizes average almost exactly the same. To find whether the variation was caused by softer material in the large rivets, four test pieces of the larger sizes were turned down to ½-in. and tested for double shear. The results gave ratios within 1% of the ratios in Table I. for ½-in. rivets of the same material. It seemed probable that the increased bearing stresses in the larger size—the thickness of plate remaining the same—might be the cause, and the larger indentation in the larger test pieces corroborated this view.

To determine the effect upon the shearing strength of increasing the bearing stress, an apparatus for single shear was then constructed having the shearing bearing stresses 1⅔ times the former ones. The shearing ratio of the ½-in. rivets was decreased nearly 4% and the 1-in. 1¼%. As even with this apparatus, the ½-in. rivet did not reach the usual bearing stress, it is quite probable that the shearing ratio would be still smaller for the usual conditions of joints. These results tend to show that the amount of the bearing stresses affects shearing strength, the latter decreasing with an increase in the former. They, at least partially, explain the higher ratios for the smaller rivets in Table I.

To determine the effect of the hardness of the shearing plate upon the shearing strength of the rivet material, an apparatus for single shear was constructed with ⅝-in. bars of 56,000-lb. mild steel. With this apparatus not more than one or two rivets could be tested in a single hole, for the distortion of the plate became quite marked. The results are given in Table II. It will be seen that the shearing ratios have been increased about 4.6% over the corresponding values in Table I. This increase in the ratios



Apparatus for Testing the Shearing Strength of Rivet Steel.

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*Abstract of a paper by Arthur N. Talbot, Professor of Municipal and Sanitary Engineering. Reprinted from "The Technograph, No. 12, University of Illinois, more than neutralizes the decrease found by reducing the bearing areas to the values used in practice as discussed in the preceding paragraph.

TABLE II.—Tests to Determine the Influence of Soft Plates on the Shearing Strength of Rivets.

Material.	No of tests.	Ult. shear. strength.	Ratio shear to tension.	Inc. in ratio.
Victor rivet steel, ½-in....	1	41,500	86.3	6.3
Wrought iron, ½-in.......	1	41,600	83.9	2.4
Structural rivet steel, ½-in.	1	46,200	83.4	5.1
Victor rivet steel, ¾-in....	2	41,000	82.1	6.4
Wrought iron, ¾-in.......	2	40,400	80.5	3.5
Wrought iron, 1-in.......	1	37,000	76.4	3.6
Best boiler rivet steel, 1-in.	1	38,550	78.2	5.0

It may be considered, then, that for the usual bearing stresses, with mild steel plate and soft steel rivet metal, the ratio of shearing strength of the rivet to its tensile strength is less than that generally quoted, 0.80, and that 0.75 is a more probable value. It seems to be shown, also, that an increase in the bearing area of the rivet will give increased shearing strength to the rivet. The use of hard steel plates with soft steel rivets likewise decreases the shearing strength of the rivets.

In all the preceding discussion, comparison of the shearing strength of the rivet has been made with that of the tensile strength of the rivet itself. The ratio of the shearing strength of the rivet mètal to the tensile strength of the plate will be lower yet. For 48,000-lb. tensile strength rivet metal and 56,000-lb. steel plate, the ratio is 0.65; and for 55,000-lb. rivet metal and 62,000-lb. steel plate, it is 0.68. These results indicate that the ratios commonly used in designing joints (the shearing strength of the rivets equal to three-fourths or five-sixths of the tensile strength of the plate) are too high and hence that rivet spacing should be made closer. While these conclusions are based upon results found beyond the elastic limit, it does not seem possible to obtain comparative data within that limit.

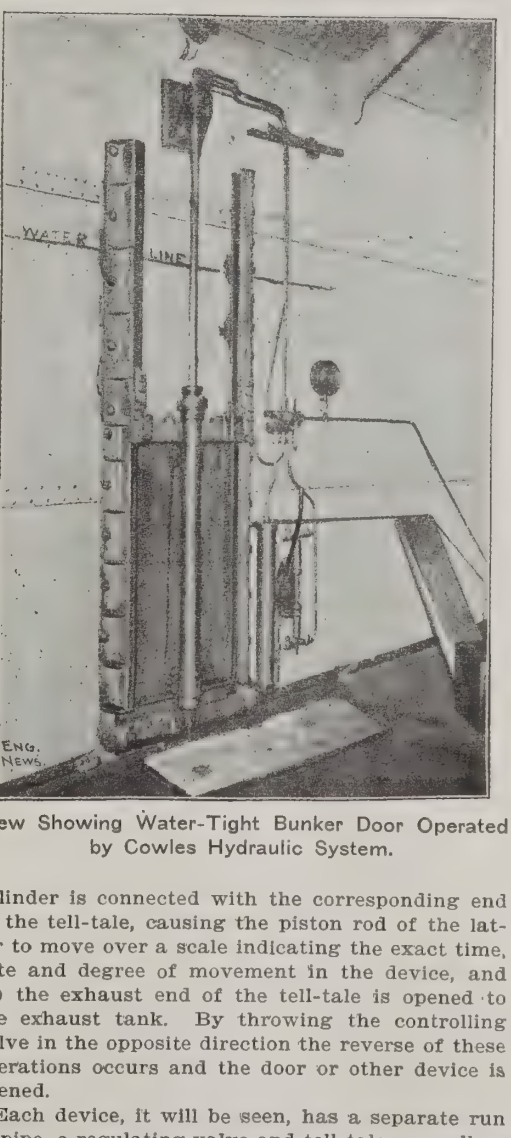
The writer does not accept the statement sometimes made that the shearing strength of rivets has little influence upon the strength of the joint, on the ground that the friction of the plates will hold the tensile stress well up to the elastic limit of the plate; for he does not think that it has yet been conclusively proved that the friction is so great. Tests made in the Laboratory of Applied Mechanics on riveted joints show that slipping occurs at or below the usual working stresses. The average of 22 double-riveted lap joints, hand riveted, gave 4,900 lbs. per sq. in., the maximum being 9,500 and the minimum 3,000. The average of 16 double-riveted butt joints, machine riveted, gave 9,000 lbs. per sq. in., the maximum being 13,000 and the minimum 5,500 lbs. Tests made elsewhere indicate that slip occurs at or below the usual working stresses, although some show much higher results. At any rate, it is not safe to assume that friction between the plates will prevent shearing stresses in the rivets, and with this view the shearing strength of rivet material becomes an important matter.

THE COWLES SYSTEM OF WATER-TIGHT BULKHEAD DOORS FOR THE U. S. CRUISER "CHICAGO."

One of the novel features of the reconstructed cruiser "Chicago," which will shortly be turned out of the Brooklyn Navy Yard ready for service, is the system of hydraulicly operated water-tight bulkhead doors, designed by Naval Constructor W. B. Cowles. To the layman the number of bulkhead doors, hatches and valves in the modern warships, which have to be closed often almost instantly in certain emergencies, is hardly appreciated. For example, the battleships "Indiana," "Massachusetts" and "Oregon," of the United States Navy, each has 272 water-tight compartments, with 354 doors and hatches and 294 valves, altogether 648 openings which have to be closed quickly under certain conditions. To close these openings and bring the cellular structure of the ship into operation in the case of an emergency requires, it is stated, the work of 110 men, exclusive of officers. It is easy to see, therefore, how in certain cases it may be practically impossible to bring all these safety devices into operation no matter how well disciplined the crew may be.

The cardinal ideas of Mr. Cowles' invention is to insure greater certainty of operation by taking it out of the hands of many persons and concentrating it by mechanical means into the hands of one stationed at a convenient central point. The problem involved several factors besides that of certain and safe central control of the valves and doors located in widely scattered positions. It was necessary to provide that the central control should involve no harm to the men whose duties might be in the various compartments by closing the avenues of escape independent of their will. Further, it was necessary that the doors should be such as would close against the pressure of water, or, in case of the bunker doors, through coal.

Two methods of central control, known as the "double line" and the "single line" systems, are employed. In the "double line" system the primary circuit consists of two cylinders with their pistons and rods connected by a double line of small piping in which is placed a controlling valve which governs the admission and release of pressure to and from the circuit and between the cylinders. The cylinders may be of any convenient dimensions, but while they are not necessarily duplicates, the corresponding ends must have equal piston displacements. One cylinder, called the power cylinder, is placed with its piston rod in connection with the device to be operated, for example, a bulkhead door, as shown by the accompanying illustration. The other cylinder, called the tell-tale, is placed at the point from which it is desired to operate the device. Operation is brought about as follows: The controlling valve is moved to the proper point, say, to close the door, when three things take place simultaneously: (1) Pressure is admitted to one end of the power cylinder causing its piston to move and close or otherwise shift the device; (2) the exhaust end of the power cylinder is connected with the corresponding end of the tell-tale, causing the piston rod of the latter to move over a scale indicating the exact time, rate and degree of movement in the device, and (3) the exhaust end of the tell-tale is opened to the exhaust tank. By throwing the controlling valve in the opposite direction the reverse of these operations occurs and the door or other device is opened.



View Showing Water-Tight Bunker Door Operated by Cowles Hydraulic System.

Each device, it will be seen, has a separate run of pipe, a regulating valve and tell-tale, as well as individual operating cylinders, and can be operated by itself alone. The regulating valves and tell-tales are all located in one place, namely, the central station, and 120 sets may be placed on an operating board 40 × 80 ins. in size, projecting not more than 10 ins. from its face. The emergency attachment consists of a primary circuit, so arranged and connected that its power piston will simultaneously throw into the closing position any desired number of the controlling valves in the central station. The power cylinder of the emergency circuit is in the central station, but its tell-tale and controlling valve are placed at the point where the danger to be guarded against will most naturally first be discovered. The number of groups of central station valves controlled by emergency circuits can obviously be made as great or as small as desired.

To complete the power transmission system only one other device is necessary, which is the liberty valve. This is placed near the door or other device to be operated and consists of a spring controlled valve arrangement which may be operated by a person liable to have his escape shut off by the operator at the central station or at one of the emergency stations. The person in danger by simply throwing the liberty valve shuts the power off and thus arrests the closing of the door which it governs until he can escape, when the spring restores the normal condition and the door closes behind him.

The foregoing describes the "double line" system quite clearly. The "single line" system, which is the one employed on the "Chicago," works upon the principle of superimposing one pressure on another in the same pipe to obtain at will two separate and distinct ways of operating and controlling a device at a distance. This is done through a single pipe in combination with suitable valves, connecting pipes, and a power cylinder, much in the same general manner as in the "double line' system, but with one run of pipe in common for all devices instead of individual runs for each. There is, however, no central station such as there is with the "double line" system. Individual operation of a device is controlled by the liberty operating valve at the device, but the emergency operation of all devices simultaneously is controlled by a controlling valve and tell-tale placed at some central point.

The particular installation on the "Chicago" consists of eleven vertical sliding doors, all in the engine and boiler compartments, made of ¼-in. steel plates with vertical angle iron stiffeners and with manganese bronze plowshares to force a way through coal. The power cylinders for each door are made of seamless brass tubes. The system is operated by a steam accumulator and duplex pump of the Worthington type, which are placed under the protective deck. The hydraulic main is 2 ins. in diameter, reduced in suitable steps. The emergency gear consists of a power cylinder with a 4-in. stroke, operating the by-pass cock on the accumulator and a corresponding tell-tale and controlling valve in the conning tower, connected by a ⅛-in. pipe and forming a primary circuit. Ingenious devices are provided to tighten the doors at side and bottom. The side tighteners consist of traveling rollers held between a wedge track and a wedge bar, each of these latter being the full length of the door. The wedge track is secured permanently to the door, and the wedge bar rides with the door throughout its travel, except during the short tightening interval at the closing end of the stroke, within which the wedge bar is held stationary on the guide, thus causing relative movement between the wedge track and wedge bar on the rollers. This movement presses the wedge bar out against the guide lip, and the wedge track, with the door and seating strip, in against the seat.

Tests which have been made show the ability of bulkhead doors of this type to close against a head of water and also through piles of coal. Their operation and control are also proven to be satisfactory. The chief objection which has been raised to the system is that it adds another to the already large number of complex mechanical devices of the modern war ship.

NOTES AT DETROIT.

The city of Detroit claims the title of "the convention city," and the fact that it had 150 conventions last year seems to make good this claim. It has a special organization, the Detroit Convention and Business Men's League, whose object is to invite and secure the attendance of such gatherings, and to arrange for their entertainment. This is done in order to advertise the city and spread its reputation, although the direct advantage to trade seems to be doubtful. Mr. O. A. Bierce is Secretary of the league.

The city has an area of 29 square miles, a frontage of 9.2 miles on the Detroit River, and has a population of about 300,000. It is substantial and attractive in appearance, having wide, well-paved and remarkably clean streets, fine buildings, and an atmosphere free from smoke, in spite of the fact that the city has numerous manufacturing establishments. A system of boulevards surrounds the city, and there are numerous large and small parks, while many of the streets are lined with trees. Woodward Ave. is probably one of the finest residence streets in the country. There are 235 miles of paved streets, exclusive of 11 miles of macadamized boulevards, and the paving includes 20 miles of asphalt and 20 miles of brick. Where car tracks are laid on streets having asphalt paving, brick is laid between the rails and tracks, the asphalt being brought close against the outer rails. At present there is a squabble between the City Council and the Board of Public Works as to the use of brick, the former favoring a ten-year guarantee, and the latter favoring the selection of brick by test. Under the present system the brick submitted by contractors are put through the rattler and absorption tests. Much of this class of paving requires repair in four or five years, and the requirement of a ten-year guarantee would, it is said, bring the cost up to that of asphalt. In the meantime but little brick paving is being laid. Both red and yellow brick are in use, and it is proposed to lay several kinds of brick on one street for actual observation as to the relative wear.

The city has 175 miles of main sewers and 276 miles of lateral sewers. The sewer system is now practically complete, and but little work is being done on extensions. Mr. Henry D. Ludden is City Engineer, which office includes also that of engineer for the Board of Public Works.

There are 167 miles of street railway and 71 miles of suburban lines, while 127 miles of suburban line are now under construction. All these are operated by electricity. In the paved streets grooved rails are used, and steel ties are used to a limited extent under heavy girder rails on concrete, there being only four ties to a rail. The cars are noticeable for their cleanliness and the good condition in which they are kept. There are two long electric lines running in competition with railway service; the Rapid Ry. to Mount Clemens, 15½ miles, and the Detroit, Ypsilanti & Ann Arbor Ry., to Ann Arbor, 38 miles. Mr. J. D. Hawks, M. Am. Soc. C. E., is Engineer and Manager of this road. Double-track cars, fitted with air brakes, are used on these lines, and baggage is carried in separate cars on the former and in combination cars on the latter.

The electric light plant is owned and operated by the city, and supplies 1,800 arc and 3,500 incandescent lamps, most of the former being mounted in groups on the tops of tall towers of iron framework. The report of the electric light commission, which has just been issued, puts the present cost of $83.50 per arc lamp, which the commission compares with a probable cost of $90 if the work was done by contract at this time. The city's water supply system dates back to 1824, and has been in charge of a water commission since 1852. There are two 6-ft. intakes and one 5-ft. intake, and three 42-in. force mains. The water is pumped direct through a distribution system of 526 miles of 2-in. to 45-in. pipe at preshure of 10 to 35 lbs. The pumping plant consists of four engines, three of which have a capacity of 24,000,000 gallons, while the other has a capacity of 35,000,000 gallons per 24 hours. There are 3,002 fire hydrants, 549 fire cisterns, and 73 hydrants in the auxiliary fire system. Meters were first introduced in 1889, and there are now 5,392 in service, which metered 19% of the entire amount pumped by the engines in 1897. The Fire Department has 21 steam engines, a fire-boat, 6 chemical engines and 417 men, while its equipment also includes 445 miles of fire alarm telegraph, 356 alarm boxes, and 581 reservoirs.

The Deep Waterways Commission, appointed by the government to investigate and report upon the proposed waterway connecting the Great Lakes with the Hudson River, has its headquarters in Detroit. This commission is composed of Mr. Alfred Noble, Mr. George Y. Wisner and Mr. G. W. Rafter, all members of M. Am. Soc. C. E. Parties are now in the field surveying routes from Lake Ontario and the Hudson River, one of which is proposed to utilize Lake Champlain as a part of the waterway. The preliminaries for the design of the lock gates are in charge of Mr. Henry Goldmark, M. Am. Soc. C. E., who has made extensive investigations as to the different forms of construction used in this and other countries. It has practically been decided to use iron gates, with a single skin, these gates being used in pairs. The full report of the commission will probably not be made until near the end of next year.

Detroit is a very important railway center, both for through and terminal traffic. It has a freight belt line and extensive freight yards, and in the city are three passenger stations for the twelve railways centering at this point.

The Michigan Central Ry., like the Grand Trunk Ry., has its own terminal station, and does not use the union station. Its general offices are in the station building. On this road a number of experiments with rail joints have been made, and it is now trying the Long and Fisher joints to a small extent. It has also 20 miles of track laid with a base-support joint, devised by Mr. A. Torrey, the Chief Engineer, in which a piece of inverted 65-lb. rail is placed under the ends of the 80-lb. track rails and secured by two, or in some cases three U-bolts, which pass under the inverted rail and have their ends secured by nuts above the flanges of the angle bars. This requires no lowering of the joint ties, as in joints having bridge plates which rest on these ties, and though the lowering is made light of by manufacturers of joints of the "bridge" type, Mr. Torrey finds that it is the cause of considerable trouble in track work. An experiment is also being made with short bars having studs on the ends, the distance between the studs being 1-32-in. less than that between the bolt holes. These clamps are put on hot (are on each side of the rail) and are covered by the angle bars. Notches cut across the rail heads by a Bryant saw, to represent joint spacing, have resulted in a rapid cutting out of the rail beyond the joint. Mr. Torrey is a believer in continuous rails, and has an experimental rail length of 500 ft. put up with turned bolts in drilled holes. The maximum expansion of this length is 4½ ins. The road has now 80% of its main track laid with 80-lb. rails, and 32-in. four-bolt joints are taking the place of the old 38-in. six-bolt joints. Rails for relaying have their ends cut off and are then laid upon a bed in lots of 80 rails, and numbered with chalk. A man then takes a special caliper and a box of 80 slips or "dominoes," and calipers the height of head at each end of each rail, marking the heights and the number of the rail upon a domino. When this is done he sorts out 60 of his slips, or "plays dominoes" with them until he has matched rail ends of the same height. He then re-numbers the dominoes in this order, and also numbers the rails in the same order with paint. A loading machine then loads the rails on the car, putting No. 60 first, so that in unloading on the track No. 1 will be the first rail handled. In this way good joints are secured at small cost. The 20 rails which do not match well go into the next lot.

Detroit is also one of the important lake ports, and the traffic through the Detroit River in 1896 included 33,290 vessels with an aggregate gross tonnage of over 35,000,000 tons. The traffic includes a great variety of craft, from small sailing and steam vessels and barges to the modern freight and passenger steamers of over 400 ft. in length, and the immense steel barges which some of the freight steamers tow as consorts. Among the most interesting vessels are the "Northwest" and "Northland" of the Northern Steamship Co., which resemble the Atlantic liners, and run from Buffalo to Duluth, an inland route of nearly 1,100 miles. Other notable craft are the fast sidewheel steamers of the Detroit & Cleveland Navigation Co., which runs from Detroit to Mackinac and Cleveland. These are driven by two-cylinder, compound vertical beam engines, of the type which has so long been a feature of American marine engineering. The dimensions of the "City of Mackinac," built in 1893 for this line by the Detroit Dry Dock Co., are as follows:

Length over all	275 ft. 0 ins.
Beam	38 " 6 "
Width over guards	68 " 11 "
Depth	15 " 0 "
Gross tonnage	1,736 tons
Cylinder, h. p.	42 × 88 ins.
Cylinder, l. p.	66 × 132 "
Boilers, two double-ended	12 × 19⅝ ft.
Speed, in regular service	18 miles per hour
Paddle-wheels, diameter	25 ft. 7 ins.

The manufacturing industries of the city are numerous and varied, including steamships, marine and stationary steam engines, gas engines, salt and soda-ash, railway cars, stoves, paint, sulphite fiber, and a multitude of smaller industries. There are in all about 2,000 manufacturing establishments, employing about 50,000 persons. At Wyandotte, about 12 miles down the river, are the remains of what is said to have been the first Bessemer steel plant established in this country. According to local accounts, a Detroit man went to England to negotiate with Bessemer, but the latter declined to make any agreement, and the former then obtained employment in Bessemer's works as a sand shoveler. Having learned the secret of the process he returned to this country, and, about 1860, established the Wyandotte plant, where steel was made, plates were rolled and a ship was built of these plates.

The Detroit Dry Dock & Engine Works Co. has a dry dock and shipbuilding yard at Wyandotte and another dry dock and an engine works in Detroit. The members of the American Society of Civil Engineers visited both plants, and examined the steel freight steamer "Troy," 425 ft. long, recently launched by the New York Central R. R. Its single screw will be driven by a quadruple expansion engine, supplied with steam by Scotch boilers, carrying 220 lbs. pressure. Considering the comparatively short runs, however, it is questionable whether there will be sufficient economy in fuel to compensate for the increased cost and complication of the engine. In this ship even the deck houses are of steel plating, and a somewhat peculiar arrangement is an anchor protruding from the stern. A portable pneumatic riveter was used for much of the work, especially for countersunk rivets in the deck plating, a pneumatic hold-on being applied underneath. A pneumatic chipping chisel cuts off the slight projection of the rivet above the plate, and it is then smoothed down by the riveting hammer. Steamers, engines and boilers for the Klondike service are also being built. At the shipyard is a drilling machine which is held up to its work by magnets, and the boilers are fitted with a very simple but effective smoke consumer, designed by the superintendent of the yard. It consists of a sliding and a fixed grating the whole size of the furnace door, and by regulating the admission of air above the fire by this damper, smoke can be entirely prevented. This was shown by opening and closing the damper, and the consequent disappearance or appearance of smoke from the stack. At the engine works is a shaft which was bought for iron, but which on being heated and put under the hammer broke with a fracture that showed simply a mass of granules or crystals which could be rubbed apart in the hand.

The Detroit Bridge & Iron Works is not now very busy in the shops, but has some large plate-girder through span having the ends rounded for the sake of appearance. These are for the Paragould Southeastern Ry., of which Wm. H. G. Kelly is the Engineer. This firm built most of the spans of the new Grand Trunk Ry. bridge at Montreal, which has been described in our columns. It has completed the erection of all the spans except the channel span, which is the longest. Owing to the headway required under this span a shallow floor was necessary, and this consists of transverse 24-in. 100-lb. I-beams, placed close together and covered with a plate to which the track rails will be bolted. The erection of the new trusses is done from a traveler like an inverted U which straddles the old tubular spans, the horizontal top member resting on trucks which run on rails laid upon the top of the tube. Several of the miter-cutting and shearing machines in the shops are mounted on turntables, so that they will cut work at any angle, thus avoiding the trouble of swinging long angle iron, etc., at an angle to the machine. Compressed air riveters and hoists are largely used, the latter having a valve devised by the shop foreman to regulate the admission of air according to the load, and so obtain a uniform speed of hoist. Railway turntables, with a pedestal bearing of turned conical rollers between planed and finished plates, are a specialty of this firm, and were described and illustrated in our columns some time ago.

The Detroit Graphite Manufacturing Co. has supplied nearly 8,000 gallons of its gray paint to the Navy Department for painting our warships the present service color, and considers that it is entitled to some credit for thus making the ships so nearly invisible that the Spanish gunners could not hit them. The company's paint is also specified by the War Department for the guns, gun carriages, etc., of the coast defenses. The viaduct of the Detroit Union Station Co. crossing a number of freight and switching tracks was painted with the graphite paint in 1893, and shows no signs of rust or deterioration, although it is constantly subjected to the smoke and gases from engines standing or passing under it. On one of the columns which has been damaged by a derailed car, the broken edges of the paint are pliable and tough, and the rust on the part where the paint has been knocked off has not spread under the paint. This paint is used extensively for bridges and structural iron work, and also for cars, gas tanks, boilers, smokestacks, etc.

The Frontier Iron Works are now making a specialty of gas engines, as the number of engine works established by shipbuilding works has materially reduced their former business in marine engines. Single-cylinder vertical engines are built of from 1 to 10 HP., and double-cylinder horizontal engines are used for powers of 10 to 100 HP. The special feature of these latter engines is their steadiness of running, which makes them well adapted for electric light plants, and we shall shortly illustrate and describe one of these engines.

The Griffin Car Wheel Co. has its parent plant at Detroit, with branches at Chicago, St. Paul, Denver and Tacoma. This company is distinct from the New York Car Wheel Co., which also operates the Griffin patents and has plants in the eastern states and in Europe. The Detroit plant has a capacity of 250 wheels per day, a large majority being of 33 ins. diameter. A bottom-pouring ladle is used, the 2½-in. hole in the bottom being opened or closed by a graphite plug on a rod in the ladle, which is operated by a lever. This device, which is patented, ensures the pouring of clear metal and the exclusion of dross. Each ladle holds a little more than enough iron for a wheel. The wheels are kept in annealing pots for five days. Street car wheels are a specialty, and these have curved spokes. A great source of trouble is the variety of tire and flange sections demanded for these wheels, there being no standard, as in railway wheels. This lack of uniformity results in considerable expense for chills. General castings for locomotive and bridge work, etc., are also made, and for specially hard metal, steel rail scrap is melted with the iron. An unusual system of accounting is in force here, under which the books are closed and balanced for profit and loss every month.

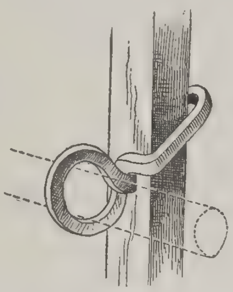
The Michigan-Peninsular Car Co. has two separate car works and a rolling mill, employing in all some 4,000 men, and turning out about 100 freight cars per day. The north works (or the old Penisular Car Works) have a capacity of 52 box cars per day, and have built 54 flat cars in a day. Tracks with turntables at the intersections are laid through the yards and buildings. In the machine shops are several multiple drills, some with six drills for drilling arch bars for trucks, and one with eight drills for miscellaneous work. Two men work at this latter machine. Wheels are pressed on their axles by a 50-ton hydraulic press. There is one foundry for axle boxes and miscellaneous work, and another for car wheels. The latter has a capacity for 400 wheels per day, and is equipped with the Whiting system of cranes and trolleys to handle the flasks, etc., and to carry the wheels to the annealing pits, where they remain for from three to five days. There are four regular cupolas, and a fifth for testing work.

In the woodworking shop the wood passes forward all the time from machine to machine, until it leaves the further end of the shop ready for the erecting shop. In this latter shop separate gangs of men attend to setting up the "bottoms" or underframes, the floor, side framing, sheathing, roofing, etc. All parts are cut, bored, mortised, etc., to templates, so that the apparently complicated framing goes together rapidly, like a child's puzzle in the hands of an expert. This, together with the systematic handling of material, and the division of labor, expedites the work and keeps the labor cost down to a minimum.

These works have now orders in hand, among others, for 500 box cars, 34 ft. long, for the Chicago, Rock Island & Pacific Ry., and 3,000 box cars, 36 ft. long, for the Baltimore & Ohio R. R. The largest cars ever built here, and perhaps the largest freight cars ever built, are some furniture cars for the Chicago, Rock Island & Pacific Ry. These cars are 50 ft. long and 9 ft. 2 ins. wide, of 60,000 lbs. capacity, and drawings of these we shall give in a later issue.

A GERMAN CLAMP CONNECTION FOR STAGING CONSTRUCTION.

The accompanying sketch shows a clamp connection invented by Mr. Ludwig Gauby, of Oedenburg, Germany, to be used instead of bolted or spiked connections in constructing stagings for building construction of all kinds where the ordinary staging of vertical and horizontal timbers in several stories is used. The method of applying this clamp to the vertical post and the manner in which the horizontal member is inserted through the eye is made clear by this sketch. In Germany the common practice is to use round timbers for staging, and the eye of the clamp is, therefore, made circular, but it is plain that this eye can be made rectangular and of the proper size to fit the square timbers commonly used for staging in America. To all appearances this clamp should be a very useful device wherever staging in large quantities has to be used, as it enables the timber to be used over and over again without damage, is easily removed and shifted to a new point, and allows of almost any desired variation in vertical adjustment, besides being cheap, compact and easily handled by any workman of ordinary intelligence. According to the circular which we have received describing this clamp, it is quite extensively used in Germany, and has given good satisfaction.



A German Clamp Connection for Staging Construction.

Ludwig Gauby, Oedenburg, Germany, Inventor.

WATER SUPPLY FROM THE SAND DUNES OF THE NETHERLANDS.

In commenting upon the water supply of Amsterdam, U. S. Consul G. J. Corey speaks of the sand dunes along the coast as the great source of fresh water. These dunes are formed of sand blown up from the seashore; the basis is sand, but peat is mixed with it in some places, and at the sea-level layers of compressed peat are frequently found; but never on the side nearest the sea. The dunes near Haarlem have a base width of nearly 2½ miles, with summits 20 to 23 ft. above the sea.

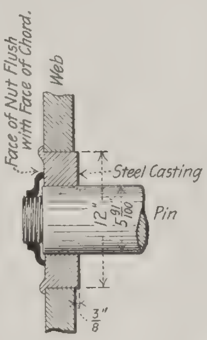
The rainfall percolates through the sand and flows landward and seaward; and the contained water is not only fresh to the sea-level, but to a depth of 66 ft. below sea-level. This would indicate that either the subsoil is based on fresh water, or the hydraulic pressure of the dune water prevents the entrance of sea-water; it is also possible that the water, originally salt, has become freshened by the dune-water pressure.

The quantity of water percolating through the dunes, and contributing to ground-water supply, is estimated at 11.91 ins. per annum. From a range of dunes 2½ miles wide, the quantity of water thus percolating is estimated at 240,000,000 gallons per year per kilometer (.62 mile) of dune length. This quantity can not all be drawn off, however, as a certain volume must be permitted to flow both ways to counteract the pressure of salt water coming from both sides.

For the Amsterdam supply the water is collected in open canals, which are always above the sea level. For the Hague water supply the water is always collected in stoneware pipes, in a bed of shells, 13 ft. below sea-level. In Haarlem the water is collected in wells sunk 50 to 60 ft. below sea-level. This water contains much iron in solution, and it has to be filtered at the three cities named; and when gathered in wells or in pipes it must be aerated before being filtered. The deep drainage system has been in operation for a short time only, and the Haarlem works are still incomplete.

BUSHED PIN CONNECTIONS FOR THE SURPRISE CREEK ARCH, CANADIAN PACIFIC RY.

The novel expedient of bushing the connecting pins was adopted in constructing the 290-ft. 4½-in. steel arch recently constructed over Surprise Creek, on the Canadian Pacific Ry. The main span of this structure consists of two braced steel arch ribs with 6-in. pin connections at the panel points of both top and bottom chords. These pins give sufficient bearing for the posts, diagonals and the top chords, but not sufficient for the heavy pressures of the arched bottom chord. The bearing area of the last members was, therefore, extended by the use of steel disks, or bushings, of the form shown by the accompanying illustration. The general design of this bridge was worked out under the direction of Mr. P. A. Peterson, M. Am. Soc. C. E., Chief Engineer, Canadian Pacific Ry., and the details were developed by the contractors, the Dominion Bridge Co., of Montreal, P. Q.



Bushed Pin Connection for Surprise Creek Steel Arch, Canadian Pacific Ry.

THE RUSSO-CHINESE AGREEMENT, of March 27, 1898, relating to Port Arthur and Ta-lien-wan, is given as follows by the "Peking and Tientsin Times," from what that journal considers a thoroughly reliable source: For the due protection of the Russian Navy the Emperor of China leases to Russia Port Arthur and Ta-lien-wan, together with the adjacent sea; but China reserves her sovereignty over this territory. The limits of the territory transferred are to be fixed in a treaty to be made at St. Petersburg. After such treaty all land within this territory held by Chinese shall be considered as leased by Russia for a period of twenty-five years; though this period may be extended by mutual agreement. One high Russian official shall control all military forces and all civil officers within this region; all Chinese soldiers shall withdraw, but ordinary Chinese inhabitants may remain. It is agreed that Port Arthur shall be a naval port for Russia and China alone, and it will be closed to the warships and merchant marine of all other nations. Part of the harbor of Ta-lien-wan will be a commercial port free to all nations; but another part of this harbor shall be exclusively reserved for Russian and Chinese warships. Russia has the right to build, at these two places, forts, barracks, etc. China agrees that the procedure sanctioned in 1896 regarding the construction of railroads by the board of the Eastern China Railway shall, from the date of the signature of this treaty, be extended so as to include the construction of a branch line to Ta-lien-wan, or, if necessary, in view of the interests involved, of a branch line to the most suitable point on the coast between Newchwang and the Yalu River. Further, the agreement entered into in September, 1896, between the Chinese Government and the Russo-Chinese Bank shall apply with equal strength to this branch line. The direction of this branch line and the places it shall touch shall be arranged between Hsü Ta-jên and the board of the Eastern railroads. The construction of this line shall never, however, be made a ground for encroaching on the sovereignty or integrity of China.

A STEEL HIGHWAY TRACK has been recently invented by Mr. H. L. Stillman, of Charlestown, R. I. For the flat-wearing surface he proposes to use worn-out T-rails with the head sawn off and the base inverted. The stringers are made by sawing diagonally through a block of wood twice as wide as it is high, and then using these two blocks so that the tops are inclined towards the center, and the web of the T-rail is placed between the blocks and secured by a bolt passing through the rail and the two blocks. Flat, or bar iron strips are bolted to the inclined surfaces, and the result is practically a steel trough, with inclined sides and a flat bottom formed by the inverted rail base. The inventor claims that by using these old rails a single track road of this type can be built for less than one-half the cost of an ordinary macadam road of single width.

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It is pleasing to note that, in addition to Naval Constructor Hobson, other staff officers of the United States Navy obtain recognition for their services, in the list of officers recommended for promotion by the Secretary of the Navy. In this list are six Chief Engineers and one Passed Assistant Engineer. While all of these officers of the Steam Engineering staff have well earned their promotion. Chief Engineer Robert W. Millegan, of the battleship "Oregon," especially deserves this recognition, for it is to his unceasing care and attention to the machinery of his ship that the country is indebted for the wonderful run made by this warship, from the Pacific to the Atlantic coast of the United States, and also for the speed developed that insured the surrender of the "Christobal Colon" in the Santiago fight. In the popular admiration for the so-called fighting men of our navy we are too apt to forget the men in the engine-room; yet it is upon the thorough training, technical skill, unending watchfulness and devotion to duty of the steam engineering staff, under conditions that try to the utmost the physical and moral endurance of men, that the captains of our warships practically depend for their victories. A modern battleship would be a useless, floating hulk, without the aid of a multitude of motors that propel and handle the ship, supply ammunition and point the guns and perform many other almost equally important offices. The efficiency of these motors, the manner in which they perform their many offices, is the measure of the efficiency of the warship; and this great responsibility rests upon the shoulders of the engineering staff alone. It must also be remembered that, unlike the officers on the deck, who have the enemy in sight and are nerved to the utmost endeavor by all the excitement of battle, the engineer officers perform their equally important duties shut up in the hold of the vessel and subjected to terrific heat. They cannot personally note the progress of battle; and they only know that in case of torpedo attack or ramming they may be sent to the bottom without ever seeing their destroyer. With a fire-room temperature sometimes exceeding 200° F, the strain upon officers and men is something terrific; and the skill of the first and the unselfish devotion to duty of the latter, as more than once exemplified in the present war, should never be forgotten by the people of the United States.

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From a private letter printed in the New York "Sun," from First Assistant Engineer C. N. Offley, U. S. N., in charge of the starboard engine-room of the "Oregon," we gather some hints as to the reasons why this ship made a run of nearly 15,000 miles at an average speed of 11 knots, and yet was in such good condition that she was at once ready for battle on her arrival in Cuban waters. In the first place, the machinery of this ship was well designed, strong in all details; and what was even more essential, it was erected in the ship with the utmost care and thoroughness. But with these qualities given, the strain put upon it in this long voyage was such that would have told upon the best machinery, had it not been kept in constant and thorough repair in all its parts. We find by the letter of Mr. Offley that at every stop in port, connections were overhauled, brasses were examined, cleaned and scraped where necessary, air pumps and circulating pumps were cleaned and repaired, and main cylinders and valve-chests were wiped out and oiled. Equal attention was paid to the boilers, and every leak in pipes, engines, etc., however small, was carefully stopped at once, so that the evaporators and distillers, of 5,000 gallons capacity daily, practically supplied fresh water alone to the boilers. Every endeavor was made to avoid the use of salt water in the boilers; and to the success of this endeavor the record made by the "Oregon" is largely due. In a word, from the day this ship went into commission, the constant effort of her Chief Engineer was to keep all machinery as near perfection as human skill and never-ceasing watchfulness could make it. The whole record of this battleship, taken together, reflects equal honor upon her designers and builders, and upon those who maintained her utmost efficiency under most unusual and trying conditions; conditions never equaled by any other warship of the "Oregon" type.

◆

The complaints of bad water at the various camps of the United States Army raises the question, what is possible in the way of purification where supplies naturally pure are unavailable? The answer depends upon a variety of conditions, the most important of which are the nature of the impurities and the permanency of the camps. Obviously the removal of mud and bacteria are quite different problems, while methods available for permanent camps are quite out of the question for temporary ones. Settling basins or coagulation combined with filtration will remove mud, and sometimes the two processes may be used to supplement each other. Filtration alone, either with or without coagulants, will remove bacteria, if properly conducted. Either distillation or simple boiling are highly effective, but even the latter is very expensive, while the former is so costly as to render it almost impracticable. Where recourse must be had to such extreme measures only water designed for drinking is likely to be treated, and a dual supply, or pure and impure water, in a camp or elsewhere is always dangerous, it being almost impossible to compel even disciplined soldiers to take any extra trouble to secure pure water when there is no physical difference between it and the impure, as is often the case with sewage-polluted as contrasted with unpolluted water. In addition, distilled or boiled water is lacking in oxygen and thus tastes flat, and is unpleasantly warm, unless it is artificially aerated and cooled, which means so much added expense as to render such treatment unlikely. Coming now to filtration, wherever there is a choice between a large central and numerous small, isolated filter plants, the central plant should by all means be chosen as certainly the cheapest and almost invariably the most efficient. That one plant is cheaper than several is too obvious to need explanation; that it is almost sure to be more efficient may not be so self-evident, though none the less true. The reason for this is that the greater the number of filtration plants the less will be the skill of the men in charge. Where camps are not permanent the smaller filter plants may have the advantage of greater ease in transportation, but there may also be more danger of breakage, as the filters or parts of filters are liable to be more fragile as they diminish in size. In general, it may be said of nearly all the portable, so-called domestic filters, beware!!! This by no means applies to all of them, IF they are well cared for. Generally speaking, the freer the filters work, meaning now those of the stone or earthenware type, the less efficient they are. All of them must be cleaned with frequency and care, and sterilized from time to time, the frequency of sterilization depending on the character of the filter. The slow-working porcelain or baked clay filters must operate under pressure, or give extremely low rates of filtration. In conclusion, it may be said that unless it be in the rarest emergencies there is no excuse for typhoid fever in any of our military camps, for at the worst boiled water can almost always be made available as an emergency supply, and the strictest orders issued against drinking any other water, thus throwing the responsibility on the individual soldiers. For a permanent camp it is doubtful whether the government would be justified in shifting the responsibility in this manner, except under the most pressing circumstances, although it is certainly open to question whether severe military punishment should not be given a soldier who endangers his life and that of his companions by carelessly drinking impure water when pure is easily available, especially in view of the severity of the penalties imposed for the infraction of rules which are really less essential to military success.

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The slight buckling of some of the members in four of the six stiffening trusses of the Brooklyn Bridge, which was briefly noted in our issue of Aug. 4, calls much needed attention to the necessity of a more rigid regulation of the surface-car traffic over that structure. Among those best informed, it is almost needless to say, there has never been any doubt as to the ability of the bridge to carry the surface cars with absolute safety. It has been equally recognized, however, that if this load was not uniformly distributed, that is, if the trolley cars were to be frequently bunched together over one portion of the suspended structure, while other portions were clear, the strains in certain parts of the structure might assume an undesirable and perhaps an unsafe character. Both of these facts were clearly pointed out by the Board of Experts appointed to investigate the feasibility and practicability of permitting the surface and elevated cars to cross the bridge, in their report of Feb. 8, 1898 (Eng. News, Feb. 18, 1898). After reviewing the different phases of the question carefully, the Board of Experts concluded that the additional load could be carried with perfect safety upon the conditions that:

> The tracks be placed next the outer trusses, and that the minimum clear distance between cars while on the suspended structure shall be 102 ft., and that their speed shall not exceed seven miles per hour.

So important was the strict obedience of this regulation respecting headway considered to be by the Board of Experts, that the remaining four conditions were devised to insure its being enforced beyond doubt, and, finally, the Board advised that at the start the trolley car service should be limited to not more than one-half the number of cars that the railway companies deemed necessary until the employees became sufficiently skilled in the duties they had to perform to ensure that the proper headway would always be preserved.

Notwithstanding the emphasis with which the observance of a perfectly safe interval between cars was insisted upon by the board of expert engineers, and despite their contract agreement to observe it, the surface railways have paid very little attention to the regulation of their traffic in that respect. In fact, as everyone knows who has had occasion to cross the bridge on the surface cars, it has been the exception when the proper headway has been observed. During the hours of heaviest traffic in the morning and evening cars are often run with an interval of barely a car length between them, and on a number of occasions a blockade has packed a part or the whole of the suspended structure with cars only a few feet apart. It was such a blockade which, com-

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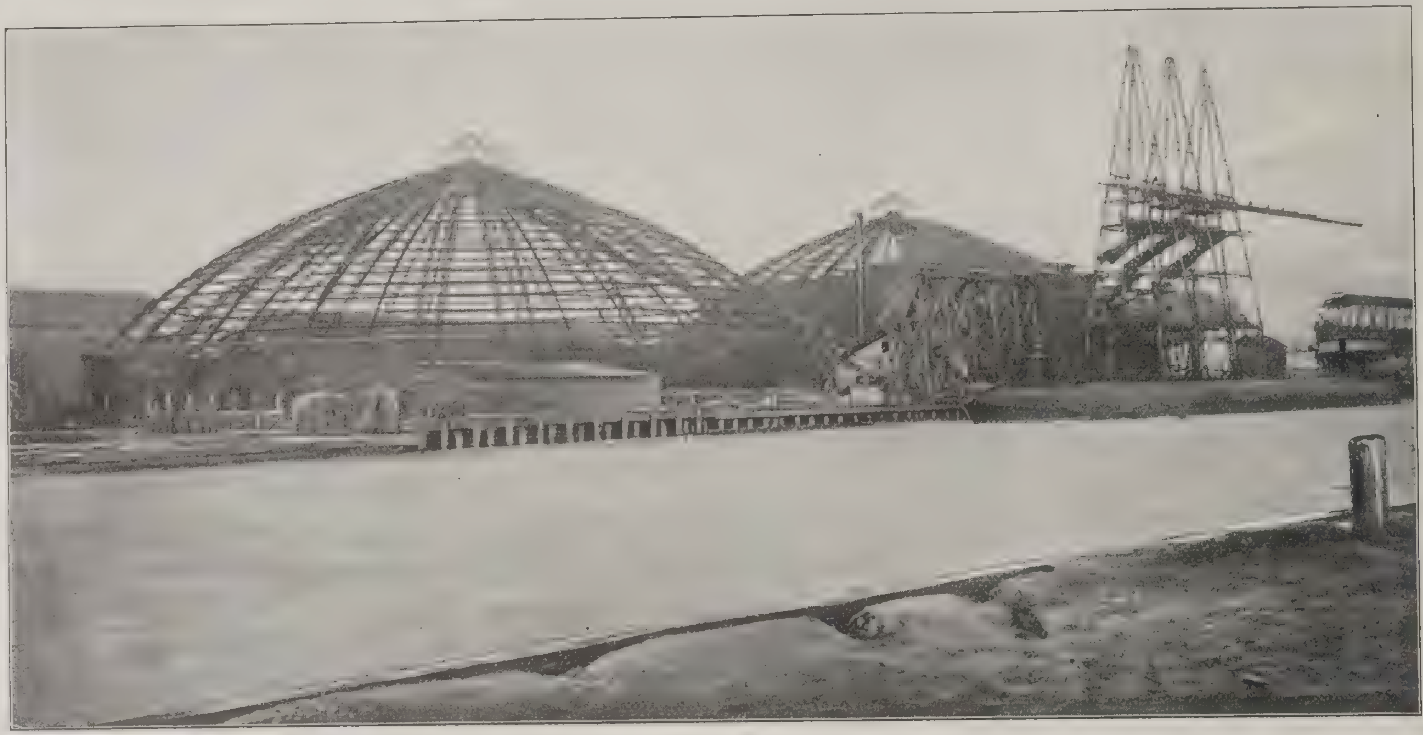

FIG. 1. GENERAL VIEW OF ANTHRACITE AND BITUMINOUS PLANTS WITH WHARF CONVEYOR AND TOWERS.

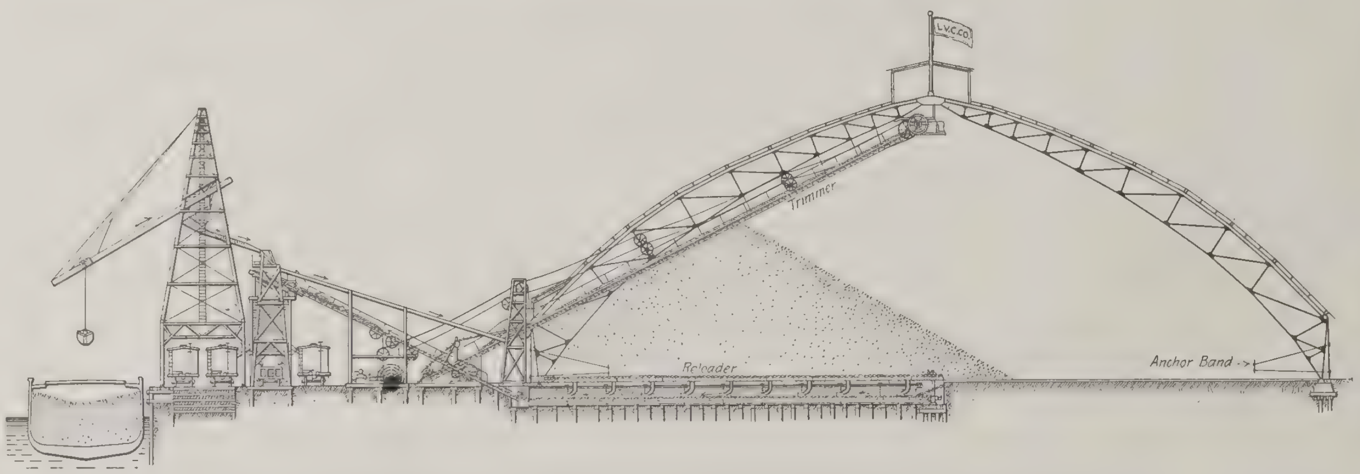

FIG. 2. SECTION OF ANTHRACITE PLANT, SHOWING METHOD OF OPERATION.

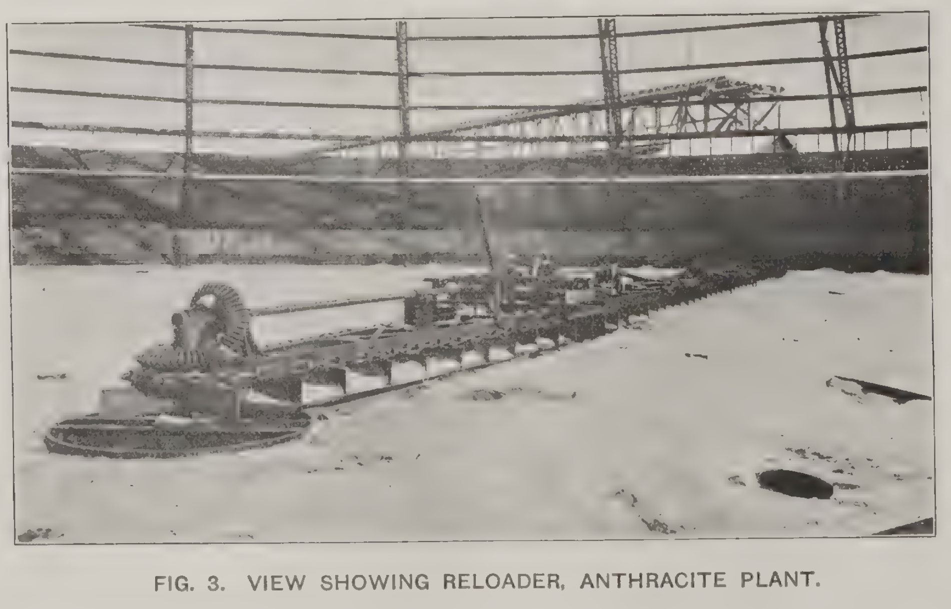

FIG. 3. VIEW SHOWING RELOADER, ANTHRACITE PLANT.

FIG. 5. VIEW S

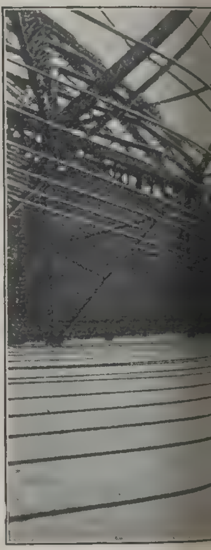

FIG. 8. VIEW SHOW

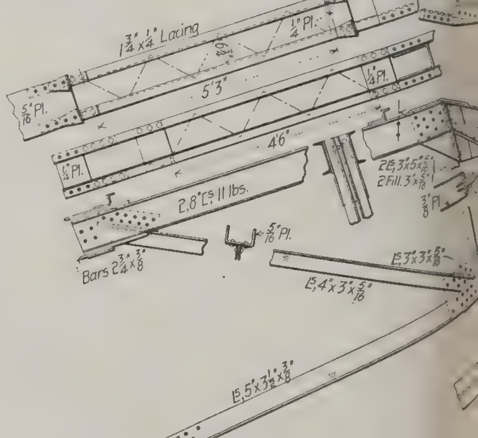

FIG. 6. DETAILS OF SPECIAL APEX CONN
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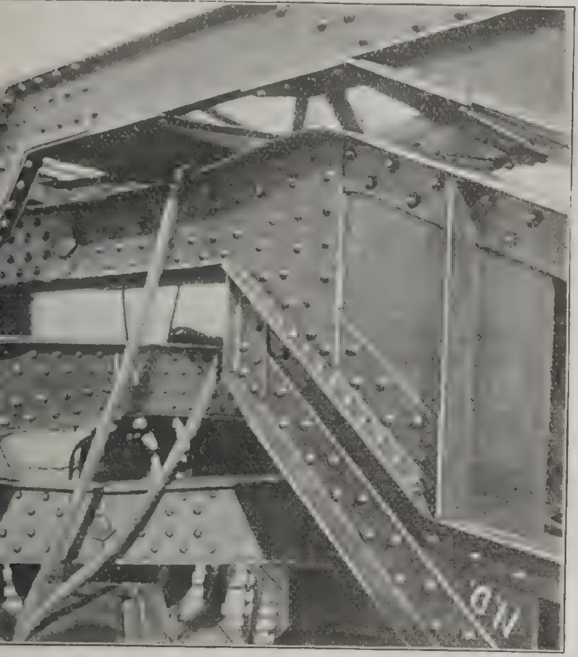
COAL STORAGE PLANT OF LEHI

Dodge Coal Storage Co.



ROOF TRUSS CONNECTIONS AT APEX, ANTHRACITE PLANT.

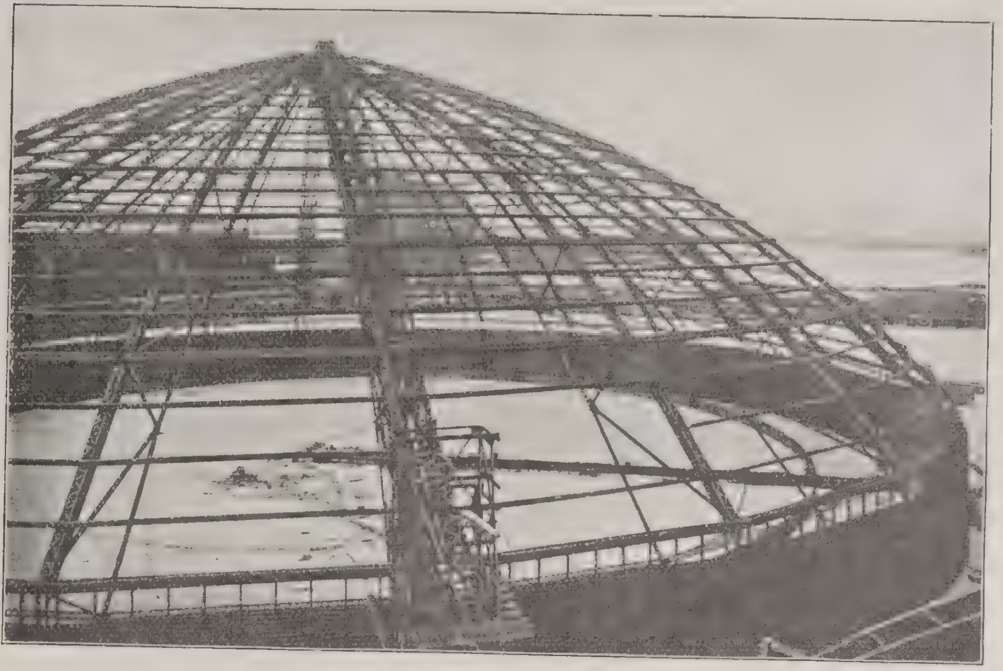
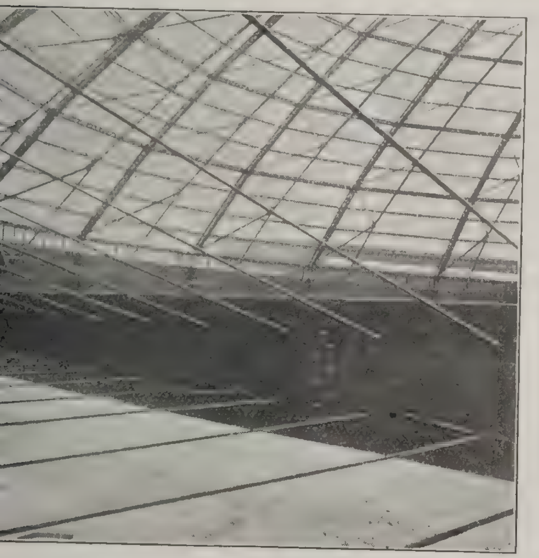


FIG. 4. VIEW SHOWING TRIMMER TRUSS, ANTHRACITE PLANT.



NING WALL AND ANCHOR RING, ANTHRACITE PLANT.

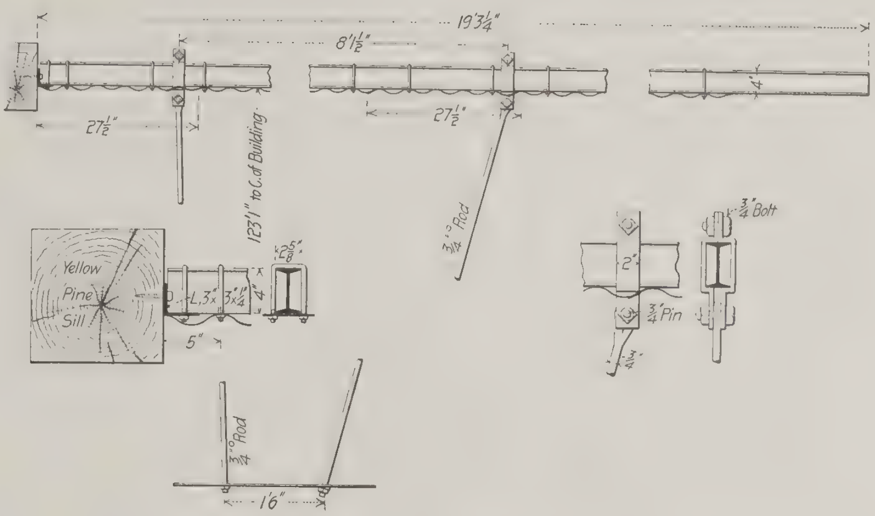
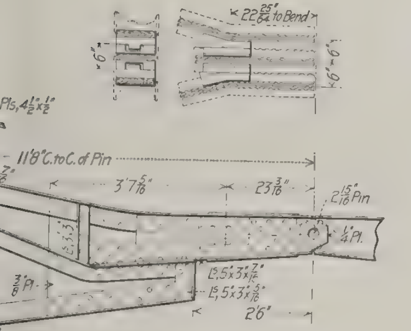


FIG. 7. DETAILS OF RETAINING WALL CONSTRUCTION, ANTHRACITE PLANT.



ROOF TRUSSES, ANTHRACITE

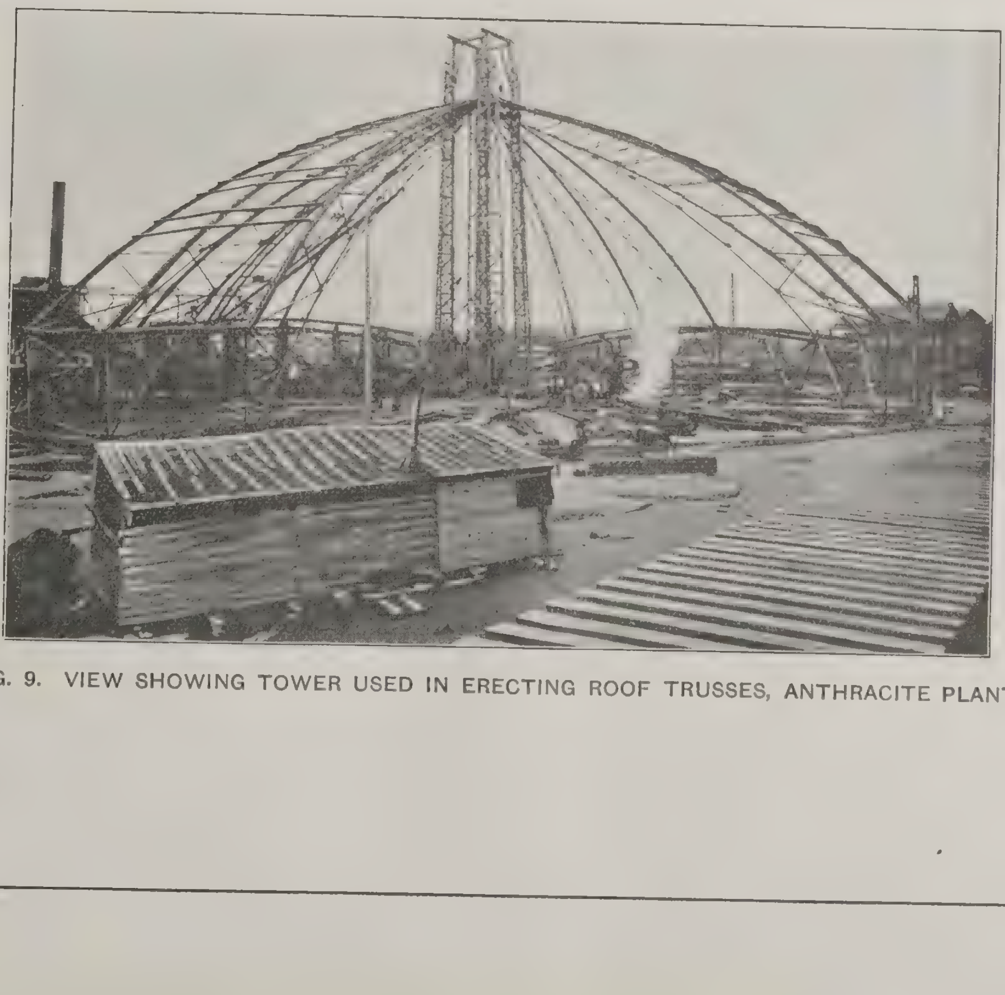


FIG. 9. VIEW SHOWING TOWER USED IN ERECTING ROOF TRUSSES, ANTHRACITE PLANT.

CO., WEST SUPERIOR, WIS.

nia, Pa., Designers.

bined with an unusual expansion of the cables by the very hot weather, threw an excessive compressive strain onto the cantilever portion of the stiffening trusses near the Brooklyn tower and caused the slight buckling of certain of the members. The damage done, while probably immaterial in itself, and certainly of no permanent injury to the supporting power of the bridge as a whole, was sufficient warning that the proper precautions in loading the bridge, which were so strongly recommended, should not be lightly neglected. The disposition of the surface railway companies to neglect these precautions is a perfectly natural one. Their object in crossing the bridge was for the purely business purpose of securing additional traffic and as much of it as possible. From the very beginning the increase has been more than they could accommodate even with great overcrowding during the rush hours, thus encouraging them to disregard any limitation set upon the number of cars which they could run. It is possible that these conditions will be somewhat altered when the elevated railway lines get their full quota of trains in operation across the bridge, and the constant pressure on the surface lines to overcrowd the bridge will be relieved. Whether this is the case or not, there can be no doubt that the bridge officials should see to it that the stipulations respecting the headway between the surface cars are properly observed, which they certainly have not done up to this time.

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Municipal ownership of public service industries, in the interests of good government and public welfare, was the keynote of the meeting of the League of American Municipalities, recently held at Detroit. In the discussions of matters bearing upon this question, some important points were brought out which are frequently neglected or overlooked by zealous advocates of this system. These points accentuate the fact that municipal ownership is not necessarily a means of effecting good municipal government or the best relations between capital and labor. One point, which it is hardly within our province to discuss, was that municipal administration should be entirely independent of national or party politics. Another point was that without the civil service system, municipal ownership may be far less advantageous than corporate ownership. If the water or lighting plant is used as a political department, employment in which may be given as a reward for political services rendered to parties or persons, then the plant will almost certainly be operated with less efficiency and less economy than under corporate ownership, as it is at least to the financial interests of a company to keep men who are experienced in the work required of them. If employees are to be appointed, promoted or discharged without regard to merit, then municipal ownership will fail in one of its main purposes, and possibly in all. Still another point was that the class known as the "best citizens" must become something more than fault-finders, and must be prepared to take some active part in municipal affairs if any material improvement is to be made in municipal government. The financial interest of the average citizen in public affairs is small as compared with that of the professional politician, who looks to "politics" as a means of making money, and the latter has therefore a much greater incentive to devote his time to the public business of the municipality, although he does it in his own peculiar way, primarily for his personal benefit. At the present time, municipal administration is left very largely in the hands of men of this latter class. It was pointed out in the discussions referred to that the people of the United States are patriotic enough in time of war, and are willing to risk health, comfort, business, and even life, in the interests of their country. Good municipal government, however, requires patriotism enough in the quiet times of peace to make citizens ready to sacrifice some time and comfort in order that proper attention may be given to municipal affairs by men who work for the best interests of the public and the municipality rather than for merely selfish and personal interests. On the other hand, the idea of sacrifice is carried altogether too far in the demands made on and compensation given salaried officials whose services partake of a professional nature—engineers, city attorneys, health officers and commissioners of public works, where the latter are single-head commissions, with large executive functions. Such men should be sufficiently well paid to attract the best members of the respective classes from which they are drawn, to give dignity to their positions and to place them above the small temptations that lead to the first downward steps in the paths of bribery and corruption. The sacrifices, we urge, should not, as is now so common, be made by these public servants, who are expected to give all or the best part of their time to municipal service. Instead, they should be made (1) by every well-meaning and self-respecting citizen, through keeping himself properly informed regarding the affairs of his municipality and voting accordingly for or against every man and measure submitted to the suffrages of the people; and (2) the sacrifices should be made by the natural leaders of these same good citizens, in giving time to the shaping of public opinion and in serving on boards and commissions more or less honorary in character, it being understood that both routine and expert duties in connection with such commissions will be rendered by properly paid officials, engaged on the civil service plan where practicable.

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THE VALUE OF EXTREME FINENESS OF GRINDING FOR HYDRAULIC CEMENT.

The extreme degree of fineness to which hydraulic cements are now required to be ground is a comparatively modern feature of cement specifications. Twenty years ago most cement users laid far greater stress upon the qualities of weight and color, which are now considered insignificant in comparison. When once engineers came to believe in the value of fine grinding, however, the progress made in developing this quality was very rapid. Cements which were regarded as finely ground ten years ago will not meet the standard requirements for fineness today, and the point has apparently not yet been reached where a still greater degree of fineness is not considered as an advantage. As an illustration, a well-known engineer has recently stated that in his opinion the point of fineness at which a cement was "really a cement and ceased to be sand" lay somewhere between a powder which would pass a sieve of 40,000 meshes and one which would pass a sieve of 160,000 meshes per sq. in. Few engineers, perhaps, would hold such an extreme degree of fineness essential, but the tendency everywhere, in Europe as well as in America, is, nevertheless, to place greater stress upon fine grinding and tests for fineness for Portland cement particularly.

It is reasonable to presume that this belief has not gained its popularity with engineers without some basis, and it may repay a little study to determine upon what particular merits for practical use extreme fineness has come to be considered a valuable quality for cement. Such a study will also be of value, we think, in shedding light upon the further problem whether it is desirable to continue the demand for still greater fineness of grinding, particularly such extreme degrees of fineness as those suggested by the figures just quoted.

At the very outset the generally accepted theory as to the inertness of the coarser particles of cement, as it is generally stated, needs to be corrected. By many recent writers on cement it has become the habit to class this coarse residue as practically inert. Some authorities even go so far as to regard it as a mere adulterant or as acting like so much sand. Such statements, when made without qualification, are entirely misleading. Experiments show that this coarse residue has a true cementitious value, of more or less amount, depending upon the size of the particles. Space will be taken here to quote only one of the most recent experiments in proof of this statement, but there are plenty of others which might be quoted with equal force. These figures are compiled from a series of tests made by Mr. David B. Butler, Assoc. M. Inst. C. E., and described by him in a paper published in the last volume of the "Proceedings" of the Institution, and they are as follows:

Portland Cement.

	Retained on —50 sieve.— 6 mos., lbs.	12 mos., lbs.	Passed 50; —ret. on 70— 6 mos., lbs.	12 mos., lbs.	Passed 70; —ret. on 120— 6 mos., lbs.	12 mos., lbs.
A.........	150	160	200	200	250	330
B.........	95	120	110	160	175	200
C.........	90	120	140	170	190	280
D.........	90	140	115	197	192	200
E.........	..	180	190	292	330	420

The experiments show that compared with the fine, impalpable cement dust the coarse particles are evidently of greatly inferior cementitious value, but that they are not wholly inert. In fact, it would perhaps be better if they were, as will be shown further on. The fact obviously is that as the water is able to combine more readily with the fine than with the coarser particles, they set sooner and develop strength faster. Ultimately, the coarse particles also become hydrated and set and harden, but considerably after the fine dust has reached a somewhat permanent stage of hardness. The real objection to the coarse residue, if there is any, lies in this delay in its final hydration rather than in its inertness.

A further investigation of the figures presented by the experiments just quoted brings out this and a number of allied facts of significance. It appears from the accompanying table: (1) That the finer a cement is ground the more rapidly it sets, and, somewhat less certainly, (2) that finer grinding seems to correct any tendency to unsoundness. Both of these conclusions are corroborated by previous French and German experimenters and are not really new, but they illustrate the two facts which it seems needful to emphasize here.

Table Showing Effect of Fineness Upon Time of Setting; Rise in Temperature During Setting, and Soundness.

Cement.	Condition.	Per cent. residue on sieves of— 180.	76.	50.	Time of setting— Initial, mins.	Hard, mins.	Increase of temperature during setting.— °F.	mins.	Return to normal temperature, mins.	Faija hot water test.
J.	....Normal	22.4	6	0	25	45	22 in	40	120	Sound.
"	....Reground	Trace.	0	0	1	5	38 "	5	90	"
K.	....Normal	26 6	10	2.7	30	90	17 "	100	240	"
"	....Reground	Trace.	0	0	6	15	32 "	11	150	"
L.	....Normal	24.4	7.6	1.5	30	120	9 "	60	180	Blown.
"	....Reground	Trace.	0	0	7	15	29 "	13	120	Sound.
M.	....Normal	30	6.7	1.2	20	60	21 "	34	150	"
"	....Reground	Trace.	0	0	2	10	26 "	8	75	"
N.	....Normal	28.4	9.3	1	15	30	25 "	21	120	"
"	....Reground	0.6	0	0	1	10	32 "	4	120	"
O.	....Normal	26.4	7.7	0.5	(1)	360	2 "	39	160	"
"	....Reground	0.4	0	0	8	25	27 "	12	95	"
P.	....Normal	18	3	0.8	15	240	15 "	23	120	Badly blown.
"	....Reground	0.4	0	0	2	240	23 "	5	100	Slightly blown.
"	....2% gypsum	18	3	0.8	(1)	1,440	1 "	15	35	Blown.
Q.*	....Normal	34.8	16	3.6	20	30	17 "	35	180	Badly blown.
"	....Reground	1.6	0	0	2	5	26 "	5	180	Sound.
"	....2% gypsum	34.8	16	3.6	(1)	1,440	1 "	15	30	Blown.

(1)Time of initial set indefinable.
*A specially prepared over-limed cement.

If a finer grinding of cement corrects a tendency to "blow," it is evidently a most important thing for engineers to know. That it does do this seems open to very little doubt, and it may be readily explained, we think, why it should. One of the most prolific causes of "blowing" in cement is quite generally admitted to be an excess of uncombined lime. The hydration of this lime causes expansion whether a cement is fine or coarse, but in the finely ground powder the hydration takes place during gaging, owing to the ease with which the water gets access to the almost impalpable grains, and the expansion is immediate and uniform and does no damage. In the coarse powder, on the contrary, the uncombined lime in the interior of the particles does not hydrate, and consequently expand until the surrounding finer grains have set and thus swelling and cracking results; or, in other words, the cement "blows."

That the foregoing explanation covers all the causes of unsoundness in cements no one will contend for a moment, but it does give a reason, we think, why a very finely ground cement shows less tendency to "blow" than the same cement coarsely ground. It indicates, furthermore, that in holding the theory that the coarser residue is inert we neglect a possible source of danger. If the coarse particles were really inert, like so much sand, for instance, they would not be acted upon at all by water. All the effect they could possibly have would be to make the hardened cement more porous and thus allow the freer entrance of disruptive elements into the cement stone. The great importance of this feature of porosity was fully discussed in Engineering News of July 29, 1897, and need not be alluded to further here.

The evidence deduced so far, while it is not so conclusive as one could wish, tends on the whole to show that it is not the inertness, but the activity of the coarse residue, that makes it most undesirable. If inertness were the only charge against the coarse residue, the moderate percentage of coarse material would be of no great importance. About the only disadvantage resulting would be a reduction in the ability of the cement to take sand. The hardening of a finer cement mixed neat is more rapid, but it attains less final strength than when more coarsely ground.

The effect of fine grinding upon the setting properties of cement is also an important matter to be kept in mind. The tendency of engineers to-day seems to be to call for slower setting cements as well as finer grinding. The figures given in the table and corroborated by other experiments indicate pretty certainly that these qualities are antagonistic to each other, and if engineers persist in demanding both something must be done by the manufacturer to modify this antagonism. The question is, what will it be? Aeration will usually render the cement slower setting, but this is a process which takes time and labor to accomplish properly, and in the rush of manufacture and construction work it is likely to be neglected for some easier method. The danger is that adulterants may be employed.

By adding a small percentage of ground gypsum to the cement the figures given in the table show that the rate of setting is materially retarded. They also show that the tendency to blow is increased. This form of adulteration is mentioned particularly because it is already largely practiced in Germany. In fact, the addition of not over 2 per cent. of powdered gypsum to Portland cement is sanctioned by the German Cement Manufacturers' Association. Several high authorities maintain, however, that the addition of gypsum should never be sanctioned where cement is to be used in sea water, and experiments recently made show that the addition of 5 per cent. of gypsum causes decided disintegration. Even if the addition of 2 per cent. of gypsum is allowable, it is evidently very easy to overstep the mark. Until, then, the ultimate effect of adding gypsum to retard the rate of setting is more fully investigated it seems the part of wisdom to regard it with suspicion.

The next feature of extreme fineness of grinding which is of most particular interest to engineers is its effect upon the strength of cement. Fortunately, the evidence is so complete upon this point that it can be quickly dismissed. Gaged neat, as already stated, a very fine cement is stronger at early ages and weaker at great ages than a cement more coarsely ground. Mixed into mortar with sand, however, the superior strength of a fine cement over a coarser cement is very evident, at least in the earlier periods of hardening. A mortar high in sand exhibits this value of fine grinding more, however, than a mortar low in sand. In many cases a very rich mortar made with a coarse cement reaches nearly the same ultimate strength as when made with a very fine cement. The attainment of extreme fineness may not always, therefore, be economical when the extra cost of fine grinding is considered. This bears directly upon the inquiry already suggested, whether such extreme fineness as powder which will all pass a 40,000 mesh sieve is practically worth attaining.

There is much to be said upon this question and space can be taken here only to suggest a few of the most prominent considerations. It seems likely first of all that to produce regularly a cement finer than will pass a 40,000 mesh sieve means considerably increased cost in manufacture. As a single illustration, manufacturers question whether mechanical screening is practicable where screens finer than 200 meshes per lineal inch are required, and if finer grinding is required some new method of separating the sufficiently fine from the coarse powder must be devised. Doubtless, such a method can be devised, but can it be done without increasing the cost? This is a fact not yet determined. The further problem of too rapid setting because of such very fine grinding is also yet to be solved. When, however, these questions are finally settled there is still another to be decided. May it not be cheaper to develop a certain strength of mortar by using a coarse cement low in sand than by using a fine cement high in sand? We know for a fact that this is true of many similar cases. It is cheaper, for instance, to attain a certain strength of mortar or concrete in some cases by using a rich natural cement mixture than it is by using a poor Portland cement mixture. The case of using a fine or a coarse cement is quite similar.

To summarize what has been said we may conclude: (1) The coarser particles of cement are not inert but have a certain cementitious value approximately in inverse ratio to their size, and because of this activity introduce an element of danger from blowing; (2) the extreme fine grinding of cement decreases its cohesive strength, but immensely increases its adhesive strength, and, consequently, its value as cement, but the attainment of extreme fineness may not always be economical in practical construction, owing to the extra cost of fine grinding; (3) the finer grinding of cement greatly hastens its value of setting and may introduce the necessity of using adulterants or other artificial means of retardation; (4) finer grinding seems to correct a tendency to unsoundness by allowing the water to attack the uncombined lime during gaging instead of after setting, as is the case when it is confined within the coarse particles.

On the whole, these conclusions demonstrate the advantage of fine grinding. They bring out clearly, however, that this merit is not entirely unalloyed with disadvantages. This is the truth which we have wished especially to emphasize in this brief discussion, for the reason that in many instances it has seemed to us that the greatly superior strengths shown by fine cements over coarse cements in short-time neat cement tests has led cement users to grant them superiority on that evidence alone. As we pointed out in our issue of July 28, high short-time tests are likely to be overestimated in practical value if good judgment is not exercised. Fineness of grinding considered from the point of view of strength alone involves a similar danger.

In conclusion, attention may be directed to the figures in the accompanying table, which show the relation between the rise in temperature of cement during setting and its soundness. Some authorities, as is well known, have advocated this rise in temperature as a test for soundness. The figures in the table do not support this theory. In fact, they show that this evolution of heat bears a distinct relation to the time occupied in setting. To require that a cement shall show little or no rise in temperature during setting ensures an extremely slow setting cement but does not guard against an unsound one.

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LETTERS TO THE EDITOR.

Report on the Condition of the Paints on the 155th St. Viaduct, New York City.

Sir: We have read in Engineering News of July 28, Mr. Henry B. Seaman's comment on your editorial of July 21, in which, referring to the paints used on the 155th St. Viaduct, he says: "All the paints used in this test were patented paints." We wish to take exception to this statement, as Dixon's Silica-Graphite Paint was one of the paints used, and it is neither patented nor a compound. The name silica-graphite fully designates what the pigment is, namely, silica and graphite. The silica is not silicate of alumina, as some have wrongly supposed, but is, practically speaking, a pure silica ground to an impalpable degree of fineness. The graphite is not one of the amorphous forms of graphite, nor is it of the soft Ceylon variety; it is a hard, tough, flake graphite which comes from the famous Ticonderoga mines in New York state, which are owned by the Dixon company. Graphite paints, to possess the greatest durabliity, so far as the pigment is concerned, must be made of the toughest and best form of graphite, and graphite varies greatly.

Yours very truly,
Jos. Dixon Crucible Co.

Jersey City, N. J., Aug. 10, 1898.

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The "Arithmetic of the Steam Engine" Again.

Sir: Waiving all further discussion of those points relating to sensible heat, horse-power, etc., about which we appear to differ, I would beg a few more lines of space to defend the position regarding energy, momentum and vis viva which I have taken in the little volume that has given rise to this correspondence.

To begin at the beginning, everything connected with these subjects starts from the well-known relation which, derived from actual experiment, governs the movements of heavy bodies acted upon by a constant accelerating force, namely:

$$v = a\,t. \qquad (1)$$

In which relation v = velocity in feet per second at a given instant; t = corresponding time of action in seconds, and a = acceleration due to constant force in feet per second, per second. From (1) we derive:

$$t = \frac{v}{a}$$

Multiplying both sides of the equation by $\frac{v}{2}$

$$\frac{t\,v}{2} = \frac{v^2}{2\,a}$$

Now $\frac{v}{2}$ = mean velocity of a body moving from rest under the influence of the acceleration, a, at the instant when its velocity = v. But time into mean velocity = distance covered during the given time, hence the next above equation becomes:

$$h = \frac{v^2}{2\,a}, \qquad (2)$$

In which equation h = distance traveled in given time t. The element of time disappears from this equation.

The acceleration due to terrestrial gravitation being represented by g, (1) and (2) become for the special case of heavy bodies falling upon the surface of the earth:

$$v = g\,t. \qquad (3)$$

$$h = \frac{v^2}{2\,g}. \qquad (4)$$

According to the second clause of Newton's second law of motion, as quoted by Jamieson, "The change in the quantity of motion is therefore proportional to the force applied, and takes place in the direction of that force." Hence, the corollary of primary significance in dyramics—"Constant or uniform forces acting freely upon heavy bodies impart to such bodies accelerations proportiona to the intensities of the forces themselves." (Arithmetic of the Steam Engine. p. 61.) This law enables us to measure the intensity of forces imparting given accelerations to bodies possessing certain weights, by comparing these accelerations to the acceleration imparted by gravity. The law may be thus stated: A force, F, imparting an acceleration (or retardation), a, to a body of weight, W, is to such weight as a is to g. Or, expressed as an equation:

$$\frac{F}{W} = \frac{a}{g}. \qquad (5)$$

Which reads: Force is to weight as acceleration is to 32.2.

These elementary preliminaries being established, let us revert to our formulae (1) to (5). From (1), we have:

$$a = \frac{v}{t}$$

Substituting this value of a in (5) gives:

$$F\,t = \frac{W\,v}{g}. \qquad (6)$$

This is the formula of momentum, and it gives the steady force, F, necessary to communicate or extinguish the stored energy of a body of weight, W, moving with a velocity, v, in the time, t, which elapses before the body comes to a state of rest.

Multiplying both sides of (6) by $\frac{V}{2}$, gives:

$$\frac{F\,t\,v}{2} = \frac{W\,V^2}{2\,g}$$

But we have already seen that $\frac{t\,v}{2} = h$. Therefore,

$$F\,h = \frac{W\,V^2}{2\,g}. \qquad (7)$$

This is the formula for vis viva, and it gives the steady force, F, necessary to communicate or extinguish the stored energy of a body of weight, W, moving with a velocity, v, in the distance, h, traversed by the body before coming to a state of rest.

Every heavy body moving with a certain velocity has stored within it, in virtue of its property of inertia, a certain amount of energy depending upon its weight and velocity. We estimate this energy by the force necessary to produce or destroy it. The right hand member of (6) represents the passive force, F, necessary to destroy the energy stored in a body of weight, W, moving with the velocity, v, in one second of time. The left hand member is the product of the force and any given time necessary to accomplish the same result. Note, as bearing upon your previous criticism, that the left hand member is simply "weight into time." The necessary element of motion is only to be found in the right hand member.

The right hand member of (7) represents the passive force, F, necessary to destroy the stored energy in the distance of one foot, assuming throughout English units. The left hand member is the product of the force and any given distance necessary to accomplish the same result. Note again that the left hand member of (7) is "weight into distance."

An illustration: A flywheel rotating with a certain velocity contains a certain amount of energy stored in its rim. If steam be suddenly shut off and a steady, stationary force of a certain number of pounds be applied to the brake-drum, the stored energy will be gradually extinguished and the wheel will stop in a certain number of seconds. During that time it will perform a certain number of revolutions before coming to a stop. The energy stored in the wheel is the same, and the force applied to the break is the same, and we can estimate the amount of energy neutralized by the given force, neglecting other resistances, either in terms of time, when it becomes a problem in momentum, or in terms of distance, when it becomes one of vis viva. This is why I said in my book that "Momentum represents the stored or acquired energy of weight acting through time," and that "Vis viva represents the stored or acquired energy of weight acting through distance."

No exposition of mathematical principles is complete without a numerical example. Let us add a little to the data of your example of a ship weighing 10,000 tons, acted upon by a weight of 1 lb. for a period of 100 seconds, so as to make it amenable to calculation, and let us suppose that the ship has been moving with a certain steady velocity, V, when the propelling force is suddenly withdrawn and she forges ahead in virtue of her inertia, until stopped by the steady resistance of 1 lb. applied for a period of 100 seconds. With what velocity was she moving, and in what distance did she stop? Reducing the tons to pounds and applying (6) we have:

$$V = \frac{1 \times 100 \times 32.2}{20000000} = 0.000161 \text{ ft. per second.}$$

As for the distance traveled before stopping, we have above her initial velocity, which was gradually reduced to zero. Her mean velocity was therefore one-half of the above, or 0,0000805 feet per second, and it was maintained for 100 seconds. Hence the required distance is 0,00805 feet. This result can also be obtained directly by using (7). This example is, of course, fanciful, but it serves the purpose of illustration.

It will be noted that in all the above illustrations the stored energy only has been considered. In the case of a locomotive running with a certain regular speed the resistances offered only prevent an increase of velocity. If the steam be shut off, they overcome the stored energy and bring the machine to a stop. When speed is maintained against resistance, the problem is one of work and neither of momentum nor vis viva.

I could not explain all this so fully in my little book without sacrifice of brevity. I believe, however, that the subject is of sufficient importance to render the above elucidation of interest and possibly of utility to many of your readers.

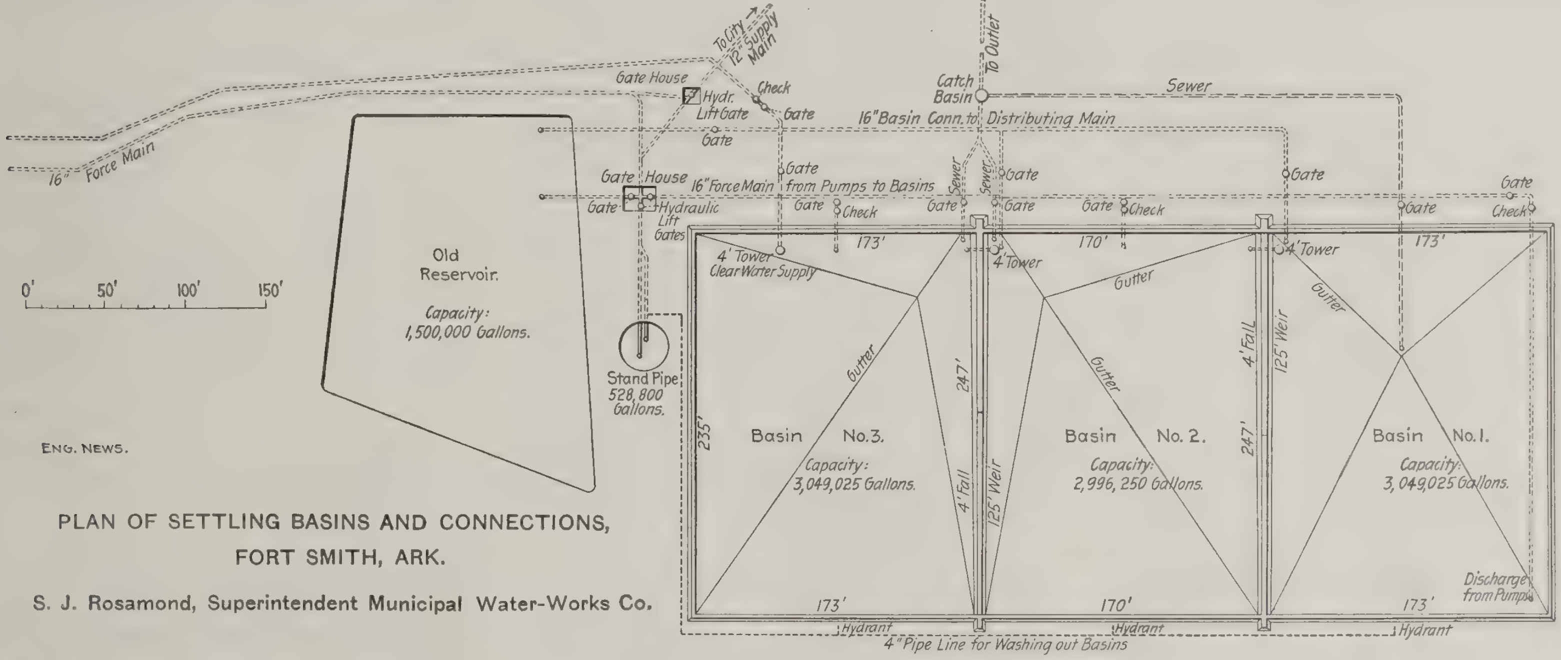
Very faithfully yours,
E. Sherman Gould.

Yonkers, N. Y., Aug. 1, 1898.

(We give place to Mr. Gould's letter, and will say that our difference with him relates practically only to the definition of the terms energy, momentum and vis viva. The last-named term we consider and obsolete one.—Ed.)

THE NEW SETTLING AND AERATING BASINS, FORT SMITH, ARK.

Three new settling basins, with a combined capacity of about 9,000,000 gallons, were put in operation at Fort Smith, Ark., in November, 1897. They were designed by Mr. S. J. Rosamond, Superintendent of the Municipal Water-Works Co., and built under his direction. We are indebted to Mr. Rosamond for the information from which our description of the basins has been prepared.



PLAN OF SETTLING BASINS AND CONNECTIONS, FORT SMITH, ARK.

S. J. Rosamond, Superintendent Municipal Water-Works Co.

Fort Smith had a population of 11,311 by the U. S. Census of 1890, and of 20,100 by the directory census of 1898. The water-works were built in 1884. The supply is pumped from the Poteau River, to a stand-pipe and direct and also to settling basins. Besides the settling basins there is an old reservoir with a capacity of 1,500,000 gallons.

The old and new basins, the stand-pipe and connections are shown in plan by the accompanying illustration. The pumping station is about 2,500 ft. from the old basin.

The bottom of the new basins is solid rock, covered with 2 ins. of cement mortar. The basins are so located on sloping ground as to give a fall of 4 ft. from No. 1 into No. 2, and from the latter into No. 3. Advantage is taken of this to aerate the water by passing it over weirs, now stopped off to a length of 75 ft., but with a full length of 125 ft. for use when the consumption increases. Clear water may be drawn from any one of the three basins through a tower 4 ft. in diameter, and 15, 14 and 10 ft. in height for basins Nos. 1, 2 and 3, respectively. These towers are of ¼-in. wrought iron, and are provided with inlets at different levels so the water may be drawn from the top, middle or bottom of the basin, if desired; generally it will be drawn from the top.

The average water consumption is about 2,000,000 gallons a day in summer. The Poteau River, from which the supply is taken, is quite turbid at times. The settling basins, Mr. Rosamond states, have given satisfactory results. He also says that the stand-pipe is filled only when the river is clear, and is always drawn upon for fires, the direct pressure being reserved for emergencies. In case of an exceptional demand it might be necessary to use water without sedimentation, but probably this occurs only at long intervals.

GUN-FIRE ANALYSIS OF THE SANTIAGO SEA-FIGHT.

The gun-fire is analyzed, for the Santiago sea-fight of July 3, by Lieut. B. W. Wells, Flag Secretary for Commodore Schley. The total number of guns on the seven American and six Spanish ships engaged is given in detail as follows:

United States.		Spanish.	
Caliber.	No. guns.	Caliber.	No. guns.
13-in. B. L.	8	11-in. B. L.	6
12-in. B. L.	6	6-in. R. F.	10
8-in. B. L.	32	5.5-in. R. F.	30
6-in. B. L.	14	4.7-in. R. F.	6
5-in. R. F.	12	12-pdrs.	4
4-in. R. F.	6	6-pdrs.	38
6-pdrs.	90	1-pdrs.	10
1-pdrs.	28	Maxim-Nordenfeldt	4
Maxim-Nordenfeldt	3	Hontoria 37-mm.	24
Machine guns	26	Machine guns	14
Total	225	Total	146

While the United States had fourteen 13-in. and 12-in. guns, only two shots from these struck the enemy's ships. In rapid-fire guns the Spanish had 50 of this type, including 12-pdrs., against 18 on the American ships; in smaller guns the proportions were 131 on the U. S. ships to 76 on the Spanish ships, omitting machine guns. The accurately destructive fire of these small guns on the American ships drove the Spanish from their guns; though the 8-in. American fire probably did the most serious damage.

When the Spanish ships left the harbor they headed westward and brought their full port batteries to bear; while the American ships were closing in bows-on. As a result, the following table gives a fair estimate of the number of guns engaged on each side:

United States.		Spanish.	
Caliber.	No. guns.	Caliber.	No. guns.
13-in.	4	11-in.	6
12-in.	4	6-in. R. F.	5
8-in.	32	5.5-in. R. F.	15
6-in.	7	4.7-in. R. F.	3
5-in. R. F.	6	12-pdrs.	4
4-in. R. F.	3	6-pdrs.	21
6-pdrs.	47	1-pdrs.	5
3-pdrs.	4	Hontoria 37-mm.	21
1-pdrs.	4	Maxim-Nordenfeldt	4
Machine guns	8	Machine guns	7
Total	119	Total	91

To determine the metal thrown per minute, says Lieut. Wells, take the time allowed from fire to fire for the 13-in. gun as a unit. Then in that length of time the weight of metal from the 13-in. guns would be 4,400 lbs. The allowed time from fire to fire for the 13-in. is 320 seconds, and for the 12-in. it is 300 seconds, hence the weight of metal thrown by the 12-in. in 320 seconds is 3,613 lbs. These quantities for other calibers are found similarly; hence we have:

Guns.	Metal, lbs.	Guns.	Metal, lbs.
13-in.	4,400	4-in. R. F.	1,584
12-in.	3,613	6-pdrs.	7,520
8-in.	12,000	3-pdrs.	384
6-in.	1,778	1-pdrs.	1,720
5-in. R. F.	3,840		

Total weight thrown in 320 seconds, lbs. 35,839
Weight thrown per minute, lbs. 6,720

In determining this quantity for the Spanish guns the same time allowances are used as for similar types of United States guns. The weights of projectiles are for common shell, and have been ascertained as nearly as possible. The time unit is 300 seconds, being the interval from fire to fire of the United States 12-in. gun.

Guns.	Metal, lbs.	Guns.	Metal, lbs.
11-in.	3,516	4.7-in. R. F.	1,584
6-in.	3,750	6-pdrs.	3,150
5.5-in. R. F.	10,277	1-pdrs.	960
12-pdrs.	800	Maxim-Nordenfeldt ...	300

Total weight thrown in 300 seconds, lbs. 24,133
Weight thrown per minute, lbs. 4,827
Machine guns are omitted.

It will be noted that the weights thrown per minute were as 6,720 to 4,827; this is approximately as 139 to 100. Therefore the fire of the United States ships, instead of being treble that of the Spanish ships, was one-third greater, and this small difference could not alone account for the disparity in results.

Lieut. Wells concludes that the victory was due, in part, to the following causes:

1. The greater accuracy of fire of the United States vessels.

2. The use of wood in the Spanish ships to such an extent as to render the extinguishing of a fire practically impossible after several large shells had cut up water mains and hose.

3. The greater number of guns of 8-in. caliber on the United States ships.

4. The better morale due to the fact that all the crews had been under fire a number of times during bombardments along the Cuban coast at Santiago de Cuba and at San Juan.

5. The value of a large secondary battery was demonstrated, for the work of the 6-pdrs. contributed largely in keeping down the enemy's fire by driving them from their guns.

6. The necessity for more and better protection for the gun's crews. With the men disabled or driven from their stations, the ship is of little value as a fighting machine. The armor of the "Colon" kept out 5-in. shells at a range of about 3,000 yds. This would be a very great superiority in many cases.

7. The small danger of injury to the water-line portions of the ships. So far as is known, no vessel was penetrated between wind and water. Moderate armor protection at the water-line, with a strong protective deck, would permit a more efficient distribution of the armor around the gun positions.

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A HIGHER INDUSTRIAL AND COMMERCIAL EDUCATION.*

The material prosperity of any country is the foundation of the happiness and of the progressive enlightment of its people. To learn the essential conditions of such a prosperity, therefore, is a matter of supreme importance. In the former times, all knowledge of material things was traditional, and had to be learned by the traditional methods; to-day nearly all knowledge is scientific, and should be acquired by scientific methods. Formerly the industries were directed by mechanics, who by a long apprenticeship had slowly acquired the manual methods of their predecessors; to-day they are most successfully guided by men of large scientific attainments; and in the near future such scientific direction will be absolutely essential wherever there is free competition in the market to be supplied. Prosperity, or even supremacy, in material things in the past, is, therefore, no promise of such a position in the future, and as a proof of this, we have but to compare the past achievements of England and its present subordination to Germany.

That an interior country like Germany, without a navy, and with little foreign commerce, could in a quarter of a century increase her manufacturing capacity ten-fold and make it equal to that of England;* increase her shipping twenty-fold, making it second to that of England; effectually establish a regular export trade with every country on the globe, and by at once cheapening products and improving their quality, put herself in a position to hold these markets indefinitely; that all this could be accomplished in the face of open competition, and in this age of universal publicity, is indeed marvelous and would alone prove that old methods have lost their potency, and that something new has arisen under the sun.

When we seek an explanation of these wonderful achievements we find only a rational and provident application of means to ends, but on the most gigantic scale and persevered in far more consistently than has ever before been even planned, to say nothing of the execution. It is evident that the efficient direction of any industry to-day demands a very large amount of technical knowledge which cannot be learned at the bench or in the shops. While self-education is always possible, the obstacles are commonly prohibitive, and at best the results are meagre and unsatisfactory. Germany has seen this situation most clearly, and it is to her clear conception of this problem, and her rational and thorough solution of it, that has raised her industrially from poverty and obscurity to wealth and fame in the short period of a quarter of a century.

The German Mono-technic Schools.

Seeing that the capacity for production is limited only by the inteligence and foresight of a people, and that there is a rapidly growing and prospectively unlimited demand for all kinds of artistically manufactured goods, Germany set to work some twenty-five years ago to supply this demand by the intelligently directed labors of her own people. This country had long been the home of classical and military learning, but it now became also the very center and head of technical and industrial education. The members of this society are all quite familiar with her high-grade engineering schools, but we are not so familiar with her industrial schools. In fact, we have commonly spoken of these with more or less indifference, calling them trade-schools. We have assumed that the difference between them and the engineering schools was one of kind, rather than of quality or degree. As a result of some recent study of the leading industrial schools in Germany, I am inclined to question the justice of our position. Since the sciences of mathematics, of physics, of electricity, of chemistry, of mechanics, of steam engineering, and of the materials employed, enter so largely into all these school courses, they are, in fact, schools of applied science, and they now pass in Germany under the very appropriate name of mono-technic schools. Such schools are there found for all the leading industries of the empire, and there are many schools for the same industry. Thus there are in Germany 13 schools devoted to the textile industries, each with its peculiar organization specially adapted to the region in which it is placed. As little duplication as posible is practiced, and when the same field is covered in two or more schools, variations in methods are introduced for the purpose of comparing results. The students entering these schools have first to complete the course of study in the "Real Schools" (or say, through the sophomore year of our engineering schools), and then the course of study in the mono-technic schools is three years of 45 hours a week, on the successful completion of which certificates are granted.

The fine and costly buildings in which these schools are installed; their elaborate equipment with all the needful chemical and physical laboratories, and machinery to convert them into regular commercial factories; their large corps of trained teachers, and the very small number of students admitted to take their full courses; the administrative care and oversight given to them, and their very small tuition fees, all serve to make the training given in them extraordianrily expensive to the state. Thus the textile schools of Crefield had last year only 108 regular day students in the weaving school, and 40 in the dyeing and finishing school. In the weaving school was the director with 15 assistant lecturers, and six other assistants; in the dyeing and finishing school there were the director and three assistant lecturers, a special chemist for dyeing and for finishing, or a force of 29 instructors for 146 regular students. There were, however, irregular students in attendance on night and Sunday courses. The plant of this school included extended chemical and physical laboratories fully equipped, drawing rooms, lecture and testing rooms, chemical museum, library and reading rooms. The mechanical equipment was that of a complete weaving, dyeing and finishing works, for all the finer grades of woolen and silk goods. Commercial work is done on a large scale, the students doing the work under the direction of the assistants. Specially difficult tasks in dyeing are here undertaken and successfully accomplished, and regular consignments of this character are made by some of the leading factories of the empire.

This school is only one of hundreds in Germany which are training up a class of men for the direction of all kinds of commercial works in which scientific knowledge is finding its embodiment and application. As a result of this training we find such great industries as the Aniline and Soda works at Ludwigshafen on the Rhine, which has grown from employing a total force in 1865 of 30 people to employing 5,000 men and over a hundred trained chemists in 1897. Also the optical and electrical works of Schuckert & Co., at Nuremberg, which started on a very small scale in 1882, but which now employs over 4,000 men, besides a large scientific staff, and which had in 1897 unexecuted orders on hand aggregating $15,000,000. Three-fourths of of all the coloring matters and pharmaceutical products now produced from coal tar is made in Germany, their total annual products of this class aggregating $40,000,000. The earliest chemical discoveries of these products were made in England, but there was not sufficient knowledge of applied chemistry in that country to utilize these discoveries.* It is such examples as these, of which there are many, that indicate that Germany is reaping the fruits of the painstaking and farseeing policy she has entered upon, and if other nations wish to share her prosperity, they must act with a like wisdom and determination. The proof that Germany's remarkable industrial prosperity is traceable very largely to her educational methods† is so patent to the people themselves that they voluntarily unite to support schools in their particular trades. Thus of the 248 mono-technic schools in Prussia alone, which are so supported, the painters and decorators have 32; the shoemakers, 9; the tailors, 16; the bakers, 20; the butchers, 6; the smiths, 26, and so on.

Every trade has its own school aside from those supported by the state and by the municipalities. The artisans themselves see that systematic and scientific teaching entirely outclasses the old apprenticeship system, and these schools are constantly multiplying. In Saxony alone, there are 111 of these mono-technic schools, besides ten schools of agriculture and 40 of commerce. In the Grand Duchy of Hesse, with a million inhabitants, there are schools of agriculture and sculpture, nine schools for artisans, 43 for industries, and 82 schools of design. The Grand Duchy of Baden, with 1,600,000 inhabitants, supports schools of industry, architecture, commerce, clock-making, cabinet-work and music, with an annual expenditure of $280,000. In addition to these schools peripatetic teachers are employed to go from house to house to instruct in embroidery and the use of the sewing machine, the state selling these machines at a greatly reduced cost on condition that the purchaser shall explain its workings to her neighbors. In fact, Germany, as viewed from without, would seem to be in the throes of a kind of educational fever. No doubt a large part of this educational work has been necessary as a result of the very backward condition of the common people along these lines, and to such an extent these methods could not find a place in this country, but aside and beyond these limits may we not see in the example of Germany the royal road to industrial prosperity? While the industrious character of the people, the military spirit which pervades all her industrial and commercial affairs as well as the military department; the absolute stability of her governmental policy and the fixedness of her currency and financial basis; and the disposition to be satisfied with small wages and profits so long as these both rest on a sure and permanent footing; while all these certainly contribute largely to her present material prosperity, these same advantages are also held with her in common by some other countries which are not, however, sharing her present prosperity. The tremendous military budget of Germany cuts deeply into her productive profits, so that without this her commercial advancement would have been still more marked. It is not her army of soldiers, however, which other nations need to fear, but her army of scientifically trained directors of industrial enterprises, and of the highly educated commercial agents, at which they may well tremble.

But Germany not only educates the men who manufacture, but she is also beginning to look well to the training of the men who are to carry their goods to the ends of the earth and report back the peculiar needs of every locality. Schools of commerce are being organized, modeled after those of France and Belgium, in which in addition to what is taught in our "commercial colleges," will be found a speaking and writing acquaintance with several foreign languages, especially English, Spanish and French, if these have not already been acquired; political economy; industrial and patent laws; railroading; shipping; postal and telegraph regulations; banking, exchange, coinage and national schemes of finance; industrial history; commercial geography, etc. A German National conference was held on this subject a year ago, and a new system of commercial education is now being established all over the empire. Modern languages form a part of the elementary school training, especially English, so that the entering students in these schools are likely to be well equipped in this particular. With such material as these schools will turn out, their students coming from the better mercantile classes, and having the manners and bearings of gentlemen, the large manufacturing and mercantile houses can establish branches in all the leading foreign countries, and with the system of foreign German banks, which are even now found everywhere, the conditions are ripe for the ready and rapid sale of German products in all parts of the world. From a remarkable publication by Mr. Frederick Emory, just issued from the Bureau of Foreign Commerce of our State Department, on the recent increase in our foreign trade, and in reference to the necessity for the individual manufacturer and merchant to study carefully the trade conditions in foreign countries, I quote:

> Nor is it with the relation of the different nations to one another that we are alone concerned. The industrial changes current within the territory of each obtain a new and much graver importance in their possible effect upon our nascent development as an exporter of manufactured goods. The conditions contributing to the rapid growth of manufacturers in recent years; the fiscal changes in Russia, India and Japan as well as in some of the Latin-

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*Abstract of the Presidential address of J. B. Johnson, M. Am. Soc. C. E., before the Society for the Promotion of Engineering Education, Boston, Aug. 18, 1898.

*See Mulhall's Industries and Wealth of Nations, 1896.

*Report of Technical Instruction Committee, City of Manchester, England, 1897, page 12.

†This is universally acknowledged by all who have examined into her system. See English Consular Report, No. 2,046, entitled, "Trade in Germany," April, 1898.

American countries; the extraordinary impulse given to the industrial growth of the German Empire as a factor of international trade; the advance of Russia on similar lines; the rapid progress of the Siberian Railroads toward an open port on the Yellow Sea; the efforts of Great Britain to meet the encroachments of other nations; the decline of the sugar industry in the West Indies as a result of the beet-sugar competition; the troubles of Spain with her colonies; the discovery of gold in Alaska and the adjacent territories in British Columbia; the tariff legislation of the United States, Canada and other countries; all the phases of economic changes during the past year, have an interest and importance for the individual operative in the United States which are greatly enhanced by the transformation now going on in our industrial life, converting us slowly but surely from a people absorbed with the internal development of a virgin continent into one of the great commercial powers of the world, with the international interests and responsibilities which such a position naturally **applies.**

Evidently in order to keep abreast of all such changes which are constantly going on the world over, a special class of highly trained men are required. And here too, the supply of such a new and improved kind of clerical assistance would at once create its own demand.

It would seem the time is now ripe in this country for the establishment of such schools. They are needed as much or more for the training of our foreign consuls as for the commercial agents of the large business houses and industrial establishments.* In France there are eleven of these high-grade colleges of commerce.†

The course of study in these colleges of commerce is two years, with a preparatory year, all of 33 lecture hours a week. The following is a brief outline of the distribution of this time, the minimum age being 16 years, which is predicated upon about our college entrance conditions, to which has been added in the preparatory year about all that is taught in our American so-called commercial colleges:

Distribution of Time in the French Colleges of Commerce.
(Time two years.)

11 hours per week to Commercial Methods and Transactions in what is called the commercial bureau.
3 hours of Commercial Geography.
1 hour of the History of Commerce.
2 hours to a study of Commercial Products, involving the actual handling of the materials.
2 hours to Commercial Law, maritime and industrial.
1 hour to Political Economy.
1 hour to Typewriting.
4 hours to a speaking and writing knowledge of English.
4 hours to a speaking and writing knowledge of some other modern language, as German, Spanish, Italian or Arabic.
3 hours to some special course in Transportation, Chemistry, Microscopy, Commercial Technology or Stenography.

The Lesson for Americans to Learn.

But, you may say, what is all this to us? Have we not the finest system of public schools in the world? Have we not any number of manual training schools and numerous Pratt and Armour Institutions? And finally, have we not a great many engineering schools as good as the best, even in Germany? And have we not "Commercial Colleges" without number? Suppose I grant all this, may I not still say that the common schools give no special preparation for any kind of employment; that the manual training schools likewise fit for nothing in particular; that our engineering schools fit for very narrow lines of professional employment and commonly educate men away from the industrial pursuits rather than towards them; and as for our so-called commercial colleges what do they teach beyond arithmetic, book-keeping, stenography and typewriting? Where then does the scientific training for the manufacturing and commercial industries come in? I submit that it does not come in at all. That our factories and business houses are largely managed by men of little or no scientific training, who have learned their craft in the traditional way, who are, however, of an inventive turn of mind and who read the trade journals. They are a great credit to the system that has produced them, and many of them have become self-educated into an excellent state of efficiency; but they are far from the ideal directors of such business and very far indeed from the standard already achieved in Germany.

The most essential conditions of our future material prosperity, therefore, are, as I conceive them, a specific scientific training for the directors of each and every kind of manufacturing and commercial activity. This is the burden of my address; the imperial and paternal government of Germany has worked out this problem to a most fruitful issue, but probably no other country could duplicate it. England has been trying for ten years to do so, but with very poor success; instead of highly educating a few leaders and directors of industry and commerce, they are vainly trying to raise the whole class of apprentices and clerks by a wholesale system of shallow night-school instruction. Surely a duplication of the imperial German system is not to be thought of in this union of 45 independent States. The great question for us to solve is how to obtain a corresponding specific training for our industrial officials. The problem is a difficult one; to expect that our American municipalities would engage in such a rational expenditure of funds is beyond our credulity or hope. Our State Legislatures could hardly be expected to realize this need so fully as to inaugurate and consistently to support a series of such schools. The National Government now pays out directly to the several State agricultural colleges about a million dollars a year. If this amount, or more, could be annually devoted to a properly administrated series of "mono-technic" schools, suitably located, they would soon prove their worth and probably the larger industrial establishments would soon follow by joint effort in establishing additional ones. It is true that some beginnings have been made. At the universities of Pennsylvania and of Chicago the studies in political and social science have been given a commercial application, and at the State University of Ohio a special course of study has been put in operation covering the clay industries, but not including cement manufacture. All our mining schools fairly cover the theory and some laboratory practice of our various metallurgical operations, and this is usually supplemented by tours of inspection to large typical works.

Doubtless we have other similar beginnings towards the higher industrial and commercial education here contemplated, but we certainly have not yet set ourselves earnestly to solve this problem. It may be that the higher commercial schools and many of the "mono-technic" schools could best be established in connection with our various universities and engineering schools, and yet we seldom find them so connected where they have been brought to their highest development.

Our organized commercial bodies would seem to hold out the greatest promise of favorable auspices for the inauguration of such a system of "mono-technic" and commercial schools, not a single example of either of which is now found in this country. The problem is, however, not without its difficulties, and before anything is done or even recommended, the whole question should be looked into by a commission appointed preferably by the National Government through the Bureau of Education. Should not this society take the initiative in such a movement? I believe it should. I believe the future material prosperity of this country is very largely dependent on how we solve this problem. Let us remember that we can no longer judge of the future by the past; to-day both the successful manufacture and the sale of goods are reduced to exact sciences. Old things are done away and all things have become new. Let us see to it that our ship of state shall be guided by the lights which are now so successfully leading others through the channels of progress, rather than to continue to steer by the vanishing lights of a unique and tortuous past which may soon land us on the sandy banks of delusion and improvidence.

AN ELECTRIC COAL-MINING PLANT IN PENNSYLVANIA.*

The electric mining plant described is located in Westmoreland county, Pa., at Scott Haven, about 27 miles south of Pittsburg, on land owned by the Youghiogheny River Coal Co. This property includes about 5,800 acres, fully four-fifths of which lies on the west side of the Youghiogheny River. During the last 15 years operations have been extensively carried on and up to the present time about 750 acres have been mined. The several mines are scattered over the property, and were formerly operated by separate steam plants.

It was considered advisable by the company to change this and to adopt a method whereby any or all of the mining operations involved could be performed by power generated at and distributed from a central plant which would be capable of enlargement to meet the requirements for many years to come. Electricity was adopted and a location selected for the generating station, which was approximately in the center of the property, close to the Youghiogheny River. This selection was also influenced by its convenience to the main colliery office, its nearness to one of the mines and the fact that at that point was a large brick building which could be used for housing the machinery.

In this way the extreme distance eventually to be covered was limited to three miles in one direction, and four in the other. The present capacity of the power station was determined by considering the character and amount of machinery to be operated at the mines selected to be fitted up. This was as follows:

	HP.
Three locomotives, the average capacity of each being 1,167 short tons of coal, plus refuse, hauled about 1 mile per ten-hour day, say	150.0
Five pumps, of a total capacity of 800 U. S. gallons per minute	40.5
Three fans, of a total capacity of 270,000 cu. ft. of air per minute	105.0
Two screens (only one installed yet)	17.5
One machine shop	10.0
Twelve coal-cutting machines	152.0
Total full load of motors, HP.	475.0

The total number of motors was to be 29, including two on each locomotive, and the average was 18.2 HP.

The boiler plant as installed consists of six 125 HP. externally fired, horizontal, steel tubular boilers, 66 ins. in diameter and 18 ft. long, with 58 4-in. tubes. The working pressure is 100 lbs. per sq. in. These were arranged in two batteries of three each, with independent sheet iron chimneys 32 ins. in diameter and 60 ft. high. Each boiler delivers steam through a 5-in. pipe to a 12-in. header running the whole length of the boiler room. Feed water is taken from a 130-ft. artesian well, and from the pit of mine No. 1, the water from both being pumped into a 35,000 gallon mixing and settling tank. Fuel is hauled by mules on a timber trestle close to building and dumped into hoppers at the rear of the boiler room. There are four McEwen 150-HP. center-crank single-valve horizontal non-condensing engines, with automatic cut-off and cylinders 15 × 16 ins. These are placed in a line parallel to the backs of the boilers and are supplied with steam through 5-in. taps, which pass through the brick wall separating the engine from the boiler room. Exhaust steam is taken care of by a 10-in. pipe

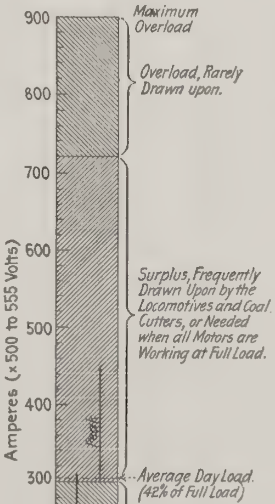

Diagram Showing Capacity and Loading of Power Station of the Youghiogheny River Coal Co., Scott Haven, Pa.

TABLE I.—Particulars of Mule versus Electric-Locomotive Haulage at Scott-Haven, Pennsylvania.

Main haulage.[1]	No. 1 Mine. Mules.	No. 1 Mine. Locomotive.	No. 2 Mine. Mules.	No. 2 Mine. Locomotive.	Pacific Mine. Mules.	Pacific Mine. Locomotive.
Number of mules or locomotives	12	1	12	1	15	1
Number of muledrivers or trainmen	3	2	4	2	5	2
Load hauled per day of ten hours, tons	740	1,000	1,090	1,450	600	1,000
Distance hauled,[2] ft.	5,300	6,500	5,400	5,400	5,400	5,400
Speed miles per hour	3.5	8	3.5	8	3.5	8
Mileage per day[2]	30	55	30	51	35	60
Number of trips made per day	30	25	....	27	....	30
Number of cars hauled per trip[3]	17	35	....	42	....	25
Gage, ins.	43.5	43.5	43.5	43.5	41	41
Weight of rails, lbs. per yd.	16	30 to 55	16	25 to 55	16	30 to 55
Weight of empty car, lbs.	1,100	1,100	1,100	1,100	1,100	1,100
Weight of load, lbs.	2,670	2,670	2,670	2,670	2,670	2,670
Mileage made by original wheels of locomotives	....	9,350	....	....[4]	....	7,500
Cost per ton per mile, approx.,[5] cts.	1.28	1.10	1.00	0.82	1.90	1.25
Rated HP. of locomotives.	....	50	....	50	....	50
Weight of locomotives, tons	....	10	....	10	....	10

[1] As distinguished from "gathering," i. e., collecting the loads from and returning empties to the working places in reference to a central or main point or points inside, to and from which the locomotives run.
[2] Varies in Nos. 1 and 2 mines.
[3] Varied in No. 2 and Pacific mines with mules.
[4] New in July, 1896.
[5] Includes interest, repairs, etc.
Note.—The ton referred to in the table = 2,000 lbs.

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*See an article by Senator White, on Our Inadequate Consular Service, in "The Forum" for July, 1898.

†For a full description of these and also of those of Belgium as well as a complete exposition and analysis of the entire system of English technical education, see Proceedings of the International Congress on Technical Education, held in London, June, 1897, under the auspices of the Society of Arts. See also Prof. James' Report on the Education of Business Men in Europe.

*Abstract of a paper read by Mr. William S. Gresley before the Institution of Civil Engineers.

beneath the floor, which ends in a 500-HP. Hardwick feed-water heater.

The belt wheels of the engines are 64 ins. in diameter, with a 16-in. face, each engine driving through a 15-in. belt a General Electric 100-K-W. 4-pole railway generator running at 650 revolutions per minute. These machines have a no-load voltage of 500, and are over-compounded 10%, giving a full load voltage of 550, and will safely carry a 25% overload for 15 minutes. A suitable switchboard is arranged to permit parallel running, or almost any combination of generators and circuits.

In considering the question of transmission a 10% drop was allowed in feeders, the longest of which would be about 17,750 ft., although the average was 6,518 ft. The transmission lines are nearly all bare copper wires or cables supported on insulators and poles in the customary way, except that separate feeders are run in most cases for cutters, fans and pumps, each set using, however, a common return. Where it was necessary to cross the river, submarine cables were employed. In each case these were 550 ft. long, the sizes and use being as follows:

One cable 0.257-in. in diam. . .	Feeder for pump in No. 4 and South West mines.
Two cables 0.460-in. in diam. .	Feeders for locomotive, pump and fan at Pacific mine.
One cable 0.592-in. in diam. . .	Feeder for locomo., pump, fan and coal cutters in No. 2.
One cable 0.699-in. in diam. . .	Bunched return for all west side mines.

The overhead trolley with rail return is used for haulage, while power or light wires are hung along the tops and sides of tunnels, headings, drifts, or galleries. Daniel-Garton lightning arresters and switches are placed just outside pit-mouths or buildings containing motors. The mine equipments are much the same, and the following description of mine No. 1 will suffice for an understanding of all.

The track, 3 ft. 7½-in. gage, is of 30-lb. rails spiked to sleepers spaced 24 ins. c. to c. Where loaded trains are started the rails are 55 lbs. per yard. The locomotive has two 25-HP. enclosed motors geared to the two sets of 28-in. chilled cast-iron drivers. The motors are series-wound and are operated by a series parallel controller, the operator also having within easy reach the reversing lever, brake lever, etc. The locomotive weighs 10 tons, and has a draw-bar pull of 2,500 lbs. at a speed of 8 miles per hour. As operated it hauls 665 mine cars, containing about 1,000 tons of coal, with refuse, a distance of 6,000 ft. in 10 hours. Table I. affords a comparison of electric and mule haulage, showing the considerable saving resulting from the use of the former.

For drainage, a 6½ × 8-in. horizontal triplex Knowles' pump is geared to a 10-HP., 4-pole, shunt-wound, slow-speed motor. This pump is capable of raising 150 gallons per minute against a head of 150 ft. For ventilating, an 8×3½-in. Capell fan is belted to a 25-HP. multipolar motor. The fan runs at 625 revolutions per minute and discharges 75,000 cu. ft. of air per minute.

Table II. gives the particulars of the electric ventilating apparatus used at the Pacific mine and mines Nos. 1 and 2.

TABLE II.—Particulars of Electric Fan Ventilation at Scott-Haven, Pennsylvania.

Type of fan, Centrifugal; name, Capell.

	No. 1 mine.	No. 2 mine.	Pacific mine.
Diam. of fan, ft.	8	12.5	8
Width of fan, ft.	3.5	5.	3.5
Revolutions per minute	210	124	210
Volume of air passed, cu. ft. per min.	60,000	78,050	61,600
Draft gage, ins.	1	1.2	....
HP. of motor	25	50	30
Speed of motor (r. p. m.)	625	625	625
How connected	belt	belt	belt
HP. input	16	20.24	17
HP. in air circulated	9.5	15.	12
Mechanical efficiency, %	59	72	60
Fuel used per 24 hrs. in lbs. (estim.)	1,800	2,800	1,900
Approx. cost of fuel, cts.	20	31	21
Distance from power house. ft.	800	2,050	17,750

There are eleven Jeffrey chain coal cutters each driven by a 12-HP. motor. These work at an average distance from the power house of 9,700 ft., and during two shifts of nine hours each undermine about 800 tons of coal. To permit shifting about, each motor is provided with a reel holding 300 ft. of heavily insulated twin concentric cable. These machines cut through veins of a conglomerate of fragments of coal measure, often cemented together by iron pyrites, and this without any apparent damage to the cutters. Table III. affords a fair idea of the dimensions of these cutters and the various operating data.

TABLE III.—Data pertaining to Jeffrey Coal Cutters in Use at Scott-Haven, Pennsylvania.

Depth of cut made by machine	69 ins.
Width of cut made by machine	36 "
Height of cut made by machine	4 "
Weight of machine	2,800 lbs.
HP. of motor on machine	12 HP.
Area under-cut per run or cut	17 sq. ft.
Position of cut in the seam	A few ins. above the floor
Time occupied in making one cut	4.5 mins.
Power consumed when cutting	15.4 HP.
Power consumed when backing out of cut	2.8 "
Average number of cuts or runs made per shift	30
Number of shifts worked per day, about nine hours each	2
Tons (of 2,000 lbs.) produced per shift per machine	60 tons
Time occupied cutting	About three hours
Time occupied moving machine about, changing bits, etc.	About six hours
Average number of cuts made in each 21-ft. room	Seven
Number of bits or knives upon a chain	Forty-five
Weight cut per chain used up	35,000 tons (of 2,000 lbs.)
Production per man, by machines, per day	6 tons
Production per man, by pickwork, per day	4 "
Number of 21-ft. rooms apportioned to each machine per double shift.	24 rooms
Number of men operating each machine per shift	Two men
Fewer men employed where machines operate, or increased production per miner by use of machines	33%
Less pit room required where machines operate	33%
Output per machine per year	28,000 tons (of 2,000 lbs.)
Cost of blasting and loading up machine-cut coal	One-half pick-mining rate
Cost of under-cutting by machines	One-eighth pick-mining rate
Approximate saving by machines, including renewals, supplies, interest and depreciation, per 2,000-lb. ton	9 cts.
Proportion of machine-cut coal to total output in mines using machines	70%
Increased yield of lump coal due to machines	About 3%

The electrical apparatus installed displaced the following:

Forty mules on the main haulage lines; 12 mules working pumps or hauling water tubs; 20 men and boys driving mules, pumping and bailing; 6 men attending to ventilating furnaces; 3 steam pumping plants and 33% of the miners, where coal cutters are used. On the other hand, it was necessary to establish a mechanical department quite unlike anything existing in the old system. This is in immediate charge of a competent electrician, who is responsible for the working of the plant, and hence passes upon all men operating coal cutters and other mining apparatus.

Formerly, when coal was burned at 12 different places, 14 tons, valued at $5.60, were consumed each 24 hours, while at present the centralized plant consumes 17 tons of mixed slack and coal, at a cost of $3.75, in the same time, performing however, besides the pumping and ventilating, work formerly done by men and mules.

From a series of readings, taken every ten minutes during three working days, the average current for each of the five coal cutters in mine No. 1 was found to be 26.2 amperes, while the "repeated" maximum was close to 75 amperes. During this test separate generators were operating two locomotives, two fans, four pumps, and one screen, and records were taken of the current required by these. The plotted results form extremely irregular curves ranging all the way from 60 to 350 amperes, while fluctuations of as much as 100 amperes occur in a few seconds.

The station had, as a whole, at the time of the test, an average day load of close to 300 amperes, and an average weight load of about 140 amperes. The full capacity of the station is indicated by Fig. 1, which shows the average proportion of output furnished to the mining machines proper, the fans, pumps, etc., and the locomotives, and the height of the maximum peak belonging to each and apt to be called for at any time.

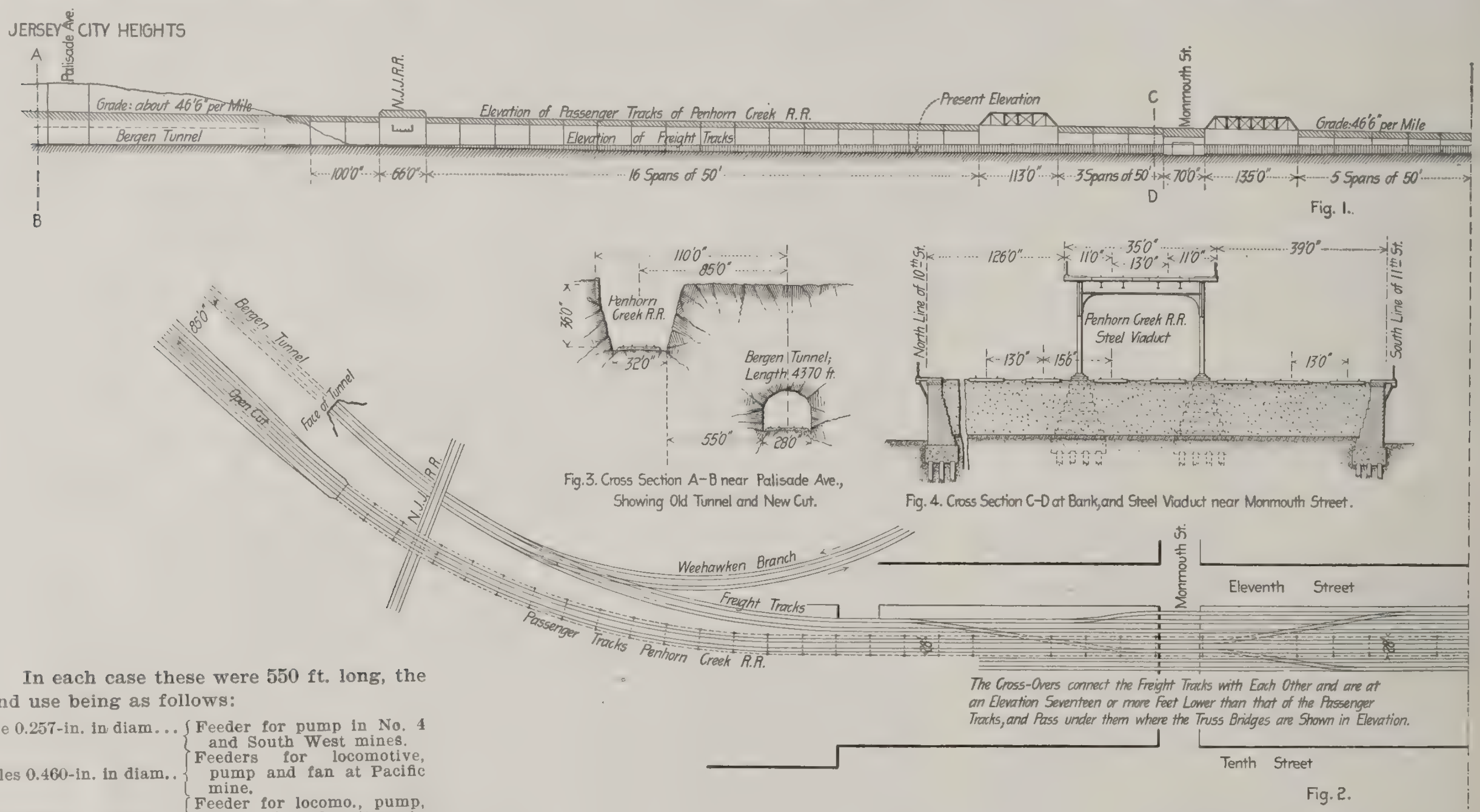


Fig. 1.

Fig. 3. Cross Section A–B near Palisade Ave., Showing Old Tunnel and New Cut.

Fig. 4. Cross Section C–D at Bank, and Steel Viaduct near Monmouth Street.

The Cross-Overs connect the Freight Tracks with Each Other and are at an Elevation Seventeen or more Feet Lower than that of the Passenger Tracks, and Pass under them where the Truss Bridges are Shown in Elevation.

Fig. 2.

TRACK ELEVATION OF THE

The installation cost about $117 per HP. of engines; operating, stores and repairs cost about $25 per HP. per year, or about 3 cts. per ton of coal produced or delivered at the tips. It is estimated that the coal cutting portion of the outfit is paying about 50% on the original investment, the apparatus apart from this represents an investment paying about 25%.

Comparison between the old and new methods of mine haulage is given in Table I., a study of which, in connection with similar data, published in Engineering News of Feb. 24, 1898, will prove of interest.

* * *

TRACK ELEVATION OF THE ERIE R. R. THROUGH JERSEY CITY, N. J.

An important piece of track elevation work, which will include some unusual and specially interesting features, is the elevation of the Erie R. R., from the Jersey City terminal station to Jersey City Heights. The present railway crosses at grade all the streets from the river front back to the high bluffs under which the line passes by a tunnel, and it is only by the maintenance and operation of gates, more or less obstructive to the uses of the streets, that accidents are avoided. After long negotiations between the city and the railway authorities the latter agreed to elevate its tracks and thus eliminate all grade crossings.

In working out the plans, however, the railway included an important improvement by which the present Bergen tunnel through the Jersey City Heights will be avoided by its passenger trains. This tunnel is 4,381 ft. long, and the passage through it is a source of much discomfort in the summer, all the car windows and deck lights being necessarily closed in order to exclude the smoke and gas.

Besides this, all the passenger and freight traffic of the whole Erie R. R. entering the Jersey City terminal, including all the trains over the Erie's numerous suburban branches, are now compelled to pass through this tunnel. As trains are run through the tunnel on the block system, and no train is allowed to enter the tunnel until the train ahead has passed out of it, a fixed limit is set to the number of trains which can arrive or depart from the Jersey City terminal in a given time. During several hours of suburban travel in the morning and again in the afternoon, the tunnel is given up wholly to the use of passenger trains; and the freight traffic is stopped.

The plan adopted is to retain the present tunnel line for freight traffic only, and build a new passenger line in open cut across Jersey City Heights.

Figs. 1 and 2 represent the plan and elevation of part of the work proposed. Beginning at a point west of the terminal, the passenger tracks will rise for some 2,000 ft. to Henderson Street—the first street crossed. The freight yard branches will also grade up to the new elevation of the passenger tracks at Henderson Street. In all, six streets will be bridged over, to give a clear headway of 12 ft. The freight tracks, after crossing the last street, will grade down to the present elevation at the tunnel. About 2,400 ft. from the terminal, however, at a point just east of Grove Street, the two passenger tracks will begin to rise above the freight tracks (continuing parallel to them) by a grade of 46½ ft. per mile. This grade continuing up to the Heights, through which the line will pass in an open cut having a maximum depth of 36 ft. The tracks in the cut will be about 45 ft. above those in the tunnel, and the center lines of the cut and tunnel will be 85 ft. apart, as shown in Fig. 3. This new line is styled the Penhorn Creek R. R., and beyond the Heights it will descend to the present grade of the main line across the Jersey meadows.

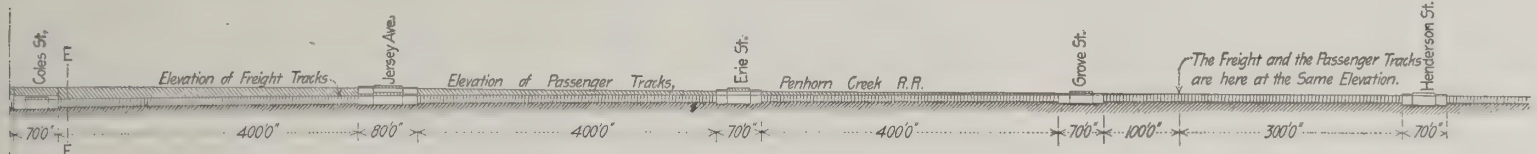
For the freight tracks there will be vertical masonry retaining walls, with a solid earth filling between them, the width being from 100 ft. to 200 ft., the latter width taking in the entire block between 10th St. and 11th St. The walls will be of stone, with concrete foundations supported by piling. An enlarged section of the wall is shown in Fig. 6. The bridge abutments will be of generally similar construction. The piles are spaced 33 ins., 36 ins. and 45 ins. apart, c. to c., with a load of 16 tons per mile. Without the piles the pressure would be 1.8 tons per sq. ft. of foundation. Not all of the foundation are piled.

For the passenger tracks, a similar construction will be followed as far as Coles St., the width being 30 ft., but from that point to the Heights there will be a steel viaduct with 50-ft. plate girder deck spans, and plate girder and truss bridges over roads and railway tracks. The total length of this viaduct will be about 1,750 ft. Figs. 4 and 5 show the construction of the viaduct and bank, respectively. The viaduct will have two rows of columns, 28 ft. apart, c. to c., connected by longitudinal and transverse plate girders, the latter of which will support the four lines of floor beams. A footwalk is provided on each side, the total width over the floor of the viaduct being 35 ft.

When this work is completed, freight trains will run between Rutherford and the Weehawken yard, or the main freight yard or elevator at Jersey City, without using any track or switch used by passenger trains of either the main line or branches. The separation of the freight and the passenger traffic will then be absolute. Yard work is now in progress, the contract having been let in April, but the construction of the new passenger line will not be undertaken at present. The foundations will, however, be put in during the construction of the embankment and retaining walls, and the cut through the Bergen hill may also be excavated.

The north retaining walls and the north parts of the abutments will first be built and earth filled in to form a bank wide enough for the main tracks, so that the construction of the south walls and the south parts of the abutments can then be proceeded with. The excavation for foundations will be in some cases as deep, 10 or 12 ft. below the present surface, the material being paid for as excavation and being used for filling. The piles must be at least 8 ins. diameter at the small end, and 12 ins. diameter 3 ft. from the butt. The masonry will have a rock face. All cement is to be of leading American brands, cement mortar being composed of 1 part natural cement and 2 parts of sand. Natural cement concrete will be composed of 1 part cement, 2 parts sand and 4 parts stone. Portland cement concrete that will be laid under water will be of the same proportion, while that laid in air will be composed of 1 part cement, 3 parts sand and 5 parts stone. The north retaining walls, concrete pier, north parts of abutments and filling about 42 ft. wide, to carry three tracks, are to be completed by October, 1898, and all the work is to be completed by October, 1899. The contractors are Grattan & Jennings, of Buffalo, N. Y.

The plans were prepared by Mr. C. W. Buchholz, M. Am. Soc. C. E., Chief Engineer of the Erie R. R., to whom we are indebted for blue prints and specifications.



Coles St.
E
F
Jersey Ave.
Elevation of Freight Tracks
Elevation of Passenger Tracks,
Erie St.
Penhorn Creek R.R.
Grove St.
The Freight and the Passenger Tracks are here at the Same Elevation.
Henderson St.
70'0"
400'0"
80'0"
400'0"
70'0"
400'0"
70'0"
100'0"
300'0"
70'0"

Profile.

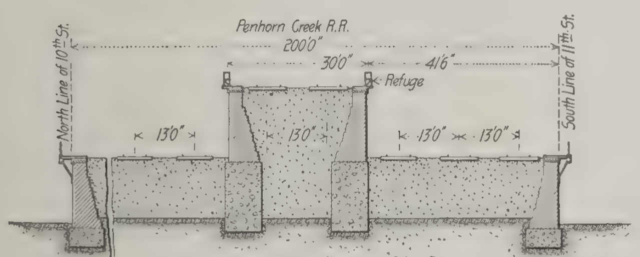


Fig. 5. Cross Section E–F at Bank near Coles St.

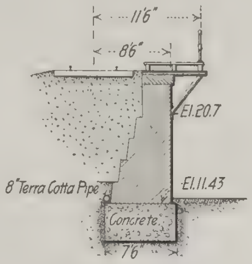
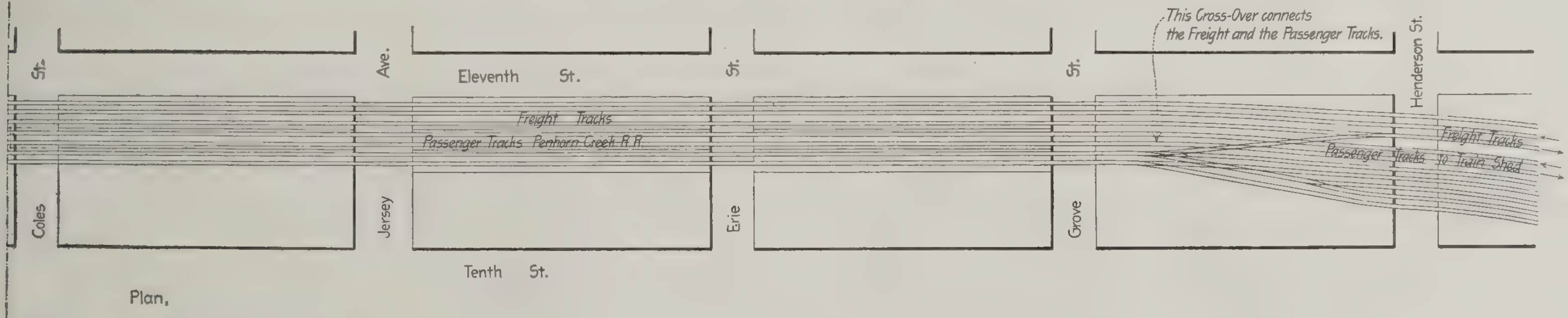


Fig. 6. Enlarged Cross Section of North Retaining Wall, West of Monmouth St.



St.
Ave.
Eleventh St.
St.
St.
This Cross-Over connects the Freight and the Passenger Tracks.
Henderson St.
Freight Tracks
Passenger Tracks Penhorn Creek R.R.
Freight Tracks
Passenger Tracks to Train Shed
Coles
Jersey
Erie
Grove
Tenth St.

Plan.

ERIE R. R. IN JERSEY CITY.

* * *

BOOK REVIEWS.

AUTOMIBLES SUR RAILS.—Par G. Dumont, Ingenieur des Arts et Manufacturers. Encyclopedie Scientifique des Aide-Memoire, M. Leaute, Directeur. Paris: Masson & Co. Paper; 7½ × 4⅝ ins.; pp. 184; illustrated.

This is practically a continuation of a previous publication of the same author on "Electromotors and their Applications." In his preface Mr. Dumont notes that the first application of a self-moving vehicle on rails, for ordinary street traffic, was that of Andraud and Tessie du Motay, who, in 1838-40 built a machine at Chaillot, France, operated by compressed air and seating eight persons. It worked well enough, but was not practicable. In 1848, a steam train, carrying 60 passengers, was worked for a time on some secondary lines near Bristol, England; and in 1859, steam tramways were successfully operated in the United States. In 1876-77 the English engineer, Grantham, introduced the first type of vehicle in which the steam motor was made a part of the vehicle itself, and in this same year, 1877, Mekarski established at Nantes the first public automobile service operated by compressed air. The first horse tramway in France was built in 1856, on a line extending from Paris to St. Cloud, and it was called the

"American" railway; but the first horse-car line in Paris itself was not in operation until 1875.

Mr. Dumont goes on to treat his subject under the seven heads of traction, by steam motors, by compressed air, by gas-motors, by carbonic acid and by ammonia engines, by cableways and by electric motors. Without going into the detail of each class it is interesting to the general reader to indicate how many methods have been proposed, and more or less successfully applied, for supplanting the horse on street and suburban lines of travel on rails.

Under the general head of steam motors we have the Rowan system of 1882, with vertical boiler and a motor beneath the carriage; the Serpollet system of 1887, in which instantaneous vaporization is secured by very thin boiler-tubes exposed directly to the fire; the steam turbine motor of A. Gerard, not yet actually in service; the Versailles-Maule system, which resembles the Rowan motor, but carries the motor-engine and boiler on a separate bogie-truck; the Lamm and Francq system, which omits the boiler and fire and carries a reservoir of hot water under pressure; and the Honigman system of fire-less boiler, in which the escaping steam is reheated by contact with very concentrated soda, and transmits this heat to the boiler and uses it again in the vaporization of water. Unhappily, the action of the soda upon the metal parts of the apparatus rapidly destroys them. Under compressed air motors, the author commences with the Mekarski system of 1877; he follows with the compressed air-motor of Hardie, tried in 1879 on the Metropolitan Elevated Railway of New York; the Scott Moncrieff motor of 1881; the Beaumont compressed air locomotive of 1885, and the Popp-Conti system, which differs from the Mekarkski device in using the air at a lower relative pressure. Motors operated by gas were introduced by Messrs. Banks and Baines in 1885, upon tramways in Australia. The first application was not successful, but it stimulated inventing in Germany, England, the United States and in France. The Luhrig system was brought out in Germany in 1893, upon the Dresden-Wildermann railway, 2½ miles long. Two Benz motors, of 7 or 8 HP. each, were operated by the explosion of gas, and the system is now quite generally used in Germany. Mr. Borig, of Berlin; Connelley, of New York; Pintch; Hasse; Holt & Crossley, of Manchester, and Grob, of Leipzic-Entrsch, have all patented devices for the application of gas to tram-motors. Mr. Barbet uses a mixed system of compresed air and gas; and Mr. Moutelar employs the first to start the train and then keeps up this motion by gas-engines.

Among petroleum motors the best known is the Daimler; but the Roger motor is being successfully tested in France. Motors operated by some very volatile liquid take their origin from the liquifaction of carbonic acid by Faraday, and the elder Brunel is credited with the invention of the first motor of this type. In 1835, Ghilliano and Christin, and in 1862, Marquis took out patents for carbonic acid motors; in 1891, Belzon, in Germany, actually built a carriage operated by a carbonic acid motor; and in 1892, "The New Power Co.," of New York, introduced a similar motor for street railways. In these motors the gas was carried in long, steel or iron bottles, generally under a pressure of 75 atmospheres, and was sent directly to the cylinders of the engine, where it was fired by a gas-jet. In 1821, Gurney advocated the use of ammonia as a producer of power, and in 1871, Dr. Lamm, in America, and Gen. Beauregard and M. Tellier, in France, made experiments promising success. In 1893, Mr. T. W. Morgan-Draper made an ammonia-engine, basing his system upon the property possessed by anhydrous ammonia of liquifying at about — 34° C., at the ordinary pressure, and at + 27° C., under a pressure of ten to twelve atmospheres: By heating a vessel containing liquified anhydrous ammonia to more than + 27° C., gases are emitted generating a tension of ten to eleven atmospheres, and this pressure is utilized in an ordinary engine. The escaping vapor is absorbed by water and the heat generated is utilized in heating the ammonia receptacle. At the New Orleans Exposition of 1893, Mr. F. F. MacMahon operated a motor of this type, weighing 7 tons, and capable of making a run of 24 miles.

Cable traction and electric motors, operated by both overhead, underground and interrupted conductors, are fully described by our author in separate chapters. The first application of electricity to street-car service in Paris was in 1881, at the Electrical Exposition of that year; but it was not until 1890 that an actual test was made by equipping a line, running between the Madeleine and Levallois, with the accumulator system. In 1892-93 similar lines went into operation, from the Opera House to St. Denis, and from St. Denis to Neuilly; in 1897 the system was further extended from Neuilly to Courbevoie, and from the Place de la Republique to Aubervilliers. A large part of this section of the work is devoted to the description of American apparatus, and this will not be repeated here. In his concluding chapter Mr. Dumont makes a comparison of the cost of operating the different systems of street-car traction described. This comparison, translated from the metric units, stands as follows:

	—Steam.—				Electric.	
Per car-mile	Rowan system.	Serpollet system.	Compressed air.	Gas.	Trolley.	Accumulator system.
Number of places for passengers	43	50	50	50	50	50
Weight fuel consumed, lbs.	10.6	9.0	15.3	58.2*	5.†	10.8
Operating cost:						
Motive force, cts	3.9	3.3	7.7	6.4	5.3	4.2
Wages, cts	2.6	2.6	2.6	2.6	2.6	2.6
Water, oil, repairs,etc,cts.	4.8	3.7	3.5	4.3	2.2	4.2
Totals, cts	11.3	9.6	13.8	13.3	10.1	11.0
Sinking fund, @ 10%, cts.	3.5	3.5	4.8	3.4	5.5	4.2
Total expense,traction,cts.	14.8	13.1	18.6	16.7	15.6	15.2

---

* = cu. ft.

†This consumption of 5 lbs. of coal per car-mile is deduced from experiments made on the trolley lines of Rouen.

The above table is supposed to represent a typical system, 18 miles long, equipped with 30 cars, with a part of these held in reserve, and each car averaging a daily run of about 90 miles. In the items of wages paid and cost of materials, etc., no direct comparison is possible with American practice; but as the motive cost is the true standard of economy in the various systems of traction, some comparison can be made here. The reports of the Railway Commissioners of Massachusetts and New York, for 1897, show that the cost of electric motive power on the street railways of those states ranged from 2 to 3 cts. per car-mile, in the majority of cases, with some lines reducing this cost to one cent. This is in spite of higher wages paid; and the reduction in cost is wholly due to excellence of equipment, the longer lines operated, and to the valuable experience gained by American managers in the operation of electric railway systems. It is difficult to tell just what the "total expense of traction" in the above table does include; but in the case of the Massachusetts street railway system for 1896, the total expense of operation, as deducted from gross to obtain net earnings, was 19.7 cts. per car-mile; this average is for 1,277 miles of main track, averaging in cost $46,041 per mile, and of which 1,241 miles were operated by electric power.

AUTOMOBILES SUR ROUTES.—Par L. Perisse, Ingenieur des Arts et Manufactures. Encyclopedie Scientifique des Aide-Memoire, Paris. Paper; 7½ × 4½ ins.; pp. 206; illustrated.

This is a companion work to "Automobiles sur Rails," lately published by the same house and reviewed in this journal. The history of motor-vehicles for ordinary roads is taken up, from the steam-carriage of Cugnot, of 1770, and the author briefly describes the various English road motors which preceded and immediately followed the application of steam to railways. Mr. Perisse follows this historical portion with a general discussion of motors, transmission gear and accessories, and then describes the various types of motors designed for use on highways under the general heads of: Carriages for personal use; vehicles for common passenger transport, or omnibuses, and motors for carrying heavy merchandise. This is the valuable portion of the book, but the space here available forbids any adequate abstract. The conclusion of the author, resulting from a careful study of all existing methods of road-motor construction and practice are worth noting.

Mr. Perisse first points out the fallacy of the arguments usually advanced by the opponents of motors in comparing the power exerted with that of the horse and in ordinary vehicles. He claims that the results of all the recent motor-trials show that cost of traction is incontestably less with motors than with horses, notwithstanding the cost of fuel and materials. The one element still to be settled by long experience only is the expense of repairs and the daily cost in constant work with a motor. This is the question which the development of the motor can alone settle, by simplified mechanism and proper design in all parts of the apparatus. In comparing the various types of motors, he finds that the use of steam generally requires a heavy generator, when sufficient power is wanted; and the problem is one of weight and the employment of a clumsy fuel, with the added disadvantages of escaping hot gases and steam. The advantages are, the ability to vary the speed with steam pressure and to regulate the consumption of fuel by the amount of actual work to be performed. It is undoubtedly the motor for the transport of heavy loads, and devices are already in use for suppressing or mitigating any nuisance from smoke and steam. The steam-motor utilizes for adherence a part of the useful load.

Petroleum motors do not permit the regulation of the speed by the power produced, as in the case of steam. Mechanism, often very complicated, is necessary to bring about this change in speed. The petroleum motor also requires great care in its management, and the cost of traction is often very high, owing to the fact that the consumption of fuel is practically constant and independent of the work done. Under ordinary use there is great vibration of the body of the vehicle, resulting from the great speed of explosion-motors; and, finally, there is an objectionable odor from the burning oil, which may perhaps be eliminated by better construction. The advantages of the petroleum motor are that it may almost instantly be put into service; the fuel is easily handled; the dead weight of the vehicle is less than that of the steam-motor, and repairs are thus less costly. It is best suited for rapidly transporting passengers from one town to another; and it is the true tourist vehicle, for when speed is demanded, it can be secured even at less fuel economy. It may be applied to hotel omnibuses and to family coaches, but the useful load should never exceed about 3,300 lbs.

Electric motors present great advantages, as the traction is easy and regular, silent and unaccompanied by objectionable odors or steam. But the accumulator is heavy, cumbersome and of little capacity in proportion to the dead weight carried. In the present development of electric road-motors, it is difficult to foresee how these vehicles can be made to travel over a route of 36 to 60 miles. It is probably best adapted to city use, for comparatively short runs, and it may be sufficiently developed to supplant the cab-horse. As applied to omnibus service in England the results are not very promising.

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A TOWN IS TO BE MOVED on the Messaba range of Minnesota iron mines. The town of Eveleth has been in existence about four years, and has a population of 2,500, with hotels, banks, stores, etc. Late exploration has brought to light a bed of rich iron ore beneath this town that is valued at not less than $15,000,000, and the town must move on. The townsite proprietors had made stringent reservations in their deeds as to mineral rights, and they now offer all lot-owners in the western half of the town free lots in a better site eastward, with streets graded and sidewalks laid. They are now also seeking proposals for the wholesale removal of buildings on the ore tract. The owners of the land are Robinson & Flynn, Murphy & Dorr and E. M. Fowler, all of Detroit, Mich. They bought the land for the pine timber upon it, without dreaming of the wealth below the ground. They now receive about $300,000 annually in royalties upon the Fayal and Adams mines alone, says the Chicago "Tribune."

WEATHER TABLE FOR JULY, 1898. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Degrees Fahrenheit.)				Wind.			Precipitation. Inches and hundredths.		
		Average.	Max.	Min.	Range.	Velocity in miles per hour. Average.	Velocity in miles per hour. Max.	Direction at time of max. velocity.	Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	68.0	94	34	60	7.8	36	NW	1.66	0.72	10
	Portland, Me.	67.8	97	52	45	7.0	27	NW	1.78	0.80	11
	New York City	74.1	99	57	42	8.6	36	NE	4.76	1.96	12
	Pittsburg, Pa.	77.2	99	51	48	5.0	24	W	2.56	0.96	11
	Chicago, Ill.	73.4	94	59	35	13.2	48	N	1 94	1.22	5
	Omaha, Neb.	75.3	95	59	36	7.3	32	NE	4.20	3.56	7
	St. Paul, Minn.	72.8	91	54	37	7.0	29	W	1.94	1.35	6
	Duluth, Minn.	65.9	90	46	44	9.2	30	NW	1.33	0.53	10
	Bismarck, N. Dak.	69.8	97	38	59	9.3	34	NW	1.64	0 53	6
	Average	71 6	95	50	45	8.3	33	—	2.42	1.29	9
Southern Cities.	Washington, D. C.	78.8	101	54	47	5.3	32	NW	2.86	1.24	10
	Louisville, Ky.	79 6	97	58	39	6.8	31	W	2.15	0.94	7
	St. Louis, Mo.	78.2	96	57	39	7.8	35	W	7.44	5.08	12
	Savannah, Ga	81.2	99	63	36	7.2	35	NW	8.53	3.18	19
	Kansas City, Mo.	77.3	96	61	35	7.4	50	NW	4.93	1.93	9
	Jacksonville, Fla	82.0	98	67	31	7.2	36	S	12.03	3.25	23
	Chattanooga, Tenn.	79.2	97	59	38	6 0	35	NW	6.48	1.80	15
	New Orleans, La.	81.5	97	70	27	7.4	32	NW	4.57	1.25	14
	Memphis, Tenn.	79.2	95	62	33	7.7	42	SE	4.28	1.84	13
	Palestine, Tex.	80.8	101	62	39	5.6	30	SE	2.29	1.15	9
	Average	79 8	98	61	36	6.8	36	—	5.56	2.17	13
Western Cities.	Helena, Mont	65.4	90	36	54	7.9	39	SW	1.71	1.47	7
	Port Angeles, Wash.	56.4	82	42	40	8.0	28	NW	0.17	0.08	4
	San Francisco, Cal	56 2	88	47	41	15.8	41	W	None.	.0	0
	Salt Lake City, Utah.	75.9	97	49	48	5.8	29	S	0.18	0.08	4
	Santa Fe, N. Mex.	68.2	89	49	40	5.7	34	NE	2.31	0.50	13
	Denver, Colo.	72 4	96	49	47	7.9	45	NW	0.67	0.23	10
	Yuma, Ariz	91.9	113	73	40	—	38	SE	0.00	.00	00
	Average	69.5	94	48	44	8.5	36	—	0.72	0.34	5

ENGINEERING NEWS
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AMERICAN RAILWAY JOURNAL.

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THE CHICAGO SEWER DISTRICT, lying between 79th, 106th and Halsted Sts. and the lake, known as the 95th St. low-level district, has recently been a subject of controversy. This district was shown on the map in our issue of April 21, and, as described in the article on the intercepting sewer system, it has an area of about 10,800 acres. It was proposed to put in about 122,187 ft. of brick sewer, 2½ to 13½ ft. in diameter, leading to a pumping station on 95th St., from which the sewage would be raised and discharged through an outfall into the Calumet River. This river is already a foul stream which pollutes the water of the lake, and it is urged that the pollution should be checked instead of being increased by the sewage from the 95th St. district. Two plans for the latter purpose have been suggested: (1) to connect the sewer system of the district with the new intercepting sewer system; (2) to connect it with the Drainage Canal by means of a channel striking the canal at "the Sag." The latter plan is the one generally favored, and both the Mayor and the Commissioner of Public Works are opposed to any further discharge of sewage into the lake. After a public hearing, at which the property-owners sustained the position of the authorities, the engineers of the sewer department were directed to prepare new plans, providing for carrying the sewage to the Drainage Canal.

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A CALUMET RIVER DRAINAGE CANAL is now being planned by the direction of Mr. L. E. McGann, Commissioner of Public Works, of Chicago. The river now flows into the lake, but as it carries a great quantity of sewage and filth from packing houses, etc., it is a source of serious pollution to the city's water supply from the southern intakes. The proposition to discharge the sewage of the 95th St. sewer district into the river has called attention to the present state of affairs, and measures are to be taken to treat the Calumet River like the Chicago River, and reverse its flow, giving a flow westward from the lake into the Chicago Drainage Canal. The general plan is to build a canal about 100 ft. wide and 14 ft. deep, from Lake Calumet along the course of the Little Calumet River to the point on the Drainage Canal known as "the Sag," a distance of about 15 miles. This would have a capacity of 300,000 cu. ft. per minute, and would serve as a feeder for the Drainage Canal. The cost is estimated at $3,000,000. Should there be any objection to this plan, the Calumet canal could be connected with the Illinois & Michigan Canal. A special drainage district may be organized, with a Board of Trustees to carry out the work, but the Commissioner of Public Works hopes that the U. S. Government will take the matter up and build a navigable canal from the mouth of the Calumet River to the Drainage Canal, thus giving a route by which vessels can avoid the detour through the Chicago River. The general plans for the new canal are to be prepared by Mr. John Ericson, City Engineer; Mr. F. E. Davidson, Superintendent of Sewers, and Mr. Wm. Lowe and Mr. Hill, Engineers of the Sewer Department.

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THE CAMBRIA STEEL CO., a new corporation, is about to absorb the Cambria Iron Co., of Johnstown, Pa. The new company is to have a capital of $24,000,000, and the Iron Co. is guaranteed 4% dividends and the stockholders may subscribe for three shares in the new company for each of the Iron Co.'s shares held. The Cambria Iron Co. has been in existence nearly 50 years and has a capital of $8,000,000, with assets of $29,000,000 at current low valuations. The works have outgrown this capital and the new company has been formed.

AMERICAN STEEL FOR BELFAST SHIPYARDS is an import that is causing concern among Scottish steel makers, says "The Engineer." The firm of Harland & Wolff, of Belfast, is credited with a consignment of 800 tons of large steel ship-plates from Pittsburg. These plates are 28 × 5 ft. and weigh 2 tons each, and are supposed to be landed at Belfast from $2.40 to $2.88 per ton less than if bought from Scotch or British makers. This Belfast firm consumes in shipbuilding about 40,000 tons of steel and 8,500 tons of iron per year, besides using in this time about 60,000 tons of other materials. The existence of a fine line of steamers running between Belfast and the United States, and the advantages of the rapid delivery of large quantities of steel at low prices, are supposed to account for the demand upon American steel manufacturers. In years past almost the whole of the steel used in the Belfast yards came from the West of Scotland; increased consumption calls for additional supplies from the East Coast, Wales, Barrow and America.

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THE RUSSIAN BATTLESHIP which the Cramps, of Philadelphia, are to build will have a displacement of 12,700 tons, and will be able to maintain a speed of 18 knots for 12 consecutive hours, with all coal, ammunition and stores aboard. She is to be superior to any class of battleship now afloat; and the new United States battleships should be her equals, at least. If our builders can furnish other nations with the best vessels of this class in existence, it would be worse than folly to talk of providing inferior warships for our own navy.

◆

THE CONDITION OF ADMIRAL CERVERA'S SHIPS is reported upon as follows by the Chapman-Merritt Wrecking Co.: The "Vizcaya" and "Almirante Oquendo" are total wrecks, not worth saving for junk. The "Maria Teresa" has a hole 15 ft. long in the bottom close to the keel; this is being patched up and she will be first taken into Santiago harbor, and then possibly to Havana to be further fixed up for her journey north. The "Christobal Colon," says Capt. Smith, of the wrecking company, is in such a precarious position that he has little hope of saving her. The "Reina Mercedes," in Santiago harbor, can be easily floated.

◆

THE EIGHT-TRACK DRAWBRIDGE over the Chicago Drainage Canal will be a Scherzer rolling-lift bridge, the contract having been awarded to the Scherzer Rolling Lift Bridge Co., of Chicago, Ill., at its bid of $369,140, exclusive of the operating machinery. The sum of the bid was made up as follows: Plans, $27,000; substructure, $166,575; superstructure, $175,565. The list of bids was given in the supplement of an issue of Aug. 4, and we expect to describe the bridge in a later issue.

◆

A SIX-TRACK DRAWBRIDGE, on the Scherzer rolling-lift system, is to be built for the New York, New Haven & Hartford R. R., to carry the tracks of the new terminal station at Boston, Mass., across the Fort Pond channel. The plans were made by the Scherzer Rolling Lift Bridge Co., of Chicago, and the contract for construction has been let to the Pennsylvania Steel Co.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Aug. 21, on the Providence Division of the New York, New Haven & Hartford R. R., at Sharon, Mass. The accident was a rear-end collision between two passenger trains, and according to reports resulted from the failure of a signal light to work properly. Four persons were killed outright, one seriously injured and 12 or 15 were more or less seriously injured.

◆

A LOCOMOTIVE BOILER EXPLOSION occurred on Aug. 17 in the round house of the Santa Fe, Prescott & Phoenix R. R., at Prescott, Ariz., resulting in the death of two and serious injury of two others. The report states that the firebox and part of the boiler, weighing four or five tons, was blown about 1,200 ft.

◆

THE FALLING OF A PORTION OF THE SIDEWALL of the Carnegie Tunnel on the Chartiers division of the Pittsburg, Cincinnati, Chicago & St. Louis Ry., at Pittsburg, Pa., on Aug. 22, killed 8 men, seriously injured 7 others, two of whom will probably die. The men were part of a force engaged in tearing out the tunnel and were preparing to pull down the west wall when, without warning, the wall fell forward, burying those standing in front.

◆

THE LONDON WATERLOO AND CITY ELECTRIC Underground Railway is now formally opened to traffic, from the Waterloo railway station to the Mansion House, a distance of 1½ miles. This distance is run in five minutes for a fare of 4 cts., or 6 cts. for a round trip. The cars have a central passageway, and they are equipped with Westinghouse air-brakes and are lighted by electricity. An electric third-rail system permits a maximum speed of 25 miles per hour.

AN AMERICAN LOCOMOTIVE FOR ENGLAND, recently built by the Baldwin Locomotive Works, Philadelphia, Pa., is a narrow gage tank engine for the Lynton & Barnstaple Ry., having a gage of 23½ inches. The engine has side tanks and a rear coal bunker behind the enclosed American cab. It has outside cylinders 10 × 16 ins., driving the rear pair of coupled axles with wheels 33 ins. diameter, and under each end of the engine is a pony truck with 22-in. wheels. The weight is 46,000 lbs., of which 29,000 lbs. are on the driving wheels.

◆

THE AMERICAN MAIL STEAMSHIP CO., launched, on Aug. 18, the "Admiral Dewey," the first of the four steamships being built for this company by the Cramps, of Philadelphia. Each of these steamers will be 280 ft. long, 36 ft. beam and 25 ft. depth of hold, the tonnage is 2,000, and a speed of 15 knots is specified. They are twin-screw steamships with triple-expansion engines. The "Admiral Dewey's" keel was laid on May 25, and her hull has consequently been built in about 11 weeks. The contract called for her delivery, complete in all parts, during the month of October.

◆

A JAPANESE SHIP-CANAL is under consideration. It would connect Osaka Bay, on the Pacific side, with the Sea of Japan, by way of Lake Biwa. This lake covers 46% of the length of the line. Including the lake, the length of the canal would be about 75 miles. The estimated cost ranges from $70,000,000 to $150,000,000, and the time of execution from 10 to 15 years.

◆

ONLY ONE BIDDER FOR A NEW WATER SUPPLY for Jersey City responded to the call for bids on Aug. 18. Mr. Patrick H. Flynn, of Brooklyn, submitted two formal propositions, each for water from the Rockaway River, delivered by gravity at an elevation of 210 ft. above mean high tide. The prices under each plan for a plant capable of delivering 50,000,000 gallons a day were about $7,500,000, or about $8,000,000 for a 70,000,000-gallon plant. If the plant should not be purchased until some years after completion the price would be considerably higher. The prices for water by the million gallons ranged from $36 to $20, for quantities varying from 25,000,000 to 70,000,000 gallons per day. Mr. Flynn was one of four bidders last February, and his bid is higher now than then.

◆

BIDS FOR 16 TORPEDO-BOAT DESTROYERS and 12 torpedo boats were opened at the Navy Department, Washington, D. C., on Aug. 23. The specifications were that the destroyers should be of about 400 tons, and should cost not to exceed $295,000 each, with a speed of 28 knots; while the torpedo boats were limited to 150 tons and $170,000 each, with a speed of 26 knots, making a total of about $6,900,000, the amount appropriated for this work. The bids received were in most cases for one, two or three boats, and all were within the figure set by Congress. As a large number of bids were received and as estimates were asked on two propositions, one as planned by the department, the other based on the bidder's idea, it will require some time to sort and tabulate the bids received, which will be necessary before awards can be made. One firm offered to build destroyers with a speed of 40 knots. Neither Cramps nor Hereschoffs presented bids.

◆

RULES FOR APPOINTMENT to the Corps of Civil Engineers, U. S. N., have been issued by Commodore Endicott, Chief of the Bureau of Yards and Docks. The applicants must be 25 years and not more than 35 years old. A naval medical board will examine them as to physical fitness, and a board of officers appointed by the Secretary of the Navy will examine applicants as to their mental and professional qualifications. Each applicant must give evidence of American citizenship and apply to the Secretary of the Navy for a permit to be examined. As to professional qualifications, there must be evidence of having received a degree of civil engineering from some professional institution of good repute, and a record of at least three years' practical experience as a civil engineer. The mental and professional examination will be competitive and in writing. It will comprise the following subjects: Testimonials; English grammar and composition; elementary physics; elementary geology; analytical geometry; differential and integral calculus; applied mathematics, including mechanics of solids and fluids and strains in structures; construction materials; engineering construction; topographical, trigonometrical and hydrographical surveying, and mapping; instruments and their use and adjustment. To pass a satisfactory examination candidates must attain an average of at least 80% in applied mathematics, construction materials and engineering construction, and a general average of 75%. An examination will be held on Sept. 6 at the Navy Yard, Washington, D. C., at 10 a. m.

◆

AN OBSERVATORY ON PIKE'S PEAK is to be built by the Manitou & Pike's Peak Cog Ry. Co., and the contract has been signed for the construction of the tower. It is proposed to mount in this tower four powerful telescopes for the benefit of visitors—and the profit of the railway company.

I E 1,500-HP. ENGINES FOR THE BERLIN, GERMANY, ELECTRIC WORKS.

We illustrate in the accompanying cuts the general details of the two new engines built by the Goerlitz Machine Works, of Goerlitz, Germany, for the Berlin Electrical Works, the company operating the five central lighting stations of Berlin, Germany. These two engines are exactly alike, and, as will be seen from the general view, Fig. 1, they are cross-compound engines with the cylinders supported on vertical cast-iron A-frames. The cranks are set 108° apart and the hollow shaft is 15.75 ins. in diameter at the bearings. For convenience and to avoid the possibility of a complete shut down, this crank shaft is made in two sections, the adjoining ends of which are provided with solid flanges which are bolted together. There are four ample bearings, one on each side of each crank.

The high-pressure cylinder is 36.61 ins. in diameter, the low pressure 57.09 ins. and the stroke is 43.31 ins. With a steam pressure of 10 atmospheres (about 150 lbs.) and a speed of from 105 to 110 revolutions per minute the nominal horsepower is 1,500, although the engine can be worked up to 1,900 HP. Both cylinders are jacketed with live steam.

The steam for operating the engine passes from the boilers through the main steam pipe and valve into the high pressure receiver HR (Fig. 3). From the receiver it enters the high pressure cylinder at the proper time and exhausts into the low presure receiver LR, from which it in turn passes into the low pressure cylinder and thence through the exhaust pipe to the condenser.

The valve mechanism, known as the "Collmann," after its inventor, is operated by two sets of bevel-gears just outside the bearings G G, and two vertical rods which run up alongside the cylinders and drive continuously through spiral gears and a short horizontal shaft. This shaft is provided with eccentrics and bell cranks, which operate the rods controlling the 8 poppet valves, four of which, a, b, c, d, are shown in Fig. 2. The governor is placed on an extension of the high pressure driving rod, Fig. 3. It is of the usual fly-ball type with dash pot and a system of links and levers which adjusts the admission for the high pressure cylinder. The exhaust of the high pressure and valves of the low pressure cylinder are fixed and do not vary with the load.

The crossheads are keyed to the piston rods and are provided with a slide plate which bears against a flat slide guide on one side only of the A-frame. The connecting rod is of the ordinary marine Y type and straddles the crosshead.

The air pumps are operated by levers supported by offsets bolted to the A-frames and connected to the crossheads by suitable links. The diameter of the air pump cylinders is 32.48 ins. and the stroke is 9.45 ins. The jet condenser is fitted with main and auxiliary injectors, the latter being supplied from a cold water tank, and is used only when starting up to avoid disturbing the condensers of other engines which feed from the same water main. The main injector is opened and the auxiliary closed when the engine is running smoothly.

At each end of the engine and mounted directly upon the shaft is the field of a 700 K-W. 3,000-volt alternating generator. These fields are heavy and serve as balance wheels to steady the engine. The specifications required that with a sudden change of load of 25% the speed should not vary more than 1½%, and that the variation should not be greater than 3% when the full load was thrown off or on. As will be seen from Fig. 1, the various operating valves are conveniently placed at the front within easy reach of the engineer. Lubrication is accomplished from a central point, the "Ritter" system being employed. We are indebted to the "Zietschrift des Vereines Deutscher Ingenieure" for the matter from which this description and the illustrations have been prepared.

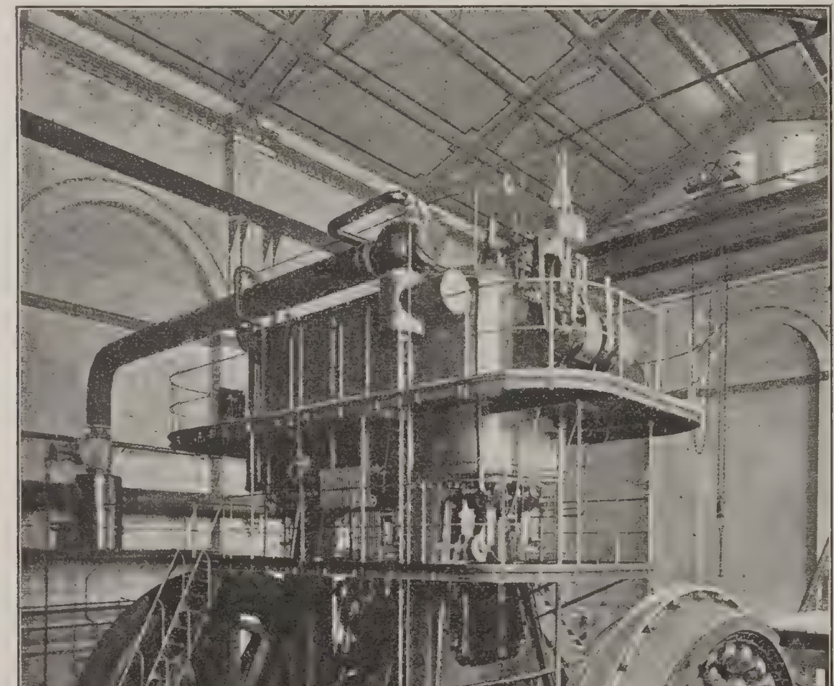

FIG. 1.—A 1,500-HP. CROSS COMPOUND CONDENSING ENGINE FOR THE BERLIN, GERMANY, ELECTRIC WORKS.
The Goerlitz Machine Works, Goerlitz, Germany, Builders.

* * *

BRIDGE WORK ON THE KANSAS CITY, PITTSBURG & GULF R. R.

(With two-page plate.)

In the description of the Kansas City, Pittsburg & Gulf R. R., published in our issue of Feb. 17, we promised to give some further information respecting the bridge work on the line. In the present article we describe more particularly three specially interesting features of this work: (1) The Waddell patented form of 100-ft. through truss; (2) the concrete piers of the Arkansas River bridge; (3) the construction of these piers, with the engineering difficulties encountered and overcome.

From the tabular statement given in the former article it will be seen that the bridge work on the main line, 788 miles, amounts to 92,288 ft., or about 17.5 miles, as follows: Timber trestles, 83,462 ft.; truss bridges (including 1,471 ft. of the Arkansas River bridge), 5,927 ft.; plate girders (50 and 60-ft. span), 1,695 ft.; I-beams, 1,204 ft. Mr. Robert Gillham, M. Am. Soc. C. E., M. Inst. C. E., is Chief Engineer and General Manager, and Mr. J. A. L. Waddell, M. Am. Soc. C. E., was Consulting Bridge Engineer.

Steel Superstructures.

Plate Girders.—The plate girder bridges are of two standard lengths, 50 and 60 ft. span, both of which are deck bridges. The 50-ft. spans are 5 ft. deep, with web plates ⅜ × 59¾ ins., and top and bottom chords, each composed of two 66-lb. angles, 6 × 6 ins., and a cover plate ½ × 16 ins. The stiffeners are 24-lb. angle irons, 3½ × 3½ ins., those at the ends having fillers 9-16 × 4 ins., while all the others are crimped. At the middle of the span are inside and outside splice plates ⅜ × 12 ins. The rivets are of soft steel, ⅞-in. diameter. The girders are set 6 ft. apart, c. to c., and connected by four bracing frames, riveted to ⅜-in. connection plates. The two end frames have four 24-lb. angles (top, bottom and two diagonals), 3½ × 3½ ins., while in the two intermediate frames the bottom angle is omitted. A ⅜-in. plate is riveted at the intersection of the diagonals. There is also a single system (non-intersecting) of top lateral bracing of angles of the same size, also riveted to connection plates. At the sliding end, a 1¼-in. bearing plate, 20 × 20 ins., is secured to the bottom chord by countersunk rivets, and rests on a ½-in. bed plate, 21 × 21 ins. The anchor bolts are 1¼ ins. diameter, and the bolt holes in the bottom chord are slotted ½-in. on each side of the bolts to allow for expansion. The live load is Waddell's "Class X," and the dead load is 900 lbs. per lin. ft.

The 60-ft. girders are 6 ft. deep, with web plates 7-16 × 71¾ ins.; chord angles, 6 × 6 ins., 72 lbs.; cover plates, ⅝ × 16 ins., 42 ft. long; top lateral bracing, 30-lb. angles, 4 × 4 ins. The stiffeners, splice plates, and bracing frames are similar to those in the 50-ft. spans, but there are three intermediate frames. The girders are set 7 ft. apart, and the dead load specified is 1,000 lbs. per lin. ft.

Waddell's "A-Type" Truss.—This is a decidedly interesting style of truss, the designs for which have been patented by Mr. Waddell. It is a four-panel truss bridge, having eye-bars in the bottom chords and center verticals, and rigid members for all the other portions of the trusses and for the lateral system. In his "De Pontibus," Mr. Waddell states that for a number of years he was dissatisfied with all railway bridges for spans between the superior limit of the plate girder and a length of about 150 ft. He considered that ordinary through Pratt trusses were too light and vibratory, and that riveted bridges as then built were clumsy, unscientific and uneconomical. In 1893, when he was retained by the Kansas City, Pittsburg & Gulf R. R. to design some bridges, he persuaded the General Manager to have a "type A" truss of 100 ft. span built as an experiment, and this style of structure was soon afterwards adopted as the standard 100-ft. span of that railway. These bridges are also used on the St. Louis Southwestern Ry., and have been adopted by the Nippon Ry., of Japan, for spans of 65 ft. to 116 ft. The advantages claimed for this type of bridge are great rigidity in all directions, ease and cheapness of erection, and economy of metal when structures of this type are compared with structures of other types having equal strength and rigidity.

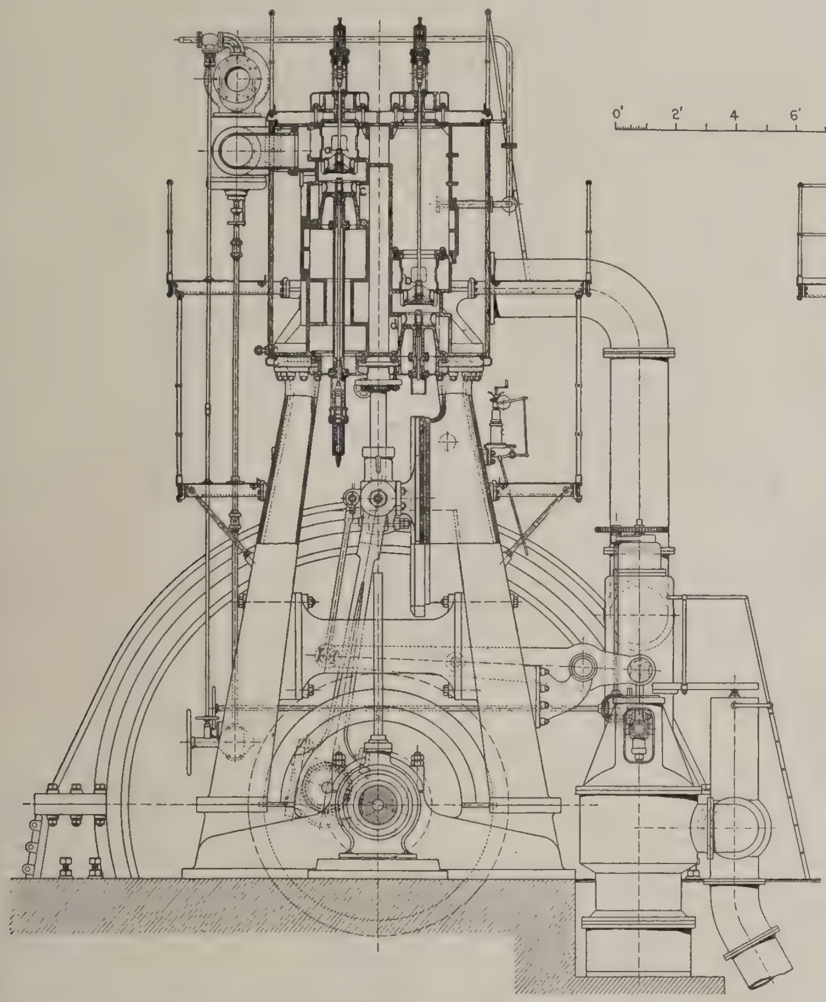

FIG. 2.—SECTIONAL END ELEVATION SHOWING DETAILS OF HIGH PRESSURE VALVES, CROSSHEAD AND AIR PUMPS.

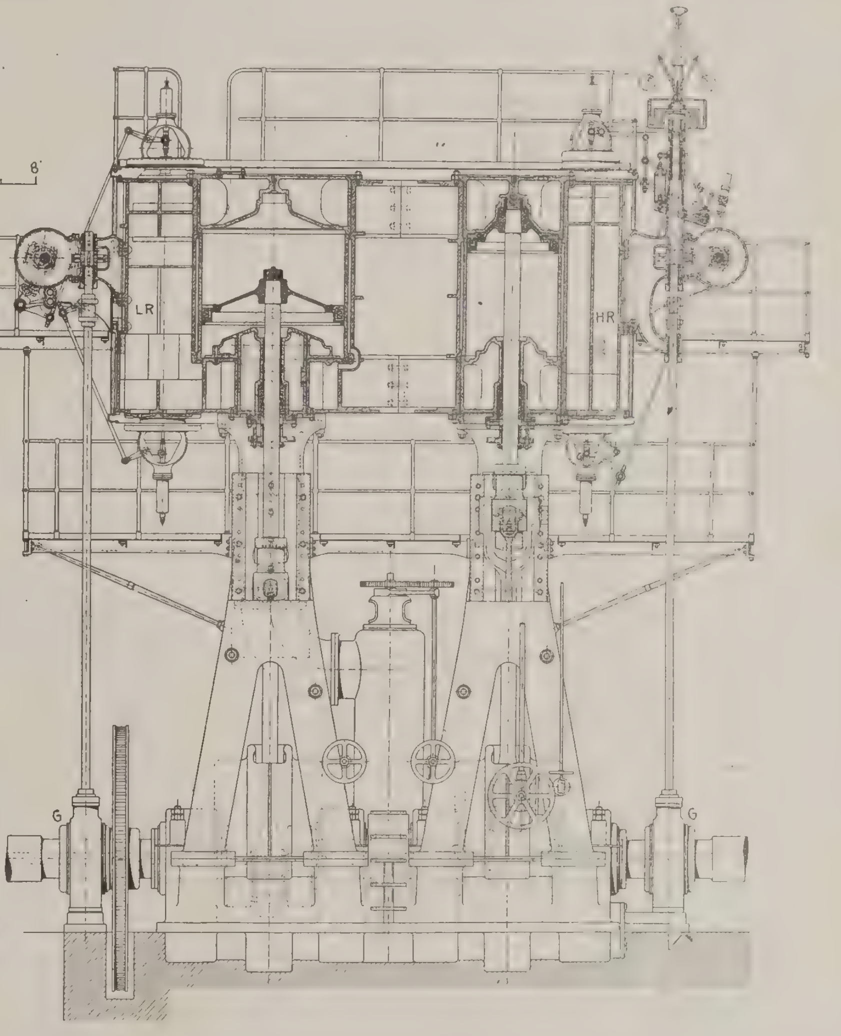

FIG. 3.—SECTIONAL FRONT ELEVATION SHOWING DETAILS OF CYLINDERS, RECEIVERS AND VALVE MECHANISM.

The 100-ft. spans of this type on the K. C., P. & G. Ry., are triangular trusses, 100 ft., c. to c., of end pins, and 40 ft. high at the center, as shown in Fig. 1. Each inclined top chord is built up of a cover plate ⅜ × 18 ins. (6.75 sq. ins. section), and two 15-in., 96-lb. channels (19.2 sq. ins.), 11 ins. back to back, laced below with bars ⅜ × 2½ ins. The bottom chord is composed of pairs of 1 × 5-in. eye-bars, 25 ft. long (10 sq. ins.), while the center vertical is composed of two eye-bars 1¼ × 5 ins. (12.5 sq. ins.). Each of the other two verticals is composed of two 10-in., 57-lb. channels (11.4 sq. ins.), set back to back 10 ins. apart, and connected by lacing bars ⅜ × 2 ins. The two diagonals are each composed of 10-in., 60-lb. channels (12 sq. ins.), 7⅝ ins., back to back, with similar lacing. The end pins are 5 ins. diameter, and the other pins all 4 ins. diameter. Fig. 1 shows the general elevation and plan of the bridge, while Fig. 2 shows the composition of the trusses.

The trusses are 17 ft. apart, c. to c., connected by top transverse struts at the three panel points, with diagonal bracing between these. The clear headway is 21 ft. 2 ins. Plate-girder floor beams, 4 ft. deep, are fitted between the bottoms of the three verticals, projecting but little below the bottom chord. These carry plate girder stringers 38 ins. deep, spaced 8 ft. c. to c. Horizontal and vertical bracing is fitted between the stringers, and the ends of the floor beams are also connected by diagonal bracing. The middle floor beam is riveted to hangers of two 10-in., 57-lb. channels, 10 ins. apart, connected by bracing, attached to the eye-bars by 4-in. pins.

The floor system consists of yellow pine ties, 8 ins. wide and 10 ins. deep, spaced 5 ins. apart in the clear and boxed out ½-in. over the chords of the stringers. Most of the ties are 10 ft. long, but every fourth tie is 14 ft. long, the ends supporting two foot planks 2 × 10 ins. Inside 60-lb. guard rails are used, 5 ins. from the track rails. There are also heavy outside guard timbers, 8 × 10 ins., laid flat and boxed out 2 ins. over the ties, which is an unusual depth of boxing, and is intended to prevent bunching of the ties by derailed wheels. These timbers, which are 8 ft. c. to c., are bolted to every tie, the ¾-in. bolts being in two staggered rows, and having ogee washers on top of the guard timbers.

The dead load is assumed as 1,400 lbs. per lin. ft. The live load is Waddell's standard loading, Class X, the equivalent uniform load per lin. ft. being as follows: 4,000 lbs. for trusses, 4,600 lbs. for floor beams, and 5,750 lbs. for stringers. The camber is such that under a live load of 4,000 lbs. per lin. ft. there will still be a camber of at least ¼-in.

Through Truss Bridges.—The through bridges of 127 ft. and 150 ft. span are of interest in that the trusses have riveted connections instead of pin connections, as shown in Fig. 3. The inclined end posts and top chord are composed of two 15-in. channels, set back to back; the end posts have a cover plate on top with lacing on the bottom; while the chord has top and bottom lacing. The bottom chord and end verticals are of H section, built up of four angles with transverse stay or batten plates at intervals. All the other truss members are composed of two channels set face to face, and connected by lacing. Connection plates of ample area are used at all panel points, as shown, and knee braces connect the top lateral struts with the posts. The floor beams are plate girders 4 ft. deep, resting on angle brackets on the posts and riveted to the posts. The rail base is 4 ft. 4½ ins. above the center line of the bottom chords. The trusses are 28 ft. deep, c. to c. of chords, and have panels 25 ft. long. They are set 17 ft. apart c. to c., and have a clear headway of 21 ft. 6 ins.

The 200-ft. spans have pin-connected trusses. Special features of these trusses, as of the other trusses, are the substantial character of the design, the heavy floor beams and overhead bracing, and the substantial design of the connections.

All the material is of medium steel, put together with ⅞-in. soft steel rivets, except that ¾-in. rivets are used in some of the angles and lacing bars. The truss members were assembled in the shops and had the rivet holes reamed to a perfect fit. The rivet holes were punched ⅛-in. smaller than the rivets and then reamed to a diameter 1-16-in. greater than that of the rivet. The ends of all stringers and floor beams, and of all abutting members, are planed, so as to have a perfect contact. The metal work was given one coat of paint at the shops and two after erection in the field. The general particulars of 150-ft. and 200-ft. spans are as follows, the loading being all per lin. ft. of span and the live loads being Waddell's Class X:

Length, c. to c. of end pins	150 ft. 0 ins.	200 ft. 0 ins.
Panel length	25 " 0 "	28 " 6⅞"
Truss depth at center	28 " 0 "	37 " 7 3-16
Distance between trusses, c. to c.	17 " 0 "	17 " 0 ins.
Clearance above rail base	21 " 6 "	21 " 6 "
Dead load for trusses	1,700 lbs.	1,920 lbs.
Dead " floor system	700 "	700 "
Live " trusses	4,140 "	4,020 "
" " floor beams	4,900 "	4,720 "
" " stringers	5,925 "	5,720 "
Wind load for top lateral system	150 "	200 "
Wind load, bottom lateral system	450 "	500 "

Arkansas River Bridge.—This bridge, shown in Fig. 4, is the longest on the line, aggregating 1,471 ft. It has a through truss channel span of 250 ft., flanked on the north by five deck trusses (4 of 127 ft. and 1 of 147 ft., c. to c. of end pins) and a plate girder of 50 ft. span. On the south there are three deck trusses of 147 ft. and a plate girder of 50 ft. span. The high water elevation is 31 ft. above low water elevation, and the base of the rail is 60 ft. 6 ins. above low water.

Concrete Piers; Arkansas River Bridge.

The ten piers and two abutments of the bridge over the Arkansas River are all built of monolithic concrete, and in the construction of the piers numerous difficulties were encountered. The following table gives the dimensions and cubic contents of the piers:

Concrete Piers of the Arkansas River Bridge; K. C., P. & G. R. R.

No.	Height, ft.	ins.	Length and breadth—At base.—ft. ins. × ft. ins.	At top.—ft. ins. × ft. ins.	Low water, cu. yds.—Above.	Below.
Abut. A..	33	3	53 8 × 10 5½	12 0 × 5 0	418.85	.....
Pier 1..	46	9¼	24 0 × 8 6	21 6 × 6 0	243.20	47.47
" 2..	46	4½	24 0 × 8 6	21 6 × 6 0	243.20	44.68
" 3..	49	5¾	24 0 × 8 6	21 6 × 6 0	243.20	66.32
" 4..	65	3¼	30 4 × 14 0	23 6 × 6 6	479.59	138.17
" 5..	64	4¼	29 0 × 12 0	23 6 × 6 6	479.59	107.08
" 6..	36	7½	24 8 × 8 6	21 6 × 6 6	219.81	.....
" 7..	20	4	24 0 × 8 6	21 6 × 6 6	125.14	.....
" 8..	21	0	24 8 × 9 2	21 6 × 6 6	111.29	.....
" 9..	20	6	24 8 × 9 2	21 6 × 6 6	107.21	.....
" 10..	20	10½	24 8 × 9 2	21 6 × 6 6	110.52	.....
Abut. B..	40	4¾	19 4 × 10 0	12 0 × 3 0	139.94	.....
Total					2,921.54	403.72

Mr. A. M. Nelson was engineer in charge of construction at this bridge, and in a report made to Mr. Robert Gilham, the Chief Engineer and General Manager, he gives an interesting account of the methods of construction, and the methods of overcoming the difficulties. An abstract of this report we give below, believing it to be of special interest and value. It should be explained that abutment A and pier No. 1 are at the south end of the bridge, the enumeration running from south to north. Fig. 5 shows the details of these piers and abutments:

Surveys.—The positions of the piers were determined by triangulation, for which four independent base lines were used. On the south side of the Arkansas River a perpendicular was erected, extending 1,500 ft. east and 1,272 ft. west of the center line. From this double base line the distance across the river was calculated, and checked by calculation from another line thrown off at random from the bridge tangent, at a point that afterwards proved to be 10 ft. 1 in. south of the center of pier No. 8. This measurement was subsequently checked again by another line thrown off at right angles to the center of pier No. 10, and extending 2,000 ft. to the east.

Several points were established on each of these base lines, and angles read to and from each of these points, all of which were read and re-read 20 times, giving direct interpolation of the angle to within 3 secs. From this close reading of the angles, and the accuracy with which the base lines were measured, the various calculations checked within 0.026 ft.

The base lines were measured in the following manner: We first used an ordinary 100-ft. steel tape line, supported at intervals of 25 ft. upon the tops of stakes which were driven to a perfect level. This measurement was afterwards checked with a wooden rod 20 ft. long, and measured to knife blade scratches.

At corresponding distances from the triangulation points and the tangent—that is, distances corresponding to the distances from the initial point to the centers of the piers—piers were staked out on these base lines, so that before the construction of the piers progressed far enough to obstruct the view, cofferdams and cribs could be set by direct sight. In all cases when it was impossible to see across the river to any point, the angles could be turned so that a right angle intersection could be made on the direct points in the stream, locating the exact center or points corresponding to the points used on the shore. These angles were all of 45°, thus making it unnecessary at any time to have to refer to field notes, or for any purpose carry maps or plans or notes of the survey into the field. At any time, and under any circumstances or conditions, points could be given by direct intersection from some of the number of base lines established.

The masonry was begun on both sides of the river, and when all the piers were completed and the falsework placed in position, so that direct measurements were obtainable, the measurements checked out as close as it was possible to measure, illustrating the care and accuracy with which the former work had been done. All points on shore were additionally referenced with hubs and guard stakes, so that at low stages of the water the points for piers Nos. 3, 4 and 5 could be easily established from these intermediate references.

In addition to this, we placed at right angles from each of the three above-mentioned piers, range stakes, to enable the contractors to float their cribs and cofferdams into position without having to wait for the engineer to give them lines or points. These ranges were so arranged that the intersection of the lines would bring them in direct position and could be used by the contractor's foreman by day or by night.

The triangulation points, ranges and all other points were preserved without very much difficulty through the construction of the work.

Concrete.—On June 17, 1895, the Arkansas Construction Co. entered into a contract with McGee, Kahmann & Co., of Kansas City, Mo., for the construction of the piers. Work was to be commenced immediately and completed by Oct. 1, 1895. The 10 piers and 2 abutments were to be built of Portland cement concrete according to plans and specifications furnished by the Arkansas Construction Co. The concrete was composed of 1 part Portland cement, 2½ parts of coarse sharp sand, and 5 parts of clean broken stone. The sand and stone were found on the site of the bridge. The cement was to be of the best quality of hydraulic Portland cement. Although the Arkansas Construction Co. showed a preference for North's Portland cement, no first-class brands were barred. Subsequently two brands of cement were used, North's Portland (Condor brand) and Kelley Island Cement Co.'s Lagerdorfer (Tower brand), both filling the requirements of our specified tests, and giving good results in the work.

The contractors moved onto this work about July 1, and began the preliminaries, although no actual construction was done until Aug. 22, when the first concrete was mixed and placed in the mold or form of pier No. 7. On March 6, 1896, the last batch was hoisted into the form of pier No. 4, and on July 22, 1896, the plastering of all of the piers and abutments was completed.

Molds or Forms.—The forms were all made of 2-in. yellow pine board surfaced on one side, and sized to 1¾ ins. The semicircular ends each tapered at the rate of 1 in. per ft., and were made by first making a double segmental set of ribs, placed 5 ft. apart vertically, and spiking timbers, 2 × 6 ins. (which had been tapered to fit these circles), to the segmental ribs. At each end of these ribs were angle irons bolted to the vertical stanchions, which were 4 × 6 ins., and answered as corner posts of the form.

Between these corner posts there were two additional vertical posts supporting the sides or flat surfaces of the form. They were sheeted up to the inside with yellow pine boards, 2 × 12 ins. These posts were about 4 ft. c. to c. and were held firmly in place by having at intervals of 5 ft. perpendicularly a ¾-in. iron rod, passing through a 1½-in. gas pipe which was fitted inside of the form, the gas pipe acting as a strut, while the rod on the inside was in tension. The construction of the molds is shown in Fig. 6.

These forms were placed in position with the transit instruments, and were watched closely and frequently checked. There being no means to brace the form in the middle of the river except from the interior, it made it a little difficult to keep them in position. This was done, however, by using X-bracing on the interior of the semi-circular ends, and removing it when the concrete would reach the bottom of the braces. After the piers were completed, the gas pipes, of course, remained within the concrete; upon taking the forms apart the rods were easily removed from the interior of the gas pipe.

On the forms of piers Nos. 1, 2, 3, 4, 5 and 6, at the point where the straight barrel of the pier meets the battered line of the upper portion of the structure, there is built with the pier a projecting mold to hide this union as well as to trim and beautify the structure. The form for this molding, Fig. 7, was made by sawing the form blocks with a scroll saw, and fitting cottonwood strips, ½ × 1½ ins., which had been previously soaked in hot water to make them bend readily to the form blocks. This

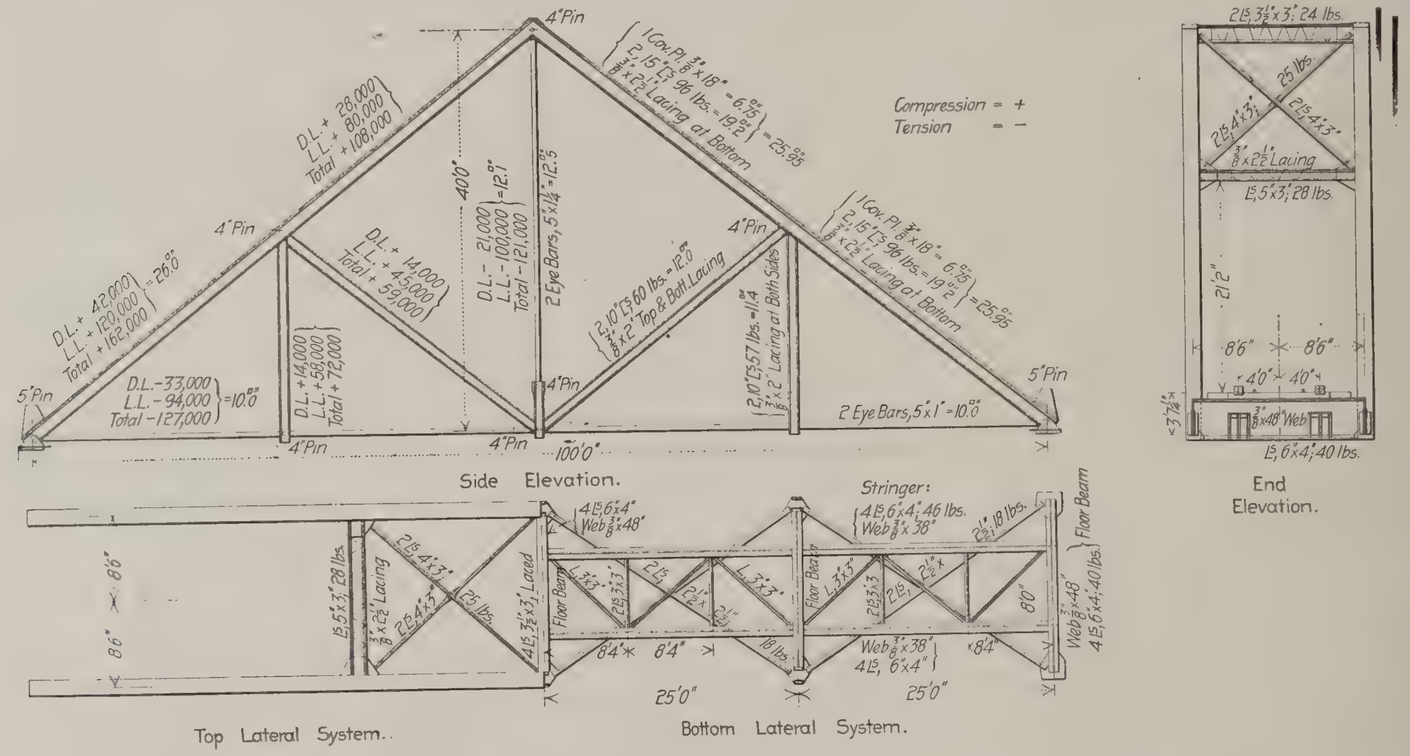

FIG. 1.—WADDELL'S PATENTED "A" TYPE OF THROUGH TRUSS FOR SHORT SPANS.

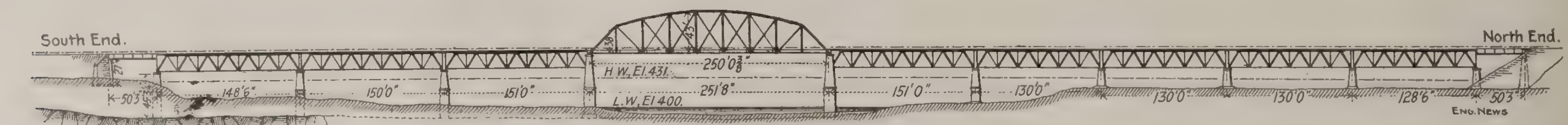

FIG. 4.—ELEVATION OF ARKANSAS RIVER BRIDGE; K. C., P. & G. R. R.

molding was also used on both abutments, and adds very much to the appearance of the structure.

Abutment A.—This is built on sand 7 ft. below the surface of the ground, and is the only one of the structures that is not on solid rock throughout. This abutment, having a broad base and circular wings, was not intended or designed to go down to solid rock, and a year after it was first commenced it had not shown any signs of settling, although it supports an embankment about 30 ft. high, which was placed against this abutment as soon as the form was removed, or within ten days from the time the last concrete was put in the forms.

On Oct. 7, 1895, the base course was put in, which is one foot larger than the neat size of the abutment in all directions. On Oct. 8 and 9, the form for the abutment proper was put in place, and the concreting continued until Oct. 12, when the work was stopped until the foundation of pier No. 1 could be secured, which was then in quicksand. On Nov. 13 work was resumed on the abutment, and it was completed (except the plastering) Nov. 20. The form was removed Nov. 27 to allow the grading contractors to finish up the embankment; and the plastering on the back of the abutment and the portions of the face to be covered with dirt was finished as soon as the form was removed. The balance of the abutment was plastered and finished Dec. 13. All of the coping on the top of the wings is made of concrete and the bridge seat proper is Carthage limestone.

Pier No. 1.—This was the most troublesome of all the piers, notwithstanding the fact that it was built on the bank (practically on dry land). It began to give trouble from the commencement of the work, showing signs of caving and sliding in the excavation. Later on the excavation was carried down to the level of the sand bar, or an elevation of 408, and then a frame 3 ft. larger than the pier was placed in position, and round piles 2 ft. apart were driven to the bed rock on the outside of this crib or frame. The whole excavation was shored to keep from caving, but when the excavation reached the water level, or an elevation of 402, part of the shoring gave way and a number of men narrowly escaped being buried.

The scheme of the contractors was to sheet up the piles on the inside as the excavation progressed. This worked very well until the water was encountered, and then the sand came in so rapidly that it was impossible to use the longitudinal sheeting any further. The contractors then concluded to drive small Wakefield piles and put the frame on the inside. The excavation was carried on in this way, and the piles driven down as the excavation progressed, until quicksand was struck, when another line of small Wakefield piles was driven, and the quicksand excavated by means of shovels until the sand began to cave in around the outside of the crib. This left large crevices, which were filled with hay, sheaf. oats, sorghum stalks, willow boughs, stable manure and other material, in fact anything that would stop leaks. In some cases burlaps and everything available that would stop a crack between the boards was used. The manure and hay eventually worked through the openings between the piles, and very seriously interfered with the pumps in the foundation, many times causing them to be stopped. Eventually the contractors worked the quicksand down within 18 ins. of the bed rock, where they worked day and night for 18 days without lowering the quicksand at all.

A plan was then suggested that finally worked well, and enabled the foundation to be speedily secured. It was as follows: Small cofferdams or minnature forms, 2 × 4 × 2 ft., were made, and placed one at a time along the outside of the neat work, allowing a slight projection of the small form outside of the neat lines of the main forms. These small forms were made with water-tight sides and open top and bottom, so that they could be easily removed after the concrete inside had had sufficient time to set. These forms were placed in the quicksand. 1 ft. apart, allowing the water and quicksand to pass between them in its flow to the pumps, and then the forms were worked down to the bed rock by baling out all of the sand and water from inside them. As fast as one was filled with concrete another would be sunk, baled out and filled, and so on until the circle was completed. When the small forms were all in and filled there was space left between the sides of these small forms and the crib proper for the passage of the sand and water. Next the 1 ft. passageways were to be closed, but it was then apparent that some means must be employed to allow the free flow of water and sand to the pulsometer pumps, which stood in the center of the pier, about 5 ft. from the east end; so for the time being two channels were left, one running north and south and the other east and west, intersecting at the pump. After the form for the pier was in place, it became necessary to put a form around the pump, in order to build up the concrete and leave the pump in a sump or cistern until the pier could be built above the danger line, or the present water mark.

The next step was to confine the water and quicksand to the sump. This was accomplished by putting in a 6-in. wrought iron pipe to connect the outside passageways directly with the pump, and exclude the sand and water from the inside of the form, except that which passed through the pipe. This was done in both channels, and the work of sealing the foundation then commenced.

In the 12-in. spaces left between the small forms, one Wakefield pile was inserted on either side. making a tight joint with the other Wakefield piles that had been driven around the small forms previously, and left there after the completion of this connection. The sand on the bed rock on the interior of these small spaces was then taken out, and the concreting of these openings was then carried out.

All the concrete in this foundation, up to elevation 407, was put in place by means of a chute. The concrete was wheeled in with wheelbarrows into the form, and shot into position to prevent separation of the mixture. The first concrete for this pier was mixed and put in position on Nov. 9, 1895, and the pier was completed on Nov. 23. The form was removed Dec. 2, and the pier was plastered soon after the removel of the form. The coping was set about Dec. 10.

The bank is filled in around the pier as it originally was, and reveted with an 18-in. dry masonry wall, laid with the slope of the bank. which is 1 on 1½. The wall contains 143.7 cu. yds. of masonry, and was let at $2.75 per cu. yd.

Pier No. 2.—This was the easiest and simplest of the piers in the bed of the river. The foundation was secured by driving Wakefield piling around a crib 3 ft. larger than the foundation. This piling is shown in Fig. 8. Some of these piles reached the bed rock, but many of them did not. As the excavation progressed, shores were inserted to protect the sides of the cofferdam. When the excavation reached the lower ends of some of the piles which the contractors failed to get down, then another frame was inserted and another row of small Wakefield piles was driven, and then before bed rock was reached still another row of Wakefield piles was driven.

This proved successful, and concreting was commenced on Oct. 26, 1895, and completed Nov. 3; this pier was partially plastered in December, but owing to the cool weather the plastering was discontinued until May, 1896, when this pier was finished up. It contains 287.88 cu. yds. of concrete; 44.68 cu. yds. of which are below, and 243.2 cu. yds. above an elevation of 400.

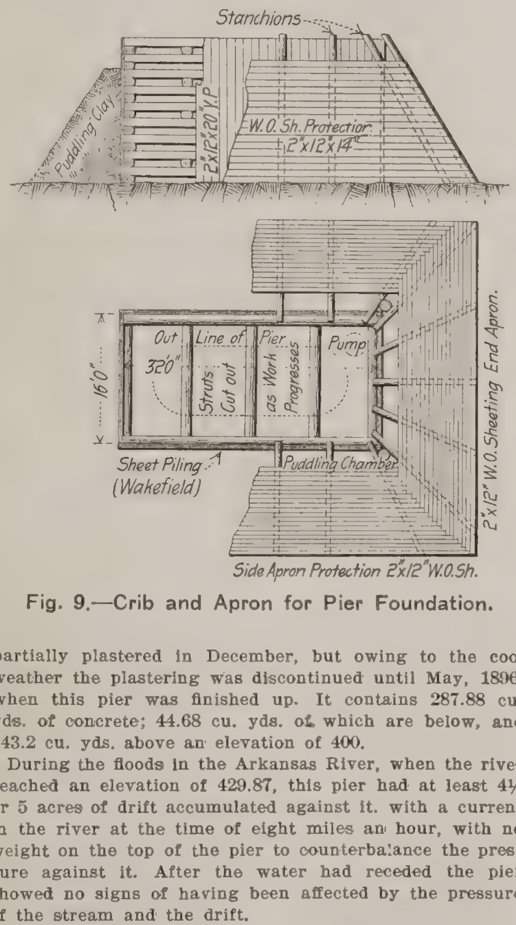

Fig. 9.—Crib and Apron for Pier Foundation.

During the floods in the Arkansas River, when the river reached an elevation of 429.87, this pier had at least 4½ or 5 acres of drift accumulated against it. with a current in the river at the time of eight miles an hour, with no weight on the top of the pier to counterbalance the pressure against it. After the water had receded the pier showed no signs of having been affected by the pressure of the stream and the drift.

Pier No. 3.—This pier was constructed by building a crib of round timbers, flat on the outside and placed in position in about one or two feet of water, and driving Wakefield piles on the outside of the crib, and then placing, by means of a diver, about 1,000 burlaps filled with sand about 10 ft. out from the bottom of the crib. These burlaps were for protecting the crib, and they were hauled in by means of barges. The whole crib was puddled with stiff puddling clay. Numerous small rises in the river from local rains gave considerable trouble, and it was with considerable difficulty that this crib was made to resist the pressure of the water from the outside, and quantities of hay and cane stalks were used to stop the leaks. Finally an auxiliary cofferdam was driven to protect the puddling from the current, after which bed rock was reached. The foundation for the pier was dry, and all dirt and slime was wiped off of the rock bottom with burlaps. There were a few loose flat stones, which were removed with little difficulty.

The character of all the river foundations was a grayish blue sandstone, very hard and rough, and with only an occasional seam. The general surface of the bed rock is quite level.

The pier was commenced by putting the first concrete in position Nov. 18, and was finished Dec. 6, 1895.

The form was removed Dec. 13, and the pier withstsood the floods and drift of Dec. 19 and 20, 1895, during which trees and logs struck the fresh concrete and left no traces of the effects after the flood had receded.

Pier No. 4.—This was the last pier constructed, and many difficulties were encountered during its construction, as the bed rock was scoured by the current of the river and was perfectly bare. A crib was made of round logs, flat on one side with the flat side turned out. This crib was subdivided into four parts or chambers, and loose struts were used to separate the chambers as well as to resist the pressure of the forces from the outside. Wakefield piles were then driven around this crib and sheet piling driven outside of that about 10 ft. away, forming a chamber between the sheet piles and the Wakefield piles, which was filled with puddling clay. The sheet piles were also puddled on the outside, and protected by sand bags. Numerous breaks occurred in this cofferdam, and considerable annoyance was caused by unexpected rises in the river.

Finally, when all was in readiness to begin the concreting, the rains set in and heavy floods occurred all over the country, especially in the valley of the Arkansas and streams tributary to it. They were swollen and overflowed their banks, and the Arkansas River rose rapidly and washed away the cribs, sheet piles, pumps and everything within its banks. All the sand that had been placed on the Cherokee shore, and the broken stone for the whole of pier No. 4, and about one-third of pier No. 5 (about 1,200 cu. yds.), was washed away.

The contractors' pumps, hoisting engines and other machinery, tools, etc., were all left in the bottom of the river. This very naturally affected the progress of the work. This flood occurred Dec. 19, and the water did not recede until after Jan. 21, 1896, when another crib was built similar to the one above described, and the same style of Wakefield piles was used, except that they were longer and the crib was built 4 ft. higher, so that small rises in the river could not affect this foundation work. This crib was protected with aprons built of 2-in. oak planks, set at an angle in all directions, giving chambers between the crib and the aprons an enlarged base. This aperture between the crib and the apron was filled with puddling clay, and a great deal of hay, burlaps and other material was used in connection with the clay to stop leaks in the cofferdam. This construction is shown in Fig. 9. The foundation, on bed rock. was rather smoother than the others, having no loose material on it whatever. The concreting was commenced Feb. 8, and finished March 6, 1896. This pier has an enlarged base, as shown in Fig. 5. It contains 617.76 cu. yds. of concrete, 138.17 of which are below and 479.59 above an elevation of 400. The stone for this pier was all broken by hand, the crusher having been shipped away before the flood.

Pier No. 5.—This is the channel pier on the Cherokee side, and was constructed by using a separate cofferdam made of yellow pine timbers, 2 × 12 ins., 16 ft. long, except the bottom and top fillers, which were 10 × 12 ins., 16 ft. long. The cofferdam was rectangular in shape, 32 × 16 ft., and 18 ft. deep; it was sheeted upon the inside and outside with 2-in. pine boards running longitudinally, and calked with two threads of oakum. The vertical studs. 2 × 12 ins., 18 ft. long, were placed 2 ft. apart. This left chambers or recesses, 12 × 24 ins. between the studs, to be subsequently filled with sand to sink the crib; the recesses being left open at the top for that purpose.

The two parts of the cofferdam joined at each end, the joints being provided with cushions made by tacking canvas facing to the edges loosely, and stuffing them with oakum, making a cushion about a foot thick. The bottom of this cofferdam was built to conform to the contour of the bed rock, which was bare and very rough. At a point 3 ft. above the bottom an additional canvas apron about 12 ft. wide was secured to the sides of the cofferdam by nailing strips 4 ins. wide to prevent the canvas from tearing. This canvas was stretched out horizontatlly and weighted with sand bags, and also with puddling clay.

The contractors abandoned the idea of loading the pockets of the cofferdam with sand, and subsequently loaded the top with burlaps filled with sand, and the canvas apron was loaded with sand bags for 12 or 15 ft. Puddling clay was used, and the whole exterior of the cofferdam was thoroughly puddled. This cofferdam did not prove a success. There was no struts placed inside before the pumps were started, consequently as soon as the water was pumped out the cofferdam sprung in at the center, all along the sides, causing great leaks. The pumps had to be shut down, and divers sent inside to place shores to resist the pressure of the water. Sand bags were also used at the bottom to stop leaks temporarily, as well as keep the lower edges of the cofferdam from further bulging in or slipping. After much time had been lost, the cofferdam was thoroughly braced inside and the foundation for this pier was secured. The bed rock showed a crevice about 2 ft. wide running diagonally across the east end; this was excavated to a depth of 6 ft., when it disappeared. The character of this foundation is bluish gray sandstone, and this crevice seemed to be simply a crease in the solid rock. Concreting was commenced on Dec. 6, 1895, and completed Jan. 31, 1896. On Dec. 18 the pier was built to an elevation of 134.5. The high water then set in, and nothing more was done until Jan. 29. During this flood a portion of the form was torn away by drift wood, but the pier was unhurt. The plastering on this pier was completed July 22, 1896.

Pier No. 6.—This has a foundation above low water mark, but at the time of construction the water was about 2 ft. over the foundation. A half crib was used, a double tarpaulin being fastened to the top of this half crib and extended out in the river about 12 ft. This was puddled with clay and the water kept out. The solid rock sloped at a considerable angle in this foundation, and it had to be blasted to a level. The base of this pier was put in to receive the form on Oct. 28, 1896, when the concreting was commenced. The pier was finished Nov. 5, 1895, and the pier was plastered in June, 1896. In July the river was low enough to permit working around the base, when the Arkansas Conctruction Co. put in 17½ cu. yds. of Portland cement concrete reinforcement around the base, completing the pier, which contains 219.81 cu. yds. of concrete, all above an elevation of 400. This does not include the reinforcement done by the Arkansas Construction Co.

Pier No. 7.—This was the first pier built. It is a shore pier on a solid gray sandstone foundation, only about 18 ins. of excavation through loose rock being necessary to reach the foundation. It was commenced Aug. 23, 1895, and completed Aug. 26, 1895. The pier has a reinforced base, this reinforcement being done by the contractors.

Pier No. 8.—This was the second pier constructed, and the foundation for it is similar to that of No. 7, except that it is deeper to the solid rock. This pier was commenced Aug. 21, and completed Aug. 31, 1895, and contains 111.29 cu. yds. of concrete in the pier proper. It was plastered in December, 1895. The weather turned cold just after this pier was plastered, and a quantity of the plaster was loosened by the action of the frost. In July, 1896, just before the plastering was all completed on the other piers, this pier had all of the loose plaster removed, and was replastered and washed down with a strong solution of cement mortar or liquid cement. The high water of December, 1895, tore up a quantity of loose rock around this pier and exposed the foundation of the east end. In July, 1896, the Arkansas Construction Co. reinforced the base of this pier by putting 24 cu. yds. of concrete around it.

Pier No. 9.—This has the same kind of a foundation as No. 8, except that it is still deeper to the solid rock, and the loose rock through which the excavation is made has a tendency to be more solid, the last 18 ins. of this excavation being through hard, blue slate. This pier contains 107.21 cu. yds. of concrete. The concreting was commenced Aug. 28, and was finished Sept. 26, 1895.

Pier No. 10.—This is built on a hard blue slate foundation, perfectly smooth and solid. The concreting was commenced Sept. 9, and was completed Sept. 24, 1895. This pier has an embankment about it, which is protected by a rip-rap wall above high water mark.

Abutment B.—This abutment, at the north end, is on a hard blue slate foundation, which is level, smooth and solid. The concreting was commenced Aug. 28, and was completed Oct. 28, 1895. This abutment contains 139.94 cu. yds. of concrete and was plastered two coats, floated on with a cork float. The steel float and the third coat were not used except on that portion exposed above the embankment, which is 6 ft. below the top of the abutment. This piece of masonry is covered by an embankment, so that only the top is exposed to view.

STEEL TIES ON THE NETHERLANDS STATE RAILWAYS; 1881 TO 1898.

The use of metal ties was commenced on the Liege & Limburg line of the Netherlands State Railways in 1865, and since 1880 very careful observations have been made of the results obtained with the different types of metal ties which have been in service. This line is on Belgian territory and will soon be transferred to Belgian ownership, under an agreement between the governments of the Netherlands and Belgium, by which each country will purchase those lines within its territory which are now operated as a part of the railway system of the other country. Under these circumstances, the observations as to the metal ties on the Liege & Limburg line will be discontinued, and the Resident Engineer, Mr. Ch. Renson, has therefore prepared a final report on the general results of these observations for the 17 years ending with Jan. 1, 1898. This report will be published in full in the July number of the Bulletin of the International Railway Congress, and we present herewith an abstract containing some very interesting and instructive information. In our issue of April 7 we presented an abstract of a report on the experience with steel ties on the Gothard Railway, of Switzerland, and discussed the relation of the steel tie question to the track of American railways. It is to be noted that on both these foreign lines, where the ties have been used extensively and under proper supervision, very satisfactory results have been obtained both in point of efficiency and economy. The following is the abstract of Mr. Renson's report:

The first trial section of track with steel ties was laid on the Liege & Limburg line in 1865, but in 1880, Mr. J. W. Post, Engineer of Permanent Way of the company, which operates the state railways, was commissioned to study at home and abroad the results obtained from the use of metal ties, and also to inquire into the latest improvements in their manufacture. This investigation resulted in a series of extensive and practical tests, which have been continued in a systematic manner during the past 17 years. The trial sections are 27 in number, and have carried from 100,000 to 150,000 trains.* The present report shows the relative merits of the different systems tried. Up to 1888 ties of types I. to IX., Fig. 1, with fastenings of types A, B and C, Fig. 2, had been put in service. Since then, types X. and XI., with holes drilled instead of punched, and fastenings D, have been introduced, as shown in Figs. 3 and 4. Type O is now obsolete, but most of the ties of this type, which were laid in 1865, are still in use, but their wooden blocks have been replaced by cast-iron blocks. Types I. and II. are of iron, the others are of steel.

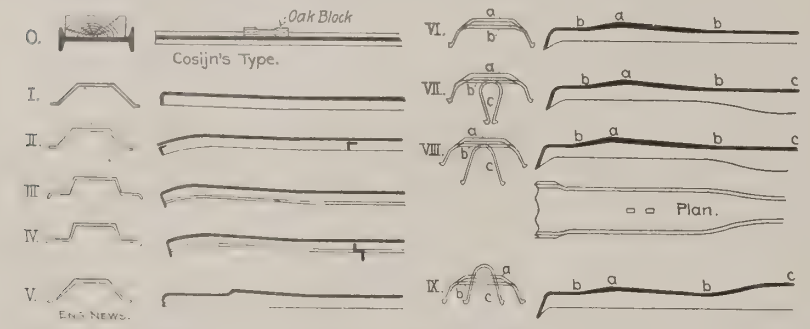

FIG. 1.—STEEL TIES ON THE NETHERLANDS STATE RAILWAYS; TYPES 0 TO IX.

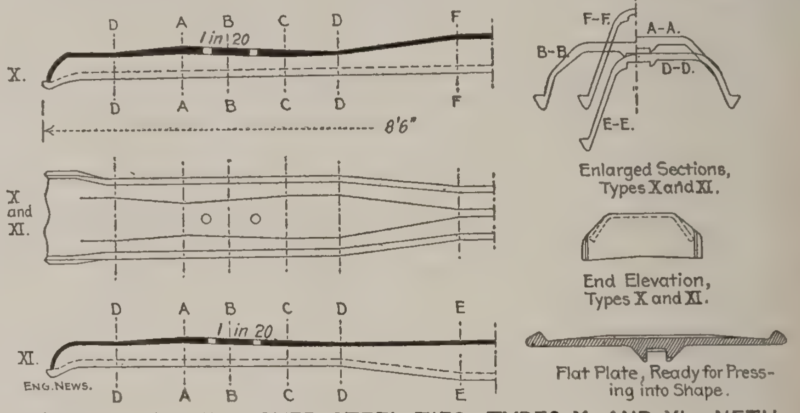
D
A
B
C
D
F
1 in 20
X.
8'6"
X and XI.
XI.
E
Eng.News.
F-F.
A-A.
B-B.
D-D.
E-E.
Enlarged Sections, Types X and XI.
End Elevation, Types X and XI.
Flat Plate, Ready for Pressing into Shape.

FIG. 2.—POST'S IMPROVED STEEL TIES; TYPES X. AND XI.; NETHERLANDS STATE RAILWAYS.

The 27 trial sections of track are on single track, laid with T-rails, the steepest grade being 1.6%, and the sharpest curve 1,148 ft. radius (5°). The traffic carried is from 14 to 25 trains per day, and 29 trains per day over one of the sections. In the accompanying table, the cost of maintenance per mile, and per 10,000 trains, is given for 21 sections, the others not being long enough for statistical purposes. The section No. 1, with oak ties, is a basis of comparison for the ten sections having 25 or 29 trains per day, but not for those with only 14 trains per day, as the relative cost of maintenance is higher, owing to the fact that these expenses are affected by the number of trains as well as by the time the track has been exposed to frost, rain, etc. The figures relating to sections with the lighter traffic are given in parentheses. The expenses are given in labor instead of money, which allows of their being compared with those of railways in countries having a different system of currency.

From my observation of the 27 trial sections during 17 years, and from the statistics of maintenance expenses of 21 of these sections, I present the following results:

The ties with punched holes show, after three or four years' service, little cracks beginning in the corners of the holes (rectangular with rounded corners) and caused by the punching operation, which usually bruises the metal, even in the case of mild steel. These cracks, generally invisible at first, are gradually enlarged by the train traffic. Ties with drilled holes do not crack in this way.

The ties of type I. last longer than oak ties. Calculated at the actual prices, the annual charge for renewal of these ties is only half that of oak ties. The maintenance expenses of tracks with tie I. are higher than those of oak ties; but if the difference is deducted from the difference in annual charge for renewal, there is a surplus of about $43 per mile of track in favor of this tie. It must be observed that type I. is the smallest, lightest and worst of the types tried and is now considered decidedly inferior. The work expended on the inferior systems of fastenings, A and C, had an unfavorable influence on the cost of maintenance of the ties which have these fastenings. For tie I. the maintenance expenses were higher than those for oak ties; for tie II. the difference was less, and so on; each following type being an improvement on the former. For the Post tie of type VI. those expenses are less than for oak ties, and the result is still more favorable for the improved Post types VII. to XI.

The rusting of steel ties is insignificant, even if the roadbed consists of cinders, as is the case on the greater part of this line. Of how little importance the rust is, is clearly shown on another line of the company. In 1865, 10,000 ties of the Cosijns type, Fig. 1 (iron I-beams laid flat and having two oak blocks), were laid between Deventer and Olst. About 200,000 trains have passed over these "venerable" ties, now 33 years old, but they are expected to last much longer, for the oak blocks, which only lasted three to eight years, are now being replaced by iron blocks.

A very important point, which till now has not attracted sufficient attention, is the way in which the tie affects the rail flanges, especially in regard to local wear of rail-flange, tie and fastenings. The rail being much better fastened on the metal ties, the hammering of the rail under traffic (often observed on wooden ties) is avoided. By measuring two series of rails, which had been 14 and 16 years in service, it has been found that on metal ties the local wear of rail, tie and fastenings is insignificant.

When I discovered the little cracks in the metal ties (with punched holes), Mr. Post designed the fastenings of type D (Fig. 4), permitting the use of bolts without a square collar, the head of the bolt being retained between two fillets rolled on the under surface of the tie (Figs. 2 and 4). With these

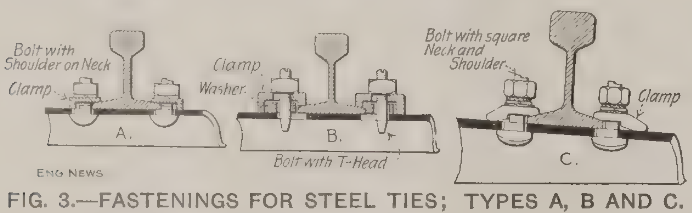
Bolt with Shoulder on Neck
Clamp
Clamp
Washer
Bolt with square Neck and Shoulder
Clamp
A.
B.
C.
Bolt with T-Head
Eng News

FIG. 3.—FASTENINGS FOR STEEL TIES; TYPES A, B AND C.

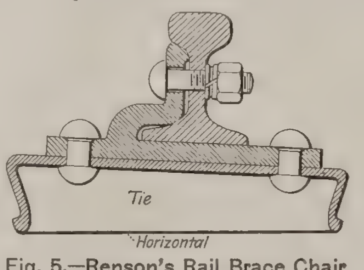

Fig. 5.—Renson's Rail Brace Chair for Steel Ties on Sharp Curves; Netherlands State Railways.

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*Descriptions of the forms of ties experimented with and details of the results obtained with these ties may be found in the following publications:

"Maintenance Expenses of Track on Metal Ties," by J. W. Post, "Transactions of the American Society of Civil Engineers," June, 1888.

"Report on Metal Ties," made by Ch. Bricka to the French Minister of Public Works, 1886.

"Report on Metal Ties," made by J. M. Kowalski to the International Railway Congress, and published in the "Revue Generale des Chemins de Fer," February, 1886.

"Report on Metal Ties," made by E. E. Russell Tratman; Bulletins Nos. 3, 4 and 9 of the Forestry Division, U. S. Department of Agriculture, Washington, D. C., 1889, 1890 and 1894.

round bolts the holes in the tie must be round and can be drilled.

The great difficulty was to induce the steel works to put in the plant necessary for exact, quick and cheap drilling of the four holes per tie. There was some opposition on that point; just as there was at the time when the railway officers wanted to get the holes in steel rails drilled instead of punched. It was only in 1889 that a reasonable contract could be made.

The Post ties X. and XI. (Fig. 2), with fastenings D (Fig. 4), which have been in the track now since 1890, are superior to any of the former types.[†] They not only require very little maintenance work; but whereas types I. to IX. show cracks after three or four years' service, not one of the types X. or XI. (and they have been carefully examined) show a trace of cracks.

Results of Service with Steel Ties on the Netherlands State Railways, 1881 to 1898.

Trial section.	Length, ft.	Max. grade, %.	Radius of curves, ft.	Trains per day.	No. of ties.	Type of— Ties.	Type of— Fastenings.	When laid.	Observations ended Jan. 1.	Days in service.	Trains carried.	Days of 1 man's labor for maintenance— Total.	Days of 1 man's labor for maintenance— Per mile pr 10,000 trains.	No. of ties rem'v'd observation ended.
1.	3,306.24	1.20	1,640	25	1,120	Oak.	Spikes.	1881.	1895.	4,932	123,300	1,367¼	177.4	1,120
2.	3,430.88	1.20	2,460	25	1,133	I.	A	1881.	1896.	5,297	132,425	2,330¾	271	1,133
3.*	3,027.44	0.12	tan.	25	1,000	I.	A	1881.	1898.	5,966	149,150	2,652¾	311.3	305
4.	3,634.24	0.29	tan.	14	1,200	I.	A	1881.	1898.	6,044	84,616	2,078	(358)	73
5.	2,371.44	0.34	tan.	14	800	I.	A	1881.	1898.	5,966	83,524	1,489½	(391)	0
6.	1,685.92	0.16	3,280	25	600	II.	B	1882.	1898.	5,479	136,975	1,200½	275.8	263
7.	1,436.64	Level.	3,280	29	500	II.	B	1882.	1896.	4,748	137,692	1,156	308	500
8.	1,512.08	0.80	tan.	25	500	II.	B	1882.	1898.	5,479	136,975	972¾	248.4	82
9.	905.28	0.40	tan.	25	300	II.	B	1882.	1898.	5,479	136,975	737½	314.5	48
10.	3,630.96	0.39	tan.	14	1,200	II.	B	1882.	1898.	5,479	76,706	1,819¾	(34.5)	55
12.	849.52	1.30	1,640	25	300	II.	B	1883.	1898.	5,206	130,150	467¾	224.2	47
13.	1,128.32	0.65	1,640	14	400	II.	B	1883.	1898.	5,221	73,094	595½	(382.2)	159
14.	3,332.46	1.60	1,148	25	1,328	III.&IV.	A	1883.	1898.	5,206	130,150	2,527¾	308	1,328
15.	1,485.84	0.65	1,640	14	500	III.&IV.	A	1883.	1898.	5,221	73,094	780¼	(380.6)	210
16.	1,512.08	0.08	6,560	14	500	III.	A	1883.	1898.	5,054	70,756	781	(385.5)	48
17.	698.64	1.30	1,640	25	250	IV.	A	1883.	1898.	5,206	130,150	533½	309.6	77
18.	1,512.08	Level.	tan.	14	500	IV.	A	1884.	1898.	5,054	70,756	691¼	(341.9)	0
19.	1,528.48	0.08	tan.	14	505	V.	A	1884.	1898.	5,054	70,756	867¼	(424.2)	6
20.	2,220.56	0.10	6,560	14	735	VI.	C	1885-6.	1898.	4,232	59,248	636	(254.8)	0
24.	3,280.00	Level.	tan.	25	1,081	VI.	C	1887.	1898.	3,867	96,675	683¼	114.5	12
27.†	560.88	1.60	1,148	25	200	Special.	Sp'cial.	1888.	1898.	3,287	82,175	194½	222.5	0

*This section is on marshy ground.

†This section has special ties with riveted rail brace and tie-plates, Fig. 5.

Note.—The maintenance figures in parentheses are for track sections having a lighter traffic, and are therefore not directly comparable with those of the other sections. The maintenance work is low on most of these sections, but shows higher figures when divided by the number of trains.

I prefer type X. with "dromedary" waist (Fig. 2), to type XI. with low waist, because with type X. the middle of the tie is not bedded in the lower and firmer part of the ballast, and so the support of the tie is sure to be under and near the rail seats.

A series of these ties, which were examined in 1897, show that the wear of the rail seats of the tie is insignificant and that the wear in the holes also is of no consequence.

For lines with very heavy traffic, however, it may be economical to still further lengthen the life of the tie by applying between the rail base and the tie a mild steel plate, say 10 or 12 mm. thick. In order to examine whether this might cause any reduction in the firmness of the fastening of rail to the tie, I armed some ties of types X. and XI. (fastenings D) with such tie-plates as shown in Fig. 4, and I found that there is no objection to their use, the gage of the track being as constant with these plates as without them.

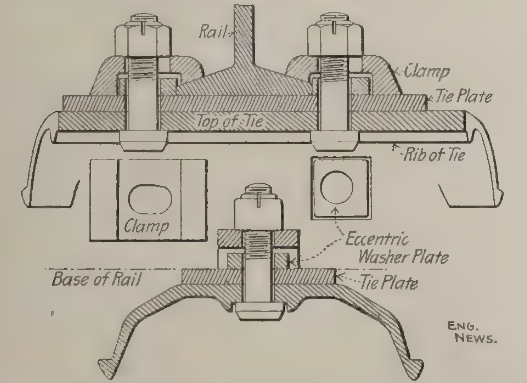


Fig. 4.—Post's Improved Fastening for Steel Ties; Type D. (Showing Tie-Plate.)

These plates can easily be renewed when worn and thus practically lengthen the life of the ties indefinitely, even on lines with heavy traffic.

For very sharp curves in main track, I have tried since January, 1890, a special tie with stamped iron chairs (Fig. 5), which is rather expensive, but gives satisfaction in every respect and is superior to any special system tried on the sharp curves of our lines. Rivets of 30 mm. applied by machine would be preferable to those of 25 mm., as used on the trial track.

As my impressions after these 17 years of experimenting, statistics and observation, I can give the following conclusions:

Grave defects have been discovered, especially the cracks in types I. to IX., and also imperfections in the fastenings A and C. These inconveniences were so important that they would have resulted in abandoning the use of metal ties altogether, had not Mr. Post found the way to avoid them.

The cracks of the ties, which are principally caused by the punching of the holes, are eliminated in the rolled mild steel Post ties, types X. and XI. (Fig. 2), by drilling the holes, strengthening the rail seats and rolling on the under surface two fillets to prevent the bolts from turning. The patent on this has now expired. It is my conviction that the life of these types of ties will be equal to many times the life of oak ties.

The local wear or notching of the rail base by the fastenings, which is sometimes important when spikes or screws are used on wooden ties, is considerably reduced by the use of the eccentric washer plate (Fig. 4), having a large contact surface. Thus not only is the life of the rails lengthened, but the cost of renewal of fastenings has also been reduced to less than that for the renewal of fastenings on oak ties.

If a good design of nut is used (which does not work loose by the vibration), the wear in the holes and on the rail seats of the tie, of the rail base itself and of the fastenings, is insignificiant, and thereby the annual charge for renewal of this track is much less than what it is with wooden ties.

The cost of maintenance, which is somewhat higher with types I. to V. (Fig. 1) than with wooden ties, is decidedly lower with types VI. to IX., and especially with types X. and XI. and fastenings D.

The track gage keeps better on ties X. and XI. with fastenings D than on oak ties and by the solid connection between rail and tie the security is greater. As to resistance to shifting sideways and creeping lengthways by the traffic, these steel ties are far superior to wooden ties.

I would only prefer oak ties in the following limited cases: (1) On badly drained road; (2) On new high and not yet consolidated embankments; (3) On marshy ground; and, (4) With ballast which is but little permeable.

For lines with very heatvy traffic the following improvements might be made:

1. Enlarging the base of ties X. or XI. (Fig. 2) by taking 260 or 270 mm. width (instead of 235 mm.), and 2.7 m. in length (instead of 2.6 m.); this is in order to still further reduce the expenses for packing or tamping.
2. Provide the ties with two tie-plates (Fig. 4) each, in order to still further lengthen their life.
3. Increase the depth of the ends of the tie (Fig. 2) to prevent lateral displacement of the track on sharp curves and in the case of high speed or the lurching of the locomotive.
4. Use bolts 25 mm. thick, instead of 22 mm.

The supplementary expenses caused by these experiments during 17 years are very trifling and the results obtained have proved very useful. The observation of the trial tracks has enabled us to get a definite opinion as to the value of different systems of ties and fastenings. The gradual, but important improvements which we owe to Mr. Post, have contributed to assure the development of metal track all over the world, and also to ensure both greater economy and security.

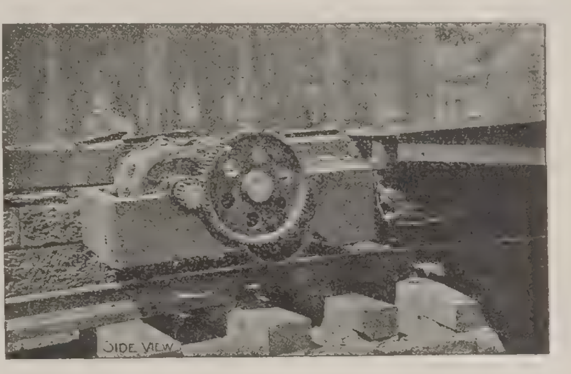
Finally, I am glad to state that the result of our 17 years' work not only fully confirms the favorable opinion of many engineers, who especially studied the metal track question, particularly Messrs. Ch. Bricka, J. W. Post, A. M. Kowalski, E. E. Russell Tratman, Ch. Lebon and Dietler, but also that our results quite agree with the favorable results on some of these railways,[*] where this question has been examined extensively and with perseverance, by giving different systems a fair and honest trial without preconceived ideas.

[†] The ties with variable section are either rolled in trough shape or they are manufacturd by rolling a flat bar (with variable thickness in some parts, Fig. 2), which is afterwards pressed into trough shape in a matrice. With the same section under the rail base, the economy of material in comparison to constant section is about 15% for the trough shape rolling; it is less with the flat rolling system. It is a long time since these rolling systems were patented; the patents are probably expired and public property now.

[*] See the report of February, 1898, of the Gothard Railway, Switzerland, of which an abstract is to be found in Engineering News of April 17. It is also worthy of notice that the use of steel ties is increasing yearly on the French and German state railways, and that the percentage of steel ties on all railways of the globe taken together is steadily rising.

THE WESTINGHOUSE "ELECTRIC DONKEY" FOR OPERATING TURNTABLES.

In our issue of May 27, 1897, we illustrated a very successful form of electrically operated locomotive turntable which had been put in operation a short time previously at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul Ry. This installation consisted simply of an electric motor and the necessary reduction gearing mounted upon a frame provided with a single traction wheel running on the circular pit rail. Somewhat similar devices have been installed by other railways, the motor in most cases being made in the machine shops of the railway and being more or less crude in design. As these simple means have proved very successful and seem likely to be used more commonly in the future, we illustrate in the accompanying cut a special turntable motor carriage recently put on the market by the Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa., and designed on the same general lines as the one used at the West Milwaukee shops of the C., M. & St. P. Ry. previously described. This motor carriage or "electric donkey," as the builders name it, weighs complete 3,700 lbs. The motor proper is of 10 HP., and the power required to operate the table when loaded with a 100-ton engine is stated to be about ½ HP. per hour.



Electric Donkey for Operating Turntables.
Westinghouse Electric & Mfg. Co.,
Pittsburg, Pa., Makers.

◆

THE IMPORTS AND EXPORTS OF MANUFACTURES of iron and steel, into and from the United States, have practically reversed value conditions since 1880. From figures lately published by the Treasury Bureau of Statistics, and from a table giving the amounts for each year, we obtain the following comparison for periods of 5 years:

Year.	Imports.	Exports.	Year.	Imports.	Exports.
1880..	$71,266,699	$14,716,524	1896..	$25,338,103	$41,160,877
1885..	33,610,093	16,592,155	1897..	16,094,557	57,497,872
1890..	41,679,501	25,542,208	1898..	12,615,913	70,367,527
1895..	23,048,515	32,000,989			

The list of iron and steel exports is an elaborate one, but some of the most important items for the fiscal year, 1898, are as follows: Bar iron, 12,308,615 lbs.; cut nails, 32,310,393 lbs.; wire nails, 22,894,099 lbs.; locomotives, in value, $3,883,719; wire, 136,951,924 lbs.. Sewing machines, electrical apparatus and supplies and agricultural implements of American make practically go to all parts of the world.

◆

FIGURES SHOWING THE CONDITION of Spain have been compiled by the Philadelphia Commercial Museum. According to this report the population is 18,000,000, of which number 8,726,519, 6,764,406 of whom are women, have no trade or profession. There are 4,033,291 men and 828,531 women engaged in agriculture. School statistics show 1,728,920 pupils with 39,582 teachers, 24,624 of whom are men. There are 97,257 public employees, 64,000 on the pension rolls; 30,477 male and 78 female physicians; 1,151 male and 32 female writers; 3,497 theatrical people; 3,497 male and 319,506 female servants; professional beggars of both sexes number 91,227; priests, 43,238, and nuns, 28,549.

◆

A METRIC CONGRESS of the leading textile maunfacturers of the world will probably be held in Paris in 1900. The congress is called mainly to overcome the difficulties arising from the want of system in numbering the thread used in the textile industry. The U. S. Consul at Liege, Mr. H. W. Gilbert, calls the attention of American manufacturers to this meeting, and says that more business would follow the employment by United States makers of weights and measures to which foreign buyers and consumers were accustomed.

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The problem of devising an economical and efficient system of generating and transmitting power for long-distance electric railway operation has become during the last few years one of particular interest to engineers. That there is likely to be a steady growth in railways of this sort there seems every reason to believe, but there is less certainty in the minds of engineers as to the best system for operating them. At present the tendency of practice appears to be to employ some form of polyphase current transmission with direct-current motors for actual car propulsion, the alternating current being transmitted to suitable sub-stations, where it is changed to direct current for supplying the motors by means of rotary converters. It is practically this system which is employed on the Chicago & Milwaukee Electric Ry., which is described elsewhere in this issue, and which is the most recent, and in some respects the most noteworthy, example of long-distance electric railway construction of which we know.

In this railway we have a generating station located approximately at the center of the road, convenient to coal and water, and equipped with modern economical engines directly connected to 5,500-volt three-phase generators. High tension transmission is used to suitably situated sub-stations, where rotary converters change from three-phase to direct current, which by means of feeders and the trolley eventually reaches the car motors. Other combination generators supply either direct current for nearby sections or low-tension alternating current for transformation to high-pressure for transmission. The engines and generators are coupled in such manner as to permit any combination of engines and generators to avoid shut-downs. Storage batteries are used in connection with the direct-current portion of the system to balance the system, equalize the load, etc.

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While this train of transformations is successful mechanically and, generally speaking, financially, and has many features which indicate that it may hold its own for some time to come, one is forced to regret that more attention has not been devoted toward developing a practical two or three-phase street railway motor. There seems to be no inherent reason why such motors cannot be made to meet the rigid requirements of power, speed, control and efficiency as well as the present direct-current motor has. The matter of conveying the current to the moving car or train would entail more apparatus, it is true, but, on the other hand, the extreme simplicity and the smaller amount of attention required at the central and sub-stations would seem more than to counterbalance the double trolley necessary. In such a system the current could be generated at any desired voltage up to about 10,000, using stationary armature machines. At the sub-stations static transformers would step this pressure down and feed directly into the trolley circuits, thus eliminating the rotary transformers and the present annoying factors of electrolysis, the effect upon telegraph lines and ground return telephones, etc.

Of course, it can be argued that there is nothing to be gained by the less complicated system, and that the use of the rotary converter and storage batteries, while they increase the amount of apparatus, and cause a loss in transformation, they more than compensate for this by permitting the installation of machinery of smaller output and by insuring better regulation. It is, however, quite possible to use a storage battery plant in connection with a three-phase generating system, if instead of using an ordinary three-phase generator, motor generators are employed, as in the plant already mentioned, in which the dynamos are directly connected to the engines and can run either as direct-current generators, for feeding circuits near the station, or as three-phase generators, for distant circuits. To illustrate the statement just made, suppose such a plant, equipped with an adequate storage battery plant, with the direct-current side connected with the battery plant, and the three-phase side feeding the line during the times when the load was light, as in the early morning, midday or late at night. During these hours of light traffic the engines could be operated at an economical load charging the battery. As the load on the three-phase circuits began to increase, however, the engines could be maintained at this proper load, the battery voltage increased by suitable combining switches, and the direct-current side of the generator used as a motor to help over the "peak." In this way all apparatus could be run at full load, which would thus permit the use of smaller engines and generators, because they would always be working at their most economical point.

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Not a little attention has been paid of late in various assemblies of engineers to the standing of engineering as a profession; and it is encouraging to note, despite isolated discouraging instances, that the general public is slowly coming to understand that engineering is a profession, governed by the same rules of honor that govern the legal or medical professions, and its members have a right to similar honorable treatment.

There is, however, much hard work still to be done by the profession in securing the position that it deserves. Perhaps one of the hardest things an engineer who stands up for the honor of the profession has to overcome is the attempt of occasional manufacturing concerns to undermine his employers' confidence in his integrity and impartiality.

An aggravated instance of this sort has just come to our notice, where a manufacturing concern added insult to attempted injury by tendering a bribe to the engineer. Circumstances made this concern especially anxious to sell its goods to this particular customer, as he had already made extensive use of them, but not with perfect satisfaction. This much is said in order to present any extenuating circumstances in the case. The story, as briefly as possible, is as follows: An engineer was called in to make plans for a certain work. He found a patented apparatus in use which had become inadequate for its purpose, through increase in the output of the plant, and the efficiency of which, as compared with other methods, was at least open to question. For a variety of reasons the engineer recommended the adoption of a new system, under which contracts could be let in the open market. The client accepted his recommendation, and work by day's labor was started, although the letting of contracts for the bulk of the work was postponed until warmer weather. About this time, the company whose apparatus was to be displaced went to the client and urged a reconsideration. Later the engineer received a letter from one of the officers of the company in which it was assumed that the engineer's recommendation of the non-patented process was because his services would be more largely required in its installation, and an offer was made of 5 per cent. commission, if he would alter his recommendation and favor the company's apparatus. The offer was, of course, refused.

Next the company began a stubborn fight to discredit the engineer in the eyes of the client, taking the ground that the engineer in advising the adoption of a certain process was a trade competitor, and entitled to no more consideration than themselves. They brought forward the old argument that they could furnish undoubted financial guarantees as to the cost of their plant, which the engineer was, of course, unable to do. They unblushingly admitted their offer of a commission to the engineer, and declared that the offer and acceptace of such commission was a matter of course.

◆

We are exceedingly pleased to state that, notwithstanding all the specious arguments and powerful influences which the company's agents brought to bear, the client was wise enough to perceive their fallacy and to order the work carried out on the engineer's original plans.

We doubt not that not a few of our readers have had similar experiences at one time or another; and have felt the need that in some way the profession should stand together to repel such assaults as this on its integrity and honor.

It is one of the hardest tasks that comes to many an engineer to stand up before a Board of Directors or City Council, to defend his own integrity, and make plain that he stands as their impartial adviser and representative, while the wealthy and influential promoter, the glib-tongued lawyer or the ubiquitous sales agent, who is urging that the engineer's advice be rejected, is merely working for his own profit. Is there any way in which engineers can uphold their professional standard and assist each other to win the day in hard-fought battles of this sort? We know of no way except for each man to stand up manfully and fight his own battles to the best of his ability; and further, to see that so far as possible no professional recognition or distinction shall attach to the man who degrades the honor of the profession by accepting commissions from those whose wares he recommends, or who undertakes to give advice which he is not competent to furnish.

If the engineering profession can do this, honest manufacturers will have no reason, as it must be be confessed they now sometimes have, for offering commissions in order to secure a hearing for their goods or for appealing from an engineer to his principal because their goods have been judged unintelligently or unfairly.

NATIONAL SOCIETIES OF MUNICIPAL OFFICIALS.

The organization of the League of American Municipalities, a year ago, naturally raised the question, is another society for municipal officers needed? The recent meeting of the League at Detroit, reported in our issue of Aug. 11, affords some answer to the question, but does not settle it. Doubtless most of those in attendance at Detroit felt well repaid for going there and for having organized the League, but in the long run would not more have been gained if the members of the new society had joined some of the existing associations, thus strengthening them and widening their field of usefulness? There were already in existence a number of societies, some limited to one branch of municipal activity, and others broader in scope, which would have given warm welcome to all who have united with the League. Whether these other societies would have met all the wants of those who have joined the new one is a fair subject for discussion. The question

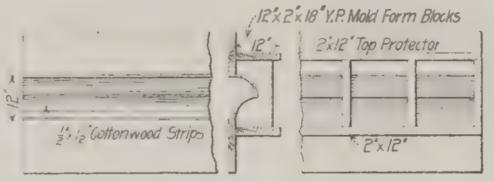


FIG. 7. FORM FOR CONCRETE MOLDING OR CORNICE.

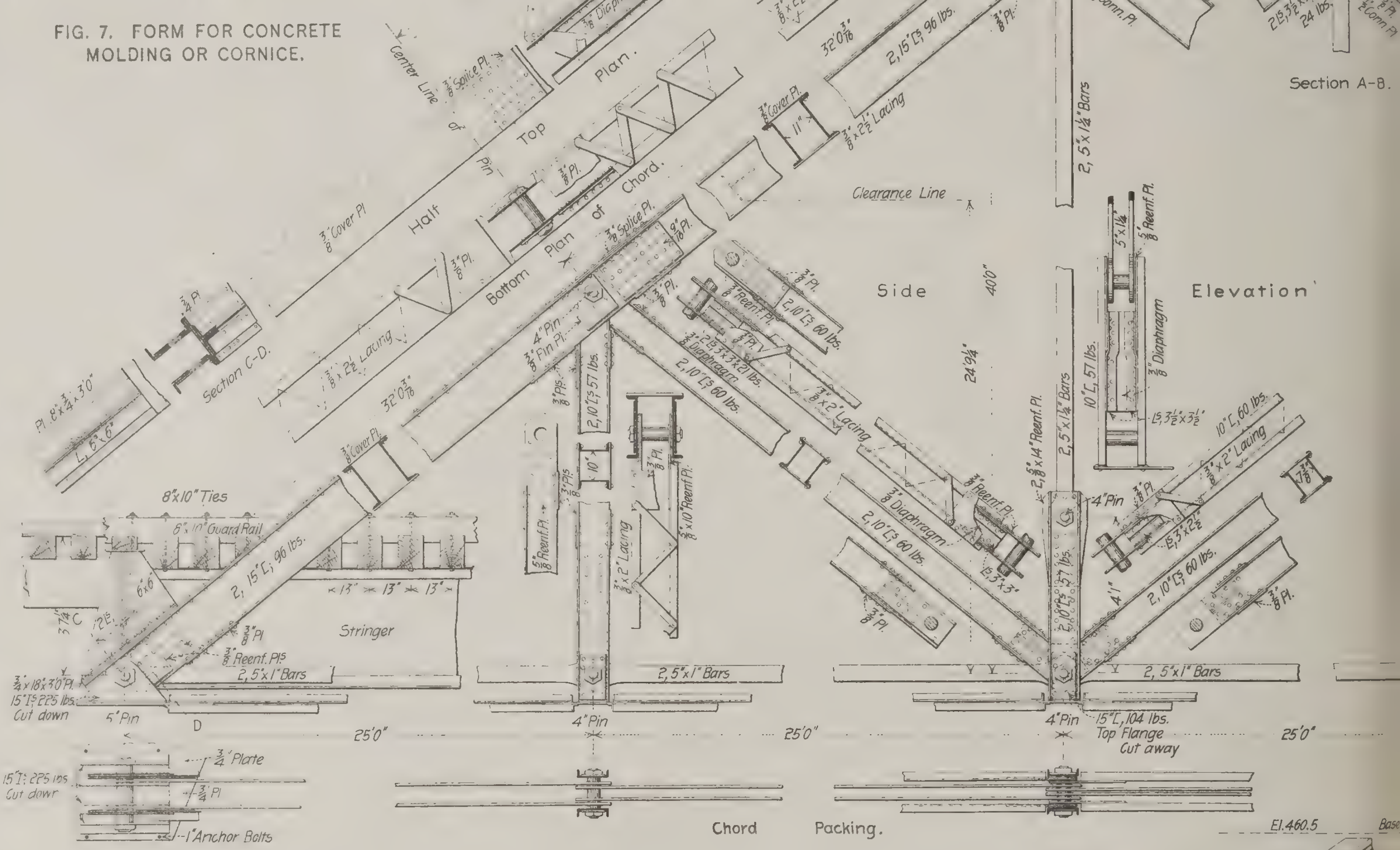


FIG. 2. DETAILS OF "A" TYPE OF THROUGH TRUSS OF 100 FT. SPAN.

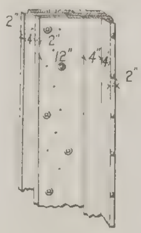


FIG. 8. WAKEFIELD SHEET PILING (SHOWING CORNER PILE.)

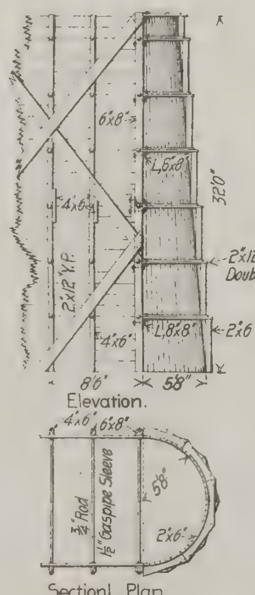


FIG. 6. MOLD OR FORM FOR CONCRETE PIER.

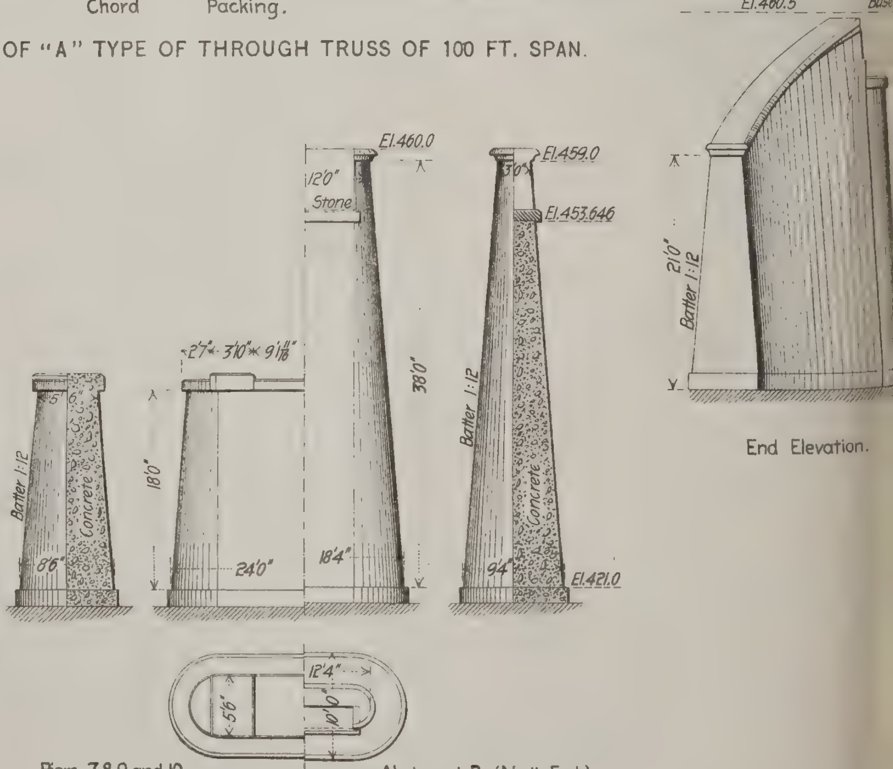
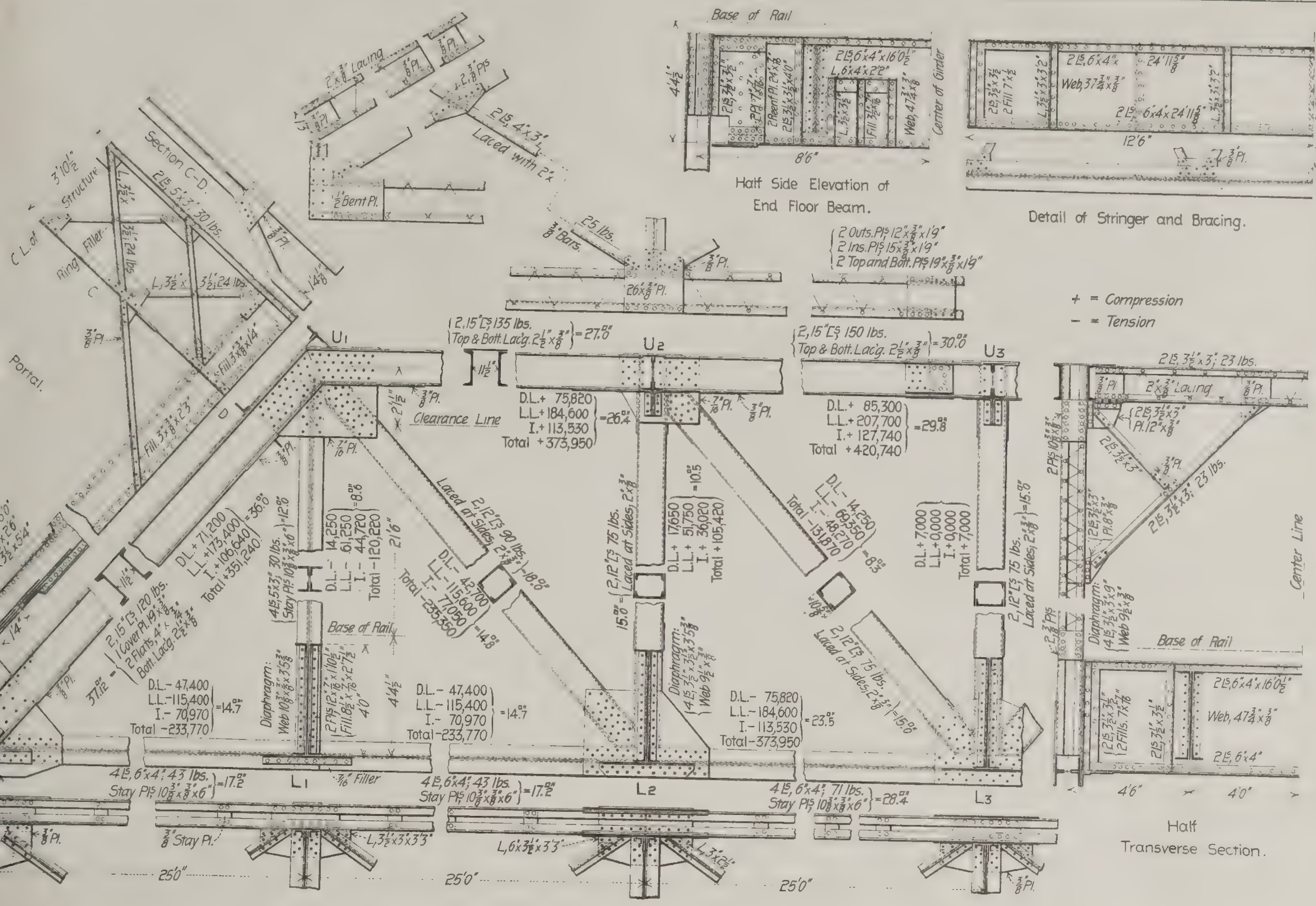


FIG.

STEEL BRIDGES AND CONCRETE PIERS

Robert Gillham, M. Am. Soc. C. E., M. Inst. C. E., Chief Engineer and General Manager.

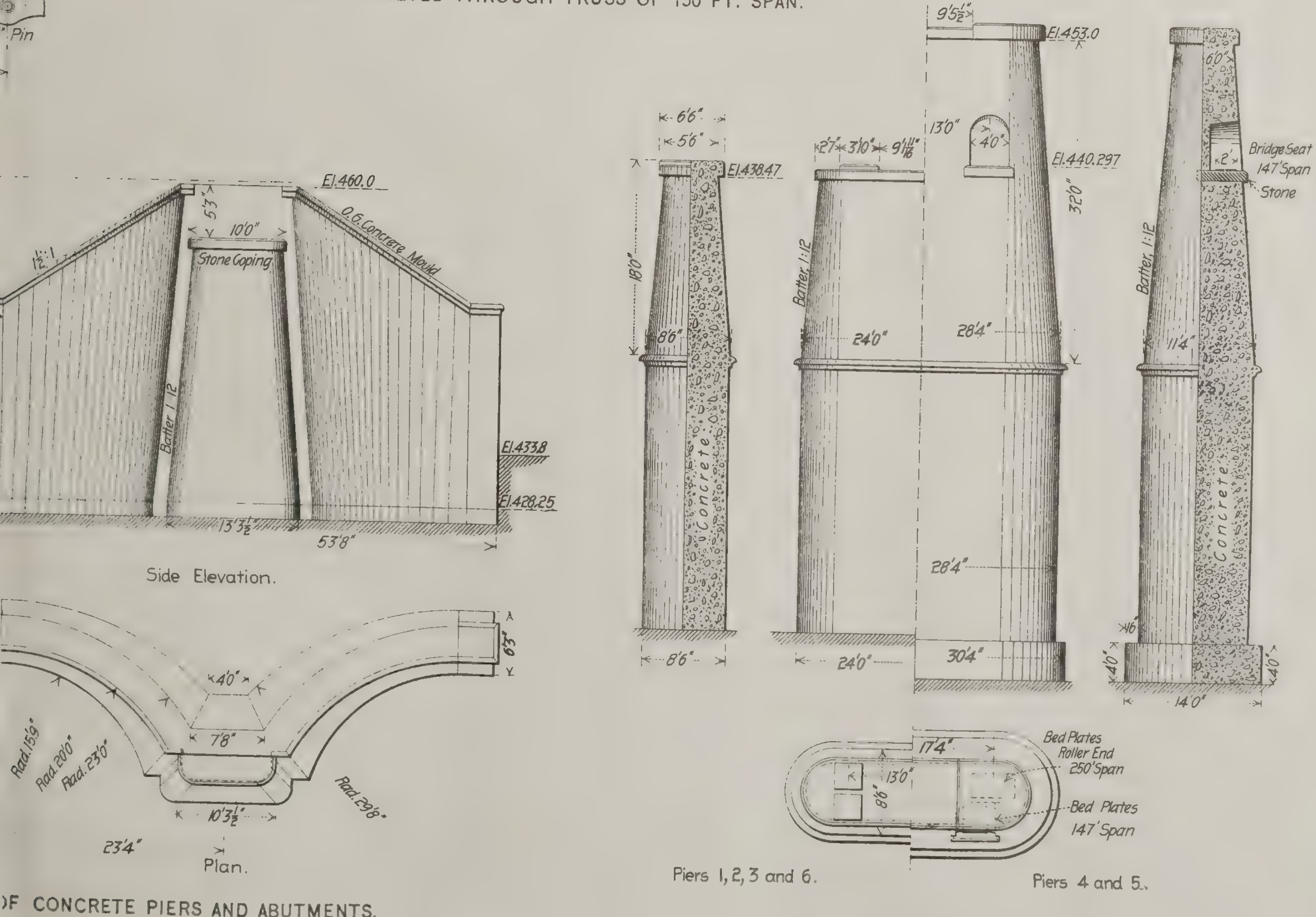


Half Side Elevation of End Floor Beam.

Detail of Stringer and Bracing.

Half Transverse Section.

FIG. 3. RIVETED THROUGH TRUSS OF 150 FT. SPAN.



Side Elevation.

Plan.

Piers 1, 2, 3 and 6.

Piers 4 and 5.

OF CONCRETE PIERS AND ABUTMENTS.

S CITY, PITTSBURG & GULF R. R.

J. A. L. Waddell, M. Am. Soc. C. E., Consulting Bridge Engineer.

CHAS. HART & SONS, LITH., 89 VESEY ST., N. Y.

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UNIVERSITY OF [illegible]

opens a broader field of inquiry and gives occasion to pass in review the causes which led to the formation of the various engineering and other societies open to the municipal officials of the United States and Canada, and to consider the extent to which they are meeting the needs that brought them into existence, or the opportunities that have since arisen. We shall not undertake an elaborate analysis of the subject, our primary object being to examine the claims of some of the newer societies to membership and to indicate how all may be improved in some essential particulars.

When we consider the rapidity of the growth of American cities, the diverse elements of their population, physical conditions and local industries, and perhaps above all the great lack of uniformity of their governmental organization, due to the fact that each state legislature frames city charters not only without regard to other states but in many cases with equal disregard to uniformity within its own limits, it is a wonder that our municipal affairs are not worse than they are. Growth without system and public improvements without knowledge of what has been done elsewhere have been the two great characteristics of American cities. The current of municipal life has been so rapid and our citizens have been so engrossed in their own affairs and in the success of partisan national government that they have been carried along by the stream instead of controlling it. The branches of municipal government that show the greatest number of exceptions to this rule are the very ones that have longest had access to membership in technical societies of national scope, namely, city engineers, water-works superintendents and health officials.

Not so very many years ago the American Society of Civil Engineers was the only national body of men concerning itself with the technical aspects of municipal affairs. That society, ever since it began to be a force in the profession, has given a portion of its attention to water supply, sewerage and paving, but it covers none of these subjects thoroughly and has strangely neglected so important a matter as garbage disposal. Of the many things the city engineer is called upon to deal with, bridge engineering is perhaps the only one whose progress and status is shown by the transactions of the society.

In the earlier days of the American Society of Civil Engineers the consideration it gave to sewerage and paving was more in proportion than now to the development of those branches, for such work was small in amount and done in a haphazard manner, except in some of the larger and more enterprising cities, where it was in the hands of engineers to whom the society was open and capable of meeting most of their wants. With water-works officials the case was different. They were already a large class, with a great variety of perplexing problems to solve and much valuable information to exchange with their fellows, when the society was first coming into prominence. The society met practically none of the wants of the water-works men who were not engineers and only a small part of those who were, largely because those wants were outside the scope of the society. In the early eighties, therefore, the American and the New England Water-Works Associations were formed, and have since grown into two strong bodies, with many members who are engineers, but far more who are not. These associations have the great advantage of being able to give their whole energies to water-works affairs, going into as much detail and personal experience as the members may find profitable. The New England Association holds monthly meetings through the winter and publishes quarterly proceedings of much value, thus taking a high rank among technical societies. The American Association, though holding only one meeting a year, does good work. Taken together, these societies seem to meet all the wants of water-works officials, and if they lack in consideration of questions of pure hydraulics this deficiency is made good by the American Society of Civil Engineers.

Chronologically, there should be mentioned as having been formed about this time the American Public Health Association, a body which has broadened its practical scope and usefulness until it now includes within its membership a few engineers, many health officers, both city and state, and some laymen. The medical profession, naturally enough, has been the dominant element in this association, but such engineering questions as water and sewage purification, street cleaning and garbage disposal figure largely and well in its proceedings. The municipal health officer has for years had his needs well provided for here.

Other phases of municipal affairs provided for by national associations which may be mentioned but need not be discussed, are education, libraries, charities and correction, and quite recently parks and cemeteries. Street railways, gas and electric lighting plants are wholly or largely under private ownership, and have their own national societies, so there are no men devoted to these industries without a society haven.

Gradually, for some years prior to 1894, there was felt to be a need for an organization which would bring together those municipal officials responsible for streets, sewers, and some other public works only lightly touched upon, if at all, by the existing national societies. It seemed especially desirable to reach a class of city officials more uncertain, perhaps, in their tenure of office, than city engineers and water-works superintendents, and therefore all the more in need of the instruction and stimulus of a live national society. As it was realized that many of the individuals joining such a society would soon drop out, it was decided to allow cities to join in their corporate capacity, with the privilege of individual membership for as many officials from each city as might desire it. Along somewhat such lines as these the American Society of Municipal Improvements has developed during the last four years. Some of the officials designed to be reached by this society are more or less closely in touch with several branches of municipal affairs, such as boards of public works, while mayors, councilmen and financial officers are or should be interested in all classes of public improvements and certainly need instruction from some quarter, coming as so many of them do, from business life to municipal affairs and dropping out again before they gain much experience in their new field. With a membership so diverse in its official duties and interests it is not strange that the new society has taken up practically the whole range of public improvements, with some financial and administrative questions in addition.

Within the past few years it has begun to be recognized that the machinery of city government needed attention and that good men were as essential as good methods. Accordingly, good government clubs and municipal reform associations have sprung up all over the country and the National Municipal League has been organized to bind together these clubs and such individuals as desired to further the cause of good city government. This national organization has by no means been confined to municipal officials, but it has afforded an opportunity for the co-operation of all such officials as are interested in its objects.

With all the societies described above it would certainly seem as though no further national organizations of municipal officials were needed. But in the summer of 1897 a call was issued for a convention of mayors and councilmen, which resulted in the formation of the League of American Municipalities. It is hard to say just what causes led to this step. It seems likely that not all the officials responsibble for it were aware of the existence of the various societies already open to them, while others may have felt the need of a comprehensive society, less technical in its character than those named. The attention given by the new society to questions of municipal ownership suggests the idea that there was a desire for a free and extensive interchange of opinion on this subject. Judging from the report of the Detroit meeting of the League (Engineering News, Aug. 11, 1898), mayors predominate among its most active members. The discussion of technical subjects at the Detroit meeting seemed to partake largely of the relation of personal experiences, often limited in time and extent. All this is good so far as it goes, and if combined with more papers and discussions from men who were thorough masters of their subjects it would be all that could be desired. The danger seems to be that, in certain lines, we shall see at these meetings blind leaders of the blind, unless a new element is infused into them.

The League of American Municipalities held its first meeting so closely in advance of the fourth meeting of the American Society for Municipal Improvements as to deprive the latter body of some of its intended speakers. This, coupled with the similarity of the two bodies in scope, has suggested the idea of deliberate rivalry on the part of the new organization. That the two societies appear to be serious rivals there can be no question, but whether this was intended by the new one we cannot say. There are indications that the two societies are drifting into quite different lines, both in membership and methods. When the League was being organized it seemed very doubtful whether it was needed and its future must settle that question. Could the two bodies work together it seems as though material gain would result. The mayors and councilmen would learn from their fellows more actively engaged in the design and construction of engineering works, and the engineers and various commissioners responsible for such works might be benefited from a more intimate association with other classes of city officials, not the least of which benefit would arise from a growing respect for technical men on the part of the other officials. A mere reduction in the number of societies demanding time and money would be an advantage which needs only to be mentioned to be appreciated by many.

Before closing this article it seems desirable to call attention to some of the limitations and possible improvements in the societies passed in review. First of all, it is to be noted that a national society holding only one meeting a year and publishing merely an annual report must of necessity have a somewhat narrow range of usefulness, especially where there are many and rapid changes in membership. More frequent meetings may perhaps be held only with difficulty, or if held can be attended by only a small part of the membership, but they add life to an organization. Committee meetings might be practicable at intervals during the year where larger gatherings are out of the question. The conclusions reached at such meetings, together with other information, might be printed and sent to all members at intervals between the publication of the annual reports.

Many society meetings lose in value because of too crowded programmes. This requires haste in the reading of papers and often limits or entirely cuts off discussion.

The discussions brought out by many papers in the most successful societies, notably in the Institution of Civil Engineers, are of greater value than the papers themselves, and with the papers often form a resume of the whole subject in hand. Most of our societies are lame in this respect. Written discussions should be encouraged, but neither these nor much oral discussion can be expected on papers at all technical in character unless the papers are printed and sent to members in advance of the meetings, a practice that most of the societies reviewed above do not follow.

If discussions are to be of value those participating must be held to the subject by the chairman of the meeting, and in addition the discussions should be edited before publication, making free use of the blue pencil if desirable.

While the officers of any society can do much towards the securing of good papers, these are often largely the result of volunteer efforts on the part of the members, a fact that should be remembered and acted on by all.

In conclusion, we think the limitations and possibilities indicated above show that it is more desirable to strengthen on old society, where possible, than to create a new one. Good work requires good men and plenty of money, and these are best secured by uniting rather than dividing forces.

LETTERS TO THE EDITOR.

Errata in "De Pontibus."

Sir: Permit me through your columns to call the attention of those of your readers who have purchased my "De Pontibus" to a few errors therein. On page 203, 19th line, for "is" write "are." On page 204 the formula should read:

$$P = 550 \frac{HP.}{v}$$

The 550 factor was dropped in typewriting the chapter, which, by the way, was written three times to bring it into its final shape. The other chapters were all rewritten once, and in some cases twice. The first copies of the book that were issued contained also the following typographical errors. On p. 141 the heading should be Chapter XIV., not Chapter XVI., and on p. 157, line 22, last word should read "rever-," the "ver" was left out. These are all the errors thus far discovered, barring blurred letters and omitted hyphens. It was my endeavor to bring out this work without a single error of any kind, but it seems that I was unsuccessful, notwithstanding the combined efforts of my office assistants, several friends and myself. It is by no means an easy matter to produce a book containing some 160,000 words without letting a few errors creep in. It is possible that there are still others than those here indicated. If anyone discovers any, I hope that he will do me the favor to point them out without delay. Very respectfully yours,

J. A. L. Waddell.

Kansas City, Mo., Aug. 13, 1898.

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Power of Windmills.

Sir: Mr. Fargusson's suggestion of the formula HP. = .001 D^3 as representing the power of a wind engine in a 16-mile wind seems to fit some of the results found by Mr. Murphy as published in Water Supply Papers, No. 8, but comes far from representing the results found by experiments of Mr. F. H. King, of the University of Wisconsin. Mr. Fargusson considers the Aermotor favorably and gives the formula HP. = .002D + .0001D^3 as his judgment of its power. This would rate a 16-ft. Aermotor at 0.44 HP. Mr. King found it to give 1.08 brake HP., and about 0.25 actual HP. Mr. Murphy's 16-ft. wheel with which I am familiar gave 0.433 HP., which is very close to Mr. Fargusson's formula. The term HP. as applied to a windmill is apt to be very misleading, as its power at any wind velocity is a function of its load as well as of the wind energy at its disposal. This is clearly shown by comparing the two results cited. Since during only about 4% of the year is the wind at 16 miles per hour, and only about 10% even in the immediate neighborhood of that rate, the usefulness of a windmill rating based on a single wind velocity and unknown load is doubtful. For instance, knowing that a mill actually gives 0.5 HP. in a 16-mile wind, could one predict what would be the output in any season? I think not. This is usually desirable to know, and only by knowing the wind distribution can it be discovered. The following figures which I am using are based upon records kept for seven years, and represent mean values for a well loaded mill reaching its maximum efficiency in a 16 to 20-mile wind:

Table Showing Millions of Foot Pounds of Output per Square Foot of Sail Area in Each Month; Distribution Based on Kansas Wind Records:

January	1.38	July	1.17
February	1.6	August	.8
March	2.58	September	1.59
April	2.49	October	1.6
May	2.07	November	1.9
June	1.58	December	1.67

The figures represent millions of foot pounds of work in lifting water, done by each square foot of sail area exposed by the mill. The figures include the effect of winds between 6 and 30 miles per hour. They also include the varying efficiency of a typical mill between these extremes of velocity and distribution. They cannot take into account the very important factor of relative load on the mill, but they do take into consideration the wind distribution and the variations in efficiency of a typical plant at the various speeds. To estimate the probable amount of water pumped by a 10-ft. mill, say in July and August, add the figures from the table for those months 1.17 + 0.8 = 1.97, representing 1,970,000 ft. lbs. of useful work for each square foot of sail area. A 10-ft. wheel has about 55 sq. ft. of sail area, giving a total for the two months of about 100,000,000 foot pounds of useful work. From this the quantity from any depth of well can be readily found. I know of no other figures or formulas which will give this kind of information. From the nature of the problem such estimates cannot be very accurate, yet, using these figures which do not include Mr. King's work in any way, they check with his work so closely as to be remarkable. They also check with some of Mr. Murphy's results as far as the data is discoverable. Mr. King's 16-ft. windmill and pumps actually did 2,679,000 foot pounds of useful work in the year. The sail area was about 135 sq. ft. Using the figures as I have deduced them would have predicted a yearly output of 2,700,000 foot pounds.

Very respectfully,

O. P. Hood.

Houghton, Mich., Aug. 13, 1898.

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BREAKWATER CONSTRUCTION ON THE AMERICAN COAST.*

In this paper reference will be confined to that class of breakwater construction which belongs to the ocean coast of our country, thereby omitting any detailed allusion to breakwater construction upon the great lakes, where the conditions surrounding the problem are so widely different from those belonging to the ocean coast, that but little correlation exists between them.

Without a definition there might be some misunderstanding as to the class of constructions to which reference will be made, since we find that the terms breakwaters, jetties and piers are sometimes confusingly used. A breakwater is an artificial structure, providing a harbor or roadstead with protection against waves, and differs from the other constructions named, in that it is essentially a wave-breaker.

Breakwaters, through their object, may be divided into two classes, viz., those which give shelter and protection to commercial harbors or their entrances; and those sheltering an anchorage or roadstead: the latter are denominated harbors of refuge, and are only used by vessels in transit, which have occasion to escape from the violence of passing storms. Each of these classes might be technically further divided according to their particular type of construction; which in turn is decided by the question of initial or ultimate economy, with due regard to effectiveness. For example, where durable rubble stone could be cheaply obtained the breakwater would probably consist of random stone, of suitable sizes, deposited in the form of an embankment, or mound. Where such stone could only be obtained at considerable cost, concrete blocks might be substituted, and either deposited as the random stone would be, or in the form of a massive and regular wall; or the stone might be used for a substructure surmounted by the concrete blocks as a superstructure. The latter form has been extensively used abroad; but has never been adopted, though frequently considered, upon the ocean coast of our country.

An abundance of durable stone, convenient to the coast, is to be found along that part of the Atlantic north of Cape Hatteras, and along the Pacific coast. This fact, supplemented by the modern methods of cheap quarrying and handling of stone, has made its use much more economical than that of concrete blocks, and has thereby decided, in this country at least, the question in favor of random stone for breakwater construction along our ocean coast.

The limits of this paper will not permit more than a passing reference to the forces impressed upon breakwaters through wave action; but brief allusion thereto becomes necessary, since the amount and direction of these forces must be carefully considered before the proper design and position of the breakwater can be adopted, or the general principles of breakwater construction understood. In the problems of the engineer, the maximum force likely to be impressed upon the structure determines the necessary stability to be given the construction. While it is difficult to estimate, except approximately, the force or impact of breaking waves, observation and experience furnish some data for deductions. The English engineer, Thomas Stevenson. followed by others, has furnished the results of experiments, through the aid of marine dynamometers, which assign values to the wave forces to be met and resisted. These observations recorded pressures in the North Atlantic of 6,000 lbs. per sq. ft.; and in the German Ocean of 3,000 lbs. M. Le Ferme, from the destruction of the beacon at the mouth of the Loire, calculated that the wave forces impressed upon the work must have exceeded 4,800 lbs., and probably approximated 6,000 lbs. per sq. ft. The most remarkable observed instance of the power of waves was afforded by the movement of a solid mass of masonry, set in cement in the form of a massive block, weighing 1,350 tons, at the end of the Wick-Bay breakwater. The mass, 45 ft. wide, 26 ft. long and 21 ft. high, was completely turned around upon its base, and at last tilted off its foundation.* Extraordinary as this may appear, it was subsequently surpassed when another concrete block, substituted for the one just described, was in like manner carried away, though it contained 1,500 cu. yds. of concrete masonry, and weighed about 2,600 tons.

In 1884, Mr. William P. Judson, C. E., made some observations upon Lake Ontario at Oswego, N. Y., to determine the height, velocity and impact of the waves upon the breakwater at that locality, with the following results: During a severe northwest gale, the waves at a distance of 1,000 ft. outside the breakwater, attained a height of from 14 to 18 ft. above the normal surface of the lake, with a velocity of from 30 to 40 miles per hour. Dynamometers attached to the face of the breakwater at depths of 8 ft. below the surface, at the surface, and 8 ft. above the surface, recorded pressures, respectively, of less than 10 lbs., 600 lbs., and at the higher elevation about 1,000 lbs. per sq. ft. The instances referred to are the maximum forces which have been observed, but, since they depend upon local conditions, cannot be assumed as those which are to be the standard in all cases. The height and force of impinging waves at any locality depend upon the force and duration of winds, the depth of the water, the fetch or distance over which the waves move, and the angle of incidence at which they strike the breakwater.

Theoretical conditions indicate that the energy of the impact of waves varies as the cube of the waves' height. Stevenson, from observation, developed the empirical formula, $h = 1.5 \sqrt{d}$, for the determination of wave-heights, which is considered as representing with tolerable accuracy the heights of waves during heavy gales, in which h is height in feet, and d the fetch of the waves in miles.* The results of this formula for low values of d are somewhat too small, while for large values of d they are too great. Scott Russell considers that 27 ft. is the greatest height of waves in the British seas; and Sir G. Airy, from theoretical consideration, concludes that from 30 to 40 ft. would be the extreme height of unbroken waves, except under rare conditions. Dr. Scoresby observed waves in the mid-Atlantic which averaged 26 ft. in height, and moving with a velocity of over 30 miles per hour, while the highest wave he estimated to have a height of 43 ft. Waves have been observed off Cape Horn with a height of about 50 ft. Previous to the laying of the first Atlantic cable, an effort was made to carefully collate the most reliable information upon this point; the result was that 50 ft. was considered as the extreme height of waves in the open sea.

On the assumption that, at the instant of breaking, the vertical section of a wave at the surface is a common cycloid, and that the height, d, of the wave is not greater that the depth of water in which it moves, theoretical considerations indicate that the maximum wave energy, in foot-pounds per lineal foot of the wave crest, =

$$\frac{64 \pi d^3}{32} = 2 \pi d^3;$$

the weight of a cubic foot of sea water being taken at 64 lbs.† for wave-depths of 10 ft., this gives an energy of 6,300 foot-pounds, and, for wave-depths of 15 ft., about 21,000 foot-pounds. If the form of the wave at the moment of breaking is that of a prolate cycloid, as some authorities assert, its energy would be about 60% greater than that above stated. While such calculations are more curious than valuable, they nevertheless serve to convey some idea of the forces impressed upon breakwaters by wave-action.

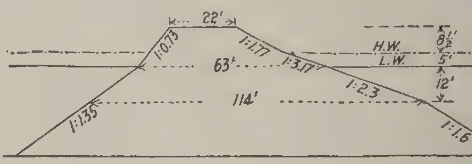

Fig. 1.—Section of Old Delaware Breakwater.

The destructive effect of waves of translation also depends greatly upon the angle of incidence between their line of impact and the axis of the breakwater, and, other conditions being equal, this force of impact will vary with the sine-square of the angle of incidence. At Wick it was found that by changing the direction of the axis of a part of the work, so as to reduce this angle from 90° to about 80°, the breakwater withstood the action of waves, which previously had been such as to repeatedly destroy the work.

From this brief consideration of the wave-forces impressed upon a breakwater, it is evident that its design, from the standpoint of stability, must depend upon conditions arising from the location of the work. In the case of random-stone breakwaters, this question of stability depends upon the cross-section of the work, and the dimension of the stone used upon the active slopes. Such a breakwater essentially consists of two parts, viz., the substructure or that part below the surface of the water, and the superstructure or that above water. The wave-action which it is necessary to arrest by a breakwater does not extend to a great depth below the surface of the water; therefore, the superstructure and the upper part of the substructure are the effective parts of the breakwater, as well as the parts of the construction which are subjected to the most destructive action of the waves. A large part of the substructure, therefore, becomes simply a means of supporting the superstructure, and the limited part of the substructure which is exposed to marked wave-action. In general terms, the necessary dimensions of the superstructure and the upper part of the substructure, determine the dimensions of the remainder of the work. While the superstructure must resist severe wave-action, it must likewise preserve the needed tranquility of the areas behind it, by being carried to a height sufficient to prevent waves being thrown unduly over the top of the structure.

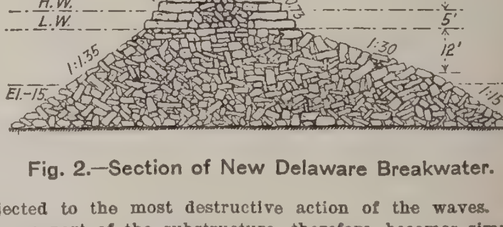

Fig. 2.—Section of New Delaware Breakwater.

The bounding surfaces of a random-stone breakwater consist approximately of plane surfaces, forming the top, bottom and sides: the latter, at more or less of an inclination dependent upon the special part of the work to which they belong, are called the slopes. One side of the work is exposed to the action of the sea, while the opposite side rests in the comparatively quiet water of the protected area. The sea face of the work, while receiving and arresting the energy of the waves thrown upon it, is not, from the limited depth of wave-action, exposed throughout all of its depth to the same amount of destructive force; therefore that side of the breakwater need not be provided, for its entire depth, with the same measure of stability.

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*From Proceedings of the Engineers' Club of Philadelphia; paper by Louis Y. Schermerhorn, M. Am. Soc. C. E.

*"Harbor and Docks," Harcourt, pp. 28, 31.

*"The Design and Construction of Harbors," T. Stevenson, p. 25.

†"Report, Chief of Engineers, 1889," p. 1321.

Experience upon American breakwaters has determined that the depth to which energetic wave-action extends is about 12 or 15 ft. below the surface of water; and this depth is generally assumed, upon our works, as the approximate plane of rest for the material which is used.

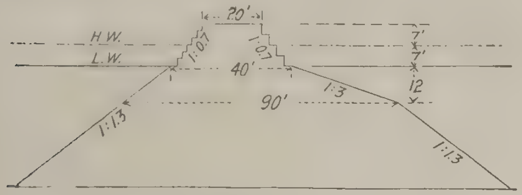

Fig. 3.—Section of Proposed Breakwater, San Pedro, Cal.

Since our breakwaters are all placed in tidal waters the position of this plane must vary with the amplitude of the tide, which in the breakwater locations to be referred to is between 3 and 8 ft. Upon leading European breakwaters, of nearly the same type as those under consideration, the increased exposure of their sites, and the height of ocean waves impressed upon the works, lowers the plane of rest to a depth of about 20 ft. below the surface of the water; while the tidal range of their localities is nearly double that above given for American breakwaters. It is evident that these facts must materially change the details of American and European practice.

In a qualified sense, the so-called plane of rest is more of an abstraction than a well-observed and established fact, and it should not be inferred, from the use which is made of this term, that a clearly defined depth-limit to the disturbing effect of wave-action can be undeniably assumed, within the limits usually ascribed to this plane. It is true that a point must exist in a wave's depth where the impulsive force is a maximum, and it is equally true that upwards and downwards from this point the force must decrease; but the law of this decrease does not permit the conclusion that wave-action entirely ceases at the depths assigned to the plane of rest in breakwater construction. It simply means that at the assumed depths the disturbing effect of the waves has been so reduced that it is no longer able to move the special stones constituting the slopes at such depths. If these stones were larger the plane of rest would be raised, and conversely, if they were smaller it would be lowered.

From the foregoing consideration the slopes of a random stone breakwater may be divided, from the forces impressed upon them, into the following: (1) that part of the sea face which is below the plane of rest; (2) that part which is between the plane of rest and the surface of the water; and (3) the part above the surface of the water. On the harbor side but two divisions of the slope need consideration, viz., that below and that above the water surface. Upon the sea face below the plane of rest the random stone will assume a slope coincident with the angle of repose of the material, unaffected by wave-action; on that part between the plane of rest and the surface of the water, the slope will be formed by wave-action, modified somewhat by the dimensions of the stone constituting the slope; while above the surface of the water, both on the sea and harbor faces of the work, the slopes will be artificial, and dependent upon the size of the stone and the care with which they are laid. On the harbor face, where the structure is not exposed to wave-action, the slope from the surface of the water to the bottom will be that of the angle of repose of the material. These several slopes, as determined by experience and practice, will be considered later.

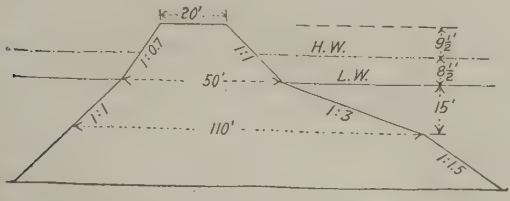

Fig. 4.—Section of Sandy Bay Breakwater.

Where the wave impinges upon a nearly vertical surface, the wave is thrown to a considerable height, and in falling is reflected, in part, seaward; while experience indicates that a talus causes the wave to break and thereby dissipate its energy upon the sloping surface on which it impinges; this is said to be fully realized when such a slope is about 1 on 3. Upon the vertical face type of breakwaters waves have been observed as thrown to a height of 200 ft.; this fact serves to strikingly illustrate the energy contained in waves, and the stresses brought upon the construction in the arrest of wave-force. Upon any slope less than the angle of repose of the material, the size of the stone determines largely the stabliity of the slope to resist forces tending to disturb its equilibrium. In general terms such stability increases with the dimensions of the stone used; and, within proper limits, the active slopes of the breakwater must be increased—with a proportional reduction of the aggregate volumes of material used in the work and a consequent reduction in cost—by the use of larger individual masses of stone in these slopes. The limit of such economy is reached, however, when the increased cost of larger stone equals the saving in the cost of the aggregate volume of stone used in the work. This has led in European practice to the use of immense blocks of concrete upon the most exposed part of the sea slopes of random-stone breakwaters.

The dimensions of the stone used in the active slopes of the substructure usually vary between 2 and 5 tons, with smaller stone constituting the interior volume of the work. Since the superstructure is above the surface of the water it permits of the cheap application of labor to the orderly arrangement of the stone constituting its mass, whereby a saving in volume, and consequent cost, is obtained by using very large stones, laid with some approximation into the form of a rough, though strong and heavy wall. Upon this part of the work stones weighing from 3 to 10 tons each are used on the sea and harbor faces, with a core of somewhat smaller stones.

Under American experience and practice the general slopes of the several parts of the sea and harbor faces are as follows:

Sea face, below the depth of 12 to 15 ft.	1 on 1 to 1 on 1.5
From 12 to 15 ft. depth to low water.	1 on 3
Low water to top of superstructure.	1 on 0.7 to 1 on 1
Harbor face, from bottom to low water.	1 on 1 to 1 on 1.3
Low water to top of superstructure.	1 on 0.7 to 1 on 1

The superstructure usually has a width on top of about 20 ft., and with the slopes above given the dimensions of the resulting sross-section of the entire structure become dependent upon the height of the superstructure and the depth of water in which the breakwater is placed. Upon the two most recent works, viz., the breakwater for the National Harbor of Refuge in Delaware Bay, which is now in progress, and the proposed breakwater for the Harbor of Refuge on the coast of Southern California, at San Pedro, the top of the superstructure is placed at a height of 14 ft. above the plane of low water. With these dimensions for the superstructure and the slopes above given, the breakwaters at the localities named obtain a width of about 40 ft. at the plane of mean low water, and about 90 ft. at the assumed plane of rest, 12 ft. below the plane of low water.

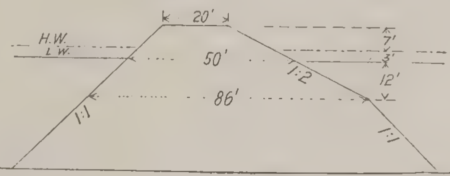

Fig. 5.—Section of Point Judith Breakwater.

The most typical random-stone breakwaters of the ocean coast are at Sandy Bay, Cape Ann, Mass.; Point Judith, R. I., and Delaware Bay, Del. A second breakwater is in progress of construction in Delaware Bay; while the report of a recent Board of Engineers decides upon San Pedro Bay, California, as the proper site for a breakwater to give protection to deep-water commerce, and furnish a harbor of refuge for the South California coast. The Delaware breakwater had its inception in a plan submitted in 1828 by a board of commissioners appointed by Congress. The project proposed the construction of two massive works, on the peirres perdue or rip-rap system, separated by an interval of 1,390 ft.; the larger work, called the breakwater, to afford safe anchorage during gales from the north and east; and the lesser, called the ice-breaker, to protect shipping against northeast gales and the heavy drifting ice of the bay. These works were commenced in 1828, continued under regular appropriations until 1840; resumed after the war in 1866, and completed in 1869. The aggregate amount expended was $2,192,103, which resulted in the construction of 2,558 ft. of breakwater, and 1,359 ft. of ice-breaker. In 1882 a project was adopted for closing the gap between the two detached works; and in 1883 work was commenced thereon. At the present time this work is in progress, and will probably be completed at an early date, whereby the entire construction will attain a length of sligthly more than one mile. The cost of the entire work will be about $3,000,000.

By combining a large number of sections of the Delaware breakwater, as determined by careful survey, the present slopes of the work may be classified as follows:

Plane of rest—sea face—at depth of 12 ft. below low water:

Sea face slope, below plane of rest.	1 on 1.6
Between plane of rest and low water.	1 on 2.9
Between low and high water.	1 on 3.17
Between low water and top of superstructure.	1 on 1.77
Harbor face slope, between bottom and low water.	1 on 1.35
Between low water and top of superstructure.	1 on 0.73

It should be noted that the slopes directly above and below low water line on the sea face of the work vary but slightly from each other; the lower slope being 1 on 2.9 and the upper 1 on 3.17, or respectively about 19° and 17½°. This slight difference of about 1½° is probably within the error of determination, and without serious error the entire slope between the plane of rest and the base of the superstructure can be taken as about 1 on 3. The assumption that the plane of rest occurs at 12 ft. below low water is simply derived from the evidence of these slopes. These slopes are graphically shown on the section below.

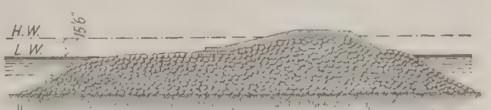

Fig. 6.—Section of Breakwater at Plymouth, England.

The mean cross-section of the first Delaware breakwater has the following dimensions:

Width at top of superstructure	22 ft. 0 ins
Height of superstructure above high water	8 " 6 "
Difference between high and low water	5 " 0 "
Width at high water	43 " 0 "
" " low "	62 " 9 "
" " plane of rest	113 " 9 "
" " bottom	166 " 0 "
Total mean height	43 " 6 "
Mean cross-section, in square ft.	4,100 "

The ice-breaker, which from its position is much less exposed to the action of the waves, has a slope upon the sea face of 1 on 2, and on the harbor face of about 1 on 1.3; the mean cross-section of the ice-breaker is about 3,600 sq. ft. The calculated volume of the breakwater and ice-breaker, including voids, as determined from surveys, was 595,000 cu. yds. The quantity of stone delivered in the works was 892,528 gross tons. These figures would seem to indicate that 1.5 gross tons were required for each cubic yard of volume of the breakwater.

The foundation of the works must have sunk somewhat into the bed of the harbor. through the weight of the mass; recognized scour at the ends of the structure caused considerable material to fall into these holes; while other material has probably been carried by the sea outside of the limits of the work. These volumes have been omitted by the survey, and consequently have given too small a mass for the material deposited in the work. A survey of the material deposited in the gap between the breakwater and ice-breaker gave 1.17 gross tons per cubic yards of enrockment; while the careful measurement of a large volume of stone weighed onto barges gave 1.15 gross tons per cubic yard of volume. Observation derived from rock in settled railroad embankments give about 1.18 gross tons per cubic yard of space occupied. From these considerations Major Raymond derives the conclusion that 1.25 gross tons per cubic yard of random-stone embankment is an ample allowance for each cubic yard of breakwater after the settlement of the mass, and any loss of stone which may occur.* The stone which has been used in the Delaware breakwater weighs from 160 to 170 lbs. per cu. ft.

The Delaware breakwater has been the prototype for all other acomplished or proposed random-stone breakwater construction upon our ocean coast; and while its details have not been exactly repeated, the experience gained upon the work has been utilized both in design and construction at all other localities. The early records of this work seem to indicate that the Board of Commissioners, who designed the breakwater in 1828, were materially influenced by the dimensiens and slopes used upon European breakwaters at that date, and that its foundation width was based upon anticipated slopes such as would be derived from the examples then before them; therefore, it cannot be correctly assumed that the cross-section of the Delaware breakwater of to-day is exactly the result of slopes derived from the action of the wave forces which have been impressed upon them. The history of the work indicates that, at some time after its commencement, those in charge probably abandoned the idea of following the early adopted cross-section, and in place thereof sought to obtain such slopes as would result directly from the action of the waves; therefore, it follows that probably the resulting cross-section of the work of to-day is a compromise between anticipated and realized slopes upon the several parts of the structure.

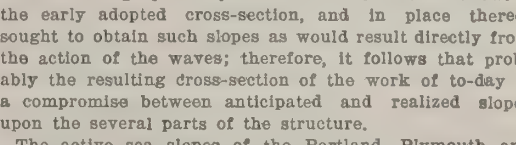

Fig. 7.—Section of Breakwater at Holyhead, Wales.

The active sea slopes of the Portland, Plymouth and

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*Report of Chief Engineers, 1891, page 1081.

Cherbourg breakwaters vary from 1 on 4 to about 1 on 8; while, as previously noted, the flattest slopes of the Delaware breakwater are about 1 on 3. In this respect it presents a striking contrast to European breakwaters in the steepness of its active sea slopes. While the Delaware breakwater is not exposed to the force of seas such as are thrown upon the European works named, it is highly probable that its slopes, through the method by which they have been obtained, are more nearly in equilibrium with the forces which are impressed upon them than obtains in the European cases referred to.

It is evident that the maximum economy in random-stone breakwater construction is realized when the slopes and consequent cross-section are such as to place the work in simple stable equilibrium with the forces which it is to resist. Any additional material beyond this would be unnecessary, and, therefore, an extravagance. To secure a stable section, and at the same time provide that it shall contain the minimum volume of material, requires that its method of construction should be carried on in the three following stages: (1) The formation of the volume below the plane of rest; (2) the deposition of the volume between the plane of rest and the base of the superstructure; (3) the construction of the superstructure. This order of construction has been developed and carried into practice by Major C. W. Raymond, Corps of Engineers, U. S. Army, who has present charge of the completion of the Delaware breakwater, and also the construction of the new breakwater in Delaware Bay. Major Raymond's extended experience in breakwater construction on the ocean coasts of the United States placed him upon the Board of Engineers for the location and plans for a harbor of refuge upon the coast of Southern California; and upon his plans and specifications the several reports upon this important work have been mainly based.

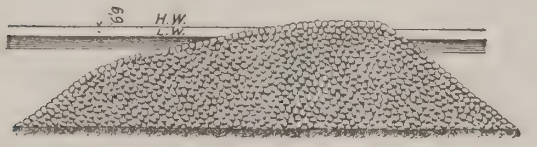

Fig. 8.—Section of Breakwater at Portland, England.

Under the order of construction above indicated the deposition of the random-stone is confined strictly to a width and depth conforming to the width and depth of the cross-section of the breakwater at the assumed plane of rest; by this method the material on the slopes is forced to assume the steeper angles of repose which properly adhere to this part of the work; at the same time the initial settlement of the foundation and this part of the mass is secured. When this lower section of the breakwater is completed it is followed by the second stage, the formation of the mass between the plane of rest and the base of the superstructure, by the deposition of all material within the width of the base of the superstructure; care being taken in this important section to deposit the larger stone upon the sea side of the breakwater. This brings the construction within the disturbing action of the waves; and as this part of the work progresses the stones upon the sea face of the work assume such slopes as to place the work in actual equilibrium with the wave forces impressed upon it; thereby leaving to the sea the task of largely declaring the slope and consequent stability which is required to meet the peculiar conditions of the exposure. If the engineer, for any reason, has erred in judgment by assuming too steep slopes, the action of the sea revises his calculations, and, beyond the possibility of mistake, corrects the error. It is evident that by this method the minimum volume of section, and consequent maximum economy of cost, consistent with required stability is obtained.

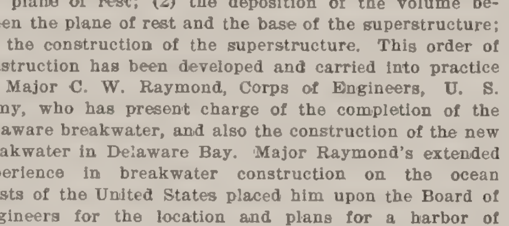

Fig. 9.—Section of Breakwater at Cherbourg, France.

By the time the entire breakwater has been completed to the height of the base of the superstructure an opportunity has been given this part of the work to thoroughly settle, so as to be in condition to receive the construction of the superstructure, which is not undertaken until a condition of stable equilibrium has been attained by the substructure, and its upper surface carefully levelled to receive the superimposed mass.

The superstructure, in the most recent types of American random-stone breakwaters, consists of rough, strong walls upon the sea and harbor faces of the work, built of larger stone systematically placed, so as to secure a strong bond; the space between these walls being filled with stone varying in size so as to form a compact mass without large interstices. This part of the work requires the use of powerful derricks for handling and properly placing the large stone constituting its mass. Under the methods above outlined, the several widths of deposits for the random-stone are marked by carefully placed ranges, and within their limits all material is strictly deposited. In this respect the practice now varies greatly from that of former times, when wide latitude was given to the areas upon which the stone was initially deposited in the efforts, then in vogue, to form predetermined slopes through the deposit of stone directly upon such slopes. Until later times it has been the practice to transport the stone to the site of the work upon sailing vessels, deck-scows, barges or other available means of water transportation; this necessarily resulted in more or less of a haphazard method of discharge and deposit, arising from the fact that the vesels used were not fitted with machinery and appliances for quickly and accurately placing the stone in the work. Such methods unquestionably resulted in considerable waste of material through its not being deposited exactly upon intended areas.

Under the methods now in operation upon the new breakwater for a National Harbor of Refuge in Delaware Bay, the material below the assumed plane of rest, as well as a part above this plane, is transported to the work in dump scows of 1,400 tons capacity, and specially arranged construction, whereby the entire load of such scows is released at once, and, without the intervention of labor or machinery, deposited, en masse, through the bottom of the scows directly upon the width of section on which the material is desired. Besides ensuring accuracy of deposit, the abolishment of the former large element of hand labor in the discharge of stone, permits the unloading of these scows during a rough condition of the sea, when, under past methods, it would have been either impracticable or, if attempted, resulting in an uncertain and unsatisfactory deposit of the material upon areas probably somewhat removed from those on which the stone should have been deposited. The remainder of the plant for the delivery of the stone in the new breakwater consists of large seaworthy barges, of 1,500 tons capacity each, provided with powerful steam derricks, capable of handling 15 tons, for quickly and certainly placing the stone at desired points.

The breakwater for the National Harbor of Refuge in Delaware Bay, which is now in progress, a section of which is shown here, is located outside of and nearly 2½ miles north from the existing breakwater. It is placed in water from 13 to 53 ft. deep, has a length of about 1½ miles, and covers a protected anchorage against the heaviest storms of 552 acres, with a minimum depth of 30 ft., and an additional area of 237 acres, with a minimum depth of 24 ft. These combined areas would give free and good anchorage to more than 1,000 vessels. The work is estimated to contain 1,384,000 net tons of stone, and will cost, with the projected ice piers, probably about $2,500,000. Although only commenced during the present season, the specifications for the work require its completion by December 31, 1901, through the annual deposit of about 280,000 tons of stone. Since the prevalence of severe or stormy weather practically reduces the working season available for depositing material in this breakwater to about seven months for each year, it follows that an average output of 40,000 tons per month must be provided for by the contractor. The work is being executed at this rate, which is far beyond anything ever before attained in earlier breakwater construction. The average price paid for stone in the old Delaware breakwater was about $2.50 per gross ton. Under the existing contract for the construction of the new breakwater, which covers the entire completion of the work, the price is $1.18⅜ per net ton.

The proposed breakwater for the projected deep water harbor at San Pedro, California, a section of which is also shown here, is located in water from 19 to 51 ft. deep. It has a projected length of 8,500 ft., and covers an anchorage area of 615 acres, with depths varying between 24 and 36 ft. The work is estimated to contain 1,782,000 cu. yds. of stone, or 2,290,000 gross tons. The material in the superstructure below the plane of rest is estimated at $1.25 per cubic yard; that above the plane of rest at $1.50 per cubic yard, and the stone in the superstructure at $3.00 per cubic yard. The entire estimated cost of the work, including contingencies, is $2,901,000.

The National Harbor of Refuge at Sandy Bay, Mass., was commenced in 1885, and is still in progress. It has a projected length of 9,000 ft., and covers an anchorage area of 1,377 acres, carrying a mean low water depth of 24 ft. and over. The material below the plane of rest. which in this case has been assumed at 15 ft. below water surface, consists of stones not exceeding 4 tons in weight; while the portion above low water requires stone not less than 4 tons and averaging 6 tons in weight. The contract prices paid for the stone already deposited in the work have been from 60 to 75 cents per net ton. The larger stones comprising the superstructure will greatly exceed the foregoing prices: the proximity to the work of large granite quarries has permitted the exceptionally low prices paid for the stone. The estimated cost of the entire project is $5,000,000.

The breakwater at Point Judith, R. I., was commenced in 1890, and is still in progress. It has a proposed length of about 10,000 ft., including an auxiliary breakwater protecting one of the entrances to the harbor. The protected area, carrying 18 ft. depth and over, is about one square mile. The work is built in water from 18 to 30 ft. deep, and its estimated cost is $1,250,000. In 1893 the government contracted for the entire completion of the work at the rate of $1.28 per net ton for all stone required.

By way of comparison the following sections of European breakwaters illustrate the difference between American and European practice in the construction of random-stone breakwaters, as well as the marked variation in the active slopes of such works. It should not be too strongly assumed that slope variations are due in all cases to corresponding differences in the forces impressed upon the active slopes, since such variations are partly due to preconceived ideas as to the necessities of the case, the dimensions of the stone used, and the methods by which the slopes were formed.

In addition to the constructions upon the American coast before referred, random-stone breakwaters exist at Gloucester and Hyannis harbor, Mass., and at Stonington and New Haven, Conn. These breakwaters are only typical of their localities since they are not designed to cover areas which would give protection to the larger class of ocean vessels, but rather to the coastwise commerce of their vicinities.

All breakwater construction in this country has been carried on under governmental appropriations made by Congress at intervals of one or two years. The separate appropriations were seldom more than five or ten per cent. of the estimated cost of the work, and until recently competitive bids were received and contracts entered into for the expenditure of each specific appropriation. Under this system each contractor was obliged to add to the cost of the work, and thereby to its cost to the government, the initial expenses of obtaining and opening quarries, and providing the special plant required, and with each change of contractors the government paid for the expense of organizing, fitting out and starting another. Under the limited tenure with which the contractor held the work, it was impracticable for him to adopt methods and appliances upon a scale large enough to permit the work being carried on with economy to the contractor and consequent advantage to the government.

In a construction of the magnitude of the breakwaters described involving the quarrying, handling, transportation and deposit of several million tons of stone, it is evident that the work can be most economically accomplished when the amount to be done under a specific contract is so large as to justify such an initial outlay for facilities and plant as will permit the work to be carried on upon a large scale. This has been rendered possible upon the Point Judith breakwater, and also upon the new breakwater in Delaware Bay, by Congress providing for a single contract for the entire work at each locality, under large annual appropriations, whereby the work can be completed in about five years. By this plan the contractor is justified in providing appliances and methods for carrying on the work upon a scale which could not be approximated under the former method of separate contracts for each specific appropriation. The resulting economy to the government is evidenced by the fact that under the former methods of contract, the average price of stone deposited in the old Delaware breakwater was about $2.50 per ton, and that delivered during the last thirteen years about $2.30 per ton; whereas the work now in progress upon the new breakwater, at nearly the same locality, costs the government under the method of continuous contract $1.18½ per ton, or a saving over former prices of nearly 50%.

Harbors of refuge are but seldom used by the larger class of ocean steamers, for, unless disabled by accident, they are generally competent to pursue their way during a storm, or else ride out a gale in the open sea with comparative safety; and, unless engaged in the coastwise trade, they would seldom be in a position to avail themselves of the protection of a harbor of refuge, even if it was desired. With sailing vessels or steamers carrying barges in tow and coastwise commerce such harbors are of the greatest utility, and they are placed at localities which make them most convenient of access to this class of commerce when approaching or leaving our ocean coast. During head winds or upon the announcement of dangerous approaching storms the sailing, barge and coastwise commerce have great need for harbors of refuge, and they are utilized to their full value.

THE CHICAGO AND MILWAUKEE ELECTRIC RY.

One of the longest and most interesting of the numerous long-distance electric railways in this country will be the line between Chicago & Milwaukee, two sections of which are now in operation. The Chicago & Milwaukee Electric Ry. Co. has the franchise for the line from Evanston to Waukegan, 31 miles, and the section of this between Waukegan and Highland Park was opened to traffic in July. Work on the southern part of the line is now being pushed, and it is expected that by October it will be completed to Evanston. At that point it will connect with one of the electric lines of the North Chicago Street Ry., with the Evanston branch of the Chicago, Milwaukee &

St. Paul Ry., and with the Northwestern Elevated Ry. when this latter line is completed. There is already a line in operation from Kenosha northward through Racine to Milwaukee, 33 miles, and the direct result of the opening of this line was to lead the Chicago & Northwestern Ry. to take off a large proportion of its local trains on account of the loss of traffic. Between Kenosha and Waukegan is a gap of 16 miles, but we are informed that negotiations are being made for closing this. The sketch maps given in Fig. 1 show the entire route, and also the route of the present line from Waukegan to Evanston. From the latter it will be seen that the line passes through a continuous series of the suburban towns which are such a feature of the lake shore north of Chicago. At Fort Sheridan is the government reservation, and there are manufacturing districts at North Chicago and Waukegan.

The project was originated by Mr. C. E. Loss, engineer and contractor, of Chicago, who made a beginning two years ago by building a line from Waukegan south to North Chicago, 4.4 miles, the average earnings on which line have paid 5% on $120,000. Later on, he built the line between Fort Sheridan and Highland Park, 4 miles, at a cost of $50,000, and this line has shown even greater net earnings. Mr. Loss then secured the balance of the franchises for the through line, and sold the entire project to a syndicate on the basis of the earnings, with a certain percentage for the securing of the franchises. He was then made a director in the new company, and given the contract for the entire line. The company was originally styled the Bluff City Electric Street Ry. Co., but this title was changed to the North Shore Interurban Ry. Co., and the present owner is the Chicago & Milwaukee Electric Ry. Co., the officers of which are as follows: President, George A. Ball; Vice-President and Treasurer, A. C. Frost; Secretary, George M. Seward; Directors (in addition to the above officers), Frank S. Reeves and C. E. Loss.

The line between Waukegan and Evanston will be 31 miles in length, and will lie between the Chicago & Northwestern Ry. and the lake shore all the way to North Chicago, where it will have two subway crossings, one under the Chicago & Northwestern Ry. and the other under the Elgin, Joliet & Eastern Ry. There will not be a single railway crossing at grade. The line will connect about 15 cities and towns having an aggregate population of about 75,000, and the fares will be about half the amounts charged for the same distances on the Chicago & Northwestern Ry.

The road is now a single-track line, with turnouts, but it is double track in Lake Forest, and next season will probably be double tracked throughout. While the greater part of its length will follow existing roads, there will be about eight miles on a private right of way of 25 to 50 ft. wide, and this strip of land will be protected by a five-wire fence of barbed wire. The company is doing the necessary grading to obtain as level a line as possible, and the maximum grade will be a short length of 3% at the subways. The minimum radius of curvature is 55 ft. The two subways will be similar to those in the track elevation work in Chicago, consisting of steel plate girder through spans carried on masonry abutments. That under the C. & N. W. Ry. will carry two tracks. There will only be 150 ft. of trestle work, which will be of substantial construction. Fig. 2 shows a section of a part of the line, the track being laid on a parkway at one side of a macadamized road. A block signal system is in use on that part of the line now in operation.

The track consists of 65 and 72-lb. rails of the "T" and "Shanghai" sections, and also 85-lb. girder rails, all in 60-ft. lengths, with splice bar joints having eight bolts in two rows. The ties are of oak, spaced 18 ins. c. to c., laid in broken stone and slag ballast. The "Protected" rail bond is used, which is a specialty of the Forest City Electric Co., of Cleveland, O. The 72-lb. rail and the rail bond are shown in Fig. 3.

In the business center of each town iron center poles are used, these being 28 ft. long, in sections 5, 6 and 7 ins. diameter. For the other parts of the line cedar side poles, with bracket arms, are used, the poles being 30 ft. long and 7 ins. diameter at the top. The high-voltage transmission wires are supported on glass insulators carried on wooden cross arms on the side poles. Each pole is painted, and those carrying the alternating-current lines have danger notices stenciled upon them. The span wires are of 5-16-in. galvanized wire, and the trolley wire is of No. 00 B. & S. gage.

The company is aiming to build a first-class railway, suitable for running trains at a speed of 25 to 30 miles per hour with comfort and safety. The line now under construction is being built for a contract price of $25,000 per mile, this being for a single track, but the price includes the private right of way, five acres of land near Fort Sheridan for the power house and car house, the double-track subway under the C. & N. W. Ry., and about two miles of macadam paving 18 to 20 ft. wide, with drainage, catchbasins, etc. It also includes a cash bonus of $10,000 as compensation on account of franchises.

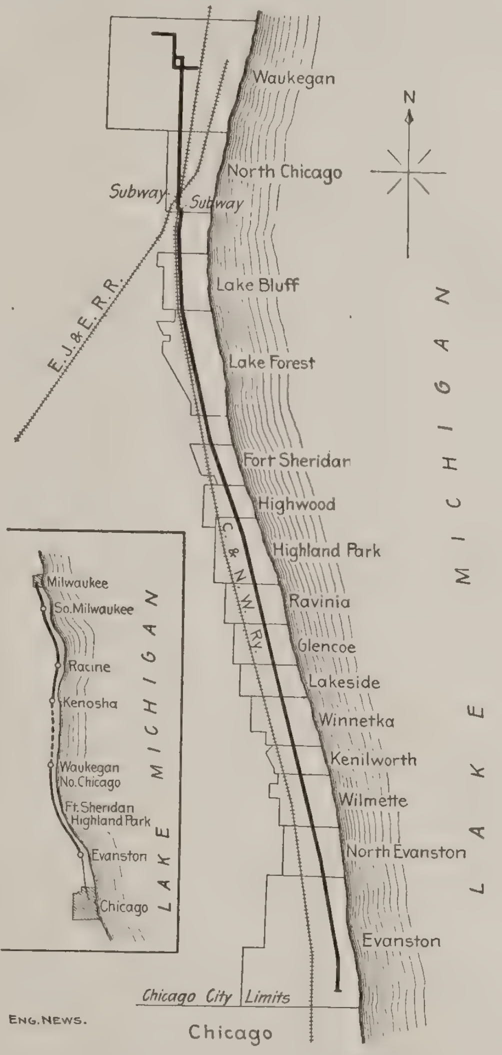

Fig. 1.—Sketch Maps Showing the Present Line and Completed System of the Chicago & Milwaukee Electric Ry.

Four-wheel and eight-wheel cars will be used, all having vestibuled ends and transverse seats, and the motor cars will haul trailers. The motor cars will have General Electric motors of 35 HP. for the smaller and 50 HP. for the larger cars, of the latest type for high acceleration, enabling the car to attain its full speed of 30 miles per hour in 19 seconds. Arrangements have been made to carry freight and light baggage, and perhaps mails also. There are now in use ten 30-ft. cars built by the St. Louis Car Co., of St. Louis, Mo. Two passenger cars of the interurban type, and two combination passenger and baggage cars are being built by the Pullman Palace Car Co., of Chicago, Ill. These four cars will be 38 ft. long, each mounted on a pair of Peckham standard railway trucks and equipped with two 50-HP. motors.

The transmission system of this long-distance, high-speed, electric railway is of particular interest, the aim having been to devise a system which will require but a minimum outlay in first cost, but which can be added to as the load increases in a manner consistent with the original installation. It was also required that it should operate with a fair degree of economy from the start, and at the same time be capable of the highest operative efficiency when eventually completed. The great cost of copper for the feeders which would have been necessary to operate the road by means of a direct-current station situated at the center of the line prohibited the use of the direct-current system, and it was also recognized that the operation of two power stations for a road of this size, or of a booster system operated from one power house, would not give a good efficiency.

The plan adopted, and the one which is thought to combine all the above requirements, consists of a combination direct-current and three-phase alternating-current distribution system, with a single generating station placed at the center of the line. The sections of the road adjacent to the power station are supplied with direct current from the power house itself. Sections of the line at a distance from the power house get their supply of current from sub-stations. These sub-stations each contain a rotary converter, consisting of a three-phase alternating-current motor and a direct-current generator combined in one machine. The sub-station motors are supplied with power over a high-tension transmission line consisting of three small copper wires extending back to the power house. The direct current from each sub-station is distributed to the trolley by means of the usual system of feeders extending in both directions. The location of these sub-stations and their distance apart is governed by the conditions of traffic and somewhat by the nature of the grades along the line.

The power station is located at Highwood and the sub-station for the operation of the northern portion of the road is situated near the southern limits of North Chicago. Connecting the power house with the sub-station is an eight-mile, 5,500-volt, three-phase transmission line of three No. 8 wires. From the sub-station the No. 00 trolley wire is reinforced by a No. 0000 feeder extending four miles south and a No. 000 feeder extending 3½ miles north.

It is claimed that there is no reason why a road 100 miles in length should not be operated by this system from one power house located either at the center of gravity of the system or upon a site possessing peculiar advantages of rail and water facilities. The small investment required for copper will appeal to the investor, while the possibilities of economies of fuel and labor due to the concentration of the power generating apparatus into one station makes the proposition a promising one to the engineer. The development of this road and the economic results of its operation will be awaited with considerable interest.

An objection sometimes urged against the three-phase system is the possibility of danger from carrying such a high voltage through the feeder system, but it is to be remembered that this is a medium or low voltage compared with that of electric lighting and power systems now in use, notably about Niagara and in the West.

The power house and car barn will be of brick, with steel roof trusses, and a plan of the building and plant is given in Fig. 4. The present plan consists of one 400-HP. engine and one 250-K-W. dynamo, but the complete plant will comprise two additional tandem, compound, condensing Corliss engines of 800 HP. each, and four additional direct-connected General Electric composite generators of 250-K-W. capacity. Steam will be supplied by six Cahall-Babcock & Wilcox water-tube boilers of 250-HP. rated capacity, fitted with the Hawley down-draft furnace. These boilers will be arranged in three pairs or batteries, and three boilers are now in place. The boiler setting is such as to make each battery entirely independent of the brickwork which surrounds it. The feed water is taken from the city mains, and supplied to the boilers by the boiler feed apparatus of the Q. & C. Co., which has recently been described in our columns. The fuel is slack coal, which is delivered in front of the boilers directly from the cars. Each pair of boilers will have a fuel economizer, with the by-pass flue passing underneath. The steel smokestack is of sufficient capacity for eight boilers, in case it should be necessary to eventually add another pair of boilers.

The engines are of the horizontal type, and run at 125 revolutions per minute. The 400-HP. engine now in service has cylinders 17 × 36 ins. and 30 × 36 ins., and a flywheel 14 ft. in diameter, weighing 40,000 lbs. The governor is of the Provell inverted type, fitted with an automatic safety stop to prevent the engine running away. This stop blocks the governor balls up except in the event of the governor belt breaking, and the device requires no manipulation in starting or stopping the engine.

The present engine is of the side-crank type, but the two future 800-HP. engines will be of the center-crank type, as shown in Fig. 4. Each engine is designed to sustain an overload of 100%, this provision being made for emergency service, when the engines can be made to develop a power greatly in excess of their rating by admitting high-pressure steam into the receiver through a reducing valve.

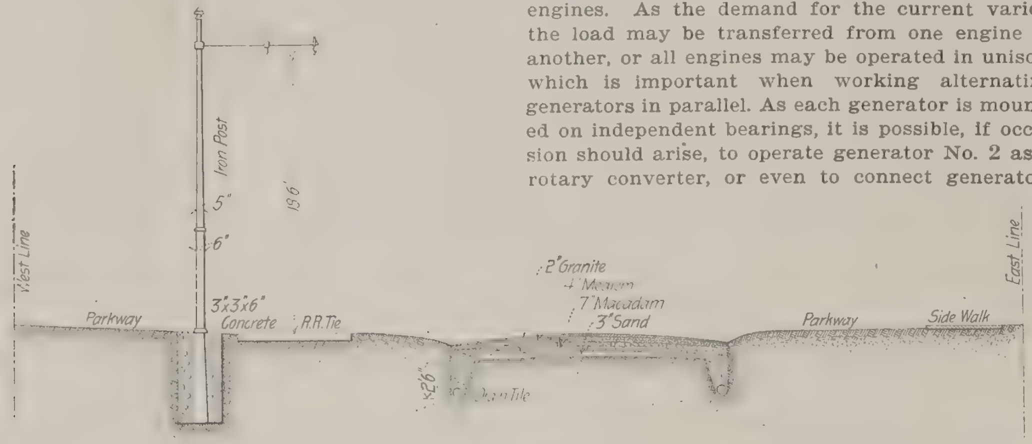

FIG. 2.—CROSS-SECTION OF ROADBED, SHOWING PARALLEL MACADAMIZED ROADWAY AND PARKWAY; CHICAGO & MILWAUKEE ELECTRIC RY.

Special attention is called to the electrical generating plant, two types of generators being employed. Generator No. 1, which is next to the 400-HP. engine, marked No. 1 in Fig. 4, is an alternating three-phase machine, made by the General Electric Co., and has a capacity of 250 K-W. at 125 revolutions per minute. It has 24 poles, and, therefore, delivers a three-phase current of 25 cycles per second. This current is generated at a potential of 5,500 volts, ready to be delivered directly to the transmission lines without the use of transformers. Generators Nos. 2 and No. 4 are combination machines, and have also a capacity of 250 K-W. when running at 125 revolutions per minute. Each of these generators, however, can deliver its output either as direct current or as three-phase current. It has but one armature, but the windings of this armature are connected on one side to a comutator and on the other side to collector rings. The potential of the direct-current end is 600 volts, while the three-phase current is delivered at a voltage of 380. The generator can deliver its rated capacity of output from either the comutator or the collector rings. It can thus be used to supply current directly to the trolley passing in front of the power station, or can be used to operate the motors in the sub-stations, or for both purposes at the same time, dividing the load in proportion to the demand.

These two generators, as above noted, are of considerably lower voltage than the other three, and when their three-phase current is transmitted to the sub-station its potential is raised from 380 volts to 5,500 volts by means of static transformers placed in the basement, as shown in Fig. 4. The transformers are cooled by a blast fan operated by a 1-HP. induction motor.

The engines and generators are connected by means of the Arnold system, which has already been described and illustrated in our columns, and which has been adopted in a number of power stations. Each generator is mounted on a quill or hollow shaft, and suitable couplings connect this solid shaft with either of the engine shafts or the generator quills in such a manner that each generator can be operated by more than one engine. Thus, engine No. 1 can run either or both generators No. 1 and No. 2, while engine No. 2 can be used to drive four generators when they are eventually installed. In case of a break-down to any engine, the other engines in the plant can be made to carry an increase of load by the method already described. The flexibility of this system makes it unnecessary to install a reserve unit, as an accident to an engine would not cripple the entire unit. This system is also particularly adapted to a station of this character, containing two different types of generators. When the load is light, the road may be operated from the combined alternating-current, direct-current generator, which is always available from two engines. As the demand for the current varies, the load may be transferred from one engine to another, or all engines may be operated in unison, which is important when working alternating generators in parallel. As each generator is mounted on independent bearings, it is possible, if occasion should arise, to operate generator No. 2 as a rotary converter, or even to connect generators Nos. 1 and 2 so that they could be used in the same manner.

Each sub-station will contain the static step-down transformers, the rotary converter and a storage battery. It has not been considered necessary to have this equipment in duplicate, as it is intended to mount the machinery needed for a sub-station (static step-down transformers and one rotary converter) upon a truck fitted with motors. In case of break-down at any sub-station, the battery can be relied on to supply current for several hours during which time the portable reserve sub-station equipment can be propelled to the crippled station and connected ready to operate until the repairs have been made.

The storage battery in a sub-station of this character has many advantages. It supplies all the sudden and excessive demands for current, due to the fluctuating load, peculiar to a road of this kind, and operating heavy trains. The rotary converter can be made to carry a fairly average load, while in turn the generating machinery at the power house can be oprated under constant conditions, and this feature of steady load will tend towards fuel economy at the generating station. As the sub-station batteries are able to respond for short periods to an excessive demand, the generating station is relieved from the necessity of supplying the occasional maximum load, and consequently machinery of much less capacity is required at the station than if the batteries were not used. There is also a correspondingly reduced investment required for transmission lines and rotary converters.

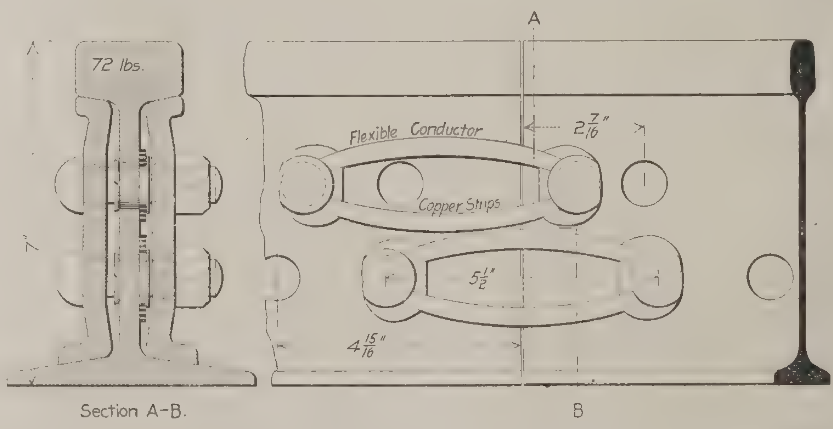

FIG. 3.—RAIL AND JOINT, SHOWING THE PROTECTED RAIL BOND; CHICAGO & MILWAUKEE ELECTRIC RY.

There is still another advantage peculiar to this combined direct-current system of distribution. The self-induction of the alternating-current motors in the sub-stations causes "leading" and "lagging" currents, which may become extremely troublesome. The best condition for operating is when the power factor of the curcuit is unity; or when the apparent energy is equal to the real energy. The strength of the motor field can be adjusted at any given load so as to neutralize the inductance of the line, and leave the current nearly in phase with the E. M. F. If the motor can operate at or near this given load, the power factor will not depart far from unity and the circuit will act like a continuous-current line. If the load varies, however, to any great extent, the resulting "false current" may compel the transmission over the lines of a current greater than that really required to operate the motor. The storage battery furnishes a reservoir to receive or deliver energy as the load varies, enabling the rotary converter to carry a practically steady load, and thus helping materially in maintaining an electrical balance in the alternating-current circuits. It is considered that as the road is extended and the traffic becomes heavier, the conditions of the service will probably make the installation of a battery at the main power house a desirable investment.

The plans for the power plant and transmission system were prepared by Mr. B. J. Arnold, of Chicago, who is Consulting Engineer for the company, and it will be seen from the foregoing description that these plans include some decided novelties in electric railway engineering practice.

The principal contractors for materials are as follows: Dynamos, motors and electrical equipment, the General Electric Co., Schenectady, N. Y.; steam engines, the Filer & Stowell Co., Milwaukee, Wis.; boilers, the Aultman & Taylor Machinery Co., Mansfield, O.; rails, the Johnson Co., Lorain, O.; wire, John A. Roebling's Sons Co., Trenton, N. J.; cars, St. Louis Car Co., St. Louis, Mo., and the Pullman Palace Car Co., of Chicago, Ill.

The general contractors and builders of the line were C. E. Loss & Co., of Chicago. Mr. Loss, who was the original projector of the line, as already noted, has made a specialty of electric railway construction. In addition to the Chicago & Milwaukee line, he has also built the Pullman, the Calumet, the Englewood & Chicago,* and the Kankakee electric railways, in Illinois; the Hammond, Whiting & East Chicago, and the Broad Ripple railways in Indiana; the Sheboygan and Waukesha electric railway in Wisconsin; the Cleveland and Chagrin Falls and the Ironton electric railways in Ohio; the St. Charles and the Orleans railways in New Orleans; and the line from Jalapa to Coatepec in Mexico.

In the earlier part of this article we pointed out that while the present Chicago & Milwaukee line extends only from Chicago to Waukegan, there is also an electric railway in operation south from Milwaukee to Kenosha. This line is owned by the Milwaukee, Racine & Kenosha Electric Ry. Co., of which Mr. Matthew Slush is President. The line is 35 miles in length, of which seven miles are on a private right of way. The cars run into Milwaukee over the tracks of the Milwaukee Electric Ry. Co., and have their terminal at the City Hall, the arrangement between the two companies entitling every passenger going into the city to a transfer to any point on the latter company's lines. The track is laid with 72-lb. rails and is ballasted with broken stone. The maximum grades are 3% and the sharpest curves of 60°. The power station is at Racine, and contains two compound engines of 1,500 HP. and two Westinghouse dynamos of 1,200-K-W. capacity. Long eight-wheel cars are used, having a 50-HP. motor on each truck. Each car will seat 50 passengers, and has toilet-room, smoking-room and a drinking-water tank. The cars are run singly, the time allowed being 2 hours 20 minutes, and there are 18 regular trips each way daily, besides which a number of special cars are run. Packages are carried, and in June a combination car was put on to carry mail and express matter, packages, fruit, milk, etc. The passenger fare is 70 cts., or $1 for the round trip.

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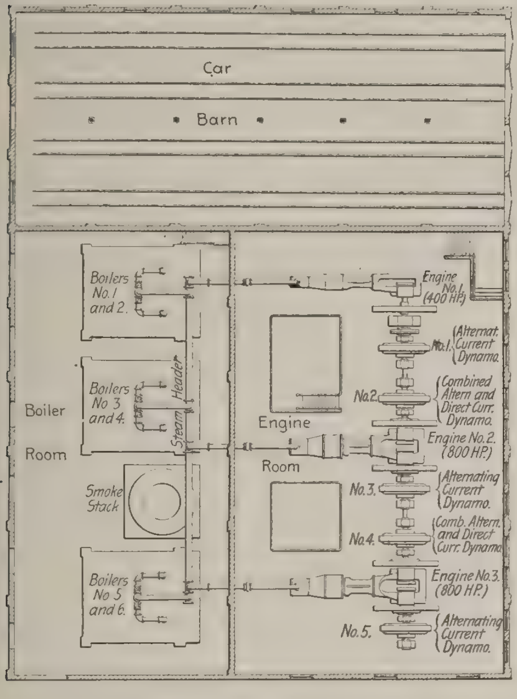
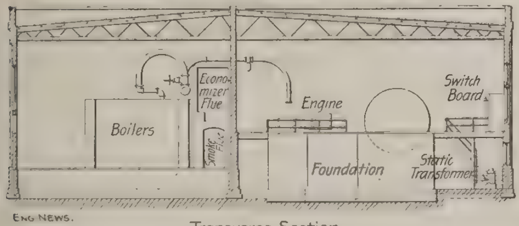
*This is a storage battery line, and has been described in full in our issues of Jan. 6 and Feb. 3, 1898.


Car
Barn
Boilers No. 1 and 2.
Boilers No 3 and 4.
Boilers No 5 and 6.
Boiler Room
Steam Header
Smoke Stack
Engine Room
Engine No. 1. (400 HP.)
No. 1. Alternat. Current Dynamo.
No. 2. Combined Altern. and Direct Curr. Dynamo.
Engine No. 2. (800 HP.)
No. 3. Alternating Current Dynamo.
No. 4. Comb. Altern. and Direct Curr. Dynamo.
Engine No. 3. (800 HP.)
No. 5. Alternating Current Dynamo.

Sectional Plan.



Transverse Section.

Fig. 4.—Power Station and Car House of the Chicago & Milwaukee Electric Ry.

B. J. Arnold, M. Am. Inst. E. E., Consulting Engineer; C. E. Loss & Co., Chicago, Ill., Contractors.

* * *

SIXTH ANNUAL MEETING OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

The sixth annual meeting of this society was held in the Walker Building of the Massachusetts Institute of Technology, in Boston, on Aug. 18, 19 and 20. This time was selected because the meeting of the American Association for Advancement of Science was to be held at the same place in the week beginning Aug. 22, and the meeting of the American Mathematical Society and the Conference of Astronomers and Physicists were to be held on the same dates (Aug. 18-20), thus making it convenient for the professors of engineering schools, who compose the greater portion of the membership of the Society for the Promotion of Engineering Education, to attend the meetings of the other societies. The society has now reached a membership of about 270, and about 70 members were registered as in attendance, a very large proportion for any scientific society whose membership is scattered over the whole country. The meetings were of exceptional interest and value. The papers presented were, many of them, of a high grade, and the discussions were brisk and full of interest. The members seemed to be animated with one common purpose, to improve the courses of education in our engineering schools, and in their consideration of this important subject they viewed it from all sides, not merely scrutinizing the minor details of the courses of study, but treating it from the broader standpoints of enhancing the dignity of the profession and of advancing the civilization of the world. Two notable addresses in which this broad view was taken were the address of the president, Prof. J. B. Johnson, on "A Higher Industrial and Commercial Education an Essential Feature of Our Future Material Prosperity" (Eng. News, Aug. 18), and Dr. R. H. Thurston's address on "The Correct Theory and Method of Organization and Conduct of Professional Schools."

The first session was held on Thursday morning, Aug. 18. After the reports of officers, election of members and other general business had been attended to, Prof. Johnson delivered his address. This was followed by a paper by Prof. Gaetano Lanza, of the Massachusetts Institute of Technology, of which we give an abstract below:

The Class-Room and the Laboratory in Their Mutual Adjustment to the End of the Most Efficient Instruction.

In giving a student an engineering education we wish to fit him, as thoroughly as possible, to grapple successfully with the duties and responsibilities of his profession, not only those of a technical nature, but also those which he must assume as an engineer and as a man.

Pure science and literature should not be neglected in his training.

To impart to the student a thorough mastery of scientific principles far outweighs in importance anything else that can be done for him, and this is the chief function of an engineering course.

The class-room work forms the basis of the course, and the laboratory work, to serve its purpose, must be based upon the class-room work which has preceded it, must be thoroughly co-ordinated with it, and must be made to depend upon it, to use it, and to serve as an aid to illustrate the principles involved. Without the laboratory work, the modern development of our engineering schools would have been impossible; for the laboratory work has not merely served to illustrate and elucidate the class-room work, but has also reacted upon it and caused the class-room work to be so modified as to accord with the facts; and thus has been produced an enormous development in the class-room work itself.

The functions of the engineering laboratory are partly to emphasize and illustrate the work of the class-room, partly to drill the students in performing carefully and accurately such experimental work as they are liable to be called upon to perform in the practice of their professions, and partly to teach them to carry on experimental investigations.

In order to fulfill these purposes there should be an intimate relation between the class-room and the laboratory work, and the student should be made to work up the results of the tests in the light of what he has learned in the class-room.

Any organization which does not tend to preserve the most intimate relation between the two, is not for the best interests of the students and should not exist.

A brief discussion followed, in which it was generally admitted that all of Prof. Lanza's points were well taken. The next paper, by Prof. H. B. Smith, of the Worcester Polytechnic Institute, was entitled:

Note on the Organization of an Electrical Engineering Laboratory.

The paper discusses briefly the importance of, and method of securing, system and flexibility in the equipment of an electrical engineering laboratory, whether for routine undergraduate work or for advanced research, and described the construction of a laboratory designed by the author to secure these ends.

In the afternoon visits were made by many of the members to several departments of the Massachusetts Institute of Technology. The evening was devoted to hearing a long address by Prof. R. H. Thurston, of Cornell University, The following abstract was furnished by the author and printed in the programme:

The Correct Theory and Method of Organization and Conduct of Professional Schools.

The correct theory and method of organization and conduct of professional schools, generally; the special methods applicable to (a) professional schools of engineering; (b) to trade schools; (c) to manual-training schools; (d) to mixed professional and educational curricula. The subtopics under this subject are:

(1) In the technical high-school, what properly determines the form and extent of its technical and other courses?

(2) In such schools, what should be the extent and character of what may be termed the distinctive and essential entrance requirements? What the non-essential requirements?

(3) In the technical college, what should be the nature and extent of these two different classes of demands? What courses should be offered in response to the demand for technical instruction from people whose sons must go directly into business from the lower schools if they cannot obtain a directly useful technical training?

(4) The professional engineering school, now being evolved—the distinctly professional school, having the same position and purpose as, in other professions, the law and medical schools—must soon, if not at once, require definition and delimitation from the academic colleges. What should be the entrance requirements?

(It is understood, of course, that what is practical is limited by the practicability of the existing schools providing it, and that what is desirable is determined by the demands of the profession relating to distinctively professional courses.)

(5) To what extent should the existing views and traditions of the people generally, and the prejudices of the academic teachers and monastic scholars, be deferred to, in the construction of the curriculum of the professional school of engineering, in which, as must be assumed, the work is to be professional training and not, in the accepted sense of that word, education?

(6) If, as is the fact in the state of New York, a body of academicians—its Board of Regents—assumes to control and to dictate to the faculties of the professional schools, what course should be taken to secure independence from such inexpert direction and to insure the management of professional institutions by professionally expert faculties?

(7) Assuming that it is obvious and is admitted that the form and extent of a professional course must be simply that which is demanded by the character of the work of that profession, and that it may be taken for granted that students entering such institutions will, as a rule, if not invariably, have sufficient intelligence and judgment to secure just as much of liberal education, of real education, in the accepted sense, as possible—what should be the length, the extent, and the limitations of such courses in the distinctively professional school?

(8) In such institutions, what other than professional work, if any, should be offered? What entrance requirements would suffice? Should the policy be that of a wide range of non-essential entrance requirements and high academic culture, with, necessarily, few students; or should the entrance requirements be restricted to characteristic and essential introductory work? With, presumably, unobstructed freedom of entrance of all classes and conditions of men; provided only that the poorest of them has attained competence in preparation in the essential requirements for entrance upon professional studies as taken up at the beginning?

(9) In the technical high-school, and in the technical college, of the more common sort in this country, in which some educational work is usually necessarily offered, where should the lines be drawn in respect to entrance requirements, and, in constructing the courses themselves, in such semi-professional schools?

(10) What are the similar conclusions respecting trade-schools and what respecting the manual-training schools now becoming common in our cities?

(11) How shall we classify all these various, as yet undefined courses and schools, in order to secure some definite principle of organization and operation?

The morning session on Friday began with a discussion of Prof. Thurston's paper. Prof. Woodward, of the Columbia School of Mines, pleaded for adherence to broad lines of general training and avoidance of too great specialization. He advocated that such inefficient management as the New York Board of Regents should be thrown out of existence. Prof. Fletcher, of Dartmouth, argued for the purely professional school of engineering, which leaves all elementary work to other schools.

The first paper presented was Prof. Haynes' description of the mounting and use of a spherical blackboard, read by Prof. Eddy, of Minneapolis. The importance of such a piece of apparatus in teaching spherical geometry, spherical trigonometry and astronomy was clearly shown, and the best methods of its use briefly explained.

A report of the Committee on Uniformity of Symbols was followed with interest by the audience, who seemed to have all suffered inconvenience from the confusion of various illogical symbols used in many sciences. The committee urged the universal adoption of symbols, as few in number as possible, but sees no way at present of securing this result. Two years ago a committee on this subject reported systems of symbols for different branches of engineering, which are published in the last volume of the "Transactions," but that committee's report was deemed unsatisfactory by many members, and a new committee on the subject was then constituted. This committee now reports that it is unable to prescribe a system of symbols which is likely to meet with general favor, and made two recommendations, first, that the consideration of the subject of symbols be dropped, and second, that a new committee be appointed to consider definitions of the terms used in engineering. The first recommendation was adopted unanimously, but the second was laid on the table by a large vote, and thus disapproved, and the committee was then discharged.

The first paper of the session was entitled "Some Phases of Engineering Education in the South," and was read by J. J. Wilmore, Professor of Mechanical Engineering, Alabama Polytechnic Institute.

The difficulties to be met by engineering education in the South are in some respects peculiar to the section, and in others, common to all sections. The problem of preliminary preparation is one, the solution of which all can share. In some of the southern states, however, it is more trying than elsewhere. This problem, complicated by the demand for a multiplicity of subjects other than engineering subjects, makes the arrangement of a satisfactory course of study difficult.

No college ever yet had as much money as it needed, but in the South the lack of funds is more keenly felt than in other sections, for the following reasons:

(1) The necessity of separate institutions for white and for colored students. The funds that might support one are insufficient for two.

(2) The absence of personal bequests and donations to white colleges in the South.

(3) The fact that lower fees are charged the students than in other sections of the country.

From the statistics of nine colleges in each section, selected to be as nearly representative as possible, the income per student for the northern colleges averages $242, and for the southern colleges $172. The average number of students per instructor in the northern colleges is 10.7, and in the southern colleges 12. The greatest income per student is $440, and the least $64. The smallest number of students per instructor is 6.2, and the greatest, 15.6. These statistics are based on the total attendance, and while not an absolute index of the engineering work, should give relatively the conditions in the two sections.

The inertia of the old prejudice of practice against theory is still an important factor in southern industrial management. This makes it difficult for our students to get positions which they are qualified to fill, without first undergoing a year or two of drudgery from which they secure little, if any, benefit.

The conditions, however, improve from year to year, and the prospect for the future is far from discouraging.

A paper was then presented by Prof. J. P. Jackson, of the Pensylvania State College, entitled;

"Electricity in Engineering Courses Other Than Electrical."

The present extended use of electricity in industrial undertakings has made a knowledge of its control indispensable to the well-rounded engineer.

College courses preparing for the older engineering professions were established while electricity was of small service. Through human inertia these courses have tended to continue on their old lines. The present time, therefore, finds training in electricity far from satisfactory in engineering courses other than electrical.

The work usually assigned is the electricity and magnetism of the general college physics course, with possibly one term on its applications. No time is given to a vigorous advanced treatment of the subject from an engineering standpoint. The college physics course might as well be depended upon to give the requisite training in applied mechanics or thermodynamics.

In addition to the work now usually scheduled, a thorough training in the laws of direct and alternating currents, as they apply to the practical utilization of electricity, should be added. This should be taught by an engineer, and should be assigned time comparable to that given the steam engine, hydraulics and hydraulic machinery, etc. This time could be obtained with advantage by cutting out special work. An outline of such a course is included in the paper.

As scientific knowledge increases, engineering courses must give more time to fundamental principles at the expense of mere technical practice. Hence such courses tend to converge.

If electrical engineering studies are to be satisfactory they must be under the supervision of an engineering department, and should not be taught by instructors in the departments of physics.

The next paper was by Mr. F. L. Dunlap, of the Worcester Polytechnic Institute, and was entitled "A Course in Industrial Chemistry for Technical Schools." The course, he said, should be directed toward practical results. His own students are sold raw products at their market value, and, after being purified in the laboratory, the refined material is purchased from them, thus stimulating their activity by a financial gain, through their chemical skill.

Prof. Brown Ayres, of Tulane University, Louisiana, in the discussion which followed, spoke of industrial chemistry in its relation to the development of sugar production. The American sugar chemists, he said, have nearly all come from abroad, because they are not rightly educated in the United States. The great increase in our sugar business, owing to the acquisition of new cane-raising territory, will greatly increase the demand for this class of chemist.

The next paper was by Prof. W. K. Hatt, of Purdue University, on

A Laboratory Apparatus for Impact Experiments.

Longitudinal impact is produced by the fall of an 845-lb. cast-iron weight or hammer on a specimen of steel rod. The rod is held at each end by conical wedges fitting in steel bushing pieces. The hammer is fixed to the lower end of the specimen, the lower bushing bearing against a shoulder made in the core of the hammer.

The combination of upper bushing, rod, and hammer, is lifted to a desired height and then released. The upper bushing is caught in the descent by cross pieces fixed to the uprights of the apparatus, and rupture of the specimen results. The circumstances of the impact are recorded on a revolving drum by a pencil attached to the hammer. The resulting curve furnishes data from which the ultimate resilience, elongation, time of impact, etc., are obtained.

The resilience is worked up in two ways: (1) by the application of the principle of work and energy to the descending weight, and (2) from the load-elongation diagram, whose abscissæ are the elongations of the specimen and whose ordinates are the corresponding forces, computed from the known mass of the weight and its retardation.

The apparatus illustrates to the student some principles in mechanics and some phenomena of rupture, and may be applied to purposes of research.

In the afternoon an excursion was taken by many members to examine the Boston subway under the Common, which was built to relieve the congestion of the streets by trolley cars, and the machinery for its ventilation, which is highly successful.

At the evening session the first paper was read by Prof. S. A. Reeve, of the Worcester Polytechnic Institute. It was entitled,

The Direct Study of Thermodynamics.

Prof. Reeve has been very successful in the use of the temperature-entropy diagram, the use of which he illustrated by several large drawings. The student should first, he said, be shown that heat and other forms of energy change places, and that energy is one and indivisible, appearing in different costumes as mechanical and electrical. He must then learn to see the two elements of force and mass in all energy, gaining a clear idea of what energy is.

There is nothing more mysterious in the passage of heat from a body of high temperature to one of lower temperature than in the flowing of water down hill or the corrosion of a metal by an acid. Heat runs down temperature as unavoidably as the stone falls from the hand when released. Heat engines and their opposite, refrigerating machines, are the apparatus to be used in thermodynamics instruction.

Prof. Peabody, of the Massachusetts Institute of Technology, and author of a text-book upon thermodynamics, proceeded to argue with a view to disprove among other things the assertion that it is of prime importance to develop an understanding of what energy and mass are in the minds of engineering students. Prof. Peabody fervently wished that he himself might first understand what these primary foundations are, but humbly confessed his ignorance. He stated that the chief reason that students found so much difficulty in thermodynamics was that they were not sufficiently well grounded in the calculus, and that thermodynamics lost all terrors to a student who had properly mastered his mathematics. Prof. Reeve was unfortunate in not having any defenders of his method of teaching among the audience. It would be well if teachers of thermodynamics would investigate it more carefully. If there is an easier way of penetrating thermodynamic mysteries than by first mastering differential equations it ought to be more generally known and followed.

The report of the standing committee on Entrance Requirements was then presented by Prof. Tyler. This committee is doing good work in collecting and publishing the statistics of the requirements of different schools, and in endeavoring to bring about some degree of uniformity. The subject was referred to the council, with instructions to take action upon several recommendations made by the committee, one of which is that of enlarging the committee so as to secure representation from different sections of the country.

The paper was read by Mr. W. B. Hoag, professor of civil engineering in the University of Minnesota, upon "A Course in Highway Engineering for Civil Engineers." The author made an earnest plea for a campaign of education upon the necessity of good roads, saying that road missionaries are needed before road engineers, and the farmers taught the immense profit that would accrue to them from good highways to their local markets. Now they are content to gage their loads by their estimate of the state of the roads, then trust to their luck and to Providence for the outcome.

Prof. Hoag briefly sketched the history of road-making from those used in the construction of the pyramids and the Roman successes in paving, down to the developments of modern macadamizing. He claimed that the art of road-making has not kept up with the advance in other arts, and that the United States is lagging in the rear of every other nation of equal general progress, in this very vital test of civilization.

The most interesting feature of the session on Saturday morning was a short extempore address by W. T. Sedgwick, Professor of Biology in the Massachusetts Institute of Technology, on "The Claims of Sanitary Science to a Place in the Curriculum of Engineering Education."

Prof. Sedgwick is a brilliant lecturer, and the abstract of his address printed in the programme, which we give below, gives a poor idea of the vigor with which he handled the subject. The abstract says:

> The strength of the claim upon a curriculum already overcrowded depends simply upon the relative efficiency of the subject in contributing to the end in view, and this efficiency being in many cases difficult or even impossible to determine with any accuracy, opinions will differ, and curricula will differ, accordingly, in an entirely natural and probably very wholesome way.
>
> A very great amount of modern engineering is essentially sanitary. Water supply, with its reservoirs, filters, dams, conduits, pipes, pumps, meters; sewerage, with its plumbing, drains, pumps, disposal works, sludge basins, and purification problems; warming and ventilation, with their questions of humidity and conductivity, affecting the health and ill-health of man, as well as questions of the purity of the air in respect to gases and micro-organisms; the construction of halls and buildings, of factories and tunnels, to be used by human beings, subject to infection, varying in lighting and air space; all of these have either their origin or their proper control in modern sanitary science.
>
> It seems to the writer proper and wise, therefore, to provide a short course of instruction in the fundamentals of this subject; and such a course, consisting of fifteen lectures, with demonstrations, has now for some years been given by him with much success to civil engineers, architects, and others, in the Massachusetts Institute of Technology. A comprehensive survey of the course and its results appears in the complete paper.

In the discussion, a member said that the course of 15 lectures described by Prof. Sedgwick should be taken as a part of a liberal education by all students in colleges, rather than having it confined, as he suggested, to civil engineering students. The subject was not only of vast importance to the whole race of men, but, as presented by him, was essentially a culture study, in giving the student some insight into many different sciences and expanding his intellect in a greater degree than could be done by any course of 15 lectures on almost any other subject that could be named as a branch of liberal education. This view was generally favored by others who took part in the discussion.

Other papers presented at this session and discussed very briefly on account of lack of time are given in abstract below:

Undergraduate Thesis Work.

This paper was read by Edgar Marburg, Professor of Civil Engineering, University of Pennsylvania. and was in abstract as follows:

> Former discussions of this subject indicate marked differences of opinion. These differences are probably more apparent than real. This paper is intended chiefly to elicit discussion.
>
> The thesis is not regarded as a test of the acquirements or capabilities of the students. It is recognized rather for its value in affording more advanced and specialized training. The general character of the subject should be determined by the student's predilection, or by the nature of his prospective employment, or better, by both. Its choice should always be selected in consultation with the instructor.
>
> In civil engineering, a design or an occasional resume requiring extended reading and study is preferable, generally speaking, to such so-called original experimental work as the average undergraduate is capable of. In a design, an excessive amount of routine work can be avoided; in an experimental subject, this is usually impracticable. The value of the former, educationally, is at least as great; as a means of professional training, usually much greater. In an experimental thesis there is more danger that the best interests of the student will not be held strictly in view.
>
> The curriculum requires careful adjustment. Assuming a two-term year, courses most essential to thesis work should be completed during the first term. There should be less prescribed work for the second. The choice of subject and certain preliminaries should be disposed of during the first term; weekly periods should be assigned to thesis work throughout the second. The practice of not appointing fixed hours is deprecated.
>
> The student should be left to his own resources within reasonable limits only. The work throughout should be under the conscientious supervision of the instructor. The undergraduate requires and should receive certain assistance that reference books do not and cannot supply.

The Construction of Models by Students as an Aid in Teaching Descriptive Geometry.

This paper was read by Henry S. Jacoby, Associate Professor of Bridge Engineering and Graphics, Cornell University.

> Probably no course of study in the curriculum of engineering students makes such demands upon the imagination as a thorough course in the elements of descriptive geometry. The lack of preliminary training in this respect renders the subject difficult to a number of students. Some improvements, however, has been made recently in the attempt to educate the student's imagination to a proper comprehension of the forms in solid geometry.
>
> There is a wide gap between the single projection used in geometry and the two or more projections employed in descriptive geometry. Models are used extensively, but the most of them relate to the latter part of the course, or to the application of the elements. The models available only in the class-room are insufficient for the best results. The student needs the model during lesson preparation. He can make the most useful ones with little expenditure of time and labor from cardboard, thread, and wire.
>
> The chief value of a model lies in the effective aid in securing, at the beginning of the course, clear conceptions of the relation of the figure in space to its projections, and in that it can be viewed in those directions which show that the projections form adequate representations of the object for the purposes of the constructive arts. It is not necessary to have models for all the principal problems, but only for selected ones. In the study of the tangency and intersection of surfaces and the form of warped surfaces, the class-room models answer the purpose with but few exceptions.

The Training of Engineers for the Maintenance of Way Department on Railroads.

This paper was read by J. C. Nagle, Professor of Civil Engineering and Physics, Agricultural and Mechanical College of Texas, and was in abstract as follows:

> This paper discussed the question of the proper qualifications of those entrusted with the responsible duties of maintenance of way on railroads, and took the ground that all such work should be entirely divorced from the operating department, being placed under engineering control. As to the training that engineers of maintenance of way should have, as well as that of others in responsible positions, it was maintained that an engineering college or university course is essential; but as these institutions are now equipped, the requisite knowledge of details cannot well be given. A plan whereby this may be accomplished was suggested, and an experiment upon one of the leading railroads of Southern United States was cited to show that young engineers can be found without difficulty, ready to serve as apprentices in any capacity, provided that hope of advancement is held out to them. It will be contended that roadmasters and superintendents should be engineers (and even section foremen should have such training as an engineer finds necessary), but at the same time they should have served in the lower ranks of the track force in order to thoroughly understand every detail of their work. This would require the co-operation of the railroads and technical schools, but in the end would tend towards the betterment of both—the engineering school adapting the courses of instruction to the needs of the railroads, and the latter profiting by the use of technically trained men in every branch of the maintenance of way department.

In the afternoon an excursion was taken down the harbor, by courtesy of the chief engineers of the Boston and Metropolitan Sewerage Systems, to visit the pumping plants and the outfalls of both systems, and also the plant now under construction for the utilization of garbage by the Arnold process.

THE POPULATION OF CONTINENTAL EUROPE is given by "La Revue Francaise de l'Etranger" as 380,000,000, made up as follows:

European Russia and Finland	106,200,000	Turkey in Europe	5,800,000
Germany	52,300,000	Roumania	5,600,000
Austro-Hungary	43,500,000	Portugal	5,000,000
		Sweden	5,000,000
		Holland	4,900,000
The United Kingdom	39,800,000	Bulgaria	3,300,000
		Switzerland	3,000,000
France	38,500,000	Greece	2,400,000
Italy	31,300,000	Denmark	2,300,000
Spain	18,000,000	Servia	2,300,000
Belgium	6,500,000	Norway	2,000,000

The density per sq. kilometer, which is about equal to 0.386 sq. miles, is: Belgium, 220; Italy, 169; Holland, 149; England, 126; Germany, 97; Switzerland, 73; France, 72; Austria, 69; Spain, 36; Russia, 20. While the annual increase of the population of Russia has been 1.45 for every 100 in the last ten years, that of Germany has been 1.15, of Austro-Hungary 0.96, of England 0.35, of Italy 0.45, of France 0.08. If this rate is continued, the populations at the end of 100 years will be: Russia, 228,000,000; Germany, 106,000,000; Austria, 79,000,000; England, 65,000,000; Italy, 44,000,000, and France, 40,000,000.

ENGINEERING NEWS
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THE NEW WARSHIP PROGRAM of the naval board of experts calls for the speedy construction of fifteen ships, of which six are to be heavily armored fighting ships; six are to be small protected cruisers, and three are to be midway between these extremes. The three battleships are to have 13,500 tons displacement on 25½-ft. draft, and have a minimum speed of 18½ knots with all stores and coal aboard. The three large armored cruisers will have 12,000 tons displacement, a speed of 22 knots and a steaming radius of 10,000 knots. There would also be three semi-armored and protected cruisers, of a highly improved "Olympia" type, and six 16-knot protected cruisers of an improved "Detroit" type, with 13,000 knots steaming radius. All these ships will be sheathed with oak and copper. The battleships will have armor over the entire ship, 12 ins. thick amidships, tapering to 5 ins. at the bow, and made of Krupp-Harvey steel. They will carry four 12-in. guns of extra length, for the use of smokeless powder; the two turrets will be of the elliptical balanced type, with sloping fronts. All the ships in this program will have water-tube boilers and twin quadruple engines. Bids for the three battleships authorized by the last Congress are now in the hands of the Navy Department. But these vessels, as called for, are mere duplicates of existing battleships of 11,500 tons displacement, 15 to 16-knot speed, and 16½-in. armor over vitals only. Under the present program the construction of these ships may be abandoned altogether, unless the bidders take advantage of the Secretary's appeal for greater speed. The $9,000,000 appropriated for these ships may thus apply to the present program, which will call for about $40,000,000 expenditure.

◆

BIDS FOR RAPID-FIRE PROJECTILES, in lots of 100,000 each, were opened at Ordnance Bureau on Aug. 23. About thirteen bidders appeared, and the prices offered were as follows:

6-pdrs. projectiles......99 cts. to $2.87; average about $1.35
3-pdrs. " ......75 cts. to 1.97; " " 80 cts.
1-pdr. " ......39 cts. to 97 cts.; " " 45 cts.

◆

ARMY ENGINEERING WORK AT SANTIAGO is reported upon by Col. Edward Burr, Corps of Engineers, U. S. A., now of the 5th Army Corps, U. S. Volunteer Engineers. The Engineer Battalion under his command built a crib landing-pier at Siboney, 125 ft. long and extending to a depth of 9 ft. of water; this work was completed in 7 days. The battalion also made about six miles of road, under difficult conditions; replaced with a timber trestle a 60-ft. steel span of the Aguadores bridge, destroyed by the Spaniards, and repaired the La Cruz and Boniato bridges.

◆

TRANSMISSION LINES OF ALUMINUM will be used for carrying current from the Snoqualmie power plant to the cities of Seattle and Tacoma, Wash. There will be one main line 47 miles long to Tacoma, and about half way a branch of 12 miles to Seattle. Nos. 2 and 3 B. & S. aluminum wires will be used, containing 99.30% of aluminum, about 0.25% of iron and 0.30% of silicon, which will be alloyed with 1.50% of Lake copper. The total weight is estimated at 150,000 lbs. This is practically the first use of this material for long distance high tension lines.

THE NEW FRENCH CABLE which was formally opened on Aug. 17 is owned by the Compagnie Francaise des Cables Telegraphiques. It is the longest submarine cable yet laid, being 3,200 miles long. The copper conductors weigh 661 lbs. and the gutta-percha insulation 400 lbs. per nautical mile. Owing to the considerable length of this cable its transmission speed will be limited, with present apparatus, to 90 letters per minute, operating simplex, and 170 words with the duplex. The speed of the Anglo-American cables is about 2½ times that of the French cable.

◆

THE LARGEST INDUCTION MOTOR IN THE WORLD was recently completed at the works of Brown, Boveri & Co., Baden, Switzerland, and was described in the "Electrical World" of Aug. 25. The motor is a 1,000-brake-HP., 10-pole, 46-cycle, 2,500-volt machine, running at 544 revolutions per minute under full load. Complete it weighs 27 tons, and consists of the usual stationary part made in the form of a ring and mounted upon slide frames; the rotating part, with the shaft hollowed at one end for the connectors to the starting collector rings to pass out, and two heavy end-bearing plates, which can be moved along the tracks to expose the parts for examination or repair. The motor will be used to operate a large centrifugal pump to be installed in the municipal pumping plant of the city of Geneva.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Aug. 28 on the Louisville & Nashville R. R., near Birmingham, Ala. The first section of the train carrying the 69th New York Volunteer Regiment jumped the track on a sharp curve and five cars were wrecked. One soldier was killed outright and two others died later, while five were seriously injured.

◆

A COLLISION AT SEA OCCURRED off the Banks of Newfoundland on Aug. 20 between the Thingvalla Line steamer "Norge" and the French fishing schooner "La Coquette," which resulted in the drowning of 16 of the schooner's crew. The collision occurred in a dense fog.

◆

FLOATING AN IRON TANK, 82 ft. diameter, to a new foundation was lately successfully performed at Dunkerque, France. This tank was nearly 33 ft. high and had a total weight of 140 metric tons. Newly imposed fire regulations required the removal of this tank a distance of about 131 ft. to a new beton foundation previously prepared. To avoid the cost of dismantling and again setting up the tank the owner constructed a dike about the two foundations; the tank was hermetically sealed and air was pumped in by a compressor at the refinery. Water was then pumped into the diked area from the neighboring canal, and the air pressure was regulated as the water rose about the tank. When the tank floated it was hauled by cables to its new site and as the compressed air was released the tank settled into its place, without injury or deformation.

◆

TELEPHONE STATISTICS OF EUROPE show an increasing demand for telephone apparatus. The following table, prepared by the U. S. Consul at Chemnitz, Germany, shows the present number of lines and instruments:

Country.	Number of lines.	Instruments.	Inhabitants to each telephone.
Sweden	293	42,354	115
Switzerland	295	23,446	129
Luxemburg	57	1,356	160
Germany	534	131,577	397
Holland	31	7,900	615
Belgium	15	9,400	682
France	407	31,681	1,216
Austria	124	18,950	1,318
Spain	48	10,810	1,597
Hungary	36	8,458	2,168
Italy	54	11,815	2,629
Russia	53	16,050	6,988
Bulgaria	5	243	13,616
Roumania	6	337	16,042

◆

THE RAILWAY RETURNS for the United Kingdom, for the year ending Dec. 31, 1897, give the following official statistics of railways in operation at that date:

THE BLOCK SYSTEM is in operation on all but 3¾ miles of the New South Wales Government Railways, different methods of blocking being used, as follows:

	Miles.
Absolute block, double track	163¼
Electric train tablet, single track	563
Electric train staff, single track	415¼
Ordinary staff and ticket, single track	1,547¼
Freight lines, double track (no block)	3¾
Total	2,692½

◆

LOCOMOTIVES FOR RUSSIAN RAILWAYS are in brisk demand, and it is stated that an order for 550 locomotives of American types has been placed with the Putlov Works, at St. Petersburg. Fifty of these will be express and the remainder freight engines. The long distances to be run and the relatively slow speed of Russian service requires an exceptionally large number of locomotives. About the latter part of August 77 complete American locomotives were received for the Russo-Chinese roads; 50 of these came from the Baldwin Works and the rest from other American builders. A large number of freight engines are still required for the Siberian roads, together with railway supplies of all kinds, and large orders are expected to be placed in the United States about November next.

◆

THE TRANS-SIBERIAN EXPRESS TRAIN, which recently set out from St. Petersburg, is luxuriantly fitted up. The train includes five coaches; two for second and one for first-class travelers, and one dining and one baggage car. All the windows have plate-glass dust-screens; there is a bathroom, a buffet and a barber-shop; a library and a piano, and a stationary bicycle for exercise on the way. The train is lighted by electricity, and the kitchen is capable of providing a hot dinner for 60 people. There is no charge for the barber or for paper and envelopes; but the bath costs $1.00, and three hours' notice must be given. Starting at Moscow the traveler can now get to within about 200 miles of Irkutsk on the sixth day. This train, the second specially fitted and equipped for this service, started out with 40 passengers.

◆

THE RAILWAYS IN INDIA, on March 31, 1898, aggregated 25,454 miles open and sanctioned, of which 21,156 miles were open for traffic, leaving 4,298 miles under construction or authorized. This was a net increase of 766 miles over the length of line in operation in March, 1897. The grand total includes 13,707 miles of Indian standard gage (5 ft. 6 ins.), 10,374 miles of meter gage, and 447 miles of special gages, mostly 2 and 2½ ft. Only about 1,300 miles were double-track. The rolling stock equipment includes 4,205 locomotives, 12,500 cars in passenger service and 78,789 cars in freight service, the total number of vehicles being 94,720. Of this equipment 1,035 engines and 5,480 cars are fitted with the automatic vacuum brake, while 630 cars have the train pipes but no brake apparatus. About 2,600 passenger cars are fitted with the Pintsch compressed gas lighting apparatus, and this system of lighting is being rapidly extended. The average percentage of operating expenses to gross earnings was 47.8% (29.47 to 69.59%) on the standard gage; and 50.76% on the meter gage (33.66 to 92.71%). The average number of passengers and the average journey per passenger, were 189 passengers and 42 miles on the standard gage, and 215 passengers and 36¾ miles on the meter gage lines. The average haul per ton of freight was 160 and 124 miles respectively. The employees were 296,495 in number, of whom 4,793 were Europeans, 6,902 were East Indians, and 284,800 were natives. The flood damages were exceptionally severe, and an earthquake also caused a considerable amount of damage. The accident list shows 79 passengers and 230 employees killed; and 338 and 368 injured.

◆

THE NEW YORK STATE FOREST PRESERVE will be soon increased by the purchase of 50,000 acres of wild mountain forest land, in Ulster, Delaware and Sullivan counties. This will be added to the Catskill Mountain Forest Preserve, which already contains 56,212 acres in Ulster county. The new purchase includes some of the highest mountains of the Catskill Range, and covers the headwaters of the Delaware River.

Report of Railways in the United Kingdom for Year Ending Dec. 31, 1897.

	England and Wales.	Scotland.	Ireland.	United Kingdom, grand total.
Double or main track, miles	9,705	1,408	619	11,732
Single track, miles	5,113	2,039	2,549	9,701
First-class passengers	26,526,020	4,459,260	1,512,393	32,497,673
Second-class passengers	58,789,395	....	3,973,255	62,762,650
Third-class passengers	812,745,556	101,994,671	20,419,651	935,159,878
Total passengers carried	898,060,971	106,453,931	25,905,299	1,030,420,201
Goods traffic, tons	315,869,515	53,466,221	5,046,530	374,382,266
Passenger receipts, gross	£34,461,205	£4,196,872	£1,454,525	....
Freight receipts, gross	£40,395,865	£5,846,802	£1,614,505	....
Total receipts of traffic	£79,759,776	£10,438,957	£3,538,321	£93,737,054
Total working expenses	£45,723,761	£5,384,639	£1,975,404	£53,083,804
Expenditures to receipts, per cent.	57	52	56	57
Locomotives	16,600	2,092	787	19,479
Passenger cars.	37,142	5,053	1,858	44,053
For passenger service	14,152	2,110	1,096	17,358
Freight cars	480,119	134,649	17,562	632,330
Miscellaneous	13,309	1,368	468	15,145
Total of vehicles	544,722	143,180	20,984	708,886
Capital, shares and stock	£708,423,602	£118,286,280	£30,579,111	£857,288,993
Loans and debenture stock	£282,444,279	£37,196,794	£13,085,109	£332,726,182
Totals	£990,867,881	£155,483,074	£43,664,220	£1,190,015,175

THE POWER PLANT OF THE HUDSON RIVER POWER CO., AT MECHANICSVILLE, N. Y.

The large water power and electric plant recently completed at Mechanicsville, N. Y., owes its existence to Mr. R. N. King, President of the Stillwell-Bierce & Smith-Vaile Co., of Dayton, O. Early in 1897 Mr. King became interested in the Mechanicsville water power, and after securing assurances of patronage from several large users of power, he organized the Hudson River Power Transmission Co.

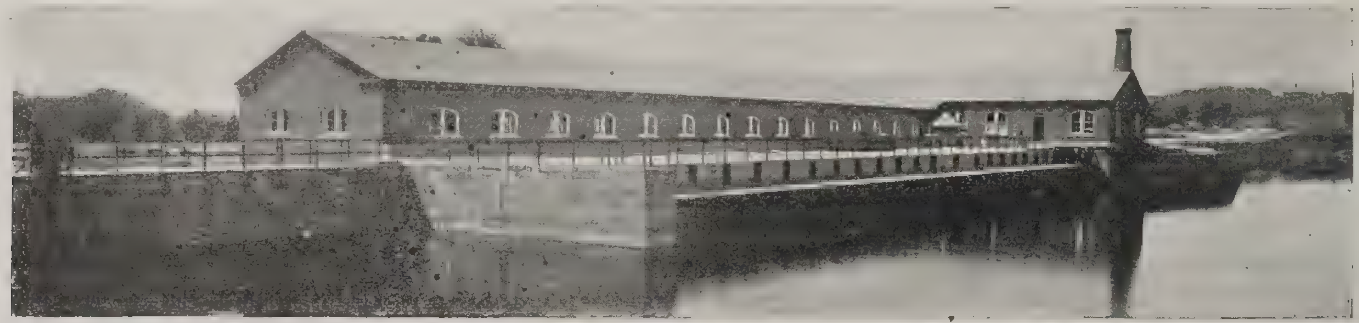


Fig. 4.—POWER HOUSE AND WESTERN DAM OF HUDSON RIVER POWER CO., MECHANICSVILLE, N. Y.; VIEW LOOKING DOWN STREAM.

The site selected is only 2 miles from Mechanicsville, 11 miles from Troy and 18 miles from Albany, in each of which towns there is a large market for power. Only 17 miles away is Schenectady, where the great works of the General Electric Co., occupying some 130 acres, were daily using tons of coal to operate steam engines, which in turn drove the dynamos necessary to supply current for operating the shop motors, testing apparatus, etc.

Naturally, as this company was to be one of the chief users of the power, their engineers were consulted regarding the electrical features of the installation. The hydraulic engineering features of the development were carried out from plans prepared by Mr. A. C. Rice, Chief Engineer of the Stillwell-Bierce & Smith-Vaile Co.

Location.—At the point chosen for the hydraulic development, the Hudson River is about 1,200 ft. wide, and is divided into two channels by Bluff Island, which stands about one-third the way across from the Western bank. The physical conditions make the location an ideal one for a dam and power house. During the greater part of the year the flow is sufficient to produce from 7,000 to 10,000 HP. In order to make the excavations for the dams and power house, coffer-dams were built across both channels. These were partly swept away by a heavy freshet, which caused considerable delay. It was also found that the rock excavated was unsuitable for concrete, of which the permanent dams were to be constructed, and it was necessary to build a special track and haul broken stone from a quarry near Schenectady.

The western channel of the river is closed by the power house, which extends from the shore out into the river about 250 ft., and by a concrete dam 26 ft. high above the bed of the river, 10 ft. wide on top, and 18 ft. wide at the base, extending from the end of the power house to Bluff Island. The upstream face of the dam is vertical and the downstream face has a batter. The top of this dam is at an elevation that the water will never reach, and it is not, therefore, designed to serve as an overfall, but the dam is provided with four arched waste gates 4 ft. wide and 6 ft. 9 ins. high, operated in the same manner as those in the main dam.

The main dam, Fig. 1, extends across the eastern channel of the river, and is also of concrete throughout. This dam is 16 ft. high above the river bed, 8 ft. thick immediately below the crest, and 16 ft. thick through the base. The dam is set between massive abutments anchored to the rock sides of the river bank and island. The upstream face is vertical, the downstream face is curved and provided with a horizontal apron 14 ft. wide, designed to give a horizontal direction to the fall, and prevent wash or scour at the toe of the dam.

This dam springs from two abutments, the eastern is 20 ft. long, 26 ft. high above river bottom, 16 ft. thick at the top, and 34 ft. wide at the base, while the western abutment is 100 ft. long, the other dimensions being similar to those of the eastern abutment. The length of the spillway between abutments, Fig. 2, is 800 ft. In the western abutment are 12 arched openings for waste gates. Each of these gates is 4 ft. wide and 6 ft. high, and is opened and closed by a heavy iron hoist operated by rack and pinion. The eastern dam is practically a solid rock wall capable of safely resisting any flood. It was severely tested in the spring of 1898, when an unusually large freshet came against it, yet, notwithstanding the fact that the dam was green, it was in no way injured.

To prevent any floating rubbish, ice, or logs reaching the racks or choking the waste gates, a floating wooden boom stretches from the western end of the spillway diagonally for a distance of 400 ft. to the edge of the normal river bank, and then for a distance of 1,000 ft. to the main embankment of the Mechanicsville highway. This boom is anchored to a line of stone-filled cribs.

From the west end of the power house to the Mechanicsville highway a broad embankment has been built to serve as a roadway, and cut off the flow along the river bank in high water. It was built of earth and slate rock with a concrete core, and is shown in section by Fig. 3.

Power House.—The power house, Fig. 4, lies between the west bank and the short concrete dam, nearly filling the space between the island and the west bank of the river, and is practically a continuation of the dam. It is of concrete, with the exception of the upper walls, and its construction is of the most substantial character. The foundations are carried down to the bedrock, and the house is carried on heavy steel box girders resting upon steel I-beam columns. The latter are imbedded in concrete walls carrying arches which form the floor of the generator room and the floor on which the wheel flumes rest. The walls form a separate and distinct tail-race 22 ft. wide for each set of turbines, from which the water may be shut out at will.

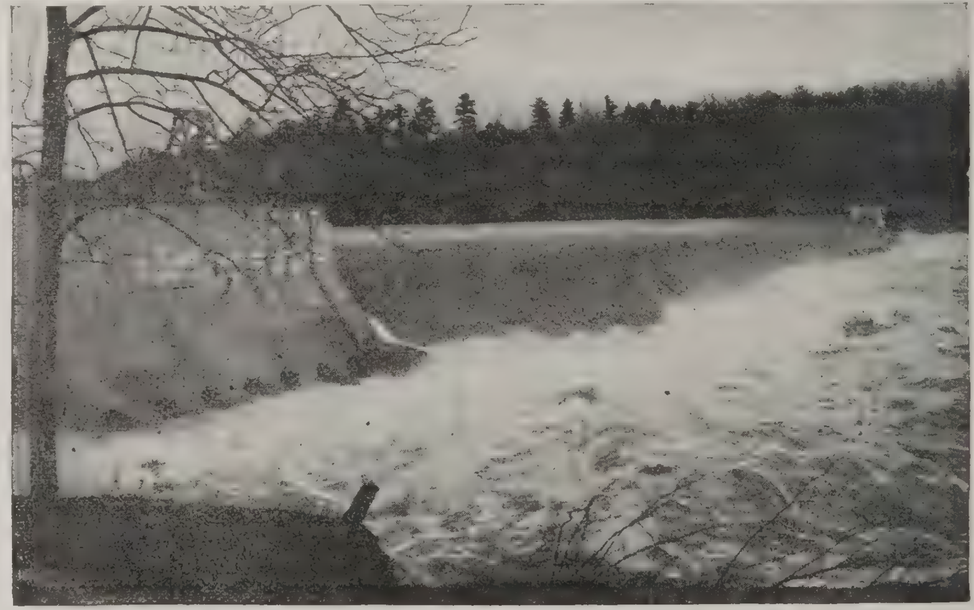


Fig. 2.—DOWN STREAM SIDE OF MAIN DAM SHOWING WASTE WATER PASSING OVER.

The house is divided into two parts by a thick head wall, Fig. 5. The upstream part contains wheel chambers for 7 1,000-HP. wheels, of which 5 only are at present occupied. The downstream portion contains wheel governors, and the electrical apparatus. The length of the power house proper is 257 ft. 6 ins.; the width of the dynamo room between head wall and south wall 34 ft., and the width of the wheel chamber portion 32 ft. 6 ins. The total width of the power house is 60 ft 6 ins. At the western end an L extension runs upstream 87 ft. 5 ins. long and 44 ft. 10 ins. wide. A retaining wall runs down stream from the power house along the western bank a distance of 50 ft.

Arched chambers are provided for 7 main wheels and two exciter wheels. Each main chamber is 32 ft. 6 ins. long, 22 ft. wide and 17 ft. 5 ins. high, and is provided with two 6-ft. manholes. Each exciter wheel chamber is 32 ft. 6 ins. long, 17 ft. 5 ins. high and 10 ft. wide. The head wall of the chambers is 6 ft. thick, the wall on the upstream and both sides 3 ft. thick. In the head wall of each main chamber is set a heavy cast-iron cover through which the turbine shaft passes in a watertight packing box, carrying the ring oil bearing for the shaft. The saving in space effected by the new arrangement of housing and coupling together of the turbines, patented by the Stillwell-Bierce & Smith-Vaile Co., has diminished considerably the size of the power house. A 20-ton crane from the works of Pawling & Harnishfeger, Milwaukee, runs the entire length of the dynamo room.

In front of the wheel chambers and running the entire length of the power house, is a trash rack of steel bars supported on a framework of steel channel and I-beams. This rack effectually prevents the access to the wheels of any rubbish or floating material that may escape the boom.

Water Main Wheels.—There are ten pairs of 42-in. horizontal Victor turbines, built by the Stillwell-Bierce & Smith-Vaile Co., of Dayton, O. Each main turbine consists of two pairs of wheels, which, at the normal speed of 114 revolutions, and the obtainable head of 18 ft., is rated at 250 HP. The total power of each set of turbines is, therefore, 1,000 HP. At present 5 units are in position, the two additional turbines will be installed later. The turbines for the exciters consist of three 18-in. Victor cylinder gate wheels, having, at 259 revolutions per minute a total of 300 HP.

Two draft tubes lead from each main turbine, the forward tube descending straight into the tail-race beneath the power house, the rear or up-stream tube curving and flaring downward and outward. Each tube is 9 ft. 6 ins. in diameter at the bottom. Two draft tubes are also allotted to each set of exciter wheels.

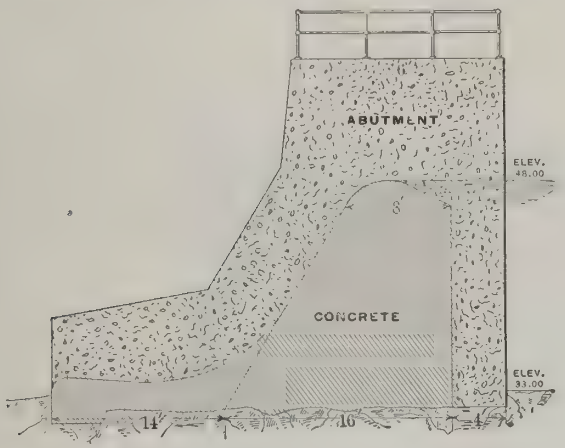


Fig. 1.—Section of Main Concrete Dam Showing Overfall and Section of Abutment.

The speed of each set of main wheels is regulated by a Geisler electro-mechanical governor, mounted on a platform directly over the turbine shaft, and between the head wall and the generator. The use of electricity renders the mechanism of this governor extremely sensitive and effective, and the gates can be entirely opened or shut in 6 seconds should the full current be thrown on or off. The driving pulley is replaced by a rawhide pinion, giving a rigid connection between the governor and the wheel. The governor wheel speed may be increased to shut off or throw on in less than 6 seconds, if necessary. This type of governor is now in use in many of the most important electric power transmissions in this country, including those of Columbia, S. C.; Pulzer, N. C.; Lachine, Que.; West Kootenay, B. C., and Montmorency, Que. The exciter wheel gates are controlled by improved "Snow" governors. They are especially adapted to the regulation of water wheels driving exciters, and are provided with adjustable stops, which limit the hoisting action on the gate as soon as the gate is fully open.

Generators.—These are placed in a large well-lighted room, Fig. 6, 34 × 255 ft., and 30 ft. 5 ins. high in the clear, from floor to roof truss. The ultimate generator capacity of the station is 7,000 HP., in 7 generators, each of 750 K-W. capacity, although only 5 have been installed and are now running. These are uni-tooth, three-phase, 40-pole 750-K-W., 114-revolution alternating current machines, having revolving fields and stationary armatures. They are wound to deliver to the transmission lines, 36 amperes at a periodicity of 38 cycles and a pressure of 12,000 volts. They are arranged for operation in parallel at constant voltage. By using the revolving field type of generator it was possible to secure this high pressure directly from the machine without the use of step-up transformers. As the current is to drive synchronous and induction motors, to operate lights and to be converted into direct current through rotary converters, a frequency of about 40 cycles was selected as most suitable.

The alternators are similar in their main characteristics to those successfully used in the Lachine Rapids plant at Montreal; that is, the armature frame or ring is of the box type, 15 ft. 4 ins. in diameter and 36 ins. wide. It is bolted to a base 18 ft. 2 ins. long by 10 ft. wide, along which it may be moved parallel with the shaft, in order that the revolving field spider and poles may be uncovered should occasion arise. The field ring is bolted to the spokes of the spider and carries 40 poles each, securely fastened by two bolts to the ring. The whole revolves on a shaft 15 ins. in diameter, provided with a rigid bolt-coupling on the turbine side, which connects with the turbine shaft. The dynamo shaft is also extended at the other end for coupling to a vertical steam engine in case of necessity.

The following reasons for selecting this type of alternator have been given by Mr. C. P. Steinmetz of the General Electric Co.:

> In addition to the advantage which the stationary armature type has over the stationary field type in allowing a high transmission voltage to be taken directly from the armatures, it allows of a fairly low saturation of the magnetic circuit giving an almost straight saturation curve. This is preferable in power transmission, since a considerable increase in the voltage may be obtained if needed to cover excessive drop in the lines due to heavy loads, and the voltage may be maintained even if the speed remains low.

The exciters for magnetizing the fields of the generators are placed one on each side of the stairway leading to the switchboard gallery. They are 6-pole, 100-K-W., 125-volt standard General Electric machines with ribbed field frame and iron-clad armatures.

Switchboard.—The switchboard is erected on a gallery on the north wall of the dynamo room, and is built up of nine polished blue Vermont marble panels, each 7 ft. 6 ins. × 3 ft. and 2 ins. thick. Five are used for the generators and two for the feeders; one is the total output panel and the last is for the control of the exciters. The generator panels occupy the left side of the board, and space is left for two additional panels. The feeder panels are on the right side; the total output panel is between these and the generator panels.

Each generator panel is equipped with one inclined coil alternating ammeter reading to 75 amperes for the armature, and one direct current ammeter reading to 150 amperes for the field. Above each of these is a pilot lamp and a synchronizing lamp. Beneath the two ammeters is an inclined coil voltmeter reading to 15,000 volts, and beneath this instrument are three single-blade, double-throw, quick-break, high-tension switches, which are each mounted upon pyramids of corrugated hard rubber. Similar pyramids intervene at the back of the board between the bus-bars and the boards. The corrugations give a total distance of about 8 ins. of surface between the metal clips and hinge and the surface of the marble on each side. As these switches are to break current of 12,000 volts they are tested to break without difficulty currents of 21,000 volts. For safety the switches are made without handles, an eye being made in the end of each blade, into which a hook at the end of a stick may be inserted and the switch opened by the attendant from a safe distance. Further, to prevent any dangerous arcing from blade to blade, marble barriers 1¼ ins. thick, 3 ins. long and 12 ins. wide, from the face of the board are erected between the blades.

On the left hand side of each generator panel sub-base are two 100-ampere, double-pole, double-throw, carbon-break switches—one the field switch, the other the lighting switch. On the back of the panels are the high tension fuse blocks.

These fuse blocks, designed for 20,000 volts, are of the snap break expulsion type. They are mounted on pyramids of corrugated hard rubber, which contain copper spring contact clips between which the two copper blades on the block enter, connecting the fuse block to the line. The aluminum fuse is held tightly between two arms which are movable around a pivot and may be pulled apart by two strong spiral springs encircling this pivot. As soon as an increase of current in the line melts the fuse, its two halves are instantly pulled apart, thus preventing the formation of an arc between the two halves. The melting of the fuse can only occur in a small chamber protected by wooden blocks. The whole fuse block is inserted in the line by simply pushing the two blade-like copper contacts between the clip contacts, which are connected by solid copper rods to the bus-bars. The field rheostats are hung beneath the gallery, and are operated by hand wheels conveniently placed on the gallery.

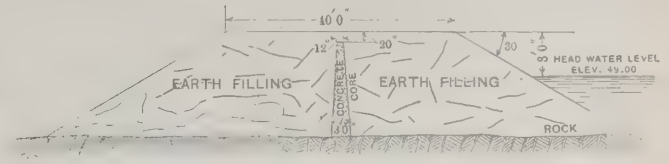


Fig. 3.—Section of Earth Embankment Forming Roadway.

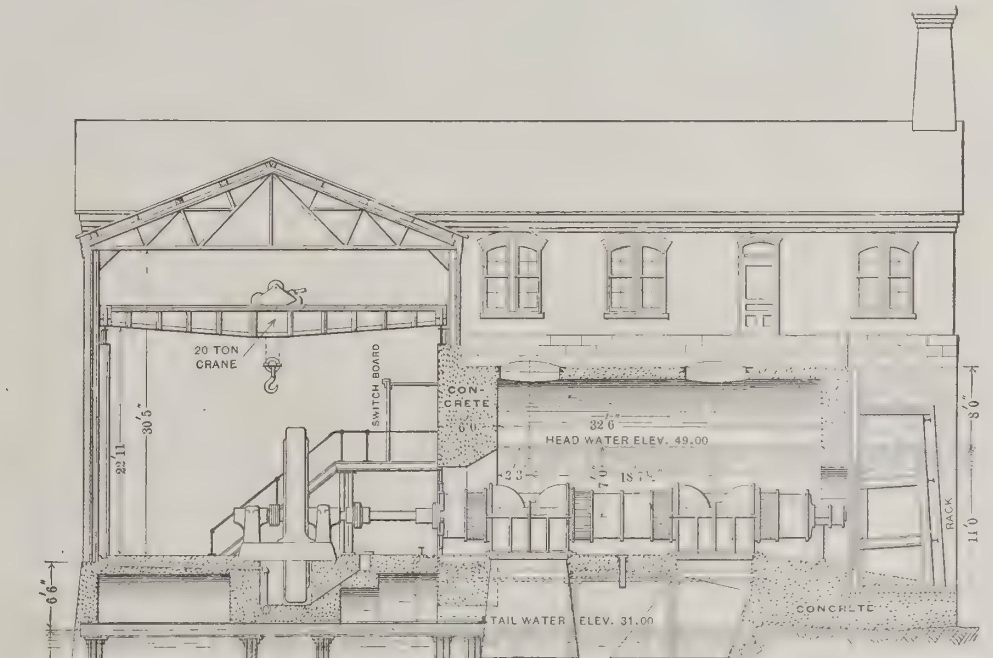


Fig. 5.—SECTION OF POWER HOUSE SHOWING TURBINES, DRAFT TUBES, GENERATORS, ETC.

The exciter panel controlling the two direct current exciters carries two pilot lamps, two circular dial ammeters, each reading to 1,000 amperes, one volt-meter reading to 150 volts, one four-point pressure switch, one synchronizing switch, two 880-ampere, triple-blade, double-throw, equalizer switches and two packed card rheostats placed at the rear.

The two feeder panels are alike in every respect, and each outgoing line is provided with an independent ammeter reading to 150 amperes and a quick-break, double-throw, high-tension switch similar to those on the generator panels, and similarly mounted on the board. Mounted also on corrugated hard rubber pyramids are the six circuit breakers or automatic plunger switches, which are a special form of quick-break, non-arcing switches. A rocker arm controls the three switches for each set of bus-bars, so that they may be all released at once. On the upper part of each feeder panel at the back is a current transformer for each outgoing line, two recording single-phase watt meters, each reading to 25 amperes and 12,000 volts and two potential transformers. On the front of the output panel are 2 Thomson recording watt meters for balanced three-phase circuits, each reading to 300 amperes and 12,000 volts and 12 triple-pole, single-throw 100 ampere switches with fuses for the lighting circuits. On the back are 4 potential and 2 current transformers.

The lightning arresters are of the G. E. short gap type, similar to those installed on nearly all of the important long distance transmission lines in this country which have proved most satisfactory. It will be remembered that this arrester allows the passage of any high potential discharge, but effectually prevents the line current from following and maintaining an arc. The action of the arrester is dependent upon the cooling effect of two metal cylinders, 2 ins. in diameter and 2 ins long, placed 1-32d-in. apart, aided by the reversal of the alternating current and the introduction of a low non-inductive resistance, composed of graphite rods. The line is protected by double-pole 2,000-volt arresters connected 6 in series to give the necessary number of spark gaps. There are 3 sets of these; one at Mechanicsville, grouped around the first transmission pole in a small house 15 ft. square, one set where the overhead pole line connects with the underground cable and the third at the General Electric works.

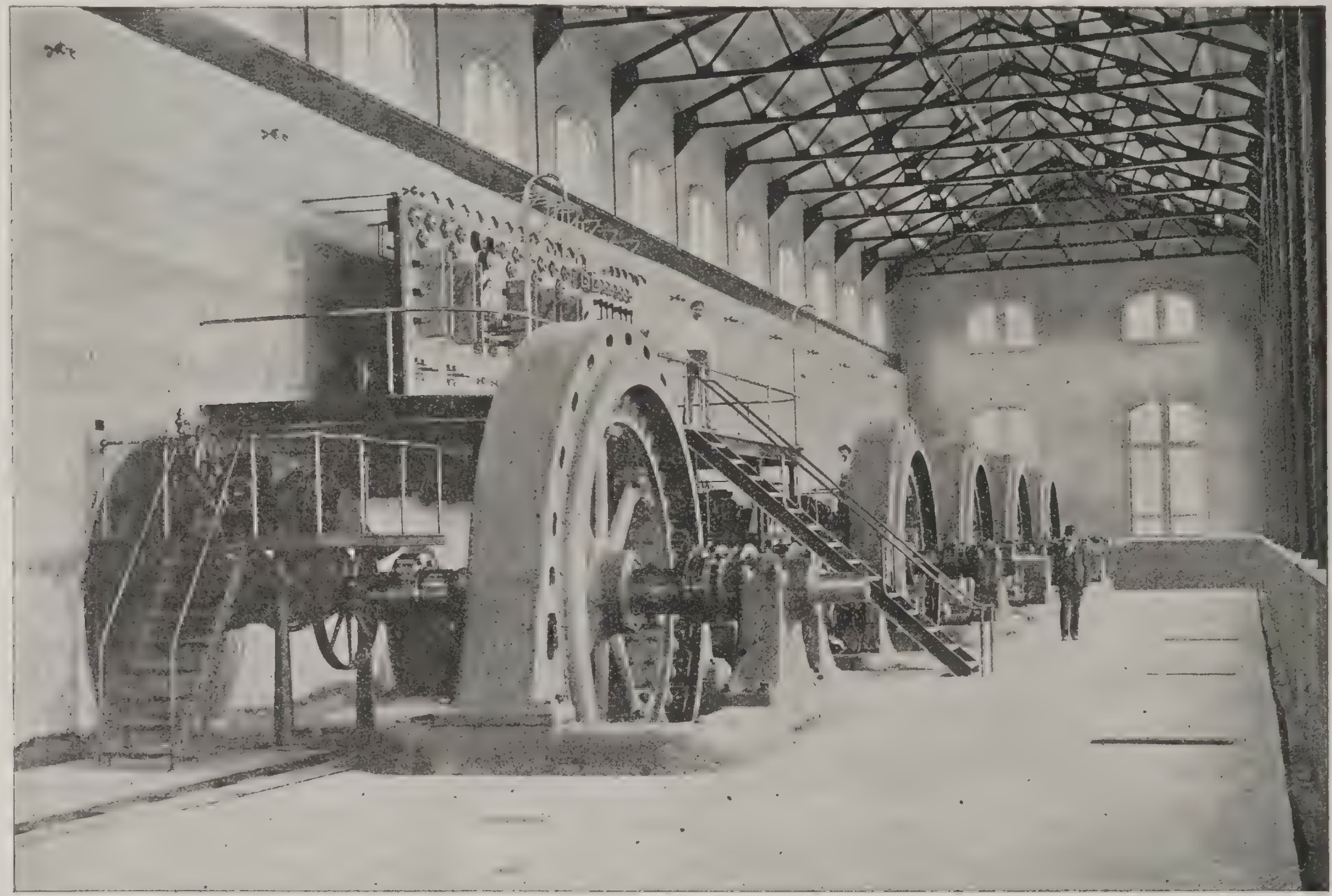


Fig. 6.—INTERIOR OF DYNAMO ROOM SHOWING FIVE THREE-PHASE GENERATORS, SWITCHBOARD, ETC.
General Electric Co., Schenectady, N. Y., Builders.

The lead covered cables from the generators are taken out at the base of the machine, and are laid in ducts in the floor. The cables rise on a frame from the floor duct to the switchboard on the gallery, from the back of which the line wires rise to supports bolted to the I-beam on the north wall, which supports one of the crane runways, and thence around the building part way and out.

The transmission line from Mechanicsville to Schenectady is the only one in place at present. It consists of three No. 000 B. & S. bare wire, this large gage being employed in order to give the line as high self-induction as possible. The insertion of self-induction in transmission lines is a departure from earlier practice. In cases where synchronizing apparatus is used, self-induction is now considered necessary, and is artificially brought into the line in the shape of reactive coils in cases where the natural self-induction is too small. The circuits are carried on poles, 30 to 60 ft. long, and all 8 ins. in diameter at the top. Each pole carries one cross arm, on one side of which are two porcelain insulators of the triple petticoated type, a third being on the other side. For lightning protection a barbed wire, frequently grounded, runs along the tops of the poles.

The line takes a westerly direction to East Glenville, and then due south to Schenectady. At the end of the Glenville bridge over the Mohawk, the town limits, it is carried down to the ground and connected to three cables of No. 1 B. & S. stranded copper wire, insulated by one-quarter-inch rubber and 3-32-in. lead sheets, which are laid in terra cotta conduits. These cables run 1,700 ft. along Washington Ave., rise to poles again, pass through Rotterdam St. to the Erie Canal, and along the canal to a point directly opposite the General Electric Company's power station. They then cross the canal and enter the works.

The introduction of this transmitted electrical power into this factory will work a considerable change. At present all the machinery is driven by electric motors, while the testing department demands an independent supply of current for the work it carries on. There are at present, therefore, two distinct generating plants. The 550-volt motors in the testing department are supplied from an engine driven multipolar generator of 500 K-W. capacity, while a smaller engine drives a number of exciters, which allow of independent control of the excitation of all machines is this department. The factory is operated by a number of 250-volt motors running on the same circuit as the factory lights. These motors will not be changed, and the steam plant which supplies them will be retained as a reserve in case the power from Mechanicsville should fail. The electric power plant superseding the present steam plant at the works will, therefore, consist of two synchronous motors. one of 500 K-W., the other of 100-K-W., and three 400-K-W. rotary converters —the synchronous motors for the testing department, the converters to supply current to the factory motors.

The large engine driving the 500-K-W. multipolar generator is superseded by the 500-K-W. synchronous motors. This is a 12-pole, 400-revolution machine of the revolving field type, wound directly for 10,000 volts. The small engine driving the exciters is replaced by the 100-K-W. synchronous motor—an 8-pole, 600-R. P. M. revolving field machine similarly wound. This disposition renders the testing department independent of everything but the speed of the Mechanicsville generators which will be kept as nearly constant as possible.

The three rotaries supplying 250-volt current to the factory motors are 10-pole, 400-K-W., 480-R. P. M. machines, having two commutators and two sets of collector rings, connected to independent windings on the armature. They receive the three-phase current from independent secondary coils of the same set of air blast transformers. When connected in multiple they furnish current at normal pressure of 250 volts, but as they may be called upon to furnish current to the testing department, in case the demand exceeds the supply from the synchronous motor driven machine, they may be connected in series to give 500-volt current, operating in parallel with the railway generator, driven by the synchronous motor in the testing department. Synchronous motors were selected in preference to induction motors on account of, first, their more constant speed and greater efficiency; second, because they do not produce lagging currents, but the phase displacement and power factors may be controlled as desired by means of controlling the field excitation. It is also a fact that synchronous motors of the revolving field type and of good design are self-starting even under heavy load, and will easily carry two or three times full load without falling out of step for a time, which is limited only by the heating of the motor.

The entire construction of the dams, power house and lines has been carried out by the National Contracting Company, of which G. M. Furman is general manager. Mr. R. A. Mathews, superintendent, and J. A. Leonard, constructing engineer The electrical equipment is furnished by the General Electric Company and the hydraulic equipment by the Stillwell-Bierce & Smith-Vaile Co., of Dayton, O., to which company was confided the entire development contract. It took the Hudson

River in its natural condition and turned over to the operating company the plant in running order.

The officers of the Hudson River Power Transmission Company are: General Edmund Hayes, of Buffalo, N. Y., president; R. N. King, president of Stillwell-Bierce & Smith-Vaile Co., of Dayton, O., vice-president; G. M. Furman, Newark, N. J., treasurer; Mr. E. J. Richards, Boston, Mass., superintendent; J. S. O'Shea, manager.

Our acknowledgments are due to the General Electric Co. for the cuts and information made use of in the preparation of this article.

SEWAGE PURIFICATION BY INTERMITTENT FILTRATION AT CENTRAL FALLS, R. I.

The city of Central Falls, R. I., has an estimated population of 16,000, compactly located on an area of only 1.3 square miles. A public water supply was introduced in a portion of this territory in 1879, the city having been formed only a few years ago. Sewers were first put in operation in 1889. The sewerage system is divided into two districts. The larger of these districts was the first to be provided with sewers, the contents of which are discharged into the Blackstone River without treatment. At the close of 1897 this district had about 6¼ miles of sewers, and 374 house connections.

In 1893, a report on a sewerage system for the second, or western district, was made by Mr. S. M. Gray, M. Am. Soc. C. E., of Providence. Mr. Gray recommended the construction of both sanitary and storm sewers, but on the separate plan, the sewage proper to be treated by chemical precipitation. In 1894, Mr. L. C. Heywood, the engineer for the town of Lincoln, from which the city of Central Falls was afterwards set off, recommended combined sewers, with disposal by intermittent filtration, advising the present location for filter beds. The sewers were begun under Mr. Heywood, who died in January, 1895, and was succeeded by Mr. Wm. Faitoute Keene, Assoc. M. Am. Soc. C. E., the present city engineer, before more was done about the filter beds than to buy the land. Mr. Keene designed the settling basins and filter beds now in use and they were also built under his direction as city engineer. The effluent from the beds, together with the storm overflow, discharges into the Moshassuck River, which empties into the head of Narragansett Bay.

About Sept. 1, 1896, the sewers and filter beds were put in use. At the close of 1897 there were about 1½ miles of sewers in the district, including the outlet, with 87 house connections, serving 101 houses. On June 11, 1898, the number of connections had increased to 98 and these gave service to 112 houses. Each house in this district had an average of about ten inhabitants by the census of 1895.

The lower portion of the outlet is a 60 × 90-in. brick sewer, of horseshoe shape, 863 ft. in length, with a grade of 0.1 ft. in 100 ft. There has been trouble with sand in the invert of this sewer, which has reached a depth of 1 ft. between periods of removal. At the lower end of the outlet sewer there is an automatic device by means of which the entire flow may be shut off from the beds during heavy rains. This device consists of a brick well, 5 ft. square inside, with a 12-inlet from the brick sewer, and two 12-in. outlets, one of which is the overflow. The regulating is done by a float connected with a shut-off gate on the trestle pipe line, mentioned below, so arranged that when the float reaches a certain height the gate closes, and the sewage runs through to the overflow pipe.

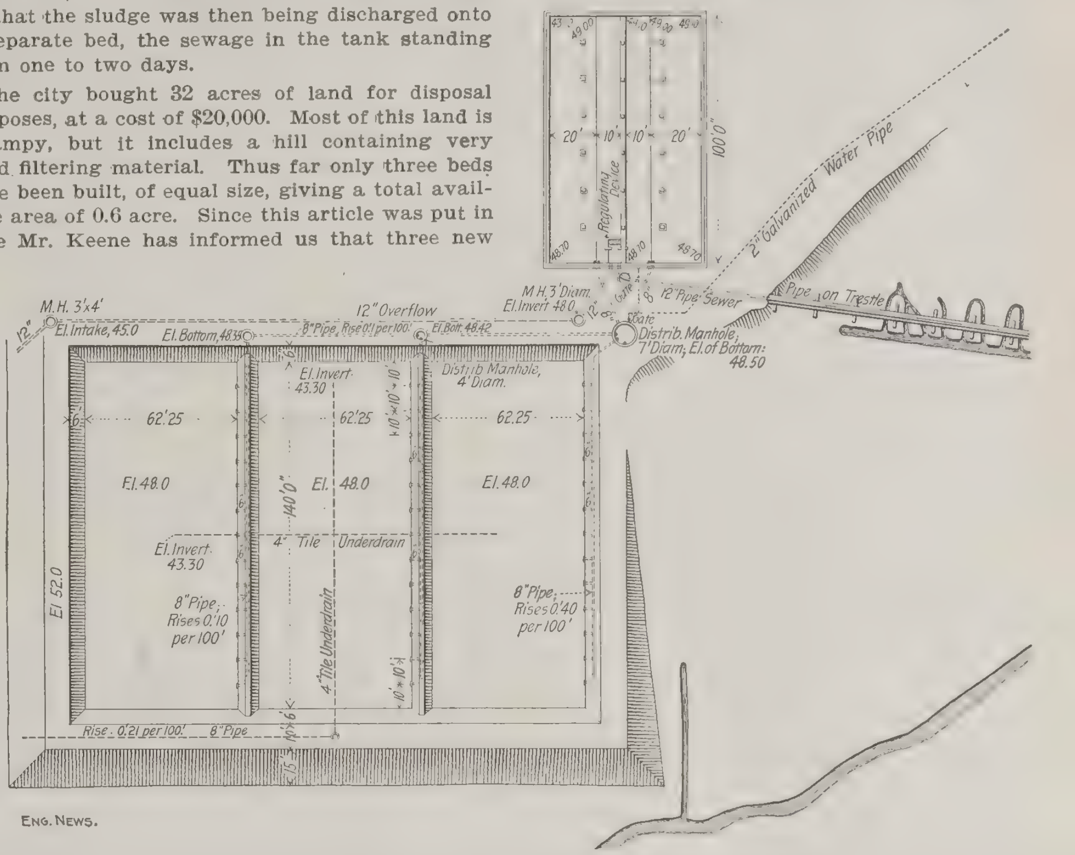
The sewage is conveyed from the end of the brick outlet across the swamp to the settling tanks and beds through a 12-in. Akron pipe on a timber trestle. The pipe is in 2-ft. lengths, with yarn and cement joints. Settlement of the trestle was expected and provided for, but the settlement has been greater than was expected. The trestle was built only for temporary use.

Two settling tanks are provided, near the beds, as shown by the plan. This plan gives the principal dimensions of the tanks, beds and accessories, with the exception of the available depth of the tanks, which is 40 ins.

Only one of the two settling tanks is used at present. Each tank has an available capacity, for purposes of sedimentation, of 70,000 gallons. Both tanks are floored over and have a roof forming a one-story building. Part of the enclosed space is used for a gage room and office, and the remainder for the storage of sprinkling wagons and other city property. Beneath the gage room is a small receiving and regulating tank for each of the settling tanks.

When the plant was visited in November, 1897, by a member of the editorial staff of this journal, the practice was to discharge the one tank in use when the sewage in it had accumulated to a depth of 25 ins., or about once in two or three days. The sludge was then being turned onto the filter beds, but in June, 1898, Mr. Keene informed us that the sludge was then being discharged onto a separate bed, the sewage in the tank standing from one to two days.

The city bought 32 acres of land for disposal purposes, at a cost of $20,000. Most of this land is swampy, but it includes a hill containing very good filtering material. Thus far only three beds have been built, of equal size, giving a total available area of 0.6 acre. Since this article was put in type Mr. Keene has informed us that three new beds are under construction, each with an area of 0.2 acre. No chemical analyses of the sand have ever been made.



Eng. News.

PLAN OF SETTLING TANKS AND FILTER BEDS FOR THE SEWAGE DISPOSAL WORKS OF CENTRAL FALLS, R. I.

Wm. Faitoute Keene, City Engineer.

The total amount of sewage treated during 1897 was 4,042,721 gallons, or an average of about 11,700 gallons a day. This, on an area of 0.6 acre, is equal to about 19,500 gallons per acre per day. Mr. Keene places the flow of sewage in June, 1898, at about 20,000 gallons a day, and states that the sewage is very strong, as no ground water enters the sewers. He says that in consideration of the fact that authorities allow one acre for each 1,000 inhabitants, and their 0.6 acre is treating the sewage from 1,120 people, he does not think the rate is a low one. According to his figures the flow is now nearly double the average for the year 1897, being at the rate of about 33,000 gallons per acre per day.

One man is stationed at the beds for the purpose of caring for them and recording the amount of sewage treated, together with the temperature of both air and sewage. In November, 1897, the beds were found to be nicely graded and everything appeared to be in good condition. The sand is light in color, giving the beds a unique appearance. The embankments are of sand and have not yet been covered with grass. The sand was handled for about 12 cts. per cu. yd. The total cost of the plant, including the trestle across the swamp, but not including land, has been about $10,000 thus far. The unit cost will be diminished as the disposal works are extended. We are indebted to Mr. Keene for courtesies extended during the visit of our representative to the plant, and for drawings, reports and notes furnished to us.

THE FIRST RAILWAY IN KOREA.

The American victories in the Philippine Islands will undoubtedly have an important result in calling attention to American commercial movements in the Far East and in promoting our foreign commercial interests. In a recent issue we described some of the work done by Americans in the Hawaiian Islands, and we are now able to present some interesting particulars of the railway which is being built in the little empire of Korea by the Seoul & Chemulpo Ry. Co., under a concession granted in 1893 to Mr. James R. Morse, president of the American Trading Co., of New York city. Until within the past few years, Korea has been probably the most isolated and self-dependent state in the world, having few relations with other countries and being practically devoid of all the improvements of modern civilization, but the advent of the railway will undoubtedly lead to the opening up of the country for foreign trade.

The railway will extend from the port of Chemulpo to the capital city of Seoul, a distance of about 25 miles, but it will not be completed until early in 1899. Delays in the construction have been caused by the owners recently deciding upon extensive changes in reducing the maximum grade from 2% to 1%, and decreasing the mimimum curvature from 8° to 6°. Other delays have occurred in reclaiming from the sea all the land necessary for extensive terminals at Chemulpo, necessitating the construction of a strong sea-wall and much filling in on the foreshore. The line will pass through a country composed of valleys and small hills, the highest and lowest elevations or summits being 146 ft. and 35 ft. For two-thirds of its length the line will pass through rice fields. The traffic will consist largely of rice, beans, coal and general freight. The gage is 4 ft. 8½ ins., which is the same as that of the Chinese railways, except that the new Manchurian Railway will be of the Russian standard gage of 5 ft., being an extension of the Trans-Siberian Ry. It is expected that eventually a line will be built northward from Seoul to connect with the Manchurian line, or with the North China Ry. from Pekin.

There are no very important engineering works, with the exception of a steel truss bridge 2,063 ft. long, having ten equal spans, which crosses the Han River four miles south of Seoul. This bridge was built by the Universal Construction Co., of Chicago, (Illinois Steel Co.). Timber trestles are used for other crossings, and it is probable that these will be replaced by steel structures in the near future. There are no tunnels, and the materials encountered in excavation are mainly granite, decomposed granite, clay and loam. The American-Oriental Construction Co. has the contract for construction, and most of the work is done by small sub-contracts; Korean, Japanese and Chinese laborers being employed.

The track is laid with 56-lb. rails, rolled by the Illinois Steel Co., the joints being spliced by soft steel angle-bars with four bolts. The ties are of Korean and Japanese timber, similar to pine of moderate quality, and there are 15 ties to a rail. The ballast is of broken stone.

The equipment includes four locomotives, 20 passenger cars and 100 freight cars. The locomotives are tank engines of the mogul type, built by the Brooks Locomotive Works, of Dunkirk, N. Y., and one of these was illustrated in our issue or Feb. 24. The cars are of the American type, and most of them were made by the Jackson & Sharp Co., of Wilmington, Del.

For the information respecting this railway we are indebted to Mr. D. H. Collbran, of the American-Oriental Construction Co. (formerly of the Colorado Midland Ry.), who is in charge of the company's interest in Korea. Mr. Collbran has the concession for an electric railway at Seoul, and five miles of 25-lb. rails for this line have been shipped from this country. He is also negotiating for a concession for the electric lighting of that city.

THE DAVIS AVENUE CANTILEVER HIGHWAY BRIDGE, ALLEGHENY CITY, PA.

We illustrate herewith the strain sheet and some of the more important details of a cantilever highway bridge now being built to span a deep ravine which intercepts the approach to Riverview Park, in the city of Allegheny, Pa. The park has an area of about 250 acres, and is being rapidly improved by drives and footpaths. It is situated in the northern part of the city, and at present is reached by only two main streets from the center of the city. The bridge illustrated is designed to give access to the western portion of the park from all that portion of the city lying to the north and west. A road along the bottom of the ravine, which the bridge crosses, also gives access to the western end of the park. The contract for building the bridge has been let to Mr. Gustave Kaufman, M. Am. Soc. C. E., of Pittsburg, Pa., for $25,754.

The illustrations explain quite fully the principal structural features of the bridge, and only a few of the minor details need to be mentioned here. Fig. 1 shows the strains and composition of the different truss members; Fig. 2, a half transverse section disclosing the latticed floor beams and stringer and floor construction, and Fig. 3, details of the abutment anchorages. As will be seen, the roadway is carried by seven lines of intermediate stringers and two guard rail stringers, and each sidewalk by one intermediate stringer and an outside stringer. The intermediate roadway stringers are rolled I-beams, but the sidewalk and guard rail stringers are made up of plates and angles. These stringers rest on top of the floor beams and are riveted to them. On top of the stringers come buckle-plates ¼-in. thick arched 2½ ins., which are riveted to the top flanges of the I-beams with rivets to be spaced not more than 5 ins. apart. These buckle plates sustain the floor covering of concrete and asphalt paving. The specifications call for a thickness of 2½ ins. of concrete over the highest part of the buckle plates, the concrete to consist of Portland cement, clean, sharp sand, and 1½ in. broken stone. The paving of asphalt will be 1½ ins. thick.

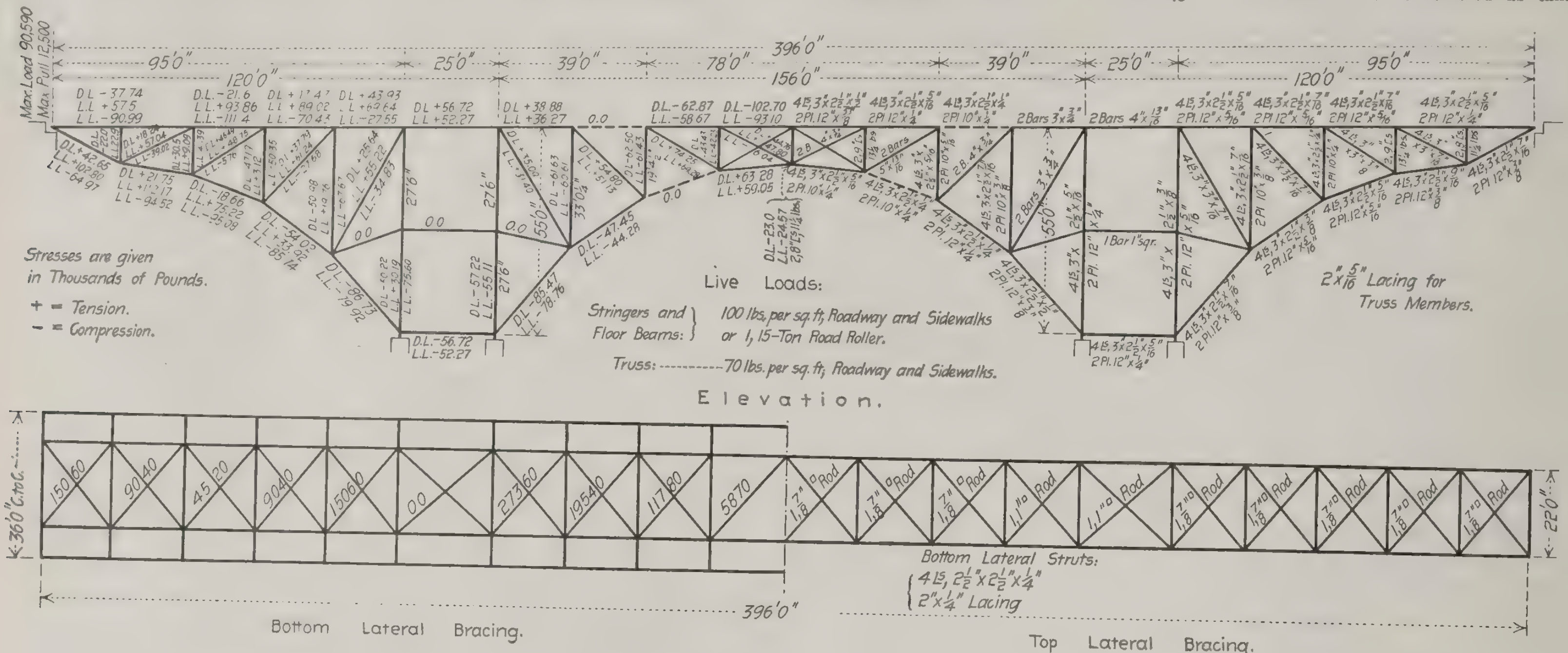


FIG. 1.—STRAIN SHEET AND MAKE UP DIAGRAM, DAVIS AVE. CANTILEVER HIGHWAY BRIDGE, ALLEGHENY CITY, PA.
D. L. Fulton, Superintendent Highways and Sewers, Allegheny City, Pa.
Gustave Kaufman M. Am. Soc. C. E., Pittsburg, Pa., Contractor.

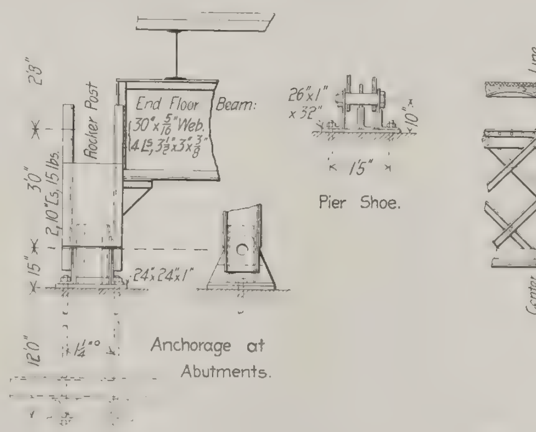


Fig. 3.—Abutment Anchorages, Davis Ave. Bridge.

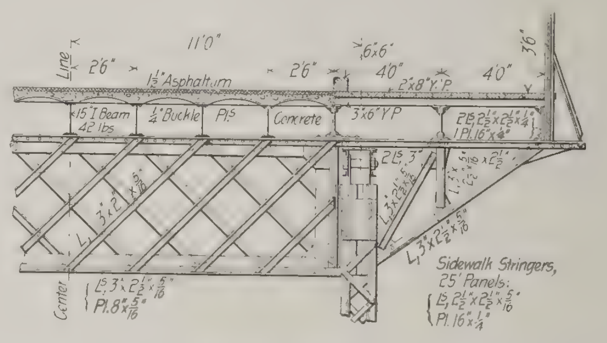


Fig. 2.—Transverse Section of Davis Ave. Bridge, Showing Sidewalk and Floor Construction.

All parts of the bridge will be of steel except the lateral rods and welded parts, which will be of wrought iron. The various members were designed so that the following unit strains would not be exceded:

Bearing on shop rivets	15,000 lbs.
" " field "	12,000 "
Shearing on shop rivets and pins	7,500 "
" " field "	6,000 "
" " pin plates	6,000 "
Binding on pins	20,000 "
Bearing " "	18,000 "

For wind stresses an addition of 25% was made to the above unit strains. In regard to riveted work the specifications contained the following requirements:

> Rivets will not be less than ¾-in. in diameter. Direct tension on rivet heads shall be avoided. The pitch of rivets shall in no case exceed 6 ins., nor be less than three diameters of the rivet. At the ends of compression members the pitch shall be four rivet diameters for a length equal to twice the total width of member. The effective diameter of a driven rivet shall be assumed the same as its diameter before driving. Where practicable, the distance from edge of any piece to center of rivet shall be two diameters of rivet. The shearing or bearing value of countersunk rivets in plate ⅜ to ⅝-in. thick will be taken as one-half the full value. Countersunk rivets in plates less than ⅜-in. thick will not be considered as taking any of the stress, and in plates ⅝-in. thick or over the regular value shall be used. In deducting rivet holes to obtain the net section in tension the rivet hole will be taken with a diameter of ⅛-in. larger than the undriven rivet for rivets with full heads and ¼-in. larger for countersunk rivets. All rivet holes shall be punched 1-16-in. larger in diameter than the diameter of rivet to be used.

The requirements for workmanship called for first-class methods and finish, but present nothing unusual. In regard to the material, the specifications state that,

> All steel must be uniform in quality and must be made by the open-hearth process. It shall contain not more than 0.08% phosphorous in the finished product, and shall have an ultimate tensile strength of not less than 56,000 lbs. nor more than 64,000 lbs. per sq. in.; an elastic limit of not less than 30,000 lbs. per sq. in.; an elongation in 8 ins. of not less than 25%, and shall show a reduction in area at the point of fracture of not less than 45%. Steel for rivets shall have an ultimate strength of from 48,000 lbs. to 58,000 lbs. per sq. in.; an elastic limit of not less than one-half the ultimate strength; an elongation of 26% in 8 ins., and a reduction of area of not less than 50% at the point of fracture.

The usual bending, hammer and drifting tests were required of all steel. For the information from which this description has been prepared we are indebted to Mr. D. L. Fulton, Superintendent, Bureau of Highways and Sewers, Allegheny City, Pa.

A SMOKE INSPECTION SYSTEM has been installed at Pittsburg, with Mr. Jas. J. Brennan as chief inspector. From local press reports it appears that the work at the start will be largely of an advisory character.

THE CONDUIT ELECTRIC RAILWAYS of Washington, D. C., had to shut down on Aug. 12, owing to a severe rain storm, which flooded the conduits and short circuited the conductor rails, causing in some cases a delay of several hours.

◆

THE BOSTON ELECTRIC SUBWAY ran its first regular passenger car over the entire line on Aug. 19. The American Society for the Advancement of Science was holding its annual meeting in Boston, and members of the Section for the Promotion of Engineering Education were the first passengers.

◆

THE NEW YORK STATE COLLEGE OF FORESTRY, at Cornell University, was established by Act of Legislature in April, 1898, and this act authorized the trustees of Cornell to create a department in the University with the above name; establish a demonstrative forest of 30,000 acres in the Adirondacks, which was to be the property of Cornell University for 30 years, and appropriated the sum of $10,000 for the organization and maintenance of this "College Forest." The object of the College of Forestry is to furnish instruction in the principles and practice of forestry and to especially educate managers of forest properties. This college has now been organized, with a full faculty and with Mr. Jacob Gould Schurman as its President. The college year begins on Sept. 22 and closes on June 22, with three terms in each year. A pamphlet has been issued setting forth the requirements for admission, nature of studies and examinations, tuition fees, etc.; and this pamphlet can be obtained by addressing the Director of State College of Forestry, Ithica, N. Y. Tuition is free to students who are residents of New York. The degree issued on graduation is that of Bachelor of the Science of Forestry.

◆

THE EAST BOSTON TUNNEL PROJECT is being discussed before the Rapid Transit Commission in Boston. No less than seven routes are proposed; though the one most favored is that having an opening on the Boston side at State St. or Adams Square and striking Lewis St., and Maverick Square, at the East Boston end. The commission believes that it is authorized to permit the construction of such a tunnel and the consent of the Secretary of War has been asked and a favorable answer is expected. The project is strongly opposed, however, by certain Boston interests. The chief argument used against it is the great first cost and the heavy expense of maintenance. These opponents say that the ferries will still have to be maintained, though their revenue will be reduced by the tunnel traffic; it would not connect with the subway system, and it would be impossible to concentrate existing traffic at the Boston end of the tunnel. The advocates of the tunnel are still to be heard from.

◆

A NICARAGUAN FINE WOODS CONCESSION has just been made to Mr. H. C. Emery, of Chelsea, Mass., for 15 years. This is practically a renewal of an old concession to Mr. Emery under which he shipped about 12,500 logs annually. Mr. Emery is to build 50 miles of a 3½-ft. gage railway between Rio Grande and Pearl Lagoon, and this property is to revert to the government at the end of the concession. He pays $20,000 gold down and $10,000 per year in gold for 15 years. But his concession is said to be exceedingly valuable, as it gives him the monopoly in the shipping of mahogany, rosewood, cedar and other valuable woods; he has also the right to import, free of duty, all supplies for the men engaged in cutting wood and for building and maintaining this railway.

◆

A PLAN TO DEVELOP THE WATER POWER of the Shawinigan Falls on the St. Maurice River, which is about 100 miles from Montreal, Canada, has taken definite form. The head obtainable is 165 ft. with a supply of water estimated to be sufficient to develop 200,000 HP. The Shawinigan Water Power Co. contemplates installing apparatus to utilize about 100,000 HP. Bids are now being asked for the hydraulic construction, as noted in our advertising columns.

◆

THE IRON AND STEEL COMBINATIONS, which has been in process of organization in Chicago for some time, is now authoritatively said to include the following five companies: Minnesota Iron Co., with its Duluth & Iron Range Railway, and Minnesota Steamship Co.; Illinois Steel Co., with its Chicago, Lake Shore & Eastern Railway; Southwestern Connellsville Coke Co.; Elgin, Joliet & Eastern Railway; Lorain Steel Co., of Lorain, O., and the Johnstown Steel Co., of Johnstown, Pa., lately merged with the Lorain Co. The promoters of the combination still hope to later include the Cambria Iron Co., Bethlehem Iron Co., Tennessee Iron & Coal Co., Pennsylvania Steel Co., Colorado Fuel & Iron Co. and the Carnegie Steel Co. The capital of the new combination will probably be $200,000,000; and the five companies named as in the deal have a capitalization of more than $75,000,000; those named as still outside are capitalized at over $90,000,000. The Carnegie Co., however, officially denies having any connection whatever with this trust. The new company would be called the Federal Steel Co., and the syndicate to furnish working capital will be managed by J. P. Morgan & Co., says Judge E. H. Garry for the committee of ten on organization.

◆

CUBA AND PORTO RICAN TRADE is already interesting American manufacturers and shippers. The ending of unstable conditions, bad credits, revolutions and generally unsatisfactory trade relations, existing under Spanish rule, is expected to largely develop the natural wealth and commerce of these islands. In 1893 the total Cuban trade with the United States was about $100,000,000, and $6,500,000 with Porto Rico. In the same year Spain's trade with Cuba was $34,000,000 and $8,700,000 with Porto Rico. Our exports to Cuba, in 1893, was $23,000,000, and business men believe it will be $50,000,000 within five years. More adequate transportation facilities are being already promoted; and Baltimore, among other points, is planning a new line of steamers for the West Indian trade.

◆

THE SOO CANAL TRAFFIC for July last breaks all previous records. The freight tonnage amounted to 3,246,787 tons, as compared with 2,856,767 tons for July, 1897; an increase of 390,020 tons. This record includes both the U. S. and the Canadian canal; the registered tonnage being 2,331,062 for the 2,025 U. S. craft passing, and 314,043 tons for the 559 Canadian craft. The chief items of east-bound traffic were 1,558,564 bushels of grain, 2,055,574 net tons of iron ore, and 2,358,267 bushels of wheat. The total east-bound freight was 2,491,019 net tons, and the west-bound, chiefly coal, amounted to 755,768 net tons The traffic for June of this year was 2,949,465 net tons.

◆

COINAGE DURING THE FISCAL YEAR of 1897 from the United States mint included a total of 102,521,641 coins, representing the following denominations: Gold, 170,473 double eagles, 724,562 eagles, 917,067 half eagles, 19,380 quarter eagles; silver, 4,158,780 dollars, 2,600,780 half dollars, 8,484,780 quarter dollars, and 12,560,780 dimes; base, 19,015,343 nickels and 53,871,696 pennies. The total value was $25,604,792.11, made up of $15,278,865 in gold, $8,836,443 in silver, and $1,489,484.11 in copper and nickel.

◆

TULARE LAKE, in Tulare Co., once the largest body of fresh water in California, is now dried up. About 1872 the lake was about 80 miles long and 35 miles wide at the greatest width, but its depth was never great. Irrigation was introduced into this region in 1872-75, and as the water was drawn off from its tributaries the lake began to shrink in size. In 1895 the lake was only 4 to 5 miles wide; and though it remained stationary in its dimensions for some time, lack of rainfall and increased demands for irrigation upon its former tributaries have finally prevailed, and Lake Tulare has dried up. Farmers are now reclaiming the land and putting it into shape for cultivation, and channels are being made and gates put in to control the waters that a rainy season may send into the old lake basin.

◆

THE BRUGES SHIP CANAL, now under construction in Belgium, was practically started in 1890, with the purpose of again connecting the town with the coast by a canal, with a port at Heyst. Work was actually commenced in 1896 by the Compagnie des Installations Maritimes de Bruges. The canal will be six miles long, 72½ ft. wide at bottom, 229 ft. at the water line and 26¼ ft. deep. The harbor will be formed by a long mole, running out from shore in a curve of 4,000 to 6,000 ft. radius; its end being parallel to the coast line and 2,788 ft. distant at low-water, and including an area of 270 acres. This jetty is solid to low-water mark; and then open for 984 ft. to facilitate the circulation of the tide and prevent deposits of silt and sand. From this opening to the end the jetty is being made of concrete blocks resting on iron caissons, each 82 ft. long by 24 ft. wide and varying in height with depth of water. These caissons are built on shore and floated to their sites, and then sunk by concrete in a dredged bed. The upper part of the concrete caisson blocks, each weighing from 2,500 to 3,000 tons, will be 3 ft. above low water, and on these will be placed 50-ton concrete blocks to a height of 28 ft. above high water. The lock at the end of the ship canal is controlled by a caisson-gate that can be slid into a recess at right angles to the canal in ten minutes, with electricity as a motive power. The work is to be completed in 1902, and the contract price is $7,793,805.

◆

TWELVE RIVER STEAMERS, built by Moran Bros. Co., of Seattle, Wash., were lately successfully sent from that city to the Yukon River, in Alaska, a distance of about 4,000 miles by sea. These boats were each 175 ft. long, 35 ft. wide, with a molded bow and a depth of 6½ ft. They are propelled by a stern paddle-wheel, in two sections, operated by two direct-acting steam engines, with 20-in. cylinders and 7-ft. stroke. They are fitted with a complete electric lighting plant and search-lights. The hulls are built of Puget Sound fir and the general construction is that of the usual vessel of this type. These steamers were to be delivered ready for service at the mouth of the Yukon River, and the Moran Bros. Co. undertook the task of sending the flat-bottomed vessels 4,000 miles by sea; and they have performed this unprecedented feat. The boats were built exceptionably strong with this voyage in view, and the start was made from Roche Harbor about May 25, under Mr. Robert Moran, twice Mayor of Seattle, accompanied by three stout ocean towboats and five coal barges. St. Michaels, near the Yukon, was reached on July 26; but the fleet had passed through two heavy storms; one vessel of the fleet was totally wrecked, but without loss of life, and some of the captains and crews having been frightened off by the earlier experience, the trip was made shorthanded. The route lay along the coast line all the way; but owing to the able management of Capt. Moran, ten of the steamers were delivered in sound condition and the other had sustained slight injury only.

◆

THE DISCHARGE OF THE GREAT LAKES is being determined by the U. S. Deep Waterway Commission, and Mr. Geo. Y. Wisner, M. Am. Soc. C. E., of the Commission, has furnished to the "Monthly Weather Review" the following summary of the results thus far obtained:

> Lake Erie.—The discharge into Niagara River for mean lake level will probably prove to be about 235,000 or 240,000 cu. ft. per second (instead of 250,000).
>
> Lake Superior.—The outflow, namely, the discharge through St. Mary's River, was determined in 1895, by Mr. Haskell, as 72,600 cu. ft. per second for mean lake level, instead of the 86,000 formerly adopted.
>
> Lake Michigan plus Huron.—The discharge of the St. Clair River will probably be diminished proportionately, viz., about 10 or 12%, reducing it from 225,000 to 200,000.
>
> Lake St. Clair.—The discharge of Lake St. Clair, through Detroit River, will fall below 200,000 cu. ft. per second for mean condition.
>
> As regards the run-off for Lake Superior, a fair estimate for the watershed is 40%, as the country surrounding the lake is very rolling and rocky. For lakes Michigan, Huron and Erie, 33% is about right.
>
> Adopting these values we have the following results:
>
> Lake Superior.—Total supply, 4.2 ft.; total discharge, 2.6 ft.; leaving 1.6 ft. for evaporation and errors in the estimates.
>
> Lake Huron plus Lake Michigan.—Total supply, 6.6 ft.; total discharge, 5.0 ft.; leaving 1.6 ft. for evaporation and errors in the estimates.
>
> Lake St. Clair plus Lake Erie.—Total supply, 27.8 ft.; total discharge, 25.5 ft. (adopting 235,000 ft. per second), leaving 2.3 ft. for evaporation and errors in the estimates. Discharge for Lake Huron is probably less than 200,000, which would increase this excess by 20% above the estimate for Lake Huron and decrease that for Lake Erie.
>
> Nothing more definite can be hoped for until the final report of the engineers who are now at work on the physics of the lakes and waterways.

◆

GRANULATED BLAST-FURNACE SLAG BRICK is desribed by F. W. Luerman in "Stahl und Eisen." Brick made from fluid slag is unsuitable as a building material, as it is impermeable to air and makes walls damp and the house unhealthy, says the author. On the other hand, brick made from granulated slag is five times as permeable as ordinary burned brick and much stronger. The fluid slag is granulated by passing it through water, and the silica is separated in a soluble condition so that it hardens quickly in the air and combines easily with caustic lime. These bricks are compressed and not burned; hardening takes place in from 6 to 8 days when about 10% of burned and slack lime is added; but longer for the simple granulated slag. The color of the brick is that of grayish-white sandstone, and as little mortar as possible is used in laying them. The weight varies with the dryness; usually 6,000 bricks make a 20-ton carload. Well hardened slag bricks are claimed to withstand a crushing load of 160 to 180 lbs. per sq. in.; they resist high temperature exceedingly well, and they can be used to advantage in chimneys and stacks. As to absorption, an ordinary burned brick is said to fill its pores with water in 12 hours, while it takes 190 hours to soak thoroughly a slag brick. The best brick is said to be made from puddling and Thomas pig-iron slag; Bessemer and foundry slag rank second. The cost of the slag-brick plant is placed at $5,000; and at several German works the cost of the brick is as low as $2.38 per 1,000. For 1,000 bricks from 6,000 to 7,000 lbs. of slag and 450 to 700 lbs. of burned lime are required.

◆

TO COUNTERACT THE EFFECT OF WATER upon lead pipe, Mr. Liebrich, in the "Zeitschrift fur angewandte Chemie," of July 26, recommends the use of carbonate of soda. He says the essential causes of this attack upon the lead are the joint action of oxygen, or of air and carbonic acid. The presence of bicarbonate of lime in the water limits the dissolving action by apparently interfering with the formation of carbonates of lead and zinc. Mr. Liebrich says that while the carbonate of lime diminishes the dissolvant action upon the metal, it does not arrest it completely. He, therefore, recommends the use of carbonate of soda, in a quantity that is sufficient to fix the carbonic acid, without rendering the water alkaline. He admits that when the water is in active circulation, as in the daytime, the quantity of lead in solution is extremely small; but he contends that in the morning, after the water has stood in the pipes all night, the dissolvant effect is very noticeable.

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The provision of special means for obtaining easy access to the superstructure of large bridges in order to perform the necessary work of inspection, painting and minor repairs is a matter which deserves greater recognition than it has generally received from engineers. European bridge builders have paid some attention to such features in a few instances, and in constructing the great arch bridge at Muengsten, Germany, which is described elsewhere in this issue, an unusually elaborate system of traveling stagings for reaching all parts of the metal work were designed and built by the engineers, but in America we cannot recall a similar structure where such devices have formed a part of the original work. This fact is all the more noticeable, because of the number of really large bridges which we have in this country where suitably designed inspection stagings or platforms could have been constructed at a very small cost, compared with the saving which they would have effected in future inspection and repairs. No engineer need to be told that it does not matter how well a bridge may have been designed and constructed in the beginning, it has to be inspected and minor repairs made frequently thereafter, and it must be periodically painted as long as it is in service. In nine cases out of ten, moreover, it depends upon the ease with which access can be obtained to the metal work which needs these attentions whether care is given to it at once, and when it will result in the greatest benefit, or whether it is deferred until the conditions are such that the work cannot be postponed any longer. It is in some respects one of the most creditable features of the Muensten bridge that every member of the whole superstructure, including the great arch span, can be easily reached by the engineers or inspectors who may for any reason desire to examine it.

◆

An interesting interview with Admiral Sampson upon the war appears in the Boston "Journal" for Aug. 21. As Admiral Sampson was formerly Chief of the Bureau of Ordnance in the U. S. Navy Department, and is a widely acknowledged authority upon all that pertains to gunnery and explosives, his opinions as here expressed are worthy of the fullest consideration. In the first place he says that this war has taught many things to naval experts throughout the world; and one of the chief of these is the absolute necessity of making warships fireproof. He would not stop at the fireproofing of wood, but recommends that ships should be built practically without wood at all. As to torpedo boats, he warns the people who believe that boats of this type have been shown to be practically useless in naval warfare, that torpedo boats have never had a really fair test in this war. Those in use have been faulty in construction and equipment; and, as a rule, necessary qualities have been sacrificed to speed until they are mere egg-shells. Admiral Sampson contends that torpedo boats have their legitimate uses, but they should be made stronger, and there is no good reason why they should exceed a speed of 25 knots. In regard to the contention that 8-in. and rapid fire guns did most of the execution at Santiago and Manila, it is pointed out that the Spanish fleet at Manila was lightly armored; and at Santiago, the lightly armored parts were exposed to destruction, and it was these portions that were so badly wrecked. When it comes to piercing armor the large-caliber guns must be used, for the armor-piercing qualities of naval guns are almost exactly proportioned to their caliber; for example, an 8-in. gun will penetrate 8-in. armor, but a 12-in. projectile is required to penetrate 12-in. armor. Admiral Sampson says that smokeless powder should be at once supplied to our warships for several reasons. The most important of these is the resulting increase in velocity, from about 2,100 ft. per second for ordinary powder, to about 2,500 ft. for the smokeless powder. The smoke from the combustion of ordinary powder is also a great disadvantage, as it interferes with the sighting of neighboring guns, and consequently decreases the accuracy and rapidity of fire. One remarkable point made by Admiral Sampson is that out of 12,000 men engaged on the fleets there have been only 20 casualities throughout the war; a record unprecedented in any previous naval war. He ascribed practically all of the success of our ships to the fact that the United States navy is always upon a war footing; and ships are handled with as much exactness and discipline, and target practice is carried out with as much care and precision as if an enemy were constantly in sight. The same remark applies to the distribution of supplies and to the care of the well and the sick on board of our vessels. This generally excellent physical condition of our man-of-wars men is most remarkable, when it is remembered that some of the crews were not off their ships for more than six months.

◆

Our attention has been called to an error regarding the names of the members of the Deep Waterways Commission, mentioned under "Notes in Detroit," in our issue of Aug. 18, 1898. Mr. Geo. W. Rafter, M. Am. Soc. C. E., is not a member of the Commission, but is its engineer in matters relating to the water supply of the canal, control of floods of tributary streams and allied matters. The third member of the Commission is Col. C. W. Raymond, M. Am. Soc. C. E., of the U. S. Engineer Corps.

◆

THE REDUCTION IN RAILWAY TRANSPORTATION RATES IN THE UNITED STATES.

The decrease in railway passenger and freight rates in the United States since 1867 is made the subject of a special report recently published by the Division of Statistics of the Department of Agriculture. With a wealth of figures which we have never seen equalled regarding the subject the report traces the reduction in rates of transportation for the railway system of the country as a whole, and also for a large number of individual railways in widely separated geographical locations. In no case subsequent to 1868 do the former figures represent less than one-third of the total railway mileage of the country, so that they afford a fairly true index of general conditions. Their value for deduction is further increased by the fact that they have all been reduced to a gold basis, and are, therefore, susceptible of absolute comparison, which is not the case with many similar statistics where this reduction to a common basis has not been made.

To enable our readers to make these comparisons for themselves the accompanying table has been compiled from the detailed figures given in the report. This table, as will be seen, shows both the average freight rate per ton mile and the average passenger rate per passenger mile for each year from 1867 to 1896, inclusive. The decrease in freight rates per ton mile since 1867 has been fully 60 per cent.; that for passenger rates has been smaller, but except for about ten years previous to 1878 these charges have also shown a continual decline.

Table Showing Railway Rates in Cents per Ton-Mile, and Cents per Passenger-Mile, from 1867 to 1896, Inclusive.

Year.	Average cents per ton mile.	Revenue cents per pass. mile.	Year.	Average cents per ton mile.	Revenue cents per pass. mile.
1867	1.925	1.994	1882	1.102	2.391
1868	1.810	2.164	1883	1.204	2.402
1869	1.709	2.144	1884	1.136	2,323
1870	1.889	2.392	1885	1.011	2.216
1871	1.789	2.632	1886	0.999	2.142
1872	1.846	2.521	1887	0.984	2.245
1873	1.613	2.486	1888	0.941	2.108
1874	1.520	2.544	1889	0.922	2.165
1875	1.421	2.378	1890	0.941	2.167
1876	1.217	2.183	1891	0.895	2.142
1877	1.286	2.458	1892	0.898	2.126
1878	1.296	2.573	1893	0.878	2.108
1879	1.513	2.484	1894	0.860	1.986
1880	1.232	2.442	1895	0.839	2.040
1881	1.188	2.446	1896	0.806	2.019

While the means by which this steady reduction in the charges for freight service has been brought about are in a general way at least familiar to most engineers, they will bear being briefly restated. It is not always fully realized that, noteworthy as the reduction in the charges for carrying freight has been, it has been made possible only by a far more remarkable decrease brought about in the cost of carrying it. This has been due to a variety of economies resulting directly and indirectly from the general mechanical and commercial development of the country.

The mere growth of the country itself, offering a larger and more varied traffic and enabling the railways to utilize their facilities more fully, has obviously been a very important factor in bringing about greater economy in cost of transportation. A part of the gain has also been due to consolidation, by which connecting railways have been enabled to administer their affairs more cheaply. But the most notable part has been due to improved methods of handling the traffic itself, which have been made possible by the general introduction of more powerful locomotives and larger capacity cars, and by improving the roadbed, track and structures to withstand these increased speeds and loads.

With the increased capacity for doing business, railway managers arranged their rates to secure this business, without which it is needless to say the improvements in rolling stock and track would have amounted to very little. Gradually the fact came to be realized by the railways that for obtaining freight to fill their cars any rate was a paying rate when it would cover the difference between hauling them empty and hauling them full, provided, of course, that such rates developed additional business which could be obtained in no other way. The universal recognition and observance of this principle has been the largest single factor in making possible the extreme low freight rates of America as compared with other countries.

Interesting evidence of how this reduction of empty car mileage has acted is found by comparing some of the figures given in the report from which the above table was compiled. These figures show that the increase in the average number of tons of freight hauled one mile per mile run by freight trains has been from 81 tons in 1867 to 111 tons in 1877, 155 tons in 1887, and 199 tons in 1896. In other words, the increase in the efficiency of freight train service has made it possible to perform twice as much transportation per mile of line in 1896 as in 1867, without increasing train mileage.

These factors, which have had so much to do in reducing freight rates, have not been equally influential in reducing passenger rates. The reasons for this are obvious upon a little consideration. It must be remembered, however, that though it may appear from the table that the decrease in the charges for the transportation of

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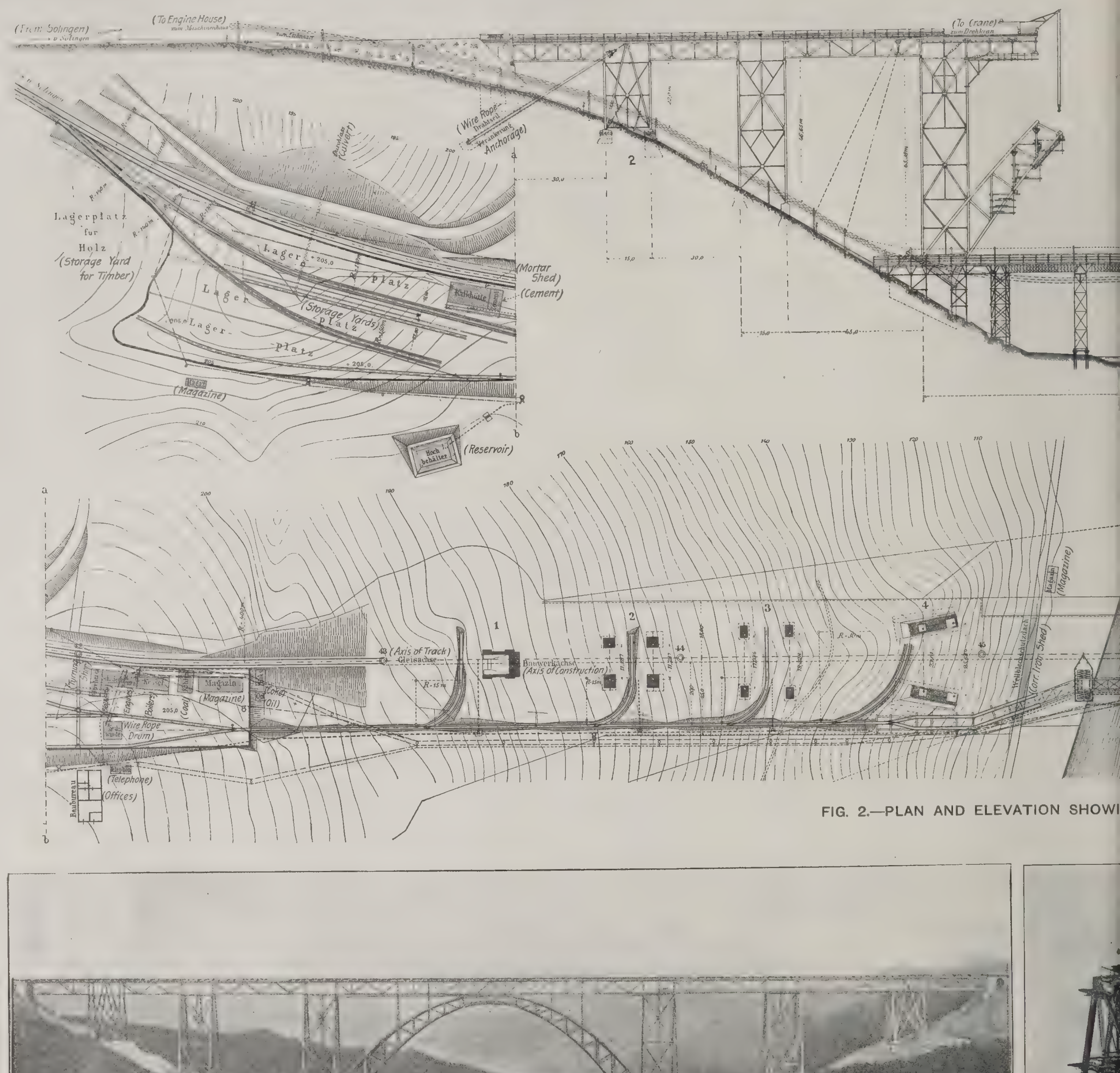


FIG. 2.—PLAN AND ELEVATION SHOWI

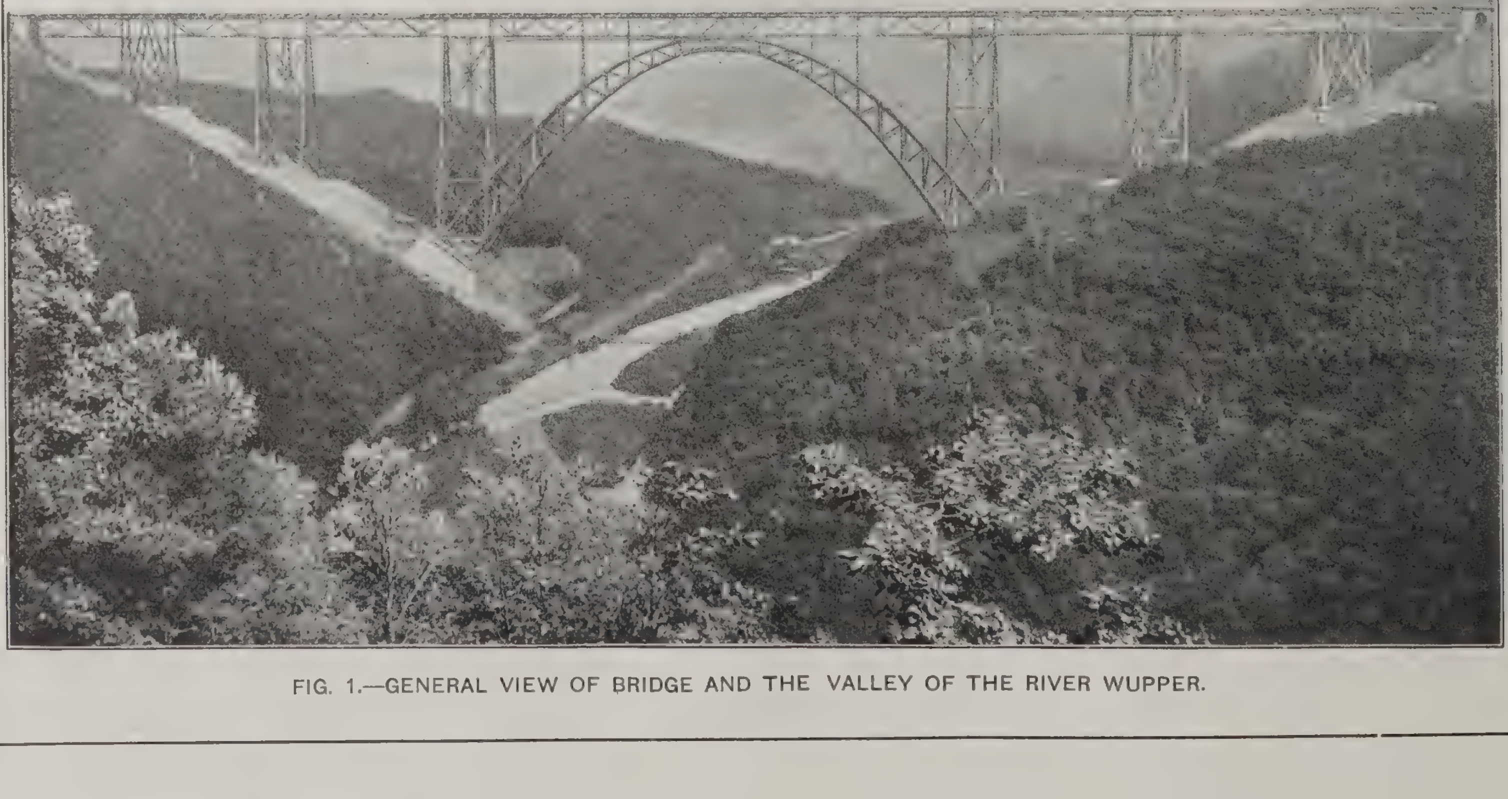
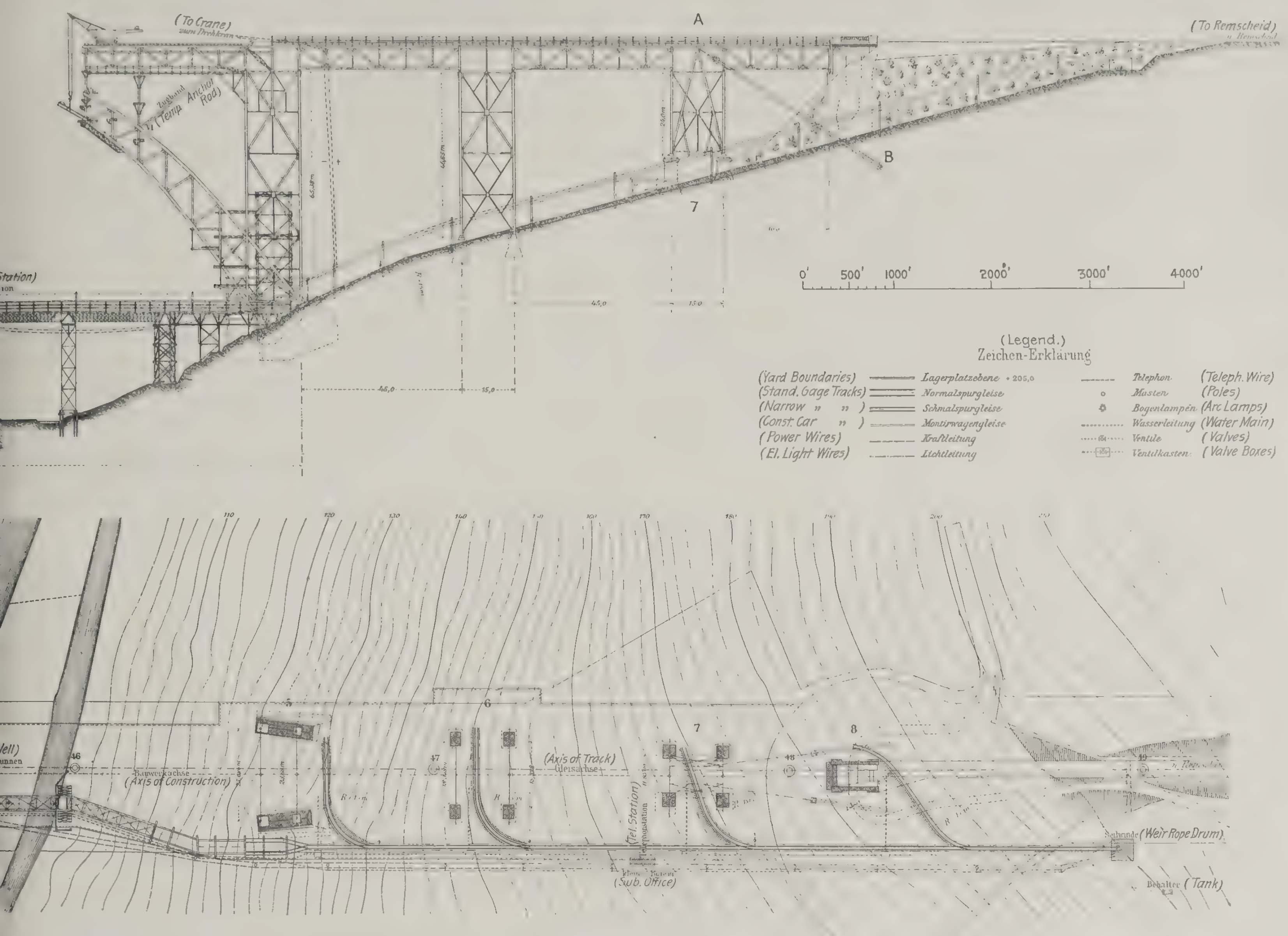
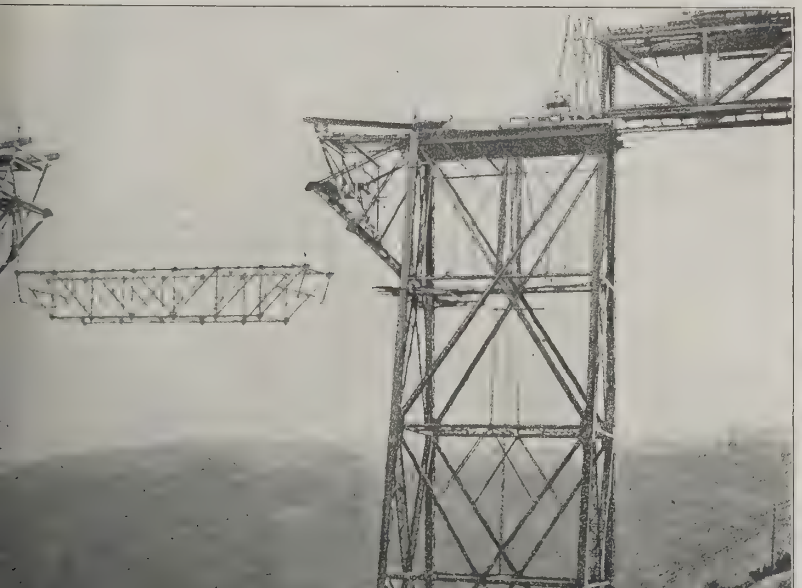


FIG. 1.—GENERAL VIEW OF BRIDGE AND THE VALLEY OF THE RIVER WUPPER.

FIG. 3.—VI



CTOR'S PLANT AND METHOD OF ERECTION.



ERECTION OF TEMPORARY STAGING TRUSS FOR VIADUCT SPANS.

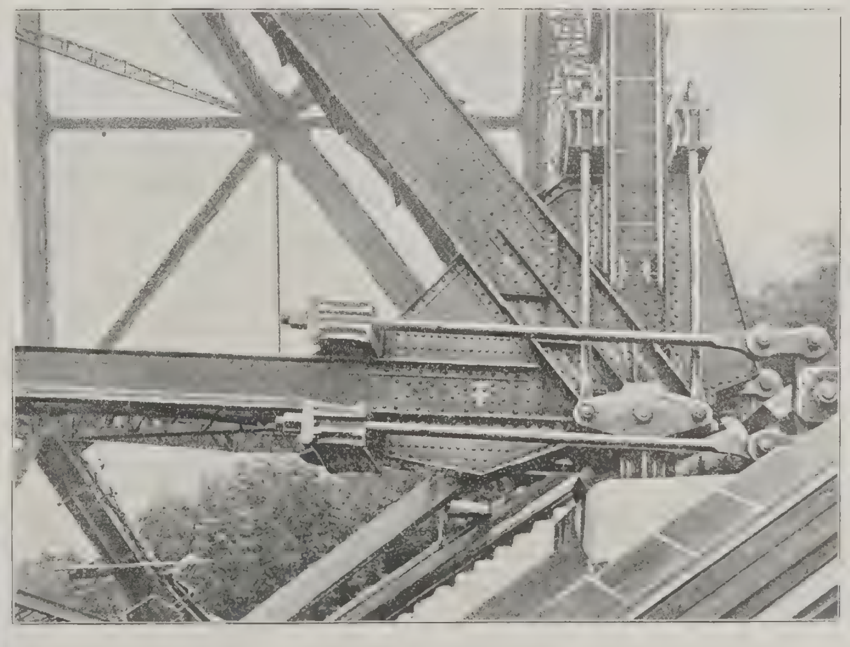


FIG. 4.—HYDRAULIC ADJUSTING DEVICE AT FEET OF UPPER CHORDS OF ARCH RIBS.

STEEL ARCH RAILWAY BRIDGE, MUENGSTEN, GERMANY.

Nuremberg Machine Works, Nuremberg, Germany, Designers and Contractors.

Mr. A. Rieppel, Engineering Director.

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passengers has not been as great as that in the charges for freight service, the thing which the traveler purchases with the money paid as fare has varied in his favor in every important element except that of distance. The dollar with which a man purchases transportation on a modern fast passenger train, provided with air brakes and automatic couplers, running over stone-ballasted track laid with 80 and 100-lb. rails, and on a line equipped with block signals, purchases vastly more than a dollar paid 30 years ago, or, for that matter, even a decade ago. Studied in this light the apparently small decrease in passenger rates shown by the table assumes a different aspect.

So much for the methods by which the enormous reduction in railway rates in a single generation has been brought about. There is another phase of the subject, however, which is not brought out in the report, and which deserves to be considered. Statistics show that while the decrease in the cost of hauling freight and passengers has been coincident with the reduction in the rates charged, yet this decrease has been relatively smaller. On the Lake Shore & Michigan Southern Ry., for example, where these figures have been compiled on a uniform basis for the past 28 years, we find the following relative figures of income, cost and profit per ton mile, and per passenger mile at five-year periods:

	Freight service			Passenger service		
	Income, cts.	Cost, cts.	Profit, cts.	Income, cts.	Cost, cts.	Profit, cts.
1870	1.504	.932	.572	2.612	1.708	.904
1875	1.010	.737	.273	2.378	1.824	.554
1880	.750	.435	.315	2.135	1.086	1.049
1885	.553	.399	.154	2.058	1.250	.808
1890	.626	.458	.168	2.246	1.492	.754
1895	.561	.410	.151	2.139	1.368	.771
1897	.545	.356	.189	2.018	1.407	.611

Similar results are obtained when we analyze the figures published during the last few years in the statistical reports of the Interstate Commerce Commission covering the railways of the United States as a whole, showing that the particular figures given above are fairly typical of general conditions.

It is clear that the approximation of cost and income shown by such statements cannot contiuue indefinitely; the time must come when no margin will exist for a further reduction of freight rates particularly. Already, in fact, there are prominent railway managers who assert that this point has been reached, and that if railway rates are reduced further, the saving must come by reducing wages, or by practicing false economies in maintenance and renewals. Evidently the questions whether this statement is justified, and whether we can expect no further reduction in railway rates are worth some trouble to answer.

First of all, it is worth while to inquire whether the influences which have done so much to reduce the cost of railway transportation in the past have lost all their power for securing further economies. It will be admitted, we believe, that consolidation yet has something in store for us by further reducing expenses due to competition and the duplication of managements. But without going so far as this, it may be seriously questioned whether the efficiency of train service has been brought to nearly as high a standard as it is capable of reaching. Notwithstanding the great growth in the proportion of paying load hauled by freight trains, the average train load to-day is far below what is possible with modern equipment. Few engineers also will be ready to admit, we think, that no further economies are to be expected from the mechanical and engineering department of our railways.

No such revolution probably will ever again be wrought as that which followed the introduction of the steel rail, but a multitude of minor economies, the possibilities of which are being found out and improved each year, are gradually reducing the important items of expenses coming under the heads of maintenance of equipment and of maintenance of way and structures. In both these departments, notwithstanding all the improvements which have been made, the tools for conducting transportation are in many cases those designed for other conditions than they are now called upon to meet, and they are not, therefore, economical. No better evidence of this is needed than the constant progress being made by railways in replacing their old structures with new ones more durable and better fitted to perform economically the duties which devolve upon them.

The opportunity open to the traffic department to increase the efficiency of train service has already been mentioned. As the natural resources of the country are developed and its industrial life enlarges, offering a larger traffic, it will become easier to realize this opportunity, and it cannot be doubted, we think, that the future will show a material reduction in the figures of empty car mileage. But it must appear to anyone who studies the subject, we imagine, that more direct economies than this are still possible in conducting traffic. Take for illustration the single item of expense resulting from the employment of the present army of freight solicitors and the multiplication of outside agencies bidding for competitive traffic. Men well informed in railway traffic affairs freely acknowledge that, taken as a whole, these outside solicitors and agencies cost the railways more than they come to, and the crop of wastes and worse evils which has grown up about the practice is familiar to every student of railway traffic affairs.

The opportunities for further economies in the cost of hauling freight which have been mentioned, and others which will doubtless occur to the reader, indicate then that there is still room to reduce freight rates, low as they already are. Not the least important result of this conclusion is the force with which it exhibits the enormous and almost controlling factor which the steam railway has become in the transportation system of the United States. This is a matter which the advocates of ship canals have been slow to understand. As we have frequently asserted, it has yet to be shown that, when all the factors are fully considered, the margin between the cost of shipping freight by canal and shipping it by rail, even at the present rates, will pay for the cost of constructing such enormous waterways. But instead of a system which has reached its limits of economy in transportation in its present schedule of rates, these canals will have to compete with one which is evidently capable of still further reducing the costs of operation. This is a matter, however, which we have already considered at length, and with this brief reference it will not be alluded to further here.

A suggestive comparison which may be made in conclusion is the relation between the average yearly farm prices and railway rates during the period covered by the large table above. It appears from quite complete figures covering this point, which are given in the report, that for any series of years except the earliest, which may be selected, the decline in railway rates has been greater than the decline in the price of any of the leading staple crops. Wheat has declined in price 23 per cent. less than railway rates, and hay fully 12 per cent. less. The cost of shipping anthracite coal from the mines to tide water is to-day less than half what it was in 1869, but its price has decreased only about 10 per cent. in the same period. Similar results are obtained when the reduction in price of other commodities is compared with the decline in the rates charged by the railways for transporting them.

LETTERS TO THE EDITOR.

Notes of an Engineer in Colorado.

Colorado Springs.—This city has long stood in a class almost by itself, as being the largest in the West dedicated almost exclusively to the health and pleasure seeker. It is also the headquarters for most of the large mining enterprises of the Cripple Creek mining camp near here. The city is the chief point for side-trips to the several summer and pleasure resorts in this locality, of which Manitou is the most important, and also for visits to many of the most noted scenic attractions in the country. The streets and avenues are of generous width, 100 ft. and 140 ft. respectively, and the city extends over much territory. Notwithstanding this, however, the street car system seems to have been planned more with an eye to reaching the outside resorts than to the convenience of the citizens, and though 40 miles of track run through and out of the city the facilities, except for two or three of the principal streets, are quite poor. The line to and through Manitou take almost seven miles of track, the one to Cheyenne Canon, five miles, and the one to Roswell (a suburban railway town north of the city) about the same. No center poles for the trolley wires are allowed, which makes an excessive length of cross-wire between the pole lines near each curb.

Colorado Springs was one of the first cities to use street car sprinklers. The American Street Sprinkling Car Co., of Worcester, Mass., is operating one of its sprinklers here, the local street car company furnishing the power and the motorman. The car has an arm about 20 ft. in length, extending out horizontally, to sprinkle from. The car holds about 2,500 gallons, which makes a very heavy load on the rails. During the summer it is started early in the forenoon and is kept going all the day.

The city has about 30 miles of sewers, ranging in size from 6 ins. to 21 ins. The separate system is used. It was begun in 1888, and 1½ to 2 miles are being added yearly. The city, as stated in Engineering News of Feb. 23, 1893, adopted irrigation as a means of sewage purification, and the method worked well until the summer of 1894 when the unprecedented flood, due to the cloud-bursts in this vicinity, overran the sewer farm on the banks of the "Fountain Qui Bouille" or Fountain Creek, practically ruining it. Since then the sewage has been turned directly into the creek. This has renewed the old conflict with the landowners below the outlet, and the city is now considering the question of using the sewage again for irrigation, but on a larger scale and further removed from the city than before.

Colorado Springs has a water supply system with many interesting features, which was described at length and illustrated in Engineering News of Aug. 27, 1896. The most prominent part that lacked completion at that time was the Strickler Tunnel, intended to divert the water from the west slope to the east slope of Pike's Peak. I learned that this tunnel was not near completed, though 2½ years had elapsed since the letting of the contract. On the east end the rock was extremely hard and wholly without cleavage, requiring the rock to be literally honeycombed with drill holes, which even then blew out a very small quantity of material at a blast. The rock at the west end, while not nearly so adamantine, was seamy, which in addition to interfering with drilling developed large quantities of water. This had to be pumped out, as the grade here is descending. A large crevice filled with water, sand and gravel was encountered last November, and this led to making a detour from the center line to avoid it. Early this July the same crevice was struck some 12 or 15 ft. to one side of the center line, letting loose such a flood of water that for a while it was reported that the undertaking would have to be abandoned. The contractor is now making a wider detour than formerly. While it is tedious work to go through these crevices it is not at all impossible.

The tunnel is to be 6,242 ft. long, and it is hoped to complete it this year. While it is realized that the contract price—$100,000—will not nearly compensate the contractor, he is intent on saving his $50,000 bond. The electrical disturbances of the power machinery, difficulty of getting in supplies, etc., have done much to delay the work.

The Beaver Creek 16-inch main is also being paralleled this year. This supply main carries water from the Middle Beaver Creek to the top of Seven Lakes Divide. During the past two years the distribution system of the city has been steadily extended. About all of the public engineering works of Colorado Springs have been designed and carried out by Mr. H. I. Reid, who was city engineer for 14 years until April 18 of the present year. Mr. Reid is now conducting a private office as civil and consulting engineer, in the Gazette Building.

Colorado Springs is connected with Colorado City and Manitou on the west by two steam and one electric railways, and also by the main wagon road and a scenic driveway called the Boulevard. Colorado City—half-way to Manitou—was the first capital of the territory, but sadly fell behind all its competitors. On the building of the Colorado Midland Ry. to Leadville in 1887, however, the location of the shops here gave this town new life. And within the past two years a large chlorination plant for the reduction of the gold ores from Cripple Creek has been built and put in operation. These are just southwest of the city, and four miles from Colorado Springs. The present haul of the ores from Cripple Creek is 50 miles, but mostly down hill. Much is expected of the electric railroad now building to give a more direct connection between these two towns and the Cripple Creek district. The projected line runs up Bear Creek Canon from here directly toward the mining camp in a southwesterly direction. The haul to the reduction works will then be 25 to 30 miles, and the intention is to have several other plants built by the time the road is completed.

Pueblo.—Pueblo has been called the "Pittsburg of the West." The city now has a population of between 35,000 and 40,000. The smelters, steel works and railways are the three classes of industries that furnish the bulk of the employment to the workingmen, and there are about 75 smaller manufacturing institutions. About 5½ million dollars per year are disbursed in wages, on account of the industrial enterprises, or about $15,000 for every day in the year.

The three smelters, the Pueblo, Philadelphia and Colorado, had an output in 1897 of over $20,500,000 in value of gold, silver, copper and lead. This was an increase of over $5,000,000 on the product of 1896, which was the largest heretofore. Notwithstanding the great decrease in the prices of the three latter metals since 1892, before the great slump in silver, the output of the smelters has nearly doubled since that year. The amount of gold turned out increased from 50,000 ozs. to 313,000 ozs., nearly entirely due to the discoveries at Cripple Creek. The Pueblo Smelting & Refining Co.'s smelter has the largest value of annual product of any in Colorado, and Pueblo for some time has held the position of the first smelting city in the world.

The Bessemer steel works of the Colorado Fuel & Iron Co. is the largest manufacturing plant in the state. When built in 1881 it was up-to-date in every respect, but most of the machinery became antiquated so that lately the plant has not been able to compete with those in the East having the modern improvements. In rolling rails, for instance, the handling has been almost entirely by hand. Early during the present year the plant was completely overhauled, and all of the old machinery except that in the nail mill and bolt factory was replaced by the latest improved. The rail mill, the plate mill and the structural steel mill have now the automatic mechanical devices for carrying the steel through from one set of rolls to the next without handling by hand. The rail mill has a maximum capacity of 1,200 tons daily. The rollers are of the interchangeable pattern and can be so adjusted as to handle structural iron when the demand for rails is not large enough.

It is recognized that the manufacture of structural and merchant iron and steel has become more and more the leading industry for rolling mills. About $450,000 were spent in these improvements. The whole plant will employ 2,500 men when all departments are running. In the mill 50,000-lb. and 20,000-lb. Shaw electric cranes are now used, where formerly only jib cranes were employed. For work in the yards there is a heavy track crane built by the Industrial Works of Bay City, Mich.

During 1897 the production of the works, in round numbers in pounds, was as follows: Merchant iron, 38,000,000; spikes, 4,300,000; bolts and nuts, 3,400,000; cast-iron pipe, 11,000,000; castings, 1,600,000. These were large increases over 1896, particularly in pipe. The pipe foundry does not run constantly like the others. It was idle for two months early in 1897, and for several months during the present year. The steel works supply material directly that is used over much of the West, and their product worked into forms for mining mill plants finds its way all over the globe.

The Colorado Fuel & Iron Co. is the largest of the kind in the West. It owns and operates many mines of coal and iron and numerous coke ovens in southern Colorado and New Mexico. A force of 7,000 men is employed. During 1897 the product of the mines and coke ovens was $4,000,000, and of the steel works $2,000,000 more; a total of $6,000,000. Of this about 84% was distributed as operating expenses. As stated before, the company produces its own iron and steel for the Bessemer works. The general headquarters of the company are at Denver.

Pueblo has some municipal works of considerable interest. The Arkansas River runs through the center of the city from east to west, thus dividing it into North and South Pueblo. This river is subject at times to tremendous floods, some of which have overflowed the business and manufacturing districts along the bottom lands and have done much damage. Large sums of money have been spent by the city in constructing earth and slag levees and masonry walls for confining the waters within proper channels. About $50,000 was spent on this work in 1897, and $50,000 more is being spent the present year. The official width of the river through the city is 152 ft. The large amount of slag available at the smelters here allows of its being used very cheaply for rip-rapping the earth embankments. This substance, as it comes from the slag-pots in a hemispherical form, allows of being broken up into shapes that make an ideal material for steep rip-rapping, the pieces being laid in snugly and with the smooth surface next to the water. Where stone masonry is used the walls are vertical and on the line of the established river channel. At three of the principal streets the river is spanned by "triple triangular" truss bridges, a very unusual type in the West. Two of these are made wide enough to include street car tracks. All are single span. There are three large viaducts crossing the numerous railroad tracks along the low lands, one of 1,050 ft. length and two of nearly 400 ft. length each.

Pueblo's sewer system, as originally planned, was the Waring, but it has been added to by different city engineers and changed a good deal. The city has a very fair electric street car system that reaches the more important parts of the city and suburbs. The return current is conducted through a continuous wire laid between the rails. No paving has been done by the city as yet. The railways have a fine union depot in South Pueblo, completed in 1890, and some of them also have separate depots on the North side.

Florence.—Florence is the center of the most important oil producing region in the West. All the illuminating oil for Colorado, Wyoming, Montana, Utah and New Mexico (except for the east part of Montana and southeast part of New Mexico) is produced here. The Continental Oil Co., of Denver, a branch of the Standard Oil Co., supplies this oil, buying it from the refineries at Florence. There are over a half-dozen companies around Florence that produce oil, but it all goes to two large refining companies here. The production of the wells for 1897 was about 2,000 bbls. per day, while the capacity is 3,500 to 4,000 bbls. In refining, about 33% to 35% of the crude oil is obtained as refined petroleum. There is a great demand for the fuel oil which is a residue from the distillation. In the past most of this has been shipped, but during the last year there has been a great demand for it by the several gold reduction works here, for roasting the Cripple Creek ores in the treatment by cyanide, chlorination and smelting processes; consequently much less fuel oil is now available for shipment. Lubricating oils, axle grease, etc., are other oil products.

The Florence oil fields were first opened up in 1885, and since then drilling has gone steadily on. The wells usually run from 1,500 to 3,000 ft. deep, and the oil has to be pumped from 1,500 to 2,300 ft. An 8-in. casing is first put down (generally to bed-rock), then a 5⅝-in. one, then a 4¼-in. one, and finally a 2-in. one, all inside of one another. The oil rises in and is pumped from the 2-in. pipe, and the gas rises between it and the 4¼-in. pipe. Gas is obtained at many of the wells, and the pump rod for oil is then at one end of the walking beam of the engine, while the gas is led to a pump cylinder worked by a rod at the other end. The engines for pumps are usually of 15 HP., the pumps of 14-in. stroke and forcing oil at each stroke. The gas is forced through mains and used by numerous families for domestic purposes. No wells producing less than 10 bbls. per day are pumped here, and they run from that up to 200 bbls. Each well has a derrick of standard style, 74 ft. high. The residuum or fuel oil is used as fuel at both the wells and refineries.

Extensive coal beds are also found in the vicinity of Florence, and the coal camps to the southwest of town ship all the way from 700 cars in the summer to 1,800 cars per month in the winter time.

Cripple Creek Mining District.—I took a run from Florence up to this famous district, spending two days at it. The center of the district is but a few miles southwest of Pike's Peak and just behind the front range of the Rocky Mountains.

The history of Cripple Creek reads like a romance. In 1859, during the Pike's Peak excitement, prospectors passed through this region, but being totally unfamiliar with the occurrence of gold in compounds they little realized the stores of latent wealth they were leaving behind. In 1891 attention was drawn to the gold that was occasionally found in its free state in the gulches. At that time this region was but a "cow pasture," taken up by rangemen who roamed the hills with their herds of cattle. The first substantial results were obtained in Poverty Gulch, running through the present city of Cripple Creek. Outsiders were slow to believe that any great wealth could come out of this district. The people of Colorado Springs were the first to put faith in the value of the discoveries, and as a consequence more persons of this town have been rendered wealthy by this district than in all the rest of the country besides.

The output increased from 10,000 ozs. in 1891 to 100,000 ozs. in 1893, but the public at large was still skeptical as to the permanency of the district. In the latter year the closing down of the silver mines resulted in a large influx of skilled miners and prospectors into this region. By the end of the year public opinion was changing, and during the next year much capital from Denver and the East was invested. The first railway reached the district in 1894. During this year, however, occurred the great strike, which curtailed production and development, though the former reached 3¼ million dollars.

Geologically considered, the district consists of a granite floor upraised in the central portion above the general average level of the surrounding country, in the form of a very irregular basin. In this basin at the close of tertiary time a violent volcanic outburst took place, which formed the present surface of the ground and resulted in the mineralization of the district. The fissures in the ground were filled with silicious waters carrying gold and other metals. So at the present time the gold is usually found in quartz veins surrounded by a porphyritic breccia. Owing to the action of the elements the ores have been oxidized to depths varying from 50 to 400 ft. below the surface. Below this zone the "live" ores are reached mostly in the forms of sylvanite and calaverite, chiefly the latter. The average composition of the ores shows the following proportions: Tellurium, 57.45%; gold, 40.6%; silver, 1.95%. The compound often has a steel-gray color, in appearance like a fracture. At the Independence Mine, where the vein is of very high value, it may be seen in bands of ¼-in. thickness spaced about 3 ins. apart. The number of mines shipping or in a position to ship at the close of 1897 has gradually increased to 250.

All the mines are worked or reached by means of shafts, and though several long tunnels are projected and under construction for the purpose of tapping the mines at greater depth (thereby serving for hauling out ore and for drainage) none has yet reached the depth to become a factor of much consequence. The production of the camp has increased year by year, until in 1897 it was over $12,000,000 or $1,000,000 per month. This placed Colorado in the front rank as a gold-producing state, her output for that year being between $21,000,000 and $22,000,000. California, which had before held the lead, contributed only $17,000,000 in 1897. Of the $61,500,000 produced in the United States, Cripple Creek is thus credited with one-fifth. At the present time the output is about $1,250,000 per month.

Of the leading mining companies here, the Portland stands at the head. It was incorporated March, 1894, with a nominal capital of $3,000,000 in $1 shares. The production increased from about $600,000 to over $2,100,000 in 1897. The Portland group comprises about 135 acres on Battle Mountain. The main working shaft is now down about 800 ft., has a hoisting engine of 600 HP., with drums of 14 ft. diam., and carrying a 6-in. flat rope cable, and has double-decked cages. The engine can hoist at the rate of 1,000 ft. per minute. The company pays regular dividends of 1% per month on the par value of the stock.

The Independence Mine, situated on the same mountain, is owned by W. S. Stratton, the eccentric millionaire, and its returns are not made public. Its output has averaged over $1,000,000 for the past three years. The Victor Mine is the oldest of the large producers, and its product has averaged nearly $500,000 the past three years. The average value per ton of ore from 47 of the principal properties has varied from $30 up to $350, this latter being the average value of ore from the Orizaba Mine, from which 353 tons have been shipped. The average value of milling ore at present is $25 to $30 per ton, of smelting ore (which is shipped much farther than the last) is $75 to $90. About one-third of all the ore is sent to the smelters.

During the early days of the camp a great mistake was made in assuming the ores to be free milling, and a number of stamp mills were erected which were found to save only a portion of the value in the ores. Some of these, however, are still run to treat ores of too low a grade to justify treating by any other process. But the chlorination and cyanide processes are now used nearly entirely for all ores not rich enough to send to smelters.

The first named process is more regular and adapted to a larger variety of ores than the second, but is more expensive. In cyanidization, as well as in chlorination, roasting is used on the Cripple Creek ores before leaching, except for the oxidized ores near the surface. For the sulphide and telluride ores roasting is necessary. Ores of whatever kind have to be roasted in the chlorination process. The chloride of lime and the sulphuric acid required in the chlorination process are much more expensive than cyanide of potassium, and the process also requires lead-lined vessels. The chemistry of the cyanide process is more complicated, however. For treating the Cripple Creek ores there are at present 9 reduction plants in operation, five using the cyanide and four the chlorination process. Five of these plants are at Florence and vicinity, one at Colorado City, one at Gillette, and the other two in the heart of the camp. The Metallic Extraction Co.'s cyanide plant, near Florence, has a capacity of 400 tons per day.

At Colorado City is the great chlorination plant of the Colorado-Philadelphia Reduction Co. Over a dozen buildings contain the machinery for the reduction of the ores, and the capacity is 250 tons per day. The process here is as follows: After being finely pulverized at the roll house, the ores are conveyed to the roasting department, 90 × 160 ft., where they are passed through two immense Ropp roasting furnaces, each with a capacity of 150 tons per day. From here they pass to the cooling room and thence to the chlorination department or barrel house, 68 × 150 ft. Here are 10 revolving barrels, each 6 ft. in diam. by 14 ft. long, of iron lined with lead, and with a capacity of 10 tons to each charge or 30 tons per day. In these the ores are chlorinated through the affinity that gold has for chlorine gas, the gold being extracted and converted into a chloride of gold solution. In this form it passes through a series of sand filters, from which the liquor passes into the eight immense tanks of the settling and precipitating departments, where any remaining slimes are settled. The clear liquor is then decanted into six precipitating vats below, where the gold is precipitated by the use of sulphureted hydrogen of gas, producing gold sulphide. This is pressed and dried and is then ready for melting in the crucible furnaces. From these the gold bullion—950 fine—is shipped for refining at the government assay offices.

The growth in population of the Cripple Creek district has kept pace with the mining development, and as a result a community numbering over 40,000 souls is now included within its bounds, where a few years ago less than 100 persons (all males) were to be found. The city of Cripple Creek—the metropolis of the district—contains between 15,000 and 20,000 people. In April, 1896, nearly the whole of the city was destroyed by two fires that rendered 15,000 people homeless. It has since been rebuilt, and the shacks so characteristic of a new mining camp replaced by substantial buildings.

The city has an excellent water-works supply. The water is obtained from Pike's Peak and conveyed through an 8-in. pipe line for 5 miles to a reservoir above town, which gives about 80 lbs. pressure. The distribution system consists of 8-in., 6-in. and 4-in. pipe. The works were built by and owned by the Michigan Pipe Co., of Bay City, Mich., who used their bored log pipe (wrapped spirally with flat bands) of the Wyckoff pattern. Iron is used only at T's, etc. The pipe was made at their factory. After being bored, it was dipped in coal tar, then banded, then dipped again and rolled in sawdust, which last protects the tar and allows it to be handled. This pipe is well suited for this country on account of rock being so near the surface, as it can be laid in a much shallower trench than iron pipe as regards freezing. It came in lengths of about 10 ft. Water rates are reasonable, the charges for a six-room house being only $22 per year.

The other principal town of the district is Victor, which, though only four years old, has a population of 8,000 to 10,000. This is more nearly a typical mining town than Cripple Creek, most of the large mines (including the Portland and Independence) being located quite near by.

Power for operating the mines has become quite an item of expense in the Cripple Creek district. All coal has to be hauled in, and there has been presented the interesting problem of whether it would be cheaper to (1) bring fuel in from the coal camps, 25 or 30 miles off, and 4,000 to 5,000 ft. lower, or (2) to generate electricity right where the coal is produced and transmit it for power purposes to the mining camp. One large mining corporation has decided on the former, and is building a plant of its own at Goldfield—about a mile from Victor. It will have three 750-HP. steam engines. The Colorado Electric Power Co. believes there is money in the latter method, and it has lately completed a plant for a 26-mile transmission from Canon City to the center of the camp.

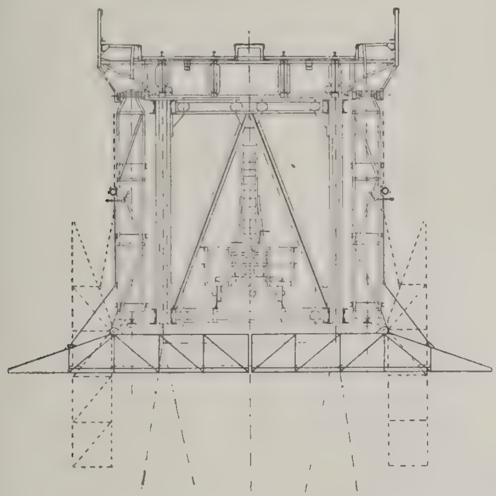


Fig. 5.—Traveling Inspection Platforms for Truss Spans; Muengsten Bridge.

Canon City is eight miles west of Florence, at the mouth of the Canon of the Arkansas River, and adjoining the famous Canon coal fields. Here on the river bank is the power house plant. The main building is 100 × 106 ft., and the converter building 27 × 72 ft. The principal machinery consists of three Hamilton-Corliss engines of cross-compound type; three three-phase 470-K-W. generators and four converters. All electrical machinery is Westinghouse make. Power is furnished by four 300-HP. Heine boilers. Room is left for a duplicate plant to be erected at the west end of the present buildings, when needed. Two shifts of ten men each are required to operate the plant. The direct distance by the transmission line to distributing station No. 1 (on the south slope of Bull Hill and between Victor and Cripple Creek) is 26 miles. The voltage is reduced here and lines are run to the different consumers.

An electric railroad called the Canyon City & Cripple Creek Electric Ry. has long been projected to connect the two places by a line much shorter than possible with a steam road, but it does not seem to have made much progress yet.

Resuming the journey to Leadville, Canon City (already noted) is first passed. The state penitentiary is located here. Several years ago an attempt was made by the state to utilize the labor of the convicts here in the construction of a large irrigation canal, called State Canal No. 1. A line was located, tapping Arkansas River within the mouth of the canon and running east as far as Pueblo. A large amount of work was done and a great expense incurred in outfitting the convicts, transporting them to and from the work and in guarding them. But finally a halt was called, as it was claimed that there would be no unappropriated water left for the canal even if built. A committee of the Tenth General Assembly was appointed to investigate and report as to the advisability of continuing work, which made a very able report advising abandonment of the project. This was done, and the only evidence now left of the work are the numerous tunnels and cuts in the rocky side of the canon near the town. W. P. H.

Salt Lake City, Utah, Aug. 1, 1898.

GRAVEL ROADS aggregating 40 miles in length are being built in Lake county, Ind. The excavation and grading is done by scrapers and then a bed of furnace slag is laid and covered with a top dressing of gravel, making a total thickness of 11 ins. at the middle. Formerly a 12-in. bed of gravel was used, but the slag costs only about half as much and makes a better foundation. The railways are assessed for taxes for this work, and in some townships pay 75% of the cost of the work, which may account in part for the people's desire for good roads. Mr. John Halloran, of Hobart, Ind., is the contractor for the work.

DOUBLE TRACK STEEL ARCH RAILWAY BRIDGE, MUENGSTEN, GERMANY.

(With double-page plate.)

The Muengsten Bridge, some of the principal features of which we illustrate on our double-page plate this week, was built to avoid a long detour in the line of railway connecting the towns of Solingen and Remscheid, lying on opposite sides of the deep gorge of the River Wupper, in Prussia. At the point where the bridge crosses it, this gorge is about 350 ft. deep, with sides inclined from 18° to 47° to the horizontal, and the parabolic arch springs from points on the opposite banks about 590 ft. apart, The stream itself is of small size, and offered little obstruction to erection.

Plans were submitted by four different engineering firms for the bridge, but the one finally adopted was that of the Nuremberg Machine Works, Ltd., Mr. A. Rieppel, Engineering Director. From a description by Mr. Rieppel in "Zeitschrift des Vereines Deutscher Ingenieure," Mr. O. J. Marstrand has abstracted the following information relating to the design and erection of the bridge. The accompanying illustrations have also been reproduced from the columns of the same publication.

The bridge, Fig. 1, is designed for two tracks and consists of a parabolic arch spanning the center opening and flanked on each side by steel viaduct approaches. The span of the arch c. to c. of abutments is 170 m. (357.8 ft.). On the Remscheid side the viaduct consists of three trestle towers, carrying one 30-m. (98.4 ft.) and two 45-m. (147.6 ft.) truss spans, and on the Solingen side of the same number of towers carrying two 30-m. and one 45-m. spans. The dimension of the tops of the towers in the line of the axis of the bridge is 15 m. (49.2 ft.). The total length of the bridge is 465 m. (1,525 ft.). Over the center span the continuation of the viaduct truss is carried by verticals to the arch proper below, spaced 30 m. and 15 m. apart, and by the crown of the arch itself.

The parabolic arch ribs have a web system of vertical and diagonal members forming a rib 4 m. (13.1 ft.) deep c. to c. of chords at the crown and 12.206 m. (40.05 ft.) deep at the abutments. The distance between the verticals or the panel length is 7.5 m. (24.6 ft.) The arch ribs are inclined inward 1 to 7 to the vertical, so that they are 5.0 m. (16.4 ft.) apart c. to c. at the crown; 25.685 m. (84.27 ft.) apart at the feet of the inside ribs, and 23.681 m. (77.69 ft.) apart at the feet of the outside ribs. The lateral wind-bracing is attached to the lower ribs, while the wind-strains in the top ribs are resisted by transverse bracing between the verticals; in the end panels this bracing is carried to the base of both the upper and lower ribs.

The sides of all towers, in the line of the bridge, are inclined to the vertical 1 to 7, and are 5 m. (16.4 ft.) apart transversely at the top. The vertical sides are 15 m. (49.2 ft.) apart. Both sides are braced by horizontals and cross diagonals. At the feet of the towers, and in the planes of the abutments of the arch, no horizontal bracing is employed. Towers Nos. 2 and 7 are designed as anchorages; the top chords of the trusses, which are continuous through several spans, being firmly attached thereto. The posts over the arch rib lie in the same plane as the sides of the arch. They are braced transversely, and are capable of transmitting lateral forces from the bridge above through the system of wind-bracing just described.

The viaduct spans, 15, 30 and 40 m. long, have vertical trusses 6.0 m. (19.7 ft.) deep and 5 m (16.4 ft.) apart. They are divided into panels 7.5 m. (24.6 ft.) long by a single system of triangulation. The principal horizontal bracing is between the top chords, and is independent of the roadway construction. In the 30-m. and 45-m. spans the lower chords are, however, also braced horizontally. At the end panels the wind-strains are carried from the top chord to the towers by transverse bracing.

The posts carrying the trusses over the arch are so connected to the bottom chord of the bridge that it is free to move and that no uncertain strains may be transmitted at these joints.

The trusses are made continuous over the approach bents on both sides, and over the arch. They rest on rollers on the top of the bents and at the abutments, but are rigidly connected at bents 2 and 7 and at the crown of the arch. Over the inside faces of bents 4 and 5 provision is made for the expansion of the top chord by separating the adjoining ends.

The floor system is so constructed of beams and stringers that the strains due to applying the train brakes and other longitudinal strains are transmitted through the stringer lying directly over the top chord to the latter, while the horizontal strains pass through stringers and diagonals into the floor beams at the panel points, and are thence carried into the chord system. All material in the superstructure is basic steel, the aggregate weight being about 5,100 t. (5,622 tons).

The methods adopted in erecting the steel work are of particular interest. In a general way this work may be divided into the erection of (1) the towers and the viaduct trusses, and (2) the arch ribs and the trusses carried by them.

Previous to beginning erection the contractors built a very extensive plant for carrying on the work. On the Solingen side of the gorge, Fig. 2, was established a yard for storing material and for the various necessary shops and store houses, power plant, etc. From this yard a railway ran down into the gorge parallel with the bridge site. A similar railway extended up the opposite side of the gorge, and a temporary bridge spanned the river and bottom of the gorge between the two railways. Spur tracks from the railway lines handled material to the sites of the several abutments and tower foundations. These railways were operated by wire cables run by electric motors placed at the top of the gorge on each side, and getting their power from the central power plant. An electric lighting system, a telephone system, water supply pipes, etc., were constructed as shown by Fig. 2, which also explains the general method of erecting the superstructure.

To erect the viaduct towers a timber staging was carried up inside the steel work on which was mounted the necessary hoisting apparatus for handling the material. The viaduct spans at the extreme ends were erected by means of falseworks built up from the ground, and the intermediate spans by means of temporary staging trusses hung between the towers. These staging trusses or spans were first erected on the ground and then hoisted to the tops of the towers and hung from temporary cantilevers attached to the towers as shown by Fig. 3. Both the cantilevers and the staging span were made of steel, and upon them the permanent span was erected as it would be upon a falseworks resting on the ground. Altogether six spans of the viaduct were erected by this method.

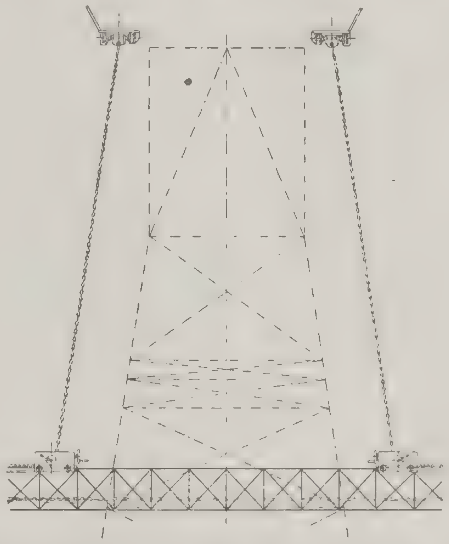


Fig. 6.—Traveling Inspection Staging for Arch Span; Muengsten Bridge.

The arch ribs and the truss spans supported by them were erected simultaneously. Referring to the elevation, Fig. 2, it will be seen that the extreme end towers were anchored by adjustable anchorages to the banks of the gorge. Between these two towers the trussed spans are continuous and serve as anchor rods. Therefore the truss span over the arch was built out as a cantilever as far as the first vertical. The arch ribs were also built out as cantilevers to the same point, when the anchor rod A B was attached as shown by Fig. 2. These anchor rods on each side held the arched structure until the closure at the center relieved them. Material was handled by revolving cranes running on top of the trussed spans. The temporary stagings for riveting are indicated by Fig. 2. The final adjustment was made by means of hydraulic jacks placed at the crown of the arch and at the upper arch chord abutment connection. This adjusting device at the abutment is shown by Fig. 4. Hydraulic jacks were also arranged to tighten or loosen the anchor cables.

One other feature of the construction which deserves to be noticed is the rather elaborate permanent constructions to be used in the future inspection, repairing and painting of the bridge. The general nature of these devices is shown by Figs. 5 and 6, Fig. 5 showing the traveling staging and ladder for examining both the exterior and the interior of the truss spans supported by the arch and the towers, and Fig. 6 the corresponding device for examining the metal work of the arch proper. For the truss spans two forms of travelers are employed, one running inside the trusses and the other outside, each being intended to reach the corresponding part of the metal work. Two of the outside travelers are employed, each having a range of travel of one-half the length of the bridge, but the one inside traveler is operated the whole length of the trussed structure. For the arch proper the traveler is simply a foot bridge suspended by chains from a carriage running on the bridge tracks. By means of windlasses these chains are shortened or lengthened so as to bring the foot bridge at the proper height for easy access to the intrados of the arch at any point in its length.

Construction was begun on the superstructure of the bridge in the spring of 1895 and the structure was completed ready for the passage of trains on July 3, 1897. Under a test load, consisting of three locomotives followed by 40 loaded cars on each track, the arch span showed a maximum depression of 15.4 mm. (0.616-in.). The cost of the bridge was 6,147,830 fr. ($1,230,000).

THE HIGHEST CHIMNEY IN AMERICA.*

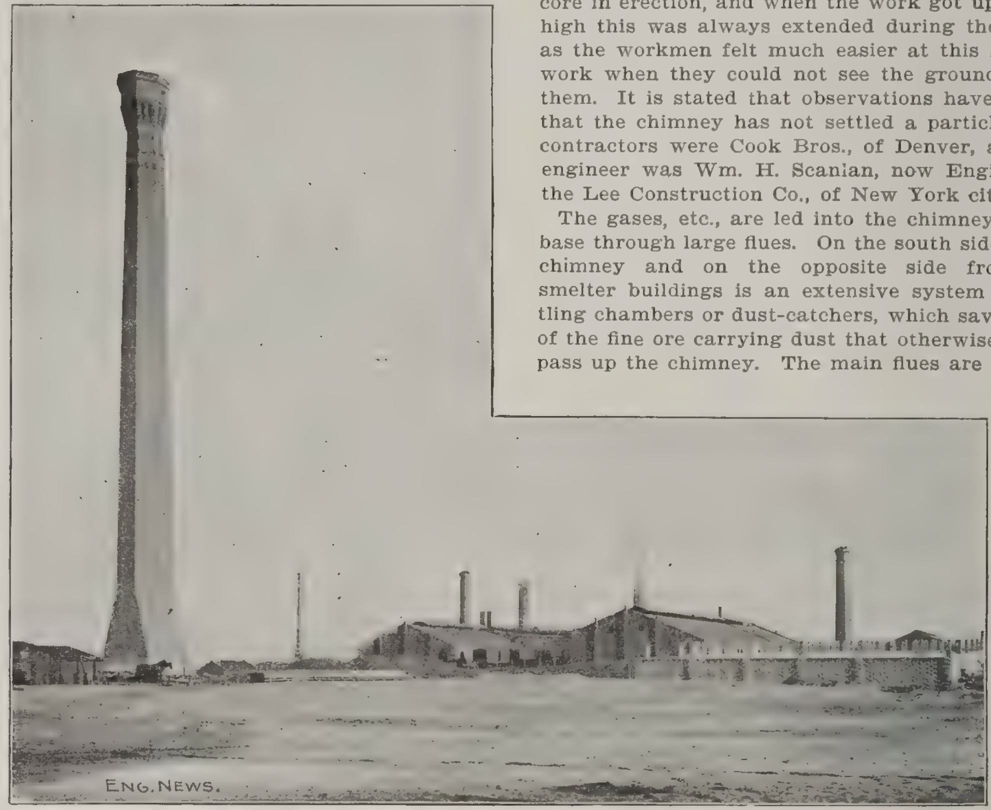
By W. P. Hardesty, C. E.

At Denver, Colo., is a brick chimney which is exceeded by but four in the world in height or size. This is the stack of the Omaha and Grant Smelter, which serves to carry away the poisonous fumes and gases generated in the process of smelting the precious ores at this extensive plant. The works here cover nearly 50 acres of ground, and before the panic of 1893 about 550 men were regularly employed. At present about 350 men are employed. After stacks of the ordinary size had been used for many years, it was decided that it would be better to erect one stack of great height, having sufficient size and draft to answer for all needs.

The present chimney has the following main dimensions: Height above the stone table at ground, 352 ft. 7 ins.; size at base, 33 ft. square; size at throat, 20 ft. in diameter; thickness of outer shell at base, 48½ ins.; at top, 13 ins.; thickness of core at base, 26 ins.; at top, 9 ins.; diameter flue, 16 ft.; foundation, 56 ft. square by 16 ft. deep.

In building, the ground was first excavated to the depth deemed sufficient, when about 2 ft. of water stood in the bottom. The material in the bottom was coarse sand. Then 8 ft. of cement concrete was put in, in which was placed a grillage of steel rails laid nearly together and crossing at right angles. These beams were used only in the masonry under and outside of the rings of masonry supporting the shell and core of the chimney. On top of the concrete was laid 8 ft. of brick work, stepped in about 1 in. at each course. On this was laid a stone footing 2 ft. thick, reaching above the ground level, and on this was built the chimney.

The shell or outer part of the chimney does not assume the regular octagon shape until 64 ft. high, the corner starting to batter off at about 25 ft. up. The exterior lines of the chimney are designed with an entastis or slight swelling, as shown. Two heavy systems of tie rods run through the chimney near its base in each direction. Where the main flue conveying the gases enters the chimney, an arch is sprung over the opening. The clearance between the flat sides of the shell and the outside of the core varies from over 2 ft. at the bottom to only 3 or 4 ins. at the top. At intervals along the sides are placed rollers to brace the core against the shell and to allow of the movement of the former in expansion. The expansion of the core when heated was estimated at about 4 ins. The draft to be expected under probable conditions as to temperature was taken to be equivalent to that caused by a pressure of 1-10 lb. per sq. ft.



THE HIGHEST CHIMNEY IN AMERICA.
Built for the Omaha & Grant Smelter, Denver, Colo. W. M. Scanlon, Architect; Cook Bros., Contractors.

The loads, etc., were taken as follows: Normal pressure on earth base, 3.2 tons per sq. ft.; total weight above foundation (on stone footing), 12,376,500 lbs.; pressure at base of shell, 148 lbs per sq. in.; at base of core, 160 lbs.; pressure on leeward side of base during a tornado, 295 lbs. per sq. in., and at windward side, 5 lbs., area exposed to wind pressure, 9,230 ft. Total wind pressure during a tornado, 369,200 lbs. Portland cement was used in the foundations, but above the larger part of the mortar was lime, and the proportion of lime was increased toward the top.

An average mixture was where a soft paste, made of about 2 bbls. of neat cement, would be added to and worked into a batch of lime mortar of about 6 times its volume, and then be hoisted to be used. All the bricks used were hard-pressed, from Golden, Colo. Push joints or shove joints were made in laying the brick, to secure the most compact work possible. At about 30 ft. below the top of the brick work, where the outer shell is but 13 ins. thick, the expansion for the cap begins. It swells out to a crown 5 ft. thick, and this was only done by using hoops and clamp rods built into the brick work to hold it together. The cast-iron cap weighs 22,000 lbs.

At intervals of 20 ft. in height, bands of 4-in. × ½-in. iron set vertically were built into the brickwork, four inches inside of the outer face.

An iron ladder is provided leading from the bottom of the space between the core and the shell to a trap door on top of the cast-iron cap.

The cast-iron cap has a lightning rod consisting of a ¾-in. galvanized wire rope securely fastened to it, the lower end of the conductor being fastened to an iron plate buried in the earth below the level of the ground water.

The following is a statement of the material actually used in the structure:

Brick	1,943,000
Lime, bushels	8,480
Portland cement.	Bbls.
1. In concrete	775
2. In stone work	26
3. In brick work	707
Total	1,508
Sand	2,331 cu. yds.
Railroad iron in concrete	48,960 lbs.
Beams under openings	2,574 "
Wrought-iron bands and rolls	23,180 "
C. I. plates and cap	56,474 "
Total	131,188 "

The chimney was built in 1892, the work being done in 120 days, and the total cost was $53,000. A scaffold was built up the interior of the flue or core in erection, and when the work got up pretty high this was always extended during the night, as the workmen felt much easier at this scaffold work when they could not see the ground below them. It is stated that observations have shown that the chimney has not settled a particle. The contractors were Cook Bros., of Denver, and the engineer was Wm. H. Scanlan, now Engineer of the Lee Construction Co., of New York city.

The gases, etc., are led into the chimney at the base through large flues. On the south side of the chimney and on the opposite side from the smelter buildings is an extensive system of settling chambers or dust-catchers, which save much of the fine ore carrying dust that otherwise would pass up the chimney. The main flues are 11 × 14 ft. There are altogether about two miles of flues and underground passages leading to the chimney from all parts of the plant, and the connections are such that all the smoke and gases from all the operations can be conducted to the one chimney.

STATISTICS OF RAILWAYS IN THE UNITED STATES FOR THE YEAR ENDING JUNE 30, 1898.

The statistician of the Interstate Commerce Commission, Prof. Henry C. Adams, has furnished to the press an advance abstract of the forthcoming tenth annual report of the commission, and from it we take the following figures of principal interest to our readers:

Mileage.—The total railway mileage in the United States on June 30, 1897, was 184,428.47 miles, there being an increase of 1,651.84 miles, or 0.91% during the year. In round numbers, Alabama shows an increase of 117 miles; Arkansas, 192 miles; California, 219 miles; Louisiana, 161 miles, and Michigan, 123 miles. The increase in mileage in the other states and territories in which an increase occurred was less than 100 miles. In a few states, as usual, a decrease in mileage is shown. The aggregate length of railway mileage, including all tracks, on June 30, 1897, was 243,444.41, the increase being 3,315.29 miles. The length of second track was 11,018.47 miles; of third track, 995.79 miles; of fourth track, 780.48 miles. The mileage of yard track and sidings amounted to 46,221.20 miles. Excepting yard track and sidings, about 32% of which are laid with iron rails, substantially 95% of the railway tracks in the country are laid with steel rails.

Equipment.—The total number of locomotives in service on June 30, 1897, was 35,986, the increase in number as compared with the preceding year being 36. Of this number, 10,017 were passenger locomotives; 20,398 freight locomotives, and 5,102 switching locomotives. The number of locomotives not classified was 469. The total number of cars of all classes reported in service on the date named was 1,297,480. The corresponding number for the previous year was 169 greater. Of these cars, 33,626, or 623 more than for 1896, were assigned to the passenger service; 1,221,730 were assigned to freight service, indicating a decrease of 157 during the year; and 42,124 were assigned to the special service of the railway companies.

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*The four chimneys which exceed the Omaha and Grant chimney in height, according to Kent's "Pocket-Book for Mechanical Engineers," are at Hutte, Saxony, 460 ft.; two at Glasgow, Scotland, 454 and 435 ft.; and Bolton, England, 367½ ft.

During the year ending June 30, 1897, the railways in the United States used 20 locomotives and 708 cars per 100 miles of line. Taking the United States as a whole, 48,861 passengers were carried and 1,223,614 passenger-miles accomplished per passenger locomotive, and there were 36,362 tons carried and 4,664,135 ton-miles accomplished per freight locomotive. All of these items show a decrease as compared with those of the preceding year. The number of passenger cars per 1,000,000 passengers carried during the year under consideration was 69, and the number of freight cars per 1,000,000 tons of freight carried was 1,647. It should be understood, however, that this average does not include such cars, mainly in the freight service, as are owned by private parties, for the use of which the railways paid during the year approximately $11,000,000. Including in the term equipment both locomotives and cars, it is found that the total equipment of railways on June 30, 1897, was 1,333,466. These figures are 133 less than on June 30, 1896.

Of this total number 525,286 were fitted with train brakes, the increase being 76,432; and 678,725 were fitted with automatic couplers, the increase in this case being 133,142. These increases are somewhat smaller than the corresponding increases for 1896. It should be noted, however, that the number representing the increase in equipment in that year was over 27,000. Further details as to equipment on June 30, 1897, show that the number of passenger locomotives fitted with train brakes was 9,899, or 83 more than the preceding year. The number of freight locomotives so fitted was 18,796, or 875 more than the preceding year. The number of switching locomotives fitted with train brakes was 3,666. The number of passenger locomotives fitted with automatic couplers was 4,687, the increase with respect to 1896 being 184. The number of freight locomotives fitted with automatic couplers was 4,192, the increase being 819. The number of switching locomotives fitted with such couplers was 741, or 147 more than for 1896. The number of passenger cars fitted with train brakes on June 30, 1897, was 33,078, and the number fitted with automatic couplers was 32,661, the increase in the one case being 665 and in the other 815. The number of cars in freight service fitted with train brakes was 453,688, or 74,630 more than on June 30 of the previous year. The number fitted with automatic couplers was 629,399, indicating an increase of 129,166. Of the total cars in service 492,559, on June 30, 1897, were fitted with train brakes, and 668,937 were fitted with automatic couplers, the increase for the year in the former case being 75,237; in the latter, 131,989.

Employees.—The number of men employed by the railways of the United States on June 30, 1897, as reported, was 823,476, or 449 men per 100 miles of line. The corresponding figures for the year ending June 30, 1896, were slightly larger. Regarding the year ending June 30, 1897, it appears that the aggregate amount of wages and salaries paid employees was $465,601,581. This amount represents 61.87% of the total operating expenses of railways, or $2,540 per mile of line. The total compensation for 1896 was $3,222,950 greater.

Capitalization and Valuation.—On June 30, 1897, the amount of railway capital outstanding was $10,635,008,074, which, assigned on a mileage basis, shows a capital of $59,620 per mile of line. The amount of capital stock was $5,364,642,255, of which $4,367,056,657 was common stock, and $997,585,598 preferred stock. The amount of funded debt was $5,270,365,819. The classification of funded debt shows that it consists of mortgage bonds, $4,539,911,595; miscellaneous obligations, $430,718,303; income bonds, $259,847,154, and equipment trust obligations, $39,888,767. The amount of capital stock paying no dividend was $3,761,092,277, or 70.10% of the total amount outstanding. The amount of funded debt, excluding equipment trust obligations, which paid no interest was $867,950,840. Of the stock paying dividends, 5.37% of the total stock outstanding paid from 1 to 4%, 6.53% outstanding paid from 4 to 5%, 5.99% outstanding from 5 to 6%, 3.58% outstanding from 6 to 7%, and 4.62% outstanding from 7 to 8%. The total amount of dividends was $87,110,599, which would be produced by an average rate of 5.43% on the amount of stock on which some dividend was declared. The amount of mortgage bonds paying no interest was $615,259,989, or 13.55%; of miscellaneous obligations, $37,345,879, or 8.67%, and income bonds, $215,344,972, or 82.87%. The amount of current liabilities outstanding on June 30, 1897, was $578,501,635, or $3,156 per mile of line.

Public Service.—The number of passengers carried during the year was 489,445,198, there being a decrease of 22,327,539 as compared with 1896. The number of passengers carried one mile during the year was 12,256,939,647, a decrease of 792,067,586 being shown in this item as compared with 1896. The number of passengers carried one mile per mile of line was 66,874, a decrease of 4,831. The number of tons of freight carried during the year was 741,705,946, 24,185,439 less than for 1896. The number of tons of freight carried one mile was 95,139,022,225, a decrease of 189,338,053. The number of tons of freight carried one mile per mile of line was 519,070, 4,753 less than for the preceding year.

Earnings and Expenses.—The gross earnings of the railways of the United States for the year ending June 30, 1897, as reported for an operated mileage of 183,284.25, were $1,122,089,773, a decrease of $28,079,603 for 1896. The expenses of operation for the year were $752,524,764. This amount is $20,464,280 smaller than for the year 1896, the operated mileage for that year being 181,982.64 miles. The operating expenses of 1897 were distributed as follows: Maintenance of way and structures, $159,434,403, decrease as compared with the preceding year, $910,547; maintenance of equipment, $122,762,358, decrease, $10,619,640; conducting transportation, $432,525,862, decrease, $9,691,720; general expenses, $36,481,269, increase, $397,984. Gross earnings per mile of line operated averaged $6,122; operating expenses, $4,106. These amounts are, respectively, $198 and $142 less than the averages for 1896.

Accidents.—The total number of casualties to persons on account of railway accidents for the year ending June 30, 1897, was 43,168. Of these casualties 6,437 resulted in death, and 36,731 in injuries of varying character. Of railway employees, 1,693 were killed and 27,667 were injured during the year. The casualties to employees resulting from coupling and uncoupling cars were, killed, 214; injured, 6,283. The corresponding figures for the year ending June 30, 1896, were 229 killed and 8,457 injured. The total number of passengers killed during the year under review was 222, injured 2,795. From summaries showing the ratio of casualties, it appears that 1 out of every 486 employees was killed and 1 out of every 30 employees was injured during the year. One passenger was killed for every 2,204,708 carried, and 1 injured for every 175,115 carried. Basing ratios upon the number of miles traveled, it appears that 55,211,440 passenger-miles were accomplished for each passenger killed, and 4,385,309 passenger-miles for each passenger injured.

HEAVY CONSOLIDATION LOCOMOTIVES FOR THE BURLINGTON & MISSOURI RIVER R. R.

One of the marked features of modern motive power equipment is the great increase in the size, weight and power of freight engines, in order to secure the economic advantages which result from an increase in the train loads hauled. We have already had occasion to illustrate and describe some of these large and powerful engines, and we are now able to give particulars of other engines which are illustrative of the present tendency towards heavy train loads.

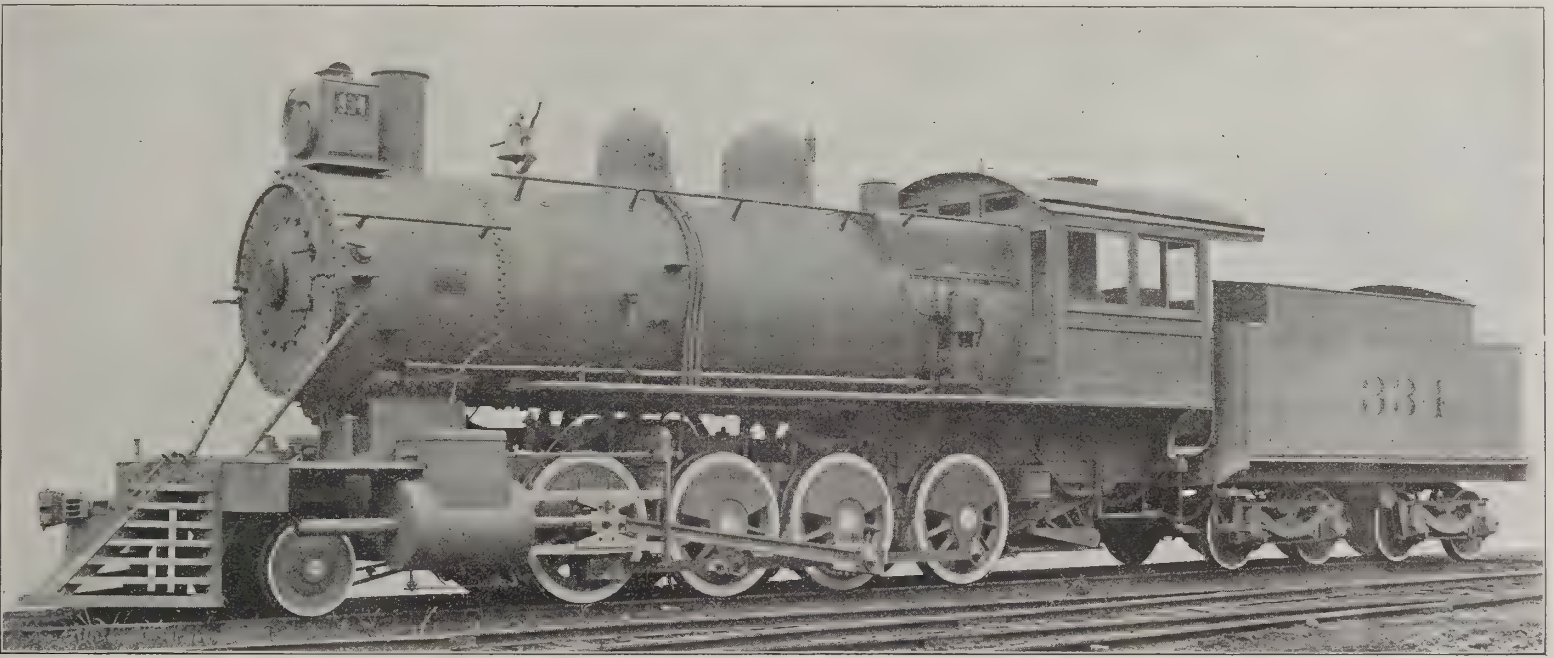

Fig. 1.—CONSOLIDATION FREIGHT LOCOMOTIVE; BURLINGTON & MISSOURI RIVER R. R.
Pittsburg Locomotive Works, Builders.

The locomotives referred to are four consolidation engines, with 166,000 lbs. on the driving wheels, intended for regular freight train service on the Black Hills division of the Burlington & Missouri River R. R. (Burlington system), between Edgemont and Deadwood, So. Dak., a distance of 107 miles. The track has the standard gage of 4 ft. 8½ ins. The maximum grades are 2% against northbound traffic and 3% against southbound traffic. The minimum curvature is 16°, and most of the curves are under 10°. all having spiral transition curves, and being equated for the grades. Mr. T. E. Calvert, General Superintendent of the B. & M. R. R. R., informs us that the slow freight trains usually make the trip in ten hours, the load behind the tender being about 330 tons northbound and 200 tons southbound. The new engines are intended to haul 15 cars where the present engines haul 10 cars. As the weak point of the present engines is in their boilers, the new engines have boilers of specially large capacity. The following table gives the comparative dimensions of the old and new engines:

	Old engines.	New engines.
Driving wheels	3 ft. 8 ins.	4 ft. 4 ins.
Weight on driving wheels	101.820 lbs.	166,000 lbs.
Weight, total	118,310 "	181,200 "
Cylinders	20 × 24 ins.	22 × 28 ins.
Boiler pressure	160 lbs.	180 lbs.

The engine has a compact and powerful appearance, with the extreme simplicity of finish which is characteristic of modern locomotives. It has a Belpaire boiler of somewhat unusual design, the shell at the firebox having convex sides swelling to a width greater than that of the flat top of the boiler sheet, so that there is a peculiar reversed curve connection between the vertical sides of the flat boiler head and the convex sides of the shell. This is somewhat similar to the boilers of the class HH consolidation engines of the Pennsylvania R. R., but in general boilers of this type have a more symmetrical arrangement of the side and top plates of the shell. Another special feature is the use of a boiler jacket of cold-rolled pickled steel, painted black, instead of the planished iron jacket which has for so long been characteristic of American locomotives, but which is now gradually giving place to a more economical form of covering. The lagging is of asbestos.

The fuel used will be bituminous coal. The firebox has a brick arch, supported on studs, and has cast iron grates of the railway company's standard pattern. The dome and sandbox are on the boiler barrel, the former having the whistle attachment in the side, and the latter being fitted with the Leach air-jet sanding device. It has also a pneumatic blow-off cock and bell ringer. A special fitting on the boiler heads carries the safety valves. The smokestack is of the bootleg or tapering pattern, with its narrowest part just above the smoke-box.

The driving wheels have cast-iron centers, and all have flanged tires. This is a somewhat notable departure from regular practice, and will be observed with interest in view of the character of the line on which the engines are to run. It is more or less of an experiment. To partially overcome the crowding against the rail, the flanges of the forward and rear driving wheels are turned down 1-16-in. below the M. C. B. standard, making the flange 1 3-16 ins. instead of 1¼ ins. The second and third pairs of driving wheels have flanges of the standard dimensions. All the driving wheels are set ⅛-in. closer together than in regular practice, the distance between backs of wheels being 4 ft. 5¼ ins. instead of 4 ft. 5⅜ ins. The pistons are of cast steel, fitted with the Dunbar packing, and have 4-in. steel piston rods. The slide valves are of the Richardson balanced pattern.

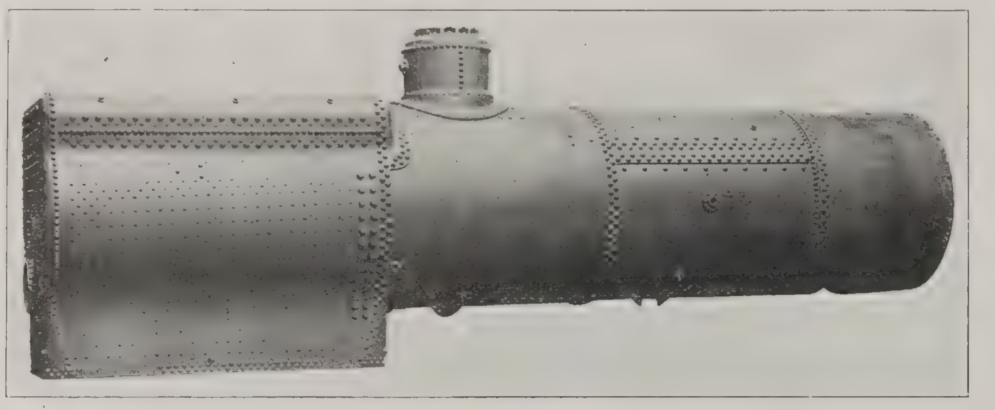

Fig. 2.—BELPAIRE BOILER FOR CONSOLIDATION LOCOMOTIVE; BURLINGTON & MISSOURI RIVER R. R.

The pilot is of wood, with a vertical projecting nose, reinforced by steel plates, and the point is supported by tie-rods from the bumper beam. Automatic M. C. B. coupler heads are fitted to the pilot and tender drawbars, and that of the latter has a swinging head and fixed knuckle. The tender is of the hopper type, built to the railway company's standards, and has semi-elliptic truck springs. The tank is 19 ft. long and 9 ft. 6 ins. wide, the length of tender frame being 32 ft. 3½ ins.

Fig. 1 is a general view of the engine, and Fig. 2 is a view of the boiler, showing the heavy character of its construction and the special features of the design.

The four engines were designed and built by the Pittsburg Locomotive Works, Pittsburg, Pa., under the general direction of Mr. G. W. Rhodes, Superintendent of Motive Power of the Chicago, Burlington & Quincy R. R., which system comprises the B. & M. R. R. R. Mr. D. Hawksworth is superintendent of motive power of the latter road.

The leading dimensions and particulars of these engines are as follows:

Heavy Consolidated Freight Locomotive; Burlington & Missouri River R. R.

Running Gear:	
Driving wheels, 8; diameter	4 ft. 4 ins.
Truck wheels, 2; diameter	2 " 6 "
Tender wheels, 8; diameter	3 " 1 "
Driving wheel centers	Cast-iron.
Truck and tender wheels	Chilled cast-iron.
How are driving-wheel tires secured?	By shrinkage.
Engine truck, swing center; journals, drvg axles	9 × 10 ins.
Wheelbase.—Driving	15 ft. 0 ins.
Total engine	23 " 6 "
Engine and tender	53 " 2 "
Truck axle to leading driving axle, c. to c.	8 " 6 "
Wheels having blind tires	None.
Weight in Working Order:	
On driving wheels	166,000 lbs.
On truck wheels	15,200 "
Engine, total	181,200 "
Tender, empty ..35,000 lbs.; loaded	94,200 "
Water in tank	41,700 "
Coal on tender	17,500 "
Does counterbalance conform to M. M. Assoc. rules?	Yes.
Cylinders	22 × 28 ins.
Form of crosshead and guides	Alligator.
Connecting rod, length between centers	10 ft. ¾-in.
Slide rod	Strap and forked ends.
Valve Gear.—Type	Stephenson link.
Ports, steam. .1¼ × 18⅞ ins.; Ports, exhaust.	3 × 18⅞ ins.
Eccentrics, throw	2½ "
Slide valves, style	Richardson balanced.
" maximum travel	5 ins.
" outside lap.	¾-in.
Boiler.—Type	Belpaire.
Diameter, barrel, inside smallest ring	6 ft. 2 ins.
Barrel plates........⅝-in.; Smokebox tube-plate.	½-in.
Horizontal and circumferential seams	Double riveted.
Joints	Butt, with inside and outside welt.
Rivets.	⅞-in.
Height from rail to center line	8 ft. 9⅝ ins.
Length of smokebox, including extension	5 "11⅞ "
Spark arresting device	Netting, mesh 2 × 2 "
Injectors, two	"Monitor" and "Friedman."
Working steam pressure	180 lbs.
Firebox.—Type	Belpaire.
Length, inside	9 ft. 5¾ ins.
Width, inside, at top, 5 ft.; at bottom	3 " 4 "
Depth, front 5 ft. 11⅞ ins.; at back	5 " 8¾ "
Side plates..........⅜-in.; back plates	⅜ in.
Crown plates........⅜-in.; tube plate	½-in.
Crown stays	Radial, 1⅛ ins.
Is firebrick arch used?	Yes.
Stay bolts (drilled) diameter, ⅞-in.; pitch	4 and 4½ ins.
Water spaces, width at front, back and sides	4 "
Tubes.—Number	292
Diameter, outside	2¼ ins.
Length over tube plates	14 ft. 6½ "
Heating Surface and Grate Area:	
Heating surface, tubes (interior area)	2,486.4 sq. ft.
" firebox, incldg brick arch t'bs	188.6 "
" total	2,675.0 "
Grate area	31.6 "
Miscellaneous:	
Exhaust nozzle, single, diameter	5, 5¼ and 5½ ins.
Exhaust nozzle, distance below center line of boiler	4 "
Smokestack, diameter at top 17 ins.; at base	16¼ "
" height above smokebox	3 ft.
" height of top above rail.	15 "
Capacity of tender tank	5,000 gallons.
Capacity of coal space	17,500 lbs.
Brake fittings	Westinghouse-American.

* * *

ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The 50th meeting of this Association was held in Boston during the week beginning Aug. 22. During the same week, or in the latter half of the week preceding, there were held meetings of several affiliated societies, as follows: American Forestry Association, Aug. 23 and 24; Geological Society of America, Aug. 23; American Chemical Society, Aug. 22 and 23; Society for the Promotion of Agricultural Science, Aug. 19 and 20; Association of Economic Entomologists, Aug. 19 and 20; American Mathematical Society, Aug. 19 and 20; Society for the Promotion of Engineering Education, Aug. 18, 19 and 20; American Folk-Lore Society, Aug. 25; National Geographic Society, Aug. 25; Botanical Society of America, Aug. 19 and 20; Conference of Astronomers and Physicists, Aug. 18 to 20.

The meeting of the American Association for the Advancement of Science was the largest it has ever held with three exceptions—Boston, 1880; Montreal, 1883, and Philadelphia, 1884. The meetings of 1883 and 1884 were enlarged by the presence of many members of the British Association. The Boston meeting of 1880 registered 998 members as present, and that of 1898 only 903. The evident decline in membership and in interest in the Association during the last 18 years is due to the growth of the affiliated societies of specialists, which have in most cases originated in the sections of the Association. By the scheme of having these societies meet at the same place and time each year they are practically the same as sections of the parent association. In fact some of these societies joined with the sections in holding their meetings. While the registered list of members present at the Boston meeting has been three times exceeded, there is no doubt that if the members of the affiliated societies who attended their several meetings but who are not members of the Association were counted, it would be found that in the week of Aug. 22-27 in Boston, there was the largest gathering of scientific men ever known in this country.

The meetings, both of the American Association and of the affiliated societies, were highly successful, both in the numbers of papers presented and in the attendance at the several sessions. Some idea of the vast amount of work done in the sections of the Association is given by the following list of the sections and the number of papers presented in each. Section A, Mathematics and Astronomy, 39 papers; B, Physics, 52; C, Chemistry; D, Mechanical Science and Engineering, 89; E, Geology and Geography, 27; F, Zoology, 35; G. Botany, 56; H, Anthropology, 55; I, Social and Economic Science, 29.

The following are abstracts of the most important papers presented in Section D.

A Combination Absorption and Transmission Dynamometer for Laboratory Purposes.

By John Joseph Flather, Minneapolis, Minn., Professor of Mechanical Engineering, University of Minnesota.

This paper describes some recent improvements in Prof. Flather's hydraulic transmission dynamometer, the most notable feature being the employment of a water-cooled pulley and a perforated rim which permits the use of a brake band that can be used for absorbing the power furnished to the machine. The fixed pulley which is ordinarily used to connect the dynamometer to the machine to be driven has internal flanges for carrying the cooling water and the rim is furnished with a number of brass bushings drilled through endwise, and provided with a regulating screw by which the amount of water admitted to the brake is readily controlled. The brake band is a three-ply cotton belt 7 ins. wide, connected through two sets of tension springs to the brake regulating screw.

The brake band may be quickly removed, thus converting the machine into a regular transmission dynamometer. In either case an automatic record is obtained on a roll of paper which is caused to pass with uniform motion under an indicator pencil that records variations of pressure.

In addition to the force curve traced by the indicator pencil the zero or datum line is traced by another pencil which is adjustable in position and may be located at pleasure on a line parallel with the axis of the shaft. Thus one is enabled to measure the total power required to run a given machine or any subdivided part of it. The two cylinders through which the driving power is transmitted are each 10 sq. ins. in area and are provided with bronze pistons actuated by plunger pins which may be located in either of two positions—the inner for ordinary work and the outer for extra heavy work, say when it is required to measure 20 HP., or when the speed of rotation is very slow. Springs of varying degrees of intensity may be used to transmit the pressure from shaft to indicator pencil. These springs are changed as in any ordinary indicator.

The work of friction of the plunger in the cylinder is practically eliminated, since the combined area of the plungers is so much greater than in the indicator piston; and since the indicator motion multiplies the distance moved by the indicator piston five times, it will be seen that the motion of the plungers is exceedingly small. The more recent machines are provided with adjustable casters which permit the weight of the dynamometer to be carried by wheels or to rest firmly on the floor, as desired.

High Speed Influence Machines.

By Charles F. Warner, Cambridge, Mass.

The causes of the electro-motive force in influence machines, their reversals and certain other peculiarities are not known; hence improvements have been effected by purely experimental means. A reference to some properties of earlier machines is made and to recent improvements under patents by Waite, Myers and Rose, Holopeter and Elihu Thompson.

The special improvements which it is the main purpose of this paper to recount are effected by special insulation, improved contacts, careful balancing of revolving parts, and peculiar driving mechanism. The inconvenience from reversals is largely overcome by a newly devised commutator. In order to provide for discharges of great frequency, such as are required, for example, to produce the Rontgen rays effectively, the principal aim has been to secure high speed with ease and safety. Two forms have resulted. One, designed for compactness, has ball bearings. The other of larger dimensions has gear metal bearings. The speed attained exceeds 4,000 revolutions per minute, which is the highest rate the author has been able to find recorded for influence machines. The regulating discharges are of great frequency and, for certain purposes, are remarkably efficient.

Instruments and Methods of Hydrographic Measurements Used by the United States Geological Survey.

By F. H. Newell.

By the organic law creating the Geological Survey, the Director is charged with the duty of the classification of the public lands and examination of the geological structure, mineral resources and products of the national domain. Under this general law extensive surveys have been carried on through nearly 19 years. It has been found that throughout a great part of the country the most valuable of the natural resources is the water. Especially is this true of the western half of the United States where all land values rest upon questions of water supply. The subject of the hydrography of the country was thus early forced upon the attention of the topographers and geologists of the survey and a large amount of information collected as incidental to other work. In 1888 the division of hydrography was created, systematizing the observations and data bearing upon the water resources, and examinations were begun of the distribution and fluctuations of waters above and under ground. The methods employed have resulted from many years of experience and are of such a character as to obtain the desired information with an accuracy consistent with a fair degree of scientific value and yet with full consideration of the expenditure available.

In the measurement of various streams, especially of the larger rivers, it has been found desirable to seek a locality where the bed and banks are fairly stable and the velocity of the water moderate. The width and depth have been obtained by direct measurements and the rate of flow determined at various points in the cross-section by means of various forms of current meters. Computations based upon the slope and other factors have been made in a few instances but mainly as a matter of curiosity to note the possible accordance with the results of detailed current meter measurements. Estimates of the flow over weirs or dams have been had occasionally, but the uncertainties involved in the leakage and discharge through gates, water wheels, etc., have been so great that little reliance has been placed upon these computations. The great bulk of the data has been derived from computations based upon the direct measurement of velocities throughout the cross-section of a stream when standing at various heights.

At the selected points, daily observations of the height of water are made, and by means of these and the occasional discharge measurements, computations are made of the daily discharge. Graphic diagrams are then constructed and averages drawn for the month, the results being expressed in cubic feet per second or in depth in inches of the run-off from the entire drainage basin. The diagrams afford a means of comparing the regimen of one river with another and of noting fluctuations day by day or year by year.

Evaporation and Seepage from Reservoirs and Rivers.

By Prof. L. G. Carpenter, Fort Collins, Colo.

From two seasons' measurements on a series of reservoirs in Colorado, the author determines that in those cases the loss from seepage is much less than from evaporation, amounting to about 2 ft. in depth per annum. Eleven years' determination of evaporation shows the loss from that source to be 41 ins. from his standard tank. From the reservoirs under observation, several years' record indicates a loss of about 60 ins. from evaporation.

(This is printed as Bulletin No. 45, Colo. Agr'l Experiment Station.)

The author reports also the results of a series of measurements made on a number of rivers in Colorado. Two measurements were made on the Rio Grande del Norte over a stretch of 80 miles; fourteen measurements on the Cache a la Poudre for 40 miles; one on the Arkansas for 200 miles; one on 40 miles of the Big Thompson; seven on the South Platte for 150 miles; a distance of over 2,000 miles gone over in detail, and on which all water taken out by ditches or entering through tributaries was measured.

While gain from seepage is the rule, there are sections on nearly all of these streams where losses are found year after year, and sometimes to a considerable extent.

The Rio Grande loses from 70 to 100 cu. ft. per second in a distance of 10 miles. On the other streams the loss is less. In the case of the Platte there is some reason to think that a portion of the water reappears. In the case of the Rio Grande, neither the water thus disappearing from the river, or the water sinking in the numerous small streams reappear within Colorado.

Energy Received from the Sun.

By Prof. L. G. Carpenter, Fort Collins, Colo.

It is well known that the sunshine on our Western plains is much greater in amount than that received by the East. For nearly ten years the author has maintained observations on the intensity of the energy received from the sun (using the Arago-Davy conjugate thermometers) and also observations on the amount of sunshine. The observations show an intensity of from 7 to 17 calories per sq. m. from 8 a. m. on sunny days, or from ½ to ¼-HP. per sq. yd. It seems as reliable as the wind, which is extensively used as a source of power for small plants.

On the Testing of Steam Pipe Covers.

By Prof. Charles L. Norton, Boston.

The manifest economy attendant upon the use of some sort of a non-conducting cover to prevent loss of heat from a hot steam pipe has led to many tests of the relative efficiency of materials in use for this purpose. There is a considerable discrepancy between the reported tests upon the efficiency of the materials in most common use, and there are some new materials used for this purpose. The facts seemed to warrant further investigation of the subject.

A series of tests has been made by means of an apparatus devised by the writer. A piece of steam pipe was heated electrically by means of a coil of wire in oil within the pipe. The amount of energy necessary to keep the pipe at a definite temperature is measured. Since the energy supplied is just sufficient to keep the pipe at a constant temperature it is therefore just equal to the energy lost by the pipe. Hence from the electrical energy supplied we may compute the heat lost from the outside of the pipe. The economy of the use of some of the better covers is computed, and an examination of the fire resisting properties of the several covers is made. (Another report of these tests was given by Prof. Norton in a paper before the American Society of Mechanical Engineers at the Niagara Falls meeting in May last.—Ed.)

Methods of Determining the Frequency of Alternating Currents.

By Carl Kinsley, Instructor of Physics and Electrical Engineering, Washington University, St. Louis, Mo.

The accurate determination of the frequency is essential for the correct computation of the relations between electromotive force, current, self-induction and capacity. Since the periodicity must usually be squared, it is essential that the determination be made quickly and with but little error.

Dr. John Hopkinson was the first to use a stretched steel wire actuated by an electro-magnet and when the condition of maximum resonance was found, the periodicity was calculated from the constants of the wire and its tension.

Dr. Campbell (Phil. Mag., Aug., 1896) proposed the use of an iron rod which was thrown into resonance in the same way. From the constants of the rod and its length the periodicity was computed. The rod he found could be more easily used than the wire.

Another method capable of great accuracy and easy manipulation includes the use of a telephone in the alternating current circuit and a resonance tube by means of which the periodicity may be calculated from equations, or it can be gathered from tables already computed. (Kinsley, Phil. Mag., April, 1898.)

A very satisfactory method will be one which includes the use of a metal strip as the primary resonator whose periodicity may be changed by means of an added weight. An electro-magnet may be used as in the first two cases to set this into vibration. The periodicity can be calculated from the constants of the vibrator (Lord Raleigh, "Theory of Sound"), or a complete calibration can be made by two determinations. It will usually be more satisfactory to standardize by actually determining the periodicity of two adjustments of the resonator. The equation to be used for that purpose is

$$t^2 = Dl^3 M + Kl^4, \text{ when}$$

t = time of one complete oscillation.
l = distance of the sliding weight from the support.
M = mass of the slider.
$l,$ = length of the vibrating rod.
D and K are the constants of this particular apparatus which may be either calculated or obtained by experiment.

The condition of resonance is obtained with great readiness and the determination may be made with as great accuracy as may be desired.

MEETING OF THE AMERICAN SECTION OF THE INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.

The first annual meeting of the American Section of the International Association for Testing Materials was held at the Engineers' Club, of Philadelphia, on Aug. 27, with Prof. Mansfield Merriman in the chair. The first business of the meeting was the consideration of the proposed by-laws of the American Section. Mr. Gus. C. Henning explained that these by-laws were to be supplemental to the general laws of the International Association and were intended solely for government of what formed one section of the Association. The by-laws as adopted, after a careful consideration of each paragraph, were as follows:

(1) The name of this organization shall be the "American Section of the International Association for Testing Materials."

(2) The objects of the American Section shall be to unite more closely those members of the International Association living on the western continent, and to co-operate in the promotion of the purposes of this Association.

(3) Each member shall pay on the first of ——— of each year, to the Treasurer of the American Section, the sum of $2.50, annual dues for the current year. Of this amount, $1.50 shall be transmitted to the International Association, by the Secretary of the American Section, and the remainder shall be used to defray the expenses of the American Section. Any member of the American Section whose dues shall remain unpaid for the period of one year shall be reported to the Council of the International Association.

(4) The Officers of the American Section shall be, a Chairman, Vice-Chairman, Secretary and Treasurer, constituting the Executive Committee, and two members of the International Advisory Board. The American member of Council of the International Association shall be ex-officio a member of the Executive Committee. The officers of the American Section shall be elected at annual meetings and shall serve for two years.

(5) The American Section shall meet annually. The time and place of each meeting shall be fixed by the Executive Committee. Special meetings shall be called whenever the Executive Committee shall deem it necessary.

Next in order was the consideration of the problems outlined by the International Association. These problems, which are to be investigated by the International committees, and the American members who will act upon these committees, are as follows:

1. "Taking as a basis the existing conditions of inspection, to establish uniform International rules for the testing and inspection of all kinds of iron and steel." Two members to be appointed.

2. "Determinations of methods of test of the homogeneity of iron and steel with the object of eventually employing these methods for inspection." Booth, Garrett & Blair, Gus. C. Henning, Prof. Thomas Gray, Paul Kreuzpointner, A. A. Stevenson, William R. Webster.

"Preparation of uniform methods for the test of paints used for protection against corrosion of railroad structures." H. B. Seaman, J. A. L. Waddell, and two members still to be appointed.

3. "Unification of methods of test of tile pipe." One member to be appointed.

"Supplemental to the solution of the question of standard consistency of standard mortars. Determination of conditions which will produce approximately similar densities in tension and in compression briquettes." Richard L. Humphrey.

4. "Investigation of the behavior of soft steel under abnormally low temperatures." Prof. George W. Bissell.

5. "Methods of tests of welds and weldability." One member to be appointed.

7. "Collections of masses of material for the preparation of standard piece tests, with special reference to axles, tires, springs (car), cast and wrought-iron pipes, as well as the separate parts of structures." One member to be appointed.

10. "Investigations of the most practical methods of polishing and etching for microscopic study of wrought iron." Albert Sauveur.

11 and 12. "Study of the relation of chemical composition to weathering qualities of building stones. Study of the effect of the gases of combustion, especially sulphurous acid. One member to be appointed.

"Study of the relation of chemical composition to weathering qualities of roofing slates." Prof. Mansfield Merriman.

14. "Determination of rapid methods for determining conditions of constancy of volume of hydraulic bond materials." Richard L. Humphrey, William M. Maclay.

15. "In what manner can hydraulic bond materials be tested for tensile strength in the shortest period of time?" William W. Maclay, Dr. Charles F. McKenna.

16. "Testing and evaluating the resolutions of the conferences relating to the determination of adhesion of hydraulic bond materials." Booth, Garrett & Blair and one member still to be appointed.

17. "Examination of propositions for the uniform determination of the value of puzzolanas as mortars." Two members to be appointed.

19. "Investigation of the effect of fecal matter on the strength of hydraulic bond materials." Two members to be appointed.

18. "Investigations of the causes of abnormal behavior of cements as to time of setting." Two members to be appointed.

22. "How can the inspection of lumber assure protection against the growth of fungi (merulius lacrymans)?" Prof. John B. Johnson.

23. "Determinations of fundamental methods for testing lubricants (oils)." One member to be appointed.

"American Committee to report to the American Section on the present state of knowledge of impact tests." Prof. W. K. Hatt, Chairman; Prof. Edgar Marburg, James Howard.

These problems were taken up one at a time by the members and discussed in a general way. Mr. Henning first outlined the process to be followed by the committees having the problems in charge. Each committee would first investigate the problem assigned to it, and then it would be presented to the Section, and finally by that body referred to the council. If agreeable the report would then be considered in a general congress. To make the work of the most value it should be apportioned according to the desires and capabilities of the members, care being taken not to duplicate work already done. Problem 7, he stated, would require a careful study of what has been done in this country.

Mr. M. White, who has charge of the Physical Laboratory of the Bethlehem Iron Works, and was suggested as a member of this committee to consider Problem 7, stated that as the work of his company was practically all done under special government specifications, limited by government inspection, it seemed to him advisable to appoint some one from a company doing a more commercial business. In discussing this, Mr. Henning pointed out that following the first meeting of the International Association, held in Switzerland, at which Capt. Carter, U. S. A., was present, the United States government had revised its specifications and had translated, printed and distributed copies of the "Resolution of Conferences" of that and previous meeting to all its officers engaged in constructional work or testing. He had no doubt but that if properly presented and sufficiently urged by the Bethlehem Co. the government would make other changes.

In regard to Problem 17 it was decided that as the International Association had not included artificial cements it would be just as well to consider this as not including sag cements. Referring to Problem 18, Mr. Henning pointed out that this was a problem of special interest to foreigners alone, and could be abandoned by the American Section, since so few sewers were constructed in this country out of concrete.

The other problems were read by title only, and it was suggested that there might be other practical problems which could and should be considered by the Section. If these were of general interest they could be brought to the attention of the International Association; if of local interest, they could be investigated separately by the American Section. At any time, however, inquiries could be transmitted abroad to obtain the benefit of foreign investigation, and the members should have no hesitancy in doing this or in suggesting problems for consideration.

Dr. R. G. G. Moldenke thought that the list should include a problem dealing with the qualities and properties of cast iron. Our knowledge of cast iron, he stated, stood now about where our knowledge of steel was 15 years ago, and it was time something was determined definitely. Later Mr. Moldenke's suggestion was put in form and adopted.

By way of explanation Mr. Henning stated that there would be three editions of "Materials of Construction," the official organ, published in English, French and German. In each one of these editions the contributed articles would be in the language in which it was originally written to insure accuracy and to preserve the original expression of the author. Other matter would be in English, French or German, according to the edition. Any American member desiring to contribute could do so, and his papers, if carefuly prepared, would be welcomed by the editors of the journal.

Mr. Henning also suggested that as no problem including an examination and study of impact testing machines and impact testing had been included, it should be done, and he stated that this test was used to a large extent and very successfully abroad; but that in this country it was in a very crude state, and very infrequently employed. Mr. Wm. R. Webster disputed this rather sweeping assertion, stating that during his experience he had personally inspected several thousand tons of steel rails, using an impact apparatus which gave fairly accurate results. Mr. M. White, of the Bethlehem Iron Co., stated that his experience with impact testing machines had been anything but satisfactory, and after considerable experimenting with two such machines made by the Bethlehem Co., one in the works and the other in the laboratory, he was more than ever at sea. Such tests gave absolutely misleading results. He had found bars with little or no elongation which gave good impact results and other bars with considerable elongation which made a very poor showing under the impact test. Nowadays it was not a question of absolute breaking so much as the fatiguing of metals; a question of how long would such materials stand and not altogether how much they would stand. For these reasons the drop or impact test, which practically tested the ductility of a metal, was not in the best repute. Mr. J. A. Riehle remarked that Mr. Howard, of the Watertown Arsenal, had designed an impact machine which was being manufactured by Wm. Sellers & Co. Attention was also called to several other machines, notably one at the Watertown Arsenal, built by the government, and one built by Mr. S. Bent Russell, and described by him in the Proceedings of the American Society of Civil Engineers.

In reply to the question whether the foreign sections of the International Association were considering impact testing machines, Mr. Henning said that they were, particularly in France, where Mr. Barba was conducting a long series of experiments. Russia also used this test largely. Prof. Merriman considered the subject one of live interest about which little was known and about which more should be known. Continuing the discussion, Mr. Kreuzpointner remarked that the few breakages of car axles and wheels afforded an indication that the principle employed in the "drop test" was scientifically correct, and that such a test answered very well for commercial purposes, although it could not as yet be claimed as a reliable quantity test. Upon the motion of Mr. Henning, it was finally decided to appoint a committee of three to study this question and see what has been accomplished by foreign investigators.

As this ended that portion of the programme assigned to the afternoon session, the delegates and guests adjourned in a body to the Hotel Lafayette for dinner, so that they could convene promptly for the evening session, called for 8 o'clock.

Evening Session.

Immediately after calling the meeting to order for the evening session, Prof. Merriman announced Profs. W. H. Hatt, of Purdue University, and Edgar Marburg, of the University of Pennsylvania, as two of the committee of three on Impact Testing, the third member to be announced later. The discussion of the topic "The Relation of the International Association to Producer and Consumer" was taken up, and in the absence of Mr. Dudley, Mr. W. R. Webster presented a brief paper, in which he said:

> The International Association for Testing Materials occupies a neutral position to the producers and consumers, where the specifications, methods of testing, and methods of manufacture can be freely discussed by all parties, with the view of eventually adopting uniform specifications for each class of material.
>
> The American Section of this Association, by showing the American manufacturers and consumers that it has practical work in view, will at once secure the co-operation and assistance of both parties. We are all much interested in seeing the American export trade increased, provided our materials, bridges, locomotives, etc., are shown to be as good, or better, than those produced in any other country.
>
> At the present time the American manufacturers of steel and bridges are very much handicapped by some of the foreign specifications. In the first place, rails will not be accepted that contain more than .06% of phosphorus, and, in the second place, in many cases, basic open hearth steel will not be accepted for bridges. The railway companies are generally represented by consulting engineers, who insist that these conditions are complied with, although, in some cases, after investigation, they have accepted American practice. Are these gentlemen right to reject rails that contain over .06% phosphorus, and in refusing to use basic open hearth steel in their bridges, or, is the practice in this country right, which allows, in most cases, the use of rails containing phosphorus up to .10%, and either acid or basic open hearth steel in our bridges, provided the physical tests are satisfactory? It is right here that the American Section of this Association can be of great service, both to the manufacturer and consumer, by taking up these specifications. If the steel makers will give us freely all the information that we may ask on these matters, and our railway companies and their engineers will do the same, then we can put this information in proper shape, and bring the whole matter before the International Association.
>
> If it can be shown that the American basic open hearth steel, made from our relatively low phosphorus iron, is as reliable as the acid open hearth steel made in this or any other country, there is no reason why the International Association should not approve of its use in bridges. And, if it can also be shown that our rails made of steel containing phosphorus up to .10%, which meet all the conditions of service in this country, and in other countries where they have been used, are as reliable as any rails made in other countries, there is no reason why the International Association should not also approve of the use of rails containing phosphorus up to .10%, provided, of course, that they meet all of the physical tests called for.

Discussing the subject, Mr. White stated that the Bethlehem Iron Co. made little basic steel. There was a prejudice against this kind of steel just as there had been against Bessemer steel, and it would take time to make people believe otherwise. In this country we use better pig iron to start with, and produce better steel, which could hardly be called acid steel when refined on a basic hearth. In response to a question, Dr. Moldenke said that a good test to determine basic or acid steel was the price. However, the province of the society was to select methods of testing either material rather than to determine which was one or the other.

Mr. H. V. Wille, Engineer of Tests of the Baldwin Locomotive Works, then read a paper and presented a number of photographs to show that the extent of segregation and the number of blowholes in steel ingots was not influenced by the process of manufacture, but were governed entirely by the shape and size of the ingot and the manner in which the steel was poured.

The discussion, which had begun to wander, was brought to the original topic, and Mr. R. W. Lesley summed up the matter in a business-like manner, saying, in substance, that times are international, especially for the United States, and our expansion in connection with recent events required that we become more international. In some industries and countries old methods are maintained, not because they are best, but simply because they are old methods. This was particularly true of some of the European countries, and it was a function of the American Section of this Association to try and have specifications and rules so altered that our goods, which were better and more cheaply manufactured, could be sold unrestricted by technicalities, both at home and abroad. In addition, international testing, to be a success, must be fairly permanent, nor should the reputation of the manufacturer be ignored in making awards.

On the same subject Mr. Henning said:

> We cannot meet foreign markets unless we know foreign specifications, and it is the object of the American Section to develop and assist in the formation of a similarity of methods which would give this understanding. This should have an air of permanency to be of real value. Another of its missions was to educate foreign countries up to an understanding of what we were doing and could do. Abroad the United States was little known, and less understood, at least from the standpoint of its possibilities. And, unfortunately, this ignorance existed among engineers as well as other classes. There they are so absorbed in their own little systems and methods that they have no time for anything else, and could not realize our seemingly exaggerated statements. One of the prime objects is, therefore, to bring the producer and consumer together and convince the foreign sections of the truthfulness of our statements, the value of our methods and the quality of our products. Our manufacturers can underbid foreign manufacturers, and our goods can fill the bill, but it is necessary for our manufacturers to tell what can be done, and from the foreign members we can learn what is wanted. The same is true on this side, hence the need of a close relation between the manufacturer and the consumer, or his agent the consulting engineer. There is no danger of foreign invasion of our markets, owing to our natural advantages, our better quality of labor, and the fact that there was always a chance for advancement.

It was the opinion of a majority of those present that American manufacturers were trying to meet requirements as far as they could under existing circumstances, and that there was no doubt but that they would gladly assist the formulation of standard specifications when properly approached.

Mr. Humphrey suggested that the discussion should not be limited to steel manufactures alone, but should include all the structural branches, as was intended in the name of the Section.

As an indication of the need of standards of some sort, Mr. Kreuzpointner mentioned an incident which had come under his observation. A boiler shop which was forced to build boilers under nine different sets of specifications, while it is generally admitted that the conditions in all boilers are practicaly the same, so much so that one set of specifications would have done in this or any other shop, and the time, energy and money spent in fulfilling the other erratic specifications could be spent in perfecting the methods and materials used in the standard specifications. The trouble seemed to him to rest largely with the engineers, who, in many cases, knew considerably less about the qualities they were so carefully specifying than the manufacturers they were putting to such inconvenience.

Mr. R. W. Lesley spoke on the same topic from the cement manufacturers' standpoint. He had made a collection of specifications submitted to him to bid on, and there were 92 specifications for Portland cement and 52 for natural cements. Abroad six of the great cement manufacturing countries, turning out some 30,000,000 bbls. of cement per year, were content with six sets of specifications.

Prof. Marburg took a somewhat opposite view, and said that while standard methods of testing and standard specifications would be a good thing for the manufacturer, there was a question as to their benefit to the consumer. It was true that the multiplicity of specifications and tests now extant did put the manufacturer to expense and trouble, but it was also true that difficult specifications, if prepared by an engineer knowing his business, and not made too difficult, caused the manufacturers to improve their products. The difference in specifications was to be expected on account of the almost uncertain knowledge we have of most of our materials. From his point of view the formulation of a collection of standard specifications for all materials would not be accomplished as rapidly as some expected. However, the objects of the society were good, and there was an ample field for work.

Mr. Chas. T. Davis, Assistant Chemist, Reading R. R., mentioned an experience the Reading had had with different specifications for the material used in railway construction. Circular letters were sent to all roads in the country, having over 900 miles of track, asking for specifications of all materials used. The number of different replies received was remarkable.

Earlier in the discussion Mr. Kreuzpointner had stated that for 14 years the Pennsylvania R. R. had kept records of all boiler material, and that its present boiler specifications were based upon these data. Mr. Davis called attention to this, and stated that the Reading road had also kept similar records. The limits allowed by the two roads was appreciably different. This was mentioned merely to call attention to one of the many difficulties likely to arise in the future.

In answer to a question about time of meetings and how the proceedings would be published, it was stated that meetings would be yearly, as stated in the by-laws, unless special meetings were called by the Executive Committee. The reports undoubtedly will be published either abroad or in a special proceedings on this side. Just at present a consideration of this point was deemed premature.

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NATURAL GAS IN INDIANA is considered in the last report of the State Geologist, and Mr. J. C. Leach, as supervisor of natural gas, says:

> The natural gas field of the state original embraced almost 3,000 sq. miles. To-day the productive area is less than half that size. The average rock pressure was in the beginning 325 lbs., to-day it is less than 200 lbs. In the heart of the field, an area of 250 sq. miles, located in Grant, Madison, Blackford and Delaware counties, the pressure decreased 30 lbs. in 1897, and now averages but 215 lbs., while in these four counties, which are the most productive of the entire field, the average pressure is but 200 lbs. The decrease in rock pressure, added to that of an exhaustion of one-half of the original productive area and the constant encroachment of salt water toward the center of the field, all point to the final exhaustion of the supply.

◆

CHINESE SALT-WELL BORING PROCESSES, says "The Engineer," are slow but usually effective. The salt wells and petroleum wells cover an area of about 2,500 sq. miles in the Setchouen, Yunnan and Shansi districts, and about 1,200 salt wells are now worked by companies or families. These wells are from 6 to 8 ins. diameter and from 575 to nearly 1,200 ft. deep, through rock. The drilling instrument resembles a string of thick iron sausages, with a strong tempered steel point. The cable is made of thin strips of bamboo, not twisted, and is worked from the end of a strong, elastic rod, resting on a roller and with a small platform at one end. The free end of the rod is worked by four or more men like a see-saw. The drill is withdrawn from time to time and water is poured in the hole, and the muddy liquid is extracted by a bamboo piston. To prevent the walls from caving in, cylinders of cypress wood are used, connected by nails. If the cable breaks it is fished up by a variety of ingenious hooks patiently applied; and if the iron perforator breaks, it is pounded out of the way by the slow fall of heavy weights. While an ordinary well can be bored in 6 to 10 years, some wells have required 40 years of incessant toil. The salt brine is extracted by a bamboo cylinder with a valve in the bottom, hoisted by a bamboo cable rolling over a small wheel and around a huge horizontal wheel, with buffaloes as motive power.

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THE THREE NEW BATTLESHIPS "Maine," "Missouri" and "Ohio," for which bids were received by the Navy Department on Sept. 1, will probably have speeds of at least 18 knots, as the modified plans of the contractors involving increased speed are likely to be accepted rather than the bids on the original Department plans, which called for a speed of only 15 to 16 knots. The bids received may be summarized as follows:

Newport News Ship-Building and Dry-Dock Co. Ship on Department plan, 15 knots speed, 11,500 tons displacement, to be completed in 31 months, $2,580,000. Ship on builder's plan, 17 knots speed, same displacement, to be completed in 32 months. $2 680,000. Ship on builder's plan, 18 knots speed, 12,500 tons displacement, 32 months' time, $2,850,000.

Wm. Cramp & Sons' Ship & Engine Building Co. Ship on Department plan, 15 knots speed, 11,500 tons, 29 months for completion, $2,650,000; or two such ships, $2,625,000 each. Ship on builder's plan, 17 knots speed, 11,500 tons displacement, 32 months' time, $2,725,000, or two such ships for $2,700,000 each. Ship on builder's plan, 18 knots speed, 12,150 tons displacement, 32 months' time, $2,885,000, or two such ships for $2,870,000 each.

The Union Iron Works. Ship on Department plan, 15 knots speed, 11,500 tons displacement, 33 months' time, $2 674,000. Ship on builder's plan, 17 knots speed, 33 months' time, $2,725,000. Ship on builder's plan, 18 knots speed, 12,200 tons displacement, 33 months' time, $2 840,000.

John H. Dialogue & Son, Camden, N. J. Ship on Department plan, 33 months' time, $2,840,000.

It will be seen from the above bids that the 18-knot vessels will be secured at a trifling increase in cost over the 15-knot vessels, which were originally designed by the Department. The increased displacement, which accompanies the increased speed, is secured by lengthening the vessels 15 to 20 ft. amidships, giving more room for engine, boiler and coal space. It is stated that the coal bunker capacity is increased to from 1,600 to 2,000 tons in the plans for 18-knot vessels offered by the bidders, while the Department plan called for only 1,200 tons bunker capacity.

The design offered by the Cramps proposes Niclausse water-tube boilers; and the Union Iron Works also proposes to use water-tube boilers. The Newport News Co., however, adhere to the use of Scotch boilers, and makes considerable changes in the battery, substituting four 12-in. guns for the four 13-in. of the Department's plan, and eight 8-in. guns for the fourteen 6-in. Ten small rapid-fire guns are also added.

◆

A CARGO STEAMER OF 13,000 TONS CAPACITY has been ordered from Messrs. Swan & Hunter, Shipbuilders, Wallsend-on-Tyne, England, by the Cunard Line, according to press dispatches from Liverpool, England. The dimensions of the vessel ordered are: Length, 560 ft.; beam, 64 ft., and depth, 42 ft., giving her a capacity of 13,000 tons of dead weight cargo, or about 20,000 tons of measurement goods. These same builders now have approaching completion for the Cunard Line the freight steamer "Altonia," of 11,000 tons capacity.

◆

THE NEW U. S. DREDGING STEAMER "Wingate Bay" had her official trial trip for speed on the Delaware River on Aug. 29. The contract requirements were for a speed of ten nautical miles per hour for four hours, under natural draft, and these requirements we are informed in a letter from the builders were fully met. The "Wingate Bay" is a self-propelling hydraulic hopper dredge, and is 140 ft. long, 30 ft. beam and 12 ft. depth. The dredging equipment consists of one 15-in. centrifugal pump which delivers into two hoppers of 250 cu. yds. capacity. The vessel complete was built for the U. S. government by the Bucyrus Co., of South Milwaukee, Wis., and the contract price delivered at Georgetown, S. C., was $73,800.

◆

THE NEW DRY-DOCK OF THE NEWPORT NEWS Shipbuilding & Dry-Dock Co. was begun on Aug. 30 with the formal turning of the first shovelful of earth in the presence of the shipyard officials and a number of visitors. The plans for this new dry-dock were prepared some months ago by Mr. Walter A. Post, General Superintendent of the company, but work was delayed on account of the war. The basin will be 800 ft. long, with a breadth of 80 ft. at the bottom and 148 ft. at the top. The depth will be 41 ft. 8 ins., from the top of the sill, giving 34¼ ft. of water at low tide. The keel blocks will extend 5 ft. above the bottom, enabling a vessel drawing 29¼ ft. of water to enter the dock. The entrance will be 106 ft. at the top and 80 ft. wide at the bottom, with granite and concrete casements. The bottom will be of stone and concrete on a row of piles bracing the entrance at each side. There will be a line of piles, six in width, down the center of the basin, on which the keel blocks will rest, while on each side of this will be a row of four piles, for the docking keel blocks to rest upon. Piles will extend from each side of the dock for a distance of 45 ft., and will be connected with the sides of the basin with crossbars for the purpose of thoroughly strengthening it. The sides of the dock will be cone-shaped concrete walls, with granite facings. At the bottom there will also be concrete with granite facing, laid upon rows of piles, with connecting cross-stringers of huge timbers in both directions. It is estimated that it will require six months to make the excavation for this immense basin, and it is hardly possible that the dock will be completed under twelve months. It will be very near and just to the north of the present dock. With two dry-docks the Newport News & Shipbuilding Dry-Dock Co. will be thoroughly equipped to handle any of the merchant or war ships afloat at any time.

◆

THE CONSTRUCTION OF TWO IRONCLADS for the Norwegian Navy is contemplated by the Norwegian Admiralty, according to reports from the British Consul at Christiana. It is stated by the same authority that the bids for construction will be called for by Oct. 8. Inquiries should be addressed to the Norwegian Admiralty, Christiana.

◆

THE IMPORTS OF CUBA AND PUERTO RICO, says the U. S. Bureau of Statistics, have averaged about $60,000,000 annually for the last decade. Of this about one-half came from Spain, about one-third from the United States and the remainder from England, Germany, France and other nations. Of this total Cuba took about 85%. The fact that Spain commanded the bulk of the traffic was due to the discriminating tariff, now abolished; and under these circumstances the class of Spanish imports is interesting. In 1895 and 1896 the chief Spanish imports, in the order of value, were: Wheat flour, shoes, flax and hemp and manufactures of these, firearms, soap, manufactures of wood, packing and cigarette paper, wax and stearin, bricks, earthenware, butter, rice and leather.

◆

BIDS FOR SMOKELESS POWDER for use on United States warships were received by the Navy Department on Sept. 3. The amount of explosive called for was 1,000,000 lbs., and the bids were made on two propositions: (1) that the government supply the alcohol and ether and (2) that the government supply the alcohol only. The bids were as follows:

	Proposition 1. Cts. per lb.	Proposition 2. Cts. per lb.
Dupont Powder Co., Wilmington, Del...	79½	80
Giant Powder Co., San Francisco, Cal...	90*	95*
Dittmar Powder Co., New York.......	80*	..
Lewis Nixon, Elizabethport, N. J........	96†	..
Laflin & Rand Powder Co..............	79½	80
California Powder Co	..	80

*For 250,000 lbs. only. †For 100,000 lbs., only.

◆

THE BALLOON IN WARFARE seems likely to have seen its best days, in view of the discouraging experience of the United States troops with the balloon at Santiago. It is evidently mere foolhardiness to send up observation balloons within range of the enemy's guns; but modern infantry rifles and light artillery can send projectiles so far that a balloon sent up out of range will be too far from the enemy's lines to discover any facts of importance, unless the weather is unusually clear.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a derailment which occurred Sept. 1 on the New York, Ontario & Western R. R., at a point about four miles south of Fulton, N. Y., and which is stated to have been caused by tramps who threw open the switch at which the train was wrecked as well as two switches to the north of the wreck. The train wrecked was a fast passenger train known as the "Chicago Limited" and, it is stated, was running at a speed of 60 miles per hour when it struck the switch and was thrown over to the side track. The rapid speed made it impossible to make the sharp turn and the train left the track. The engine was thrown 20 ft. and badly wrecked; the tender was inverted, and the head coach telescoped the baggage car. A vestibuled chair car and sleeper coming behind were both derailed. The engine driver, fireman and one brakeman were killed and eleven others were injured.

◆

THE EXPLOSION OF A HARBOR DEFENSE MINE in the Mississippi River at New Orleans, La., on Sept. 3, destroyed the U. S. Government snag boat "Meigs" and killed six of the 19 men on board. The "Meigs" was engaged in removing the harbor mines at the time of the accident, and no reason is known why the explosion should have occurred.

◆

A GRADE CROSSING COLLISION between an electric car of the Troy City R. R. and the special boat train of the Delaware & Hudson Canal Co., which occurred at Cohoes, N. Y., on Sept. 5, resulted in the death of 18 persons on the electric car and the injury of nearly as many others, some of whom will probably die. The electric car contained 35 passengers at the time of the accident and was struck fairly in the center by the passenger train which was going at a high rate of speed. The responsibility for the accident has not been determined.

◆

THE COLLAPSE OF TWO 368-FT. PRATT TRUSS spans of the New York & Ottawa R. R. bridge under construction across the St. Lawrence River, near Cornwall, Ont., occurred on Sept. 6, precipitating about 60 persons into the river, of which it is estimated that fully 30 were killed. This bridge crosses the river at a point where the stream is divided into two channels by Cornwall Island. Crossing the Canadian channel a cantilever structure is being erected and crossing the American channel a three-span Pratt truss structure. Both of these structures are designed to carry a single track railway. It was the Pratt truss structure to which the accident happened. The three spans are carried by four masonry piers constructed of rock-faced ashlar masonry, with Portland cement concrete backing. The river piers rest on cribs filled with Portland cement concrete up to within 3 ft. of low water, and the shore piers rest on concrete footings placed in excavations dug 5 ft. below low water. The foundation bed consists of hard compact clay and boulders. At the time of the accident the erection of the span between piers No. 1 and No. 2, numbering from the American shore, had just been completed and the workmen were engaged in removing the traveler employed in the erection. The erection of the other two spans had been completed previously. Accounts differ as to what actually happened, one eye witness asserting that the shore span collapsed first, dragging down pier No. 2 and the next span in its fall, while others state that the foundation of pier No. 2 had become undermined by the swift current, and it collapsed, carrying with it the two spans which it supported. The latter view seems to be the one most generally accepted as correct by the contractors and others on the ground, according to the press dispatches. A strong bit of evidence in favor of the collapse of the pier first is the fact that, according to the press dispatches, not a vestige of the masonry was apparent after the accident, and it seems hardly probable that the falling of the shore span first would have caused such a total collapse of the masonry. In our next issue we hope to present in more detail the circumstances of the accident and such evidence as is available regarding its cause. The contractors for the bridge are the Phoenix Bridge Co., of Phoenixville, Pa., who sub-let the substructures to Sooysmith & Co., of New York, N. Y.

◆

THE CABLE CARS WERE STOPPED on Broadway, New York city, between the Battery and 35th St., for nearly ten hours, on Sept. 5, from a most unusual cause. The chimney of the Houston St. power station is 14 × 4 ft. in interior cross-section. It is built of red brick and lined with a thin lining, only 4½ ins. of fire brick, this lining being bonded to the red brickwork. There is a damper in the chimney, operated automatically by the steam pressure. At 2 a. m. on the morning of Sept. 5, when the damper happened to be nearly closed, a portion of the fire-brick lining fell on it and jammed it so that it could not be opened. The draft of the boilers being thus choked, the steam supply to the engines soon failed, and the cars stopped running. Several cartloads of brick and mortar were removed from the bottom of the chimney, and it was nearly noon before the cable cars were started. In the meantime horses, horsecars and drivers were secured, and for about four hours from 7.30 a. m. a horsecar service was run.

◆

AN EXPLOSION OF CELLULOID at the works of the Celluloid Mfg. Co., of Newark, N. J., on Sept. 4, and the fire caused by it, resulted in the injury of 40 persons, three of whom are pronounced fatally injured. The explosion occurred in the celluloid scrap house, and the only reason for it so far determined is the prolonged and intense heat of the past week.

WATER PURIFICATION AT WILMINGTON, DEL.

A unique system of water purification has been in use at Wilmington, Del., since the latter part of 1894. Upward filtration is employed at the rate, as designed, of 43,560,000 gallons per acre, or 1,000 gallons per sq. ft. of filter bed. The water is treated with iron before filtration, and is aerated both before and after passing the beds. The ordinary cleaning of the beds is effected by washing the filtering material while in place with both air and water. The prototype of this filter was built at Tacoma and is said to be still used at times of bad water.

Wilmington has had a public water supply since 1804. The original works were built by a company, which sold them to the borough in 1810 for $10,000, Wilmington thus being the pioneer American city in changing from private to municipal ownership of water-works. The population of the city increased from 42,478 in 1880 to 61,431 in 1890, and is now estimated at from 70,000 to 75,000.

The water supply is taken from the Brandywine Creek, being pumped from the clear water well to storage reservoirs, with repumping for a small area of high service. Although the creek has for years past received more or less organic pollution it is doubtful whether filters would have been put in as soon as they were had it not been for the large amount of suspended matter carried by the stream. The evils of pollution were officially recognized a number of years ago and steps taken to remove them, as described later in this article. It has been the practice for some time to shut down the pumps when the water is at its worst, drawing the supply from the storage reservoirs meanwhile, but these have a combined capacity of only 40,000,000 gallons, and it is, of course, desirable to keep some water in reserve. The average daily consumption for a number of years has been nearly 6,000,000 gallons, while at times the maximum consumption for several days has been much larger. Of course the maximum consumption is very unlikely to be coincident with heavy rains and turbid water, but it is not safe to count on being able to shut down the pumps for more than four days at a time.

The filter plant was designed by Mr. George H. Sellers, late Manager and Engineer of the United States Filtering & Purifying Co., Girard Building, Philadelphia, but a resident of Wilmington until his death some two years ago. Day labor was employed for the construction of the plant, which was under the supervision of Mr. Sellers and of Mr. Joseph A. Bond, Chief Engineer of the Wilmington Water-Works.

The plant consists of five filter beds, each 16 × 125 ft., and each supplemented by ducts and pipes used for aeration and the devices for adding iron to the water. Each bed is designed for a capacity of 2,000,000 gallons in 24 hours, making a total capacity of 10,000,000 gallons, with no allowances for beds out of use for cleaning. The combined area of the beds is 10,000 sq. ft., or less than one-fourth of an acre, making the rate of filtration 1,000 gallons per sq. ft. per day, or over 43,000,000 gallons an acre, with no allowance for cleaning.

A plan and sections of one of the beds are shown by Figs. 1 and 2. Water passes from the supply pipe down into a number of conical tubes, intended to suck in air with the water, and thence into a flume, where the water first comes into contact with ten bundles of revolving iron rods and afterwards has air admitted to it through the goose necks shown in the longitudinal section. After passing the length of the first flume the water returns through another one, directly below it. More air was introduced here until quite recently when the air pipes for the lower flume were taken out, on account of the difficulty experienced in keeping them open. It then divides into two parts and flows the length of the filter bed the third time, through the two side flumes shown in the cross-section. After having flowed through the 375 ft. of flumes the water passes down beneath the filter beds into the compartment entitled "sedimentation tanks." From here the water passes upward through the filter bed and out at the end it entered, after a journey of 500 ft. The filtered water for each bed passes over a copper water wheel 2 ft. in diameter and 3 ft. in length, which turns the bundles of iron rods, the power being transmitted by means of a link belt chain. Before the water goes to the pumps air is again admitted to it through a 2-in. perforated pipe, shown at the right hand end of the longitudinal section.

Scrap iron was first used instead of iron rods, about 1,600 lbs. to each bed. This was placed in square boxes and when the corners of the latter were down the increase in power required to turn them gave a jerky motion and caused the boxes to break. The rods are suspended in a chain belt. They are of common iron, about ¾ in. in diameter, and there are about 300 lbs. of iron in each bundle, or 1½ short tons in each bed. The bundles of rods make about 6 revs. per min. The attrition of the rods as they revolve on each other was designed to cause particles of iron to be deposited in the water to serve as a coagulant. The water department has no records of the amount of iron consumed in the process, but Mr. Bond states the rods have not been renewed for two years or so. Had the rods been entirely consumed in two years iron would have been used at the rate of about 0.025 grains per gallon of water. In the Anderson process of iron treatment 0.1 and 0.2 grains per gallon are taken up by the water, according to the printed matter issued by the company controlling that process.* The lower of these two rates, or 0.1 grain per gallon, would require 14.3 lbs. of iron per 1,000,000 gallons of water filtered, or 57,000 lbs. of iron for the past two years, against the 15,000 lbs. put in place two years ago, and still but little wasted. The rubbing of the rods together as they revolve seems to do little more

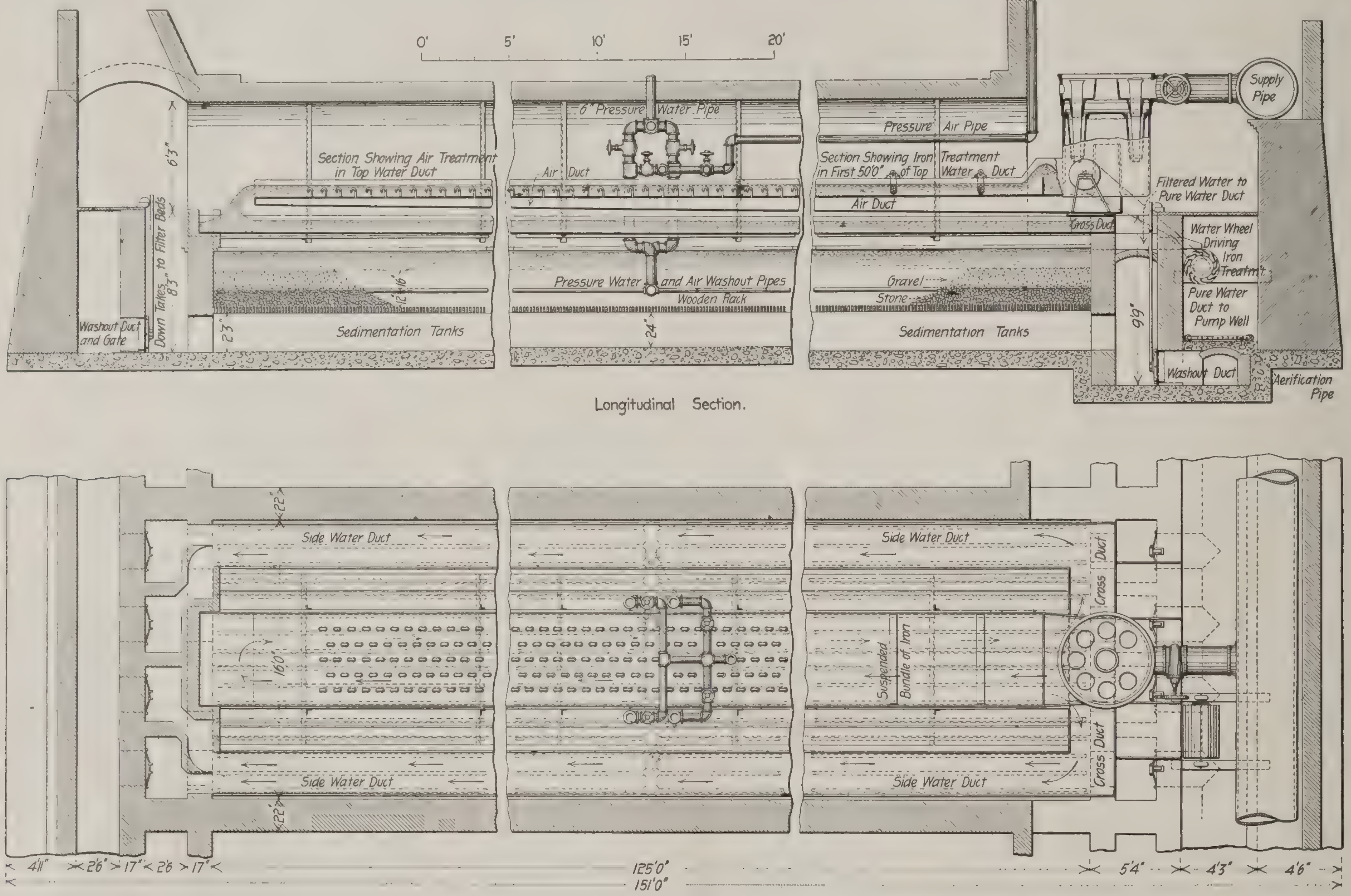


FIG. 1.—PLAN AND LONGITUDINAL SECTION OF WATER PURIFICATION PLANT AT WILMINGTON, DEL.
Geo. H. Sellers (deceased), Engineer; Joseph A. Bond, Chief Engineer Water-Works.

See p. 241, "Public Water Supplies," by Jno. W. Hill. Also see Eng. News, Feb. 14, June 6 and Sept. 5, 1885, Jan. 1, 1887, April 25, 1891 (under Society Proceedings) and Sept. 22, 1892. The Anderson process is in use in a number of places abroad.

than keep them somewhat polished, judging from the looks of the outer rods. The scrap iron, while in use, showed more wear than the rods, as would be expected.

When the plant is working at its full capacity of 10,000,000 gallons in 24 hours, or 2,000,000 gallons per bed, the time taken for the water to travel from the last bundle of rods to the sedimentation chamber is stated to be about 3½ minutes, and through the whole plant about an hour.

The air for aeration was furnished by a Clayton air compressor with an 18 × 24-in. air end until about two years ago, when a No. 4 Wilbraham-Baker blower was substituted. The blower is run by the water wheel that drives the power pumps, thus saving power, besides which the air is always available now, whereas the compressor had to stop as soon as the steam plant shut down.

The volume of air supplied is said to be about equal to the volume of water treated, doubtless meaning air at atmospheric pressure.

Originally, one whole filter bed was washed during each twelve hours, except that no washing was done for the last half of Saturday and all of Sunday. A little calculation will show that under this plan the periods between washing each bed would be alternately 2½ and 4 days. In 1896 each bed was divided into halves by plank partitions, so that only one-tenth instead of one-fifth of the plant need be thrown out of use for washing. In addition, washing is done each day now, with a "long wash" on Sunday. The filtering material was also removed and washed in 1896, one bed at a time, the "gravel and sand," to quote from the report for that year, "were again separated into their various sizes and replaced, their comparative depths (being) changed from 17 ins. of gravel and 12 ins. of sand to 12 ins. of gravel and 16 ins. of sand." This is the only time the filtering material has been taken out, washed and screened, Mr. Bond states, but reference is made further on to a clogging of the beds in 1894 or 1895, which necessitated the removal of the material.

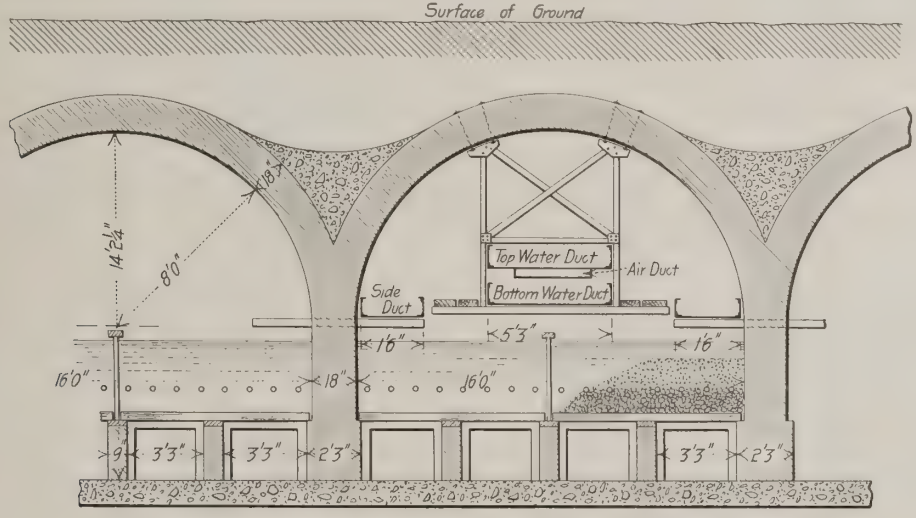


FIG. 2.—CROSS SECTION OF WATER PURIFICATION PLANT.

The original intention seems to have been to cleanse the filtering material with water admitted from above under a head of 1 ft., alternated with air admitted under pressure from beneath. In the latter case the water would still be passing upward through the bed, as when in use, but the water would be wasted. Mr. Bond stated that the air disturbed the bed by pushing the material upwards and the water carried the fine material downward. Subsequently perforated pipes were placed in the filter beds, as shown in the plan and sections. To wash the gravel the beds are now left submerged and water is wasted from below, while to wash the sand the sedimentation tanks are left filled with water and waste weirs are opened above the beds, so that the air or water, as the case may be, is forced upwards through the sand.

While filtered water has always been used for washing, as we understand it, water under pressure has been used for only about 1½ years, so that previous to this change the amount of wash water was unknown.

In 1897 the amount of filtered water used for washing was 53,183,250 gallons, or 2.6% of the total pumpage. The total amount of water pumped from the Brandywine, all of which we suppose was filtered, during the three full years the purification works have been in operation, together with the average daily pumpage, is as follows:

Year.	Pumpage, gallons. Total.	Pumpage, gallons. Daily average.
1895	2,127,600,000	5,830,000
1896	2,058,000,000	5,640,000
1897	2,041,000,000	5,600,000

There are no records of the amount of material retained by the sedimentation tanks. Every time downward washing is employed some of the sediment, if any, goes out. If necessary the sediment is further removed by the use of a stream from a hose, but this operation is not often required.

The cost of operating the filter plant is not given in the reports of the water department, but it is stated in the report for 1897 that the "expense for maintenance" for that year did not exceed "one dollar per million gallons filtered." Maintenance in the words quoted probably means all operating expenses. In the financial reports entries are made yearly under "filter account" and "filter maintenance." The former appear to include construction expenses, and the latter supplies for repairs and operation. The items under these two headings in the reports from 1893 to 1897, inclusive, are as follows:

	Filter acct.	Filter maintenance.
1893	$52,546	....
1894	38,736*	$158
1895	3,619	772
1896	4,720	425
1897	765	528
	$100,386	....

*Including $2,180 for filter house.

To the figures in the last column should be added labor, and possibly some other items, to obtain the actual cost of operation. Originally one man at $12 a week, or $624 a year, did all the work of running the filters. He now has a small amount of assistance from a laborer employed about the pumping station at $9 per week. The filter man is on duty from about 6:30 to 11:30 a. m., and from 6:30 to 11:30 p. m. No charge is made against the filter plant for the power required to supply the air for aeration nor for electric lighting. At 4% the annual interest charges on the cost of construction would be about $4,000, or about $2 per 1,000,000 gallons filtered.

Assuming the plant able to work at its rated capacity of 10,000,000 gallons per day, the cost of construction, including subsequent changes, would be about $10,000 per 1,000,000 gallons. But in the report for 1895, after the filters had been in use for less than a year, Mr. Bond recommended that their area be doubled, setting forth his reasons as follows:

> The capacity of the filter now in use, although in excess of the consumption, is insufficient to supply the pumps when they are running at their normal speed, and to decrease the speed of the pumps is poor economy, and to force the filter beyond its rated capacity is detrimental to the purity of the filtered water. If the filter area were enlarged, the rate of filtration could be lessened, and the quality of the water would be improved; besides increased facilities would be afforded for cleansing the beds, which is the secret of the efficiency of all filters. A filter of equal area to the one now in use could be built on grounds below the pumping station at a greatly decreased cost.

In explanation of this quotation Mr. Bond states that the 2,000,000-gallon water power pump is always used when any pumping is being done. This, with the 10,000,000-gallon steam pump, gives a daily pumpage of 12,000,000 gallons, which is 20% in excess of the rated capacity of the filters and 33⅓% above their capacity when a half bed is being cleaned. Under the first plan, when a whole bed was cleaned at a time, the rated capacity of the plant was reduced to 8,000,000 gallons, making the pumpage 50% in excess of the capacity of the filters. An automatic gate is provided for admitting unfiltered water to the clear water well, if necessary to supply the pumps, but Mr. Bond states that with upward filtration all the water the pumps will take can be got through the beds.

It has already been stated that the pumps are shut down when the water is very turbid, a practice followed before the filter plant was installed. This not only relieves the filters of much work, but gives them occasional resting spells. In 1894 or 1895, Mr. Bond states, it was necessary to pump very turbid water, with the result that the filtering material became so badly clogged that it had to be removed before the filters could be operated again. In view of all these facts, the filter capacity seems to be overrated when placed at 10,000,000 gallons per day and that without particular reference to the degree of purification effected. We shall not attempt to decide the proper rating, and the consequent cost of construction per 1,000,000 gallons actual capacity.

Wilmington has had a generally decreasing amount of typhoid fever, considering its growth in population, during the period for which statistics are available, or from 1881 to 1897, inclusive. The following figures show that this rate has not been notably accelerated, if at all, since the filters were started:

	Approximate population, 1 = 1,000.	Deaths from typhoid fever. Total.	Deaths from typhoid fever. Per 100,000.
1881	44	43	97
1882	46	51	111
1883	47½	32	67
1884	49	45	92
1885	51	25	49
1886	53	25	47
1887	55	37	67
1888	57	32	56
1889	59	30	50
1890	61	55	90
1891	63	35	56
1892	65	29	45
1893	67	44	65
1894	68	29	43
1895	68	27	40
1896	69	15	22
1897	70	23	33

The figures for population are of necessity only approximate. For 1881-1889 they were scaled from a population curve plotted from the U. S. census figures for several decades past. It seems to be well agreed by the city officials of Wilmington that the population of the city has remained practically stationary since 1893, and was about 70,000 in 1897. Since the latter date it is thought that it has begun to increase again, with the revival of industry.

It is to be noted that steps have been taken of late to protect the water supply from pollution. Two sanitary inspectors were appointed in 1894 to give their whole time to the sanitary patrol of that part of the stream within the state. At the start these inspectors had no authority to cause the arrest of persons polluting the Brandywine, but in 1895 this authority was secured from the legislature and is reported as being salutary, although no arrests were made that year and none are mentioned in the later reports.

Some years before the inspectors were appointed, or in 1887, the city diverted, by means of a 20-in. sewer, the waters of two small streams, Rattlesnake and Crooked runs, from the race to a point below the water-works intake. About 1887 the city began the construction of a system of intercepting sewers, which also helped to protect the water supply, although in times of heavy rain the interceptor overflows into the stream above the intake. The sewage at such times is, of course, diluted with storm water and, as has already been stated, the pumps are shut down. Since 1887, also, lateral sewers have been built with rapidity, the water mains have been extended and other sanitary improvements have been constantly in progress. Surface wells have been abandoned with the extension of the water service and those remaining in use are less liable to pollution as the sewerage system comes into more general use. Credit must also be given to improved care of typhoid patients by physicians and nurses and especially to the control of the spread of the disease through secondary infection. The milk supply, also, is doubtless less responsible than formerly for the spread of the disease.

In the practical absence of analyses of the water both before and since the filter plant was established only general impressions can be gathered from city officials and residents regarding the improvements in the physical character of the water. It seems to be agreed that the plant effects a large amount of clarification, although unable to cope with the water at its worst. Color, or stain, is only partially removed. Complaints of tastes and odors, which were heard for a few weeks some years, seem to have ceased since filtration and aeration was established, the aeration probably being the most effective agent in this connection.

We are indebted to the late Mr. Sellers for the blue prints from which the illustrations have been prepared. We are also indebted to Mr. Bond for information given and courtesies extended to a member of the editorial staff of this journal during a visit to the plant shortly after it was put in operation and again during August, 1898.

* * *

THE BELUBULA DAM, NEW SOUTH WALES.

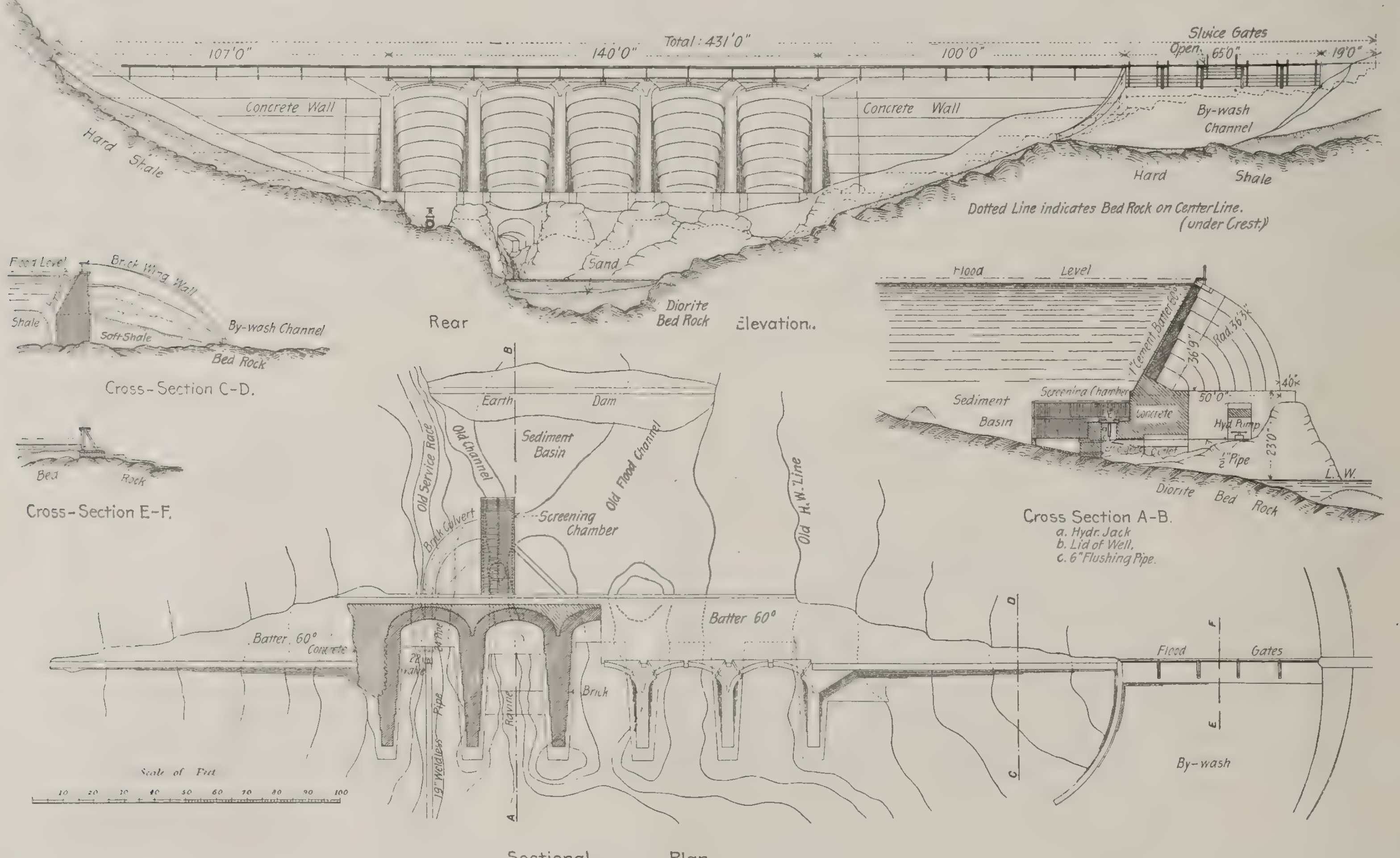
The Lyndhurst-Goldfields Co., of New South Wales, commissioned Mr. Oscar Schulze, C. E., of Sydney, to provide an installation of water power to work large deposits of low grade ore. The water was to be taken from the Belubula River, draining a watershed of 300 sq. miles, with an average annual rainfall of 30 ins. upon it. During the hot season this river is often dry for three months; and under these conditions the dam had to be of sufficient size to impound the water necessary to run three turbines, aggregating 200 HP., for these three months. As described in "Indian Engineering" (from which journal we have also reproduced the accompanying cuts), Mr. Schulze located the dam at a point on the river just above a succession of falls, with a total descent of about 175 ft. At this point the river had cut out a narrow gorge in diorite rock. The valley above this gorge is of such width and slope that a 16-ft. depth of water stores about 87,120,000 cu. ft., and gives a head of nearly 200 ft. on the turbines located about one-half mile below the dam.

The design of the dam is most unusual. The rock at the bottom of the site was found to lie in a number of sharp ridges parallel to the axis of the stream, with deep channels between. A buttressed face-wall was therefore determined upon. The locality afforded facilities for brickmaking, and this brick was found to be the cheapest material and the one with which the dam could be most quickly built. Owing to the deep hollows between the ridges of the bed of the stream, an ordinary double-faced wall would have been difficult to construct without expensive foundation work.

The total length of the dam, including overflow, is 431 ft. on the crest; the greatest height is 60 ft., with a concrete foundation varying from 1 to 23 ft. in height and above that 36 ft. 9 ins. of brick work. There are six buttresses, 28 ft. apart c. to c., and each 40 ft. long, and 12 ft. wide where they abut against the wall and 5 ft. wide at the outer end. Each buttress, as carried up in brick work, forms a segment of a circle with a radius of 36 ft. 2 ins., and it decreases in thickness from 8 ft. 6 ins. at the center to 4 ft. on the outer circumference. These buttresses form piers for five elliptical, brick arches, which are 4 ft. thick at the bottom, 1 ft. 7 ins. at the top, and lean forward on an angle of 60°. The spandrels between the arches were filled with concrete, and this concrete covered the crown of the arches to a depth of 12 ins. and joined the side walls of the dam, which were also made of concrete, with large boulders imbedded to save expense. These side walls were built on the same angle of 60° on the water-face, but were vertical on the other, with a top width of 2 ft.

The overflow, built at one end of a side wall, is 65 ft. wide, and is divided into five sluiceways; provision is also made for the water to run over the dam between the buttresses in extreme high water. The arched outlet in the base of the dam, which was left open during construction, is fitted as an emergency outlet by building out a projection on the water-face of the dam with a 5 ft. well in it covered with a 12-in. wooden lid that can be raised by a 50-ton hydraulic ram, worked by a pump at the back of the wall. The 12-in. service outlet pipe is carried through the wall with an entrance made of a tapering and rising brick culvert. The entrances to this culvert and to the two 6-in. flushing pipes are covered by a grating and surrounded by a sediment basin, formed by building an earth dam across the river bed. This same dam diverted the water to the temporary outlet during construction.

The dam contained about 6,000 cu. yds. of concrete and 500,000 bricks, and the total cost of the dam was less than $45,000. To prevent gradual silting up, a cribwork will be built later across the upper end of the valley.



BRICK AND CONCRETE DAM WITH BUTTRESSES ON THE BELUBULA RIVER, NEW SOUTH WALES, FOR THE LYNDHURST GOLDFIELDS CO.
Oscar Schulze, Sidney, Australia, Chief Engineer.

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LOSSES FROM IRRIGATION AND OTHER CANALS BY SEEPAGE.

In our issue of June 23, 1898, we published an article on "The Loss of Water from Reservoirs by Seepage and Evaporation," in which we gave the conclusions of Prof. L. G. Carpenter on this subject, as set forth by him in Bulletin No. 45 of the Agricultural Experiment Station, Fort Collins, Col. The same institution has now issued Bulletin No. 48, also by Professor Carpenter, on "Losses from Canals from Filtration or Seepage." This bulletin is based on measurements made under Professor Carpenter's direction, on years of general observation, and on measurements made by others in this and foreign countries. The bulletin may be obtained by applying to Professor Carpenter, or the director of the station. Its conclusions are as follows:

> (1) The losses from evaporation are relatively insignificant compared with the seepage losses from most canals. In the cases most favorable to evaporation and least favorable to seepage the evaporation is not over 15% of the seepage.
>
> (2) In the case of reservoirs it was concluded in Bulletin 45 that the seepage was less important than the evaporation. This is different from the results found in ditches, not because the evaporation is less, but because the seepage is much more.
>
> (3) The losses are sometimes enough to cover the whole canal 20 ft. deep per day.

(4) The loss in clay soils is less than in sandy or gravelly soils, but rarely as small as 3 ins. daily.

(5) The loss is greater when water is first turned in than after the bed has become saturated.

(6) Sometimes the canals are found to gain for the whole or part of their length, or the canals may act as drains. This is more likely to be the case when the canal is deep in the ground, when crossing lines of drainage, or when located below other ditches or irrigated tracts.

(7) In the prevailing Colorado soil, when not intercepting seepage, the loss may be put provisionally at from 1 to 2 ft. per day over the whole surface of the canal. In clay soils it is less, but still nearly one-half as much.

(8) The loss in carrying water in small quantities is relatively larger than in carrying large amounts. The increased depth of water means increased leakage. but the carrying capacity increases faster than the leakage.

(8a) From the standpoint of economy it is wasteful to run a small head. It is more economical to run a large head for a short time. In the management of small ditches the time system of distribution can be introduced to advantage, saving time and labor as well as water.

(9) It is wasteful to use two ditches or laterals when one would serve.

(10) The loss increases with higher temperature, being about twice as much at 80° as at 32° F.

(11) The loss increases with greater depth of water, but the exact relation needs further investigation.

(12) The loss will be lessened by any process which forms or tends to form an impervious lining or coating of fine material, as of clay or silt. The silt, consisting of fine sand, improves many soils. Clay is better, and especially limy clay, the lime with the clay forming an almost impervious coating.

(13) Cement linings as used in California and Mexico are not warranted by the conditions in Colorado, nor would the weather conditions be favorable. Nor is the use of wooden stave piping for this purpose likely to be profitable in many places in the state, if at all on the larger canals at present. The silting process applied with discrimination will accomplish much at smaller cost.

(14) On small laterals glazed sewer pipes may save annoyance often connected with the carrying of water in laterals for considerable distances, which, with the saving of water, may make its use an object. One of the supply laterals of the Colorado Agricultural College is of vitrified sewer pipe, over 4,000 ft. of 12-in. pipe being used.

(15) Some particular sections in canals are subject to much greater loss than the canal as a whole. Hence water can be saved by locating the leaky place and remedying it. This may be desirable to do while it would be unprofitable to treat the whole canal.

(16) There are many places where it would be advantageous to combine two ditches, by this means saving not only the loss of water, but saving superintendence and maintenance charges. With increased confidence in the accuracy of water measurement, reluctance to such consolidations should lessen.

(17) The depth of losses from laterals is probably greater than in the main ditches. The laterals are less permanent, are steeper, have less silt, and are more poorly cared for.

(18) There must be some arrangement of ditches and laterals which is the most economical for given conditions, so that the aggregate of the losses of the whole system will be a minimum. Certainly the location and arrangement of the laterals for carrying water from the main ditch is worthy of consideration by the management of the main canal, and the importance increases with the size of the canal and the width of the strip it serves.

(19) It is not to be understood that the whole of the loss from the ditches is lost to the public wealth of the state. Some, perhaps much, of the loss, may reappear as seepage in lower ditches or in the main stream and again be used. It is, however, lost to the particular ditch and incidentally is destructive to much land. With all practicable methods of prevention, there will still be abundant loss. It should be to the advantage of the individual ditch to prevent such loss as far as practicable.

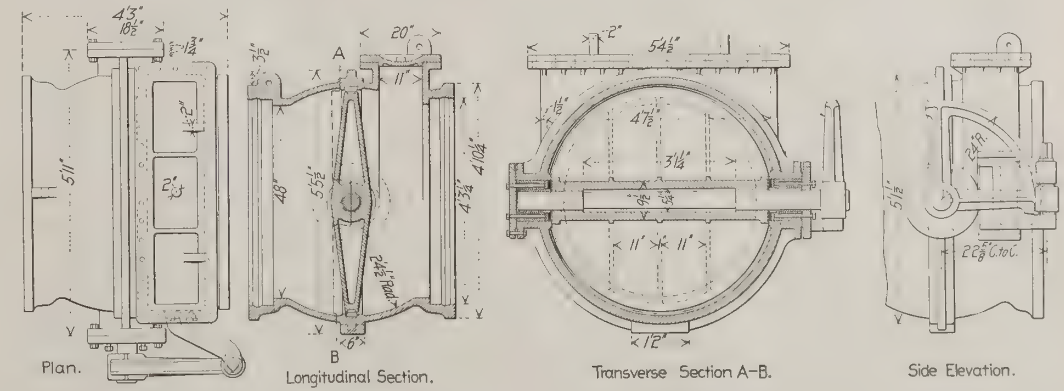
(20) A general statement of the total amount of loss of water must be made and accepted with reservation. It would appear that in the main canals from 15% to 40% is lost, and in the laterals as much more. It would thus appear that not much over one-half, certainly not over two-thirds of the water taken from the stream, reaches the fields. In the most favorable aspect, the loss is great, and is relatively greatest when the loss can be least afforded, viz., when the water is low and the ditches are running with reduced heads.

(21) There are some 2,000,000 acres of land irrigated in Colorado, and the value of the water rights, at a low estimate, is as much as $30,000,000. (The census estimates the water rights as worth $28.46 per acre.) On this basis, the capital value of the water lost by seepage in the canals and ditches may be put at from $6,000,000 to $10,000,000. From the evidence at hand at present this seems a low estimate.

◆

A 48-IN. ROTARY VALVE.

The accompanying cut shows the details of a 48-in. rotary valve, made by the Viney Independent Gate Valve Co., Ltd., Lippincott Building, Philadelphia. The two principal advantages of this valve are the quickness with which it can be opened or closed and the small space which it requires. The manufacturers claim that two men can open one of these valves in one-tenth the time required to open an ordinary lift valve. The body of the valve has a diameter only 8 ins. in excess of that of the pipe on which it is placed. This feature is valuable where valves are placed in any limited space, especially beneath street surfaces. In the city of Philadelphia about 150 of these valves, from 20 to 48 ins. in diameter, are placed beneath the streets.



A 48-IN. ROTARY VALVE MADE BY THE VINEY INDEPENDENT GATE VALVE CO., PHILADELPHIA, PA.

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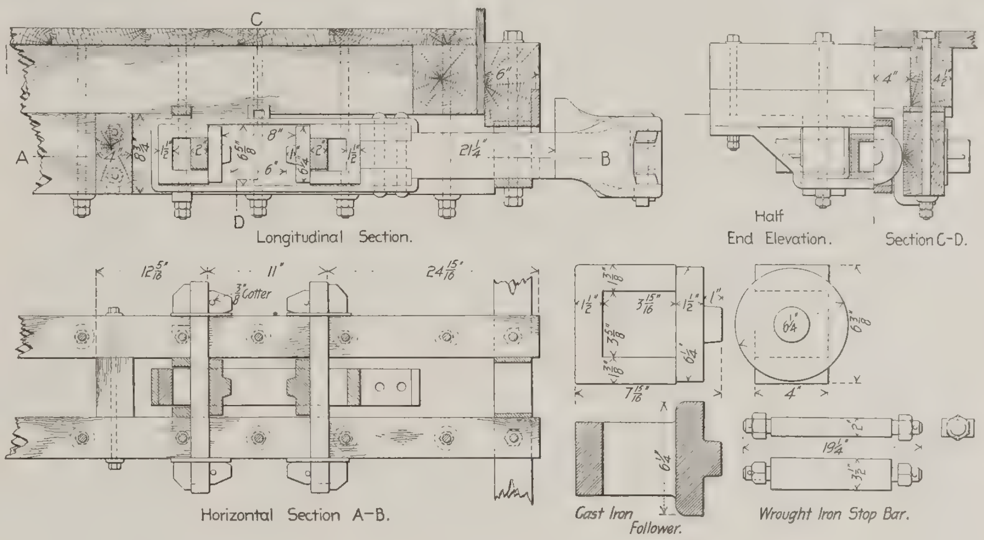
NEW FREIGHT CAR DRAFT RIGGING OF THE PENNSYLVANIA R. R.

About a year ago the Pennsylvania R. R. and allied lines secured the license to use a new draft rigging for freight cars, which promises to reduce materially the cost of maintenance of this class of equipment, draft rigging repairs being generally conceded to be one of the largest items of expense in car repairs. This new device was first tried on a number of cars on the South West System, which ran for a year without showing any signs of weakness in the parts belonging to the draft rigging, after which the Pennsylvania R. R. proper also equipped a number of its cars with the same device. As many of these cars as could be reached were recently examined, and after 1½ years' service their draft riggings were found to be in perfect condition, not a single part needing renewal in the whole lot. As far as known by the officials, not any of these cars have had any repairs done to their draft rigging since they were turned out, nor have any draft springs been found broken on them.



IMPROVED FREIGHT CAR DRAFT RIGGING; PENNSYLVANIA LINES.

Some of the cars have been exposed to unusually rough handling and have been in collisions, yet it is stated that although the couplers or the cars themselves have been more or less injured, the draft riggings have so far escaped all damage. In one instance, it is stated, a yard engine backed down into a cut of cars, of which the first one had this draft rigging, with such a force that the car, which was a flat car, had all its sills broken in two and the body doubled up like a jack-knife, yet, when the wreck was cleared off the draft riggings at both ends were found intact, draft sills and all, and the complete outfit was applied to another car the next day, without repairing any parts, except straightening some of the bolts securing the draft sills to the center sills.

In another instance a train parted between the engine and the first car, on account of a broken knuckle. The cars bumped up against the tender with such force that the tank shifted 1 ft. on the frame, and the end sills on the first car, which had this draft rigging, broke, but the rigging itself was not damaged. The following two cars, which had a different kind of draft rigging, had it broken, on one car at both ends.

An interesting test was also made at Columbus, O., about a year ago, when two cars with these draft riggings were each coupled to a locomotive headed in opposite directions. The cars were connected by means of a 30-ft. switch rope looped around the knuckle. The engines were then started at full speed, and when the rope tightened up it produced a jerk sufficient to snap off one knuckle by shearing off the pin, cracking another knuckle and bending two other knuckle pins. There was no damage done to the draft rigging of either car.

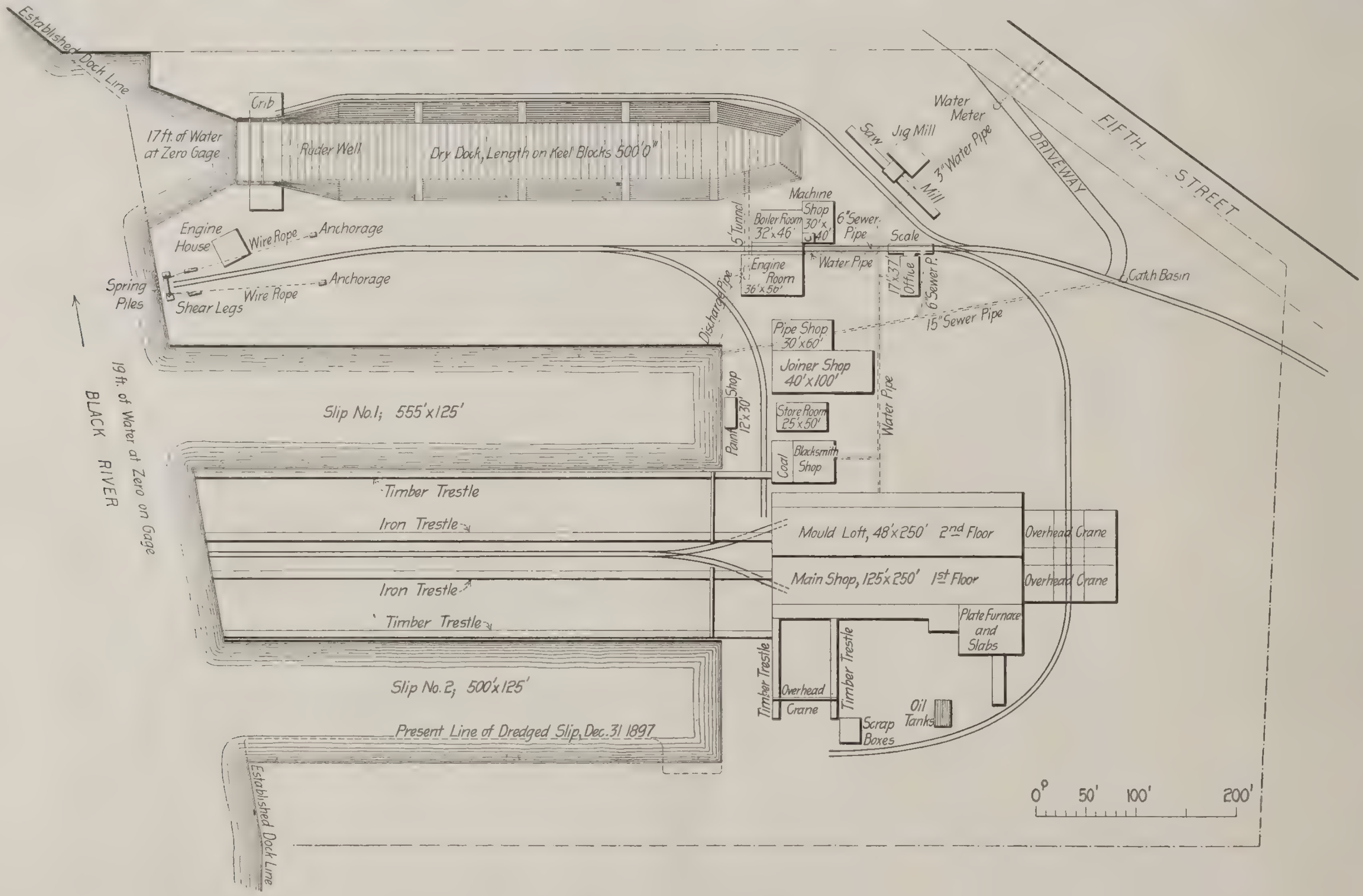
The strength, which this form of draft rigging possesses, is not, however, its principal advantage, which is the ease with which it can be taken down and put up, and the short time required to renew a coupler, the latter job having frequently been done in six minutes, often without switching the cars out of the train. To do this work it is only necessary to remove the nuts or keys securing the stop bars on one side, and then drive these stop bars through by means of a long stick projecting beyond the side of the car, where there is plenty of room for using a sledge. If a draft spring should need removal, which has not happened yet, however, the back end of the coupler with the tail strap is tipped down on the carrier iron, after the stop bars have been removed.

In the accompanying illustration two different kinds of fastenings for the stop bars are shown, which are both being tried. The one with keys instead of nuts reduces the machine work, and makes it possible to renew all parts of the draft rigging at any blacksmith shop without special tools or formers, which may be a decided advantage for cars that are apt to get out of order at distant points, away from regular repair shops.

It is estimated that this form of draft rigging can be made and applied cheaper than the one in the M. C. B. recommended practice, and it is claimed to have a decided advantage also in that it may be applied to draft sills spaced as close as 5 ins. Another feature is that the spring cannot be compressed solid, which is probably the reason why, so far, no springs have broken. It is understood that the device is to be tried on some new steel cars of large capacity, for which it is considered well adapted on account of its strength.

THE LORAIN SHIPYARD OF THE CLEVELAND SHIP BUILDING CO.

The Cleveland Ship Building Co. has recently completed a shipyard and dry dock, at Lorain, O., 26 miles west of Cleveland, and the entire plant is now in operation. The designs were prepared by Mr. James Ritchie, M. Am. Soc. C. E., of Cleveland, who also superintended the construction. The accompanying drawings show the general arrangement and details of the work. The dry dock has a total length of 560 ft., a width on top of 96 ft. between copings, a width on the bottom of 59 ft., and it will hold a vessel of 500 ft. length on the keel. It is built of timber and piling and has a steel gate, giving an entrance 60 ft. wide on the bottom and 66 ft. on the top, with a depth of 17 ft. of water on the sill at the ordinary stage. The entrance is protected by two timber cribs, and the aprons are of timber on piling. The spaces between the piles are filled with concrete, and the cribs are filled with puddled clay.



GENERAL PLAN OF THE SHIPYARD AND DRY DOCK OF THE CLEVELAND SHIP BUILDING CO., AT LORAIN, O.

James Ritchie, Chief Engineer.

The bottom and slopes of the dock are constructed of piles capped with longitudinal 12 × 12-in. oak timbers. The transverse timbers of the bottom are 12 × 18-in. Douglas fir. There are 63 of these timbers, 50 of them being 64 ft. in length, and the others varying in length from 64 to 32 ft. The slope timbers are 12 × 12-in. and 8 × 12-in. alternately, and 32 ft. long, framed into the transverse floor timbers. The slope timbers are covered by 1-in. pine boards, and upon these are laid the alters or steps. The floor consists of 4-in. pine planks laid on the longitudinal timbers, between the long transverse timbers. There are two drains, one at the foot of each slope, and they unite at the east end of the dock in a cross drain, leading to a brick tunnel, 5 ft. in diameter, which conveys the water to the pumps. The latter are two in number, each having a 30-in. discharge, and together having a pumping capacity of 50,000 gallons per minute. They were built by the Southwark Co., of Philadelphia, and have performed their service with entire success.

The dock is enclosed by a line of 6 × 12-in. tongued and grooved sheet piling, driven 20 ft. into the ground, and anchored to round piles outside by 1¾-in. iron rods. The rudder well is 10 × 15 ft., and 10 ft. deep, with a concrete bottom 24 ins. thick, the sides being protected by sheet-piling. The work of construction was commenced on Feb. 22, 1897, and the first boat docked was the "Sir Wm. Fairbairn," 438 ft. long, on Jan. 26, 1898. Since that date there have been six other large steamers docked with uniform success.

The power-house and main shop are shown on the plans. The shop is equipped with overhead traveling cranes, with all necessary tools for handling and shaping the plates and shapes for the building of ships. Each tool has a pneumatic hoist for handling the material, and all the tools are operated by electricity generated in the power-house, each tool having an independent motor. There are at present two berths for building ships, and over each is a traveling crane operated by electricity, and supported by the timber and iron trestles shown on the general plan between Slips Nos. 1 and 2. The iron trestle is fixed in place, while the timber trestle is movable, and will be taken down when the vessel is ready for launching, as all vessels are launched sideways on the lakes. There will be space for building four vessels at one time in this yard, but only two are now being built.

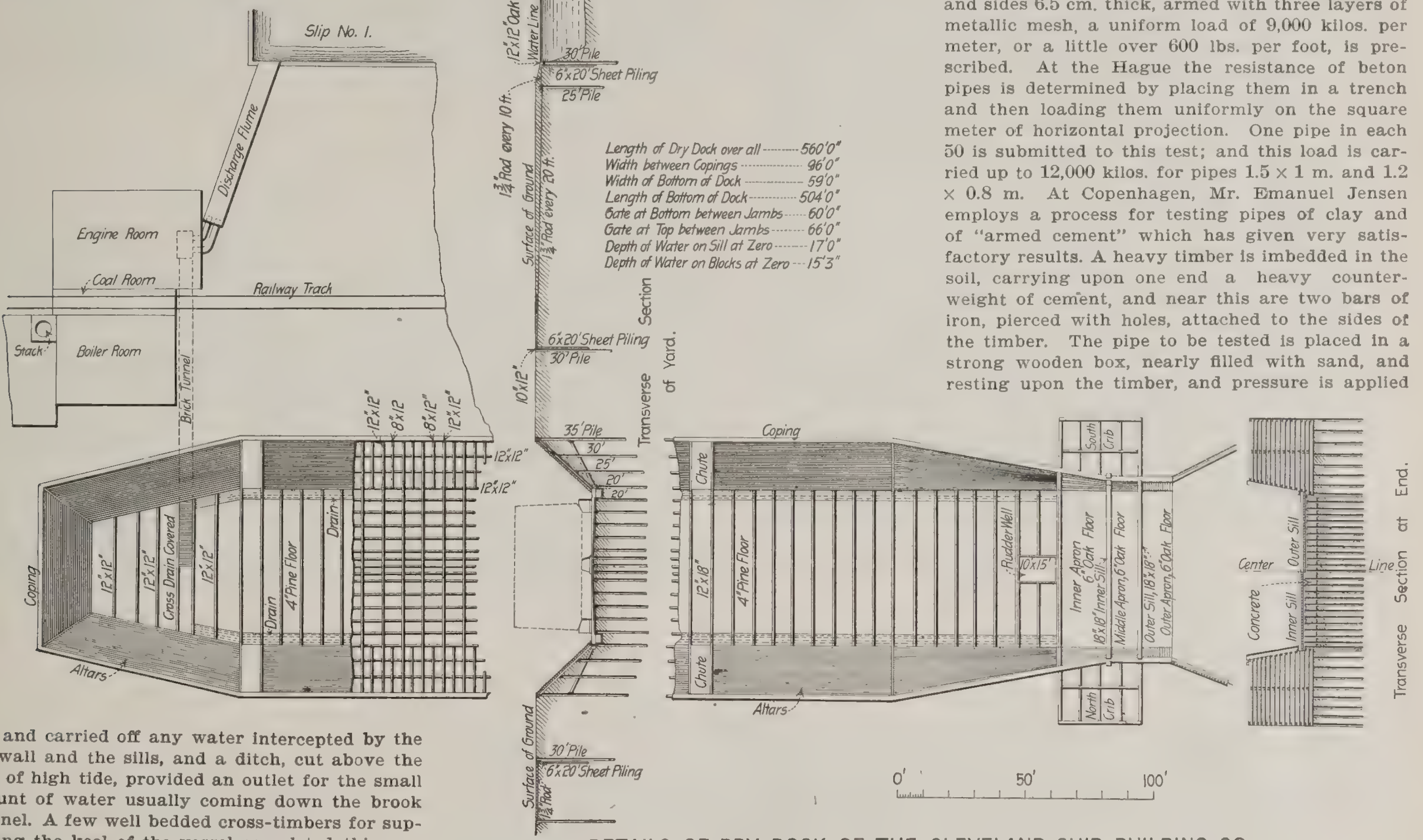
The sides and ends of the slips and the river front are protected by piling and sheet-piling, anchored back to other piles, by 1¾-in. iron rods. Under each berth are six rows of piles, capped with 12 × 12-in. oak timbers, for supporting the ships during construction. The railroad tracks shown on plan serve to transfer the material from the main line to the various overhead cranes shown on the plan, and everything has been designed with a view of simplifying the handling of material.

The framework of the main shop is of steel construction, with the first floor divided into two rooms, each 40 ft. wide by 250 ft. long, with a passageway between them 15 ft. wide, in each case measured from centers of columns. The clear headroom in this first floor is 18 ft. 6 ins.; and each 40-ft. space is covered by a traveling crane, running upon tracks on the four sets of side posts. The mold-loft is located over one-half of this first floor; it is 48 ft. 9 ins. wide, from out to out of side posts, 8 ft. 6 ins. high in the clear, and is covered by a flat, trussed, timber roof, with a 4-ply tar and gravel roof. The other half of the main floor is also covered by a tar and gravel roof laid on ⅞-in. matched pine boards, resting upon the main plate girders. Outside of the lower floor of the main shop are two parallel wooden sheds, each about 15 ft. wide, with one of these sheds terminating in the plate furnace, as shown on the general plan. The heating furnaces, for preparing plates and shapes for bending, are operated by crude oil fuel.

A NATURAL DRY DOCK.

We are indebted to Mr. T. Hodgson, of Bedford, Province of Quebec, for a description of a natural dry dock and the manner in which it has been utilized. This dock is on the Maine side of the St. Croix River, between Calais and Passamaquoddy Bay. At this point a small brook has cut a channel of sufficient width through the river bank down to about the level of low tide; the difference in tide levels at this place being nearly 25 ft.

As there was a considerable amount of shipping owned in this neighborhood and docking facilities were absent, some ingenious Yankee concluded that he would utilize the cut made by the small stream; especially as the high range of tide provided all the appliances needed to fill and empty the dry dock. Starting several hundred feet from the river, on the small tributary, a cut was made across the bed of the stream, extending into each bank, and a ten-foot wall of stone laid in cement was built. At the center opening the top of this wall was about on the level of the bed of the stream; but at the sides it extended above the highest tides. Sills were laid in the opening and a pair of ordinary lock-gates were put in place, opening outwards. A pipe controlled by a valve was laid in the center wall level with the stream bed, and carried off any water intercepted by the low wall and the sills, and a ditch, cut above the level of high tide, provided an outlet for the small amount of water usually coming down the brook channel. A few well bedded cross-timbers for supporting the keel of the vessel completed this serviceable dry dock.



Length of Dry Dock over all ---- 560'0"
Width between Copings ---- 96'0"
Width of Bottom of Dock ---- 59'0"
Length of Bottom of Dock ---- 504'0"
Gate at Bottom between Jambs ---- 60'0"
Gate at Top between Jambs ---- 66'0"
Depth of Water on Sill at Zero ---- 17'0"
Depth of Water on Blocks at Zero ---- 15'3"

DETAILS OF DRY DOCK OF THE CLEVELAND SHIP BUILDING CO.

The operation of the dock was very simple. The vessel came up the river on the flood tide and was hauled into the dock and held in position over the keel blocks as the tide ran out. As the water level lowered shores from the banks kept the vessel upright, and these are found sufficient for the class of vessel using this dock. When the tide had ran out the gates were shut and the water was kept out until repairs were completed. To undock the ship the gates can be opened at low tide and the water thus admitted on the rise of tide will float the vessel, and she can pass out and down stream on the ebb tide. This dock has been in successful operation for some years, and is an interesting example of the utilization of existing natural conditions for securing a much-needed convenience.

* * *

EUROPEAN METHODS OF TESTING SEWER PIPES OF CEMENT AND CLAY.

The International Association for the Testing of Materials, in 1896, appointed a committee to investigate the methods of testing sewer-pipes of cement and clay, as up to that time there had been no uniform method of testing, and practice varied widely. Mr. Gary, chief of the section for the tests of materials, at the test laboratory at Charlottenburg, was directed to take charge of this investigation, and his preliminary report is published in "Les Materiaux de Construction," Nos. 23, 24, the official organ of the Association.

Mr. Gary, in 1895, had already investigated, for the German Association of Manufacturers of Portland Cement, the methods employed by governments, municipalities and individuals in testing the strength of cement pipes. He found that these tests varied in each case, and none were regarded as complete for the purpose intended. Similar conditions existed in other countries than Germany.

In the investigation to be made Mr. Gary concluded that the points to be determined were as follows: The resistance to internal and external pressure; impermeability; resistance to the attack of acids; and the wear upon the interior by sand passing with the water. The tests should then mainly determine the bursting and crushing strength, and the texture and composition of the paste used. The resistance to exterior pressure is the most important property in a cement or clay pipe; for, with a few exceptions, such pipes are simply covered with earth or sand, and are not placed in masonry. The pressure upon them will differ as these pipes are laid under traveled streets, under railway embankments, or under the foundation walls of buildings; and it is necessary, in passing judgment upon the fitness of these pipes, to distinguish between the loads to which they are to be subjected in use. Mr. Gary then details the practice of a number of German cities in the test of cement pipe, as follows:

The Department of Public Works of Liegnitz requires that a cement pipe one meter (3.28 ft.) diameter should resist the pressure of a layer of earth 3 meters (9.84 ft.) thick; at Rosenheim, pipes covered with 12 to 16 ins. of earth should resist the pressure of a heavy vehicle; and at Colmar, when there is any doubt of the solidity of a pipe, a loaded wagon is passed over the laid pipe. At Schwerin, in Mecklenburg, cement pipes must resist, without cracking, a pressure equal to 50 kilograms per linear meter and per centimeter of diameter. This test is made by placing railway rails on the top of the uncovered pipe. The city of Freysing prescribes that the pipe should support a "load of 6,000 kilos, concentrated upon the top of the pipe"; and Passau demands that the pipe resist a pressure of 805 lbs. per lin. ft. At Zeitz, where the pipes are buried 6 to 8 ft. beneath the surface, a steam road roller is passed over them before acceptance. Clay pipes, 1 meter diameter, have been tested at Mannheim, by burying them in the earth, with a covering layer about 18 ins. thick. Over the pipe was then placed a double plank platform, about 3 ins. thick in all, and 3.28 ft. square, and on this was placed the test load. The rupturing load was found to be about 28,600 lbs.

For the test of pipes of "armed-cement," or cement reinforced by a double iron mesh on the Zisseler system, the engineer of bridges, at Breme, prescribes the following test: The pipe is buried in sand in a solid wooden box; then by means of a cover fitting inside the box a pressure of 7,500 kilos. per running meter, or about 500 lbs. per lin. ft., is applied to the pipe. The pipe is required to stand this pressure without deformation or cracking. For pipes of oval section, 120 × 96 cm., and sides 6.5 cm. thick, armed with three layers of metallic mesh, a uniform load of 9,000 kilos. per meter, or a little over 600 lbs. per foot, is prescribed. At the Hague the resistance of beton pipes is determined by placing them in a trench and then loading them uniformly on the square meter of horizontal projection. One pipe in each 50 is submitted to this test; and this load is carried up to 12,000 kilos. for pipes 1.5 × 1 m. and 1.2 × 0.8 m. At Copenhagen, Mr. Emanuel Jensen employs a process for testing pipes of clay and of "armed cement" which has given very satisfactory results. A heavy timber is imbedded in the soil, carrying upon one end a heavy counterweight of cement, and near this are two bars of iron, pierced with holes, attached to the sides of the timber. The pipe to be tested is placed in a strong wooden box, nearly filled with sand, and resting upon the timber, and pressure is applied to it by a lever and saddle with the lever support on a pin passing through the holes in the iron bars. The advantage of this process is that the commencement of cracking in the pipe can be noted; though this is of little advantage in the test of clay pipes, as after the appearance of the first crack the pipe will support but little more. But in the case of the Monier and Zissleer construction, where the iron skeleton augments the cohesion of the material, the appearance of the first fissure precedes by some time the final crushing load.

At the test laboratory at Malines, the resistance of pipes to exterior pressure is tested by a Kirkaldy machine; the pipe being placed between two wooden saddles which each embrace one-third of the circumference of the pipe. But as it is difficult to insure contact with all the inequalities of the pipe, the process is not satisfactory.

From the report of Mr. Gary it seems that about the only sewer pipe tests so far employed relate to the resistance against exterior pressure; and he well remarks that a uniform, systematic and reasonable test of sewer pipe, of various materials, has yet to be devised; or, at least, to be introduced, into general practice.

* * *

A STEEL CROSS, 88 ft. high and 60 ft. wide, designed to carry electric lights and other decorations will be built and mounted on the Court House tower during the convention of Knights Templar, at Pittsburg, Pa., in October. The trunk and arms of the cross are made of 5 × 3 × ⅜-in. angles, in the form of a lattice column and girder, which is 12 ft. in width.

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We deem it in no way inappropriate to make some reference in these columns to what may well become one of the most notable events of modern times, the formal announcement by the Czar of Russia of an International Conference looking to the disarmament of the great nations of the world, to the extent at least to which their standing armies and navies are a menace to each other. No words of ours can add emphasis to the language with which this absolute ruler of a hundred and thirty millions of people portrays the horrors of war, and the crushing burdens which Europe's vast military armaments impose upon her people. As His Majesty truly says:

> To put an end to these incessant armaments and to seek the means of warding off the calamities which are threatening the whole world—such is the supreme duty imposed to-day upon all states.

The people of this nation, as a whole, will welcome with heartiness this word for peace, spoken by the man who more than any other one man living holds the destinies of nations in his hands. The United States maintains its army and its navy as a means of national defense, and by its fortunate location and its own varied natural resources, it is more secure against foreign invasion and attack than any other nation of the earth. Certainly, this country will never seek to make its military strength a menace to the welfare of any other civilized nation, and its good will toward other members of the great family of nations is such that it should gladly co-operate in every endeavor to increase international comity and reduce the burdens under which European nations now suffer.

The riots at Milan last summer are an indication of conditions in Southern Europe which cannot be overlooked. If civilization is to be maintained, and if governments are not to be swept downward by a wave of anarchy, the crushing burdens under which the people are struggling must be lightened. The vast waste of life and energy and treasure in military and naval armaments must be stopped. Of course, sufficient military forces to preserve internal order and to maintain the governments which civilized nations have established in barbarous lands are a necessity; but the frantic struggle to show superiority over one's neighbor in size of armies or strength of fleets has reached a stage where its burdens are only to be compared to a state of permanent warfare.

The United States, in the full flush of rejoicing over its unparallelled victories in the war just closed, does not forget that its war was fought to bring peace to lands where war, and oppression only less onerous than war, had been the rule for a century. We want no wars, and especially no wars of conquest or aggression; and it is to be sincerely hoped that our government may cordially welcome and do all in its power to further the great reform which the Russian Emperor has set on foot.

◆

The agitation for higher speed in the three new battleships, "Maine," "Missouri" and "Ohio," which was begun in the editorial columns of this journal last June and was continued in the newspaper press throughout the country, receives ample vindication in the bids for the new vessels which were opened at the navy department Sept. 1 and are published on the first page of this issue. It appears from these bids that American shipbuilders are ready to build battleships with a guaranteed speed of 18 knots at a trifling increase in cost over vessels of 1,000 tons less displacement and 3 knots slower speed. No small credit is due to Secretary Long for his fairness and open-mindedness in hearing the arguments in favor of higher speed, and deciding upon the issue of the supplementary circular to bidders, under the terms of which the plans and proposals for 18-knot vessels have just been submitted. That these proposals will be accepted seems hardly open to question, unless, indeed, the naval authorities should decide to reject all these bids and call for new bids for the 13,500-ton battleships which are contemplated in the comprehensive naval program that has recently been framed. In view of the limit of cost, $3,000,000, set by Congress, however, it seems most likely that the present plans for 18-knot vessels will be accepted.

◆

The Engineers' Club of New York city paid a well-deserved compliment to the engineers who have been on active duty with the fleet off Santiago, when it tendered them a dinner on Thursday evening, Sept. 1, at the club's house. It is frequently deplored that in the report of our naval engagements, and in the public mind, small credit is given to the heroes who fight below decks in temperatures that are oftentimes more of a menace to life than the shots from an enemy. It is entirely proper that organizations of engineers should take the lead in remedying this and in according public honors and distinctions to the men whose heroism and devotion to duty are often as great as those of any officers on the vessel, and who contributed in no small degree to the glorious victory won on July 3.

◆

As one of the results of the annexation of the Hawaiian Islands and of the possible large expansion of United States territory, in Cuba, Porto Rico and the Philippines, frequent enquiries are already reaching this office regarding the prospects for engineers in these new possessions. These letters usually come from young engineers, ambitious to force an opening for themselves and anxious to be among the first in the field. While approving of the spirit which prompts this movement, we would advise considerable caution in carrying out the contemplated scheme of seeking professional employment in these remote lands. There is undoubtedly abundant need for engineering enterprise in all of the one-time Spanish possessions; but time must elapse before the conditions are ripe for any radical change of methods which would call for active engineering work. Stable government must be established before capital from the United States will seek investment in these islands; and the people must be made to understand that the misrule of past centuries is at an end before they will be ready to accept and appreciate new methods and new ideas. This means the displacement of well-rooted old ideas; a period of change; and possibly of conflict between the old and the new, which may consume a long time. In this coming revolution in these new possessions, the engineer is doubtless one of the most important factors; but money is absolutely necessary to carry out engineering works, and the conditions must first be such that there is reasonable safety for the investment of money. Our advice to such young engineers is, therefore, to watch capital; to connect themselves at home, whenever this is possible, with those who propose to furnish the means to build engineering works in our new possessions; and to follow the capitalist, and not to precede him. Any other course would probably mean a disheartening struggle, a long wait under unfavorable circumstances, and disappointment. We say probably, because in any field there is usually a chance for a man of exceptional ability and energy or experience; and such a man—on the ground, might find the means for inducing capital to follow him to our new territory. But a man of this type would also succeed equally well at home, where the chances are quite as abundant and the ruling conditions are more favorable. As to the Hawaiian Islands, we would warn our correspondents that American engineers have been for years established there, and at the present time, at least, the supply exceeds the demand. Within a few years, and with the aid of American enterprise, capital and administrative methods, we confidently look for a marked economic advance, in the two West Indian Islands especially; and for the building of railways and highways, improvement in water supply and the sanitation of towns, and in the development of the enormous agricultural wealth of these islands; in other words, there will sometime be abundant work for engineers and a large market for those supplying engineering materials. But while the field is now open for the careful study of engineering possibilities by the experienced man of affairs and engineering expert; the conditions are not yet ripe for the employment of the young engineer who has his experience yet to gain. His chance will come later; when the time arrives for carrying out the plans formulated by the pioneers in the new field.

◆

The recent promotions of the naval officers who participated in the engagements at Manila and Santiago, while well deserved by these officers, have unfortunately done injustice to other officers. By advancing the list numbers of the promoted officers those who are not promoted and who are thus "jumped over" suffer a loss of numbers just as if they had been punished in that manner for some crime or offense against the naval regulations. In many cases an officer who loses some numbers by having other men advanced over him loses his chance of gaining the higher grade and higher pay which he reasonably expects to receive before reaching the age of retirement. It is stated in a press dispatch that Secretary Long will ask Congress to pass a bill to reward brave officers with a medal of honor and an increase of pay of 10 per cent for life, but it is understood that this bill is designed wholly to affect subsequent cases and not to correct the injustice already effected by the promotions. It is to be hoped that the Navy Department may devise some plan, which Congress may approve at its next session, by which the heroes of Manila and Santiago may receive proper rewards without inflicting injustice upon men equally brave but who did not have the same opportunity to show their bravery.

THE SUCCESS OF THE DETROIT MUNICIPAL ELECTRIC LIGHTING PLANT.

The city of Detroit, as most of our readers will recall, has made the largest venture in the way of a municipal electric lighting system of any city in the United States.

The subject of municipal lighting has been extensively discussed and bitterly fought over during the past ten years. Advocates of municipal ownership have magnified the savings which they claimed would be made when cities ceased to rely on private companies to light their streets. The opponents of municipal ownership, on the other hand, have urged that the loss through incompetent and dishonest officials and employees, in the case of municipal plants, would leave the taxpayer in a worse state than when lights were secured by contract.

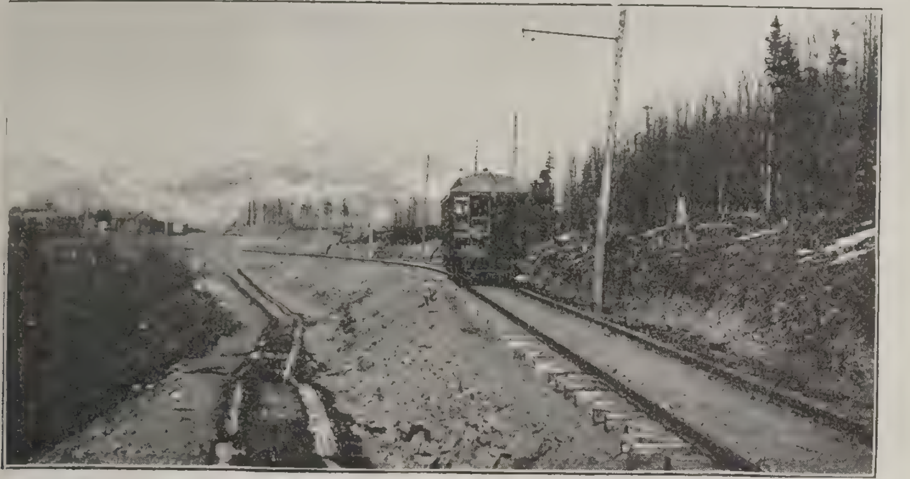

FIG. 2. VIEW NEAR SUMMIT ON CRIPPLE CREEK DISTRICT ELECTRIC RY.

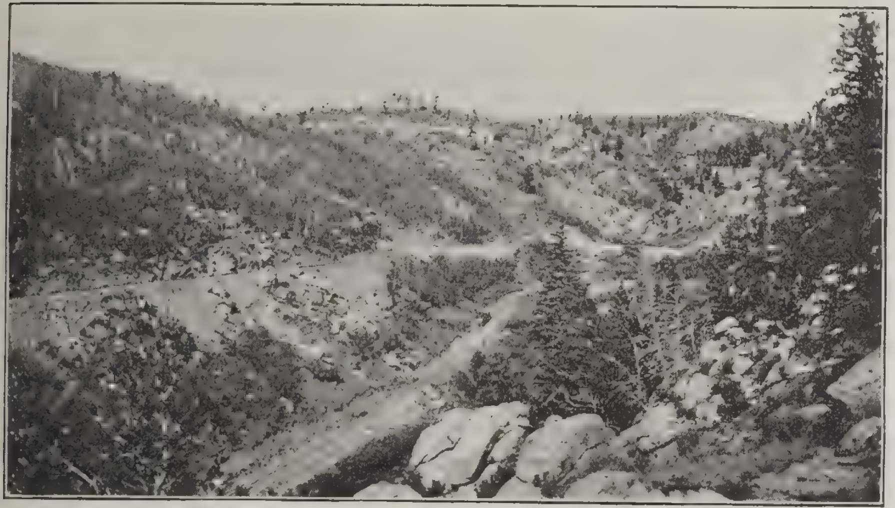

FIG. 3. PART OF THE WILBUR LOOP; FLORENCE & CRIPPLE CREEK RY.
H. A. Sumner, Locating Engineer.

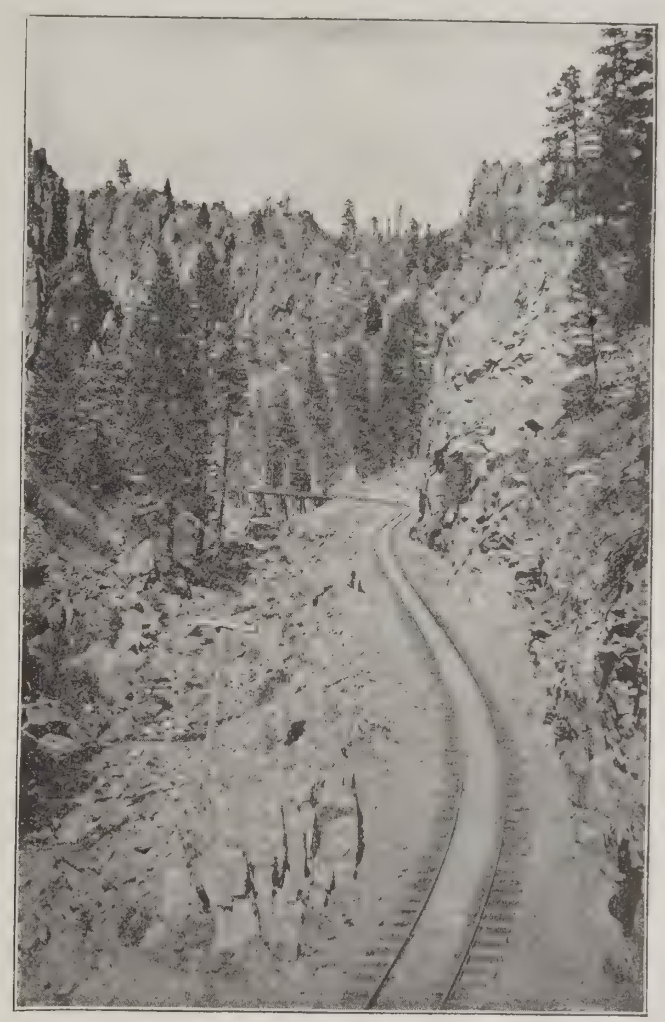

FIG. 5. VIEW ON LINE OF FLORENCE & CRIPPLE CREEK RY.

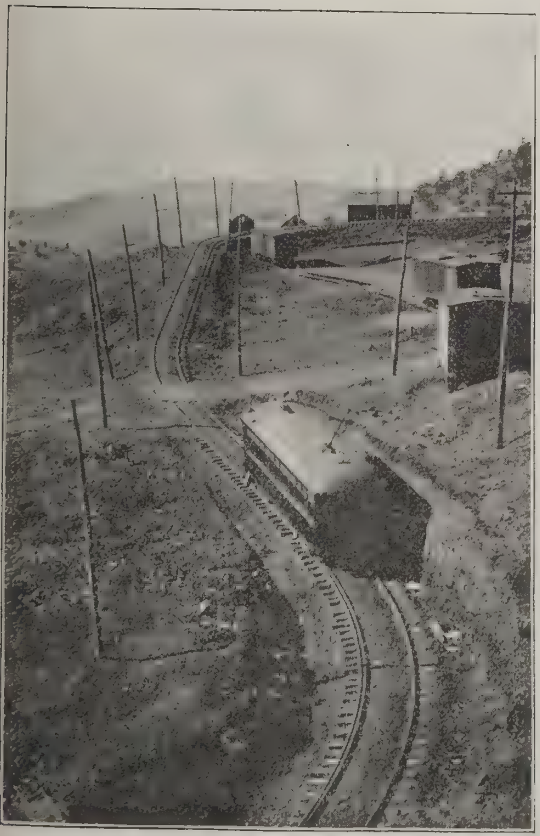

FIG. 4. CRIPPLE CREEK DISTRICT ELECTRIC RY. NEAR PORTLAND MINE.
W. H. Leffingwell, M. Am. Soc. C. E., Chief Engineer.

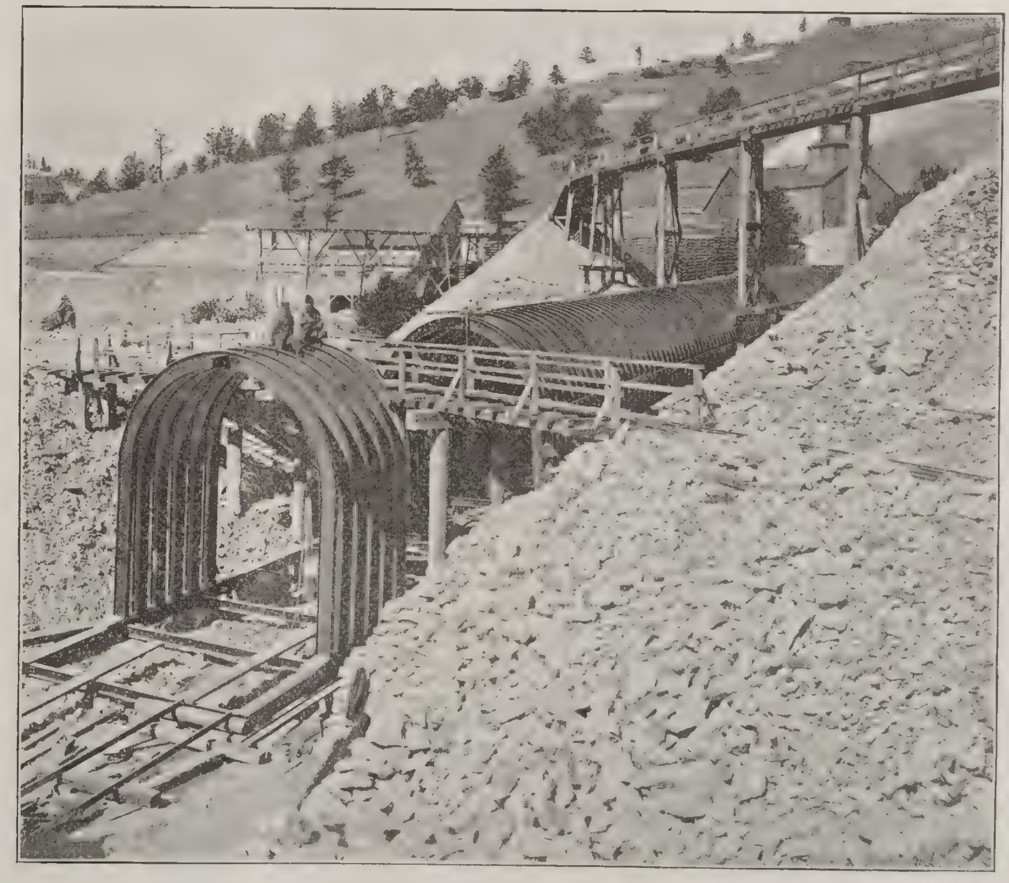

FIG. 1. STEEL FRAME TUNNEL THROUGH DUMP OF THE PORTLAND MINE ON THE GOLDEN CIRCLE R. R.
R. W. Stewart, Chief Engineer.

RAILWAYS IN THE CRIPPLE CREEK MINING DISTRICT.

TABLE I.—Investment and Output of the Detroit Municipal Electric Lighting Plant.

Year ending June 30.	1897.	1898.
Total investment*	$721,400	$771,297
Investment per arc lamp	337.88	293.69
Investment per incand. lamp ..	18.93	18.52
Plant capacity, arc lights	2,000	2,250
Plant capacity, incand. lights..	3,000	3,500
Av. arc lights actually operated	1,564	1,744
Same for incandescent	3,064	3,901
Total hours operated, arcs....	3,790h. 55m.	3,786h. 20m.
Average hours operated.	10h. 23m.	10h. 23m.
Total scheduled lamp-hours, arc	5,873,295	6,505,352
" hours of out lamps.....	1,371	7,465
" hrs. lamps actually b'rn'd	5,871,924	6,497,887
K-W. hrs. output, arc.........	2,716,628	2,975,019
" " " incandescent	263,784	306,596
" " " total........	2,980,412	3,281,615
Total coal purchased, lbs.....	15,032,230	17,075,525
Lbs. used per K-W. hour.......	5.01	5.23
Cost of coal per ton	$2.06	$1.97
" per lb., cts.......	0.103	0.098
" per K-W. hour, cts.	0.516	0.513
Number of men employed.....	105	93
Total payroll for year	$76,394	$65,660
Total operating expense	110,141	99,713
Cost per K-W. hour, cts.......	3.696	3.038
Cost per lamp-hour, arc., cts..	2.3	2.2

*Exclusive of Belle Island.

It is of no small interest, therefore, to see just what results are obtained in practice and see how they compare with those which were so confidently predicted a few years ago. The third annual report of the commission in charge of the Detroit lighting system is before us. It covers the year ending June 30, 1898. As this is the third year of the plant's operation, it may be safely assumed that it is now on a fairly permanent basis. Both machinery and employees are well broken in, and the plant is old enough for the item of repairs and renewals to represent something like a steady figure.

To give first a little of the past history: The Public Lighting Commission of Detroit was created by the Michigan legislature in March, 1893. Its six members were appointed by Mayor (now Governor) H. S. Pingree, with the approval of the city council, and under their direction plans and specifications were prepared and contracts were let for a new municipal street lighting system. The first annual report of the commission, describing the construction of the plant, was reviewed in Engineering News of Aug. 13, 1896.

Turning now to the report of operations for the third fiscal year, let us consider first the cost of the plant.

On June 30, 1897, the total cost of the entire plant, excluding the Belle Island plant ($7,821), amounted to $721,400, or an investment of $337.88 per arc lamp and $18.93 per incandescent lamp, there being at that time a plant capacity of 2,000 arcs and 3,000 16-c. p. incandescent lamps. For the fiscal year ending June 30, 1898, the figures for the same items, also excluding the Belle Island plant ($18,848), are: Total cost, $771,297; investment cost per arc lamp, $293.69; per incandescent, $18.52; using the maximum capacity figures of 2,250 arcs and 3,500 incandescents.

It may be said here that the investment in machinery, etc., which is included in the above total comprises 7 Peck boilers, 5 triple-expansion engines of 240 to 340 HP., 20 arc dynamos of 50 K-W. capacity each, 2 57½ K-W. arc dynamos, 3 Westinghouse engines, 3 55-K-W. two-phase incandescent dynamos, 1,842 arc lamps, 3,901 incandescent lamps, 5,210 poles and 394 miles of wire, and all auxiliary apparatus such as pumps, condensers, feed-water heaters, etc.

In Table I. the figures for investment, output, etc., are given for both 1897 and 1898. It will be seen that the investment per lamp has been considerably reduced through the extension of the lighting system with little or no increase in the power station machinery, and that the operating expenses have been largely reduced. Table II. shows that the economy has been chiefly effected in the item of maintenance, and in shop expense, and the various items in the table will repay careful study by those interested in electric station economy. In Table III. the operating expenses have been arranged as percentages of a total.

It will be seen that station operation and the items connected with maintaining and operating the lamps made up 66.48% of the total operating expenses during 1897, and 74.11% during 1898, or an increase of 7.63%, which was accompanied by a corresponding decrease in other departments. The total operating expenses given in Tables II. and III. show a decrease from 3.696 cts. to 3.038 cts. per K-W. hour of output. There was an increase for 1898 over 1897 in total output of 301,203 K-W. hours to operate 180 arc and 837 incandescent lamps installed during the year.

TABLE III.—Percentage of Operating Expenses of the Detroit Municipal Lighting Plant, Charged to Each Department.

Department.	1897. Wages.	1897. Stores.	1897. Total.	1898. Wages.	1898. Stores.	1898. Total.	Difference in totals.
Maintenance	15.13	4.45	19.58	11.84	4.51	16.35	3.23†
Executive	8.06	.96	9.02	7.69	.83	8.50	52†
Station	18.95	18.09	37.04	22.07	20.14	42.21	5.17§
Trimming	21.61	7.83	29.44	22.07	9.83	31.90	2.46§
Shop	4.13	.60	4.73	.51	.20	.71	4.02†
Injuries & damgs	.01	.18	.19	...	.33	.33	.14§
Total	67.89	32.11	100	64.16	35.84	100	....

†Decrease. §Increase.

It will be seen that the above figures do not give the total cost per lamp per year, which is the basis on which figures for street lighting are most frequently compared. We will ascertain this a little later; but first let us see what arc lamps cost the city when it secured its light by contract.

The average number of arc lamps actually operated and the cost for each year from 1884 to 1894 is given in Table IV., which is reprinted from the report of the Commission for 1896.

TABLE II.—Operating Expenses for 12 Months Ending June 30, of the Detroit Municipal Lighting Plant.

Charged against	1897. Total.	1898. Total.	1897. Per K-W. hour.*	1898. Per K-W. hour.†	Difference, Per K-W. hour.
Maintenance: Buildings, track, dock, etc.....	$810.71	$1,452.86	.....	.....	.....
Steam plant	2,544.64	2,331.16	.....	.....	.....
Electric plant	1,461.29	3,041.19	.....	.....	.....
Miscellaneous tools, machinery, etc.......	546.63	725.17	.....	.....	.....
Conduits	1,354.96	697.79	.....	.....	.....
Towers and lamp posts..................	4,056.26	2,092.38	.....	.....	.....
Arc lamps	3,824.34	2,440.02	.....	.....	.....
Lines	6,982.23	3,525.04	.....	.....	.....
Total maintenance	$21,581.06	$16,305.61	$0.00724	$0.00497	$0.00227
Executive: Salary Sec'y and City Electr......	$3,700.00	$3,799.92	.....	.....	.....
Printing and stationery	962.08	574.44	.....	.....	.....
Store room	1,219.71	1,145.61	.....	.....	.....
Clerk's and office expenses..............	2,339.96	1,551.59	.....	.....	.....
Civil engineering and drafting...........	1,731.54	1,399.01	.....	.....	.....
Total executive	$9,953.29	$8,470.57	$0.00333	$0.00258	$0.00075
Station: Oils	$1,445.55	$1,058.16	$0 00049	$0.00032	.....
Waste	250.68	212.67	.00009	.00007	.....
Coal	16,717.15	17,857.72	.00561	.00544	.....
Miscellaneous supplies	2,396.29	954.50	.00070	.00029	.....
Wages	19,966.69	22,004.39	.00681	.00670	.....
Total station	$40,776.36	$42,087.44	$0.01370	$0.01282	$0.00088
Lighting: Trimming and patrolling..........	$23,256.76	$20,628.71	.....	.....	.....
Carbons	7,118.05	7,765.82	.....	.....	.....
Incandescent lamp renewals	662.33	956.70	.....	.....	.....
Incandescent lamp expense		453.16	.....	.....	.....
Globes and nets	492.90	460.61	.....	.....	.....
Miscellaneous	95.66	495.17	.....	.....	.....
Belle Isle Park	......	1,045.30	.....	.....	.....
Total lighting	$32,411.38	$31,805.47	$0.01088	$0.00969	$0.00119
Shop expense	$5,207.79	$716.39	$0.00174	$0.00022	$0.00152
Injuries and damages	211.50	327.70	.00007	.00010	.00003
Total expense	$110,141.38	$99,713.18	$0.03696	$0.03038	$0.00658

*Total K-W. hrs. output, 2,980,412.
†Total K-W. hrs., output, 3,281,615.

TABLE IV.—Number of Arc Lamps and the Cost to the City From 1884 to 1894.

Year.	Total No. of lamps.	Paid to companies.	Average per lamp.
1884................	24	$3,650	$152
1885................	300	71,982	240
1886................	382	91,571	240
1887................	565	115,490	204
1888................	608	117,370	193
1889................	702	128,063	182
1890................	719	137,937	192
1891................	1,031	133,717	130
1892................	1,168	152,283	130
1893................	1,279	164,831	129
1894................	1,279	169,360	132

In April, 1893, bids were asked for lighting the city for periods of from one to ten years. The bids submitted by the local electric lighting company ranged from $154 per lamp for one year to $102.20 per lamp for ten years; $124 being the price asked for five years. If the ten-year agreement had been entered into, and if the number of lamps had increased at the same rate that actually did occur, Table IV. should receive the following addition:

Year.	No. of lamps.	Addition, total cost.	Cost per lamp.
1895................	1,297	$173,538	$133.80
1896	1,483	151,562	102.20
1897................	1,564	159,804	102.20
1898................	1,744	178,236	102.20

In ascertaining the present actual cost of Detroit's street lighting, it is necessary to consider the matters of interest, taxes and depreciation, which are not included in the figures given in Tables II. and III.

The two previous reports of the commission have both been justly criticised because in their computation of the cost per lamp these items were not sufficiently considered. Thus in the first year's report, interest on the bonds issued to build the plant was included, but no mention was made of taxes or depreciation. In the report for the year ending June 30, 1897, interest and taxes were fairly estimated; but depreciation, for some inscrutable reason, was figured on the boiler plant alone.

In the 1898 report, however, all three items are included, and we find figures as follows:

Interest at 4% on $750,000, which is taken as the average investment.	$30,000
Depreciation at 3% on $750,000..........................	22,500
Taxes at $17.68 per $1,000 for city and $3.24 per $1,000 for state on $400,000, the estimated assessed valuation	8,368
Total	$60,868

This, proportioned on the basis of electrical output, gives $55,207 chargeable to arc lighting and $4,660 to incandescent lighting. Dividing the amount chargeable to arc lighting by the number of arc lamps (1,744), gives a cost of $31.65 per lamp per year. Adding this to the operating expenses of $51.85 per lamp per year and we have $83.50 as the total cost to Detroit per arc lamp for the year ending June 30, 1898.

Does this represent fairly the actual cost to the people of Detroit, so that we can fairly compare this figure with the figures for contract service given above, or with the amount which other cities pay for electric lighting?

Concerning the operating expenses, it will be generally agreed that these fairly represent the actual cost of running the works. The only thing which appears at all doubtful is whether the saving in maintenance account has not been made by putting off to a more convenient day repairs and renewals, which ought to have been made to keep the plant in good condition. If this is the case, however, it will show in the expense accounts a year or two hence. The interest estimate is certainly fair, as the city can certainly borrow money at 4%, the rate named. The tax allowance, too, will hardly be questioned by even the most rabid opponent of municipal ownership. When we come to the item of depreciation, however, dispute is sure to arise. Partisans of electric light companies will assert, we presume, that 7% to 10% is the least that should be allowed; and will instance the depreciation which has been experienced in every electric light station established prior to 1890 through the advent of improved machinery. But the past is not always a safe guide to the future. It is true that much of the machinery of ten years ago is obsolete now; but it is by no means certain, or even probable, that the same radical revolutions in electrical industry will be effected in the ten years to come. There was a time when progress in steam engine design was exceptionally rapid, and the old throttling low-speed engines were fast made obsolete by the automatic cut-off engines of the Corliss type. But at the present time there are many engines running which were built before 1880 and doing excellent and economical service too.

Let us see what a 3% allowance for depreciation means. It means that if 3% of the cost of the plant is laid aside each year and invested in a sinking fund, with interest at 4%, then at the expiration of between 21 and 22 years that fund will have accumulated to an amount equal to the cost of the plant. Of course, the plant itself will not be valueless at that time. A considerable part of it will be worth nearly as much as to-day, but we may fairly offset the value which it will then have against the increase in the cost of repairs which may be expected as the plant grows older.

Now, the question is whether 21 years is too long a time to set for the average life of the plant. We are inclined to think that it is, and that a depreciation allowance of 4%, corresponding to an average life of a little less than 18 years, would be a more accurate estimate to determine the actual cost of electric light in Detroit.

There is one other item which ought to be included in the Detroit plant's expense account to determine the actual cost, and that is insurance. True, the city does not insure the plant, and we do not question its wisdom in adopting this course. Nevertheless, the element of risk of loss by fire is as much an item in the cost of producing electric light as it is in any manufacturing industry.

Suppose we allow an extra 1% for depreciation and 1% for insurance on the investment of $750,000, this will add $15,000 to the annual expenses, and will make the total cost per arc lamp per annum, $92.10.

It will be seen from the above that Detroit is certainly effecting considerable saving over what she would have expended had she accepted the bid of $102.20 per lamp, which was made in 1893 by the Detroit lighting company for a ten-year contract. A saving in round numbers of $10 per lamp per year means $17,440 per annum with the present number of lamps. On the other hand, it seems to be clear that the company, in making its bid, named about as low a figure as it could afford and leave itself a profit that would make the business worth doing. The company would have had to pay probably 6% interest as compared with the city's 4%, and it would have had to meet the contingency of failing to secure a renewal of the contract at the end of ten years, which would have left its plant on its hands. Thus it would have been obliged to figure on a much higher rate of depreciation than the city.

TABLE V.—Average Cost of Arc Street Lighting in Each State.

State.	Hours per year.	Coal per ton.	Cost per lamp Per year.	Cost per lamp Per hour.
Alabama	4,000	$1.92	$89.00	$0.021
Arizona	3,396	2.30	121.00	.034
California	2,885	7.00	119.68	.045
Colorado	3,413	3.18	129.31	.042
Conecticut	2,730	4.28	86.02	.035
Delaware	4,000	2.32	110.00	.028
Dist. of Columbia	4,000	....	106.00	.027
Florida	2,179	Wood.	117.65	.054
Georgia	3,434	1.36	83.81	.034
Idaho	4,000	Water.	114.00	.028
Illinois	2,789	1.19	77.02	.031
Indiana	2,682	1.79	79.33	.033
Iowa	2,870	1.57	85.73	.032
Kansas	2,734	2.02	97.19	.040
Kentucky	3,063	1.20	88.07	.032
Louisiana	4,000	2.38	127.50	.032
Maine	2,629	5.00	67.50	.031
Massachusetts	2,705	4.05	93.81	.037
Maryland	4,000	3.00	127.75	.032
Michigan	3,465	2.70	77.04	.024
Minnesota	3,133	3.41	98.00	.036
Mississippi	2,179	2.33	102.00	.047
Missouri	2,917	2.54	83.00	.032
Montana	4,000	4.00	130.80	.033
Nebraska	2,894	2.21	109.50	.041
Nevada	3,680	9.50	144.00	.039
New Hampshire	2,583	4.42	81.53	.036
New Jersey	3,615	2.70	105.36	.032
New Mexico	3,275	3.92	123.33	.045
New York	3,387	2.87	93.61	.028
North Carolina	3,572	3.30	97.50	.029
North Dakota	4,000	6.35	120.00	.030
Ohio	3,350	1.56	78.87	.025
Oregon	3,689	....	127.71	.035
Pennsylvania	3,931	1.56	85.75	.022
Rhode Island	2,912	3.85	102.37	.037
South Carolina	3,088	2.65	82.50	.031
South Dakota	3,680	5.50	125.00	.034
Tennessee	4,000	2.08	88.05	.022
Texas	3,472	3.13	108.75	.037
Utah	3,545	2.63	74.90	.023
Vermont	2,254	4.37	84.67	.039
Virginia	3,723	3.07	76.09	.022
Washington	3,479	2.75	127.54	.039
West Virginia	3,089	.90	79.21	.027
Wisconsin	3,057	3.13	81.16	.030
Wyoming	3,545	1.58	166.00	.052
Total average*	3,326	$3.03	$101.18	$0.034
Detroit, 1898	3,786	1.97	83.50	.022

*Forty-six states.

TABLE VI.—Cost of Arc Street Lighting in Principal Cities of the United States.

Cities.	No. of arc lamps.	Hours per yr.	Coal per ton.	Contract per lamp per yr.	Cost pr lamp-hour.
Indianapolis, Ind.	1,100	2,179	$1.25	$85.00	$0.039
Louisville, Ky.	1,219	3,840	1.00	84.00	.022
New Orleans, La.	1,384	4,000	2.38	127.50	.032
Boston, Mass.	2,566	4,000	4.00	127.75	.032
St. Louis, Mo.	2,500	4,000	1.35	74.95	.019
Jersey City, N.J.	1,075	4,000	2.50	99.00	.025
Newark, N. J.	1,565	4,000	1.70	98.55	.025
Brooklyn, N. Y.	3,382	4,000	3.60	124.10	.031
Buffalo, N. Y.	2,500	4,000	2.00	100.00	.025
New York city	3,643	4,000	....	146.00 164.20 182.50	.037 .041 .045
Rochester, N. Y.	2,248	4,000	Water.	91.25	.023
Syracuse, N. Y.	980	4,000	2.25	91.25	.023
Cincinnati, O.	1,510	4,000	2.00	84.90	.021
Allegheny, Pa.	1,037	4,000	.95	74.31	.019
Philadelphia, Pa.	6,500	4,000	2.50	109.00 146.00	.027 .036
Pittsburg, Pa.	1,900	4,000	1.01	96.00	.024
Providence, R. I.	1,800	4,000	....	127.75	.032
Salt Lake City	4,000	4,000	2.75	72.00	.018
Milwaukee, Wis.	718 444	4,000	3.00	92.00 109.00	.023 .027
Detroit, Mich., '98	1,744	3,786	1.97	83.50	.022

On the other hand, the company would have had the great advantage of doing commercial as well as street lighting; and this it seems to us is the weakest point in the operation of the Detroit municipal plant. It is evident on the slightest thought that to furnish electric light to a town or city, at the least possible cost, one concern should undertake both the public and private lighting.

As it is, the city of Detroit appears to be getting its street lighting done more cheaply than any private company would undertake that work unless it were guaranteed a monopoly for a long term of years. Comparison with the prices paid in other cities also results in a favorable showing for Detroit. Table V. is prepared from data given in a circular issued by the General Electric Co., of Schenectady, N. Y., and is interesting in this connection. The prices given are for the winter of 1897, and are averages of practically all the arc lighting plants owned by private companies in the states given.

Comparing the Detroit figures with the average for the 1,045 electric light plants whose operations are covered by Table V., it will be seen that in Detroit the hours per lamp were greater, the cost of coal less, the cost per lamp per year less and the cost per lamp hour considerably less than the average of all stations reporting.

A still more interesting comparison may be made between Detroit's prices and the prices charged in other large cities of the United States, as given in Table VI.

In this table New Orleans, La.; Newark, N. J.; Buffalo, N. Y., and Cincinnati, O., operate practically the same number of lights as Detroit, and coal costs about the same per ton with them. All, however, with the exception of Cincinnati, pay considerably more per lamp per year. In only three cities, St. Louis, Mo., Allegheny, Pa., and Salt Lake City, is the cost per lamp less, and in these cities coal is considerably cheaper than in Detroit.

LETTERS TO THE EDITOR.

The Title of U. S. Assistant Engineer.

Sir: Several days ago I read the editorial in Engineering News of Aug. 4, on "The Position of United States Assistant Engineers," with much interest. If suggestions are in order, permit me to make one at this late date. It seems to me that the government, or "powers that be," might at least substitute the title "United States Civil Engineer," in place of "U. S. Assistant Engineer." The term "Assistant Engineer" is used by many railway and municipal engineering departments to designate transitmen, levelers, draftsmen, or even rodmen. Hence, among civilian engineers, the title "Assistant Engineer" has come to mean a person holding some such minor position on engineering work.

Of course the term "U. S. Civil Engineer" would not indicate the specialty of an expert, but it would indicate the department of engineering, in contra-distinction to the titles, "U. S. Mechanical Engineer," "U. S. Electrical Engineer," "U. S. Mining Engineer," which likewise seem to me to be very appropriate titles for official use.

Very respectfully yours,
C. E. Sherman,
U. S. Assistant Engineer.
Camp Wheeler, Huntsville, Ala., Aug. 26, 1898.

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Large Cast-Iron Wheels for Cars and Engine Trucks.

Sir: We have just noticed in your valuable paper of June 9, an article on "Locomotive Tender and Truck Wheels," in which the statement is made that one reason why American locomotives generally have small wheels is that they are fitted with cast-iron wheels, and it is not easy to make good chilled cast-iron wheels of greater diameter than 33 ins., although some foundries have attempted to cast 42-in. wheels, but with unsatisfactory results.

As we have been making wheels 40 ins., 42 ins., and even 45 ins. in diameter for the past five years, we are a little surprised at the statement, and take this opportunity of advising you of what we have done in making wheels of large diameter. We find from our records that in the last three years we have furnished 356 wheels 40 ins. diameter, 84 wheels 42 ins. diameter and two lots of 45-in. wheels; the 42-in. wheels have been used under both passenger cars and engines, and as we have had two repeat orders for those running under engines, we judge that the service has been entirely satisfactory.

We think we are the only wheel makers in the country who have ever successfully made double-plate wheels 45 ins. diameter, and as these have now been running for over a year under locomotives, we can assume that they were a success. Very truly yours,

New York Car Wheel Works,
Pemberton Smith, Engineer.
Buffalo, N. Y., Aug. 29, 1898.

(It is interesting to note that such large chilled wheels have been made, but it will be seen that the number is quite small and that they have only been made within the past few years. Their manufacture and their use on engine trucks are certainly exceptional as yet. Whatever may be the present conditions of manufacture, we believe the above letter does not in any way affect our suggestion (which was based upon investigation) to the effect that one reason why the smaller wheels have been so generally used on engine trucks is that there are greater difficulties in the manufacture of the large wheels. We have very good authority for our statement that some of the early attempts to cast 42-in. wheels produced unsatisfactory results.—Ed.)

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Spacing Stiffeners in Plate Girders.

Sir: The letter of Mr. Jos. M. Wilson on "Spacing Stiffeners in Plate Girders," published in your issue of Aug 11, does not seem to me to be conclusive; neither do the photographs of the loaded paper model seem to offer "convincing proof" that the web resists by tension only. This was quite thoroughly gone over in the discussion brought out by Mr. Wilson's paper by Prof. W. H. Burr and Mr. Edwin Thacher.* Cutting slits in the web entirely changes the conditions; just as would be the case with a Warren girder of two or more systems of web members, if one of the systems were cut.

The distortions in a plate girder under load are of a nature that do not appear to offer much room for difference of opinion. Consider, for simplicity, one panel included by two stiffeners. The top flange will shorten and the bottom flange will lengthen under the compressive and tensile stresses respectively. Then, considering the tension in the web, the panel will be lengthened or stretched out on the diagonal of the tensile stress, and this cannot possibly take place without a corresponding shortening of the opposite diagonal. The effect of stress on a cross section of the member perpendicular to the line of stress, if not confined, is manifested in both directions, width and thickness; so in the case under consideration only a part of the required shortening could possibly be due to this effect of the tensile stress. Therefore, the web will either buckle or be compressed by compressive stress. Since they do not buckle in ordinary practice the diagonal compressive stress must exist in the web.

I am not prepared to deny that the vertical stiffeners carry some proportion of compressive stress in girders as usually built, even when not subjected to concentrated loads, but where there are two or more courses for a stress to follow (a condition of ambiguity), it will divide itself inversely as the length of the course and directly as the section of the members. In other words, it seeks the shortest course and strongest members.

Since flexure (or buckling) does not ordinarily occur in the webs of plate-girders under service, the relative strength of the webs and stiffeners within the limits of working loads are directly as their sectional areas. In most cases the section of the web is much greater that that of the stiffeners. Therefore, if ambiguity does exist, the web offering the shortest course and strongest section will carry far the greater part of the stress, in accord with Rankine's theory.

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*Trans. Am. Soc. C. E., Vol. XV., 1886, pp. 431 and 468.

If someone who has the facilities would apply an extensometer to a plate girder, this question would be placed beyond discussion, to the benefit of all interested.

Albert W. Buel.

150 Broadway, New York, N. Y., Aug. 15, 1898.

Sir: I note with interest Mr. Jos. M. Wilson's contribution to the discussion on the stiffening of web plates, in your current issue. It requires but little reflection to recognize, however, that the behavior of the paper model is strictly in accord with the generally accepted theory governing the distribution of stresses in web plates.

It is to be remembered that the principal stresses—tensile and compressive—act at right angles to each other at every point in the web plate, and that their lines of action intersect the neutral plane at angles of 45°. The general appearance of these lines of principal stress is shown in Rankine's Applied Mechanics, p 342; also in Merriman's Mechanics of Materials, p. 160, although the lines are not completely drawn in the latter. The most complete discussion, known to the writer, covering this matter of internal stresses in beams, is found in Weyrauch's "Theory and Calculation of Continuous and Simple Beams (1873)," pp. 11 to 20, inclusive, illustrated by excellent diagrams, shown on Plate I., in which the lines of principal shears are, however, incomplete. It is to be observed that all diagrams here referred to, relate to beams of solid rectangular cross-section, and require some modification for flanged girders. The distribution of shear across the web of a plate girder is much more nearly uniform than in the case of a rectangular section without flanges.

From the inspection of any of these figures, it will be evident at once that when the web is cut, as in Mr. Wilson's model, and the latter placed in a position relative to a central load, as in Fig. 2, the continuity of all lines of principal tensile stress is absolutely interrupted at the diagonal slits. Not only can these tensile stresses no longer be properly developed, but in their absence or very imperfect state of development, the tendency of the principal compressive stresses to produce buckling in the web can no longer be effectively opposed. The distortion shown in Fig. 2 becomes, therefore, inevitable and might, in fact, have been predicted from purely theoretic considerations.

In Fig. 1, on the other hand, the principal tensile stresses remain, for the most part, fully operative, although, in this case also, their continuity is, to some extent, broken. It is to be expected, therefore, that, contrary to Mr. Wilson's statement, the web thus conditioned will develop less ultimate strength than if left continuous.

It may be observed, in conclusion, that the step from such a model, however its behavior may be explained, to a claim for the analogy between the stiffeners of a plate girder and the posts of a Pratt truss, is one that can be taken only in absolute defiance of sound theory.

Very respectfully, E. M.

Philadelphia, Pa., Aug. 17, 1898.

Sir: In your issue of Aug. 11 the writer has noted a very interesting communication on the plate girder by Mr. Joseph M. Wilson. The paper model is highly ingenious, illustrating how much better able a thin web is to resist tension than compression along the diagonal of a panel. Cutting the slit, however, prevents the tensile stress from stiffening the web, somewhat under compression, as it ordinarily would.

About a year ago the writer was furnished with a model plate girder by the Gillette-Herzog Mfg. Co., through the courtesy of Mr. Frank J. Llewellyn, Chief Engineer. This girder was built in accordance with the writer's design, and is shown in Fig. 1. In alternate panels the web plate was buckled ⅝-in. before assembling in the form of a very flat pyramid, with the corners rounded off; the edges of the pyramid forming the diagonals of the panel. Evidently were the web stresses, tensile and compressive, distributed as in a beam of constant section, the lateral components of these tensile and compressive stresses would neutralize each other, and the form of the buckle should remain unchanged as the load is applied or removed. If on the other hand there is truss action and the tensile stress is the greater, the buckle should spring in as the load is applied.

Under twenty-eight tons this spring of the buckle was about ⅛-in. and the buckle returned to its original shape as the stress was removed. The load was applied by the screw lever at one end and weighed off at the other. The spring of the buckled web seemed to be the same in the end panel, and the panel next the center, as would be expected, since the shear was the same in each.

Having thus shown that a part of the load is carried in a manner similar to a Pratt truss, the question of how great a part naturally arises. In the design of the experimental girder, by a rough method, the writer figured that a trifle more than two-thirds of the load would be carried in a manner similar to a Pratt truss, and the top and bottom flanges were proportioned accordingly. Thermo-electric measurement of the chord stresses indicated that the results arrived at in designing represented closely the actual conditions. Whether the writer would be equally successful in other and different cases he has not as yet had opportunity to determine. As a further proof of the truss theory, all stiffeners were found to be in compression.

The writer heartily agrees with Mr. Wilson in his preference in designing deep girders in the manner outlined by him, since a web 70 × 5-16 ins. or 90 × ⅜ ins. may be compared with the experimental girders as regards the ratio of depth to thickness of plate, and with a similar distribution of stress it is evident that cover plates in the top flange should be two panels longer than the corresponding ones on the bottom flange, and that rivets should be distributed in a manner calculated to secure the maximum efficiency of the material used instead of in accordance with a theory at variance with the practical conditions of the case.

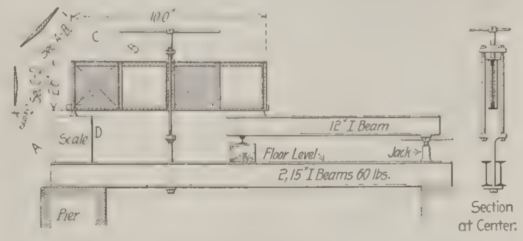

Fig. 1.—Sketch Showing Method of Testing a Plate Girder to Determine Nature of Web Stresses.

The thermo-electric measurement of stress is based on the fact that metal grows cooler on being stretched, and warmer on being compressed, and that the temperature change is proportional to the stress when this stress is well within the elastic limit. The amount of this temperature change may be closely determined by the following formula derived by Lord Kelvin,

$$H = \frac{tpe}{JSW}.$$

Where H is the thermal increase in degree centigrade; t, the temperature centigrade from absolute zero; J, the mechanical equivalent of the thermal unit; p, the pressure applied in pounds, positive if compression and negative if tension; e, the longitudinal expansion per degree centigrade, and W, the weight in pounds per foot of the bar. That the thermo-electric method of measuring stress is fairly reliable may be shown by reference to Fig. 2, the dotted line showing approximately the corrected curve. The readings for this curve were taken last winter by Mr. Frank McIntyre and the writer.

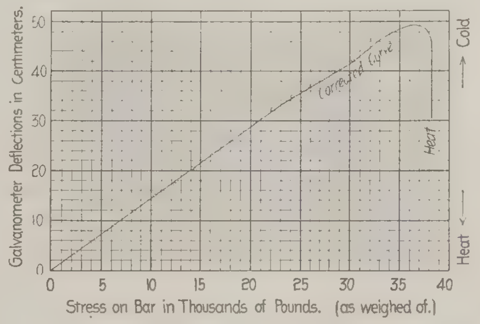

Fig. 2.—Thermal Stress Curve of Boiler Plate Steel Showing Accuracy of Results.

If in the laboratory the temperature change caused by a change in stress of less than half a pound per square inch may be readily noted, it would seem no impossible task to make fairly accurate measurements of stress on some of our railroad structures, and thereby obtain some definite information regarding the effect of the shock and impact of trains at high speed.

Where there are compound stresses, as in the web of a girder, compressive and tensile stresses acting as an angle with each other, the heat evolved by the compressive stress neutralizes an equal amount of cold produced by the tensile stress, and we can only measure the difference which is sufficient to give us a very accurate knowledge as to the exact distribution of stress in this case. Thus, in the girder shown in Fig. 1, a series of measurements were made on the web along the neutral axis of the girder, marked heating effect was found in the plate near all stiffeners, denoting compression, and cooling effect denoting tension in the center of all panels.

This last determination may be regarded as an elegant illustration of the truth of Proposition III., Chapter XV., of "Modern Framed Structures." This proposition is given by Professor Johnson as a fundamental principle of the distribution of stress, and is well stated as follows: "When there are two or more paths over which a load may travel to reach the support, the load divides itself among the several paths strictly in proportion to the rigidities of the paths." Now, in our plate girder the path of greatest rigidity would be the line diagram of a Pratt truss, with the stiffeners for the posts and the flanges as chords, since the plate under and near the stiffener, together with the stiffeners, is better able to resist the compressive web stress than the plate between consecutive stiffeners.

Yours truly,

C. A. P. Turner.

Minneapolis, Minn., Aug. 17, 1898.

(In accordance with our usual custom proofs of the above letter were submitted to Mr. Wilson, and we append his reply below.—Ed.)

Sir: I have read with interest the correspondence on my letter of July 19 (Eng. News, Aug. 11, 1898) in reference to spacing stiffeners in plate girders.

One correspondent claims that "cutting slits in the web entirely changes the conditions, just as would be the case with a Warren girder of two or more systems of web members if one of the systems were cut." Now a Warren girder is a triangular truss, pure and simple, and one of several intersections becomes a lattice (without vertical stiffeners). Each member is a necessity for equilibrium and has its determinate stress. The development of the Warren girder or lattice, by making "n" intersections equal infinity, gives the rolled I-beam or built girder without vertical struts, the web being of sufficient thickness to resist compressive forces effectively and contributing its share in an appreciable degree to the upper and lower flanges. I believe there is no difference of opinion as to the proper method of treating such a girder. The Warren girder, however, is not at all analogous to the case under consideration, of a plate girder with thin web, requiring vertical stiffeners. It appears to be claimed by at least one of my critics that the tension in one diagonal direction on the web, so stiffens it that, no matter how thin the web, it cannot deflect under compression in the other diagonal direction, and actually acts to resist as a short prism independent of its length, and, I presume, the plate is considered as doing double duty, or perhaps even more, resisting diagonally by compression in one direction and by tension in the other, horizontally by compression in connection with the upper flange and by tension with the lower flange, and vertically by compression with the strut. While not going so far as this, there are engineers who include a portion of the web with the upper and lower flanges and with the vertical stiffeners, perhaps even allowing some compressive resistance in the web in the diagonal direction, and the last clause in my letter covers this point; but I do not consider it good practice. What may or may not be allowed is so uncertain, depending on the judgment of the engineer, which is not always reliable, and the economy gained is so little, that, in comparison with the obtaining of a first-class structure, it is not worth consideration, and in my own practice I would not allow a design made under such conditions. Such "finesse" in bridge calculation may do to talk about in high theory, but it will not answer in practical work where simplicity is demanded, even at the expense of a few more pounds of material.

Let us take a girder of, say, 5 ft. depth, with vertical struts at distances of 5 ft., making square panels. The diagonal of this panel is, say, 85 ins., and for a 3-16-in. web the length of the column for compression is 453 times its shortest diameter, or if a ⅜-in. web is used it would be 226 times. How much compression would such a column resist without deflection? and what amount of tension is required, at right angles, to prevent such deflection? It may be theoretically studied out, but what practical man would depend upon the result even if he felt confidence in the theory, knowing, as he does, the imperfections of manufacture. If I read aright, this is what is claimed. Even Rankine, who has been quoted, does not do so. I have before me an old edition, but I presume the latter ones are the same, and he says:

> It is to be considered that the shearing stress at the neutral axis is equivalent to a pull and a thrust of equal intensity inclined opposite ways at 45°, and that the vertical web tends to give way by buckling under the thrust, so that its ultimate resistance in lbs. per square inch is given by the following expression:
>
> $$\frac{36000}{1 + \frac{s^2}{3000t^2}}$$
>
> in which t is the thickness of the plates of the web, and s the distance measured along a line inclined at 45° to the horizon, between two of its vertical stiffening ribs.

In the present case, $s = 85$ ins., and $t = 3\text{-}16$-in., and we find the ultimate resistance to be about 530 lbs., one-sixth of which is, by Rankine, safe, equal to 88 lbs. per sq. in.

It will be noticed that Rankine makes no claim that the tension in the other diagonal allows him to ignore the length of the column. I am familiar with what Stoney says on the subject (p. 155), and his remark that such modes of construction are, however, more or less defective; also, under Internal Braced Pillars (p. 337), when he refers to the lattice bridge and says:

> It is obvious, however, that long compression bars, even though formed of angle or T-iron, have but little stiffness in themselves, and we cannot trust to the tension bars keeping them in line of thrust at right angles to the former direction, for the tension bars may not always be in a sufficient state of strain.

It will easily be seen from the above figures what difficulties I labored under in my early engineering days in endeavoring to reconcile Rankine's method of calculation with the girders I saw in actual use.

It is customary in my own practice, and I presume also in that of others, to run the web through the girder in one piece, if it can be done, for the whole length of the girder; or if it must be spliced, it is done in the middle of a panel. The cast struts of former days were merely bolted through to keep them in place, and with wrought struts it is only necessary to rivet them sufficiently to secure them properly and firmly. The load on a strut is carried to the lower flange and by that distributed, as by a beam, of one panel length, to the web (center to center of panel), being resolved diagonally onto the web and horizontally on the lower flange. The diagonal stress is carried by the web towards the abutment to the upper flange, which also acts as a beam of one panel length, and it is resolved onto the next vertical strut and the upper flange, etc.

I have endeavored to enunciate what I consider a reasonable, practical method of computing thin web plate girders, without involving all the highly theoretical considerations which, while very beautiful, give litttle practical results of importance and may be entirely annulled by defects of manufacture. The short prism theory of resistance of web to compression I consider too uncertain to allow any practical dependence to be placed upon it where the lives of human beings may be placed in jeopardy.

I think if anyone will read that portion of my reply to the discussion on my paper on Bridge Specifications (Trans. Am. Soc. C. E., Vol. XV., p. 484), referring to plate girders, my position in the matter will be very clearly seen. Those specifications were written some years ago, and were among the first so published. Many changes and improvements have been made since then in my own work and specifications, as well as in those of others, but in this matter of plate girders my views remain the same.

Yours very truly,
Joseph M. Wilson,
M. Am. Soc. C. E., M. Inst. C. E.
Philadelphia, Pa., Aug. 31, 1898.

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Notes and Queries.

The address is desired of Mr. W. H. Wood, who was at one time a Locating Engineer for the Union Pacific Ry., and was later employed in government survey.

C. S. asks: "Assuming a quantity of air enclosed in a tight tank together with and above a quantity of water; how much of the air will be absorbed by the water at different degrees of high pressure, say 3,000 to 8,000 lbs. per sq. in.?"

The amount of air absorbed would depend on the volume of the water and the time during which it was exposed to the air, perhaps also on the temperature.

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THE RAILWAYS OF THE CRIPPLE CREEK, COLO., MINING DISTRICT.

By W. P. Hardesty,* C. E.

(With full-page plate.)

The Cripple Creek mining district is in El Paso county, Colo., the center being (in an air line) less than 20 miles southwest of Colorado Springs, which is on the main lines of railway between Denver and Pueblo. Perhaps no other mining region in the West is naturally so difficult of access as this. The elevation ranges from 9,000 to 10,000 ft. above sea level, and the district is surrounded on all sides but the west by high mountains. The summit of Pike's Peak is but nine miles to the northeast, this being the culmination of the Rampart Range, which separates the district from the plains country further east.

In 1891 attention was first drawn to the gold deposits of Cripple Creek, and within two or three years it was demonstrated that this was one of the greatest high-grade ore-producing districts in the world. The only communication with the outside world at first was by means of stages and freight wagons, the nearest railway point being Divide, on the Colorado Midland, 20 miles distant. The expenses of hauling supplies of all kinds from this station, and hauling out the ore, made it impossible during 1891 and 1892 to market ores that ran less than 2½ oz. in gold or $50 per ton. Nearly all of the product was shipped to the smelting works at Denver and Pueblo, and the cost of mining, transportation and treatment ranged from $30 to $35 per ton. In 1893 the output for the year reached $2,000,000, and it was seen that any railway reaching the district would have a very profitable business. In that year the survey for the first road, the Florence & Cripple Creek Ry., was made.

Florence & Cripple Creek Ry.

The locating engineer for this road was Mr. H. A. Sumner, who has had an extensive experience at such work in the West. The chief engineer is Mr. R. W. Stewart, with office at Florence. The road starts from Florence, on the Denver & Rio Grande Ry., and 32 miles west of Pueblo, and running northerly reaches the district at Victor, a distance of 34.6 miles. It continues on to the city of Cripple Creek, making its total length 40.3 miles. Construction was nearly all done during the first half of 1894, and on July 2 of that year the first train was run through.

The road is narrow gage, with a maximum grade of 4% compensated on curves at the rate of 0.02 ft. per 100 ft., and with a maximum curvature of 30°. There are many curves of this sharpness. It is a typical mountain road, and is one of the most recent examples of the class of mountain railways which were inaugurated by the Denver & Rio Grande Co. in the early '80's, and which so opened the eyes of the world as to the possibilities of railway location in rough country.

About eight miles from Florence the road enters Eight-Mile Canon, a narrow, tortuous channel that requires much skillful work to get through. The road as first built here lay along the bottom of the canon. During the first season an unprecedented flood came down the creek and washed out nine miles of track. The line was afterwards changed so as to run along the side, well above the creek, requiring much heavy construction on account of the difficult country. There are two short tunnels and a number of wooden bridges through this canon. The bridges often burn, so that the longest of them—a high trestle about 160 ft. to 180 ft. long, on the famous "Wilbur Loop"—has been lately replaced with iron to insure safety. This loop is made by the line doubling across the canon and running down the right-hand side of it till the summit of the ridge is reached, when it turns back and continues on its northerly course along the side of a different canon. The summit is reached at Alta Vista, only about three miles from Victor, and at an elevation of over 10,000 ft. The station at Victor has an altitude of 9,734, that at Cripple Creek is 9,396.

The track is laid with 45-lb. rails, which are being gradually replaced with 55-lb. rails. These weights for narrow-gage lines are greater than heretofore used. The engines are 40 tons weight; the passenger rolling stock is all new, but the freight cars were furnished by the D. & R. G. Ry. from its narrow-gage lines.

The Golden Circle R. R.

During the present year a road called the Golden Circle R. R. is being built from Victor to the town of Altman, on Bull Hill, which is said to be the highest town in America. The line goes directly past some of the largest mines in the camp, and the distance to Altman is about five miles, although it is but two miles by air line. Though different in name, the company building the railway is practically the same as the Florence & Cripple Creek Co. For the first mile or two there was much difficulty in securing right of way on account of other railway tracks crossed and in running close to certain mines, there being but little room to swing on account of the work being side-hill, and of the necessity of keeping up the maximum grade. It was necessary to pass through the dumping ground of the Portland mine—the largest producer in the district—and, on account of the enmity of the management of this mine towards the railway company, very stringent conditions were imposed in granting right of way. A covered way (to be gradually converted into a tunnel by the operation of dumping the waste from the mine) was necessary through the dumping ground, and, after considerable study, Mr. Stewart decided to make it of steel.

Steel Arch Tunnel.—The tunnel is of steel posts and arches resting on cast-iron piles. The width is 14 ft. and height 10 ft. to the springing line. The arch is semicircular with a 7-ft. radius. The piles on each side are spaced 8 ft. c. to c., except at each end, where it is 9 ft. The length of the tunnel is 242 ft. The piles are soft cast iron, 12 ins. outside diameter, 1 in. thick, and they were 6, 7, 8 and 10 ft. long, the average being 8 ft. A timber or log core was used in driving, the point of the pile being solid for about half its length. One or two were driven direct, by blows of the hammer on top. The tops were cut off even by a pipe-cutting machine. Cast-iron caps are put on top of the piles to receive the longitudinal I-beams, and the variation in line made in driving the piles is taken up by lead-filling between the flanges of beams and shoulders of caps. The weight on the tunnel is calculated at 14 tons per lin. ft., or 56 tons on each pile. The cost of these pile foundations was $7 per lin. ft. of tunnel. Each of the longitudinal sills for supporting the posts is composed of two 12-in. 31-lb. I-beams, having a bearing surface 12 × 14 ins. on each pile. The posts are spaced 2 ft. c to c., and each is of two 12-in. 31-lb. I-beams. Each half arch is made up of web and angles in three 4-ft. sections, spliced together with ⅜-in. plates; there is also a ½-in. plate on the outside of the angles at the springing line or connection with the post. Some trials were made at the Carnegie works of making the posts of sufficient length and bending them to produce the half arch part, but this produced minute fractures at the outer edges of the flanges, so it was not deemed advisable. The web parts of the sections have straight edges, but the angle iron flanges are bent to circular shape. For lateral bracing, an 8-in. I-beam crosses under the track at each two opposite piles, connecting the longitudinal beams. At the top of the arches is an 8-in. longitudinal beam between each two adjacent ones. At each side of the tunnel and running along at the springing line (on the outside) is an 8-in. channel iron. The roof covering and siding is of 3-in. red spruce. The cost of the steel work and the planking was about $50 per lin. ft. The intention is to brick in between the arches with two rings of brick when the boards shall have rotted out. The arches are set at right angles to the 4% grade, except the portals, which are set vertical. For 18 ft. at the lower end of the tunnel the arches are tilted to correspond to the track elevation for the 18 ft., which is in curve here, one sill being lowered and the other elevated. It is 22 ft. from the top of the arch to the original surface of the dump, and 15,000 cu. yds. of material had to be excavated to make way for the tunnel. The filling on the sides and top will be put on gradually, attention of course being paid to depositing the material so as to secure a fairly even pressure on the sides.

The calculation of the strains in the arches was done on the theory of a surcharged material on the sides and top, no allowance being made for packing. The material was called sand, and Baker's formula for side slopes of 1½ to 1 was used. The waste material from these mines usually packs much less than other material. It was calculated that the center of pressure would be at about the springing line of the arches.

The steel work was supplied by the Missouri Valley Bridge & Iron Works; but the erection was done by the railway company itself. The piles were cast at Pueblo. The railway company had other "tight places" to get through in this same vicinity, and there is a complicated overhead steel trestle crossing the Midland Terminal Ry.

Midland Terminal Ry.

This railway runs south from Divide, a station on the Colorado Midland Ry. and at the summit of the main range here, and reaches Victor in a distance of 25 miles; then turning northwesterly it reaches Cripple Creek in five miles more. The road was completed in December, 1895. The maximum grade is 3%, except for about three miles of 4% grade north of the town of Gillette. The maximum curvature is 16°. Victor Pass, shortly before reaching Victor, is the highest point on the line—elevation, 10,225 ft.

The track is laid with 56-lb. rails furnished by the Colorado Midland Ry., that road having taken them up to lay heavier ones. The rolling stock is as heavy as any used on the main line, notwithstanding which very high speeds are at times reached. This is the only standard-gage road at present reaching the district.

The Cripple Creek District Railroad.

This is the highest electric railway in the world. It connects Cripple Creek and Victor, running directly over the top of the mountains between, instead of running around them on a fairly easy grade line, as do the steam roads. It is a suburban road, and is intended to connect with a through electric line from Cripple Creek to Colorado Springs, when the latter shall have been built.

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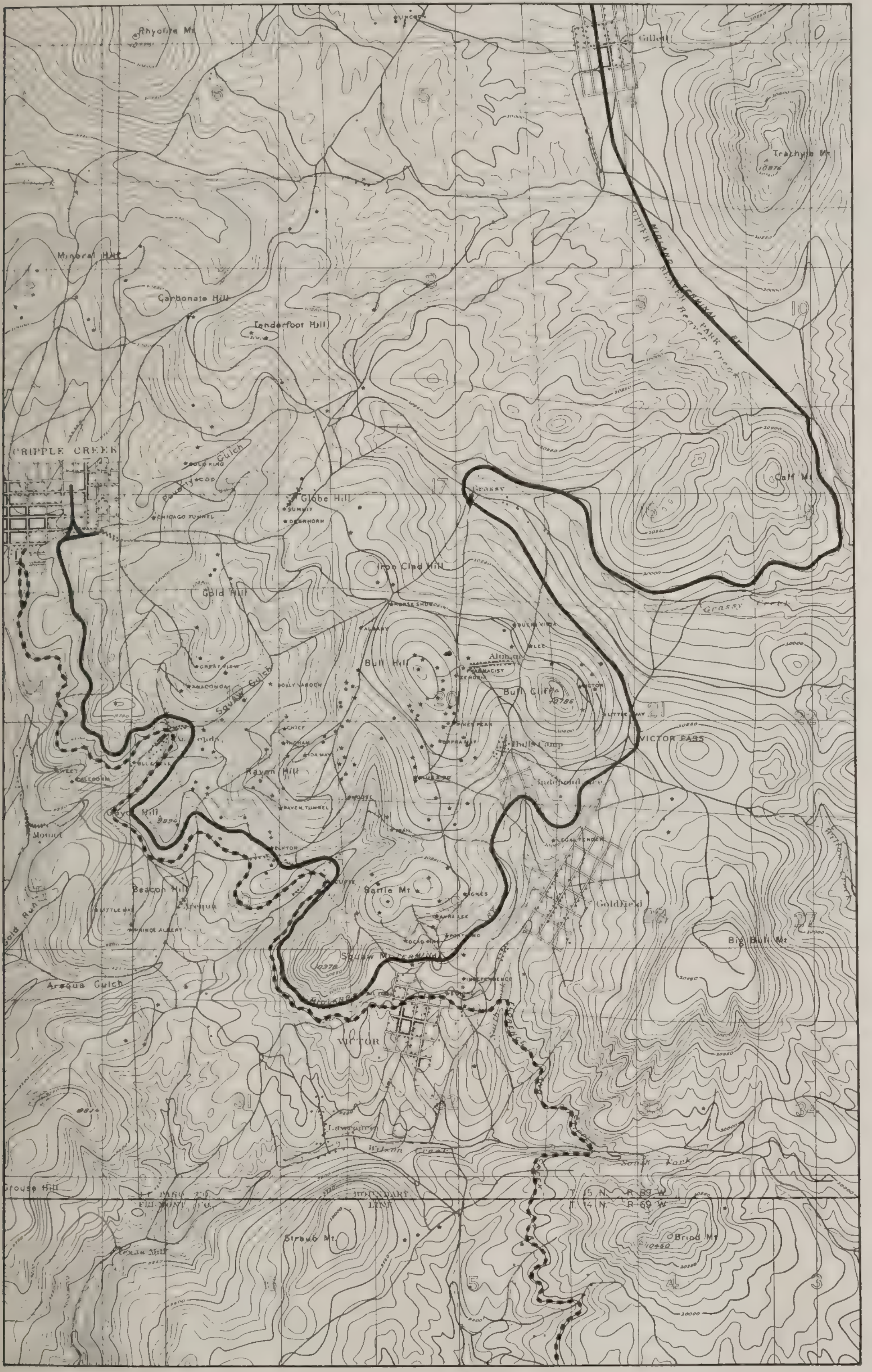
*612 Progress Building, Salt Lake City, Utah.



MAP OF THE CRIPPLE CREEK, COLO., MINING DISTRICT.

Reduced from a Map of the U. S. Geological Survey, published July, 1895, from surveys made in 1894. Datum, mean-sea level; contour interval, 50 ft.

By running over the mountains the District Ry. reaches a part of the camp that the steam roads do not, and thus secures an excellent passenger traffic. The road was completed in December, 1897. The chief engineer was Mr. W. H. Leffingwell, M. Am. Soc. C. E., of Cripple Creek, and the projector and general manager is Mr. L. D. Ross, of Colorado Springs. The road is six miles long, it being three miles each way from the station at Midway on the summit of Horseshoe pass. There is about 1,000 ft. rise from Cripple Creek to Midway, at an altitude of 10,500 ft. On the southeast side the descent to Victor is only about 700 ft., though much development was required on this side the same as on the other.

There is considerable 6½ and 7% grade, and one piece of 7½% grade at the east edge of Cripple Creek. The 7½% was used because the line would have interfered with mining dumps if it had been thrown far enough into the hill to secure an easier grade. As it comes where the rails are made slippery in muddy weather by wagons crossing the track, it is difficult running over it, and much sand is used at such times. Curves as sharp as 60° or about 100 ft. radius are used. The track is elevated ½-in. per degree of curve up to 6 ins. The grade is compensated on curves at the rate of 0.03; 60-lb. rails are used. Three cars comprise the present rolling stock. These are each 40½ ft. long and weigh, with motors, 19 tons. Two 57-HP. motors are used, both at one end. There is but little platform room, one-half of the space for each being taken up by the vestibule for the motorman. In the vestibule is the controller and also the air brake compressor and appliances. The car has two four-wheel trucks, and 3-in. tread wheels are now used, but are to be replaced by 4-in. A second-hand Armington & Sims engine is at present used at the power station at Cripple Creek, and as it can work up to only 175 HP., only one car at a time can be drawn up the hill. Two are run regularly, one always descending. A 6-pole dynamo is used, and the current goes out over the 2-wire feeder line at 550 volts, reducing to 480 and 450 on the line, however. This feeder line runs directly across the country and is tapped where it crosses or comes near the track—about ten times. The trolley wire is No. 00. The bonds for rail joints are No. 0000, No. 00 being found too light.

The cars have a seating capacity of 40, though 100 people are often carried at a load. Immediately on starting down hill the air pump is started going. Straight air is used, the pressure in the cylinder being kept at 70 to 80 lbs., while the average pressure applied is about 30 lbs. The steel brake-shoes used wear out in about three weeks. During the winter, when a snow storm is in progress, a car is kept running all the time to keep the track clear, the track-scraper being used.

The District Ry. is only a connecting link in an electric road that is intended to run from Colorado Springs to Cripple Creek. This line will join the portion already built at Midway on top of the pass. It will be 28 miles long, 14 miles each way to Colorado Springs and to Midway from the divide or summit of the Rampart range. The elevation of this pass is 10,200 ft. The maximum grade will be 7%. The engineer is Mr. H. I. Reed, of Colorado Springs. The preliminary survey from Colorado Springs runs up Bear Creek canon to the divide, where there is now being erected a water-power station. As is well known, the city of Colorado Springs obtains a large part of its water supply from the slopes of Pike's Peak in this vicinity, and the extremely high altitude of the heads of the supply allows of a great fall being used for power purposes, even at this great elevation. By an agreement with the city, the railway company has the right to take water from the former's main supply pipe here, the water to be returned to the city's system further down. A fall of 700 ft. in less than half a mile is secured, sufficient for the development of 600 HP.

From the divide over to Midway the distance by the transmission line is 8 3-10 miles. This line and the transformer station at Midway, with its three step-down transformers and switchboards, are now completed. The transmission is three-phase, three-wire, and the voltage is reduced from 6,300 to 550 volts at the station. There are to be two more power stations built on the west side of the divide, but whether for steam or water power is not yet known, it depending on the developments regarding supplies for the last. Through the inhabited portions of the country traversed by the road, the usual overhead trolley system will be used, but for the remainder of it the third rail system will be used. The cars will be so constructed that they can be attached to any steam railroad train. There are intended to be 30 trains a day, ten passenger and five freight each way—the running time of the former between Cripple Creek and Colorado Springs will be a little over one hour.

At Colorado City (2½ miles west of Colorado Springs) it is proposed to build a number of new reduction works to treat the vast quantities of low grade ore that it will then become possible to ship.

THE SUBSTITUTION OF ELECTRICITY IN PLACE OF STEAM ON A BRANCH OF THE ERIE R. R.

A recent example of the use of electricity as the motive power on a road previously operated by steam locomotives is the railway which runs from Tonawanda to Lockport, N. Y. The road is operated by the Buffalo & Lockport Ry. Co., and serves as a feeder to the Erie R. R. The company was organized in April, 1898, and immediately purchased about 5½ miles of single track running through Lockport, and leased for 99 years the Lockport branch of the Erie R. R., consisting of 13½ miles of single track from Lockport to North Tonawanda. In addition, 7½ miles of single track between Buffalo and North Tonawanda and one mile in the city of Buffalo were purchased. In this way 29 miles of tracks were acquired, all of which were equipped for electric traction.

This work involved the erection of poles, overhead trolley, feeders and the bonding of rails, and was begun May 17, 1898. On Aug. 14, almost exactly three months later, trains were in operation by electricity.

Both passenger and freight service is given, the former by running separate electric cars on half-hour headway. The freight service is handled by two electric locomotives. There are 10 electric motor cars, built by J. G. Brill Co., Philadelphia, Pa. These are mounted upon eight wheels, using two "Perfect" trucks. These are of two kinds, a combination passenger and smoker, 42 ft. long over buffers and 31 ft. long between ends, with 4½-ft. platforms, and a combination passenger and baggage car with a body length of 31 ft. 8 ins. and 4½-ft. platforms. The motor equipment consists of four G. E.-57 motors (208 H.P. per car) and two B 8 series parellel controllers. The total weight of a loaded car is from 20 to 25 tons.

For handling the freight, two 36-ton electric locomotives have been furnished by the General Electric Co. One of these, hauling a train of cars, is shown in the accompanying illustration. In general appearance they resemble the well-known Baltimore & Ohio electric locomotives and the one used on the Hoboken Shore Road, described in Engineering News for July 11, 1895, and Jan. 13, 1898, respectively. The design follows closely that of the locomotives just mentioned, sloping shields being placed on each side of a central cab, and the whole carried on two four-wheel trucks. The cab frame is made of 1¾-in. × 1¾-in. angles, covered with a sheathing of ⅛-in. iron. The main frame is built up of 8-in. channels, running the entire length, and securely riveted to cross plates at the ends directly over the center truck bearings. Heavy oak buffer beams, to which are attached draw-heads and pilots, are secured to the ends of the platform. The trucks have swing bolsters, supported by elliptical springs, and the truck frames are built up of forged and rolled iron securely bolted and riveted together, the pedestals being made of cast steel. The truck proper rests on coil springs, supported by equalizing bars. The wheels are 36 ins. in diameter, with steel rims and iron centers. The locomotives are each equipped with four GE-55 motors. The draw-bar pull at full speed is approximately 3,400 lbs., sufficient to handle a 340-ton train at about 15 miles per hour. The motors are rated at about 160 H.P. each, or a total of about 640 H.P. As the maximum speed required is quite low, two motors are at all times connected in series.

The controller is of the K-24 type, with cut-out wiring, modified to fit the special requirements of the equipment in regard to speed. Outside, the resistance points only two combinations of the motors are possible, the first throwing all four motors in series, and the second, or running position, placing motors No. 1 and No. 3 in series and the pair in multiple with motors No. 2 and No. 4 similarly connected.

The locomotives are equipped with pneumatically controlled trolleys. With this arrangement it is no longer necessary for the engineer or helper to leave the cab and replace the wheel on the wire or reverse the trolley. This is effected by a handle conveniently placed over the engineer's head. The downward motion is obtained by admission of air to a cylinder, the piston of which in moving compresses the spring, holding the pole in place while running. The upward motion is accomplished by the spring and the movement sideways by hand, both pole and handle being on a swivel plate.

The balance of the equipment consists of air-brakes, whistle, bell, air-blast sanding device, air pump, magnetic circuit breaker, magnetic switch, lightning arrester, electric lights, etc.

The following are the principal dimensions of these locomotives:

Length over all	32 ft.
Height of cab over rails	12 ft.
Distance between centers of trucks	13 ft.
Wheel base (one truck)	6 ft.
Gage	4 ft. 8½ ins.
Diameter of wheels	36 "
Complete weight of locomotive	36 tons.

The locomotives have already been subjected to several severe tests. They are specified to be capable of hauling trains of 300 tons weight, exclusive of the locomotive; but they have already proved themselves equal to hauling as many as 28 loaded freight cars at the specified speed of 15 miles an hour.

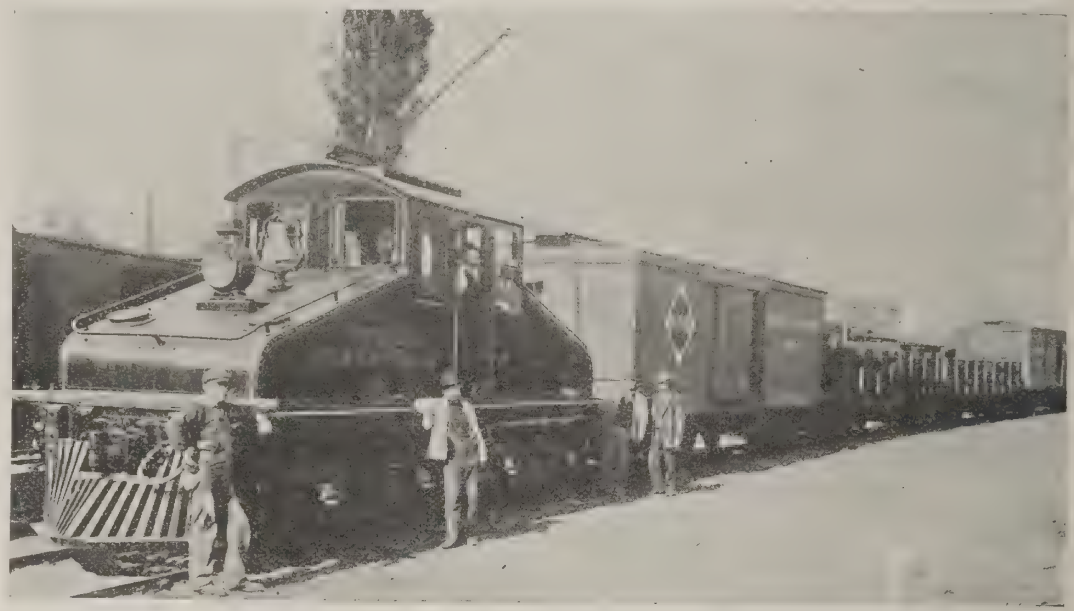
To obtain the necessary current the transmission line of the Niagara Falls Power Co. was tapped between the Niagara Falls power house and Tonawanda. A special transmission line, using cedar poles, triple petticoat insulators and No. 0000 (B. & S.) bare copper wires, carries the current to a rotary converter sub-station at Lockport. This building contains six 150-K-W. air-blast transformers, which drop the voltage from 10,500 to 350 volts, and two General Electric 6-pole 400-K-W. 500-revolution rotary converters, taking alternating current from the transformers, just mentioned, and converting it into direct current at 500 volts.

The switchboard is of the standard panel type, and consists of one panel for the high potential transmission, two panels for the low-tension alternating current side of the rotaries, two "K" direct-current railway panels for the direct-current sides of the rotaries, and two transformer panels. The switches for the high-tension current are of the quick-break type, each blade being separated from its next neighbor by a marble barrier. The blades are pulled open by means of a hooked stick, the hook being inserted in an eyelet into the end of the blade.

Another sub-station, also taking current from the Niagara Falls plant, will soon be built at Tonawanda, the intention being to operate the road in sections. The first of these sections, from the starting point in Buffalo to the city limits, will take current from the Buffalo Railway Co.'s station in Buffalo. From there to Lockport, a distance of seven miles, and half way to Niagara Falls, and half way back to Tonawanda, will be operated by the converters at Niagara Falls. It is also the intention that the Buffalo & Lockport road will either give to or take current from the Buffalo & Niagara Falls Electric Ry., should occasion arise.

The officers of the new company are: Pres., Mr. W. Carl Ely; Manager, Mr. Burt Van Horn; Superintendent, Mr. C. K. Marshall. The operating officers are the same as those of the Buffalo & Niagara Falls Electric Ry.

We are indebted to the General Electric Co. of Schenectady for the illustration and data from which this article has been prepared.



640-HP. ELECTRIC LOCOMOTIVE FOR THE BUFFALO & LOCKPORT R. R.
General Electric Co., Schenectady, N. Y., Builders.

DISCHARGE REGULATOR AND TESTS OF 14-IN REDWOOD WATER MAIN, NEAR LOS ANGELES, CAL.

The West Los Angeles Water Co. recently built a line of 14-in. redwood water main, 37,000 ft. long, to supply the National Home for Disabled Volunteer Soldiers near Santa Monica, Cal. This main is an extension of the Holywood pipe system of the company, and is shown in profile by Fig. 1. In order to avoid as much heavy pressure as possible the line follows the hydraulic gradient as closely as is feasible; and to prevent the full static pressure coming onto the pipe the flow into the same is controlled by a balanced valve operated by a float. Between this structure at Sta. 22 and Sta. 145 water is distributed to many consumers for irrigation and domestic use. From the latter station the line is built exclusively for the supplying of the Soldiers' Home. The contract with the Government authorities for this supply specified that the water should be delivered into a reservoir at the Home at a uniform rate of 348 gallons per min. To accomplish the fulfilment of these conditions from a pipe system subject to constant fluctuation of pressure, without governing the flow at the extreme end of the extension, thereby subjecting the entire pipe to a maximum pressure due to the full static pressure limited only by the elevation of the structure at Sta. 22, was a problem whose solution required something different from any appliance yet devised. To meet this requirement the automatic regulator, Fig. 2, was devised, and may prove of interest to your readers, especially as use has demonstrated its ability to perform perfectly the function required. The device needs little explanation to make its working plain. The telescopic adjuster can be set for any desired head on the weir, when the water will stand just high enough over the lip of the adjuster to admit the passage of such a quantity into the balancing pan, through the hose connection, as will supply the amount passing through the small leak hole in the bottom of the pan, and at the same time retain such an amount in the pan as will constitute an equilibrium when its weight is opposed by the weight of the valve, the movable cast-iron ball and the tension of the spring at the other end of the lever. So long as there is no change in the pressure of the water above the regulator, it is evident that this condition will continue indefinitely. Any disturbing of the equilibrium is only temporary, as the apparatus at once restores it. Thus, if there is a sudden increase of pressure, it at once results in an increase in the height of the water on the weir, a corresponding increase in the rate of flow into the pan, and a consequent partial closing down of the valve until the requisite head on the weir, for which the adjuster is set, is again restored. Should there, on the other hand, be a sudden decrease in the pressure by reason of heavy drafts above, the water fails to run into the balancing pan, that already in, leaks out until the diminished weight is accompanied by an increased opening of the valve through the action of the opposing weight and spring. The weir is not intended to conform to the correct theory for accurate measurement, it being placed for convenience quite near the valve, which results in more or less disturbance of the water. Its error is determined by use of an accurate weir located at the lower end of the line at the point of discharge into the reservoir, and is allowed for in setting the adjuster. There are no new principles in this device, but the general combination is believed to be wholly new.

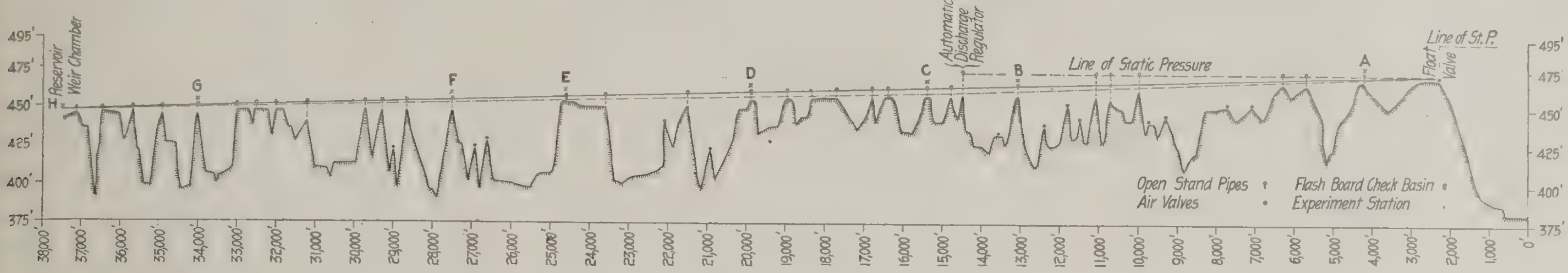


FIG. 1.—PROFILE OF 14-IN. REDWOOD WATER MAIN, NEAR LOS ANGELES, CAL.

The following observations made on the carrying capacity of the line to determine the coefficients of discharge may also be of interest:

Section.	Length, ft.	Average diam., ins.	Loss head in 1000 ft.	Lin. vel., per sec.	Value of C in $V = C\sqrt{RS}$
D to E	4,825	14.05	0.170	0.698	99
G " H	3,436	14,075	0.161	0.695	101
A " B	8,931	14.05	0.178	0.751	104
C " D	4,403	14.11	0.145	0.691	105
F " H	9,912	14.05	0.391	1.167	109
F " B	....	....	0.638	1.531	112
A " B	8,931	14.05	0.375	1.181	113

The losses of head were determined by observations made from the open stand-pipes and other structures on the line; and the volume of discharge by weir measurement at the terminus of the line. The weir itself was checked by volumetric measurement in the reservoir itself. The average diameter of the pipe line was determined by many measurements made during construction. It will be observed that the velocities experimented with are all very low, such as usually give results least concordant. Considering that five different sections were experimented on, the disparity in results secured are not bad for these velocities. The corresponding values for "n" in the Kutter formula are between 0.010 and 0.011, being nearer the latter than the former.

Mr. Arthur L. Adams, M. Am. Soc. C. E., is engineer and manager of the West Los Angeles Water Co. The office of the company is at 405½ Broadway, Los Angeles, Cal.

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THE PROPOSED FLOATING DRY-DOCK AT ALGIERS, LOUISIANA.

Proposals are now invited, by Commodore M. T. Endicott, U. S. N., Chief of Bureau of Yards and Docks, for the construction of a combined floating and graving steel dry-dock, to be located at Algiers, La. The bidders are asked to submit full plans and detail specifications, with their proposals, on or before Oct. 31, 1898, and the limit of cost for the entire work is fixed at $850,000.

The Bureau submits a general specification as a basis for the presentation of plans, etc., and from this the following abstract is made: The proposed dry-dock is to be capable of lifting a vessel of 15,000 tons displacement and 27 ft. draft of water, and the cost named is to include the dock, moorings and wharf. The length of the floating steel dock is to be 525 ft. over all, with 28 ft. of water over the keel blocks and a clear width of not less than 100 ft. If the dock is of the balanced type, it must be so designed as to admit of examination and repair in all its parts, with ease and safety; it must lift a 15,000-ton ship above the level of the river, with a freeboard of not less than 2 ft., and the entire structure must be of steel, excepting the keel-blocks, bilge-blocks and shores. If, however, the design calls for any portion of its accessory structure that is entirely beneath the water surface, such portion may be of wood. To operate the dock, steam, electric, hydraulic or pneumatic power may be used.

It is the purpose of the Bureau to give full latitude of design to the bidder; provided, that the design submitted fully meets the requirements of the naval service for the safe docking of the specified size of ship. To this end stress diagrams must be submitted, based upon standard diagrams furnished by the Bureau, and giving the length and distribution of weights in the heaviest U. S. battleship. These diagrams call for a battleship 450 ft. long, weighing 15,000 tons, and having two-thirds of this weight concentrated in the middle half of her length.

If the dock is designed as a single structure, it must be strong and stiff enough, longitudinally, to safely distribute the load over the entire length, if the vessel be docked in one end of this structure; if the design calls for a sectional dock, adequate provision must be made for so connecting the sections that the dock may act as a unit, and the sections be kept level without straining the ship; and if one of the sections should lose its buoyancy, the connections of the sections must be capable of distributing over the remaining sections the weight of the injured sections and all parts of the ship over this section. The dock must not careen more than 3° under the most unfavorable conditions of loading; providing for the vessel landing 2 ft. off the longitudinal center line, and subject to wind pressure of 30 lbs. per sq. ft. The greatest longitudinal deflection permitted will be 1 in. in 3,000, with the most unfavorable load; the greatest transverse deflection must not exceed 1 in 1,800, under similar conditions.

This dry-dock must be completed in 18 calendar months from the date of signing the contract; and proposals must be accompanied by a certified check for $15,000 as a guarantee to commence work within ten days, if contract is awarded; and there will be a bond equal to 20% of the contract price. A penalty of $200 per day will be exacted for delay in fulfilling the contract. The steel specified is acid or basic open-hearth, and the tests of this steel are fully specified.

The specifications give the following data referring to the stages of the Mississippi River at New Orleans, La.:

Zero of gage is 2.53 ft. below mean gulf level.
Zero on the gage is low water of Dec. 30, 1876.
High water of April 16, 1874, reads 16.2 ft.
High water of May, 1897, reads 19.5 ft.

The danger line was changed from 13 to 16 ft. March 15, 1897.

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COMPRESSED AIR AND ELECTRICITY AT THE LASSIG BRIDGE & IRON WORKS.

An interesting change is being made in the equipment of the plant of the Lassig Bridge & Iron Works, of Chicago, Ill., by which the use of line shafting will be dispensed with, and all the tools will be operated by compressed air or electricity, according to which power is best adapted for each particular purpose.

The compressed air plant, which is shown in the accompanying illustration, consists of a duplex Corliss air compressor, with two-stage or compound cylinders for the compression. The steam end is composed of two simple Corliss engines of 200 HP., placed side by side, and connected to crank disks on a flywheel shaft, the cranks being set at 90°. Tail rods from the steam cylinders operate the air cylinders. The steam cylinders are 20 × 30 ins., and the air cylinders are 18¼ × 30 ins. and 30¼ × 30 ins.

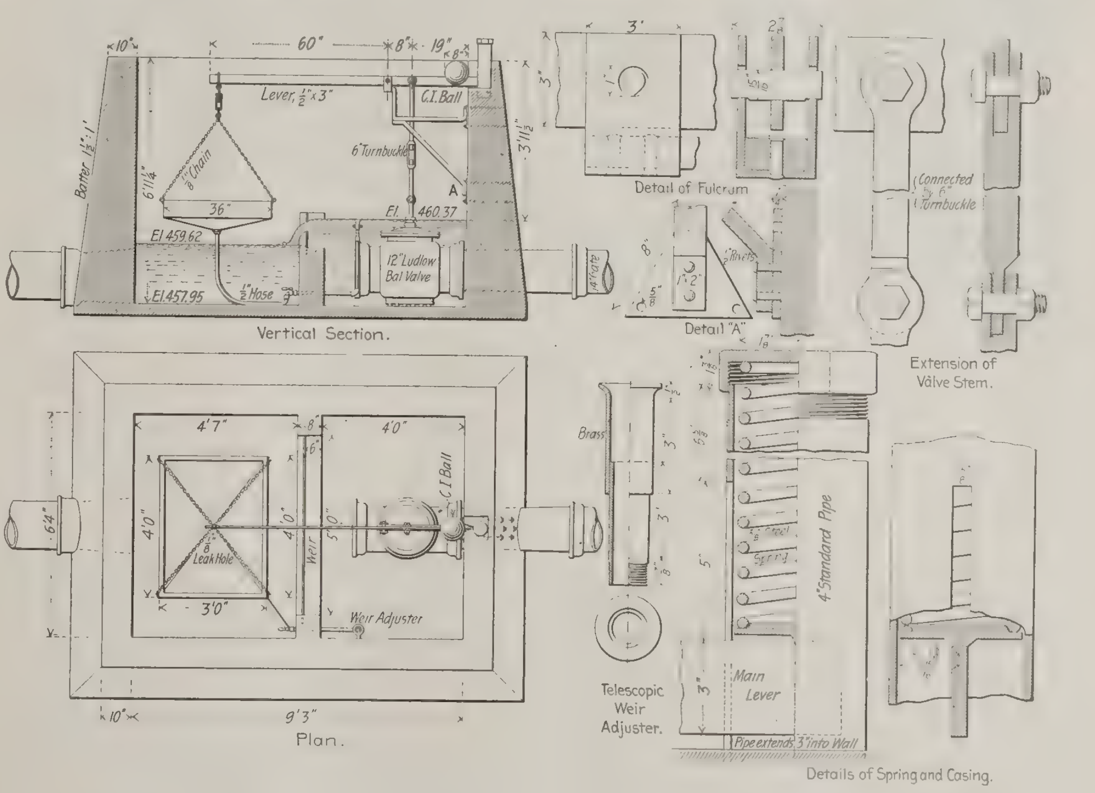
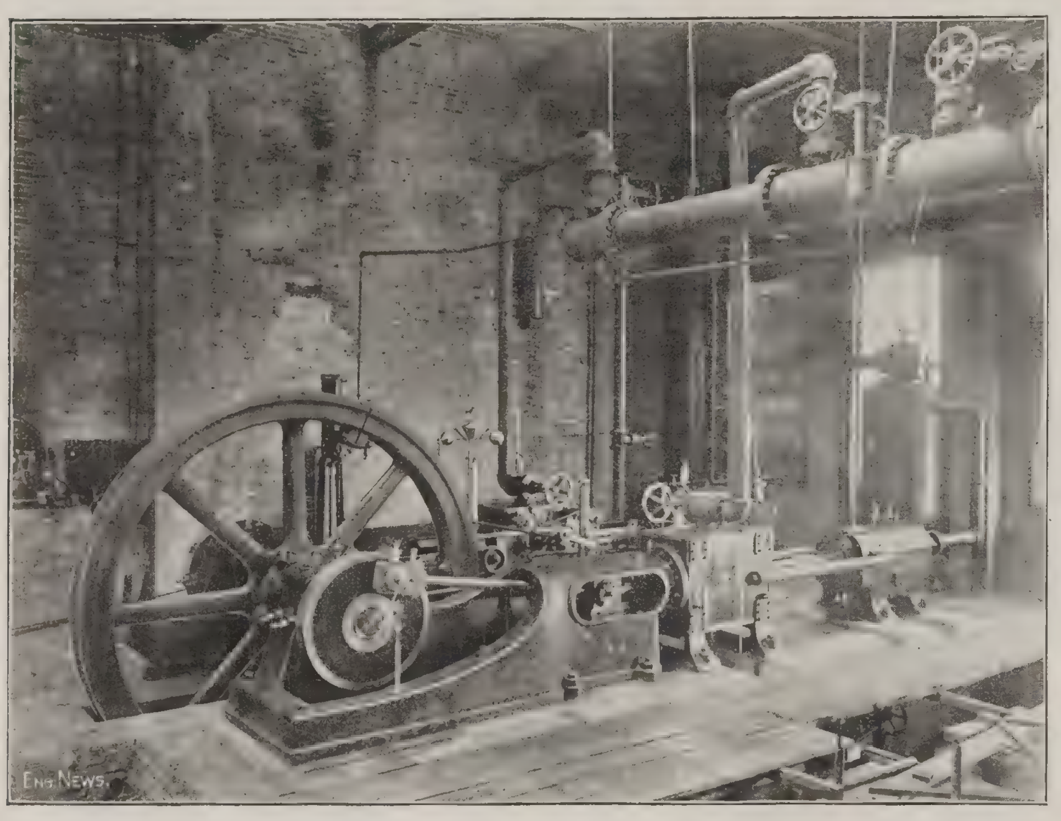


FIG. 2.—AUTOMATIC DISCHARGE REGULATOR ON 14-IN. REDWOOD WATER MAIN.

From the low-pressure cylinder the air passes to a vertical intercooler of the receiver type, having sufficient capacity to fill the high-pressure cylinder without any drop in pressure. This intercooler, which may be seen between the windows, is 42 ins. diameter and 11 ft. high. The air enters at the center of the top and passes down through a cylindrical chamber extending about two-thirds the depth of the receiver, and being open at the bottom. In this chamber is a nest of 1-in. vertical tinned brass tubes, through which an upward current of water is maintained. The cooled air passing out at the bottom of the chamber fills the receiver, and is taken out near the top of the receiver by a pipe leading to the high-pressure cylinder of the compressor. In this way the air from the low-pressure cylinder at about 240° is reduced to the temperature of the surrounding atmosphere before it enters the high-pressure cylinder. From this latter cylinder the air passes to the vertical reservoir shown in the corner of the room. The air pressure is 30 lbs. per sq. in. in the intercooler and 80 lbs. in the reservoir, the compressor having a capacity of 2,200 cu. ft. of free air per minute compressed to a pressure of 80 lbs. per sq. in.

To ensure economical working of the engine, it is desirable to maintain a practically constant pressure of 80 lbs. in the reservoir, and this is effected by means of a sensitive regulator of the diaphragm type, whose rod is connected to the governor rod, and changes the cut-off of the valve gear. In this way the economy of the Corliss engine is realized much better than by throttling the steam, and the governor has little to do except to speed up the engine when there is a heavy demand upon the reservoir.



DUPLEX CORLISS TWO-STAGE AIR COMPRESSOR AT LASSIG BRIDGE & IRON WORKS, CHICAGO.
Ingersoll-Sergeant Drill Co., Builders.

In the caps of the main shaft bearings may be seen small stud screws. There are four of these to each cap, tapped through into the pedestals, and their purpose is to take the weight of the cap, and thus relieve the shaft of the weight. The heavy pipe across the engine room is the steam main, supplying the engines of the air compressors and electric dynamos, and it may be explained that as another engine was to be erected side by side with the one shown, it was necessary to take the photograph before the magnesia covering had been applied to the pipes.

This air-compressor plant was put in by the Ingersoll-Sergeant Drill Co., of New York, and we are indebted to the Chicago office of the company for the photograph reproduced herewith. The plant will supply power for the following tools and appliances: 15 air riveters, 11 × 9 ins.; 6 rotary air drills; 6 pneumatic hammers; 4 rivet furnaces, and 36 oil heating furnaces.

The electrical equipment was planned by Mr. F. Sargent, of Sargent & Lundy, Chicago, Ill. The power plant will consist of a dynamo of 200-K-W. capacity, driven by a Corliss engine, and furnishing current to motors driving the following tools and appliances:

26 punch presses,
4 cranes,
1 derrick,
1 plate roll,
1 bending roll,
1 paint mixer,
1 milling machine,
1 link boring machine,
1 radial drill,
1 pair emery wheels,
4 batteries of radial drills, carrying 45 bits, for holes 11-16-in. to 1⅛ ins. diameter.

All the work has been done under the supervision of Mr. Emil Gerber, M. Am. Soc. C. E., Chief Engineer of the Lassig Bridge & Iron Works.

◆

THE SANITARY PROTECTION of the small lake which supplies water to the fashionable resort of Tuxedo, N. Y., contains one feature which is probably without a parallel. This is the provision that any person falling overboard from a boat on the lake is arrested and fined $25. Bathing in the lake was first prohibited, but its limpid waters were so tempting to the boys of the vicinity that in order to enjoy a dip they would contrive to fall overboard when out on the lake. The ordinance in question was therefore adopted to meet this practice, and it is said to be entirely successful.

◆

MUNICIPAL OWNERSHIP OF WATER-WORKS in Des Moines, Ia., was defeated in a popular vote taken on Aug. 28. The vote was light, only 7,500 out of 25,000 voters, and the proposition to purchase the works of the Des Moines Water Co. was defeated by about 150 votes. One reason for the defeat is said to have been that taxpayers considered the price asked by the company exorbitant, and objection was also made to the quality of the supply.

◆

A WATER POWER PLANT IS TO BE CONSTRUCTED at Wrightsville, Pa., by the Martic Water & Power Co., Mr. James H. Harlow, Chief Engineer. The work will include about 22,000 cu. yds. of excavation, 10,000 cu. yds. of masonry, 830,000 ft. B. M. of timber, and the furnishing and installation of 24 turbines with shafting and all other appurtenances complete. Plans, specifications and blank forms for bids can be obtained from the engineer after Sept. 15, as stated in our advertising columns.

◆

THE CONTRACT FOR WATER METERS required by the city of Chicago, from June 17, 1898, to May 1, 1899, is held by the Pittsburg Meter Co., of Pittsburg, Pa. The life is guaranteed for 10 years for meters up to 2 ins. in size; and two years for larger sizes. The accuracy must be within a limit of 3% for five years, during which time the contractor is to keep them in repair. They are to withstand a pressure of 200 lbs. per sq. inch. The number, sizes and prices are as follows:

Diameter, ins.	Number.	Price per meter.	Total price.
⅝	200	$6.95	$1,390
¾	200	10.00	2,000
1	200	13.00	2,600
1½	200	25.00	5,000
2	100	40.00	4,000
3	100	80.00	8,000
4	20	160.00	3,200
6	20	325.00	6,500
Total	1,040	....	$32,690

◆

THE BROOKLYN BRIDGE TROLLEY ACCOMMODATIONS will be increased by the addition of two new loop tracks at the New York terminal. These two new loops, according to the plans, will be situated about 100 ft. distant from the present loops towards Brooklyn, and will necessitate the removal of one stairway and a part of one gallery, as well as the present electric lighting plant of the bridge. The engineers of the bridge and those of the railway companies are also considering plans for improving the terminal facilities at the Brooklyn end of the bridge, but as yet have not reached any very definite conclusions.

◆

THE RESURVEY OF CHESAPEAKE BAY by the U. S. Court and Geodetic Survey has been nearly completed during the present season. This resurvey had been contemplated for several years, as the shore line and bottom of the bay had undergone many changes since the original survey, 50 years ago, but its immediate accomplishment was due to the fact that the work of harbor defence compelled the concentration of this coast survey work in some locality where there would be no fear of interruption, and Chesapeake Bay was the locality selected. The work of the resurvey has been in charge of Capt. Herbert G. Ogden, who has had eight parties, comprising altogether 24 officers and 100 men, employed throughout the season.

◆

AN AMERICAN PACIFIC CABLE from America to the Hawaiian Islands, the Ladrone Islands, Manila and Japan is just now being much talked about in the daily press. The Pacific Cable Co., which already has a license from the Hawaiian government for a cable between those islands and America, has, it is stated, sent its representatives to Japan to make the final contracts with that country if possible. This same company is also stated to have ordered surveys to be made for a duplicate or reserve cable to run from Sitka, Alaska, by the Aleutian Islands, to Japan. The estimated cost of the two cables is between $22,000,000 and $25,000,000.

◆

THE COLLECTION AND DISPOSAL OF THE GARBAGE of New York city has recently been made the subject of investigation and report by a special committee of the Board of Health, consisting of Dr. G. W. Martin and Dr. James B. Taylor. The investigation was made upon complaint that the disposal of garbage as carried out at Barren Island was becoming a nuisance and the committee reported that the nuisance had in fact become as bad as it was last year, when a strong protest was made against it. It recommended that the Sanitary Code be amended so as to compel the removal of garbage from the city every twelve hours to the place of disposal, to prevent any boat or barge used in the removal of garbage from being tied up at any city pier longer than twelve hours at a time, to have these boats covered so as to prevent the escape of bad smells, and to provide that garbage must be deodorized. The committee also recommended that the windows, doors and skylights in the buildings on Barren Island be kept closed at all times, and the air necessary be forced in by fans and drawn out by pumps, duplicate sets of the latter being required, so that the breaking of any would not require the opening of the windows. The Board adopted the report unanimously and directed the Corporation Counsel to amend the Sanitary Code to cover these recommendations. President Murphy was also empowered to revoke the permits of companies on Barren Island who do not immediately comply with the new rules.

◆

A NATIONAL ASTRONOMICAL SOCIETY is about to be organized in this country. Heretofore the astronomers have been in the habit of meeting together once a year at the annual meetings of the American Association for the Advancement of Science, they constituting a large part of the membership of Section A, Mathematics and Astronomy. The number of observatories and the number of men now devoting themselves to astronomical research make the formation of a separate astronomical society advisable. It is probable that the new society will be one of the "affiliated societies" of the American Association for the Advancement of Science, which hold their annual meetings at the same time and place. The present tendency of the old society seems to be toward disintegration into "affiliated societies," but this tendency is no doubt a benefit to the "Advancement of Science."

ENGINEERING NEWS
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A SYSTEM OF ELECTRIC SUBWAYS is at once to be built by the city of Baltimore, Md., in accordance with a city ordinance adopted by the council last June and approved by the Mayor on Sept. 4. The ordinance creates an Electrical Commission made up of the Mayor, the City Register and the President of the Board of Fire Commissioners who are to appoint a Chief Engineer, who shall be a civil engineer, and also an electrical expert, to prepare plans and specifications and superintend the construction of the work. His salary is to be not more than $4,000 per annum. The subways are to accommodate all the overhead wires in the city except the trolley wires; they are to be built by day labor or by contract, as the commission shall determine, and $1,000,000 is appropriated for their construction.

A 4-FT. SUBWAY UNDER THE MILWAUKEE RIVER has just been completed by the Milwaukee Electric Ry. & Light Co. The subway is 226 ft. long and is made up of lengths of cast-iron pipe 4 ft. in diameter, 12 ft. long and 1½ ins. thick. The subway extends between two manholes on either side of the river, each 8 ft. in diameter and about 30 ft. deep. In laying the pipe four lengths were joined together, making a section 48 ft. in length, and this was lowered from scows and the tapered end was guided by divers to enter the section already in place. The joint at the junction was then bolted up. The river at the crossing is 18 ft. deep, and a trench 12 ft. deep was dredged in the bottom in which the pipe was laid, and was afterward covered with lake sand. After the pipe line was completed and connected with the manholes, it was pumped out and all leaks were made tight. The entire subway was then filled with 3-in. ducts, of which there was room for 110. The manhole shafts were then lined with brick, and the ducts leading to the subway were put in place. The work was done under direction of Mr. Otto M. Rau, Chief Electrician of the company. Two more subways are to be built by the company at an early date.

A CHANGE FROM CABLE TO ELECTRIC TRACTION is to be made on the Broadway cable road in New York city, and work began on Sept 9. The present cable conduit will, of course, be used, and the principal work necessary is the placing in it of the insulated supports for the wires. The cable railway will, of course, continue in operation while the change is going on, and the work will therefore occupy a long time.

THE NEW EAST RIVER BRIDGE is progressing to the point of metal tower erection. Three of the four pier foundations are under way, and the two on the New York side are completed, with 23 ft. above high-water mark. On the Brooklyn side one foundation is within 14 ft. of the required height, or 23 ft, above tide, while the other caisson has not yet reached its final footing, 86 ft. below high-water mark; it is expected that this foundation will be finished in November. The contracts for the steel towers have not yet been let, owing to the financial condition of Greater New York. The $2,000,000 bonds lately authorized by Controller Coler will barely cover existing contracts.

THE QUEBEC BRIDGE CO., at its annual meeting, held in Quebec, has decided to at once call for tenders for a bridge to cost from $3,000,000 to $4,000,000. The capital subscribed amounts to $286,000, and the Dominion government has given assurance that a subsidy of 33⅓% on the cost of the structure would be voted at the next session of Parliament. The Province and the City of Quebec are both expected to grant subsidies. The site of the proposed bridge is opposite the Chaudiere, where the river is 2,595 ft. wide, at high water, and the water is 43 ft. deep. The length of bridge required is 3,100 ft., and the distance from the bed of the river to the lower chord will be 193 ft.

FIVE NEW PIERS ON THE NORTH RIVER, New York, are nearing completion, and are to be finished by the end of the year. These piers are intended for the use of the White Star, Cunard and the Wilson Steamship lines. The total cost to the city of these five piers is $6,000,000, and the shedding over them will cost about $1,250,000 more. The contract for erecting the sheds on all five piers has been awarded to R. P. & J. H. Staats. The two White Star piers are 760 ft. and 732 ft. long; the Wilson Line pier is 732 ft. long, and the two Cunard piers are 718 and 704 ft.; and each pier is 125 ft. wide, except the upper one of the Cunard piers, which is about half that width. The sheds will be one or two-story steel structures, with a continuous two-story bulkhead shed, 1,750 ft. long and 50 ft. wide, connecting all the piers. This bulkhead pier will contain the power, lighting and pumping plant. The annual rental basis for a term of ten years is as follows for the several lines: White Star, $168,750 per annum; Cunard Line, $117,088; Wilson Line, $84,375.

THE DECLINE OF NEW YORK'S FOREIGN TRADE is being investigated by a commission appointed by Gov. Black. The commission is made up of Hon. Chas. A. Schieren, Chairman; Alexander Smith, Secretary; Hon. Andrew H. Green, C. C. Shayne and Hugh Kelly. The subjects to be investigated by the commission are as follows: 1—Deepening of the channel. 2—Dock rentals. 3—Port charges. 4—Pilot fees. 5.—Matter of the availability for commerce of the water front above Hell Gate and beyond Fort Hamilton. 6—Warehouse facilities. 7—Grain elevator charges. 8—Differential railroad rates. 9—New York's lighterage system. 10—Bearing of the Erie Canal upon the commerce of New York. 11—Status of Canadian Canal competition upon New York's commerce. 12—Western demarkation line of territory contributory to New York. 13—Comparative charges at New York and other ports. 14—The establishment of a complete statistical department by the city of New York. The commission will hold its public sessions in the New York City Hall.

AMERICAN HARDWARE, says the "Hardware Record," of London, is rapidly entering the English market, and "American competition is going to be far more severe than it is at present." The export line includes bright drawn steel and all the cheaper grades of steel, brass rods, files, small malleable castings, automatic machinery for all purposes, rubber steam hose, etc. These goods, says the "Record," are now from 25% to 50% cheaper than the prices quoted on English goods in the same line. As to quality, the English workmen are said to prefer the American raw steel and brass, as being more uniform in quality and more easily worked into shapes.

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Sept. 12 on the Texas & Pacific Ry., between Jefferson and Texarkana, Tex. At this point a bridge across a branch of the Sulphur River had been weakened by the high water following a cloudburst and an east bound four-car passenger train went through into the river, killing one passenger, mortally injuring a porter and seriously injuring five other persons.

A SERIOUS DISASTER to the German torpedo flotilla, which has been participating in the naval manoeuvers in the Baltic and North seas, is reported to have occurred on Sept. 10. It is stated that one torpedo boat was sunk, two 150-ton boats completely disabled, and 12 others seriously damaged. Seven lives were lost.

A BREAK IN A PUMPING ENGINE at the Grand Rapids, Mich., water-works on Sept. 1, put the city on a short supply for two days, and left a part of the hill section without any water. The pumps was on the Holly direct system, of 7,000,000 gallons capacity, and had been running without a stop for four months. The plunger rod of one of the plungers, which was 5 ins. in diameter, and turned down to 4¼ ins. at the screwed end, stripped its screw threads, drawing itself out of the nut, which was 4½ ins. thick. The engine then began to race, but it was stopped before any further damage was done. The calculated pressure exerted by the plunger, which is 25 ins. diameter, working against a pressure of 90 lbs. per sq. in., is 4,488 lbs. The metal to be sheared by stripping the threads could not have been much less than 50 sq. ins. even if the threads were of the weakest form, or square threads, giving a very large factor of safety against ordinary stresses. It is probable that the nut had worked loose, and that this occasioned a hammer blow upon the threads, which in time would cause them to break.

DRY-DOCK NO. 3, at the Brooklyn Navy Yard, shows no signs of weakness in use, and the slight seepage of fresh water at the southern end gives no concern. The battleship "Oregon" has just been taken out of this dock, and the battleship "Massachusetts" is the next vessel to be docked in it. This is the dock which gave so much trouble, and which has been repaired under the charge of Naval Constructor Bowles.

THE BATTLESHIP "OREGON" has had her four breech-loading 6-in. guns replaced by four 6-in. rapid-fire guns, and her smoke-pipes have been lengthened 10 ft., so as to secure better draft when the blowers are not running. The battleship "Massachusetts" is also having her old 6-in. guns replaced by 6-in. rapid-fire, and her smokestacks lengthened in a similar manner. Both the "Oregon" and the "Iowa" are ready for sea again. The cruiser "Atlanta" is having her engines changed from compound to triple-expansion. It is expected to gain three to four knots in speed by this change, with little, if any, more coal consumed.

SMOKELESS POWDER FOR THE U. S. NAVY, to the amount of 1,000,000 lbs., is to be provided by contracts now made with the California Powder Co. and the Dupont Powder Co.; each is to furnish half the above amount at 80 cts. per lb., the government furnishing the alcohol used in the production of the powder.

THE WEIGHT OF SHELL CHARGES used in the United States Naval service—that is, the weight of powder with which explosive shells are charged—are as follows, black gunpowder being used in all cases:

1 pounder,	200 grains.	6 in., about	4½ lbs.
3 "	900 "	8 " "	11 "
6 "	1,400 "	10 " "	20 "
4 in., about	2 lbs.	12 " "	40 "
5 " "	3 "	13 " "	50 "

THE THREE BATTLESHIPS, lately bid for, are to be built upon the plan submitted by the Cramps, according to the decision of the Navy Department. The Newport News Co., the Cramps and the Union Iron Works, all submitted plans for fast ships, but those submitted by the Cramps were found to be the only ones entirely satisfactory to the Department. The Board of Naval Bureau Chiefs has now invited the Newport News Co. and the Union Iron Works to amend their plans so as to make their ships identical with that proposed by the Cramps. Both companies have practically agreed to do this, and it is understood that each of the three companies will receive a contract for one ship.

THE PROPOSED OTTAWA AND GEORGIAN BAY ship canal is still attracting attention in Canada. McLeod Stewart, of Ottawa, has made the following proposition to the Canadian government on behalf of the Montreal, Ottawa & Georgian Bay Canal Co. The company will build a canal with locks of 14 ft. depth, so that steamers of that draft can pass from Montreal to the Great Lakes via the Ottawa River. It will employ only Canadian labor and Canadian sub-contractors, and will use plant and machinery made in Canada, so far as procurable. It will complete surveys within ten weeks from the time the concession is approved. The guarantee required of the government by the company is $340,000 a year for 20 years, or 2% on $17,000,000, which the company gives as a provisional estimated cost of the work. No part of the guarantee need be paid till one year or more after the entire completion of the canal. The annual payment shall be diminished by the amount of the net earnings of the company. Thus, if the company makes net earnings of $140,000 the first year, the government would only have to pay $200,000. Finally, the company will agree to repay any expenditures of the government on account of the guarantee fund from its future earnings, and the government will hold a first lien on all property and franchises belonging to the company. The offer has been approved, it is said, by the well-known contracting firm, E. Pearson & Son, of London, who are the financial backers of the enterprise.

THE LARGEST CARGO EVER CARRIED on the lakes was taken last week by the schooner "Roebling," of the new iron ore fleet, from the docks at Duluth. It consisted of 7,865 net tons of ore. The vessel was towed by the steamer "Stevenson," of the same fleet, which also towed the schooner "Nasmyth," the combined cargo of the three vessels being 19,761 net tons, the largest tonnage ever drawn by one engine on the lakes. By the plan of having one large steamer take in tow two large schooners, all laden with ore, the cost of transportation is greatly reduced, a matter of the utmost importance in the cheapening of the cost of iron and steel production.

PORTABLE PLANT FOR MANUFACTURING ASPHALT PAVING.

The use of asphalt paving has in the past been practically limited to the larger towns and cities, owing to the fact that the asphalt has to be prepared in a special plant, the cost of establishing which precludes its introduction in places where only a limited amount of work can be expected. In order to overcome this difficulty there has been devised and patented a special portable plant, which is complete in itself and can be transported by rail from place to place on its own cars in regular freight trains. With such a plant, supplemented by a steam roller and the special street tools required, a contractor can undertake small pieces of work, as there is no expense for the erection of permanent plants, and when the working season is over the plant can be closed up and stored on a side track or in a shed.

The design of the Hetherington portable asphalt plant, which is described in the present article, was not an easy matter. It was necessary to combine a large number of bulky appliances and special machinery for a complete factory within small compass, upon cars suitable for transportation on railways. It was also necessary to provide a housing and working platforms, and to so arrange the plant that it could be operated conveniently and economically. Furthermore, it was necessary to provide such joints and sectional parts that the entire plant could be packed and enclosed within cars whose dimensions should not exceed the limitations of tunnels, bridges, etc., while at the same time all parts had to be made strong enough to stand the shocks and vibration due to railway service without requiring undue expense for repairs.

Fig. 1 shows in operation a large Hetherington plant recently built for the Assyrian Asphalt Co., of Chicago. Fig. 2 shows a similar plant closed and ready for transportation, but it must be noted that the front car in Fig. 1 is the rear car in Fig. 2.

The plant is all contained upon two cars. One of these, termed the drier car, is 42 ft. long; the other, or melter car, is 36 ft. long. Both are 9 ft. wide. Each car has an underframe of six steel longitudinal sills, composed of 12-in. I-beams and 12-in. channels, and stiffened by eight truss rods. Steel body bolsters are built into the framing, and the diamond trucks have also steel holsters. All castings are of steel and the only wood used is for the deadwoods, which are of oak. The floor is of ¼-in. steel plates, riveted to the steel sills. The cars are fitted with automatic couplers and air brakes, and are built with due regard to the M. C. B. standards.

The equipment of the drier car includes a 50-HP. steam boiler of special design, a 35-HP. steam engine, a boiler feed pump, a sand elevator and conveyor of the link belt type, two drums for heating sand, an air compressor and a double rotary air exhauster to create the necessary artificial draft for the fires of the heating drums. The equipment of the melting car consists mainly of a steel cylinder or agitator, and three or four melting kettles or tanks, each having a capacity of about seven tons of asphalt. These kettles are enclosed in a housing of steel plates, and between them are partitions of hollow fireproof tiles of special design. Similar tiles are used to line the housing, an air space 1 in. wide being left between the tiles and the steel plates. These tiles form an effective insulator against loss of heat and are much lighter in weight than ordinary firebrick. All the tiling and furnace masonry is so built as to be proof against damage by the vibration and jarring of the cars when traveling. The furnaces are above the car floor, the grates being let into the floor, so that there is no projection below the framing.

The cars are run upon a side track at a convenient site for the work, and are placed about 7 ft. apart, the wheels being blocked, and the corners of the cars supported by screw jacks. The sides of the drier car (the leading car in Fig. 1 and the rear car in Fig. 2) are then opened, the lower part falling down to form a working platform, and the upper part forming a roof or shelter, all supported by tubular posts which form part of the equipment. On the melter car, the inclined roof, hinged at the eaves, is folded back and forms an upper working platform above the kettles, supported by inclined braces. A light steel framing supports an awning over this platform. Between the cars is built an elevated tower, spanning the space between their ends, and having its four columns supported on the corners of the cars. This tower is built of light tubing and steel beams. Upon it, about 9 ft. above the ground, is a platform carrying the mixer, in which are mixed the necessary proportions of asphalt, carbonate of lime and hot sand to form the paving material. Suspended just above this is the sand measuring box, which contains the amount of sand required for one charge of the mixer, and is supplied from the hot sand storage bin, at the top of the tower. The latter is a large rectangular steel bin, containing a revolving screen to take out the gravel and coarser particles from the sand. Underneath the tower, and between the cars, is a roadway for the asphalt wagons.

In operation, asphalt is placed in the melting kettles, and sand is shoveled into the buckets of the cold sand elevator, seen at the side of the front car in Fig. 1. This delivers the sand into the heating drums, from which it passes into the boot of the enclosed vertical hot sand elevator, by which it is carried up to the screen, and thence falls into the storage bin. It might seem to be a better arrangement, however, to screen the sand first and not waste fuel in heating gravel, etc., which is not needed, but we are informed that there is so very little gravel in the sand as to have practically no effect on the fuel consumption, and that by using the overhead screen the refuse can be carried away by a chute without having to be rehandled. While the sand is being heated the asphalt is being melted in the kettles and thoroughly stirred in the cylindrical agitator.

When the materials are ready, the operator on the melting car opens a valve in the spout of the agitator and allows a certain amount of asphalt to flow into a steel bucket, in which it is automatically weighed. As the operator at the mixer allows the hot sand and the carbonate of lime to fall into the mixer, the bucket of asphalt is run to the mixer on a short trolley track and poured into the box. The mass is mixed violently for a short time, and the operator then pulls a lever which opens a door at the bottom of the mixer, allowing the charge to fall into a wagon standing between the cars.

The capacity, as demonstrated by actual work this season, is said to be from 1,800 to 2,400 sq. yds. of paving per day. The plant was invented four years ago, but was not fully developed until last year. The latest and largest plant is one recently completed for the Western Paving & Supply Co., of Chicago. Several plants have been built and have been operated successfully at Oswego, N. Y.; Lima, O.; Toledo, O.; Houston, Tex.; Bluffton, Ind., and Grand Rapids, Mich., where a considerable amount of work has been done. The inventor is Mr. Frederick A. Hetherington, to whom we are indebted for photographs and information, and the plants are built by Hetherington & Berner, of Indianapolis, Ind. The same firm also builds stationary asphalt plants.

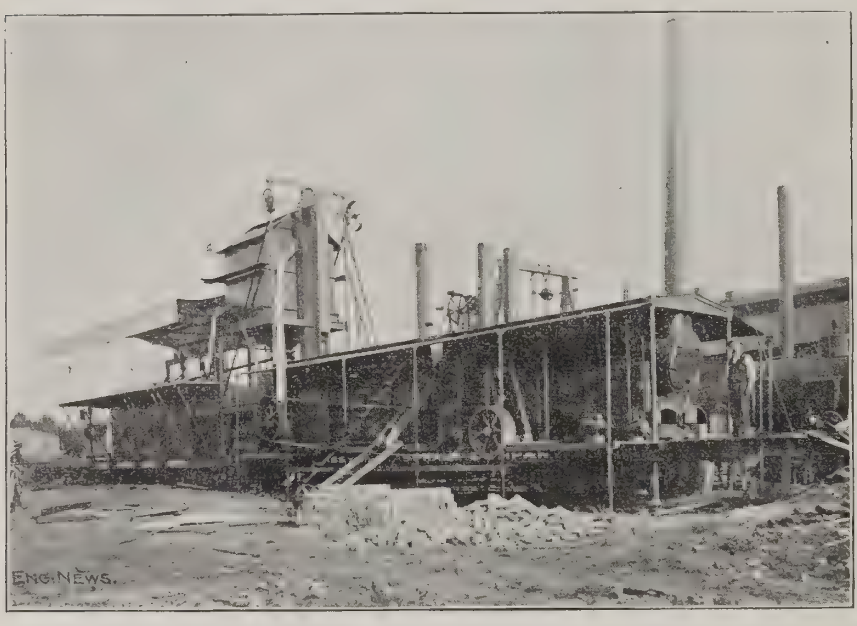

FIG. 1.—PORTABLE ASPHALT PLANT IN OPERATION.

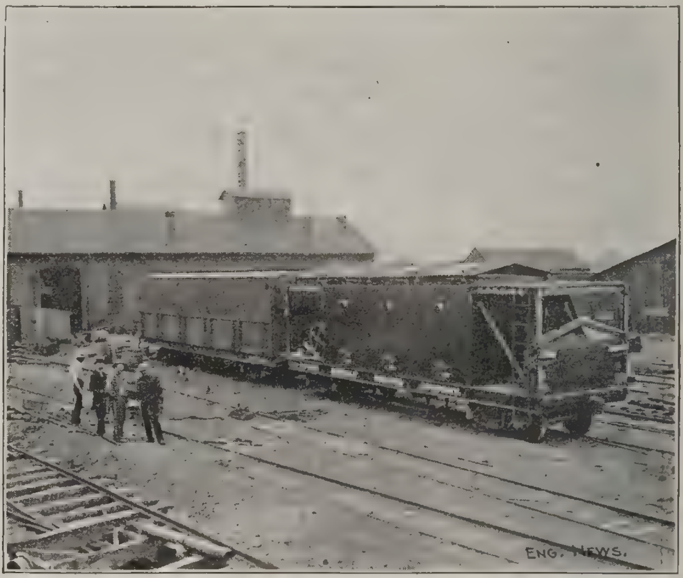

FIG. 2.—PORTABLE ASPHALT PLANT READY FOR TRANSPORTATION.

Frederick A. Hetherington, Inventor.

* * *

EQUIPMENT AND MAINTENANCE OF ELECTRIC CARS.*

By M. S. Hopkins.

Car Bodies.—For years car builders have attempted to devise a car body which would be equally durable in both summer and winter, but judging from the character of equipment now in use on the majority of roads, such a car has not yet been produced. The combination car with movable parts is not satisfactory for winter use. It is troublesome, noisy and cold, and is lacking in many of the essential features of the open car for summer service. The open cross seat car of the barge type, with running boards on the side, seems by far the most desirable type of car for summer service, offering the largest seating capacity and the best facilities for receiving and discharging passengers, which is a great advantage in city service. Considering all features, the box car, with side seats, large windows, wide end doors to the side of a roomy platform and vestibules closed on one side, seems best adapted to the average conditions of winter service. While the vestibule type closed on one side is not so convenient for the handling of large crowds, yet the additional safety afforded on double track roads should receive full consideration, even at the expense of convenience. In localities where winters are accompanied with snow fall and freezing weather, the vestibule affords protection to passengers, and motormen, and conductors are able to render very much more efficient service.

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*Condensed from a paper read at the annual meeting of the American Street Railway Association.

The long car body seems to be growing in favor with the railway manager, due to the comparatively small increase in operating expense, in comparison to increased carrying capacity, and its allowing of the increase of headway or decrease in number of cars run, resulting in a large decrease in operating expense per passenger carried.

In the construction of box-car bodies, the trusses should be as deep as possible, and great care taken to secure a perfectly rigid fastening at end of sill, as the slightest deflection throws an undue strain on the joints and framing of car body. Where side sills are plated on the outside with steel plates, all season cracks should be thoroughly filled with a thick mixture of lead and oil, and the entire surface given a heavy coat of oil paint before the plate is put on. It is hardly necessary to say that all joints should be well leaded and protected from moisture. A heavy steel roof rafter in one piece should be put in at every post, and a saving in maintenance will be made by having platform floors of oak or maple. The trolley stand should be mounted on a trussed support, which will distribute the strain to the ends of the car as much as possible.

Ash seems to be almost universally used in post and light framing of cars. This is probably due to the difficulty in securing the grade of oak necessary, the lighter weight of the ash and the greater ease with which it is worked. Yet, in spite of these difficulties, oak is far preferable, being stronger and more elastic, and a material that will give a far longer life.

Trucks.—Under the average conditions, a 22-ft. closed car or an 8 reversible seat open car body should be the limit for a single truck. Although there are single trucks which will carry a longer body fairly well, yet the increase in maintenance will in most cases warrant the use of double trucks. The local conditions should govern the type of double truck used, the bolster type in most cases being preferable for long cars on high speed, suburban service, while for city service, where heavy grades and quick starts demand maximum traction, and short curves make it necessary for the wheel to turn under sill, the bicycle or maximum traction type must necessarily be used. This type of truck is no longer an experiment, and while they possibly require more careful inspection and adjustment, very efficient service can be secured by their use.

Trucks should be made up of a small number of parts; cast and malleable pieces should be the lightest consistent with strength. Springs should be so arranged as to prevent oscillation, and give an easy riding car under all conditions from no load to full load, and when the truck is of such design as to prevent the use of an under truss, the spring base must be exceptionally long and end springs arranged to relieve strains on the car sills.

Electrical Equipment.—In the selection of electrical equipment the main point is to secure equipment of ample capacity and proper design for the service required. The bearings should be large and lubricated by oil from below and cup grease from above, and so designed that drip from bearings will fall outside of the frame. The armature should be so constructed as to permit the shaft being pushed out without disturbing the commutator and winding.

I am glad to note that the importance of light-weight and slow peripheral speed of armature has been recognized in recent designs of railway motors. The inertia or flywheel capacity of armature should be the smallest possible consistent with the work required. Engineers differ as to the best method of suspension. From a theoretical standpoint, the cradle or side-bar suspension has the lead. The dead weight is largely removed from axle, thereby eliminating to some extent the hammer blow on rail-joints, decreasing the wear on axle brasses and securing the better alinement of gears; yet, in practice, the nose suspension is still preferred by the writer, as the car starts more smoothly—the weight of the motor on the spring supports overcoming the jerk and quiver so common in other methods of support. The specifications for railway motors, as drawn up by leading manufacturers to-day, amount to practically nothing, and I would suggest that the purchaser of motors in his specifications clearly define the rating, heat limit and efficiency.

The series-parallel controller is in most respects a satisfactory device, the chief objection being the narrow range of speed on running notches. Specifications for resistance should provide that the last two points of resistance be of sufficient capacity to allow of their continued use as running notches, especially where cars are operated in city service.

There are several types of magazine fuse boxes or cutouts and single cutouts using a special fuse which possess a number of points of merit. Without going into detail, it is the opinion of the writer that, under average conditions, the standard magnetic blow-out fuse box, using a link fuse, is preferable.

Each car should be equipped with a thoroughly reliable lightning arrester. Points to be noted in selecting this device are as follows: The kicking coil, which should always be installed; the air gap, as small as possible; a positive and quick device for interrupting the current after discharge, and one which will not be injured by the discharge; a non-inductive resistance in the circuit which will limit the flow of current and thereby prevent the opening of the circuit breaker at station when several arresters operate at the same time.

Care of Equipment in Car Houses.—Generally one of the following three methods is used for daily inspection of equipment: Inspection of cars each trip; inspection of equipment at night by motor inspectors; and inspection of equipment during the day by motor inspectors and repair men.

In regard to trip inspection, I would say that in the present degree of perfection attained by manufacturers of railway equipment, trip inspection should not be necessary, except on interurban lines operating at high speed over long runs, and is of doubtful value, besides it is expensive. The period of time for making this inspection is necessarily very short, and the entire time is taken up in mere inspection—little or no opportunity being afforded in which to make repairs.

In regard to night inspection, the experience of the writer has been such as to absolutely condemn the method as expensive, slovenly and unsatisfactory. It is impossible to make a thorough inspection of cars at night, no matter how well lighted the car house may be, and the efficiency of the work done by the men is very far below that of the work during the day. Therefore, when local conditions will admit, inspection of cars during the day seems by for the most advantageous.

We will assume a car house station from which 25 cars or more are operated. There is usually one general foreman in charge of this station. His duties are chiefly those of the transportation department, but he should be a man thoroughly conversant with the usual troubles which may occur in the operation of the equipment, and know how to direct minor repairs. It would, of course, be better if he were able to personally superintend the actual work of repairs, but it is usually very difficult to find men who are good mechanics and likewise efficient in the transportation department.

For making inspection and running repairs such as should be made in car houses, it is a safe rule to have one man to seven cars. It is, however, important to have a man in all car stations, known as chief inspector of that division, who is thoroughly conversant with practical electrical and mechanical matters. This chief inspector should have under his care for inspection and repairs seven cars, and also have direction and supervision of the other two repair men who care for the remaining 18 cars.

The duties of these men should be to make a daily inspection of every car assigned to them, starting first with their motors, examining the grease in the cups, the brushes, cleaning the motors, examining connections, etc. They should remove the covers from their controllers about once in three days, and oil the same very lightly with vaseline or grease, remove any blisters which may have appeared on the contact points, and carefully examine the adjustment of contact fingers. Too much emphasis cannot be given to the inspection of all brake rigging, and very thorough inspection should be made daily from the brake-handle to the brake-shoe, and the brakes tried by inspectors before car is placed in service. A broken brake-chain or worn out shoe, a broken brake-clutch or a broken brake-pin are things that should never occur through neglect, and if an accident of this kind does occur, the cause should be immediately traced and the responsibility located. Economy in maintenance should never be exercised at the expense of absolute safety, and brake-chains, pins and shoes should be discarded long before the danger point is reached.

The actual repair work done by these inspectors should be all work possible to be done without the use of machine tools, or which, if done by them, will not require the loss of car from service for a period of more than two hours.

The question as to how often car equipment should be taken to the shops for a general inspection and overhauling, and to what tests the electric equipment should be subjected at the time of inspection, are subjects on which electrical engineers widely differ. Considering the average conditions, and assuming that equipment is in good condition, it is the opinion of the writer that the taking of cars to shops every six months should maintain the equipment in good condition and assure its efficient operation.

Motor Bearings.—Bearings should be run "close" at all times; the time of their renewal being determined by the effect of the wear on the gear and pinion, as the wear on these parts is largely affected by the wear of the bearings.

After a series of tests, covering quite a period of time, as to the wear of various materials used in motor bearings, the writer feels warranted in making the statement that either the best grade of Babbitt or brass bearings should, under the ordinary conditions, give a longer life than six months, and when a bronze bearing of the proper mixture is used and properly lubricated, a life of twelve months can safely be expected. The method of lubrication largely influences the life of brasses. The writer has, after long tests with various lubricants, discontinued the use of grease entirely on armature brasses, and in most cases on axle brasses, a good grade of engine oil, supplied through wicks, being more satisfactory and economical. In order to reduce the maintenance of brasses to a minimum, the use of phosphor bronze is strongly recommended. Street railways operating 25 or more cars will find it economical to cast and machine their own brasses.

Rough and burnt commutators are too frequently the cause of expensive motor repairs, and usually indicate imperfect motor design or inexcusable neglect. Well designed motors in good condition, even under the hardest service, provided, of course, the average work is within the rated capacity of the motor, should not require turning oftener than once in eight months. There is nothing that so well indicates to the practical man the conditions of the motor as the condition of the commutator. Whenever the commutator shows signs of burning or blackening, steps should be at once taken to prevent it. It is not advisable to try to prevent this by the continual sanding of the commutator by motor inspectors, though the occasional cleaning up of the commutator with sandpaper is necessary with all motors. The causes of trouble of this character are so numerous that mention is made of only a few of the more important.

Brushes should be soft, close-grained carbon, treated with a good lubricating compound—one which does not flow too freely from the heat from the motor, and which will not burn and carbonize on the commutator. The tension on the brushes is, as a rule, too light on railway motors. It is a common belief that heavy tension causes wear of commutator, but experience has shown that the actual wear of commutator due to friction of the brush is very small, and that increased tension will, in some cases, materially decrease the sparking, which causes the greatest wear. Improper alinement of brush-holders frequently causes sparking. In recent practice the use of side contact springs on brushes has been generally abandoned. On motors carrying heavy currents this spring is quite essential, as excessive heating of brush is caused by limited contact in the holder.

Commutator insulation should be made of what is known as the built-up mica, segments of the very softest grade of amber mica. A hard, clear mica should never be used in commutator, as this mica will not wear away as fast as the copper, and there is nothing so disastrous to the life of the commutator as high mica insulation.

The Electrical Testing of Railway Equipment.—Elaborate systems for the periodical testing of insulation on railway equipment seems to be growing in favor with some electrical engineers, but the practical value of these elaborate tests is not fully demonstrated. Experience has shown that tests of this kind are very misleading, and frequently cause the dismantling of equipment which, under ordinary conditions, had no tests been made, would have continued in service for a long time.

Judging from my own experience, it is neither necessary nor advisable to periodically test the insulation on the equipment, but to make such tests only in cases where motors are not working properly. The proper training of motor inspectors as to the little points about railway equipment which clearly indicate trouble with motor will in nearly all cases locate trouble due to weak insulation so that it can be remedied before any serious damage has resulted to any other part of the equipment.

All armature and field coils repaired should be carefully tested as to resistance and insulation to ground, and on all armatures having coils repaired, new commutator put on or commutator turned, resistance between commutator bars should be very carefully measured; using, preferably, a portable Wheatstone bridge testing-set, capable of showing clearly a variation in resistance of 1-1,000-ohm. This is one of the most important tests to be made in the care of railway equipment, as more burn-outs of armatures are caused by the slight short circuiting coils, due to solder, acids or copper turnings bridging over insulation between bars under leads than from any other cause, which can only be located by a test of this kind. Any mistake in connecting up the leads or a bad joint will at once be detected before any damage has been done.

Car Wheels.—Much has been written of late on the subject of car wheels, their wear and alinement, and still street railway managers are careless about their wheels. Too much care cannot be given to the sizing and alinement of wheels, and the pressure with which they are forced in the axle. At least 50% of the wheels removed from the cars throughout the country are caused by broken or sharp flanges or a broken wheel. The use of sand largely influences the life of wheels; but the conditions vary so widely I would not be justified in saying that a sandbox should in no instance be placed upon a car. Where it is possible to successfully operate without them, however, sand boxes should be discarded and other means used for sanding the track. It is in most cases far more economical to fit up a special car, capable of carrying a large amount of sand, and sand the track for say 100 ft. before each point where a stop is likely to be made, and on grades and in places where the track is exceptionally slippery than to sand the rail for its entire length.

Repainting of Cars.—The experience of the writer has clearly demonstrated that it is satisfactory to repaint cars without removing all of the old paint. Patent varnish removers, scalers, etc., are a snare and a delusion. The writer has found the following system of repainting cars to be quite satisfactory: First, remove all old paint by softening it with a blow-pot just enough to allow it to be scraped off with a broad putty knife, not allowing flame from the blow-torch to at any time strike the bare wood. Sand surface off well with block and sand paper. Where any new work has been put in, it should be first primed with a coat of boiled oil and a little lead and allow it to stand for not less than four days. Dashes and all iron work should be thoroughly cleaned with a strong alkali and primed with a coat of linseed oil put on boiling hot and allowed to thoroughly harden; giving one coat of oil and lead before color. If surface is rough, plaster with lead on this coat. Allow it to thoroughly harden, and sand with block; then lay on two coats of flat lead, two coats of color, varnish, stripe and ornament, finish with one coat of rubbing varnish and one coat of finishing varnish. The main object in the painting of cars should be to secure a hard, smooth surface which will hold out the varnish with the very smallest amount of material; the thinner this surface is the better. Care should always be taken where plaster is used to make it as thin as possible, and lead coats, color and varnish should all be carefully tempered, so as to set alike, as most cases of cracking of paint are due to the want of proper tempering and of lead and color coats.

A car painted in this manner should not require repainting for from 6 to 7 years, if properly cleaned and varnished. Cars should come into the paint shop, even where the best grades of varnish are used, once every eight or ten months, and be thoroughly washed down with pumice and strong soap and given a coat of finishing varnish.

After a number of trials of various floor paints and paints mixed especially for the purpose, the conclusion has been reached that there is nothing equal to pure white lead and linseed oil and suitable color for the floors of all cars. The majority of car floors are stripped, and it has been found impossible to find any material hard enough to stand on the top of the strips of a car floor, while almost any material will stand the wear, but not the moisture, between the slats. It is therefore very evident that the best paint for this purpose would be one which would best preserve the wood in the floor of the car from the constant moisture to which it is subjected.

As to the car roofs, the main object is to put as little material as possible on the canvas of car roofs, and that material should be elastic and yet withstand the action of the weather. No paint is too good for the car roof—the best white lead and oil giving the best results.

METAL TRUCKS FOR FREIGHT CARS.

(With two-page plate.)

The great success which has attended the use of metal trucks for freight cars, and the extent to which such trucks are now being introduced, has led a number of designers and manufacturers to enter this field of competition, which is already sufficient to support a practically new industry. Some railway companies also have their own special designs of metal trucks. In an article on our editorial page, we have discussed the general questions incident to the use of metal trucks, and in the present article we describe a number of examples of different types of these trucks. These examples do not include all the metal trucks on the market, but they are sufficiently numerous to illustrate all the different types.

In this article we have divided the trucks into two classes: First, trucks having springs over the axle boxes, in which the whole weight of the car (except that of the wheels, axles and boxes) is carried upon the springs; second, trucks having springs under the ends of the bolsters, in which the weight of the body and the bolsters rests on the springs, leaving the weight of the truck frame to be carried rigidly upon the axle boxes.

In the Fox truck, which was about the first steel truck to come into general use, the springs were placed directly over the boxes, instead of under the ends of the bolsters, as was the usual plan, and this practically new arrangement was widely denounced as being objectionable, particularly on the ground that the short stiff springs would make the trucks ride very hard. From the fact that this truck has steadily grown in favor since its introduction, in 1891, it would seem that this is not of such great importance, or that it has been avoided, and it is particularly to be noted that many of the later forms of metal trucks have the springs arranged in the same way. Where the springs are over the boxes, there are usually two concentric springs to each box, placed in openings in the side frames, the center of the springs being coincident with the center line of the frames. In the Cloud truck, however, a nest of four springs is used, two on each side of the frame, resting on brackets in the boxes and bearing against top seats from the frames, the webs of the frames passing between the springs. In some of the Fox trucks, built for foreign railways, plate springs are used, placed outside the frames and over the boxes, and a somewhat similar plan has been devised for the Cloud truck, but in the latter case two sets of elliptic springs are used over each box, one set on each side of the frames.

Metal Trucks with Springs Over the Axle Boxes.

The Ajax Truck.—This is a cast steel truck, composed of but three members (two side frames and one transom), each of which is a single casting of open hearth steel. The springs are over the boxes, and trucks of this type have no bolster. The construction is shown in Fig. 1. The side frames have the top horizontal from end to end, and are of I-beam section at the middle, made deeper and wider at the ends to form the pedestals, the flanges extending the full depth of the pedestals. Over the axle boxes the frame is enlarged and has the web made circular, to form a seat for the coiled springs. In some of the trucks the frames are lightened by apertures in the deeper parts of the webs. The transom is of rectangular section, with the top and bottom webs partly cut away between the center plate and side bearings to ensure lightness. The ends of the transom have flanges which fit between vertical ribs on the side frames, the transoms thus fitting snugly against the webs of the frames, to which they are secured by bolts. This arrangement prevents shearing strains upon the bolts. The truck weighs about 1,700 lbs., exclusive of wheels, axles, boxes and springs. It was designed by the Shickle, Harrison & Howard Iron Co., of St. Louis, Mo., and is manufactured by that company.

The Black Diamond Truck.—The side frames of this truck are built-up trusses, each formed of two 5-in. T bars. These are horizontal and 12 ins. apart for 15⅜ ins. at the middle, where they are riveted to the transoms. They then incline together and are riveted to cast steel fillers. Beyond these, the ends of the lower bar are curved down to fit against the inner side of the pedestals, while the ends of the upper bars are curved up to fit the top of the pedestals and then turned down vertically to form the outer legs. A double coiled spring is placed over each box. The transoms are 12-in. I-beams or channels, extending through the side frames and riveted to top and bottom gusset plates. Horizontal I-beam spacing pieces are riveted between the webs of the 12-in. I-beams. The truck weighs 1,200 lbs., exclusive of wheels, axles, boxes and springs. The manufacture has only recently been commenced, but some experimental sets are in use, and the specifications for 100 steel frame gondola cars of 70,000 lbs. capacity, for a foreign railway, contain the following clause:

> The diamond type of truck will not be permitted, and preference will be given to the "Black Diamond" or equivalent design, which insures strength, easy repairs, and arrangements to keep the truck square to its work.

One of these trucks was tested by Mr. Robert McKenna, Master Car Builder of the Delaware, Lackawanna & Western R. R., who loaded the truck with 60,000 lbs. of pig iron. This load caused a deflection of ¼-in., but there was no permanent set. The Black Diamond truck was designed by Mr. R. W. Oswald, and is manufactured by the Jackson & Woodin Mfg. Co., of Berwick, Pa.

The Cloud Truck.—This is built up of pressed steel members, and is shown in Fig. 2. It has flanged steel side frames, flanged inward on top and bottom and forming both legs of the pedestals. These frames are horizontal on top and bottom, but are made deeper at the pedestals than in the middle, while the flanges are wider at the middle and serve as gusset plates for the transom connections. The transoms are flanged steel channels, placed back to back. The center bearing is riveted to the transoms, and the side bearings are riveted to the top gussets of the side frames. The ends of the transoms are riveted to the side frames, and also to the top and bottom gussets of these frames. One of the special features of this truck is the arrangement of the springs, which, though placed over the boxes, are clear of the side frames. The webs of the frames come closer down to the boxes than in the Fox, Schoen and other trucks, where the springs occupy the openings in the webs of the frames directly over the boxes. To effect this, heavy malleable iron pedestals are used, with legs of T section, forming wearing surfaces 6 ins. wide for the boxes. These pedestals are riveted to the outside of the frame plate, and their width is sufficient to form a top seat for a nest of four coil springs, 4 ins. diameter, two on each side of the frame plate, with the web of the plate between them. This allows for the use of springs less rigid than where only two concentric springs are used, thus making an easy riding truck. A horizontal bolt, with spacing sleeve, is passed through the bottom of each pedestal. For tenders and cattle cars, two pairs of elliptic springs are placed over each axle box, instead of four coil springs; the pedestals being of special type to receive the elliptic springs. This arraangement is also shown in Fig. 2. There is no difference in the cost of the truck frames, whether coil or elliptic springs are used. The truck frame for a 60,000-lb. car weighs 1,350 lbs., and that for a 100,000-lb. car weighs 2,100 lbs., both exclusive of wheels, axles, boxes and springs. There are now about 2,600 of these trucks in service, including those under 30 steel cars of 100,000 lbs. capacity on the Pittsburg, Bessemer & Lake Erie R. R. The truck is the invention of Mr. John W. Cloud, and is owned by the Cloud Steel Truck Co., Old Colony Building, Chicago, of which Mr. Willard A. Smith is President.

The Fox Truck.—This was the pioneer of steel truck frames, and of pressed steel frames in particular, and was first manufactured in England, at the works of the Leeds Foundry. Each side frame is one plate of pressed steel, flanged inward at the top and ends, and slotted for the axle boxes, the pedestal legs being reinforced by pressed steel pieces of horseshoe shape, riveted to the frame, and a bolt with spacing sleeve holding the lower ends of the legs together. The frames are higher at the ends, over the axle boxes; and at the middle the top flanges are widened out to form gusset plates for the attachment of the transoms, which are pressed steel channels set back to back. The placing of the springs above the axle boxes was a decided innovation at the time when the truck was introduced (about 1891), and this feature was for a time the cause of much opposition. In spite of this, however, the truck has steadily grown in favor and is now in very extensive use, there being a very large number of freight cars in this country equipped with Fox trucks, while the arrangement of the springs has been copied in several other forms of steel trucks. In special cases semi-elliptic plate springs are used, placed outside of the frame plates. The weight of one truck, as used on the New York Central R. R., is 1,382 lbs. The trucks are manufactured by the Fox Pressed Steel Equipment Co., of Pittsburg, Pa.

The Hewitt Truck.—In this truck the side frames are formed of a special rolled steel shape, the section of which resembles an I-beam with the web extended through the flanges, forming a top and bottom T section, as shown in Fig. 3. The frame is 17 ins. deep over all and 12 ins. deep over the flanges. At the ends, the web is cut away and the T-shaped flanges thus left are spread apart vertically, forming top and bottom jaws to receive malleable iron pedestals. Each pedestal has its inner face slotted to receive the edge of the web of the frame, and is secured by one pedestal bolt on the outside, the bolt passing through the pedestal and the ends of the frame flanges. By removing these bolts, and thus releasing the pedestals, the wheels and axles can be removed without taking the truck from under the car. The transoms are 12-in. channels (though Z-bars are shown in the drawing). The channels are set with their flanges outward and are attached to the side frames by vertical angle iron connections and horizontal gusset plates on top and bottom. A double coiled spring is placed over each axle box, the top of the spring being covered by a hood or cap forming part of the pedestal. The truck is designed to have inside hung brakes. Rolled steel is used for all the parts except the center plate, saddle and pedestals, which are of malleable iron. The truck weighs (without axles, wheels, boxes or springs) about 1,400 lbs. It was designed by Mr. H. H. Hewitt, (General Manager of the Union Car Co.), who is President of the Hewitt Steel Truck Co., of Buffalo, N. Y. Its manufacture has not yet been commenced commercially, owing to delays in getting the special section rolled and in procuring the heavier forging machinery which experience has shown to be necessary, but the company already has orders for over 500 pairs of these trucks.

The Joughins Truck.—This was one of the first freight car trucks made up from structural shapes, and was designed with the idea of abandoning the use of the more expensive pressed steel shapes on that style of truck which has the springs placed on top of the journal boxes. Each side frame is made up of an I-beam, and the transom is formed by two I-beams, which are connected to the side frames by vertical angle irons and horizontal gusset plates. A special feature of the truck is the open-ended pedestal, which allows the wheels and axles to be removed after jacking up the car only just enough to ease the spring, instead of having to jack it up the entire height of the pedestal legs.

This pedestal has its outer leg formed by a hinged or removable piece. In one form of truck the ends of the side-frame I-beams are split horizontally and opened out, the superfluous metal in the web being cut away, leaving the top and bottom flanges. A bent steel T-bar riveted to the web forms the top and inner leg of the pedestal, the outer leg being an L-shaped piece of cast steel hinged to the outer end of the top of the pedestal and bolted to the bottom of the inner leg. In another form of the truck the fixed part of the pedestal is a cast steel piece in the form of an inverted L, riveted to the end of the side frame, while another L-shaped piece, secured by a bolt at each end, completes the pedestal. By removing the bottom bolt in either form of truck the loose outer piece of the pedestal can be swung up, clear of the axle box, and the wheels can then be run out.

The weight of the truck is about 1,200 lbs. (exclusive of wheels, axles, boxes and springs). Some of the trucks are now in experimental use under tenders on the Norfolk & Southern R. R., and have been in service for more than two years. They were designed by Mr. G. R. Joughins, who was until recently Superintendent of Motive Power of that road, and were built to his order by the Baldwin Locomotive Works.

The Kindl Truck.—This is another truck built of standard rolled shapes riveted together, but each side frame is a truss (as in the Black-Diamond truck), instead of being formed in one piece. Each frame has one tension member, one compression member and a single tie member, the arrangement resembling somewhat that of a diamond frame. The construction is clearly shown in Fig. 4, which represents a truck for 60,000-lb. cars. Two steel angles, placed back to back and riveted together, form the outer legs and tops of the pedestals. They diverge vertically between the pedestals, the top or compression member curving down 4½ ins. to meet the top of the transom, while the tension member is dropped to meet the bottom of the transom and horizontal tie angle. The inner legs of the pedestals are formed by angle irons (which serve as the guides to the axle boxes) and web plates. Over each axle box is a double coiled spring. The transom is built of two 15-in. channels, 12 ins. apart and toed out. Between them, at each end, is placed a channel end-cover with its flanges vertical and its back outward. To these end pieces the side frames are secured at top and bottom. A ¼-in. horizontal gusset plate extending between the center lines of the axles is riveted to the top angle of each side frame and to the top of the transom. This plate is 7 ins. wide at the ends, and 12 ins. at the middle, and is bent to conform to the curve of the top member of the side frame.

The truck frame for cars of 60,000 lbs. capacity weighs about 1,390 lbs.; that for 80,000-lb. cars, 1,510 lbs., and that for 100,000-lb. cars, 1,900 lbs. These trucks are now in use on 50 new steel hopper cars of 100,000 lbs. capacity on the Pittsburg, Bessemer & Lake Erie R. R., and six coal cars of 60,000 lbs. capacity on the Illinois Central R. R., while orders are being filled for 200 additional cars for the latter road. The truck frame was designed by F. H. Kindl, Chief Engineer of the Carnegie Steel Co., and is manufactured for the Kindl Car Truck Co., Old Colony Bldg., Chicago, by Wm. B. Scaife & Sons, of Pittsburg, Pa.

The Schoen Truck.—While this truck is built up of pressed steel shapes, and appears at first sight to be similar to the Cloud and Fox trucks, it is composed of a greater number of parts than most trucks of this material, the claim being made that in case of accident the truck can be repaired at the railway shops, instead of having to be sent to the maker for new frames or parts. In most metal trucks, however, one of the principal objects of the design is to keep the number of parts as small as possible, and this reduction in parts is very generally held by railway men to be a specially important feature of such trucks.

In the Schoen truck, shown in Fig. 5, each side frame consists of three main parts: (1) A horizontal top member of channel section, with the flanges upward, the ends of this member being turned down vertically to form the outer leg of the pedestals. (2) A horizontal flat bar for the bottom member, the ends being turned up to form the inner legs of the pedestals. (3) A web plate flanged inward on top, bottom and both ends, the flanges being riveted to the top and bottom members and inner pedestal legs. The legs of each pedestal are connected by a horizontal bolt at the bottom, with a spacing sleeve between the legs, and the inner legs are further strengthened by gussets or knee brackets riveted to the legs and the bottom members of the side frames. Wearing plates, which are adjustable, are interposed between the boxes and pedestal legs, and double coiled springs are placed above the boxes. The transoms are pressed steel channels, set face to face, connected by the pressed steel center-plate and side-bearings, which are riveted to them, and having steel distance pieces on the inside. The webs of the channels are bent outwards at right angles at the ends and riveted to the webs of the side frames, while the top member of each side frame is made wide, flat and dished at the middle to form a gusset plate connecting the transom with the frame.

These trucks are manufactured by the Schoen Pressed Steel Co., of Pitsburg, Pa., and are in use on a number of railways. They have been applied to many of the all-steel, hopper-bottom cars of 100,000 lbs. capacity, built by this company for the Pittsburg, Bessemer & Lake Erie R. R. It is one of these latter trucks which is shown in Fig. 5, its weight being about 1,785 lbs., exclusive of wheels, axles, journal boxes and springs. The number of parts is as follows:

	Thick.		Thick.
2 top members	½-in.	1 center plate	½-in.
2 bottom members....	½-in.	2 side bearings......	⅜-in.
2 side frame webs.....	5/16-in.	4 spring caps.......	⅜-in.
4 pedestal brackets....	⅜-in.	8 wearing shoes......	¼-in.
2 transom channels ..	7/16-in.	4 pedestal ties.......	..
2 tr'ns'm center braces	⅜-in.	4 pedestal bolts with nuts, washers & keys	
1 distance plate.......	⅜-in.		

Another form of truck is manufactured by this company, having side frames of the diamond type, but built up of pressed steel shapes. This is described later on. The builders state that their truck frames are in use under 5,000 cars. This is exclusive of metal trucks equipped with the Schoen bolster and small pressed steel parts, more than 100,000 cars being equipped with these.

Trucks with Springs Under the Bolsters.

The American Truck.—This is an adaptation of a cast steel bolster to side frames of the diamond pattern. The bolster is a single casting of soft open hearth basic steel, in shape like an inverted trough, with vertical sides, deeper at the middle than at the ends. The center bearing, side bearings, column guides and top seats for the coiled springs are all formed in this casting. The ends of the bolster project through the side frames, under the top arch bars, and rest upon coiled springs. At the middle of each side frame is a steel casting which forms the bolster columns and lower spring seat. The side frames are connected to each other at the bottom by two flat wrought-iron braces, extending diagonally across between the columns. The ends of these diagonal bars lie between the lower arch bars and the tie bars, and are secured by the column bolts passing through them, while at their intersection they are riveted together.

The bolsters for cars of 60,000 lbs. and 80,000 lbs. capacity, and for tenders, are 13 ins. wide, 4 ins. deep at the ends, and 9 ins. deep at the middle. For 100,000-lb. cars they are 11 ins. deep at the middle. They are also made in smaller sizes for swing motion trucks and for narrow-gage trucks. Each bolster is tested by hydraulic pressure to several times the load it is to carry, and the date of the test is stamped upon it.

The trucks are adapted for either inside or outside hung brakes and the spring seats on the bolsters and column castings are made to reecive any size or shape of helical or elliptic springs. The principal advantages claimed for these trucks are simplicity of construction, small number of parts, flexibility and lightness combined with strength to resist shocks and twisting strains. The trucks for 60,000-lb. cars weigh 1,574 lbs., exclusive of wheels, axles, boxes and springs. There are over 35,000 now in use on 130 different railways in this and other countries. They are manufactured by the American Steel Foundry Co., of St. Louis, Mo., whose works have a capacity of 200 trucks per day.

The Haskell & Barker Truck.—This is another application of a metal bolster to side frames of the ordinary diamond pattern. The bolster, however, is not in one piece, but is built up of top and bottom plates riveted to a cast-steel center piece or filler which is not solid, but is made in truss form. This truck is used on the 80,000-lb. coal cars of the Illinois Central R. R. (Eng. News, June 16, 1898). On these cars the bolster is 12 11-16 ins. deep at the middle and 7⅜ ins. deep at the ends, having a top plate ⅞ × 11 ins., and a bottom plate ⅝ × 11 ins. The ends of the bolster pass through the frames and have cast upon them the column guides for the malleable iron columns. Each end of the bolster is supported by a nest of coiled springs seated upon the spring plank, which is a 13-in. steel channel resting upon the lower arch bars of the side frames. The Illinois Central R. R. has 500 coal cars equipped with these trucks, which are manufactured by the Haskell & Barker Car Co., of Michigan City, Ind.

Northern Pacific Ry. Truck.—This railway is using an all-metal truck which was designed by Mr. E. B. Thompson, Mechanical Engineer of the road, and is manufactured at the company's shops. As shown in Fig. 6, it has side frames of the diamond pattern, with the American cast-steel bolster, described further on, the bolster extending through the side frames. A special feature of this truck is the use of the Barber roller, bearing under each end of the bolster. A broad saddle resting on the lower arch bar supports the end of the two angle irons ½ × 4 × 6 ins., 7 ft. 2 ins. long, which form the transoms, and on this are seated four coiled springs carrying a cap with two concave recesses on top to receive the two 2-in. rollers, which lie parallel with the track. On the rollers rests a similar cap attached to a wooden block or filler which is inserted into the end of the bolster. Mr. E. M. Herr, Superintendent of Motive Power, informs us that this truck operates very successfully and that it takes the curves more easily than the ordinary diamond truck without the roller-bearings. The top arch bar is only cambered 1 in. The bolster is of inverted trough section, with vertical fish-bellied sides, having heavy ribs on the inside of the lower edges. The center plate and side bearings are formed on the casting. Inside hung brakes are used on this truck.

The Player Truck.—This is still a third combination of side frames of the ordinary diamond pattern, with a cast-steel transom and bolster, but differs in many important respects from the other trucks described. The transom is a single trough-shaped casting, in which fits a cast-steel bolster of rectangular section. As shown in Fig. 7, the ends of the transom embrace the top and bottom arch bars of the side frames and are further secured by two column bolts at each end. The strain of the load is divided between the transom and the bolster. That upon the former is light on account of the points of support being immediately adjacent to the bearing points, while that upon the bolster is light on account of the use of a short bolster. The transom holds the truck in alinement, leaving the bolster merely the duty of easing the load upon the springs, which insures at all times the full benefit of the springs. In the ordinary diamond frame truck the bolster has this double service to perform, which results in producing a binding at the columns, causing great strain and wear with consequent shaking and loosening of the frame. The truck is adapted to the use of either coil or elliptic springs under the bolster, the latter being especially suitable for tenders. As the bolster does not extend into the side frames, the springs are consequently inside the frames, instead of being between the upper and lower arch bars as in ordinary practice. The transom is open at the ends, and the springs can be replaced through these openings after jacking up the bolster just enough to relieve the load.

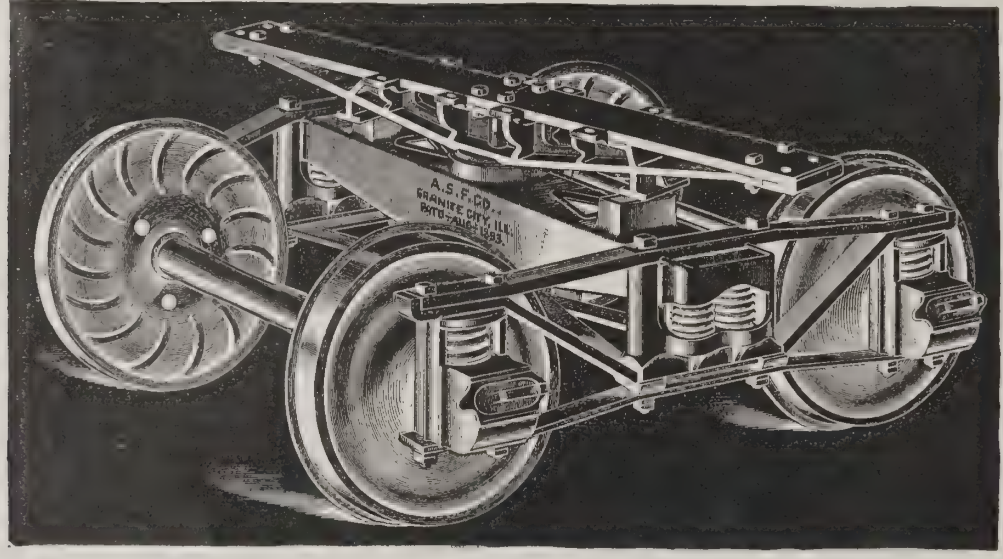
A.S.F.CO.
GRANITE CITY, ILL.
PATD-AUG. 1893.

FIG. 9.—AMERICAN BOLSTER AND TRUCK.

The truck frame weighs complete about 1,500 lbs., the bolster weighing approximately 400 lbs. and the transom 650 lbs. It was designed by Mr. John Player, Superintendent of Machinery of the Atchison, Topeka & Santa Fe Ry., and is manufactured by the Shickle, Harrison & Howard Iron Co., of St. Louis, Mo., who are also the makers of the Ajax truck, already described. There are a number of these trucks in service on the Atchison, Topeka & Santa Fe Ry., the Kansas City, Pittsburg & Gulf Ry., and other railways.

The Schoen Truck.—The Schoen web-frame truck, with springs over the axle boxes, has already been described, but the same company also makes a truck with diamond frames built up of pressed steel shapes. In this form of truck, shown in Fig. 8, each arch bar is of channel section, inverted, and is flared out at the middle to form a gusset plate for the transom connections. Over the axle boxes the lower bar fits inside the upper arch bar, and the two are riveted together. The upper bar is 7-16 × 6⅞ × 2 7-16 ins., and the lower arch bar is ½ × 5⅞ × 2 ins. A flat bar, ⅝ × 5½ ins., with its ends turned up, forms the tie bar, but this is 4 ins. below the lower arch bar, to which it is connected by a double channel piece at the middle. The transoms are pressed steel channels, set with the flanges outward, the channels being 15 11-16 ins. apart, back to back. While the springs are placed in the transverse center line of the truck, as in ordinary diamond trucks, they are not in the longitudinal center lines of the frames, but are set well inside the frames, the center lines of the springs and frames being 11¼ ins. apart. The springs are supported in a rather novel manner. A stirrup or U-shaped piece is attached near each end between the transoms, its sides being clear of the transom channels, while its top horizontal flanges rest upon and are riveted to the top flanges of these channels. The loop of each stirrup supports a saddle or seat for the coiled springs upon which rests the end of the bolster.

The bolster is built up of pressed steel parts riveted together, and is fish-bellied in shape, 12 ins. deep at the middle and 7¼ ins. at the ends. It is formed of two channels, with the flanges set inward, connected by the center plate, end plates and distance pieces. It is only 5 ft. 6 ins. long, being entirely clear of the side frames. The transoms have a great part of the vertical web removed from that part which lies between the spring hangers. The part that remains is sufficient for strength, but the makers state that by the removal of the web the torsional resistance of the transoms is so much reduced that the truck frame has great flexibility in a horizontal plane. This flexibility, they claim, enables the truck to readily adapt itself to inequalities of as much as 3 ins. in the track, without straining the riveted structure. The wheels, axles and boxes can be removed as readily as in the ordinary diamond truck. The truck frame is made accurately square in construction, as the bolt holes for the journal boxes are all drilled at once, after the truck frame has been completed in all other respects. The following is a list of the parts used to make up this truck:

Frames.	Thickness.
2 top arch bars	3/16-n.
2 bottom arch bars	½-in.
2 transoms	½-in.
2 stirrups	1-in.
2 tie bar separators	⅝-in.
4 arch bar fillers*	..
4 brake hanger carriers*	..
1 dead lever fulcrum*	..
2 suspension spring hangers*	..
2 suspension spring hanger clips*	..
Bolster.	
2 channels	½-in.
1 center plate	⅝-in.
2 side bearings	½-in.
1 center brace	½-in.
1 k.-pin supp'rt stirr'p	½-in.
2 spring plates	1-in.
2 end tie plates	½-in.

*Malleable iron.

This truck, for cars of 100,000 lbs. capacity, as illustrated in Fig. 8, weighs 1,615 lbs., including the bolster. It is made by the Schoen Pressed Steel Co., of Pittsburg, Pa., and the makers state that it is in extensive use.

Metal Bolsters.

Besides the various all-metal trucks now being introduced there are numerous designs of metal bolsters, which can be adapted to present forms of trucks, either in new construction or to replace wooden bolsters in trucks now in service. Such bolsters are in very extensive use, some of them being manufactured by makers of metal trucks and other railway supplies, while many railways are using metal truck and body bolsters designed by their own mechanical officers. Several metal body bolsters were illustrated in our issue of July 2, 1896, in connection with an abstract of a report on metal underframes for freight cars, made by a committee of the Master Car Builders' Association, and we note below a few examples of the numerous designs of truck and body bolsters now in use:

The American Bolster.—This bolster, shown in Fig. 9, is a single casting of soft open hearth steel. It is an inverted trough, with fish-bellied sides and closed ends, openings being left in the top table to reduce the weight and the corners being strengthened by ribs. On the top table are formed the center plate and side bearings, while on the outer face of each side are formed the lugs or ribs which serve as the column guides. With the truck bolster is used a cast-steel body bolster with inclined lower flanges, forming a truss shape, and having a horizontal top plate riveted to it. On the lower flange are cast lugs of inverted T section, forming the shoes of the side bearings. The truck and body bolsters are both shown in Fig. 9, which also shows the American all-metal truck already described, and all three are manufactured by the American Steel Foundry Co., of St. Louis, Mo.

The Bettendorf Bolster.—This is built up of I-beams which are subjected to an interesting process of manufacture. At each end of the web a portion is cut out, and the lower part of the beam is then pressed up by special machinery, forming a buckled rib, with a dovetailed joint at the end of the bolster. Malleable iron end plates, center braces, side bearings and center plates are then riveted on or secured by hollow lugs on the castings which pass through the holes and are beaded over, thus eliminating rivets. The Bettendorf bolsters for the Cudahy company's beef cars, shown in Fig. 10, have the truck bolster formed of two 10-in. I-beams, and the body bolster of two 8-in. I-beams, the weight of the bolsters being about 450 lbs. and 350 lbs., respectively. These are made by the Bettendorf Axle Co., of Davenport, Ia., and are among the specialties of the Cloud Steel Truck Co., Old Colony Building, Chicago.

The Marshall Bolster.—These truck and body bolsters are built-up trusses. The truck bolster consists of a cambered 12-in. steel channel, 35 lbs. per ft., with flanges downward, forming the compression member, and a plate ⅝ × 10 ins., passing under a king post at the middle of the bolster, and having the ends turned up over the ends of the channel and riveted to them. This plate forms the tension member. The truss depth is 12¾ ins. At each end is riveted a malleable casting on which are the column guides, and the center plate, side bearings and king post are also of malleable iron. The weight of the bolster, complete, is about 565 lbs. The body bolster has a horizontal top plate, with the ends bent over around the ends of the inclined bottom plate, a malleable iron filler being riveted between the plates, and the malleable center plate and side bearings being riveted to the bottom plate. The bolsters were designed by Mr. W. H. Marshall, Assistant Superintendent of Motive Power of the Chicago & Northwestern Ry., and have been applied to a large number of cars. They are being introduced by the Simplex Railway Appliance Co., of Chicago.

The Shickle, Harrison & Howard Bolster.—Cast steel is used for this truck bolster, which is a single casting, of rectangular section, but deeper at the middle than at the ends, and having openings left in the top and bottom tables to reduce the weight. The ends pass under the arch bars of the truck frame, and have cast upon them the ribs which form the column guides, but the center plate and side bearings are separate parts, riveted to the bolster. This bolster is shown in Fig. 11, and is manufactured by the Shickle, Harrison & Howard Iron Co., of St. Louis, Mo., who have already equipped 50 cars with it.

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INSPECTION AND TESTING OF MOTORS AND CAR EQUIPMENTS.*

By Frederick B. Perkins.†

I have thought it expedient for the purpose of setting forth my views on inspection to describe the work as being carried on in a modern car house containing 50 equipments. In dealing with the inspection of cars in this car house, we believe better results can be obtained by giving to each man some particular branch of the work rather than assigning to him a certain number of cars and expecting him to do all the work required thereon.

In this modern car house five repair men will be required, besides the foreman of the car house, whose duties in connection with handling of motormen and conductors, sending out cars and similar work, would require so much of his time that he could only have a general knowledge of the work of inspection in the car house. Two of this number would be required to grease and inspect the motors; one to keep the controllers in repair; one to take care of the trolleys and to assist in the care of trucks and car bodies; one to have charge of the trucks and car bodies.

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*Condensed from a paper read at the annual meeting of the American Street Railway Association.

†Electrical Engineer, Toledo Traction Co., Toledo, Ohio.

The most vital parts of the equipments are the different parts of the motor, viz., armatures, fields, bearings, brushes and brush-holders. The care of this part of the equipments should come under the head of greasing; and on the manner in which this part of the work is done depends, to a large extent, the frequency with which the cars will break down while in service; and also the amount of repair necessary to keep them in operation. Oftentimes the most ignorant and cheapest men are given the place of greasers. On the contrary, it is a position where intelligence and thoroughness are imperative.

The car should pass into the greaser's hands the first day after it is on the road and every second day thereafter. He should examine thoroughly brushes, brush-holders, gears, pinions, bearings and commutator. Of these parts, the care of the bearings and commutator is the most important, and should therefore receive the greatest amount of attention. The manner of caring for the bearings is very simple. They must be well supplied with grease or oil, and care must be taken that they are kept free from dust and grit, and also that the grease feeds properly.

In the matter of the care of commutators, electricians seem divided in their opinion as to whether they should be sandpapered or not; personally, I am not in favor of it. Instead of temporizing the commutator by sandpapering it, and thereby simply putting it in shape for one more day's work, I would get at the bottom of the trouble, and either make a commutator by some preparation of mica and copper which will not spark, or if the trouble lies deeper, remedy it by remodelling the entire motor.

I think, however, that usually the trouble is not in the commutator, nor with the motor, but in either the brushes or brush-holder, or both; and it is probable that with proper adjustment, and with proper care and treatment, we should find the trouble obviated, and sandpapering of commutators unnecessary.

The writer has personal knowledge of a large road where common brushes were used without any treatment or care except to replace as needed, and it seemed as if the man who used the most brushes was given the credit of taking the best care of his motor. The average life of brushes on this road and the above conditions, with the commutator sandpapered every day, was six days. Subsequently the sandpapering was stopped entirely, and the brushes were removed every six days and properly treated in oil. The life of brushes under this treatment was increased from six days to from forty to sixty days. The trouble with commutators, which had before been great, was reduced to a minimum; in fact, almost entirely averted.

Not less than every fourth day every controller and switch comes under the notice of the man who has charge of those parts. The main point is to clean thoroughly, using a little vaseline on the contacts. The parts that are worn should be touched up with a file or should be sandpapered, and if badly worn, should be replaced, so that at least every fourth day the controllers will be sent out in first-class condition. This man can also examine the car wiring, lamp fixtures, headlight, and all similar parts.

The fourth man will have the care of the trolley poles and wheels. These should be carefully looked over each night and oiled if necessary. The man who attends to this part of the equipment will also have considerable time to devote to general inspection of the car bodies and trucks under the direction of the general inspector. Under the scrutiny of these two men should come all the details of a car body, such as grab-handles, window-catchers, curtain fixtures and similar parts.

Concerning outside inspection, it may be a good plan to have it, but I do not believe it is desirable to have a large force. Very little of the time devoted to this line of inspection is really used in looking over the equipments, but must necessarily be consumed in getting from one car to another and in waiting for opportunities, and most of the troubles located by these inspectors are not of such a nature as to require immediate attention; and if they were the inspector could not make the necessary repairs without taking the car to the car house. Troubles of a serious nature, such as would require immediate attention and taking the car out of service, should be easily detected by the motorman or conductor, and reported at once to the proper official.

Taking up next the matter of testing, all materials purchased, such as tape, mica, etc., should be tested to keep it up to the standard. The testing room should be a separate department, and preferably should be partitioned off from the rest of the repair shop. For testing instruments I would advise the following:

A high and low reading direct current volt-meter; one having a double scale reading from 1 to 750, and from 1 to 15.

A direct current ammeter reading from 1 to 100.

A low reading ammeter would be very convenient many times, but is not absolutely necessary.

A 50,000-ohm magneto bell, an alternating current volt-meter and some handy testing set will make an outfit of instruments with which we can do all the testing required.

If the alternating current is not within reach of the car house, we must procure a small dynamo and produce it ourselves. A very small machine, say 2 HP., would be sufficient for all the needs of the testing department. If this machine is designed for about 100 volts, it would be most convenient for our use. With a few small transformers wound for 2,000 volts primary and for either 50 or 100 volts secondary, we are prepared to furnish any voltage within a range of from 5 volts to 10,000 volts.

The man who has this part of the work in charge can very easily and cheaply arrange the detail of installation of the wiring, etc. He can also make some resistance coils and many other pieces of apparatus which will greatly facilitate the quick testing of whatever may be sent to this department.

The testing room should examine and pass upon all supplies for car house or repair shop, and should issue instructions for the treating of brushes, adjustment of trolley poles and many similar questions. Enough samples of finished material should be tested to make sure that the standard of workmanship is being maintained, and armatures, fields, controllers, etc., should be tested to determine their ability to stand the electrical strains which will be placed upon them.

PRODUCTIONS AND TRADE OF PORTO RICO.

The U. S. Bureau of Statistics has just issued a brief general description of the Island of Porto Rico that possesses interest to many capitalists and engineers looking in that direction for investment or employment. As summed up by the Chief of the Bureau, Porto Rico is a delightful winter resort, a valuable tropical garden and an important strategic point. But it has an area smaller than that of the State of Connecticut, or about 3,760 sq. miles.

Under the conditions of long settlement and dense population, most of the available soil is now under cultivation, and the prospects are not flattering for any material increase in its productiveness. The valleys and coast lands are now well occupied by sugar estates; the adjoining inland area is devoted to tobacco, and the mountain sides, to the very peaks, are covered by large coffee plantations. Only one-fifth of the population live in cities and villages; and the large rural population is of extremely simple habits and wants little that we can send them in way of food, clothing, furniture, etc. The small earning capacity of the people, in a depreciated currency, limits the consumption of imported goods.

From the standpoint of the engineer, it should be said that there are only 150 miles of railway and 250 miles of good roads on the island; and these are generally along the coast line; the military road across the island, between Ponce and San Juan, being the exception. Most of the interior is reached by bridle paths over which transportation is effected by packs on small ponies. In the cities and towns traffic is carried on with bullocks and primitive two-wheeled carts. While the towns generally lack water-works, lighting plants, drainage, etc., the conditions are not such as to demand such modern conveniences, and, as a rule, the people are too poor to pay for them. Only about one-fifth of the population is able to read and write, and though a kind of public school system prevails in some cities and towns, it is not of a high order. There are about 400 miles of telegraph lines, and several of the leading towns have some telephones.

According to the latest statistics available, the exports of Porto Rico amount to about $15,000,000 per year at gold value, and the imports to $16,000,000. Coffee forms 60% of the value of the exports; sugar, 20%, and tobacco, 5%; the remainder is made up of cocoa, rum, hides, sponges, cabinet woods, etc. All of the coffee practically goes to Europe, as the growers assert that they can obtain higher prices there than in the United States; and the reduced duties to Spain encouraged export to Spanish ports. About 50% of the imports are manufactured articles, largely cotton cloth, shoes, fancy goods and household articles; rice accounts for 15% of the imports; fish, 10%; meats and lard, 10%, and flour 7%. Naturally, most of these articles come from Spain, as the duties collected were only one-tenth of those charged imports from other countries.

As to prospects for investment, the Bureau of Statistics states that coffee plantations are now held at high prices; or $75 to $200 per acre, in Porto Rican money, according to location, quality of coffee and age of trees. Sugar plantations are relatively still higher in price, because of the more expensive machinery required; and many plantations have lately been abandoned and turned into cattle ranges. Tobacco has been lately very profitable owing to the shortage in Cuban tobacco; but the continuance of this profit is thus uncertain. Tropical fruits have received little attention from either local exporters or American investors, but they might prove more profitable than the other interests discussed, as they would be ready for shipment before the Florida or California fruits come upon the market in the United States.

Any increase in the production and consumption of the island will largely depend upon improvements made in harbors, roads and transportation facilities generally; and here is the opportunity for a combination of engineering with capital in this development. But it should also be remembered that no useful coal deposits have yet been found upon the island; fuel is, consequently, high in price, and the water-power is not to be relied upon, though streams are abundant.

A PLAN FOR THE SAFE MOVEMENT OF ELECTRIC CARS ACROSS A WEAK BRIDGE.

For several years past an attempt has been made to run a trolley line across the Navy Yard bridge, in Washington, D. C. This structure was built in 1876 by Clark, Reeves & Co., of Phoenixville, Pa., and it is made up of twelve through Pratt trusses, each 100 ft. long, with a plate-girder bascule draw-span of 32 ft. Each truss has seven panels, with Phoenix columns and cast-iron boxes at panel points. Superficially the iron-work is still in fair condition. On Sept. 3, 1897, Mr. C. B. Hunt, M. Am. Soc. C. E., Engineer of Bridges of the District of Columbia, made a careful examination of this bridge, and declared it to be of insufficient strength for heavy electric cars.

In investigating the members he assumed a permissible unit stress 25% higher than that used in the original design. The weight of the motor-car was assumed at 30,000 lbs., on a wheel base of 7 ft. 6 ins.; the unloaded motor-car weighs 15,000 lbs., and it was assumed that 100 passengers, weighing 150 lbs. each, could be crowded upon it. The following results, for some of the main members and floor-beams, were obtained under the condition of two of these cars meeting each other on the bridge:

Member.	Unit stress, lbs. per sq. in.	
	Actual.	Permissible.
Trusses: Stirrup (shear) main floor beams	4,640	6,250
Flange ⅙-web added	20,000	15,000
Web (shear)	5,680	6,250
First truss vertical	12,100	11,250
Draw-span: 6-in. I-cross beams, flange	27,000	15,000
Flange, main girder, ⅙-web added	19,900	15,000
Web (shear)	2,400	6,250

It should be noted that all flange unit strains are for tension on the net section, deducting rivet holes; and that, owing to the very shallow tram rail used on the draw, no assumption was justified that a wheel-load would be distributed to more than one of the 6-ft. cross-beams, which are spaced 2 ft. apart. The only live load assumed was that of the loaded car; and as the members considered were all details, limited to one panel of load, it was thought that the motor-car would practically represent the maximum loaded condition of the bridge.

After the investigation by Mr. Hunt the Capitol Railway Co. employed an engineer to examine and report upon the bridge. This engineer declared the structure to be safe, but he recommended some slight change in details. As a final result the Capitol Railway Co. has now obtained a permit to construct a double track trolley line over this bridge. But it is provided that a single overhead inverted wooden trough shall be built on the center line, and in this two wires will be strung. A small carriage will run upon these wires and a flexible cable from it will convey the current to the motors on the car. This arrangement, it will be seen, absolutely prevents more than one motor car crossing the bridge at a time.

As the cars on one side of the bridge are operated by an electric conduit system, while those on the other side have the overhead trolley, the change of current collecting system to cross the bridge will not be so serious a matter as might be supposed at first sight.

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ADVERTISING RATES: 20 *cents per line. Want notices, special rates, see page* 18. *Rates for standing advertisements sent on request. Changes in standing advertisements must be received by Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.*

The four elevated electric railways of Chicago, or at least the three now in operation, are generally conceded to be well built and efficiently operated, and they perform an excellent service in affording rapid transit to the remote borders of Chicago. But as business ventures they do not pay. The Metropolitan West-Side Elevated Railway is in the hands of a receiver; the Alley Elevated company has been reorganized, but is not paying dividends, and it is doubtful whether it ever will; the Lake Street road has fallen into the hands of Mr. Yerkes, the chief owner of the surface railways of Chicago; and the Northwestern Elevated is not yet completed and work upon it is at a standstill. The chief reason for this failure of four well-conceived business ventures is interesting outside of Chicago; and it is to be found in the recent rapid evolution of surface railways, from horse-cars to cable and overhead and underground trolleys, with a great increase in speed and a more convenient service to the average traveler. When the Chicago elevated roads were first projected, the greater portion of the outlying districts of that city was still dependent upon the horse-car service, and the prospects seemed very bright for any system of transit which would reduce the time of travel between the business center of the city and these outlying districts. Under these conditions the elevated companies were organized, the lines were built, electric traction was adopted, and large dividends were confidently looked for. But the projectors were unfortunate enough to strike a transition period in the development of surface traffic. The rapid introduction of the trolley system in place of horse cars on the surface roads in all the outlying sections of the city completely wrecked their well-laid plans. There is no question as to the speed and excellence of service on the elevated roads, and they seem to be efficiently managed. But the point to be made, and one that must be carefully considered everywhere by the projectors of elevated or underground systems of rapid transit, is that the mass of the traveling public will prefer surface roads whenever these even approach modern standards of speed and quick service. With this system there are no stairs to be climbed and the traveler can stop nearer to his destination; in fact, it is the nearest and most accessible route of travel from one point to another, and though the surface line may be somewhat slower, this fact of proximity will settle the question of choice of route with the great majority of people using city railway lines. In our older cities, where narrow streets prevail and surface travel is liable to congestion; or in cities where the natural conformation is such that the line of travel is largely in one direction, there is doubtless room for profitable elevated or underground roads. But even under these conditions the surface lines are serious competitors. It is no longer, as it was when the New York elevated roads were built, a question of steam or horse flesh. It is a question of competition between trains on a costly elevated or depressed structure and electrically-propelled surface cars, with almost equal speed possibilities and a much less costly and much more accessible roadway.

Including stops, the elevated railways are now able to make only 11 to 15 miles per hour, and the electric surface roads, in the outlying sections, where stops are not frequent and streets are not crowded, often do nearly as well. Under these conditions it is clear that we have about seen the end of elevated railway construction, except in some cases where peculiar local conditions occur, as, for example, the crowded streets of Boston, or the long-distance traffic up and down Manhattan Island.

◆

The death of Hon. Thos. M. Cooley takes away a man to whom the country owes a debt of gratitude for faithful public service in a position of the greatest responsibility, but where few understood or appreciated the value of his work. When in 1887 Congress enacted the Interstate Commerce law and provided for a permanent commission to undertake its administration, every one conversant with public affairs realized that a most critical period had arrived in the relations between the railways and the public. The Interstate Commerce law was a necessary measure; but it contained some unwise provisions. A narrow-minded adminstration of the law might have inflicted serious injury upon railway companies and have made the law itself so unpopular as to open the door for its repeal, and thus postpone indefinitely the progress toward better relations between the railways and the people. When President Cleveland appointed Judge Cooley as the first Chairman of the Interstate Commerce Commission, he probably selected the one man in the whole country who was the best fitted to fill that post. He was not only an eminent jurist, and a man with a broad knowledge of business methods and public affairs; but more important still, he was one of the soundest and ablest living students of railway economics and of the relations of the railways to the public. The good which he accomplished, in educating the public, on the one hand, to appreciate the rights of the railway corporations, and railway officers on the other, to understand the necessity and rightfulness of Government control and supervision of railway operations, can hardly be overestimated. The Commission of which he was a member had herculean tasks to perform. It was expected to accomplish the impossible, and was criticised because it did not do it. For four years Judge Cooley labored at the head of the Commission, and then his health gave way from overwork, and was never afterward restored. He sacrificed himself for his country's welfare as truly as any soldier who meets death on the battlefield; but the great and patriotic service which he rendered during those four years of toil can hardly be overestimated.

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In the discussion upon the status of the engineer corps in the Navy, it has been sometimes urged by line officers that there is no need of placing men of technical education in charge of the engines; but good practical machinists would meet every requirement. Experience in our recent naval operations furnishes good proof of the fallacy in this view. A recent press dispatch quotes the Russian naval attache at Santiago as expressing the opinion that, aside from gunnery, one of the greatest weaknesses of the Spanish ships was in the engine rooms. The Spanish navy, like the French navy, has no commissioned engineer officers, and the engines are run by machinists. The condition of the machinery of the Spanish vessels, and especially the torpedo boats and destroyers, is testimony of the defects of this system, in the stress of war. The Russian attache is said to ascribe the remarkably few breakdowns on the American vessels to the care and supervision exercised by the commissioned engineer officers in charge.

◆

We congratulate the city of Baltimore upon the final outcome of the long controversy which has been waged there over the proposition to construct a system of municipal electrical subways. As announced on the first page of this issue, the ordinance for the construction of this system has finally been approved. In our issue of Jan. 28, 1897, we discussed editorially the reasons why the municipal ownership of subways for electric wires is desirable, and we shall not renew the discussion now. We may remark, however, that the happy outcome of the long agitation in Baltimore is due, in a considerable degree, we believe, to the work of one young engineer; and it is a remarkable illustration of what an able and conscientious engineer can sometimes accomplish in leading and guiding public opinion. Some years ago the city of Baltimore took the first step in the direction of municipal subway construction by building a system of subways for its police telegraph and electric fire alarm wires. The Chief Engineer of the Commission which performed this work was Mr. Nicholas S. Hill, Jr., M. Am. Inst. Elec. E. After this work was completed, Mr. Hill was made engineer of a Commission charged with the duty of investigating the problem of putting all the wires in the city underground, and he prepared for that commission a report in which the economic as well as the technical aspects of the subject were exhaustively discussed, and strong ground was taken in favor of municipal construction and ownership. We think it entirely probable that the final outcome in Baltimore is to be ascribed in no small degree to the able and convincing arguments which Mr. Hill presented in his report, and which we doubt not he has followed up in verbal discussions with those responsible for determining the city's policy.

It is one of the compensations which a conscientious engineer occasionally finds that though his work may be hard and his pay for it inadequate, it is often his privilege to play a large part in molding public affairs, and to wield a strong influence toward securing "the greatest good for the largest number."

METAL TRUCKS FOR FREIGHT CARS.

The introduction of steel as a substitute for wood has been a very notable feature in railway freight car construction within the past few years, but the greatest advance in this direction is being made in the trucks rather than in the car bodies. The construction of cars with steel underframes and steel bodies has been the subject of much consideration by railway mechanical officers, and has been the subject of reports by committees of technical associations and of many articles in the technical press. While steel frames and steel bodies are in use to some extent and are likely to become even more general, for reasons which we have previously discussed, yet the process of introduction is but slow in comparison with the increase in the number of cars with ordinary wooden frames and bodies. On the other hand, there is now evident a very strong tendency towards the elimination of wood in truck construction, and all-metal trucks are now being used and introduced to a greater extent than is probably realized, even by railway officers, unless they have paid particular attention to the matter. The general experience with the ordinary style of truck is that wooden bolsters, even if trussed, are not strong enough for modern cars, and that wooden bolsters and wooden spring planks have to be constantly renewed. Mr. A. M. Waitt, of the Lake Shore & Michigan Southern Ry., informs us that while in his experience this is sometimes on account of decay, in most cases it is on account of these parts being too weak to stand the strains put upon them. In metal trucks, however, he has found that it is very rare that any

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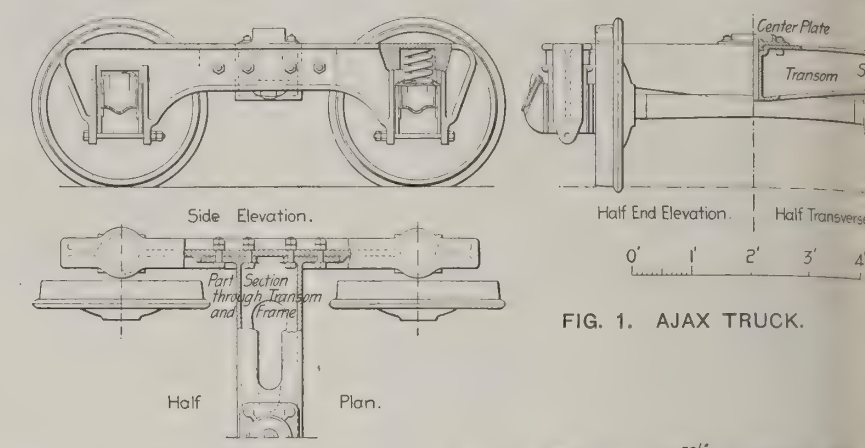
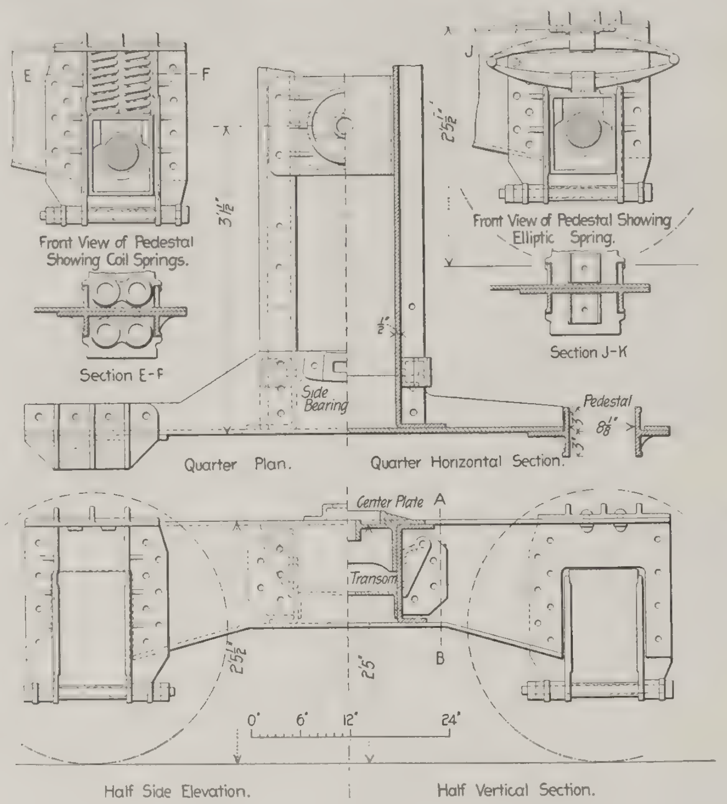


FIG. 1. AJAX TRUCK.



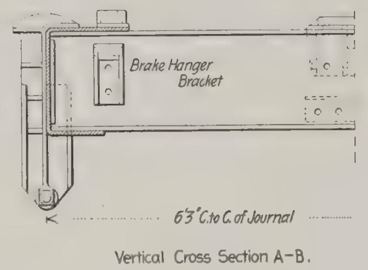


FIG. 2. CLOUD TRUCK.

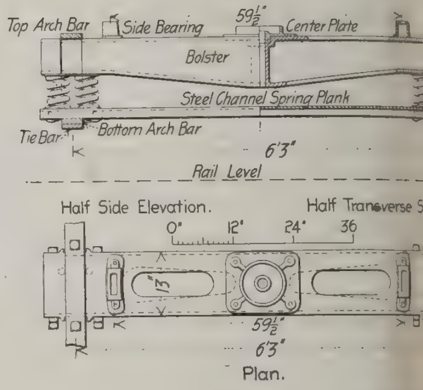


FIG. 11. SHICKLE, HARRISON & HOWARD

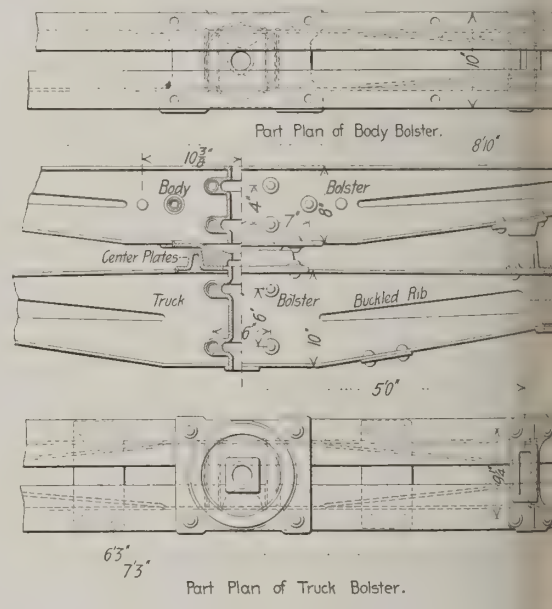


FIG. 10. BETTENDORF I-BEAM

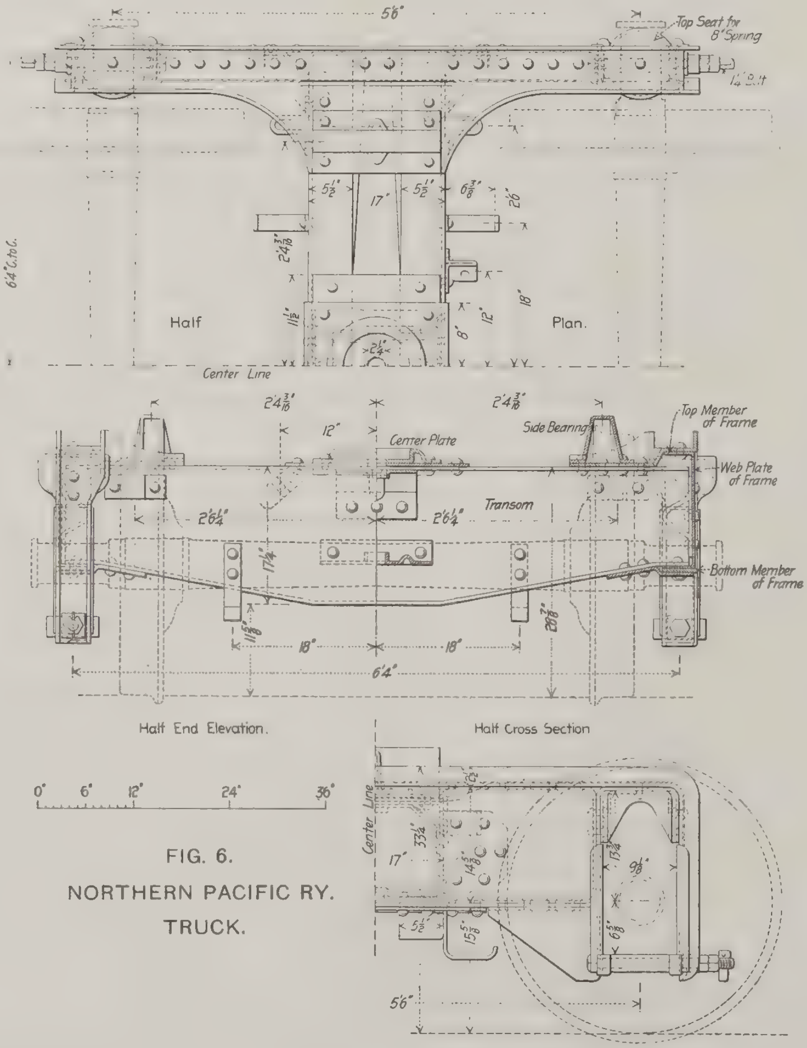
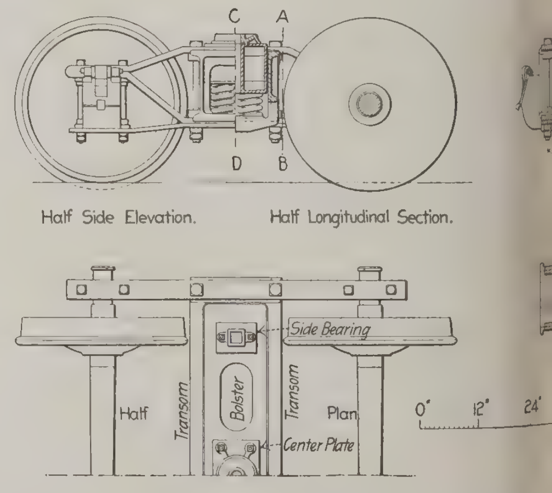


FIG. 6.
NORTHERN PACIFIC RY.
TRUCK.



METAL TRUCKS

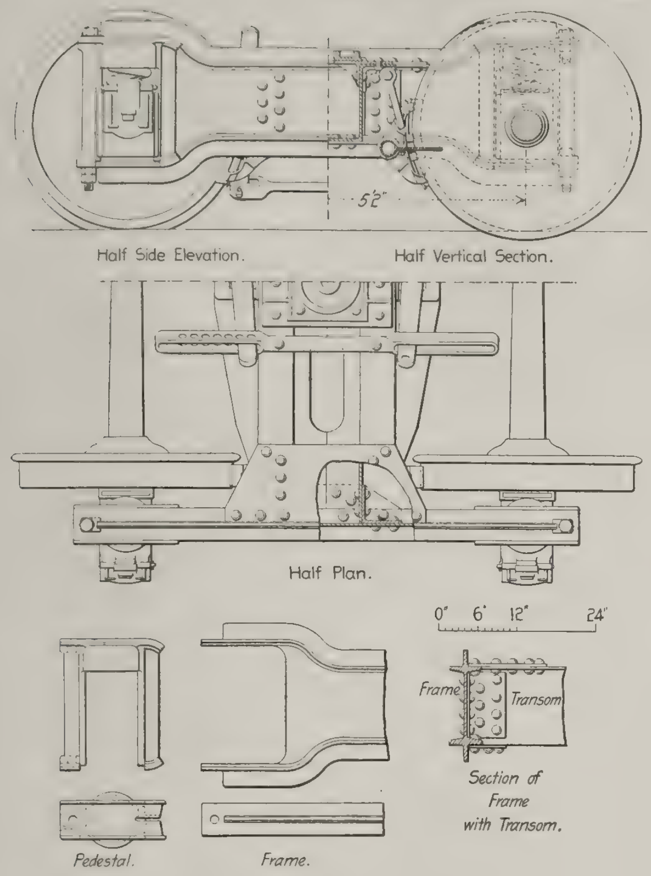


FIG. 3. HEWITT TRUCK.

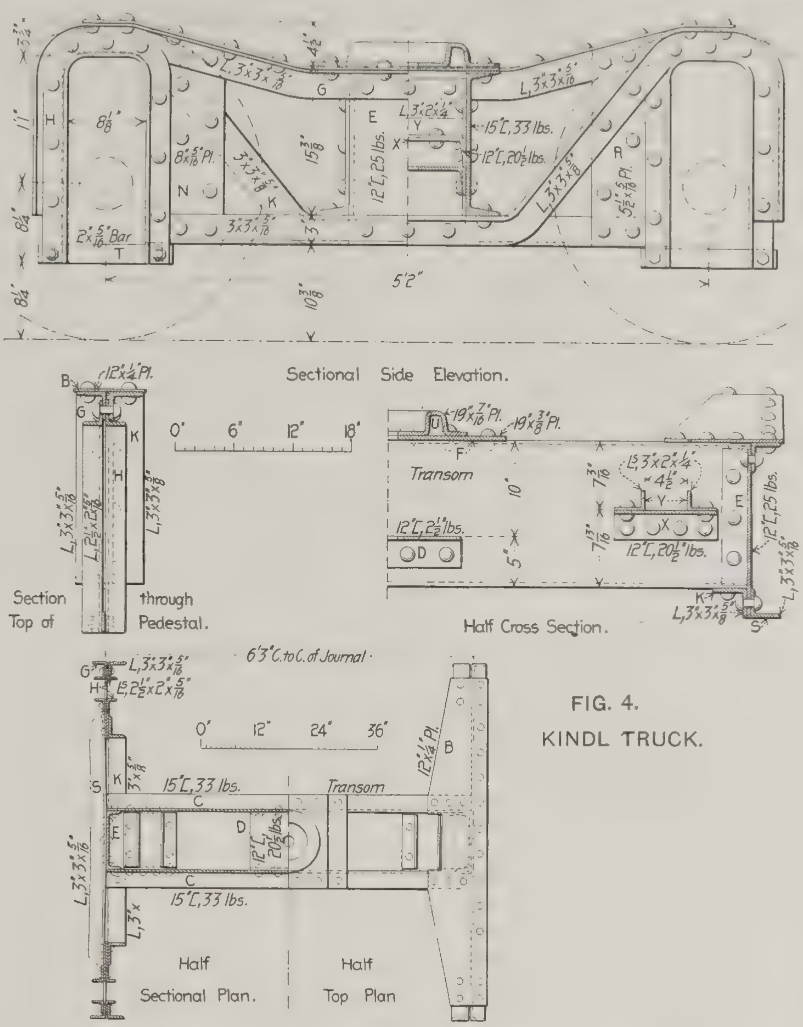
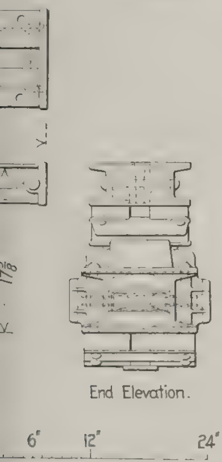


FIG. 4.
KINDL TRUCK.



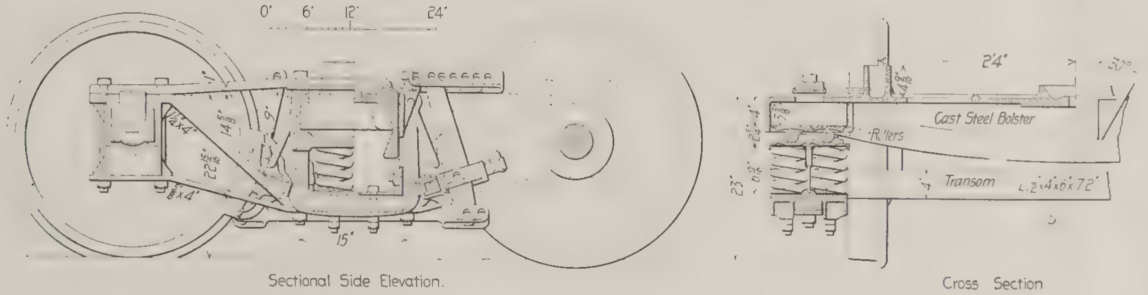
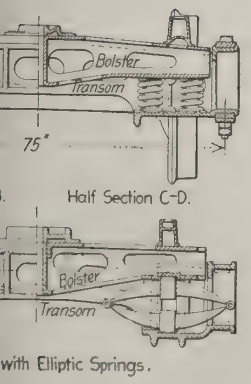


FIG. 5. SCHOEN TRUCK.



with Elliptic Springs.

PLAYER TRUCK.

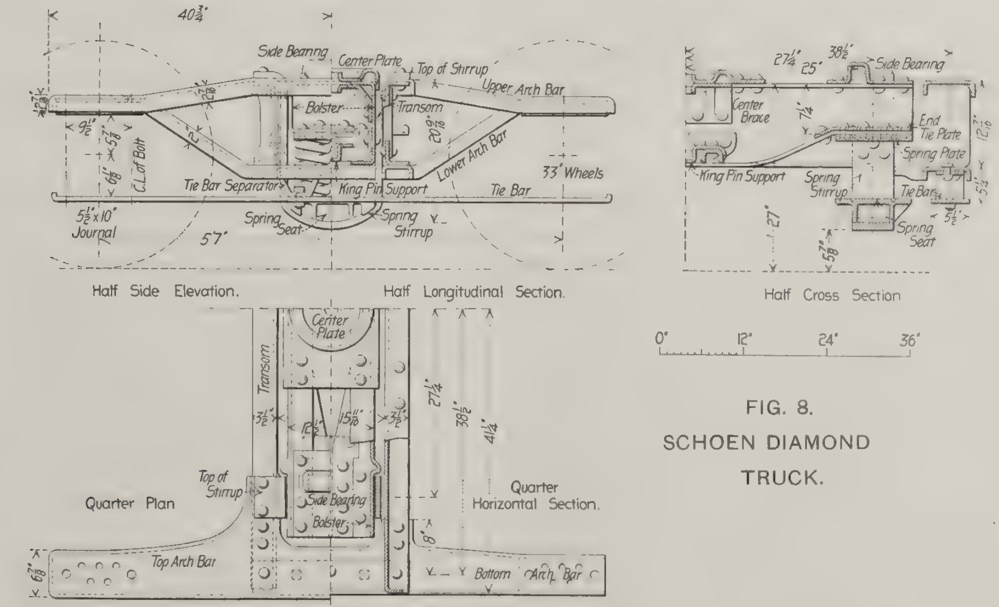


FIG. 8.
SCHOEN DIAMOND
TRUCK.

EIGHT CARS.

parts have to be renewed, if the trucks are carefully designed.

The metal truck dates back about 35 years, but its general introduction on a commercial scale only began about six or seven years ago. The Boston & Albany R. R. introduced a metal truck about 35 years ago, and this proved very satisfactory and economical, but after some years it was abandoned, for the reason that under the conditions of car interchange the road did not get the benefit of its own trucks. The cars would go to foreign roads and then be sent from one road to another, making most of their mileage on foreign roads, which reaped the advantages from the small cost for repairs of trucks. In the meantime, the Boston & Albany R. R. was operating on its line the cars of other lines, fitted with the common form of truck, and after paying the extra cost for a more economical truck it still had about the same expenses for truck repairs. While the abandonment of this metal truck was unfortunate from a technical point of view, and also probably from an economical point of view, as metal trucks soon afterwards began to come into general use on other roads, yet it was no doubt warranted by the apparent financial results. The cost of a pair of these trucks (inclusive of wheels), was about $300, or considerably more than that for ordinary trucks, but, as already noted, the economical advantages due to the good construction were not reaped by the owners.

In 1891, the Fox pressed steel truck, which was an English invention, began to be introduced in this country, and it speedily attained great success. For some years it had the field practically to itself, but competition soon began. As the metal truck grew in favor, the number of designs of metal trucks rapidly increased. At the Master Car Builders' convention of 1895, it was stated by Mr. Higgins, of the Lehigh Valley R. R., that there was then about 90,000 pressed steel trucks in use under freight and coal cars, usually of 60,000 lbs. capacity. Since that time, however, the introduction of steel trucks has been very rapid.

The principal advantages of the metal truck may be given as follows: (1) Decreased weight, with corresponding increase in proportion of paying load of the car; (2) Less cost for repairs and maintenance; (3) Kept in square permanently; (4) Easier riding; (5) Fewer parts. The first of these is not embodied in all trucks, and in others the difference is too small as to be of much practical value. In still others, however, the difference amounts to 1,800 lbs. per car, which is certainly a very important saving. The second advantage is probably the most important as far as direct and evident economy is concerned, and on this point there is very little dispute. As long ago as 1893, a Committee on Freight Car Trucks of the Master Car Builders' Association reported that of 39 replies to a question as to the cost of maintenance of wooden and metal trucks, 29 stated that the cost was less with metal trucks. The committee considered that with a good design of metal truck the cost of maintenance would be 18% less than that of the best design of wooden truck. It we compare these costs for the repairs of the frames alone, the metal truck will probably show even more favorably.

In this connection it may be stated that we learn from Mr. B. A. Hegeman, Jr., General Manager of the Lackawanna Live Stock Transportation Co., that one of the company's stock cars is mounted on two Baines trucks, built entirely of iron, which have been in service since May, 1893, or for about five years, and are now in perfect condition. The expense for repairs has been remarkably small, and during 1897 the only expense (exclusive of wheels) was $1.88 for one journal box. This company has the Baines truck under 251 cars, and they have been running since September, 1888, making an average mileage of 3,000 miles per month. Mr. Hegeman states that if it were not for the higher first cost he would have the new trucks built entirely of metal, but that wood is even now only used for the sand planks. As to the fifth point, the reduction in number of parts, this is very generally held to be of great importance, and in 1895, Mr. G. W. Rhodes, of the Chicago, Burlington & Quincy R. R., called the attention of the M. C. B. Association to the fact that some metal trucks were being designed without regard to the principal reasons which led to the introduction of the metal truck; namely, decrease in weight and decrease in number of parts. Of course this view is not universally held, and it is to be noted that at least one type of metal truck—that of the Schoen Pressed Steel Co.—is purposely built up of a large number of parts. For this system of construction the claim is made that it will facilitate repairs at railway shops, as damaged or bent parts can be cut off, straightened or repaired, and again riveted on (or replaced with new parts), instead of sending to the manufacturer for an entire new frame or to have the frame repaired.

When we consider the character of the equipment of modern railway shops, however, and the small percentage of trucks that are damaged, this particular advantage claimed for the use of a great number of parts appears to be open to very grave doubt. This view was expressed very emphatically at the December meeting of the New York Railroad Club by Mr. A. E. Mitchell, of the Erie R. R. Since the spring of 1891 this road has used the Fox trucks on all new freight cars, and by the end of 1897 it had them under 6,815 cars. Of these 13,630 trucks there were only 75 failures, for which the railway company was responsible; 32 were sent to the manufacturer to be repaired, the average cost of repairs being $28.21 per truck; 43 were repaired at the railway shops. The latter repairs were effected without any formers, presses or other special appliances, the work being done in the boiler shops, over the flange fires, or in the smiths' shops with regular forges, the cost averaging $5.32 per truck. As all the trucks were derailed, he thought the expenses would have been much greater if the trucks had been of the diamond pattern. Mr. Mitchell considered that if all the cars on the Erie R. R. had Fox trucks, he could dispense with 50% of the truck repair men, exclusive of those engaged in repairing wheel and axle defects. As to the increase of weight in metal trucks, this is in part due to the increase in car capacity and the necessity of strengthening the body and truck bolsters so as to sustain the heavy loads without deflection.

With regard to the materials of construction, metal trucks may be divided into five classes, as follows: (1) Pressed steel; (2) Combination of special bolsters and other parts with frames of the ordinary diamond pattern; (3) Commercial rolled sections; (4) Special rolled sections; (5) Cast steel. Examples of all these are described elsewhere. Pressed steel trucks are the most numerous, with the combination diamond trucks coming next. It is claimed that the use of pressed steel enables a truck to be built which is lighter than and fully as strong as one built of commercial rolled sections, as the parts can be formed to the best shape adapted to mechanical and economical advantages, while with structural shapes the design must be adapted to certain fixed forms, with an almost inevitable excess in metal and weight. For the latter, however, the claim is made that a railway company can build or repair its trucks from material purchased in the open market, while pressed steel parts must be ordered from the manufacturer of the truck. We know of but one truck—the Hewitt—in which a special rolled section is used for the frames, but while the truck itself appears to have certain advantages, yet the difficulty of procuring special sections just when wanted is of necessity an objection. This has already been experienced with the truck in question, the manufacture having been delayed by the failure of rolling mills to furnish the special section ordered until several weeks after the required time, in consequence of having larger and more important orders on hand. The use of cast steel throughout is also confined to one truck—the Ajax—although cast-steel bolsters and transoms are used in a number of trucks.

A very important feature in truck design is the arrangement of the springs. In the ordinary diamond-frame type of truck, and in some others, the springs are under the ends of the bolster, leaving the weight of the truck frames to be supported rigidly by the axle boxes. This arrangement is in use in the majority of cases. In most of the pressed steel trucks and in some other forms of all-metal trucks, the springs are placed upon the axle boxes, no bolster then being used, but the center plate resting directly upon the transom. This appears to be the better arrangement from a mechanical point of view, since the entire weight of the car and trucks (except that of the wheels, axles and boxes) is supported by the springs, thus ensuring an easier riding car. One objection to this latter arrangement, however, is the difficulty of getting springs of sufficient strength and elasticity in the small space usually available, the springs being as a rule placed in the center line of the frame, and the web of the frame being slotted to receive them. In a report on springs for freight car trucks, presented to the Central Railway Club at its January meeting, it was stated that in diamond-frame trucks the space available for the springs is about 7 ins. high and 11 ins. wide for 60,000-lb. cars, and 9 × 11 ins. for cars of 70,000 lbs. capacity and over, while in pedestal trucks the available space is practically 7 × 7 ins. for 60,000-lb. cars, and 8 × 8 ins. for 90,000 to 100,000-lb. cars. The committee, therefore, recommended nests of four single-coil springs for diamond trucks, and double-coil springs for pedestal trucks. In the Cloud truck, however, this objection does not exist, nests of springs being used over each axle box, the web of the frame not being cut away for the springs, but passing between the inner and outer pairs of springs. With this arrangement any capacity of spring can be used, although the long and satisfactory experience with the Fox truck appears to show that the arrangement of a double-coil spring over each box is sufficient if properly designed. This arrangement was used in the old metal trucks of the Boston & Albany R. R., which have already been referred to, and in similar trucks used at the same time on the Boston & Maine R. R., and New York, New Haven & Hartford R. R.

One other point to which we may refer, is the proposition to divide the load on the truck between the center bearings and side bearings, instead of concentrating it all upon the center bearing. This latter plan, which is now universal, necessitates very heavy body and truck bolsters, especially under the modern cars of high capacity. Even with such heavy construction, however, and with metal bolsters (unless these are made very heavy) it is found difficult to keep the car bodies from coming down in contact with the side bearings. When thus in contact, the trucks cannot swivel freely, and after being slewed on a curve the trucks will often fail to return to proper line, thus causing excessive rail wear and a large proportion of sharp-flanged wheels. A recent suggestion is to adopt for the side bearings a roller or ball bearing which will not be liable to get out of order, and then to let the car body rest on the three bearings. This would seem to be a rational arrangement, but the practical objections are many, among them being the difficulty of keeping roller bearings in such condition as to be absolutely free acting, and the liability to overload these bearings where heavy freight is placed at one side of car. This question was discussed in our issue of May 26, and it seems likely to be brought to the practical consideration of car builders before long, in view of the increase in car capacity, and the consequent increase in the weight and size of bolsters, together with the desirability of reducing rather than increasing the weight of the trucks.

LETTERS TO THE EDITOR.

"Practical Man" vs. Engineer.

Sir: For the benefit of your readers, and to show what an estimate is sometimes placed on an engineering education and years of experience in the profession, I will narrate a little episode that came under my personal notice recently.

An engineer was engaged some time ago to prepare plans and specifications for an electric lighting and waterworks plant for a small town in the central part of Ohio. He did the work and bids were advertised for in your valuable journal; but a week prior to the letting he resigned for some reason unknown to the writer, and consequently the council felt that it was necessary to appoint a substitute immediately, so that they might have the advantage of his advice and experience before the contracts were awarded. Consequently the Clerk of the Council was instructed to take a copy of your paper and write to a few of the engineers who had cards in your columns.

He picked out five, and several other names were obtained from various sources. These gentlemen were invited to give bids stating what they would charge to superintend the work during construction and make some alterations in the plans and specifications.

Five engineers put in bids and three of them made two trips to the town in question to make themselves known to the members of the Council and forward their several interests as much as possible. The bids for engineering services were opened and read, and amongst them was one from a plumber who had been brought in from a neighboring town.

After the bids were read, the gentlemen present were asked to come up one by one and state their experience in the branches of the profession under discussion. Those present complied, the plumber having the last call. He stated that he had had 15 years' experience as a practical plumber, and would spend his whole time on the ground and give his whole attention to the work in hand for the sum of $150 per month. With regard to the engineering part of the work, he thought that the only thing necessary in that line was to have a surveyor set a few stakes at various times, which he thought could be done for $25 at the outside. The Council then went into executive session, and soon afterwards called the plumber in and told him that he had been appointed. For a couple of hours afterwards he sat with the Council, presumably to give his advice as to which contractors should have the various parts of the work. Fancy a plumber discoursing on the merits of the different makes of dynamos, arc lamps, pumps, boilers, engines and the various other details of the system!

Let us be thankful, however, that there are a few people in the country who can appreciate the value of an engineer's experience and who are willing to give a fair compensation for his services.

Yours very respectfully,
An Engineer.

(An excellent illustration of the deficiency of the so-called "practical man" as a professional adviser was recently brought to our attention, and may be appropriately told in connection with the above letter. A large printing establishment, designed to be a model in every way, was built a few years ago directly on the banks of a large river. The power-plant for this establishment was of considerable size, and the exhaust steam from the engines proved a great nuisance. The proprietor of the plant appealed to his "chief engineer," the man in direct charge of the engines and machinery of the establishment, as to what could be done to get rid of it. The man was a good example of the so-called "practical" man. He had had many years' experience in the care of engines and boilers; but the best thing he could suggest was the purchase of a long line of pipe, which was laid along the river banks, so that the steam was discharged into the atmosphere at some distance from the works, drifting back toward them, however, when the wind was in a certain direction. It chanced that an educated mechanical engineer came that way, and to him the "practical man" told the story of the difficulty. "But why didn't you put in a condensing engine?" said the engineer. And then it transpired that the "practical man," who had spent the better part of his life as a stationary engineer, had never heard of a condensing engine, and of the fuel economy resulting from its use wherever a supply of condensing water can be had. Doubtless this is an extreme case of the ignorance of the so-called "practical man" of everything outside the very limited sphere in which he has always moved, but it is instructive as showing what losses an enterprise may suffer through a failure to appreciate the value of the services which a competent consulting engineer might render them.—Ed.)

* * *

COMPARATIVE MERITS OF SINGLE-TRUCK AND DOUBLE-TRUCK CARS FOR CITY RAILWAYS.*

By Richard McCullough, St. Louis, Mo.

Double trucks for electric cars are of comparatively recent adoption. All of the early electric cars were equipped with single trucks, and in this, horse car and cable car practice was followed.

Double trucks were first applied to cars in the desire to use longer bodies than has been customary. In the use of a single truck the best practice has been to limit the wheel base to about 7 ft., as a greater distance than this would cause the wheels to bind in curves. Assuming that the body of the car is 20 ft. long and that the platform projects 4 ft. beyond the body, the end of the platform would overhang the axle 10½ ft. This is as great an overhang as is customary, although single truck cars have been built with bodies longer than 20 ft. In this case it is necessary to provide extension springs on the trucks to check the oscillation of the car body. With a very long car body, however, the oscillation is not entirely overcome by this device, and the rocking becomes very disagreeable to passengers and very disastrous to the car and track. 22 ft. may be arbitrarily established as the limiting length of the body of a single truck car, and if we wish to use car bodies longer than this, we must adopt some truck which will avoid oscillation and which will pass around curves without undue use of power. The double truck accomplishes this, and it was to enable longer bodies to be used that it first came into use.

The truck which was first used for long street railway cars was an adaptation of that used by the steam railways. This truck contains four wheels of equal size and is pivoted over the center. It was soon discovered that for street railway use this form of truck has two very objectionable features, first, that the floor of the car must be high enough above the rail to allow the wheels to swing freely under the car, and, secondly, the motor being geared to one axle of the truck, only half of the weight of the car was available for traction. The latter is a serious objection on roads having steep grades.

From what has been said it will appear that the single truck is the truck for short cars, and the double truck is the truck for long cars. Therefore, a discussion of the relative merits of these two types of trucks will involve a discussion as to the relative merits of short and long cars. Also, as it is customary to supply long cars with cross seats and short cars with longitudinal seats, we have, instead of the comparatively simple subject of Single Trucks versus Double Trucks, which has been assigned to your committee, the more complicated struggle between the short car with single trucks and longitudinal seats and the long car with double trucks and cross seats.

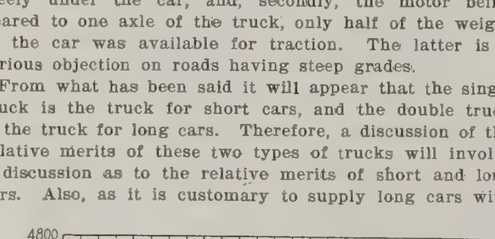


Fig. 1.—Typical Load Curve of Power Station of a City Street Railway.

It will be assumed in the discussion which follows that the road possesses the characteristic city travel, a load curve of which is shown in Fig. 1. It will be noted that two very pronounced peaks occur in this load curve, one in the morning from 6 to 9 o'clock, and the other in the evening from 5 to 7. It is at these times that the capacity of everything is tried. While the load curves of all city roads resemble each other, it is evident that local conditions will to a large extent determine the kind of car which the railroad company will operate. Some of these local conditions are, the class of people who constitute the passengers, the location of the road with reference to the established lines of travel, the amount of pleasure travel received by the road, and the keenness of competition with other roads.

The expense of the average city road may be divided up as follows:

Maintenance of way and structures	4%
Maintenance of equipment	7%
Conducting transportation	52%
General expense	8%
Fixed charges	29%

It will be noticed that the item "conducting transportation" is more than one-half of the total. This is largely made up of the wages of conductors and motormen, and is proportional to the number of cars operated. Hence, it follows that if we may by the operation of larger cars cut down the number of cars, this account may be reduced in nearly the same ratio as the size of the car is increased. There are many other reasons why the size of cars has been increased, such as the increased volume of traffic due to the higher speed and enlarged territory of the street railroads, the greater comfort demanded by the traveling public, the increased power available for the operation of cars, etc., but it is probable that the present tendency toward the increased size of car bodies is with a view of operating larger units and fewer of them.

A line operating small cars seating 28 persons, on a headway of 3½ minutes, would give the same service from a standpoint of seating capacity if it operated large cars seating 40 persons on a headway of 5 minutes. Manifestly this latter service would be preferable from the railroad standpoint for the reason just given, and the question is, would the service be equally acceptable to the passenger. In this comparison we are assuming that the larger car is the more desirable vehicle in which to ride. Would the pleasure of the ride compensate the passenger for the greater length of time which he would have to wait? This is a question which must be solved by each manager for his particular road, as its correct solution depends largely upon local conditions over which he has no control. The scrutiny with which a passenger chooses a street car varies with the length of his proposed ride. If the ride is to be short, he takes the nearest car without reference to comfort; but if he is to ride a long distance he will walk past several lines in order to choose that one on which he will have the most pleasant ride. The car question then becomes a more serious one with long roads and with roads catering to a pleasure traffic. It has usually been accepted that on those roads having a purely business traffic, the proper car is the short one operated on short headway. The author, however, is of the opinion that even in this case, the long car operated upon somewhat longer intervals would be desirable. It has often been observed that where a line operates two sets of cars a passenger will allow several cars to pass him in order to patronize that type of car which suits him best. This has been observed even in the busy hours of night and morning, when it would be fair to assume that passengers would be hurried and likely to take the first car which passes.

One of the most serious questions occurring in street railway practice is the problem of how best to take care of the rush of travel which comes morning and evening. With our present methods, there are only two ways of taking care of this travel; the first, by increasing the number of cars or units in service, and the second, by increasing the capacity of each unit. The latter method consists in attaching a trailer to the motor car, and where this is done it is usual also to increase the number of units in service. On first thought there would seem to be no better method of increasing the capacity of a road than by the use of trail cars. They are easily attached and detached, they are in service only when necessary, and they do not require the assistance of additional trainmen. An examination of the trailer system, however, will reveal the fact that it possesses serious defects. The trailer requires the services of men and horses to attach it to the cars and to move it between the car sheds and the motor cars. The opening between the motor and the trail car increases the danger of accident both to passengers and conductors. The number of entrances and exists is increased, and this augments the work of the conductor in keeping track of his fares and increases the danger of his missing some of them. If an extra conductor is placed on the trailer to collect fares, a great portion of the gain due to the trailer system is lost. The use of trailers throws an additional strain on the motors, as a heavy weight is added to the train which is not available for traction. The trouble is intensified as the load on the trailer increases; it makes the train more unwieldy in handling, and is largely responsible for the difficulty in starting and stopping quickly and in making schedule time.

To obviate the necessity of using trailers, a large car equal in seating capacity to the combined capacity of the motor and trail car may be operated. This system, however, introduces the disadvantage of the operation at all times of the day of a seating capacity needed only during a few hours of the day. It also increases the size and weight of the cars and the average power required to operate them.

In order to compare the relative economies of single and double truck cars, their advantages and disadvantages will be discussed with reference to the following points:

(1) Wear and tear on trucks.
(2) Wear and tear on motors.
(3) Power required.
(4) Wear and tear on track.
(5) The use of trailers.
(6) The seating arrangements and convenience of exit and entrance.
(7) The preferences of passengers.

These relations will, as far as possible, be reduced to a money basis, and in order to do so a comparison will be instituted between a road which operates double truck cars and one operating single truck cars, using trailers 26% of the time to take care of the heavy night and morning travel.

The bodies of the double truck cars are 26 ft. in length, and contain 18 cross seats, seating 36 passengers. The trucks are of the maximum traction type; the empty car weighs 23,500 lbs., and the motors are G. E. 800.

TABLE I.—Comparison of the Cost of Wheels and Brake-shoes on Double and Single Truck Cars for the Year 1897.

		—Truck cars—	
		Double (47).	Single (70).
Av. No. wheels used per car per year.	33-in.	8.72	6.26
	30-in. trailer	....	1.00
	24-in.	7.06	....
Cost per car per year.	Wheels	$77.92	$40.93
	Labor in replacing.	17.36	7.99
	Brake-shoes.	11.70	4.30
	Total	$106.98	$53.22
Total cost per car, year, 1,000 psgrs		$0.47	$0.38
Wheel mileage.	33-in.	17,260	25,329
	24-in.	20,916	......

The double truck car has four 33-in. wheels, four 24-in. wheels, and eight brake-shoes. The single truck car has four 33-in. wheels and four brake-shoes. Average daily car mileage, 115.

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*A paper read at the Annual Convention of the American Street Railway Association.

TABLE II.—Comparison of the Cost of Repairs and Maintenance of Trucks and Motors on Double and Single Truck Cars for the Years 1896 and 1897.

		Truck cars	
		Double (47).	Single (70).
Average passengers per car per year		226,000	141,000
Truck repairs.	Per car per year........	$181.00	$110.00
	Per 1,000 passengers.	.80	.78
Motor repairs.	Per car per year........	319.00	196.00
	Per 1,000 passengers.	1.41	1.39
Total....	Per car per year........	$500.00	$306.00
	Per 1,000 passengers.	2.21	2.17

G. E.—800 motors on double truck cars. W. P.—50 motors on single truck cars.

The single truck car has a body 20 ft. in length; it is equipped with longitudinal seats, and the entire car weighs 16,000 lbs. It will seat 28 passengers. During the period of heavy travel, which amounts to 26% of the time, trailers are attached to these motor cars. The average seating capacity of the unit, estimating the trailer as a part of the car during the time that it operated, is 35 seats, which approximates the seating capacity of the double truck car very closely. The motors in use on the single truck cars are W. P. 50.

The number of cars operated is obtained by dividing the daily car mileage by 115. It is necessary to do this because the average mileage per car on the two roads is different. The comparison is thus between 70 single truck cars and 47 double truck cars, each car making 115 miles per day. The road operating the double truck cars has the greater density of traffic.

Wear and Tear on Trucks.—It is evident that since a car equipped with double trucks has eight wheels and one equipped with single trucks has four, the former will be the more expensive to supply with wheels. Table I. shows the comparative replacement and cost of wheels and brake shoes on the two roads for one year. Table II. shows the comparative cost of maintenance and repairs of trucks and motors for two years. It will be noted that while the cost per car is much greater on the road using double trucks, the cost per passenger is the same. It would not be fair to assume from these figures that the cost of maintenance of trucks and motors per passenger is almost the same, no matter what sort of truck is used, because these figures would result largely from the fact that in this particular case the double truck car carries the greater number of passengers, but an inspection of the table will emphasize the advantage of the large unit as compared with the small one. It will be seen by a reference to Table I. that the greater part of the increased expense of maintaining the double trucks is due to the renewals of wheels and brake shoes.

TABLE III.—Comparison of the Power Required by Double Truck and Single Truck Cars.

	Average watts.	Average watt-hours per car mile.	Average speed, miles per hour.	Average watts per seat capacity.	Average watts per ton (car empty).	Avg. watt-hours per car mile, 1,000 passengers.
Double truck car. Seats, 36; weight, 11.75 tons...... Average for the entire day........	12,040	1,334	9.03	335	1,025	5.9
Double truck car. Seats, 36; weight, 11.75 tons...... Average for the heaviest trip......	13,080	1,412	9.25	335	1,025	...
Single truck car, no trailer: Seats 28; weight, 8 tons.	8,471	921	9.20	303	1,060	...
Trailers operated 26% of the time .... Average for the entire day	9,400	1,110	8.42	254	1,088	7.9
Single truck motor and open trailer: Seats, 63; weight, 10.5 tons; average for the heaviest trip.	12,680	1,440	8.84	201	1,208	...

In examining the relative strength of the various parts of trucks, the side pieces may be compared to a beam supported at two points and carrying a concentrated load. The deflection of such a beam is proportional to the third power of the span; and in the analogy, the span corresponds to the wheel base of the truck. Therefore, the shorter the wheel base the stiffer the truck side, and in view of its long wheel bases, it is evident that the single truck is at a disadvantage in this respect. For instance, a truck side where the wheel base is 4 ft. 6 ins. is 3.76 times stiffer than a truck side of equal section where the wheel base is 7 ft.

Wear and Tear on Motors.—Table II., to which reference has already been made, gives the comparative expense of inspecting, repairing and maintaining the motors of double and single truck cars. As in the case of the trucks, it will be noted that while the expense per car is much greater in the case of the double truck car, the expense per passenger is nearly the same.

TABLE IV.—Comparison of Weights Carried by Single and Double Truck Cars.

	Single truck			
		Motor car with		
	Motor car.	Open trailer.	Closed trailer.	Double truck car.
No. of seats	28	63	48	36
Total, crowded capacity..	80	140	125	110
Weight, empty, lbs.......	16,000	21,000	21,000	23,500
Per cent. weight on driv'g wheels: Car empty.	100	76	76	70
Seats full	100	67	72	70
Car crowded	100	67	71	70
Weight per seat, lbs.:				
Car empty	572	334	438	653
Seats full	702	463	568	782
Car crowded	943	622	776	1,050
Weight per unit total capacity: Car empty..	200	150	168	214
Seats full	246	210	218	258
Car crowded	330	280	298	344

Note.—Each passenger is estimated at 130 lbs.

Table IV. gives the relative weights carried by the different cars, when empty, seats full and car crowded. It will be noted that while the percentage of weight available for traction in the case of the maximum traction truck remains constant, in the case of the motor and trailer it falls off as the number of passengers increase, and is especially small if the trailer is proportionately more heavily loaded than the motor car.

Power Required.—Table III. gives the power required to operate the different cars, and is the average of a long series of watt-meter tests. In making these tests, the watt-meter was placed on a car in actual service and allowed to remain through the entire day. An examination of the tables will reveal the fact that the power required for the propulsion of the car and the care and repairs which the motors demand are much greater in the case of the double truck car. But if the number of passengers be taken into account, it is seen that the power and the cost of maintenance are roughly proportional to the number of passengers carried with either style of truck.

Wear and Tear on Track.—The wear of the rails of a street railway track is due to the grinding action of the wheel on the rail, and this is proportional to the weight on the wheel, but is intensified by the dirt on the rail, which causes the wheel to slip and acts as an abrasive agent after the slipping has begun. The weak point of a street railway track, however, consists of the joints and the openings in the special work. The energy of the blow which the wheel strikes as it passes a low joint or a crossing is equal to the product of the weight of the wheel and the height of the drop. Therefore, on any given track both the wearing action of the wheel and the destructive action of the wheel are proportional to the weight which rests upon it. If the number of wheels under a car be increased, the number of blows which a low joint receives is also increased, but the intensity of each blow is diminished. Double trucks are at no disadvantage as compared with single trucks in this respect, unless the weight of the car be increased. By reason of the shorter wheel base, double trucks go around sharper curves and go around the same curve with less output of power and less wear on the rail than single trucks. The double truck fell into disrepute when the maximum traction truck was first exploited, on account of its liability to leave the track. This was due to the small amount of weight which was placed on the small wheels. It is now customary to place 30% of the weight on the small wheels, and with track in fairly good condition, no difficulty is encountered in keeping cars on the track.

The Use of Trailers.—In the case of the two roads under discussion, the road operating single truck cars attached trail cars to the motor car for two trips in the morning and two trips in the afternoon. For the entire year trailers were operated on 26% of the trips. Allusion has already been made to the use of trailers. The advantage of the trailer on this particular road arises from the fact that the load peaks are unusually sharp. The use of the trailer increases the capacity of each unit during the heavy hours of morning and evening travel and during rush travel due to baseball games and races. On this particular road the motormen and conductors are paid 10 cts. per trip extra for all trips where a trailer is attached to the motor car. This expense largely offsets the value of this arrangement. There is no question but that the use of the trail car increases the number of accidents, for two reasons; first, because the trailer is another car, and, second, because the opening between the motor and trail car is a dangerous one for a passenger boarding or alighting from the car. It is impossible to estimate the money value of this accident liability, because in the case of many accidents it is difficult to determine what proportion of the damage was due to the trailer. Trailers must be switched at the ends of the roads and at the car sheds, and require men and horses for this purpose. The use of trailers also entails other expenses, such as car heating, cleaning, repairing and car license, which should be charged against the trail car system. To counterbalance all these disadvantages, the only advantage which the trail car system possesses is its flexibility.

The Seating Arrangements, Exits and Entrances.—As has already been stated, the cross seat is used almost so universally in connection with the double truck car that it is fair to consider the economy and efficiency of cross seats and longitudinal seats in connection with the discussion. There is no doubt that the cross seat is preferable from the passenger's standpoint.

If two car bodies of the same size are taken and cross seats installed in one and longitudinal seats in the other, the car body equipped with the cross seats will have the narrower aisle. This induces two disadvantages in the cross seat car, one, that the crowded capacity of the car is less, and the other, that when the car is crowded the time consumed in loading and unloading is increased. The latter difficulty will be the more serious the shorter the haul and the greater the number of stops.

In the early days of the double truck car it was customary to mount the body high enough so that the wheels would swing under it. This gave the car a very unsightly appearance and made it difficult of access. Three steps were necessary to reach the platform, and as these steps were steep, this form of car was particularly objectionable to ladies. By the use of the maximum traction truck, with 33-in. wheels, however, it is possible to lower the floor to within 37 ins. of the rail. By dropping the platform 8 ins. below the floor of the car, it is possible to reach the platform by the use of a single step 14 ins. above the rail. This renders the car as easy of access as the single truck car. In the opinion of the writer, the fact that the car floor may be made so low in double truck cars is the chief advantage of the maximum traction truck.

It has been attempted to facilitate the loading and unloading of large cars by providing exits and entrances other than the rear door. This practice, however, brings about what is perhaps a more serious disadvantage, as it gives the conductor more than one door to watch, renders it difficult for him to keep track of his fares, and increases the liability of his starting the car before a passenger is on or off.

The Preference of Passengers.—The preference of passengers, to which allusion has already been made, is undoubtedly in favor of the double truck car. In cities where the entire street railroad system is controlled by one company this point may not be considered of value, because passengers are obliged to ride in whatever conveyance the company chooses to furnish. However, the experience of roads which have changed their rolling stock from small, single truck cars to large, comfortable, double truck cars is that the travel has shown an immediate increase.

Outside of the question of economy of operation, there are few roads on which the use of attractive, easy-riding, double truck cars would not create a pleasure travel, especially in the summer season. In a general way, it may be stated that the single truck car is more suitable for short hauls, dense traffic, many stops and low speed. On the other hand, the double truck car is more suitable for long hauls, high speed, few stops and pleasure travel. In the existence of either extreme condition, it would not be difficult to decide which car to use. It is in dealing with intermediate conditions that the manager must use his judgment.

COMMITTEE REPORTS AT THE ANNUAL MEETING OF THE ROADMASTERS' ASSOCIATION OF AMERICA.

The following are some of the committee reports presented at the annual meeting of the Roadmasters' Association of America, held at Denver this week. The remainder will be published in our next issue.

Best Method of Preventing Creeping Rails.

It has long been known that rails do creep, but this shifting of position is not uniform, nor is it alike for both rails. In its most aggravated form, it is confined to localities and is due to local conditions.

Rails creep in the direction of the traffic on double track lines. This creep is found to be greater on down than on up-grades, and is found in its worst form where tracks have been laid over marshes or soft, yielding sub-oil; on single track it is most noticeable on down-grades and where there is a descending grade from both directions, the rails creep down and come together in the valley, causing the rails at the foot of the grade to buckle in hot weather as a result of the space between the rails which had been allowed for expansion, being all taken up. It has also been ascertained that on curves, the outer or high rails creep the more, and where there are successive reverse curves and especially on grades, the creep starts on tangent at approach, continues on high rail to the end of first curve, then the opposite high rail on reverse curve shows the more creep. In other words, the high rail on each successive curve is found to creep more than the low rail.

The cause of creeping track is because of a rolling load passing over it which depresses the track directly under it and produces a corresponding elevation and depression ahead and behind it, which may be likened to a wave motion. To illustrate this more clearly, reference is made to a series of experiments mapped out by Mr. F. A. Delano, Superintendent of Freight Terminals of the Chicago, Burlington & Quincy Railway, and under the supervision of Mr. Jas. E. Howard, of the Watertown Arsenal, a description of which appeared in the "Railway Review" of March 24, and 31, 1894, which is in part as follows:

Facilities were supplied by the C., B. & Q. R. R. for carrying on such tests. The time selected was during the month of October when the roadbed was as firm and solid as at any time during the year. The place was Hawthorne Yard, near Chicago, and a portion of the tests were made on the main line and others on sidings. The experiments consisted of measuring under locomotives of different weights, the depression of the rail. Two weights of rails were experimented upon, one weighing 66 and the other 75 lbs. per yd., the rails rested upon oak ties in all experiments; but some were supported by gravel and others by cinder ballast. The track selected was in good condition, the spikes being redriven before the work was begun. The ballast rested on hard, unyielding clay.

For the purpose of observing the depression of the rails, in one class of experiments, bench marks were established on a row of stakes driven alongside of the rail 31 ins. distant from it. A beam carrying a micrometer and an astronomical level bubble was used in observing the depression of the rail, first measuring the height, using a point on the outer flange, when the rail was unloaded, and repeating the observation when the locomotive was in different positions with references to this point, making the observations when the observed point was directly under each wheel, and when midway between them.

After a number of experiments had been conducted in this manner, it was discovered that the roadbed in the vicinity of the locomotive was sensibly depressed, and that the bench marks were influenced by the depressions. Careful measurements were made of this depression and it was found that at a point opposite the main driver of Class "H" locomotive, three-driver, connected with bogie truck, weighing 125,000 lbs., the depressions were as follows: At a point 31 ins. from the rail, 0.047-in.; at a point 61 ins. from the rail, 0.013-in; at a point 91 ins. from the rail, 0.001-in. This discovery revealed the necessity of establishing new bench marks, and in so doing a cantilever was used, having its support 10 ft. from the rail. On a track laid with 66-lb. rails and supported by oak ties, 17 to a 30-ft. rail, and in gravel ballast, the greatest depression under an engine weighing 110,000 lbs., was 0.161-in.; this was under the middle driver.

The same weight engine on the same kind of rail and ties, but supported by cinder ballast, the depression under middle driver was 0.230-in. From this it will readily be seen that there is a marked depression of the track under an engine, and when we consider that the same depression of the track takes place when the engine is moving as well as when at rest, it can readily be conceived what a destructive effect it has. With the track depressed under the weight of an engine, a corresponding rise just ahead of it to be afterwards depressed as the engine approaches and passes over it, produces a violent wave motion under high speed which is the cause of creeping rails. The outer rails on curves creep more than the inner rails, because of the lateral lever motion imparted to them by reason of the wheels hugging the outer rail more closely as a result of their cone shaped design which enables them to travel the greater while their mates travel the lesser distance in rounding a curve and because of the inclination of moving bodies to go in a straight line, which is overcome by introducing another force when the outer rail on curved track is elevated. The rails on outer edge of embankment on double track creep most because of less support than the rails near the center of roadbed. As the rails shove ahead they drag the ties with them, the only resistance being the amount and kind of ballast between them. If the track is well filled in the center but bare at the ends of the ties, another lever movement is introduced. The ballast in the center acts as a fulcrum, the tie becomes the lever and instead of moving ahead with the rail and retaining its corresponding position at right angles with it, the one end is forced ahead of the other, especially is this the case with joint ties, and more particularly where rail is laid with broken joint, with the added result of tightening the gage. Aside from this the ties are moved off their well tamped foundation on to the softer untamped bed between the ties, and if not closely watched and early corrected, the whole track will creep the more because of the looseness of the several parts, and then a general disintegration takes place, which will require several hard season's work to restore, the only means being either to draw the rail back and straighten up the ties, or else replace all of the ties to suit the new location of the rail. To do this requires as much if not more work than to make the tie renewals and surface the track.

It is doubtful if a remedy for creeping rails exists or can be found and we are none to sure that if stopped it would be only to reappear in another form. While it cannot be eliminated entirely, it is quite possible to restrict it so that in its effect it is not so destructive. The most common method is to rely upon anchorage at the joint by spiking the tie through slots in the angle bars. The value of this style of anchorage depends upon the number of ties over which the angle bar extends, which may be one, two, or three, and resistance is directly in proportion to the number of ties. In practice it is found that the three-tie joint affords the best anchorage, but it does not entirely prevent the rails from creeping. It is also found that by placing a dummy joint in the center of the rail opposite the joint, which may be made from old angle bars bolted to the rail and spiked to the slot, that additional anchorage is afforded. On some roads, specially designed dummy joints are made in clip form; these clips fit in the web of rail the same as an angle bar, but in addition extend under the base of rail like a lip chair, slotted on the inside and punched on the outside of rail for spikes, taking the place of a tie-plate as well as affording anchorage. Either of these forms give fair results.

Another method is to bolt a flat bar of iron inside the nut at joints, the bar to be twisted half around so that the tal end will be parallel with the rail and rest flatwise on the ties to which it is spiked through holes made in it for that purpose.

Still another method is to make a clip in two parts to fit snugly under the base of rail—a clip on each side, both to be united with a bolt underneath, these clips to come in contact with the edge of the tie, depending on the tie for resistance as in the other devices.

As creeping rails are the result of both vertical and lateral wave motion, the best remedy which suggests itself is to restrict that wave motion to a minimum, which can only be done by having a rail stiff in section to transmit the weight of the load over the greatest possible area of ties and ballast, to be well tied, with spikes kept snug to base of rail, and ballast dressed off as full as can be at the end of ties, and at the same time allow for drainage.

H. W. Church, Samuel Greer, John Redington, Committee.

Advisability of Increasing the Length of Rails and the Advantages to be Derived from the Use of Rails with Miter Cut Ends.

Majority Report.—Rails of 45 and 60 ft. in length have been in use on a few railways in this country, mostly in an experimental way, for the last six to eight years. The only advantage which seems to have been developed during this time by their use is in the reduction of the number of joints.

Some of their objectionable features are as follows:

1. Rail mills do not as yet appear to be able to turn out as straight a rail of 45 or 60 ft. in length as those of 30 ft.
2. Their contraction makes them more liable to flatten on the ends than rails of shorter lengths, and their greater tendency to creep makes it necessary to put on stops, which increase the expense and does not entirely prevent the creeping.
3. They are not as readily or as economically transported or handled when new, or when taken out for relaying, or for shipment when worn out, as those of 30 ft.

Miter cut rails have been to some extent tried from remote periods, and somewhat extensively so on some few lines within the last ten years or so, and the experience with them after this length of time has not been satisfactory, and they have been temporarily, if not permanently abandoned. The principal reasons for this are that they break at the ends where the head and web join, caused generally by the extension of one side of the head beyond the other, and the angle at which they have to be cut thus far shows that there is very little or no difference in the blow received from passing wheels, from those having square ends, and further, the flow of metal at the ends appears to be greater with the miter than square cut rails.

After giving these questions due consideration and from all the information obtainable, and from the experience we have, we do not at this time deem it advisable to recommend that there is enough advantage in increasing the length of rails beyond 30 ft., or to use rails with miter cut ends, to recommend their use.

R. Caffrey, Chairman.

Minority Report.—The use of rails of more than 30 ft. in length can be said to have passed the experimental stage, and the utility and economy in the use of rails 60 ft. long have been recognized by several important lines of steam as well as electric railways. The transporting of rails up to 60 ft. in length is no longer a difficult or unusual problem. From those who have used 60-ft. rails for a sufficient length of time to enable them to give reliable figures, your committee has endeavored to learn the cost per ton of handling and laying in track as compared with the cost per ton of 30-ft. rails, also to ascertain the peculiarities, defects and advantages in their use.

Through the kindness of an official connected with one of the largest Eastern lines, and one that maintains a high standard of track, we are enabled to give the result of their experience with long rails, some sixty miles of which has been laid up to the present time. This road commenced laying 60-ft. rails, experimentally, in 1894, and the result thus far has been so satisfactory that large orders have been placed for rails of the same length for further renewals. The advantages gained are, economy in handling, reduced cost of maintenance and better riding track. On level or moderate grades, stop blocks are not found necessary and are not used. On heavy grades and on unstable marsh grounds one to two stop blocks or anti-creeping devices are used on each rail. Cost of this appliance is 13 cts., and cost of putting it on is about 10 cts. each. The unloading of the rails on this line is done in a very simple manner and with a less number of men than is necessary to handle 30-ft. rails from cars in the usual way. A rope about 30 ft. in length is supplied with a hook at one end to anchor to the track, and at the other to hook through the bolt hole at end of a rail on the car. The hooks being in place the work train is started and the rail drawn nearly off. Eight men with rail tongs then lower the end of the rail as the car is pulled from under it and two men with bars throw the rail out of the track. In laying the rails in track, double the number of tongsmen and half the number of bolters are required that would be needed in laying 30-ft. rails. The creeping of long rails has not been found the serious matter that had been anticipated. The average saving on the road in question is fully 15% in handling and laying 60-ft. rails over the same number of tons of 30-ft. rails.

Through the courtesy of Mr. M. J. Caples, Assistant Engineer of the Norfolk & Western Railroad, we have information as follows as to results obtained from the use of 60-ft. rails on that line: They have 18 miles laid in winter of 1892-3, and 29 miles laid in 1894-5. The rail is 85 lbs. per yd., 5 ins. high and laid on grades ranging from 9% to 2.4% (47 ft. to 126 ft. per mile) and on curves as high as 16°, with about 40% of all the curvature over 8°, single track. Traffic over this piece of track averages four passenger trains and forty freight trains per day. Passenger engines, 10-wheel, with 98,000 lbs. on three pairs of drivers, and consolidation freight engines with 106,800 lbs. on the drivers. Ballast nearly all furnace slag. Joint fastening, "Churchill" patent 23-in. angle bar extending 3¼ ins. below base of rail between the joint ties, and a 7-16-in. plate of the same length as the angle bar. No stop-block or anti-creeping device is used.

After 5½ years' service under these conditions, Mr. Caples says of the 18 miles laid in 1892-3: "We have had no trouble whatever by reason of expansion from any of the 60-ft. rails. The ends have not been battered sufficiently to enable us to determine that it is greater than 30-ft. rails laid at the same time where the normal expansion distance has been preserved. There has been no greater tendency on the part of 60-ft. rails to creep than with 30-ft. rails." He adds that in his opinion a stop-block would be beneficial, and that battering of the ends consequent on creeping and expansion will make necessary the changing out during the present season of 130 rails (4%) of the 18 miles laid in 1892.3. The cost of unloading and laying in track has been 20% less than unloading and laying an equal number of tons of 30-ft. rails under the same conditions.

One complaint which is general, but not universal, is that rail mills send out 60-ft. rails without their having been properly straightened. It would seem that this is simply a question of mechanical skill, and the fact that some mills do straighten 60-ft. rails would bear out this view. If one mill can do it, all can be brought up to the same standard by a system of careful inspection before acceptance of rail.

After carefully considering all the information obtainable, your committee is of the opinion that the increase of the length of rails to 60 ft. is entirely practicable, and that the benefits to be derived are, a reduction of the cost of handling and laying in track, a reduction of 50% in the cost of joint fastening, if no stop-blocks are used, and of at least 25% if such a device is used, a reduction in cost of maintenance and better riding track.

The use of rails with miter ends, although not a new idea by any means, may be said to be still an experiment, and trials that have been made on several roads have been disappointing in some respects. It is certain that the principle is sound, that a diagonal opening between the rails, so adjusted that the tread of the wheel before leaving one rail engages the next, will relieve the joint from the blow incident to the passing of wheels from one rail to another over square cut ends. In 1894-5 a trunk line road laid three-quarters of a mile of 75-lb. 60-ft. mitered rails. These rails were cut at an angle of 45° and laid in single track, thus the points were facing on one side and trailing on the other. Joint fastenings, 34-in. angle bars, suspended joints. After 3½ years' hard service the joints are in excellent condition and the rails show no signs of wearing or battering at the ends. The officials who are interested and are watching this piece of track feel hopeful that the mitered 60-ft. rail is the coming rail.

In 1894-5 the Norfolk & Western Railway laid in single track, 29 miles of 85-lb. 60-ft. mitered rails, cut at an angle of 45°. Joint fastenings, "Churchill" patent. Traffic same as detailed in that part of this report referring especially to 60-ft. rails. During the 3½ years' service three or four mitered points on 29 miles of track have broken off. No trouble with wheels catching the points. The mitered rails on this road are not giving good satisfaction, as under the heavy traffic the joints are battering badly, and it is estimated that the rails will give not more than two-thirds the service of square cut rails under the same conditions.

In April, 1893, 16 miles of 75-lb. 4¾-in. mitered rail, cut at an angle of 55°, were laid trailing points on double track on the C., M. & St. P. Ry.; joint fastening, 30-in. angle bar, with six bolts, suspended joint. Traffic over it has averaged about 10 passenger trains and 10 freight trains per day. Passenger engines are 8 and 10-wheel, with 60,000 lbs. and upwards on three pairs of drivers; freight engines, standard and compound, with 84,800 lbs. on three pairs of drivers. By reason of crude or careless work in the mechanical part of the rail mill process, the rails were in bad surface when laid. One end of a large percentage of the rails were bent or dipped 1-64 to 1-16-in., apparently by having been thrust against a dog at the rail saw while hot, the ends not having been sawed simultaneously. The result was that in track, the mitered point being bent downward, the weight was thrown on the point, and some 60 rails in the 16 miles of track had 3 ins. of the mitered points broken off. Aside from this defect, the mitered rails make good riding track, and after five years and four months of hard service, show no signs of flattening or flowing at the joint; however, it can be said that neither does square cut rail laid at the same time and under the same conditions.

Good surface at joints is more easily maintained on mitered than on square cut rails. There has never been an instance of rail points slipping by or overlapping so as to form a lip.

The majority report of this committee shows unsatisfactory results obtained on the Lehigh Valley R. R. from mitered rails that have been in service about the same length of time as that on the C., M. & St. P. R. R. This rail was cut at an angle of 55° and laid with 30-in. angle bars, suspended joints.

In all the tests of mitered rails that have come under our observation, the rails have been laid without a tie under the joint, and with the exception of the N. & W. Ry., with no support for the base of the rail at the joint. Although the mitered rails, concerning which we have information, have not been in track long enough to fully develop the strong and weak points, from data obtainable your committee is of the opinion that much better results can be obtained by cutting the rails at an angle of 65° and using a tie under the joint, or a joint fastening that will give full support to the base of the rail. At an angle of 65° it is certainly not necessary to restrict the use of mitered rails to trailing points. No instance has come under our observation of any trouble with the rails cut at an angle of even 45°. Gurdon W. Merrell.

Latest Improvements in Frogs and Switches.

Your committee finds that there has been but little that may be considered new, and yet has had sufficient use to prove its value, introduced since the report of last year on this same subject. The spring rail frog and split switch continue in general use for main track work, and are constructed on general lines which are very familiar Special attention has been paid during the last year by designers and manufacturers to improving in detail the separate parts of these devices, in order to make a safer and more serviceable whole.

Frogs.—With spring frogs, the following details are carefully looked after:

(1) Anchor of spring rail or anti-traveling device. On plate frogs, this is accomplished by a link attached to a pivot on the plate and one on the movable rail. On frogs without bottom plates the spring rail is secured by means of an anchor block at the joint at the toe of frog bolted to both the fixed and movable wing rails of frog, or the spring rail is attached to plates fastened to under side of frog and spiked down to the ties. The spring rail should be so secured that the maximum amount of travel possible will not cause the spring rail to bind in either opening or closing.

(2) Holding down devices. These prevent vertical motion of spring rail and generally consist of pockets enclosing a lug which is fastened to the movable rail. These lugs are allowed a vertical play of not to exceed ⅛-in. and sufficient longitudinal play to prevent binding.

(3) Grooving of movable rail. The groove is parallel to gage line of main track side of frog, the outer line of the groove being 4¼ ins. from the gage line and inner line distant from gage by width of head of rail.

(4) Springs. The size and number of springs to each frog vary, as does also the location of the springs with reference to point of frog. The power of the spring should be ample to close the spring rail under all ordinary conditions, and should be placed as near as practicable to the center of that portion of the wing rail which fits up against the frog point. If a spring bolt is used, it should be of the best quality iron.

(5) Stops. Spring frogs should be provided with stops, which will absolutely prevent the spring rail from opening to any greater extent than the standard width of throat in a rigid frog.

(6) Heel Riser. Spring frogs, as well as all other main track frogs, should be provided with a heel riser of steel rail run back far enough so that combined width of riser and head of point rail will at least equal the width of tread of engine driver.

Rigid frogs, as their name implies, should be as substantial as possible. If of the filled, bolted pattern, the bolts should be 1 in. in diameter for rail from 4¼ ins. to 5 ins., and 1⅛ ins. in diameter for rails more than 5 ins. in height. If plate frogs, the bottom plate should be not less than ¾-in. thick, and the rails secured to it with ¾-in. rivets having a pitch of not more than 3 ins.

Switches.—The split switch, otherwise known as Clarke, Jeffery or Lorenz, is in general use throughout the country.

The general features of this switch are common to most roads, but there is a great variation in details. One of the features that has been discussed largely of late years is the number of tie-bars, and uniformity of practice in this respect has not yet been attained. While some lines show a tendency to increase rather than diminish the number of tie-bars, your committee is of the opinion that with splice switches 15 ft. long, properly re-enforced and provided with stop lug, two adjustable tie-bars are all that are necessary. The use of a wrought-iron plate extending through under both rails at the point of switch, with the ends fitted with rail braces, is an improvement that is becoming more general.

Slide plates should extend under the main rail and be heavy enough to keep from bending and should be fitted with a rail brace on the outside. Bolts and pins in connecting rods and tie-bars, except those fastening lugs to split rail, should be turned to exact size, be a neat fit, provided with nut and spring cotter, and as far as possible be of uniform size throughout the switch. We believe that the general practice is to make these bolts too small. While the essential features of the split switch are common to the switches in general use in this country, there are scarcely any two lines whose switches do not vary in some detail. Your committee believes that much greater uniformity in this respect is possible and desirable.

C. Dougherty, S. P. Adams, Peter Clark, Thos. McKune, E. H. Bryant, Committee.

Discipline, in Its Practical Application to Track Forces.

There are at this time two distinct methods of the application of discipline. The one which educates by regulations and special instructions, where the breach is regarded as an offense to be corrected by punishment which takes the form of reprimand, suspension and dismissal. The other, known as the "Brown" or "Fall Brook" system, which, according to the report read at the 27th annual meeting of the American Society of Railroad Superintendents, had at that time been adopted by 28% of the 180,000 miles of railway in the United States. In this latter system the educational feature predominates, the idea of punishment being entirely eliminated. Under it the employee is not subjected to fines and suspensions, but is judged wholly by his record, and is retained or dismissed accordingly as his record is good or bad.

Of each case requiring disciplinary action, a record is kept, and demerit marks are entered against the one at fault. All meritorious acts are likewise recorded and merit marks given. A given number of merit marks are cancelled by a like number of demerit marks, or vice versa. This gives an opportunity to retrieve a previous good standing. Further than this, each employee having a clear record for a given length of time, say six months or a year, is entitled to a certain number of merit marks, which emphasizes in a measure an appreciation of his service. It stimulates his pride and conduces to further effort to maintain his standing. At the end of each year the record is closed and a new one opened. All cases after being fully and fairly investigated are issued in bulletin form, omitting names, places, dates, etc., that there may be nothing to identify the individual with the bulletin. These bulletins point out the errors and consequences, and how they might have been avoided, that each may profit by the experience of his fellows. All meritorious acts are recorded and bulletined in like manner.

Abolishing from our minds the idea that discipline means punishment, but is purely educational, and bearing in mind that the success of any undertaking depends largely upon the skill of those engaged in it, the query naturally arises as to which of these two systems is the better as applied to track forces.

In the event of a suspension under the first-named system, it is necessary to put a substitute in charge, who, as a rule, is less skillful, lacks knowledge of the localities and conditions, and where the suspension is for a considerable length of time, the company would suffer because of this lack of skill and knowledge. The suspended employee would not only lose his time, with the consequent hardship entailed upon his family, but it causes him to feel a secret dislike for his superior and the company he serves.

With the "Brown" system, instead of the employee losing his time and his family being inconvenienced, if not immediately suffering by reason of his enforced idleness, a given number of demerit marks would be entered against his record. The company would be the gainer by his retention in the service, not having to educate a new man, with the possibility ever present of his making a still greater mistake. The retained employee would feel his error more keenly and would, I think, be less likely to err in the future, and so far as the others are concerned the lesson would be equally as good. H. W. Church.

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WIRE NAILS, says the "Iron Trade Review," have reduced the output of cut nails to less than one-fifth of what it was in 1886. About 40 years ago the United States annually produced about 2,000,000 kegs of cut nails, or about 89,000 tons; and in 1886 the maximum output was reached with 360,000 tons of cut nails. Until 1880 cut nails held the field; but in 1892 the wire nail output was the greater, with 4,750,000 kegs, as compared with 4,500,000 kegs of cut nails. This total of 9,250,000 kegs is the high-water nail output in any country at any time. In 1895 a maximum output of 5,841,000 kegs of wire nails was reached, while the output of cut nails for 1896 was less than 900,000 kegs. At the present time there are 79 wire nail factories operating in the United States, as compared with 53 in 1896. There are now 4,544 cut nail machines working, as compared with 4,598 in 1896. Cut nails have fallen in price to an average of $1.60 in the six years ending in 1896. Wire nails cost for small sizes an average of $10.90 per keg in the four years ending in 1880; while in the four years ending in 1896 the average was $3.62, and the lowest annual average was $2.93 in 1894. In standard sizes of wire nails the prices are lower; the average for 1887 was $3.15 per keg, and in 1896-97 prices fell to $1.60. But cut nails are cheaper still, the average for 1894 being $1.08 per keg of 100 lbs. This latter rate is equivalent to about $23 per ton, or little more than the English price for steel rails.

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THE PATENT ON THE JONES MIXER, an apparatus used in connection with the direct Bessemer process, has been adjudged valid by Judge Buffington, of the U. S. Circuit Court, at Pittsburg, in an infringement suit brought by the Carnegie Steel Co. against the Cambria Iron Co. The mixer patent was issued June 4, 1889, to the heirs of the late Capt. Wm. R. Jones, general superintendent of the Edgar Thompson Steel Works of the Carnegie Company. The mixer is a large covered vessel, lined with fire brick, holding 200 to 300 tons of molten iron. The pig metal is drawn from the blast furnaces into ladles, in which it is carried to the mixer and poured into it. At the same time the metal in the mixer is drawn off from time to time into other ladles, which carry it to the Bessemer converters. The mixer performs the double function of storage, enabling the converters to run regularly, while the rate of production of the furnaces is irregular, and, of mixing, by which variations in the quality of the iron received by the mixer from different furnaces are evened up, and the quality of the iron delivered to the converters is made practically uniform.

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THE COMBUSTIBLE CITY REFUSE OF BOSTON is to be disposed of under a contract made on Sept. 10 with the City Refuse Utilization Co., of which Mr. Herbert Tate, of New York, is president. The contract is for ten years, the city of Boston retaining the option of buying the plant under appraisement at the end of five years. The refuse is to be sorted and the worthless parts are to be destroyed by fire; and the compensation is a cash payment of $5,500 per annum by the city of Boston, the contractor reserving the right to all valuable material saved from the refuse. The firm of Jones & Meehan, of Boston, is now building the plant from plans made by Mr. W. F. Morse, M. E., of New York. This plant is to cost $29,000, and is to be completed in December next.

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THE SANITATION OF SANTIAGO, CUBA, under American control, is showing quick results. Gen. Wood, the Military Governor of this old and always unhealthy Spanish city, has divided Santiago into five sanitary districts, each under a physician, with inspectors of sewers, streets, houses and dispensaries, assisted by 100 street cleaners. About 500 cu. yds. of refuse are burned daily, disinfectants are distributed where needed, and a heavy fine is imposed for uncleanliness or failure to report cases of sickness or death. As a result, there is a marked decrease in sickness among the poor, and the average death rate has fallen from 70 to 20 per month. There is also decreased sickness among the new troops. The harbor is now the chief source of trouble, as the current is slight near the city. It is proposed to dredge the muddy shallows, protect the banks with stonework, or piles, and to carry the present infectious sewage two miles down the bay to a swifter current. Gen. Wood expects within another month to make Santiago as healthful as the ordinary Southern town in the United States.

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RAILWAY TICKET SCALPING is to be regulated—if not suppressed—by ordinances lately passed in Cincinnati and other Western cities. These provide that the ticket-scalpers shall take out a license and give bonds against selling spurious, counterfeit or stolen tickets. Cincinnati has lately arrested and fined eight dealers in these tickets for unlawful selling, and six others are in jail in that city. A number of railway companies have also recently made it a condition, in making reduced rates for conventions, etc., that the city where the meeting is to be held shall undertake to clear out scalping offices, which have been proven to deal in counterfeit or stolen tickets.

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THE CYLINDRICAL COTTON BALE is gaining in favor, and the American Cotton Co., John E. Searles, President, controls the system and has opened its commercial department in Nos. 11,12 Cotton Exchange Building, New York. This part of the company's business is in charge of Mr. John Martin. About 150 of the cylindrical compresses are now in operation; and the output is said to command a higher price than for cotton as ordinarily baled, as it is more compact, more symmetrical and practically non-combustible. The machinery is now perfected and the operations of the company are to be "aggressively extended."

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A RAILWAY IN HAYTI is proposed, extending from Cape Haitien to La Grande Riviere du Nord, a distance of about 18 miles to the northeast. The capital stock is fixed at $450,000, and the estimated cost is $250,000 for a narrow-gage road; the Haytien government is to guarantee 8% interest and the material is to be purchased in the United States. Mr. Henri Thomesset is the engineer, and the government grants to Cincinnatus Leconte and

Blanc Eusebe, the former being the present Minister of the Interior and Public Works, an exclusive privilege and concession for 60 years. The country traversed is a beautiful plain; adapted to the cultivation of the peculiar products of the island, and especially suitable for the growth of the banana. Mr. Lemuel W. Livingston, U. S. Consul at Cape Haitien, has forwarded the above information to the State Department.

HAWAIIAN RAILWAYS include the three following lines: The Kahului railway, 13 miles long, on Maui Island; the Hawaiian railway, 20 miles long, on the island of that name; and the Oohu Railway & Land Co.'s Line, running from Honolulu to Waianae, with a total length of 38½ miles, including sidings. The first two lines are chiefly used for carrying plantation products to shipping points. The last named line was opened in 1890, and in the year 1897 it carried 85,596 passengers, paying $30,993, and 66,430 tons of freight, paying $69,753. The equipment of this line includes 5 locomotives, 14 passenger cars and 132 freight cars.

PROGRESS ON THE TRANS-SIBERIAN RAILWAY, at the beginning of 1898, is reported as follows in the "Revue Scientifique." Commencing at Tcheliabinsk, the western terminus of the Siberian line, the railway is opened to normal traffic to Krasnoiarsk, a distance of about 1,347 miles. From the latter point to Klioutchinsk, 218 miles, the line is opened temporarily; and it will be definitely opened upon the completion of station and other necessary buildings. Beyond Klioutchinsk the rails are laid for about 20 miles, to Touloune; two bridges are to be built upon this section. From Touloune to Irkoutsk, 238 miles, and from Irkoutsk to Lisvenitchnaia on Lake Baikal, 40 miles, the roadbed is completed and nearly all the bridges and station buildings are finished. On Lake Baikal, the ice-breaker ferryboat which is to transfer trains from one bank to the other, is being erected, and it is expected that it will be finished in 1899. Surveys are still in progress for a line around Lake Baikal, but nothing will be done in constructing this road until the whole line is open. In the Transbaikal section the roadbed is graded and rails were laid between Strietensk and Mitrophanor, a distance of 200 miles; but the floods of last year carried away some of this track, and only 71 miles of rails were left in January, 1898. The eastern section is finished, the first train leaving Vladivostock for Khabarovsk on Sept. 15, 1897. The preliminary survey but not the final location has been made for the line across Manchuria.

A PER DIEM SYSTEM OF FOREIGN CAR RENTAL, devised by Mr. J. M. Daly, Superintendent of Transportation, Illinois Central R. R., is being tested, apparently with considerable success, by a number of Western railways. At present, as is well known, the general practice is for railways handling the cars of other lines to pay for their service according to the mileage made, regardless of the time consumed in making this mileage. It has been found that this plan results in a great many irregularities, one road perhaps paying its neighbor at the rate of 50 car miles per day, while it might receive from that neighbor payment based upon less than 20 car miles per day. Under the Daly plan the roads exchange car day for car day and pay mileage only on the remainder of days. The railways which have been testing the new plan are the Illinois Central, the Atchison, Topeka & Santa Fe, the Hocking Valley & Toledo, the Chicago, Milwaukee & St. Paul and the Missouri, Kansas & Texas, and at a meeting of the car service officials of these companies recently held in Chicago the following figures of foreign car service for July 1898, as compared with the same month of 1897, when the old mileage plan was in operation were presented by the committee having the experiment in charge:

	1898.		1897.	
	Days.	Miles.	Days.	Miles.
I. C.	7,644	202,776	9,737	151,009
C., M. & St. P.	7,054	188,938	7,808	136,235
Santa Fe	4,584	141,104	4,626	102,985
Il. V. & T.	201	3,205	202	2,044
M. K. & T.	1,336	49,975	1,347	54,322
Totals	20,819	585,998	23,720	446,595

According to this statement the average car miles per day increased under the Daly plan to 28.6 miles per day, against 18.8 miles per day under the old straight mileage plan, a gain of 52.1% or 9.8 miles per car per day. While it would be incorrect to conclude from these figures that the gain is due alone to the new system of paying for foreign car service, the experiment is an interesting one and should be carefully watched by railway traffic managers.

THE BRIDGE DISASTER AT CORNWALL, ONT.

The fall of two spans of the New York & Ottawa R. R. bridge over the American channel of the St. Lawrence River, near Cornwall, Ont., was briefly reported in our last issue. The number of men killed in the accident is now given as 15, while 16 were seriously injured. At the time of the accident the erection of both the fallen spans had been practically completed, and under one the falsework had been removed. On the other span the workmen had begun to take down the traveler, but most of them were working on the floor of the bridge when the accident occurred.

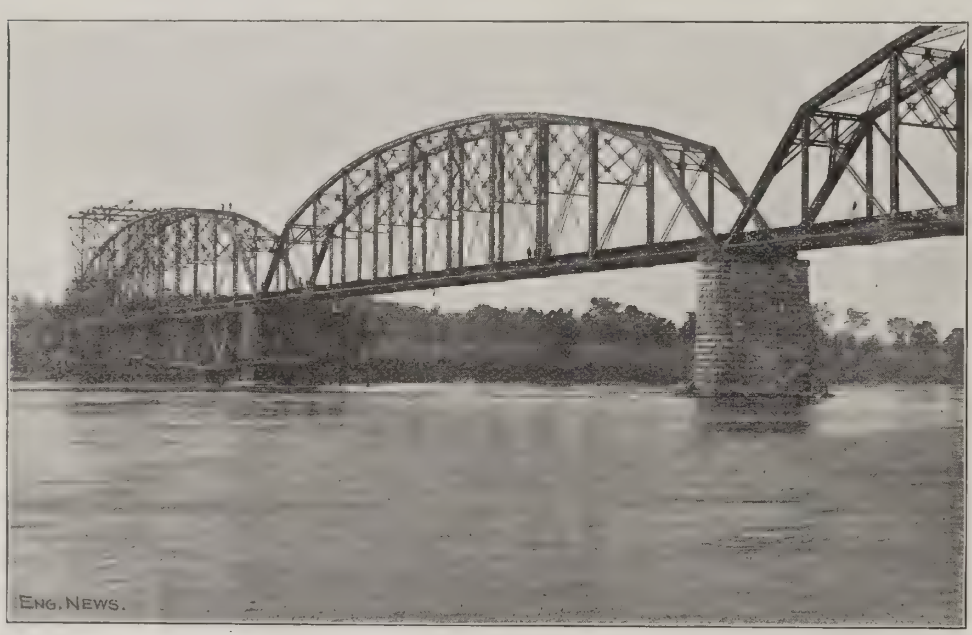

FIG. 1. THE NEW YORK & OTTAWA R. R. BRIDGE OVER THE AMERICAN CHANNEL OF THE ST. LAWRENCE RIVER, NEAR CORNWALL, ONT.

(From a photograph taken on the morning of Sept. 6. The two spans shown and the pier on the left fell at noon on that day.)

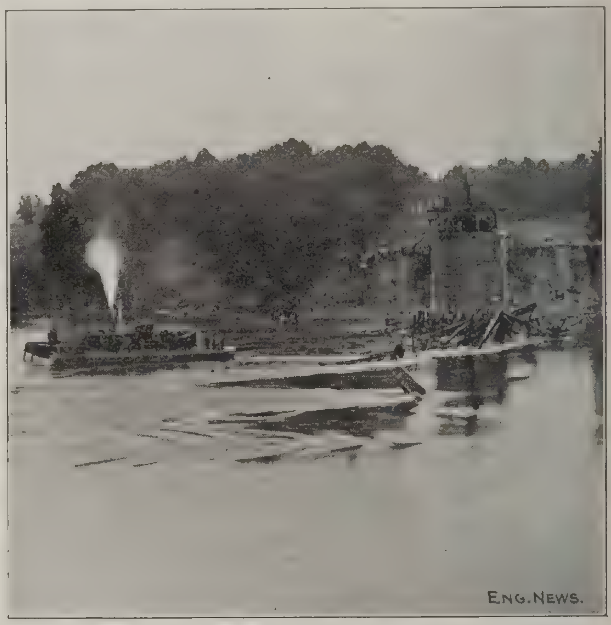

FIG. 2. VIEW OF WRECK OF THE NEW YORK & OTTAWA R. R. BRIDGE, LOOKING SOUTH FROM PIER 3,

(From a photograph taken on the afternoon of Sept. 6.)

Principal interest, of course, centers in the construction of the pier which went down with the two spans. The river at the site of the pier is about 35 ft. deep, and has a swift current, said to be about 5 to 8 miles per hour. The river bottom is a clay hard-pan in which are imbedded boulders, many of them of large size. The pier was founded by sinking a timber crib 18 ft. wide, 62 ft. long and 38 ft. in height, and filling it with concrete deposited under water by buckets arranged to empty automatically on striking the bottom. The anchoring and sinking of this large crib in the deep water and swift current was a task of great difficulty. To accomplish it a small crib filled with stone was sunk upstream to serve as an anchorage and a 3-in. steel cable was led from this to the pier crib, which was also supported by a barge on each side. Cables led to the river bank were used to swing the crib in the stream till it was in the correct position,

The swift current made it impossible to examine the bottom by divers before sinking the crib. Soundings were taken over the site of the crib, however, and the crib bottom was scored to correspond to the depth thus obtained.

After the crib was down divers went down inside and obtained samples of the bottom, which was deemed satisfactory by the engineer, and the work of concreting began. The first concrete laid, to the amount of about 50 cu. yds., was deposited in bags, all of which were placed by divers around the sides of the crib. The remainder of the concrete was then deposited from a bucket holding about 1 cu. yd. arranged to dump automatically on contact with the bottom. The concrete was deposited in successive layers of about 18 ins. over the whole area of the crib, and divers reported it as setting satisfactorily.

The concrete was mixed by hand in the proportions of 1, 2 and 5, using Glen's Falls Portland cement. It may be said here that the crib itself was built of 12-in. timbers, drift-bolted together, crossties of the same size were inserted at 10 ft. intervals, the vertical spacing being about 4 ft.

The concrete was carried up to a point 4 ft. below water level, and was then pumped dry, the top of the crib projecting above the water forming a coffer-dam. The top of the concrete appeared in good condition, and upon it the masonry was started. Two courses were laid and then work was shut down for the winter, all the above-described work having been carried out last fall. During the winter the pier was subjected to heavy ice pressure, which, as most engineers know, is a severe test of any pier built in the swift current of the St. Lawrence; but it was not moved. Early in the spring, we are informed, it was struck by a heavy timber raft, which was broken up by the collision, and the pier showed no injury.

Work on the piers was resumed in the spring and they were built up to their full height of about 35 ft. above the water, making the total height about 70 ft. from the river bed to the pier coping. The masonry of the piers was rock-faced ashlar, with a backing of Portland cement concrete.

The specifications and working drawings for the bridge were made under direction of Mr. F. D. Anthony, Chief Engineer of the New York & Ottawa Ry. Co., and were approved by Mr. A. A. Stuart, M. Am. Soc. C. E., now Engineer of the Degnon-McLean Construction Co., of New York city, who was consulting engineer to the railway company. They were also approved by the Canadian Government engineers.

The report has been widely published that a tugboat captain who witnessed the accident declared that he saw one of the spans break in two first and pull the pier over. Later accounts are to the effect that this man now says he was in the engine room when the accident occurred, and was not in a position to see whether span or pier fell first.

The accompanying illustrations, reproduced from photographs, will, we doubt not, be examined with interest by our readers. We may note that the north end of each span is in each case the fixed end. Thus on Pier 2, which fell, the channel span rested on expansion rollers, while the shore span, which still had the falsework under it, was anchored to the coping. The channel span turned partly on its side in falling, and its end-shoe is now about 25 ft. south of Pier 3, on which it formerly rested. The shore span carried the falsework down with it, and, falling into shallow water, made a tangled mass of wreckage, as shown in the illustrations.

Fig. 4 shows the masonry of Pier 2 just started. It will be noticed that it is located considerably to one side of the concrete base. We understand that this was made necessary to bring the pier in correct position, the crib being sunk a little to one side of its correct location.

The above comprises practically all the facts we have been able to obtain bearing upon the causes of the accident up to the time of going to press. The mass of debris in the river and the swift current have thus far prevented any examination by divers of the base of the fallen pier.

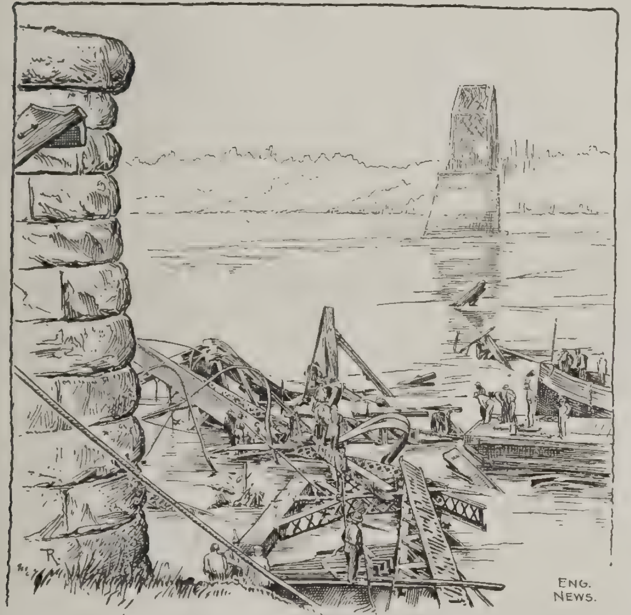

FIG. 3. VIEW OF WRECK OF THE NEW YORK & OTTAWA R. R. BRIDGE LOOKING NORTH FROM ABUTMENT ON AMERICAN SHORE.

(Sketches from a photograph taken on the afternoon of Sept. 6.)

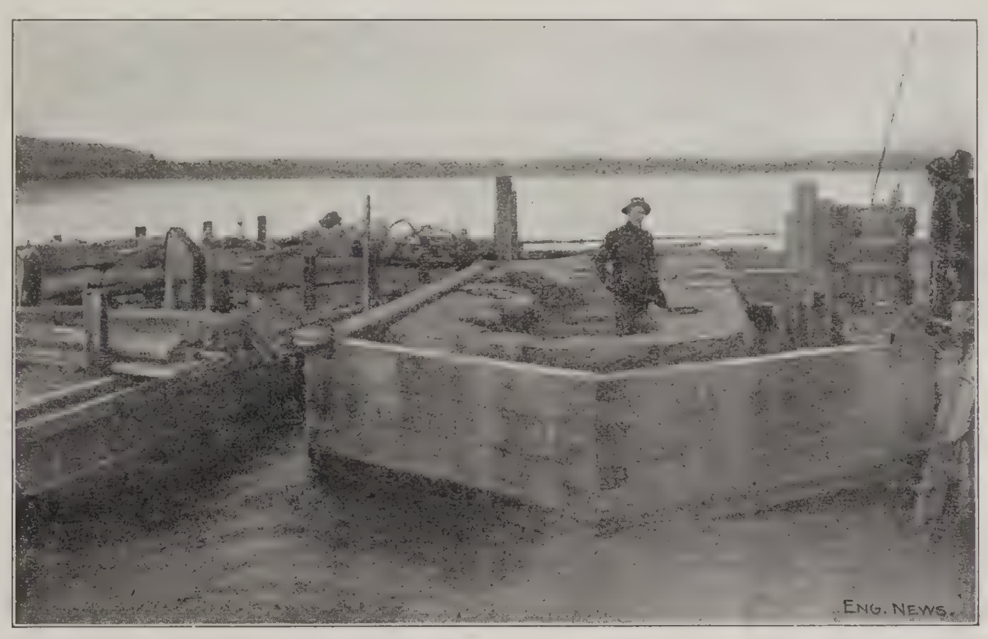

FIG. 4. VIEW OF PIER 2 FOR NEW YORK & OTTAWA R. R. BRIDGE UNDER CONSTRUCTION.

We believe engineers will generally agree that the facts thus far presented all point to the pier and not the span as the point of original failure. It is difficult to conceive how it would be possible for the failure of a member in either of the spans, and its consequent fall, to pull the pier over. There are many accidents on record of bridge spans falling or being blown down, but we cannot recall one case where a falling span took the whole pier with it. Besides this, of the two spans that fell, the falsework had been removed from under the river span; but this fell practically intact, showing that it did not break in two and drag the other down. The falsework was still under the other span, and in case any member of that span had failed, the falsework would have supported it, in all probability. Still again, the testimony of eyewitnesses is that the pier "crumbled away."

Assuming, then, the pier to be the cause of the accident, let us see where the failure was most likely to occur. In this connection, it seems to us, that a most noteworthy feature of the accident is that it came absolutely without warning. There was no premonitory cracking or settling. Now this is exactly contrary to the way in which masonry structures act. Overloaded masonry cracks and gives warning of its condition long before final failure occurs; overloaded footings give evidence by settlement that something is wrong. To account satisfactorily for the failure of the Cornwall pier, therefore, we must find some cause which would drop the pier into the river without previous settlement or cracking of the masonry; and the only cause which seems sufficiently probable to deserve acceptance is the gradual undermining of the pier by the current.

The bed of the river is a clay hardpan, according to our best information, overlaid with the usual layer of pebbles and boulders common to swift running streams in this region of glacial action. If the current is increased in swiftness enough to remove this protecting layer of boulders the clay beneath might be gradually washed away.

It is possible that the driving of the falseworks for erecting the spans so increased the current next the piers as to wash away the boulders and clay, until finally the structure became so unstable as to topple over.

The narrow base of the pier (18 ft.), in proportion to its height (70 ft.), has been criticised. It will be readily seen that two or three feet erosion under the side of so narrow a pier leaves an uncomfortably small margin of stability.

This is especially the case if the pier masonry was placed on the same side of the concrete mass as that under which erosion occurred. The reason for using such narrow cribs was, doubtless, the swiftness of the current; the difficulties of sinking cribs in such a channel, of course, increase greatly with every foot of width.

Besides erosion under the pier, the only other hypothesis which could account for the sudden failure of the pier is the bursting of the crib. If the concrete deposited under water did not set, but remained a semi-fluid mass, then it might eventually exert a pressure upon the sides of the crib which would pull out the cross braces and the whole pier would settle down. It seems quite impossible, however, that the concrete can have so absolutely failed to set as would be necessary to make this hypothesis true. It seems much more reasonable to ascribe the accident to erosion, at least until such a time as the condition of the fallen pier and crib is more fully known.

ANNUAL MEETING OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The seventeenth annual convention of this Association was held last week at Boston. At the opening session on Sept. 6, President A. E. Lang introduced the Hon. Josiah Quincy, Mayor of Boston, who made a brief speech of welcome. President Lang then gave an address in which he referred to Boston as the birthplace of the Association, and the home of the electric railway, it being the first large city in the country to adopt the trolley system on a large scale. That the founders of the Society "builded better than they knew" was shown by the fact that no changes in the constitution had been necessary, notwithstanding the remarkable advances in street railway construction and operation. Attention was called to the need of discussion of live subjects in the convention, and the following were suggested as topics possessing considerable interest: "The Suburban Railroad;" "On What Terms and Conditions Should They Enter Over Our Tracks?" and "How Can Their Building Be Encouraged?" "The Issuing of Transfer Checks or Tickets, and How Abuses Connected Therewith Can Be Limited;" "The Equipment of Buildings with Automatic Sprinklers, and the Economy Resulting Therefrom;" "The Discussion or Agitation of Municipal Ownership of Franchises, and the Most Intelligent Way to Meet the Subject;" "To What Extent Should Companies Engage in the Amusement Business, and the Best Methods of Conducting the Same;" "How Best to Promote the Interests of Employees and in Return Secure from Them the Highest Degree of Service and Loyalty."

The report of the Secretary-Treasurer, Mr. T. C. Penington, showed a present membership of 161 companies. The total a year ago was 178, of which number 17 had withdrawn, or consolidated with other companies. The financial statement showed a balance of over $3,000 in the treasury.

The first paper, entitled "The Comparative Earnings and Economy of Operation of Single and Double Truck Cars for City Use," by Richard McCulloch, Electrical Engineer, Cass Avenue and Citizen's Railway Companies, St. Louis, Mo., is abstracted elsewhere in this issue.

In introducing the discussion which followed, Mr. Ira A. McCormack, of Brooklyn, stated the experience of his road, which operated between 300 and 400 cars, had been quite different from that given by the author of the paper, and in no instance had they been able to lengthen the headway by operating cars of larger capacity. In fact the contrary was true, and cars are now being operated under a reduced headway. As now operated, on holidays the cars which ordinarily seat 60, carry a standing total load of from 150 to 180 persons, and run on the line from Court St. to Coney Island on a 1-minute headway.

Mr. John I. Beggs, Milwaukee, Wis., gave his experience in Milwaukee, where, for the past three years, experiments have been under way to determine the advantages and disadvantages of the double truck. As a result, in 1896, 20 cars were equipped with double maximum traction trucks, and put in operation. These trucks had 30-in. wheels and the cars had 18 double seats, giving a capacity of 36 passengers. A year ago these cars were enlarged to 20 seats, holding 40 passengers, and the "maximum traction trucks" were abandoned on account of their jumping the track. The past year the car length was again increased, this time to 22 seats, holding 44, but the length between buffers was maintained the same.

In a climate such as Milwaukee, it is necessary to employ one style of car throughout the year, as the short summer season, chilly winds and cold rains, make it desirable to use only closed cars, which can be operated 12 months in the year. Notwithstanding the use of a 33-in. wheel on the cars as constructed, a distance of only 32 ins. between track and sill was obtained, which made the cars easy to enter and practically removed one of the chief objections to double truck cars. Passengers are found to prefer the comfort and higher speeds of the larger cars. On the Milwaukee roads the average speed has, within two years, been increased one mile per hour, and is now 9 miles per hour. Another factor in favor of the double truck car is the reduced wear and tear due to easier riding, and better distribution of weight, which causes lighter blows at joints, frogs, etc. Notwithstanding the increased number of trucks, wheels and springs, car repairs cost less.

His company is now operating under an increased headway as a direct result of the use of double truck cars. In reply to a question by Mr. H. N. Sloan, he stated that his company is now operating 10 interurban cars over a line 26 miles long. These cars have double trucks, and are equipped with four G. E. 1,000 motors, geared to run at a speed of 50 to 55 miles per hour. These cars weigh, when complete, about 40,000 lbs., and gave no trouble from lack of traction, or track jumping. In the near future it is the intention of the company to place four motors on all cars as two-motor cars have difficulty in mounting some of the grades, which are in a few instances from 6 to 7%.

This concluded the morning session, and the afternoon was spent in an excursion to Concord and Lexington. A special train was provided by the Massachusetts Street Railway Association, which had charge of all local arrangements, and fully 300 delegates, supply men and ladies, took advantage of the opportunity to visit these historic places.

At Concord the party walked to the park. Here two monuments mark the spot where on April 18, 1775, the British troops were opposed by the "Minute Men." Rev. C. A. Staples, of Concord, in a quaint and most interesting way, told the members of the excursion party the story of the Concord battle, and pointed out the spots of historic interest.

Again boarding the train the party was carried to Lexington, where carriages were waiting to carry them about the town. The many monuments, the battlefield, Sleepy Hollow Cemetery, where Emerson, Hawthorne, Thoreau and the Alcotts are buried, and the other historic points were viewed with interest by the visitors.

In the evening a reception was held in the Paul Revere Hall, and passed most pleasantly under the efficient direction of the Ladies' Committee of the Massachusetts Street Railway Association.

Wednesday, Sept. 7.

The first paper was read by Mr. W. S. Dimmock, General Superintendent Omaha & Council Bluffs Ry. & Bridge Co., Council Bluffs, Ia., and discussed the postal service on street railways.

Mr. Dimmock said that the advantages to the business community of a street railway postal service were conceded on all hands, and the only ground for discussion, was the compensation given the companies for this valuable service. In the beginning street railway companies were anxious to carry the mails, believing as they did, that it would insure to them a complete protection by the government during strikes. In consequence they accepted rates, which when they found the protection was not as complete as expected, were considered too low. At present a fixed rate of 3 cts. per car-mile has been established by the government for street railway postal service, while the "Star Route" service costs 4.94 cts. per mile. Congress fixed this rate and made the appropriation; and it is quite within the province of the American Street Railway Association to sufficiently influence Members of Congress to have the present injustice to street railway companies remedied.

Mr. John I. Beggs, Milwaukee, Wis., said that the company which he represented was considering the carrying of U. S. mail upon its lines. So far he had opposed even carrying pouches, since it did not seem to promise any adequate return and the resulting protection did not seem to amount to much. The low rates were originally accepted by some railway companies solely to obtain the protection of the government, and the government was now attempting to force these low rates on all companies, regardless of location or surrounding conditions. The rate offered was really below the cost of operation in several cases, and yet the mail car must always have the right of way. The advantages of carrying mail pouches on platforms was questionable, as the space could be put to far more profitable use in carrying passengers, many of whom would rather ride on the platform than any other place.

Mr. Robert McCulloch, St. Louis, Mo., stated that his company had equipped two cars for postal service, intending to operate them at an inadequate rate, but expecting to derive the benefits of a United States mail route. Upon their first appearance, orders were given to have the U. S. mail signs removed from the cars.

Mr. H. C. Payne, Milwaukee, Wis., thought that the postal authorities were willing to treat the railways fairly. The trouble lies with the Congressional appropriations and not with the Department. If the matter were properly presented to the committee having in charge the Post Office appropriations there was good reason to believe that a change would result, for he found the Department officials uniformly willing to do what was fair. It would be necessary to have a committee with proper data visit Washington, and present the matter to the Congressional committee. A motion was carried to this effect; the committee to consist of five members to be appointed later.

The Secretary then read a paper by Mr. M. S. Hopkins, Electrician, Columbus Street Ry. Co., Columbus, O., entitled "Maintenance and Equipment of Electric Cars for Street Railways." The paper is abstracted elsewhere in this issue.

Mr. H. N. Sloan, Chicago, Ill., disagreed with the author regarding the inadvisability of night inspection. With his company this inspection had proved very satisfactory, all motor brushes being changed each night. As a result, commutators required turning down less frequently.

Before the adjournment of the morning session, President Lang announced the Nominating Committee as follows: W. W. Bean, D. G. Hamilton, E. C. Foster, W. F. Kelly, J. R. Chapman, Henry C. Payne and E. H. Davis.

The excursion of the afternoon included a steamer trip down the bay to Nantasket Beach, affording on the way down an excellent view of the battleship "Massachusetts," the "Solace," several smaller gunboats, and the shipping of Boston Harbor. At the Beach the visitors divided, some going in bathing, and others taking a trip over the Nantasket Beach Electric road. Later a "clam bake" was participated in by all, over 700 sitting down in the large dining-room of the Ocean View Hotel.

Thursday, Sept. 7.

This session began with the reading of a paper by Mr. Walton H. Holmes, General Manager, Metropolitan Street Ry. Co., Kansas City, Mo., entitled "To What Extent Should Street Railway Companies Engage in the Amusement Business." In this paper it was stated that conditions varied in each city, but there were certain general rules which could be laid down. The conditions of life in most cities has changed during the last few years, and in addition to police and fire protection, means of amusement, such as parks, and boulevards, were now provided. Municipal authorities were only too glad to have street railways help by constructing lines to city parks, or by constructing and operating parks of their own. Many roads did not consider new resorts paying investments, and found it advisable to improve transportation facilities to parks already existing. In many large cities the question was, however, how to properly take care of existing traffic, and not so much how to increase it. Smaller cities do without doubt afford an opportunity for recreation parks such as defined in the title of the paper. There is little difference in the kind of recreation required at these parks, usually music, baseball, football, roller coasters, boats, chutes, light comedy, balloon ascensions, etc., suffice to increase the light traffic of summer and bring the balance on the right side of the ledger.

Mr. C. D. Wyman, New Orleans, La., said that at one time he was firmly convinced that a railway man should stick to his own line of business. Recently, however, he had discovered that local conditions affect the question. In his experience the people who conduct recreation grounds, outdoor sports, etc., were not always reliable, and some supervision by the railway company was advisable. In some cities, especially in the South, it was at present not customary for people to leave their homes in the afternoon or evening of the summer months, and it was for the progressive street railway companies to break up this custom. The road he represented had established parks, with attractive entertainment, with very gratifying results. Considering the question as a whole, he was convinced that the amusement business in connection with street railways paid.

Mr. John I. Beggs, Milwaukee, Wis., said that his company had for some time given, at its own expense, band concerts in one of the city parks, and had a standing offer to duplicate any money raised by the city or any public spirited citizens for similar entertainments. The result had finally convinced him that the gain in traffic income did not warrant the increased expense, and that it did not pay street railways to go into the amusement business, at least in this way. While the company's income was increased, the operating expenses were also increased at a greater rate, and in his case the returns were found to be only about 75% of the expenditures. In many cities considerable traffic was concentrated on one line and forced in one direction which would ordinarily have distributed itself in several directions.

Mr. W. E. Harrington, Camden, N. J., said that his company had a free park, and the number of outsiders caused so much trouble that it was necessary to charge a small entrance fee. The number entering was registered by turnstile, and it had been found that they were receiving only about 70% of the money expended.

Mr. A. E. Lang, Toledo, O., remarked that his city had a population of about 140,000 inhabitants, and the railway owned a park on the lake front about 5½ miles distant. The original owners had started on rather a large scale, charging no admission and furnishing seats in any part of the Casino building free. The original cost of park and equipment was $65,000. As soon as his road came into control an admission fee of 5 cents was charged, all coming by car, or 15 cts. for the round trip. Instead of free seats, a number were reserved and charged for at 10 cts. Last year, instead of a loss, the Casino cleared a few hundred dollars, and the increased earnings of the railway company amounted to $40,000. This year the Casino Company will net $6,000 and the railway company about $50,000.

Col. N. H. Heft, Meriden, Conn., was glad that railway men were maintaining their reputation for honesty and truthfulness by telling just what they were doing. His company had inherited a park costing $45,000, with free launches, switchback, pavilion, etc., and their experience with it had been somewhat unfortunate. Street railway men were running wild over the amusement question. The whole matter must be run on a sound business basis.

Mr. W. W. Bean, chairman of the nominating committee, presented the following list for officers for the ensuing year:

President, Chas. S. Sergeant, Boston, Mass.; First Vice-President, H. C. Moore, Trenton, N. J.; Second Vice-President, Earnest Woodruff, Atlanta, Ga.; Third Vice-President, W. H. Holmes Kansas City, Mo.; Secretary-Treasurer, T. C. Pennington, Chicago, Ill.; Executive Committee, A. E. Lang, G. E. Yuille, Frank Jones, John I. Beggs and Ira A. McCormack.

For the next annual convention Chicago, Ill., was chosen. The report was accepted and the secretary ordered to cast the ballot for the nominees.

President Lang named the following gentlemen as members of the committee having in charge the question of carrying United States mails on street railways: J. T. Burnett, Boston; H. C. Payne, Milwaukee; Ira A McCormack, Brooklyn; D. G. Hamilton, Chicago, and W. S. Dimmock, Omaha.

The President also announced the presence of two railway engineers from Japan who had been attending the Association meetings, Messrs. T. Y. Dzushi, Chief of Finances and Manager of Stores of the Imperial Government Railways, and K. Sugahara, Chief Engineer of the Kobe Railway and of some street railways built in Japan. Upon motion, the privileges of the floor were extended to both gentlemen.

The second paper of the morning session, by Mr. Frederick B. Perkins, electrical engineer, Toledo Traction Co., Toledo, Ohio., entitled "Inspection and Testing of Motors and Car Equipments by Street Railway Companies," is abstracted elsewhere in this issue. There was no discussion.

The afternoon was occupied pleasantly by a trip to Plymouth, the special train leaving Old Colony Station at 2 p. m., and returning about 6 p. m., in ample time for the annual banquet, held at the Hotel Brunswick, the convention headquarters, at 8 p. m. Covers were laid for 350 persons, and the after-dinner speakers included Mayor Quincy, Hon. Geo. G. Crocker and other prominent men.

Friday, Sept. 9.

The session was opened with the reading of a paper by Mr. R. W. Conant, Electrical Engineer, Boston Elevated R. R. Co., entitled "Cost of Electric Power for Street Railways at Switchboard; Both Steam and Water." This was, without doubt, the most complete and valuable paper of the convention. We postpone its publication to our next issue. There was no discussion upon it.

The Committee on Rules for Government of Motormen and Conductors asked for an extension of time and the appropriation of $200 to permit the printing and mailing of the code prepared by them, the intention being to submit it to the members for revision and criticism. Both requests were granted. The new President, Mr. Chas. S. Sergeant, briefly addressed the members, and the final adjournment was then taken.

The convention, as a whole, is generally conceded to have been the most successful in the history of the Association, unquestionably so from the exhibition and entertainment standpoint.

While the street railway managers and engineers were in session in the main hall the Street Railway Accountants' Association was busily engaged in another part of the building.

The papers read were as follows:

"Statistics—Their Use and Abuse," Mr. E. D. Hibbs, Auditor, North Jersey Street Railway Co., Jersey City, N. J.; "Car Mileage—How Arrived at and Its Use," Mr. A. H. Ford, Secretary and Treasurer, New Orleans Traction Co., New Orleans, La.; Report of the Permanent Committee on "A Standard System of Street Railway Accounting, Covering the Classification of Operating Expenses, Classification of Construction and Equipment Accounts and Form of Annual Report." Chairman C. N. Duffy, Secy., Citizens' Ry. Co., St. Louis, Mo.

The election of officers for the ensuing year resulted as follows: Pres., J. T. Calderwood, Minneapolis; First Vice-Pres., E. R. Tighe, New York; Second Vice-Pres., R. L. Williams, Richmond, Va.; Third Vice-Pres., F. E. Smith, Lynn; Secy. and Treas., W. B. Brockway, Toledo, O.; Executive Committee, Chn., H. L. Wilson, Boston; H. E. Babcock, Elmira, N. Y.; H. O. Mackay, Milwaukee, Wis., and J. D. Fraser, Ottawa, Canada.

The selection of the Mechanics' Building, Boston, Mass., as a place of meeting insured an ideal location for both the exhibition of street railway appliances and the regular business session.

The attendance was most gratifying, including, as it did, about 900 supply men, 300 delegates and about 300 ladies, a total of about 1,500 persons. All were accorded the freedom of the Boston street railways, the convention button serving as a pass on all the city and suburban lines. The exhibition was, as already stated, the largest in the history of the Association. The exhibits, which occupied two full floors of the Mechanics' Building, are briefly described in the Supplement of this issue.

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THE BROOKLYN, N. Y., WATER SUPPLY SYSTEM is in need of extensive additions and improvements, according to a report recently made by Mr. James Moffatt, Deputy Commissioner of Water Supply of the Borough of Brooklyn. The list of improvements which are needed, and their cost, according to Mr. Moffatt, are as follows:

Additional conduit		$1,200,000
Millburn engines and coal sheds		150,000
Additional water supply, part of estimate		300,000
Improvements at Gravesend and New Utrecht		75,000
Storage reserve, postponing Millburn		600,000
Protection from pollution, postponing filter beds		100,000
Extension of distribution		150,000
Improvements:		
Sinking test wells	$10,000	
Electric light plant at Millburn and Mount Prospect	8,000	
Monuments	1,000	
		19,000
Cleaning of Ridgewood reservoir		50,000
Total		$2,644,000
Cost of engineering and contingencies		256,000
Grand total		$2,900,000

Mr. Moffatt states that as a result of insufficient conduit capacity millions of gallons of water east of Millburn have been wasted, and the pumps have often been kept idle, while at other times they are under a great strain. The present storage reservoirs keep on hand only three days' supply, so he proposes to build at Forest Park an additional reservior with a capacity of 250,000,000 gallons. Such a reservior could be built in two years, he states, at a cost of $600,000. In order to protect the water of the borough from pollution, Mr. Moffatt proposes to spend $75,000 for filter beds at Baisley's, in case it is decided that that water can be used. The report points out that the net income from the water department of the borough for 1898 will be $445,820, which will justify an additional issue of $3,940,000 in bonds to pay for the proposed improvements.

◆

WORK ON THE NEW CLEVELAND, O., WATER-works tunnel has been abandoned in the heading from the shore shaft lakeward, where the recent accidents from gas explosions have taken place. Hereafter all work on this section of the tunnel will be conducted from the first lake shaft shoreward. By working the single heading this section of the tunnel will, it is stated, be completed as soon as the portion farther out in the lake, and all danger from further explosions will at the same time be avoided. A full description of this tunnel was published in our issue of Aug. 11, 1898.

◆

THE BIRMINGHAM WATER SUPPLY, of England, is to be increased upon plans drawn up by Mr. James Mansergh and Mr. Gray, the corporation engineer. To this end the city has already acquired 45,562 acres of water shed on the rivers Elan and Claerwen, in Wales, about 73 miles from the service reservoirs of Birmingham. Storage dams will be built in the two valleys, storing about 18,000 millions of gallons of water and supplying 27,000,000 gallons per day to Birmingham. The present supply is about 18,000,000 gallons per day, with an average demand of 17,000,000 gallons, and an emergency daily demand of 22,000,000 gallons. The plans contemplate a tunnnel 6,600 ft. long, leading from one water shed to the other. Of the 74 miles of aqueduct, about one-half will be in cut-and-cover work and in tunnel; the longest tunnels will be 4¼, 2½ and 1¼ miles long. The other half of the aqueduct length will be in siphon; that across the Severn Valley being 17 miles long, with a dip of 547 ft. below the hydraulic grade line. The estimated total cost of the project is $29,255,000. It is the present intention to do all this work by the corporation; by day's labor.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Sept. 15, on the Denver & Rio Grande R. R., in Black Canyon, Colo., a few miles west of Sapinero, in which three railway employees lost their lives. According to reports an empty passenger train west bound ran into a pile of rock which had fallen from the sides of the canyon and was thrown into the Gunnison River.

◆

SPONTANEOUS COMBUSTION OF DUST in a grain elevator at Toledo, Ohio, on Sept. 20, caused an explosion and fire which cremated 8 men and fatally burned 8 more.

◆

THE "AURANIA" OF THE CUNARD LINE, which sailed from New York on Sept. 6 for Liverpool, broke her crank shaft on the morning of Sept. 13 while about 110 miles from Fastnet. She was sighted by the British steamer "Marino," from Montreal for London, and towed into Queenstown on Sept. 16.

◆

FIRE DESTROYED THE TOWN OF JEROME, ARIZ., on Sept. 11, depriving 1,500 persons of homes and killing between 10 and 20. The loss is estimated at about $1,000,000. New Westminster, B. C., suffered a like fate on Sept. 11, the entire town being burned to the ground. Several lives were lost and $2,500,000 worth of property was destroyed.

◆

A FIERCE HURRICANE swept over Barbadoes in the wnidward group of the Lesser Antiles on Sept. 11, and according to reports several hundred persons were killed and as many as 40,000 rendered homeless. The storm was accompanied by a tidal wave and heavy rains which added to the destruction. Kingston, the capital of St. Vinicent, is reported totally destroyed, and it is estimated that in this city alone 300 were killed and 20,000 made homeless.

◆

THE PROGRESS IN APPLYING AUTOMATIC COUPlers and train brakes is briefly stated in the first semi-annual report of the delinquent railways to the Interstate Commerce Commission. The report shows that of 294 petitioning carriers, 290 owned, on June 1, 1898, 1,153,290 freight cars, an increase of 20,567 over the number reported owned on Dec. 1, 1897. There are 119,614 freight cars reported equipped with automatic couplers and 67,202 reported equipped with train brakes in the six months ending June 1, 1898, which makes a total of 792,443, or 69% of the freight cars equipped with automatic couplers, and 510,636, or 44% equipped with train brakes up to June 1, 1898. Of 32,323 locomotives owned on June 1, 1898, there are 29,102, or 90%, which are equipped with driving-wheel brakes. There are 360,487 freight cars out of 1,153,290, or 31%, that are still unequipped with automatic couplers, and 642,654, or 56%, that are unequipped with train brakes, and 3,221, or 10% of the locomotives unequipped with driving-wheel brakes up to June 1, 1898. In explanation of this report, it may be stated that when the Interstate Commerce Commission granted the extension of the date when the Federal safety appliances law should go into effect until Jan. 1, 1900, one of the conditions was that every delinquent road should make a semi-annual statement of progress to the Commission.

◆

THE CONTRACT FOR THE CANTON-HANKOW Railway was signed in Washington by the Chinese Minister and representatives of the China Development Co., on Sept. 15. Ex-Senator Calvin S. Brice is the head of the American company, and this concession grants it the right to build and control a railway about 800 miles long, traversing the richest and most populous section of China. This road would connect with the Belgian road from Pekin to Hankow, now said to be under construction, and the coming connection of Pekin with the Siberian railway would make an all-rail communication between Canton and St. Petersburg.

◆

THE SHANSI, CHINA, IRON AND COAL CONCESsion to the Pekin syndicate of London was granted on May 21. The concession gives this syndicate the right to open and work the enormous coal and iron deposits in the Province of Shansi, described in Engineering News of March 31, 1898, and also the right to build and operate all railways necessary to connect these deposits with main trunk lines and navigable rivers. The bituminous coal measures cover 12,000 sq. miles; anthracite coal covers 13,500 sq. miles, in beds varying from 25 to 50 ft. in thickness; and excellent iron and petroleum abound in the same sections. This is the country examined and reported upon by Mr. C. D. Jameson, M. Am. Soc. C. E., and Mr. W. H. Shockley, M. E., also an American.

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THE PERUVIAN ANTHRACITE COAL DEPOSITS are reported upon by the Bureau of the American Republics. The deposits are on the summit of the Andes, in the Province of Hualgoyoc, and a twenty-year concession was granted to Mr. C. B. Jones, in 1892, covering a section of land 100 miles long and from 25 to 125 miles from the coast. Engineers from the United States are now surveying a route for a railway from Pacasmayo, on the coast, to the coal lands, and a line is already in operation from Pacasmayo to Yonan, a distance of 41 miles. The total distance from the coast to the mines by the proposed route is 121 miles. Mr. G. Clinton Gardner, late of the Pennsylvania R. R. and the Mexican National Ry., says that the supply of coal is almost inexhaustible, and 10,000,000 tons are within easy reach. He estimates that 2,000,000 tons can be mined annually and delivered at the sea cost for $2 per ton. The coal fields of the Andes include both anthracite and lignite, the anthracite lying on both the east and west slope of the mountain; that on the east lies 1,500 to 2,000 ft. below the summit, and is fully equal in quality to Pennsylvania anthracite. The railway will have to cross the Andes at an elevation of 14,000 ft. above sea level, though this summit is only 75 miles from the coast in a straight line. The Pacific Co., which has the exclusive right to mine the coal, is said to be backed by $20,000,000 capital; this company also has the exclusive right to build railways to the mines.

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THE PRODUCTION OF PETROLEUM in this country in 1897, according to the annual report of the U. S. Geological Survey, is almost exactly the same as in 1896, the figures being for 1897, 60,568,081 barrels, and for 1896, 60,960,361 borrels, which figure was the highest ever reached in the history of the industry. The total production since 1859, when the first oil well was drilled, at Titusville, Pa., amounts to 831,150,595 barrels.

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NEW RUSSIAN IRON AND STEEL COMPANIES are being constantly organized, according to foreign news items. The latest formed are as follows: The Riga Cast Steel Co., capital $375,000; the Gerlach & Pulst Machine Co., Warsaw, capital $500,000; the Falga Hardware Manufacturing Co., capital $200,000, and the Metalfabrik Co., of Kounl. formerly Schmidt Bros., capital $750,000. Most of these new works will need improved tools and machinery, and it is expected that much of this will come from America. There is also a large demand in Russia for railway supplies, including rail-benders, jacks, wrenches, track-drills, road-levels, etc.; but American manufacturers sending circulars to the several U. S. consuls for distribution should see to it that they are printed in Russian; any other course is a waste of time and effort. The trade in textile machinery is also a rapidly growing one in Russia. This machinery is now supplied by English and German firms; but energetic effort might secure a share of this trade for the United States. There are about 230 mills in Lodz, Poland, for the manufacture of cotton goods.

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THE INTERNATIONAL SOCIETY FOR THE TESTING of Materials has practically doubled in membership since the Stockholm Congress of 1897. According to the official list of members lately sent out, the membership in the several countries is as follows: Argentine Republic, 1; Australasia, 1; Belgium, 18; Chili, 1; Denmark, 39; Germany, 387; England, 83; France, 66; Holland, 48; Italy. 35; Japan, 1; Luxembourg, 5; Norway, 42; Austria-Hungary, 111; Hungary, 47; Portugal, 8; Roumania, 20; Russia, 315; Sweden, 68; Switzerland, 83; Servia, 5; Spain, 36; United States of America, 68. The total membership is 1,528. This society has for its purpose the unification of methods of testing materials used in construction, with the view of ascertaining their true technical properties and of improving methods of testing. The present President of the Society is L. V. Tetmajer, of Zurich, and American engineers desiring further information concernits objects should address Mr. Gus. C. Henning, Consulting Engineer, 220 Broadway, New York city. The annual dues are $1, or 5 francs.

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THE LARGEST DYNAMO IN THE WORLD is now being constructed by the Walker Co., of Cleveland, O., for the Boston Elevated Ry., Boston, Mass. This generator will have an output of 3,000 K-W. at 550 volts, or about 4,000 HP. Its speed will be between 75 and 80 revolutions per minute, its total weight 250,000 lbs., and the diameter of the circular cast-steel field frame 21 ft. 7 ins. The weight of this ring without field magnets will be 25 tons. There will be 24 inwardly projecting laminated cores and pole having a combined weight of 15 tons. The armature hub is 13 ft. in diameter and is in two parts, each of which weighs 10 tons. The shaft is 37 ins. in diameter. The armature laminations add 15 tons, and the armature will have in all 594 slots. The commutator will be 105 ins. in diameter, and will have 1,188 bars. To facilitate regulation and remove a portion of the strain from the shaft, the flywheel will be bolted directly to extensions on the armature hub. If this machine were to run at the speed of the Niagara generators, 300 revs. per min., it would have an output of 16,000 HP.

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A CONSOLIDATION OF THE WESTINGHOUSE ELECtric Mfg. Co., Pittsburg, Pa., and the Walker Co., Cleveland, O., has been officially announced. The capital stock of the Westinghouse Co. is given as $15,000,000, and that of the Walker Co. $2,500,000 with a like amount of bonds. This divides the street railway field between two companies, the General Electric Co. and the new combination.

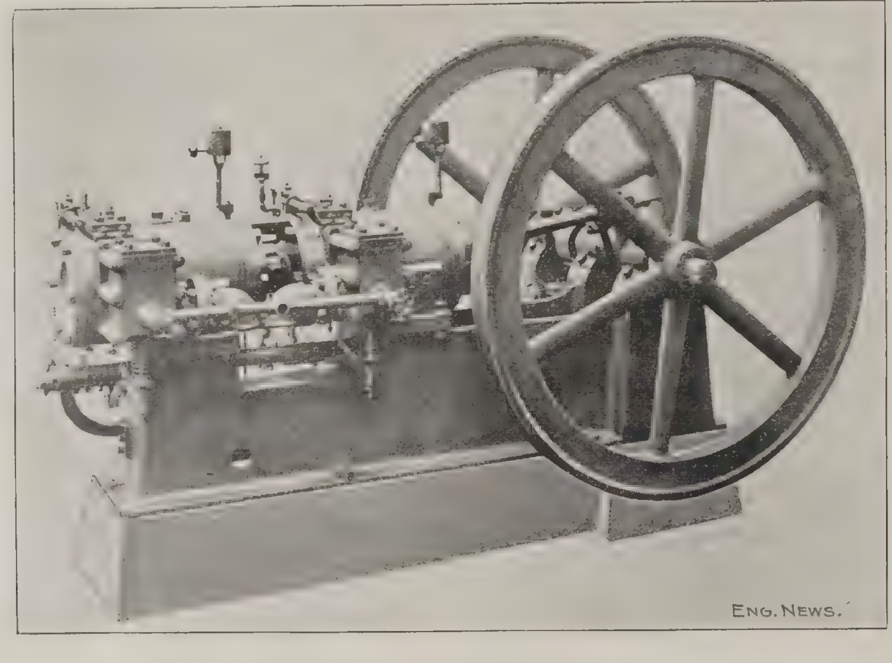
A NEW DOUBLE-CYLINDER GAS ENGINE.

One of the difficulties in the operation of gas engines is that of ensuring steadiness of running, the violent impulse given periodically to the piston by the ignition of an explosive compound within the cylinder tending to cause greater irregularity than in a steam engine where the impulse is given by a steady stream of steam, even under high pressures.

Steady running is a very important requirement, especially for electric light plants, and the double cylinder gas engine which we illustrate herewith has been designed specially to meet this requirement. This result is obtained by using two cylinders acting alternately on the four-cycle principle, thus securing a two-cycle effect, or an impulse at every revolution, instead of at every second revolution, while retaining the advantages due to the four-cycle system. The cylinders are placed tandem and have a single piston rod, and single connecting rod and crank. A sleeve supports the piston rod between the cylinders. The crank shaft is supported by three bearings, and has two outside-hung flywheels. The valves are of the vertical lift poppet type, operated from a rod driven from the crank shaft by means of a spiral gear. The fuel consumption is about the same as in a single-cylinder four-cycle engine, but there are twice as many impulses, each of which has only half the force of these in the single cylinder engine.

Gasoline or any kind of gas may be used, and for the former the charge is delivered by a feed pump. The charge is exploded by an electric-spark igniter, and the point of ignition can be changed while the engine is running. On the larger engines a compressed air starting device is used, in which the air drives the engine during its first revolutions.

These engines are built by the Frontier Iron Works, of Detroit, Mich., to whom we are indebted for information. They are made in several sizes, ranging from 10 HP. to 100 HP. on the brake, with speeds of 240 to 160 revolutions per minute, respectively. Most of the engines thus far built have been of 30 to 60 HP. Some of them are in use in driving electric light plants and others for driving pumps for water supply. All the engines are tested for steadiness at the works by driving a dynamo furnishing current to 300 to 600 incandescent lamps. The average variation is said to be only 2% to 3% under varying load, the effect on the lamps being practically as good as when the dynamo is driven by a steam engine. This is accomplished without the use of a heavy flywheel on the countershaft or any other regulating device outside of the engine.



DOUBLE-CYLINDER GAS ENGINE.
Frontier Iron Works, Builders.

DIAGRAMS OF JOHNSON'S STRAIGHT LINE FORMULA FOR DETERMINING THE STRENGTH OF COLUMNS.

By John S. Fielding.

(With full-page plate.)

The accompanying diagrams, representing the well-known straight line formula for determining the strength of columns, which were worked out by Mr. Thomas H. Johnson, M. Am. Soc. C. E., and published in the "Transactions" of that society for July, 1886, may be of interest and value to engineers. For some years the writer had had a number of tables of values of the straight line formula in use in his office. These tables had been prepared by an assistant, and some of them had never been checked, and, wishing to check them, an endeavor was made to discover some easy method for so doing. In the search for this method the writer found that since the length of the column is assumed in inches, the variation in such length for each foot is 12, and the value of the allowed unit stress varies by $b\,\frac{12}{r}$. The formula $9{,}000 - 40\,\frac{l}{r}$, $b = 40$ and $r = 1.0$, the variation is 480 lbs., and with $r = 1.1$, the variation is 436 lbs., and so on. From this it was concluded that the values could very well be plotted and made into a diagram. The five diagrams illustrated represent the formulas $9{,}000 - 30\,\frac{l}{r}$; $10{,}000 - 30\,\frac{l}{r}$; $9{,}000 - 40\,\frac{l}{r}$; $10{,}000 - 40\,\frac{l}{r}$, and also a diagram comparing the different formulas with values of y from 8,000 to 16,000 and with values for b of 30, 40, 50, 60 and 70.

Mr. Fielding's article and the diagrams accompanying it were sent to Mr. Thomas H. Johnson, the author of the straight line formula, with the request that he should give his opinion as to their value and usefulness. Mr. Johnson's letter in reply to this request is as follows:

Sir: I do not know that any diagrams representing the straight-line formula have ever been published, other than as illustrations to articles upon the subject in the "Transactions" Am. Soc. C. E., and in Engineering News. Certainly I have seen none developed on the plan of those submitted by Mr. Fielding. Mr. Fielding's scheme is all right, and I have no criticism to offer to it as a method of graphically representing the formula. I would venture to say, however, that the numerical values assigned to f and b, in the formula used Mr. Fielding, do not represent the true equation for strength of columns, as they have been arbitrarily chosen without regard to the mathematical relation to the elementary moduli of the material, and its resistance as a column. In the original paper on this subject ("Transactions" Am. Soc. C. E., Vol. XV., p. 517), it was shown that the straight line representing the strength of columns is a tangent to the curve of Euler's equation, which depends on the modulus of elasticity of the material. If the constants used are such that the line will not be tangent to Euler's curve for the given material, the line does not and cannot represent the law governing the problem. The law is represented by a straight line; but not by any straight line.

In Engineering News of Dec. 22, 1888, and again in the discussion of Mr. Waddell's paper on "Bridge Designing" ("Transactions," Am.Soc. C.E.,Vol. XXVI.,p. 115), I sought to check the tendency to the use of arbitrarily-chosen constants in the straight-line formula, by pointing out their dependence on the physical properties of the material. In the last-named paper I carried the subject further than I had done previously, and showed the relation that must be maintained by the values of f and b (Mr. Fielding's notation) in order that the equation may truly express the proper working stresses in the column.

Mr. Fielding presents five diagrams as follows, for the formulas:

$$P = 9{,}000 - 30\,\frac{l}{r};\quad P = 9{,}000 - 40\,\frac{l}{r};$$

$$P = 10{,}000 - 30\,\frac{l}{r};\quad P = 10{,}000 - 40\,\frac{l}{r},$$

and one for values of $f = 8{,}000$ to 16,000 inclusive, each in combination with values of b, of 30, 40, 50, 60, and 70. There is nothing to show what materials these respective formulas are intended to represent, nor whether for round, hinged or flat ends. I suppose, however, Mr. Fielding's object is simply to obtain the arithmetical solution of the equations as he finds them stated in various specifications. It is the persistent use of wrong constants in such specifications that I would like to correct if possible.

For any assumed value of f there can be only one value of b that will make the corresponding line a tangent to the curve of Euler's equation for the given material reduced to corresponding factor of safety, and for the same value of f the value of b will be different for each kind of material. The following table gives the correct values of b for wrought iron, mild steel (carbon 0.12), and medium steel (carbon 0.20) for the several values of f embraced in Mr. Fielding's diagrams, and for columns with hinged ends. The table assumes $E = 27{,}000{,}000$ for all three grades of material.

f	Wrought iron, b	Steel.	
		Mild, b	Medium, b
8,000	30	33½	36½
9,000	34	37½	41
10,000	37½	42	45½
11,000	41½	46	50
12,000	45	50	54½
13,000	48	54½	59
14,000	52½	58½	64
15,000	56½	63	68½
16,000	60	67	73

In Mr. Fielding's general diagram he gives too few values of b to make it available for all proper formulas. The only criticism which I have to offer is that these diagrams would tend to confirm instead of correcting the erroneous practice of writing the straight-line formula with arbitrary constants. You will note that my criticisms are directed chiefly to the latter. Yours truly,

Thos. H. Johnson, M. Am. Soc. C. E.,
Chief Engineer, P., C., C. & St. L. Ry.

Pittsburg, Pa., July 16, 1898.

* * *

EXPERIENCE WITH ACETYLENE GAS FOR CAR LIGHTING.

In our issue of March 31 last, we published some account of the experience with acetylene gas for car lighting on the Pontiac Pacific Junction Ry. Recently Mr. P. W. Resseman, general superintendent of this road, received a request for information concerning his use of this system of lighting from the Inspecting Engineer of the Government Railways of Egypt, Col. J. H. Western. From Mr. Resseman's reply we are permitted to publish the following extracts:

> We have been using the Holland system on the Pontiac Pacific Junction and the Ottawa & Gatineau Ry. for nine months. There is really no comparison between the effectiveness of acetylene gas and coal oil for car lighting. With coal oil at 14 cts. per gallon, and carbide at 5 cts. per lb., the cost of acetylene gas for car lighting is somewhat less than the same lighting by coal oil. I consider that it is the coming light for railways.
>
> We have in Canada a problem to face, however, that would not have to be met in any warm country. Owing to the severe frost in winter we have to place the gas generators inside the car to prevent them from freezing. The disadvantage of this lies in the fact that acetylene gas is most difficult to control, and the slightest leak in the generator causes a disagreeable smell in the car. This we hope to overcome and have been experimenting with better connections from generator to pipe.

I find that an ordinary passenger coach, such as we run here, previously lighted by 14 coal oil burners, can be brilliantly lighted with five 25-c. p. burners, consuming each ½-ft. per hour. The carbide supplies 5 cu. ft. of gas per lb., making the total cost of the lights 2 cts. per hour, or for a run of 4 hours, 20 to 21 cts. per car. Of course, there is incidental waste that we cannot get fully controlled. The gas is lost by the vibration of the car, but on the whole, the light is efficient and inexpensive. It is absolutely safe as far as fire or explosions are concerned. The gas is generated in small quantities, confined beneath a 7-in. column of water, and any that may escape is so speedily diffused in the surrounding atmosphere that its explosive nature is at once neutralized. In the event of a car turning over, the lights go out immediately, and the gas escapes so quickly that fire cannot affect it. So far we have had no accident from acetylene gas, and I cannot conceive how an accident can occur. In Egypt or South Africa, where the generators could be placed on the roof or underneath the car, no difficulty would be apprehended from the acetylene gas smell. We have three small generators in each car, placed directly over the top of the toilet-room inside the car. We have experienced very little trouble other than the escape of gas by improper connection. Low-pressure gas is not affected by heat or cold. The generators cost here $12. The carbide is sold here at $4.50 per 100 lbs. Side lights give us the best results. We are using the ordinary gas fixtures, and porcelain globes with 5-in. rings.

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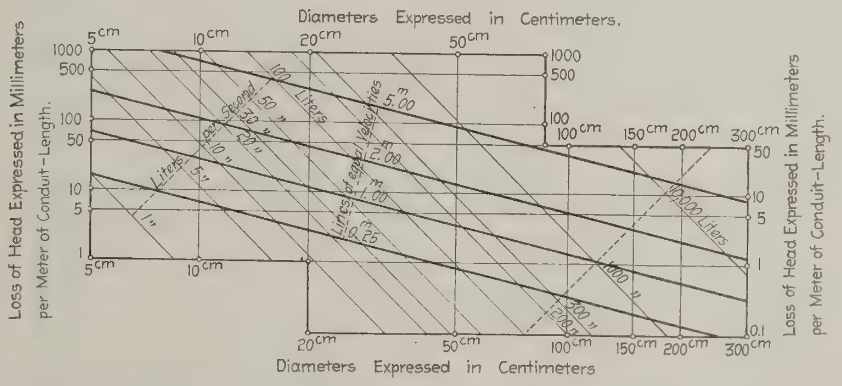
LOGARITHMIC DIAGRAM FOR CALCULATING THE FLOW OF WATER IN CONDUITS UNDER PRESSURE.

In "Le Genie Civil," for June 18, M. Jean Rey describes a logarithmic diagram for the calculating the flow of water in pipes under pressure, devised by Civil Engineer A. Van Muyden. He calls it a universal diagram, and proposes it as a useful and simple tool exact enough in its results to satisfy all ordinary requirements in hydraulic estimates.

The original diagram of Van Muyden was based upon the experiments of Mr. Darcy, made in 1857, with an empirical formula applicable to pipes up to one meter diameter, and was thus published in 1884. In a new edition of his work, just issued, Mr. Van Muyden employs the formula of Maurice Levy, and extends its applicability to conduits up to 3 meters diameter. The results are practically in accord with the Darcy formula from 0 to 3 meters; beyond that they diverge and more nearly approach the theoretical law.

In the simplified diagram here presented the abscissas represent the diameters of the conduit, and the ordinates the losses of head expressed in millimeters per meter of conduit length. The transverse straight lines represent the delivery in liters per second, from 1 to 40,000 liters. The other transverse lines join the points of equal velocities.

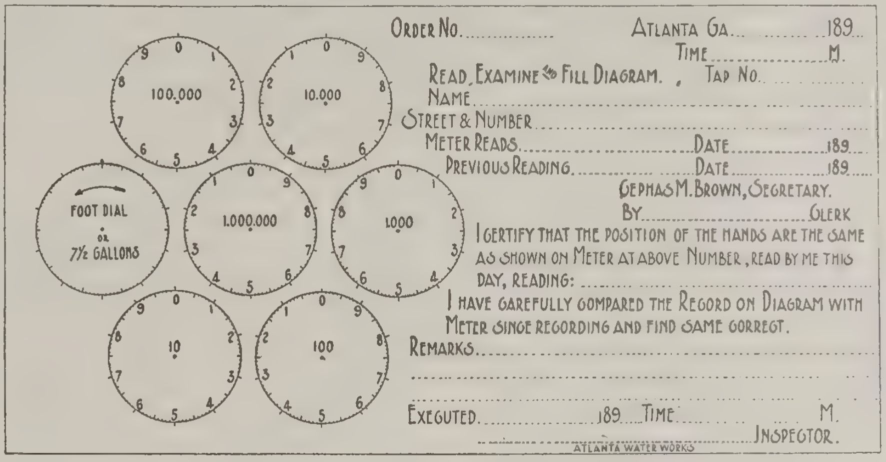


LOGARITHMIC DIAGRAM FOR CALCULATING THE FLOW IN CONDUITS UNDER PRESSURE.
Devised by A. Van Muyden.

A simple reading enables us to solve a variety of hydraulic problems. For example, the velocity of flow and the volume being given, the diameter of the pipe and loss of head can here be read; and this is true of the inverse statement. It is useful in calculating branches from a conduit, in establishing a flow for feeding a hydraulic motor and in arranging for the delivery from pumps, etc. The exactness of the diagram has been verified by numerous hydraulic installations in Switzerland, France and other countries. M. Rey deems the diagram so self-explanatory that he does not enter into further details.

A NEW FORM OF METER RECORD AT ATLANTA, GA.

The accompanying illustration shows a new system of recording meter readings which was recently put in operation at Atlanta, Ga. The reader uses a diagram on which the position of the hands is recorded, there also being a printed form to fill in, as shown by the illustration. We are indebted to Mr. Park Woodward, Superintendent of Water-Works, for the copy of the record blank reproduced herewith.


100.000
10.000
FOOT DIAL or 7½ GALLONS
1.000.000
1.000
10
100
0
1
2
3
4
5
6
7
8
9

ORDER NO............... ATLANTA GA... ....189..
TIME...................M.
READ, EXAMINE & FILL DIAGRAM. , TAP NO.. ... .
NAME...
STREET & NUMBER...
METER READS.......................DATE...............189...
PREVIOUS READING........... ......DATE..............189.....
CEPHAS M. BROWN, SECRETARY.
BY............................CLERK
I CERTIFY THAT THE POSITION OF THE HANDS ARE THE SAME AS SHOWN ON METER AT ABOVE NUMBER, READ BY ME THIS DAY, READING: ....
I HAVE CAREFULLY COMPARED THE RECORD ON DIAGRAM WITH METER SINCE RECORDING AND FIND SAME CORRECT.
REMARKS...
EXECUTED...................189....TIME............M.
..................................INSPECTOR.
ATLANTA WATER WORKS

METER RECORDING BLANK USED AT ATLANTA, GA.

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THE RAILWAYS OF THE UNITED STATES IN 1897.

From the advance sheets of Poor's Manual for 1898 the following statistics are taken relating to railway construction and operation in the United States for the year ending Dec. 31, 1897. As will be noticed, these figures cover railway operations for a period six months later than the statistics of the Interstate Commerce Commission, published in our issue of Sept. 1, 1898. The accompanying statement explains itself:

	Miles.
Mileage or railway	179,692.57
Second track, sidings, etc.	57,218.95
Total track	236,911.52
Steel rails in track	211,928.31
Iron rails in track	24,983.21

Number of locomotive engines		35,810
Cars	Passenger	25,275
	Baggage, mail, etc.	8,133
	Freight	1,229,335
Total revenue cars		1,262,743

Liabilities.

Capital stock	$5,453,782,046
Bonded debt	5,411,058,525
Unfunded debt	374,389,673
Current accounts	392,481,496
Total liabilities	$11,631,711,740
Excess of assets over liabilities	299,901,913
Total	$11,931,613,653

Assets.

Cost of railroad and equipment	$10,029,151,607
Real estate, stocks, bonds and other investmts	1,509,841,062
Other assets	222,089,700
Current accounts	170,531,284
Total assets	$11,931,613,653

Miles of railroad operated	181,132.70
Rev. train mileage:	
Passenger	342,464,408
Freight	500,326,372
Mixed	15,235,049
Total	858,026,179
Passengers carried	504,106,525
Passenger mileage	12,494,958,000
Tons of freight moved	778,385,448
Freight mileage	97,842,569,150

Traffic earnings: Passengers	$253,557,936
Freight	780,351,939
Miscellaneous	89,636,791
Total	$1,123,546,666
Net earnings	338,170,195
Receipts from other sources	95,013,907
Total available revenue	$433,184,102
Payments: Rentals, tolls, etc.	$58,600,768
Interest on bonds	231,046,819
Other interest	5,633,298
Dividends on stock	82,630,989
Miscellaneous	28,124,474
Total payments	$406,036,348
Balance, surplus	27,147,754

Summarizing some of the most important of the items in the above table and comparing them with the corresponding figures for 1896, we have the following results:

		Years		Rate of increase or decrease
		1897.	1896.	
Miles road operated.		181,132.70	180,891.19	+0.13
Tons, freight moved		788,385,448	773,868,716	+1.88
Freight mileage		97,842,569,150	93,885,853,634	—4.21
Passengers carried		504,106,525	535,120,756	—5.80
Passenger mileage		12,494,958,000	13,054,840,243	—4.29
Earnings	Freight	$780,351,939	$770,424,013	+1.29
	Passenger.	253,557,936	265,313,258	—4.43
	Other	89,636,791	89,894,754	—0.29
	T'l, gross	$1,123,546,666	$1,125,632,025	—0.19
	Net	338,170,195	332,333,756	+1.76
	Ton-mile,ct	0.798	0.821	+2.08

The share capital corresponding to the mileage completed at the end of 1897 equalled $5,621,340,647, against $5,373,187,819 in 1896, the increase equalling $248,152,828, the rate of increase being 4.6%. The funded debts of all the lines at the close of the year aggregated $5,516,056,292, against $5,461,856,598 in 1896, the increase equalling $54,199,694, being an increase of 0.99%. The other forms of indebtedness of the several companies at the close of the year equalled $380,769,705 against $344,499,969 for 1896, an increase of $36,269,736. The total share capital and indebtedness, exclusive of current accounts of all the roads making returns, equalled at the close of the year $11,518,166,646, an increase in the year of $338,622,260 over the total of 1896 ($11,179,544,386), the rate of increase for the year being 3.3%. The cost per mile of all roads making returns, as measured by the amount of their stock and bonded indebtedness, equalled $60,679 against $59,732 for 1896.

The total mileage of new railway constructed during the year was 2,188.43 miles, divided among the different groups of states as follows:

States.	Constructed in 1897.	Total mileage on Dec. 31, 1897.
New England	46.79	7,265.52
Middle	236.90	22,123.64
Central Northern	381.81	40,112.14
South Atlantic	310.46	20,496.75
Gulf and Mississippi Valley	407.98	14,918.93
Southwestern	415.62	35,533.88
Northwestern	107.39	29,719.59
Pacific	281.48	14,432.74
United States	2,188.43	184,603.19

A DIAGRAM FOR FINDING THE TRANSVERSE STRENGTH OF STEEL RAILS.

(With full-page plate.)

We are indebted to the courtesy of Mr. W. M. Wickham, of Wilkinsburg, Pa., for the privilege of reproducing the accompanying diagram for the ready computation of the transverse strength of steel rails, of the American Society of Civil Engineers' standard section, and of weights up to 100 lbs. per yd.

It will be seen that the diagram includes both beams fixed at one end and beams supported at both ends, and that bending moments up to 17,000 ft. lbs., and fiber stresses up to 15,000 lbs. per sq. in. are included, while lengths up to 30 ft. are given. Steel rails are now used so extensively in structural work, for foundations, etc., and in bridge and culvert construction on railways, that we believe this diagram will be found a great convenience by very many of our readers. While the diagram is plotted for the Am. Soc. C. E. section of rail, it can be used for almost any section with little error by measuring the height of the section and taking the corresponding height on the diagrams. The following explanation by Mr. Wickham gives a clear understanding of the manner of using the diagrams:

Diagram for Strength of Standard Rails Used as Beams.—Case "A." Given the length of beam, load, method of loading, and fiber stress to find rail section:

(1) Compute bending moment due to load in pounds feet, and from corresponding figure on lower side of diagram, trace vertically to corresponding Case line (a, if beam is fixed at one end, or b, if supported at both ends), thence to right to intersection with line marked the given length; thence vertically (up or down as the case may be) to the given fiber stress, thence to the right, passing through the required rail section.

Corrections to bending moments due to weight of rails are based on the supposition that the rail resists bending with a fiber stress of 10,000 lbs. per sq. in., so that great accuracy can only be expected when using that stress. Where great accuracy is required for other stresses than 10,000 lbs., first find a trial section, by proceeding as above, then with a bending moment equal to the sum of those due to the load and to the weight of that rail, as found above, trace through the diagram, neglecting, of course, the correction due to weight of rail. If the resulting section is the same as the one used in finding the bending moment due to weight of rail, it is the required section. If it is not, repeat the operation, using a new section until that rail is found, the bending moment due to the weight of which, added to that due to load, is the same as the one found by tracing through the diagram. Bearing in mind that for stresses less than 10,000 lbs. the diagram gives a section too small and for stresses above 10,000 lbs. gives sections too large, only one or two trials need be made to find the correct section.

Case "B." Given the rail section, load and method of loading, to find fiber stress: Compute the bending moment due to load and add to that, that due to weight of rail; from corresponding figure on diagram trace vertically to intersection of horizontal line between given rail section and the one next heavier, and note the position of the intersection with respect to fiber stress lines.

ANNUAL CONVENTION OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

The sixteenth annual meeting of this Association was held at the Manhattan Beach Hotel, Tuesday and Wednesday of last week. The morning session of the first day began with a fairly good attendance, and after the roll call, the President, Mr. G. T. Rogers, of the Binghamton R. R. Co., read his annual address, in which he said:

> Rapid transit in large cities has exerted a marked influence for the health, comfort and welfare of the resident poor and working classes, and has resulted in an equalization of real estate values, thereby avoiding a congestion of the population that has existed in the past, and creating better living conditions for all.
>
> The return upon the capital invested in street railway enterprises is generally overestimated by the public; many lines are constructed or extended and operated at an actual loss for years, but I believe that the public begins to see and appreciate the great advantage on their side, and that a more liberal policy will prevail.
>
> The resolution, recently offered in the City Council of New York, "No seat; no fare," is simply another manifestation of the old delusion that all that is necessary to get rid of an evil or an annoyance is to pass a law against it. The question is not one of making the companies do something they are not willing to do, but one of making them perform an impossibility.

Considering the question of municipal ownership, President Rogers insisted that neither state nor municipal governments should enter into industries that can be as well or better conducted by private capital.

The report of the Executive Committee stated that nearly all street railways in the state were members of the Association. The appointment of Hon. Edwd. O'Connor, as counsel, and his untimely death were mentioned. Attention was called to the fact that out of the 190 measures and amendments affecting street railways, which had been introduced in the state legislature during the year, only a very small proportion had become laws.

The first paper of the morning session, by Mr. H. M. Kennedy, General Passenger Agent Brooklyn Heights R. R. Co., Brooklyn, N. Y., was on

"Methods of Developing New Traffic on Street Railroads."

This was a consideration of the advisability of establishing the office of general passenger agent on street railways. Some of the duties of the general passenger agent were to establish happy relations with the press, to advertise the existing attractions of the road, and to establish or encourage the establishment of pleasure resorts, etc. As an instance of the successful outcome of advertising, an ice-skating rink, where the owners were losing money, was mentioned. The company was induced to invest in some posters, which were displayed on the street cars, with the result that the rink became a paying investment, and street railway traffic on the lines leading to it was largely increased.

Mr. H. H. Vreeland, President of Metropolitan R. R., of New York, said that his road was not engaged in stimulating traffic, but was doing its best to take care of the traffic it now had. In New York, on the long lines, the daily travel was almost uniform, and in winter the night traffic was the largest. On other lines throughout the country in which he was interested systematic methods of increasing traffic such as had been outlined had been adopted, and by special arrangement and advertising a considerable traffic had been built up. In only one case, however, had he recommended a railway company to build a pleasure resort. Generally speaking he was of the opinion that a manager operating his line in the proper way, which included his being out of the office a good part of the time, had little time for other things.

Other speakers described what had been done in the smaller cities of the state to stimulate travel, and it was the general sentiment that by catering to the respectable element and offering attractions suitable for women and children, operated either by the railways or under their direction, a substantial increase in traffic would follow, which would amply repay the time and money expended. The matter of bicycle riding was introduced, and, after a brief discussion, it was agreed that the use of the wheel was at least not increasing. It was further stated that by a system of charging for entrance to parks, etc., the railway company need not suffer from the use of bicycles, horses or carriages.

The next paper, by Mr. H. S. Cooper, of Schenectady, N. Y., entitled "Signal Systems for Single Track Roads," was a consideration of the requisites for a satisfactory signal system. In conclusion, ten rules were formulated, which must be fulfilled by a signal system before it could be considered satisfactory. The discussion on this paper was brief, but clearly indicated that there was no street or suburban railway signaling system on the market which could be called rapid, safe and satisfactory. The opinion seemed to be about as stated by Mr. W. Caryl Ely, of Brooklyn, "the only safe way to run a single track road at high speeds is to double track it, and that as soon as possible."

The third paper, "By-Products at Power Stations," by Mr. M. M. Penner, Fredonia, N. Y., was a description of the experience his company had had with the sale of exhaust steam. The trials and tribulations encountered with some early apparatus and the successful operation of a later type was amusingly told. In the course of his paper it was stated that the exhaust from a 100-HP. engine would heat 1,000,000 cu. ft. of building.

At the afternoon meeting, called for 3 p. m., the reading and discussion of papers was continued, the first one being by Mr. W. J. Clark, Manager of the Railway Dept. of the General Electric Co., on "Electric Railways as an Auxiliary to Coast Defense."

The next paper presented, and the one of greatest interest to engineers, was by Mr. A. J. Moxham, Assoc. Am. Soc. C. E., President of the Johnson Company, Lorain, O. We present it practically in full as follows:

"The Composition of Steel Rails to Insure Maximum Resistance to Wear."

Many years ago the London & North Western Ry. Co. reached the conclusion that what was known as a "soft" or low carbon rail gave the longest life. This was reinforced shortly afterwards by Dr. Chas. B. Dudley, of the Pennsylvania R. R., who gave the result of tests that on the face of them were to be relied upon. His paper was an able contribution to the knowledge of the day. His general conclusions led to the "soft" rail, and he went further and endeavored to determine by comparison a factor for each special chemical ingredient. His conclusions created something akin to a sensation, and they were bitterly opposed by the steel experts of the time. Perhaps the fact that the steel manufacturer of that day was not sufficiently master of the situation to economically produce the ideal rail, according to Dr. Dudley's standard, may account for a good deal of the opposition.

During the same period, however, notwithstanding these deductions, the tendency in actual specification was always toward higher carbon. The writer during this interval was a supporter of the "soft" or ductile steel for rails; and even to this day, and in view of what is to follow, it is to the writer's mind a questionable thing whether a steel of great ductility and only of moderate hardness is not the steel for steam railroad purposes. It must be remembered, however, that the problem of wear upon a steam railroad is a very different thing from that of wear upon a street railroad. The rail in steam railroad use presents a clean head, because the rail is not buried. It has to oppose principally a rolling friction, for the number of times per mile that steam railroad trains are stopped is very few, taking a general average. The street rail, on the other hand, has not only to meet this rolling friction, but has to contend with the grit from the surrounding road-bed, and with stops every few feet. Not only are the stops incomparably more frequent, but they are again multiplied into a greater number of units, as many individual cars are the rule on street railroads as against the occasional train of the steam road.

Being unable to reach positive conclusions from the published authorities and from personal contact with the steel experts of the country, or even from our own experience, it was determined to conduct experiments to this end. It was accepted to begin with, that it would be folly to try to finesse in the matter; that the best that could be done would be to try to find general, safe indications. When it is remembered that each chemical ingredient puts its own particular stamp upon the steel, and a different stamp in each particular combination with the other ingredients, and that the number of such combinations may be infinite; when it is remembered that each different heat at which the steel is rolled affects the problem; that the amount of draft put upon each successive pass should not be ignored, the necessity of this conclusion becomes evident.

The experiments have lasted for three years. The first endeavor was to take broadly a "soft" steel and a "hard" steel for the rails to be tested, securing the difference by carbon alone, leaving all other ingredients as nearly as possible the same. The experiment with these was started in Octoer, 1895, and has been continued ever since. In June, 1896, rails were added to the experiment, supplied by the West End Street Railway Co. of Boston, who at that time had determined (with wisdom as will be seen subsequently) upon a steel both hard and ductile. The conclusions, therefore, are based upon what may be described as soft steel, hard steel and steel both hard and ductile.

The rails (some 33 in all) were laid in the South 8th St. tracks of the Nassau Electric of Brooklyn. They were laid continuously, so that the same car is obliged to pass over every rail, and therefore each rail is subject to the same wear, and the wear on the head only is considered. Street traffic is ignored. This point was selected in order to reach early conclusions, as the cars pass this point at extremely short intervals, thus giving a considerable wear in a short time.

Every rail has been measured at two points, taken about 10 ft. from each end, in order to eliminate the special wear at the joints. Each rail has two cast iron boxes bolted to the outside, at the points to be measured, to permit access for purposes of measurement without disturbing the road-bed. Originally the wear was registered both by actual measurement and by taking an impression of the head of the rail by means of type-metal castings. Two slots were provided in the tram of the rail to guide the type-metal mold. Notwithstanding the great care that was exercised in taking the impressions, this method of measurement was quickly given up as the results were far from being as accurate as those taken by micrometer calipers. With these calipers, measurements of each rail were taken at three points across the head of the rail: point No. 1 being near the gage line; point No. 2 being nearly in the center of the head, and point No. 3 being nearer the outside of the head.

Speaking accurately, point No. 1 is 2 ins.; point No. 2 is 1⅝ ins., and point No. 3 is ⅞-in., all from the outside of a head 2¼ ins. wide. Methods were adopted for accurately locating the same lines, so that the comparisons in the different measurements of wear could be relied upon.

There were 17 rails of low carbon averaging 0.28; fourteen rails containing high carbon (0.59), and two were West End rails. The least wear shown was in the West End rail, the hard rail follows a good second, while the greatest wear is shown in the soft rail.

Table I.—Composition and Specific Gravity of Rails Tested.

	Soft.	Hard.	West End.
Carbon	.280	.59	.570
Silicon	.026	.056	.234
Phosphorus	.106	.097	.050
Sulphur	.066	.059	.078
Manganese	.790	.83	.980
	1 268	1.632	1.912
Iron	98.732	98.368	98.088
	100.	100.	100.
Specific gravity	7.855	7.841	7,825
Based on iron only, ignoring the metalloids	7.956	7.971	7.977

The average monthly wear amounted to .0007 in. for the West End rail, .0012 in. for the hard rail, and .0017 in. for the soft rail. The results of the experiments are conclusive on this point.

It will be noted in Table I. that the West End rails show a specific gravity of 7.825, the hard rails 7.841, and the soft rails of 7.855. But in considering specific gravity it had best be based alone upon the iron in the composition. It is well known that the other chemical ingredients affect the net result almost imperceptibly in the matter of weight, but very greatly affect density of the iron (which is the bulk of the composition) in the matter of its physical property. It will be found that where specific gravity is referred arbitrarily to the iron and the metalloids are ignored, or rather deducted, the specific gravity will tally closely with what is to be expected from the actual use of the metal. For instance in this case, ignoring the metalloids, the specific gravity of the iron in the different rails will stand as follows:

Soft rail	7.956
Hard rail	7.971
West End rail	7.977

It is interesting to note the very close relations of this arbitrary specific gravity to the relative wear as shown in the test. This is not a point to be ignored, because it is an exponent of the mechanical treatment, and it explains consistently in this, as in many other cases, why the material with apparently (but not really) the least specific gravity will show the best results in use. The analysis shows that what is needed, as may be expected, is the densest steel.

In the tension tests the results were as follows:

	Ultimate tensile strength, lbs. per sq. in.	Elastic limit, tension.	Elastic limit of compr'sion.
Soft rail	75,860	45,730	35,000
Hard rail	118,100	62,500	50,300
West End rail	120,380	53,160	47,100

The first column follows closely the determined wear.

Column two, it will be noted, does not follow the rule of wear, and in this is a lesson, the indication being that having secured a given amount of hardness, and consequently of strength, the more ductile the rail, the better the wear. In the compression tests the same lesson is learned. The elastic limit of compression standing as given in column three.

At a glance it would appear that the rail which compressed the least would wear the longest, but where difference in compression is indicative of greater elasticity without a sacrifice of ultimate strength, the more elastic rail is better.

As stated before, the only variation in chemical composition which we need look at in this comparison is the carbon, for while there is a slight variation between the two silicons in the given rails the total percentage of silicon in either is not a factor, and can therefore be ignored. The greater durability of the hard rail as compared with the soft rail speaks for the higher carbon, and it may here be noted, that so far as the higher carbon is concerned, it involves no higher cost to the street railway men.

On comparison the carbon of the West End rail is practically the same as that of the hard rail and the silicon considerably higher; but the real point of difference between the hard rail and the West End rail lies in the lower phosphorus and higher manganese. It is well known that the low phosphorus, accompanied by an increasing manganese, conduces to greater ductility. On this point, however, a word of caution is necessary. Any decrease of phosphorus from what is known as standard in Bessemer steel (0.10) can only be achieved at a greatly increased cost of manufacture, and therefore, so far as the chemical constituents of the rail are concerned, the whole problem to the street railway man is how far it is economical to go in lower phosphorus, the other hardening elements remaining the same. A steel such as is represented by the West End rail, or even a steel still lower in phosphorus it is possible to make, the question being purely one of cost. On to-day's basis an extra cost of $1.50 per ton on the low phosphorus steel is a low estimate; it would be safer to take it at $2.00. Taking the average price of girder rails at, we will say, $25.00, the extra cost of the low phosphorus would be 8%. What would be the increased wear of the rails?

The average monthly wear of the hard rail is	.0012
The average monthly wear of the West End rail is	.0007

On the face of it, it would appear, therefore, that those who could afford it were amply justified in demanding and purchasing the low phosphorus steel, but there is a hope for those who cannot afford it; and there is some doubt, after all, as to the advantages to be gained from the use of low phosphorus steel.

It is well known that a steel rail can be used until at least ½-in. is worn away from the head, or 0.5 in. On this basis, and taking the average wear of the different rails as shown in the test, it would take

25 years to wear away ½-in. with the soft rail;
35 years to wear away ½-in. with the hard rail;
60 years to wear away ½-in. with the West End rail;

and this is the case of a road which represents not average, but excessive wear; the rails in question having borne the wear of heavily loaded cars running on an average of 580 per hour for 20 hours per day, during the time of the experiments, or a two-minute headway. This means during the busy part of the day less than ½-minute headway, and during the night hours a wider interval. Taking the ordinary line, its average headway is greater than this, consequently the theoretical wear would be less. Now, all who are interested in electric roads, and have used girder rails are aware of the fact that nothing like this wear can be obtained in practice. This being the case we must look to something else besides quality of steel. The entire defect is in the rail joints used.

Had these measurements of wear been taken at the joints instead of elsewhere, the lesson would have been different. Rails are taken out of the track to-day, not because the rail as a whole has reached the point of destruction, but because the joints have become too bad for further use. It must be remembered that the experiments in question have not been extended long enough to show the effects upon the rail of the degeneration of the joints. On the wear at the joints reaching a certain point, the wear of the rail increases rapidly. For instance, in the soft rail the average monthly wear being .0017 during the time of this experiment, in 7 or 8 years from this date the wear will have continued to go on at a constantly increasing ratio, starting from the point of defect at the joint.

In the early days of girder rails the joint construction was so light that the joints quickly went to pieces. During later years, using a heavier rail and larger and better fitting splice bars, we have heard less of the joint question, for compared with the earlier roads the present track is smooth. Nevertheless, the evil still exists, and a few years from now those who to-day are deluding themselves in the belief that they have a long life for their existing tracks will awake to find out that even the construction of to-day is wasteful and extravagant. The joint which is accepted now as being passably fair is reducing the life of the rail to one-half, or perhaps even one-third of what it should be.

The conclusions to be drawn seem to me to be as follows:

First. That for street railway use, a hard rail will give the best results.

Second. That the most economical way to secure this hardness is by increase of carbon, accepting the manufacturers standard specifications for the other ingredients.

Third. That the next step should be towards an improvement of the joints.

As is well known to all present, the writer has pinned his faith to the electric welded joint as settling the question once for all, by making the union homogeneous with the rail and possessing an advantage from an electrical standpoint in the matter of conductivity. Nevertheless the cast-welded method also demands careful consideration. It is certainly preferable to anything in the nature of splice bars that we know of, provided one glaring fault can be overcome, viz.; the softening of the steel that occurs from the large body of hot cast metal located at that point, and it would appear that some means could be devised to overcome this evil.

Fourth. After making the joints perfect, what we have termed the "West End rail" would certainly justify its extra cost.

It is unnecessary to give the analysis applicable to each of these classes. I would caution, however, against the use of carbon as high as 0.59, as that was purposely taken high in what we term the "hard" rail in this experiment, the object being to reach an extreme. Carbon should be limited to from 0.50 to 0.55, with the usual leeway to cover manufacturing contingencies. It also remains a question whether the reduction of phosphorus to 0.08 (which may be done within economical limits of cost) will not give results so closely approximating the 0.05 of the West End rail as to make that figure an economical one. In any case the certainty exists that so far as the steel is concerned, a rail of the following analysis should give a theoretical wear, if the joint is perfected, of from forty or fifty years, viz.: Carbon, 0.55; silicon, 0.10 or under; phosphorus, 0.08 or under; sulphur, 0.06 or under; manganese, 0.83 or over, not to exceed 1.00.

The great lesson I would once more emphasize is that until you get the joints perfect you need not worry about the quality of your steel.

Anything in the shape of steel—the very cheapest you can buy will last longer than the joints will permit you to keep your rails in the track.

(Concluded on page 187.)

COST OF ELECTRIC POWER FOR STREET RAILWAYS AT THE SWITCHBOARD.*

By R. W. Conant.†

It is my privilege to be able to communicate to you facts and figures bearing on the operation of 44 power stations located at the important street railway centers throughout the country. These figures cover for the most part the operation of the stations during the past year, and include the experience on the roads in Boston. The aggregate capacity of power stations represented is 98,387 K-W., or 134,800 electrical horse-power. The total actual cost of operations for the production of power alone from these stations during the past year has been $1,825,000, and if the power had been produced by all at as low a cost as it was in a number of the more economical stations the savings for the year would have amounted to $443,300.

There is a great variety of opinion as to what should be included in the cost of power, and also as to whether the basis of comparison should be the car-mile or kilo-watt hour, this latter being due to the fact that up to within a few years there has been no reliable instrument for the measuring of station output. The car-mile basis is not a fixed standard. A car-mile up hill takes a great deal of power, while a car-mile down hill should take none and may be a source of power.

In the analysis of costs of operation of power stations of various sizes and types, it is first necessary to adopt a standard for the unit of power. We have seen that the car-mile is unreliable. Recording watt-meters are at present constructed which will measure the output in kilo-watt hours within a very few per cent. This statement is abundantly verified by actual experience and is gradually becoming universally recognized. It is no doubt difficult for one who has been accustomed to figure cost of power production on a car-mile basis to reconcile himself to the kilo-watt hour. It should, however, be very easy for the steam engineer who is accustomed to deal with horse-power, since the kilo-watt hour equals 1.34 electrical HP. hours.

It was evidently the idea of your executive committee in limiting the title of this paper to cost at the switch-board to abolish the car-mile and adopt the K-W. hour as the unit of power. In comparing the costs from the various stations I shall use this unit, and for the benefit of those who are accustomed to considering the costs per car-mile it will be interesting to know that on many roads a car-mile takes just about 1 K-W. hour. This is not true where grades and equipments are extremely heavy, for in such cases two or three times this amount may be required.

In the costs of power, whether it is produced by steam or water, should be included the fixed charges, as well as the cost of operation. Under fixed charges are interest, depreciation, insurance and taxes on the capital invested in the land, buildings and machinery of the power station. Under operating expenses are fuel, labor, supplies, repairs, superintendence and general expenses.

In both the fixed charges and operating expenses the component items vary between widely different limits, and it becomes impossible to construct a law that will predict the cost under all circumstances.

On the other hand, for one who has had experience it is comparatively easy to predict what the power ought to cost under a given set of conditions. What it will cost must, of course, depend on management.

In view of the variety of the circumstances governing these costs, I have deemed it advisable to establish for purposes of comparison a standard plant whose conditions are fixed. There is no intention to imply that the performance or equipment of this "standard" station is ideal, or could not be bettered, but rather to assume equipment and performance based on facts obtained from stations in actual commercial operation for some time.

This station may seem to border on the ideal, and there is no question but that its performance is consequent on favorable circumstancmes, very nearly we may say test conditions.

The station is assumed to be located on the water front, the exact spot is unimportant. The building and chimney are brick, erected on firm ground, requiring but little piling or filling. The capacity is assumed at 3,600 K-W.

For equipment three cross-compound condensing engines, cylinders 28-in. and 56-in. by 5-ft. stroke, are selected; speed 80 revolutions per minute; 150 lbs. steam pressure. There will also be 3-1,200 K-W. direct connected generators, 6 water tube safety boilers 500 HP. each; economizers and exhaust fed water heaters, electrically driven feed pumps and coal handling apparatus. Such a station would cost to install as follows:

Building, foundations for engines and boilers, chimney, coal handling apparatus, etc.	$120,000
Engines and condensers, heaters, separators and piping	91,800
Feed pumps and economizers	18,000
Boilers and flue connections complete	61,000
Generators and Switch-board complete	73,800
Land and docking facilities	17,000
Engineering and sundries	5,000
Total	$386,600

This gives about $107 per K-W. capacity.

To obtain the figure for fixed charges, I assume interest at 6%, insurance and taxes 3%, depreciation 2%, total 11%, which makes an annual fixed charge of $42,526.

I shall assume that this station produces 10,500,000 K-W. hours per annum, dividing the annual charge by this figure gives 0.4 cents per K-W. hour for the fixed charges. The depreciation is not intended to cover repairs which will be included under operating expenses. The 2% assumed for depreciation is to establish a sinking fund against the time when the station will have to be entirely replaced by one of more modern and economical design. The time of replacement is taken at 50 years,* although a few years ago this time should have been assumed much shorter, owing to the imperfect design of power station apparatus then existing. But with the present advanced state of the art, improvements cannot be expected to develop as rapidly.

In making comparisons between stations of different sizes and types, the cost of labor is the most perplexing item.

Some stations operate with two shifts, others with three. Some have engineers paid at different rates, and men which appear on the records of some are in a capacity which in others is absent or replaced by men of another class and rate of pay. I therefore give the following method of analysis of the labor item which gives satisfactory results when applied to station operation. The method can be illustrated and at the same time the operating expenses can be derived by applying it to our standard station. It is assumed that this station operates with three shifts of men, the duration of each shift being 8 hours. This makes the shift hours per day 24 or 8,760 for the year. The same number of shift hours would of course be obtained by two

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* Condensed from a paper read at the annual meeting of the American Street Railway Association held at Boston.

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* A sinking fund contribution of 2% per annum if placed at interest at 4% would equal the entire investment in only 28 years. See Wellington's "Railway Location," p. 82.—Ed. Eng. News.

TABLE I.—COST OF OPERATION OF VARIOUS STREET RAILWAY POWER STATIONS.

		Type.							Labor						Fuel						
Stations.	Capacity in 1,000 K-W.	Engines.	Generators.	Belted or D. C.*	Simple or compound.	Non-condensing or condnsg	Period avgd, days.	Load factor, %.	No. of shifts.	Length of shift, hours.	Total shift, hours.	No. of men pr 1,000 K-W.	Rate of pay, pr hour.	Output pr K-W. hour.	Lbs. per K-W. hr.	Price pr net ton.	Anthracite or bitu.	Cost per K-W. hr.	§General expenses per K-W. hr.	Total operating expenses, per K-W. hr.	Fixed chrgs.
Standard........	3.6	3	3	D. C.	C.	C.	365	33⅓	3	8	8,760	1.94	$0.27	$0.157	2.2	$3.00	B.	$0.33	$0.093	$0.58	$0.405
10..............	0.4	2	2	D. C.	S.	N.	1	24	..	..	.....	7.5	.18	...	...	2.00	.5 A.†	...	...	1.50	...
11..............	1.4	5	8	B.	S.	N.	365	23	2	12	8,760	3.7	.20	.32	6.7	2.24	A.	.75	.33	1.40	...
12..............	1.0	3	7	B.	C.	C.	365	23	2	12	8,760	3.7	.20	.31	4.3	2.93	B.	.63	.11	1.05	.44
13..............	2.6	4	4	D. C.	S.	N.	365	42	2	12	8,760	3.0	.22	,16	6.5	1.44	B.	.47	.09	.72	.24
14..............	1.6	4	4	Both.	S. C.	N. C.	365	19	2	12	8,760	1.87	.15	...	...	....	....	...	...	...	...
15..............	1.6	10	16	B.	S. C.	N. C.	183	41	2	12	4,380	6.3	.16	.25	6.5	2.10	B.	.68	.14	1.07	.24
16..............	1.6	8	8	B.	C.	C.	365	33	3	8	8,760	3.7	.20	.23	5.0	3.30	B.	.83	.09	1.15	...
17..............	0.8	2	4	B.	C.	C.	365	24	2	12	8,760	3.7	.18	.28	5.0	1.43	B.	.36	.06	.70	...
18..............	0.4	2	3	B.	S.	N.	365	..	2	12	8,760	3.7	.12	...	...	.75	B.	...	...	...	...
19..............	3.0	6	6	D. C.	....	....	31	..	2	12	744	3.0	.17	...	...	.60	....	...	...	.68	...
23..............	0.6	3	3	B.	C.	C.	183	16	2	12	4,380	3.3	.25	.51	6.0	3.44	B.	1.03	.16	1.70	1.00
25..............	4.0	10	19	B.	S.	N.	365	33	2	12	8,760	...	...	...	5.6	1.05	....	.29	...	.56	...
26..............	0.8	7	12	B.	S.	N.	365	19	2	12	8,760	...	...	...	6.8	1.15	....	.39	...	1.20	...
28..............	1.4	4	8	B.	S.	C.	31	23	2	12	744	5.0	.17	.37	7.0	1.63	....	.57	.08	1.02	...
29..............	1.9	5	5	B.	C.	C.	365	27	2	10	7,300	3.2	.21	.25	3.9	2.80	....	.55	.23	1.03	...
30..............	1.7	5	5	B.	C.	C.	365	23	2	10	7,300	3.0	.21	.27	3.3	3.00	B.	.49	.15	.91	...
31..............	0.9	3	3	B.	C.	C.	365	32	2	10	7,300	4.5	.21	.29	4.4	2.84	B.	.62	.19	1.10	...
32..............	5.3	5	30	B.	C.	C.	365	31	2	12	8,760	3.5	.20	.23	3.5	3.00	B.	.52	.09	.84	...
33..............	1.5	4	12	Both.	C.	C.	365	16	2	12	8,760	5.0	.20	.62	4.3	3.08	B.	.66	.22	1.50	...
34..............	2.0	4	4	D. C.	C.	C.	183	57	2	12	4,392	5.0	.20	.18	5.3	1.00	B.	.27	.12	.57	...
35..............	1.2	1	1	D. C.	C.	C.	365	37	2	12	8,760	2.1	.26	.15	4.7	1.24	B.	.29	.04	.48	...
37..............	1.5	3	11	B.	S. C.	N. C.	151	11	2	12	3,624	8.0	.16	1.10	7.3	1.75	.5 A.†	.63	.12	1.85	...
40..............	9.2	6	6	D. C.	C.	C.	365	36	3	8	8,760	2.7	.23	.17	3.0	1.60	A.	.24	.11	.52	...
42..............	1.8	3	6	B.	C.	N.	365	45	3	8	8,760	5.0	.26	.29	5.7	1.60	A.	.45	.18	.92	...
43..............	3.3	5	10	Both.	C.	C.	365	15	2	12	8,760	3.7	.16	.39	3.7	2.70	.6 B.‡	.50	.14	1.03	...
44..............	6.0	6	12	B.	C.	C.	365	30	3	8	8,760	3.3	.24	.26	3.5	1.60	A.	.28	.15	.69	...
45..............	1.0	4	7	Both.	C.	C.	30	28	2	10	600	3.0	.15	.16	4.7	1.90	B.	.45	.05	.66	...
47..............	0.75	4	4	D. C.	C.	C.	183	20	2	12	4,380	8.0	.12	.41	5.1	2.12	.5 A.†	.54	.21	1.16	...
48..............	0.6	2	2	D. C.	C.	C.	365	35	2	10	7,300	6.7	.15	.29	3.3	2.75	B.	.45	.28	1.02	...

*D. C.—Direct-connected. †.5 anthracite and .5 bituminous. ‡.6 bituminous and .4 anthracite. §Includes repairs, all supplies other than coal, superintendence and office expenses.

shifts of 12 hours each, as is the cast with some stations. For the three shift station, the first two probably would have the full complement of men, while the third would not, as the station might be shut down on that shift. But as there is considerable inspection, cleaning and overhauling, this shift requires almost as many men, though their rate of pay may be less. The highest rates of pay would be on the shift of heaviest load. The crew to operate the standard plant would be about as follows: Two engineers, 1 oiler, 1 helper, 2 firemen, 1 coal passer, a total of 7 men per shift.

The average rate of pay per man is taken at 27 cents per hour. This would be calculated from an actual station by dividing the total amount paid for wages, including the chief engineer's salary, by the product of the number of men operating with the hours each has worked. The number of men per shift for this station (7), divided by 3.6, which is the figure expressing the capacity in 1,000 K-W. units, gives 1.94 as the number of men per shift per 1,000 K-W. capacity. This figure will vary with the type and size of station, as we shall see later. Multiplying 1.94 by the rate of pay (27 cents) gives 52 cents as the cost of labor per hour per 1,000 K-W. capacity. This multiplied by 3.6, the number of 1,000 K-W. capacity, gives $1.87 as the total cost of labor required to operate the station per hour.

It will further aid in the analysis of the labor item to introduce the load factor. As this term is sometimes employed in a different sense from that used in this paper, I shall define it to be that per cent. which, when multiplied by the capacity of the station in kilo-watts and by the shift hours for the period gives the K-W. hours output for the time considered. In this case the average load factor for the year is taken as 33⅓%. The kilo-watt hours output of the station was given at 10,500,000, which is 33⅓% of 3,600 K-W. multiplied by 8,760, the shift hours per annum.

It has been shown above that $1.87 is the average cost of labor to operate the station for one hour, and if we obtain the average K-W. during the hour, which is K-W. hours for that period, a simple division will give the figure for the cost of labor per K-W. hours. The load factor gives the means of obtaining the K-W. hours, and by multiplying 3.6 by 1,000 and 33⅓% gives 1,200 as the average K-W. for the hour, or K-W. hours for that period. Dividing $1.87 cost of labor to operate the station per hour by 1,200 gives 0.157 cents as the cost of labor per K-W. hour. As 3.6, the figure representing the station capacity, was used as a multiplier in obtaining both the cost of labor $1.87 and 1,200 K-W. hours, it, therefore, disappears in the division and the expression for the cost of labor per K-W. hour is made independent of the capacity of the station to that extent. The rule then for obtaining the cost of labor per K-W. hour for any station is: Multiply the rate of pay of the men by the number of men per 1,000 K-W. capacity, and divide by the product of the load factor and 1,000.

The diagram, Fig. 1, gives the results of this expression for cost of labor for all usual rates of pay, load factors and men per 1,000 K-W. This diagram is based on a rate of 27 cents per hour, and there is also given a reduction table which gives the per cent. to be added or subtracted for other rates than this. To illustrate its use, suppose we have a station whose equipment requires five men per shift per 1,000 K-W. capacity. During a month of high output it might operate at a 30% load factor. On the diagram, following 5 up to 30 gives cost of labor at 45 cts. per K-W. hour. In a lighter month the station might operate at a 15% load factor. Following 5 up to 15 gives 0.90 cts., or twice as much for labor per K-W. hour.

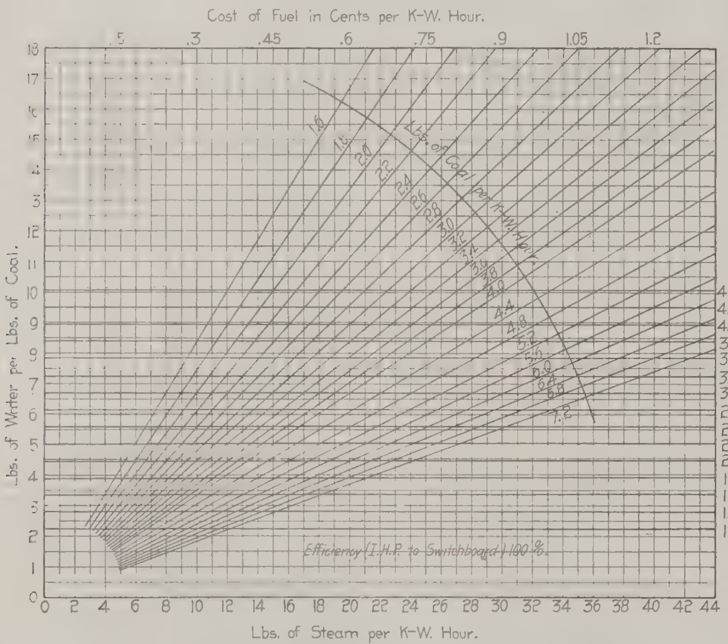

FIG. 2.—DIAGRAM FOR FINDING COST OF FUEL PER K-W. HOUR OF TOTAL OUTPUT OF A STREET RAILWAY POWER STATION, THE PRICE OF COAL, THE BOILER, ENGINE AND DYNAMO EFFICIENCY BEING KNOWN.

The diagram (Fig. 2) is calculated for 100% efficiency; for any other efficiency, add value given in right-hand column opposite that efficiency.

Per cent.		Per cent.		Per cent.	
Plant efficiency.	To be added to cost of fuel per K-W. hr.	Plant efficiency.	To be added to cost of fuel per K-W. hr.	Plant efficiency.	To be added to cost of fuel per K-W. hr.
60	67	82	22	92	9
65	54	84	19	94	6
70	43	86	16	96	4
75	33	88	14	98	2
80	25	90	11		

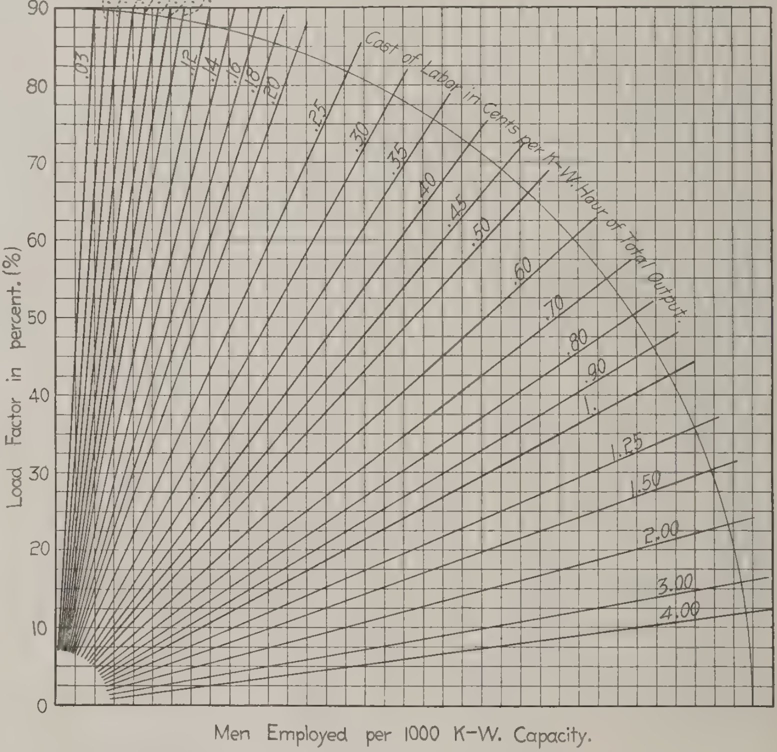

FIG. 1.—DIAGRAM FOR FINDING COST OF LABOR PER K-W. HOUR OF TOTAL OUTPUT OF A STREET RAILWAY POWER STATION, THE NUMBER OF MEN PER 1,000 K-W. CAPACITY, THE LOAD FACTOR AND THE AVERAGE RATE OF PAY BEING KNOWN.

The diagram (Fig. 1) is calculated on a basis of 27 cts. per hour as an average rate of pay. For any other rate add the percentage given in the right-hand column of the table opposite the rate employed.

Rate of pay per hour, cts.	Per cent. to be added or subtracted.	Rate of pay per hour, cts.	Per cent. to be added or subtracted.	Rate of pay per hour, cts.	Per cent. to be added or subtracted.
15	— 44.4	24	— 11.1	29	+ 7.4
17	— 37.0	25	— 7.4	30	+ 11.1
19	— 29.6	26	— 3.7	31	+ 14.8
21	— 22.2	27	0.0	33	+ 22.2
23	— 14.8	28	+ 3.7	35	+ 29.6

The cost of fuel is the next item to be considered in the operating expenses of the standard station. Considering coal as the fuel used, its cost per K-W. hour depends on the price per ton and on the efficiency of the station, which is best expressed in pounds of coal consumption per K-W. hour. The coal for standard station is assumed to be clear bituminous, costing $3 per short ton delivered.

As to the efficiency, I am able to quote from tests on a station of the same size and similar equipment. The duration of the test was 45 hours, made under actual conditions of railroad service during the day, and at night the load was kept on the station by means of a water rheostat. The average efficiency of transformation, I. HP. to E. HP. at the switch-board, was 90%. The steam consumption of the engines was 14.5 lbs. per I. HP. hour. The boiler evaporation was 9.4 lbs. water per lb. of coal from actual conditions. The coal used was New River bituminous. The economy of the station, represented by the coal consumption in lbs. per K-W. hour was 2.3. I have therefore assumed 2.2 for this figure for the standard station.

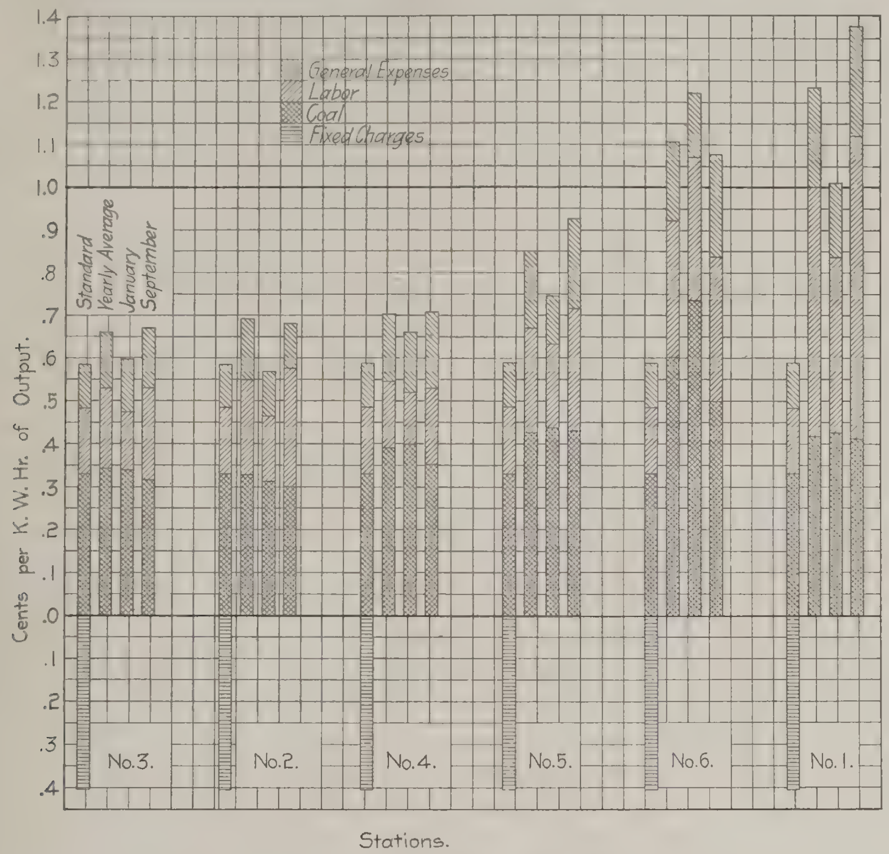

FIG. 3.—COSTS OF FUEL, LABOR AND GENERAL EXPENSES PER K-W. HOUR OF TOTAL OUTPUT IN SIX STREET RAILWAY POWER STATIONS.

(In each group of four lines, the first line gives the operating expenses (and fixed charges plotted below the base line) of the "standard" station, the second gives the average for the year's output for the station under consideration, the third is for a month of the heaviest load (January), and the fourth for a month of the lightest load (September).

Reducing price per ton to price per pound and multiplying by 2.2 gives 0.33 cts. as the cost of coal per K-W. hour. This appears in table I. under cost of fuel. As an illustration of what the cost would have been had the engines required more steam, say 26.6 lbs. per I. HP. load, as might be the case with a non-condensing engine, referring to the fuel diagram, Fig. 2, and considering the electrical efficiency boiler evaporation and price of coal to remain the same, 26.6 to 9.4 lbs. water per lb. of coal gives 3.8 lbs. coal per K-W. hour. Following this line down to horizontal $3 coal line and verticaly upwards from this point to cost of fuel in cts. per K-W. hour, we obtain 0.57 cts., were the efficiency of transformation 100%, but since it is assumed to be but 90%, 11% has to be added to this cost, as shown in the reduction table. This gives the cost of coal per K-W. hour 0.63 cts., as against 0.33 for the condensing engine.

There remains to be included in the operating expenses for this station water, oil, small supplies, repairs, superintendence and general expense, which I have estimated at 0.093 cts. per K-W. hour. The total operating expense foots up to 0.58 cts., which, added to the fixed charge of 0.4 cts., makes the total cost power from standard 0.98 cts., or very nearly 1 ct. per K-W. hour.

The application of water power to street railways has the following points of advantage. In plants operated under any but very low heads the generating machinery may be installed at a less cost than for steam. Also the fuel expense disappears, as well as a portion of the cost of repairs. A part of the labor expense will be saved, inasmuch as no engineers, firemen or coal handlers are required.

Water power produced in various parts of the country varies greatly in its cost. It is reported that the electrical energy so produced costs from $14 to $32 per annum per K-W., continuous output. This expense is largely made up of fixed charges, which increase rapidly as the expense of making the necessary improvements is greater. The standard steam plant produces power with $3 coal for $29, and with 80-ct. coal for $22 per K-W. per annum, which compare very favorably with the above for water power.

There can be no general rule given that will determine whether it is more advantageous to use water or steam power. Each case must be figured by a competent engineer, and decided on its merits.

I have compiled and classified the data of a number of representative street railway plants throughout the country which are given in Table I. In this, the numbers at the top, 10, 11, 12, etc., indicate the several stations, while the figures in the vertical columns are the data for each station derived from records extending over some time. The first column, headed S, refers to the standard hypothetical station above described. The left-hand column explains itself, the first portion describing the plant equipment, the number and kind of engines and generators, etc., the remainder giving labor, fuel and general expenses, the latter including repairs, supplies other than coal—that is, water, oil, waste, lamps and miscellaneous, as well as superintendence.

As a supplement to the table, in order to more clearly illustrate the relation of the costs, I have constructed diagrams (Figs. 3 and 4), in which the principal items of cost are plotted and the costs in the different stations are more readily comparable. In Fig. 3 the variations in the cost in the same plant at different seasons is also shown. The third line in each of the groups represents the operating expenses for January, a month of heavy load, and the last column, that for September, a light month. The first line in each group shows the operating expenses and fixed charges for the standard station. It will be seen that in general the fixed charges are approximately equal to the coal cost. Labor is roughly about half the coal, and general expenses about half the labor. These proportions are simple and easily remembered.

The author describes in some detail the equipment of the six stations, whose expenses are set forth in Fig. 3, showing the causes for increased or decreased expenditures over those of the standard station, as indicated by the diagram. To illustrate the utility of this form of diagram, and these in particular, we select two examples. The first is a large direct-connected plant and the second a small belted station, of which the author says:

Group 4 (Fig. 3) illustrates a large station including 6 1,200-K-W. generators direct connected to triple condensing engines, 2 1,500-K-W. generators direct connected to compound condensing engines, and an auxiliary plant of 40 62-K-W. generators belted to compound non-condensing engines and only used in case of emergency. Economizers, heaters and electric feed pumps complete the important part of the equipment. Group 4 indicates the costs for this station. The yearly average shows that we are approaching standard figures in labor. This item is not much less as the units are only slightly greater capacity. Load factor, rate of pay and men per 1,000 K-W. correspond very closely with standard. The general expense and coal bring the total somewhat higher. General expense is high on account of the heavy repair account. The station is about eight years old and repairs are heavy, due to replacing of worn out parts. The decrease in efficiency, as shown by the pounds of coal per K-W. hour, might be shown by a test to be due to old boilers.

Group No. 6 represents the costs for a belted plant of about one-fifth the capacity of the standard. Its equipment is 12 generators belted to 4 simple high-speed non-condensing engines. There are feed water heaters, but no economizer. High coal consumption is the feature of this diagram. The cost of fuel alone for the year is equal to the total operating expenses for the standard. Labor is also high, and the total cost of power per K-W. hour is nearly double the operating expense of the standard. This station furnishes a good illustration of the effect on the cost of power of a simple non-condensing belted equipment. It is to be remarked also that this plant has the benefit of a high load factor.

The diagrams given in Fig. 4 are plotted in the same way as those given in Fig. 3, the difference being that only the yearly average is given in each case. In examining the different stations represented the same method of analysis is followed. The author takes up each station separately, calls attention to the large or small expenditure for any one item, and traces this back to determine the cause. The equipment is in most cases outlined and other information given which can be obtained from Table I. It will be noticed in Fig. 4 that the lines representing stations 34, 35 and 40 are shorter than the standard, showing that the standard plant so fully outlined by the author is well within possible practice. In referring to the diagrams for these stations, the reason for the remarkably small operating cost is briefly explained as follows:

Station No. 34 operated at a lower cost than standard on account of the high load factor, 57%, reducing the cost of labor, and the low price of coal, $1 per ton. No. 35 is a one unit plant of 1,200 K-W. capacity. It operates with 2.1 men per 1,000 K-W., and a load factor of 37%, using coal costing $1.24 per ton. Its costs are quite a little lower than standard. No. 40 has a capacity of 9,200 K-W. It is direct connected, has economizers and compound condensing engines. Anthracite coal is burned, costing $1.60 per ton. This plant operates at less than standard figures. No. 37 is a record breaker in the opposite sense. It is of slightly greater capacity than 35, but has 3 engines and 11 generators, which require 8 men per 1,000 K-W. capacity. It has a load factor of but 11% during 151 days, from Jan. 1 to May 31, 1898. The effect of this on the cost of labor is very apparent. The cost of coal in this case is greater than the total operating expense for standard. This station pays but $1.75 per ton, but it uses 7.3 lbs. per K-W. hour, while No. 35, about the same size plant, pays $1.24 for coal, and uses but 4.7 lbs. per K-W. hour. Labor is easily 7 times as large in 37 as in 35. The load factor of 11% as against 37% would make this item three times as great, and 8 men per 1,000 K-W. as against 2.1 would again increase the cost of labor three times. The higher rate of pay in plant No. 35 prevents the discrepancy being greater.

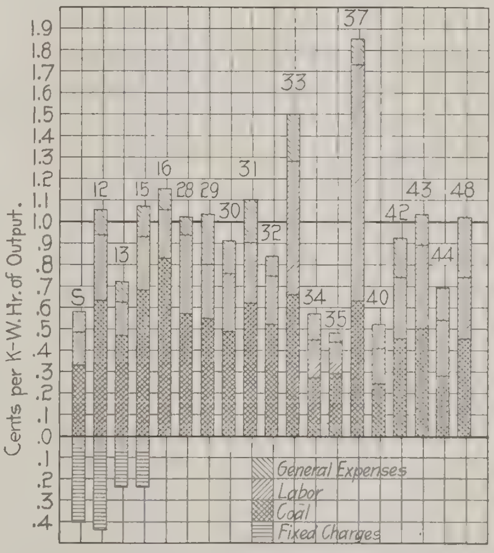

Fig. 4.—Costs of Fuel, Labor and General Expenses and Fixed Charges per K-W. hour of Average Yearly Output, in Various Street Railway Power Stations.

(Plotted from Figures in Table I.)

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In the report of the meeting of the New York Street Railway Association, in another column of this issue, will be found an interesting paper by Mr. A. J. Moxham, Assoc. Am. Soc. C. E., describing tests to determine the proper composition of steel rails to secure the best wearing qualities. The conclusions he reaches as the result of actual test of rails in the track are that high carbon rails wear better than low carbon rails, but that rails of high carbon with low phosphorus wear better than either. These conclusions are in entire accord with the opinions of the majority of expert metallurgists at the present day, who have given this subject consideration. That rails of fairly high carbon give better wear than the soft rails which were advocated some ten years ago is now attested by the practice of most of the leading railway companies in this country. The question which Mr. Moxham's paper leaves unsolved, however, is whether it will pay to specify lower phosphorus than the ordinary Bessemer practice gives in rail compositions, in order to secure still longer life for the rails. In street railway practice, Mr. Moxham says, the life of the rail is fixed by the wear at the joints, and he concludes that so long as this is the case, the Bessemer quality rail is as good as the low phosphorus rail. It seems to us, however, by no means impossible that by putting a better quality of steel in the rail, a longer life might be secured for the joints. The joints get low because the splice bars wear the under side of the rail head, and fail to give it the support it should receive. Now, if low phosphorus steel reduces the wear on the top of the head, there is good reason to suppose that it might also reduce the wear at the joints, especially if a similar grade of steel were used for the splice plates. Again it will be noted that the wear which Mr. Moxham measured in his experiments was the wear upon rails laid on a tangent. On steam railway lines, however, a large proportion of the track is on curves, where the wear is much more rapid. If, therefore, by paying $2 per ton more for a rail of lower phosphorus, its resistance to wear can be increased some 70 per cent., the matter is one which managers of both steam and street railways will do well to carefully investigate.

Mr. Moxham's estimate of $2 per ton as the extra cost of a rail of .050 phosphorus over a rail of .097 phosphorus, is, we presume, based on the acid process, using a higher grade of ore in the blast furnace. It is quite among the possibilities, however, that in the near future it may be possible to secure basic steel rails with even less phosphorus than that above specified, and at an increased cost little or no greater than the $2 per ton estimated by Mr. Moxham for 0.50 phosphorus acid steel. Such rails should safely take a considerably higher percentage of carbon than the rails tested by Mr. Moxham, and the final result should be a rail of maximum hardness, combined with high elastic limit and ultimate strength and entire safety against breakage in the track.

◆

The widening of the gage of railway track on curves is discussed at some length in a report made by a special committee of the Roadmasters' Association of America, at the annual convention held last week at Denver, Colo., and fully reported elsewhere in this issue. As many of our readers will remember this subject was brought up anew about a year ago by the committee of the American Railway Association on wheel and track gages. According to the report made by this committee (Eng. News, Oct. 14, 1897,) a considerable number of railways, including several well known for the excellence of their track construction, had abandoned or else had never adapted the practice of widening the gage on curves. On the other hand, a number of railways widened curves as flat as 1°, although hardly any two roads used the same rule for widening. A more notable feature of the report, however, was not only the great variety of practice that was shown to exist but the fact that the ideas of railway managers regarding the reasons for widening the gage were as diverse as their practice. In discussing this report in our issue of Dec. 2, 1897, we pointed out that while many railways did not widen the gage on curves this was due in a great many cases to the fact that the maximum curves on those roads were not sharp enough to demand theoretically that the gage should be widened in order to pass the locomotives and cars in common use. In the same issue we published and discussed at some length a paper by Mr. Wm. H. Searles, M. Am. Soc. C. E., which presented clearly the mechanical reasons for widening the gage on curves, and gave a number of simple formulas for calculating any special case which might occur in ordinary practice. The committee of the Roadmasters' Association which reported at Denver last week, it will be noted, indorse with slight modifications the argument and formulas given by Mr. Searles in his paper published in our issue of Dec. 2, 1897. For practical use by trackmen, however, the committee recommends the inclusion in these formulas of a factor of safety to allow for the failure of the swing motion of locomotive trucks to work perfectly, and also for irregularities in wheel gages. The amount of this factor of safety and the method of including it in Mr. Searles' formula are clearly stated in the abstract of the committee report published elsewhere, and will not be restated here. The report of the committee is on the whole an excellent one, and it must be admitted, we think, that it is very timely. As we pointed out in our issue of Dec. 2, 1897, there is no theoretical or practical reason for such diversity of opinion and practice as now exists among trackmen in this problem of curve construction. By setting this fact clearly before trackmen and giving them a simple and reliable standard of practice for all conditions of curvature and locomotive wheel base, the committee of the Roadmasters' Association has done a commendable piece of work.

◆

One of the most serious sources of complaint in the present war has been the treatment which the soldiers received on board the transports, while en route to Cuba and Porto Rico and on the return journey. From authentic reports it appears that in many cases the soldiers were subjected to conditions beside which the steerage accommodations on a merchant vessel may be considered palatial. The reason for this was that at the outbreak of the war, the Government had not a single vessel at its command fitted up as a troop transport. The best that could be done was to take merchant vessels and fit up such temporary bunks, etc., as time permitted. The absence of proper ventilation systems, sanitary conveniences and cooking arrangements on the vessels made the voyages upon them a severe ordeal even for men in robust health; and was doubtless responsible for no small amount of illness and for deaths among the sick and invalids who had to be carried on these vessels.

This great defect in our army system is now to be remedied by fitting up a number of the Government transports as regular troop ships with the most approved appliances and conveniences. No less than eleven vessels are to be thus fitted up, and the first of these, the "Mobile," is already at the Cramp yards in Philadelphia for that purpose. From the present outlook the transport of troops to and from Cuba, Porto Rico and the Philippines is likely to be frequently necessary in the future; and the fitting of vessels to carry comfortably large numbers of soldiers is a most sensible one.

◆

An excellent illustration of the fact that it costs much more to heat the fresh air that must be supplied for good ventilation than merely to maintain the temperature of a room or building is afforded by the heating and ventilating plant of the new buildings of Columbia University. These buildings are supplied with enough direct steam radiators to overcome the loss of heat through walls, windows, etc., and the entering fresh air for ventilation is blown over stacks of heating pipes so that it enters the rooms at a temperature of about 70°. The buildings have a total cubic contents of about 9,700,000 cu. ft., the heating surface in the direct steam radiators is about 56,000 sq. ft., and the ventilating system is designed to furnish about 50,000,000 cu. ft. of air per hour. When the outside air is at zero, the steam consumption of the plant is estimated as follows, in horse power: Condensed in direct heating radiators, 560 HP.; condensed in heating stacks in connection with blowers, 2,205 HP.; power required for electric motors operating blowing and exhaust fans, 635 HP. In other words, the heating and distribution of the fresh air for ventilation takes about six times as much coal as is required to simply maintain the inside temperature of the buildings. In a lecture describing this plant, delivered before the Engineering Society of Columbia University,* Mr. G. A. Suter, under whose direction the plant was constructed, gives the following useful figures from the experience with this plant:

1 HP. of steam supplies 100 sq. ft. direct radiating surface.

1 HP.-hour of steam supply heats 20,000 cu. ft. of air from zero to 70° F.

1 HP. on the shaft of an electric motor driving a blower will move 75,000 cu. ft. of air per hour into and out of the rooms.

The very large amount of power required for moving the air will be, we presume, a surprise to many engineers; but it is to be remembered that as all the exhaust steam is utilized for heating and the power applied to the air, for the most part, also appears as heat, the fan system of heating and ventilating is really not so expensive in operation as might at first sight appear.

◆

TYPHOID FEVER IN THE ARMY.

If one were asked what topic had been uppermost in the minds of the American people during the past few weeks, there could be but one answer, the condition of the returning troops. It is, or was, a common idea that army service is calculated to toughen a man. The trooper who left home pale and stoop-shouldered was expected to return from a season of drill and camp life bronzed and straight, with muscles hardened, and constitution fitted to endure hardship and fatigue. This is the ideal. The reality is that a wofully large percentage of the men who left home in perfect health and passed a medical examination of great rigor are now returning as

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*The lecture is published in the "School of Mines Quarterly" for July, 1898.

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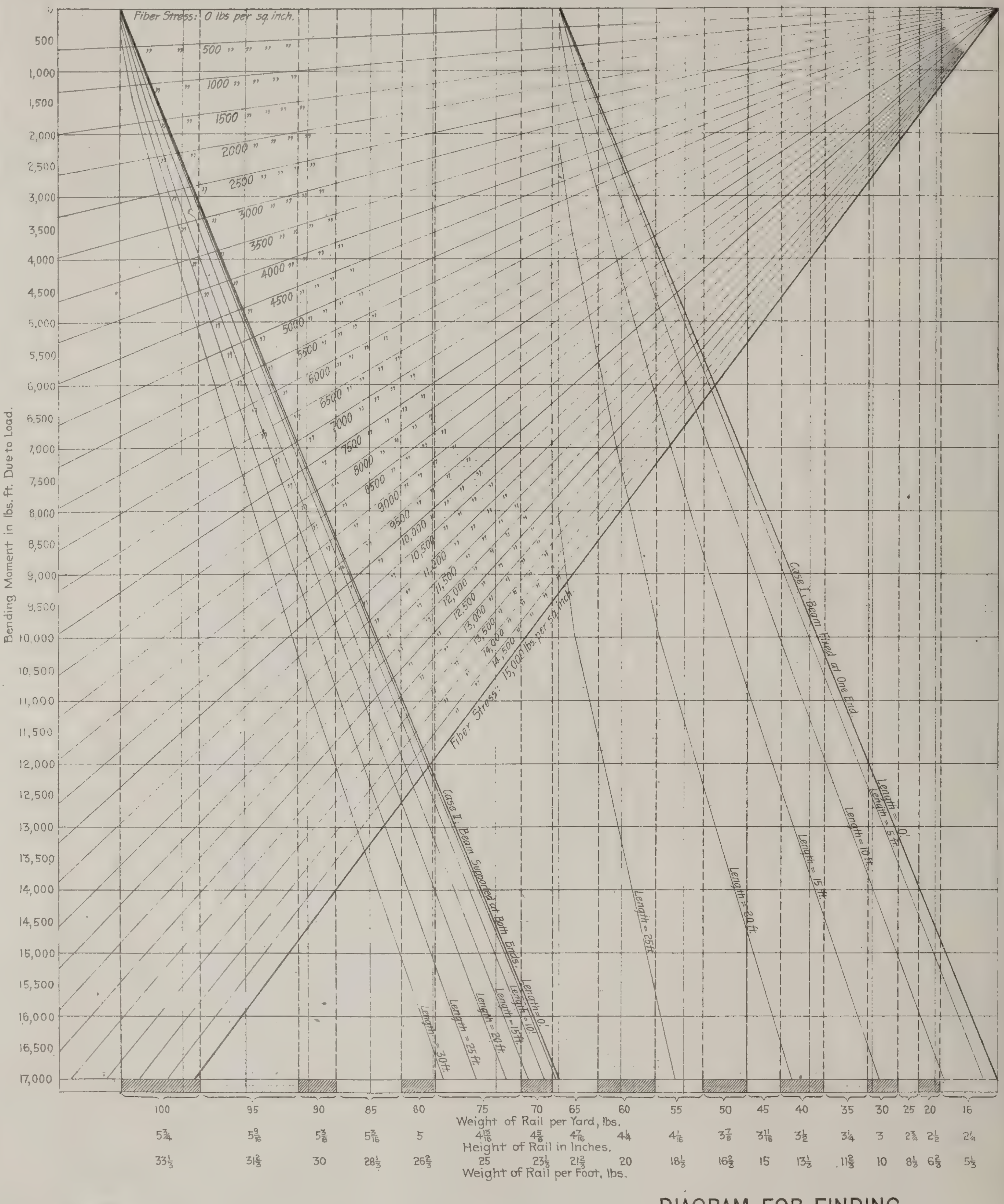


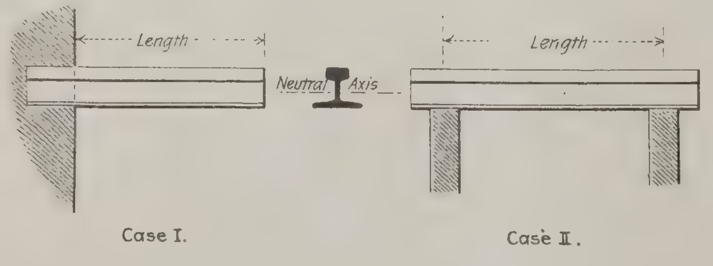
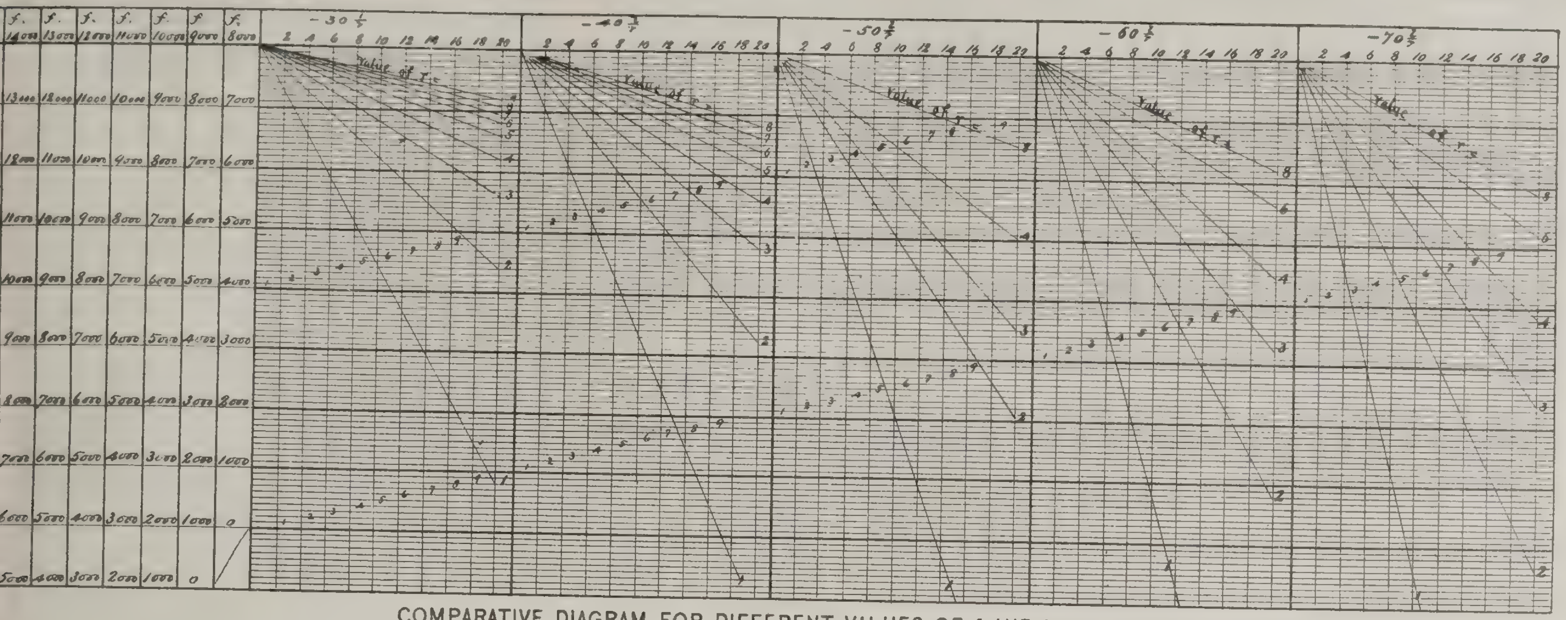


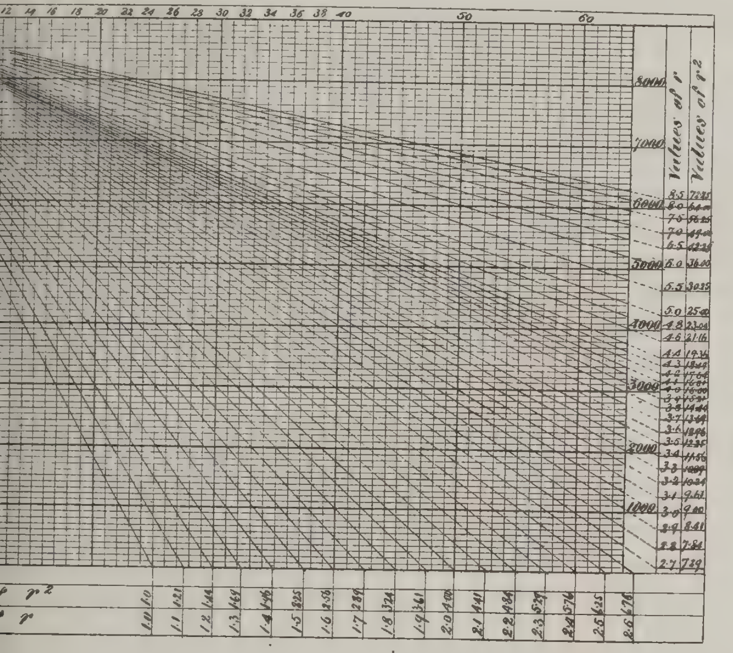
DIAGRAM FOR FINDING THE TRANSVERSE STRENGTH OF RAILWAY RAILS.

Compiled by W. M. Wickham,
Braddock, Pa.

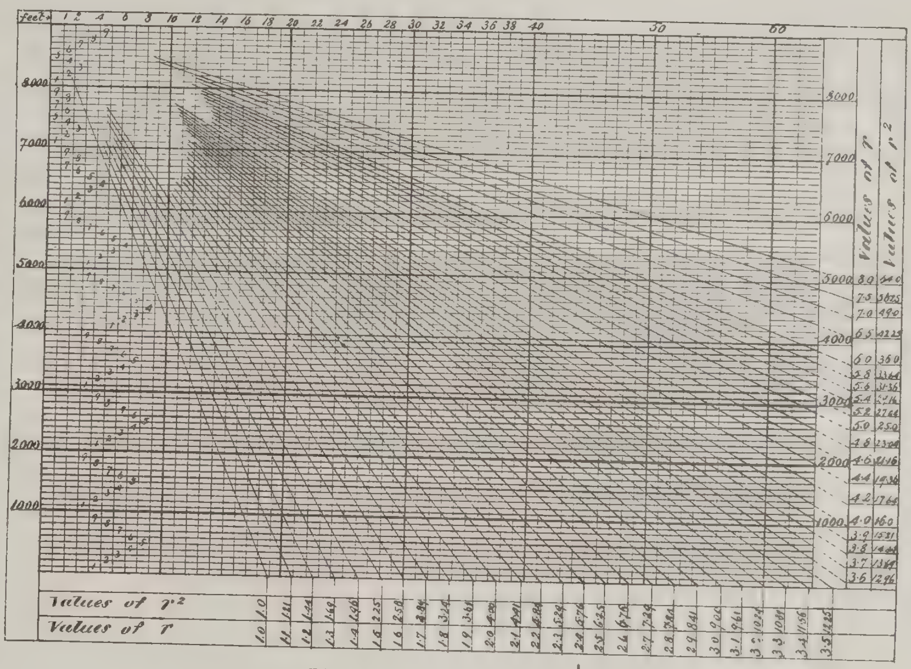


COMPARATIVE DIAGRAM FOR DIFFERENT VALUES OF f AND b.

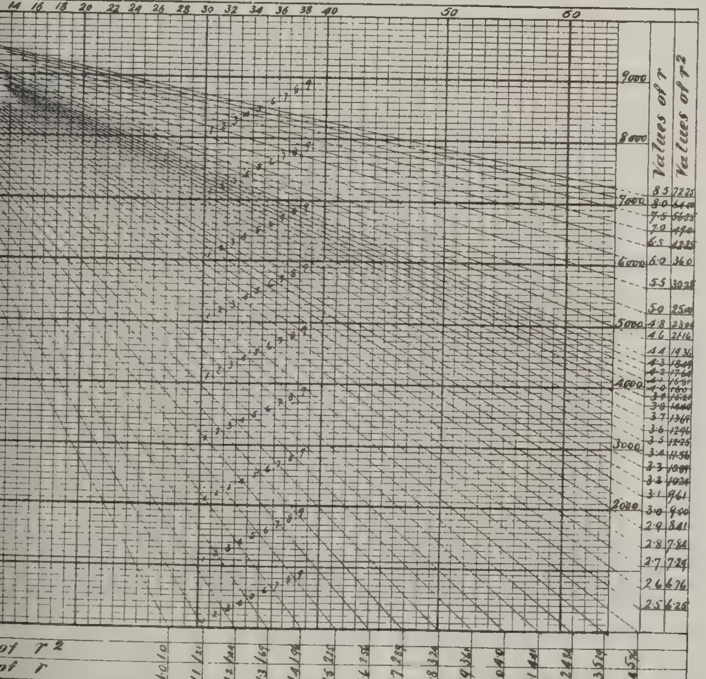
Values of f = 8,000 to 16,000 lbs., Including Each in Combination with Values of b of 30, 40, 50, 60 and 70.



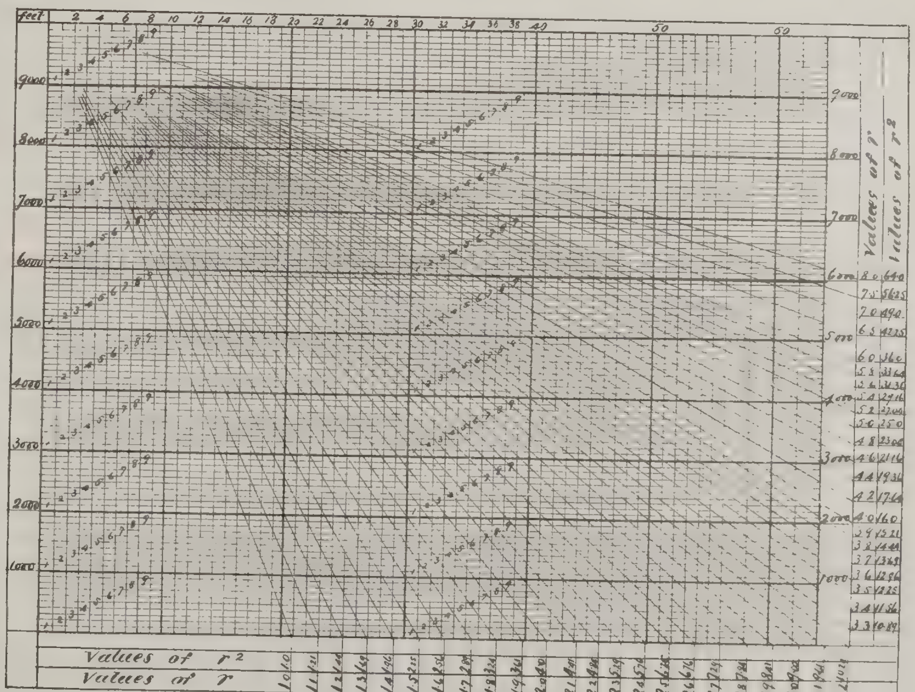
FORMULA, $P = 9{,}000 - 30\frac{l}{r}$



FORMULA, $P = 9{,}000 - 40\frac{l}{r}$



FORMULA, $P = 10{,}000 - 30\frac{l}{r}$



FORMULA, $P = 10{,}000 - 40\frac{l}{r}$

IAGRAMS OF JOHNSON'S STRAIGHT LINE FORMULAS FOR DETERMINING THE STRENGTH OF COLUMNS FOR COMPRESSION MEMBERS FROM 12 INS. TO 64 FT. LONG.

CHAS. HART, LITH., 36 VESEY ST., N. Y.

helpless invalids, and many more of those who stayed in the home camps have fallen victims to typhoid than all who were killed by Spanish bullets in Cuba.

The question that is now agitating the American people is, where does the responsibility lie for this vast loss of life and this great amount of sickness and suffering? They will not accept any assurances that this was all a necessary feature of army service; and they are right. Other countries assemble great numbers of troops every year in camps for practice manoeuvers; and their ranks are not decimated by typhoid. Of course when troops are engaged in actual campaigning, care for the health of the men must often be a secondary consideration. Strategic positions must be held in the face of the enemy though troops lie in pools of water in the trenches, and camps have to be made in fever breeding swamps. There is little fault finding heard because of the sad condition in which the captors of Santiago came home. There would have been none at all except that the loss of health by the soldiers who never left the home camps gives ground for belief that all was not done that might have been done to care for and restore the health of those who suffered from wounds and pestilence at Santiago.

That, however, is a matter by itself. The fact to which we desire to call especial attention is that the sickness and deaths from typhoid have been the one great blot on the administration of army affairs in the campaign just closed. Compared with that, all the other delinquencies and shortcomings complained of in the administration of army affairs are trivial. Deduct the deaths and illness from typhoid, and the hospital record for the past four months would be little worse than must inevitably be expected when an army is hastily assembled, chiefly from the Northern states, and is put into semi-tropical camps, in a region where malaria is more or less prevalent, at the beginning of midsummer.

The fact that the public desires to learn more than any other is, where does the blame lie for the great prevalence of typhoid in the army camps, and how is similar illness and mortality to be prevented among the troops that must soon be sent away to garrison Cuba, Porto Rico, and, perhaps, also the Philippines? Certainly, if it were generally believed that new regiments would suffer from typhoid as did the troops at Chickamauga and Camp Alger, it would be a difficult matter to find volunteers to fill them.

In the voluminous criticisms of the War Department which have been current during the last few months a great deal has been said concerning the unfitness of the camp sites selected. It has been alleged that the selection of this or that or the other location as the site for a camp was due to "political influence." The soil, the water-supply and the atmospheric environment of almost every camp have been denounced in the public press. One camp was in a barren desert of sand, where the heat was excruciating; another was a malarial and fever-breeding spot, and was inundated at every heavy rain. One was supplied with water from a running stream, which became so foul that its use was well-nigh impossible; another relied on driven wells, whose pollution, according to the reports, was a matter of certainty.

How much or how little truth there may have been in these criticisms as to particular camps, we shall not take space to discuss; but the fact that typhoid has been seriously prevalent at every large camp that has been established, except those most recently opened in the Northern states, is good proof that it was not the camp sites that were responsible in the first place for the epidemic that prevailed in them. It is easy to condemn a camp site after an army has lived upon it for weeks and scattered its debris over it; and it is easy for an unthinking man to say, as was so many times said: Why was such a site chosen when thousands of better sites are to be found in every state? Few appreciate the requirements that must be met in selecting a site for the encampment of an army of fifty thousand or more, such as that at Chickamauga. Military considerations, at the time the camp sites were chosen, were of the first importance. The army had to be gathered in camps large enough to enable brigades and corps to be formed so that there might be some practice in the movement and handling of large bodies of troops. These camps had to be located within quick rail communication of the points on the seaboard from which a forward movement might be made, and rail communication with the principal markets and supply depots was essential. The water supply of a large camp is a most difficult problem. Lakes in the South are few, and an army camped on the shore of any lake of small size would soon seriously pollute it. Running streams in the South are generally very muddy; and besides, an army of considerable size camped along a stream will quickly foul it. Under these circumstances, underground supply from driven or bored wells seems practically the only source from which an army of 50,000 men or more can derive a reasonably pure supply of water; but every sanitarian knows that such wells are liable to surface contamination unless great care is taken. For general sanitary reasons a sandy soil is the best on which to locate a camp; but wells in such a soil are more liable to surface pollution than those driven through clay.

When one bears in mind the limitations with which at the opening of the war the choice of camp sites was hedged about, it is hard to believe that Chickamauga, for example, was selected with any other idea than that it was the best adapted for the purpose. It is located in a high mountain region, the coolest and most salubrious in the South. Its railway communications with the North and East are better than those of any other center in this mountain region, and its rail communication with the seaboard is also excellent. Besides this, its proximity to Lookout Mountain, a natural sanitarium, would seem to make it a place where troops should have been kept in excellent health. It is now said, we are aware, that the soil at Chickamauga was too stony to make it a sanitary camp site; but while it is doubtless more difficult to keep a camp healthful on a rocky or clay soil than on sand, it can be done nevertheless.

Again, the fact that typhoid has raged at Chickamauga, at Camp Alger, at the Presidio, at Camp Black, at Jacksonville, and at various other camps proves not only that the camp sites were not the original cause of the trouble, but that it was not due to the mistakes of any one particular commander, or the inefficiency of the officers in any one camp or locality. The wide prevalence of the disease proves that something was wrong with the system as a whole. Just what that something is it will be the most important task of the President's proposed investigating commission to find out. At present we can only say, without pretense of having made an exhaustive inquiry, that all the information at hand inclines us to believe that the main source of trouble was, first, the ignorance and inefficiency of the officers in immediate charge of the volunteer troops; and, second, the system under which army affairs are administered. Almost all of the officers appointed to the volunteer regiments were absolutely without experience in the making or policing of army camps; and it is safe to say that in the minds of nine-tenths of them, sanitary matters were given little attention. Those who were industrious and faithful had their minds chiefly set on drilling their men into soldiers. Those who were not, paid as little attention to the sanitary condition of their men as they did to their other duties.

It may be said with truth, however, that this is no explanation of a typhoid epidemic. Decaying garbage and uncared-for sinks about a camp may offend the eye and the nostril, and these and similar unsanitary conditions may produce malaria, bowel troubles and such disorders. But to propagate typhoid, a germ from the discharges of a typhoid patient must be taken into the alimentary canal. To prevent the spread of typhoid, therefore, all that is necessary is to disinfect or absolutely kill the germs in the discharges of every typhoid patient, and this is the most important duty of the nurse in charge of a typhoid fever case, while the responsibility is the attending physicians to see that it is done. With this single precaution the disease is not contagious at all. Without it, a single patient may, under favorable conditions become a center of infection for hundreds.

Now there is good reason to believe that in their zeal to show a good health record and to keep men from "playing sick" to escape discipline or drill, the medical staff have tried to keep men out of the hospitol who ought to have been in it. The men themselves, too, in nine cases out of ten, were never willing to go to the hospital while they had any strength left; especially after the regimental hospitals were abolished and transfer to the division hospital meant leaving everyone they knew.

Of course in gathering thousands of men together, all of them traveling long distances and drinking all sorts of water on the way, some cases of typhoid are certain to occur; and a considerable percentage of these cases, there is little room to doubt, were not taken to the hospital until they had been ill for many days; in fact it is likely that not a few light cases were never in the hospital at all. As evidence of this neglect to identify typhoid in its early stages and to keep the patients in the hospital where their discharges can be disinfected, we find in the current "Medical Record" the testimony of a prominent New York physician, who diagnosed, on Sept. 5, 17 cases of pronounced typhoid fever among soldiers in the Presbyterian and Bellevue hospitals in New York city. Most of these patients were from Camp Wikoff, and not one of those who came from there had been in the hospital at all. The physician, from whom we quote, after sarcastically commenting on "the new army treatment of typhoid fever by prescribing thousand-mile railroad journeys," calls attention to the danger to the public health in the following vigorous words:

> A patient having six or a dozen diarrhœal enteric stools a day, using the ordinary closet of a railroad car travelling, say, thirty miles an hour, distributes a trail of fæces along the track, to be washed by the first rain into neighboring streams, and sets a rather bad example of hygiene to the country at large.

But besides the infection of the camps and their water supplies, by the cases of "walking typhoid," it is by no means certain that the hospitals were so conducted as to remove the danger of infection from the discharges of typhoid patients. The same physician from whom we have just quoted describes the methods of disinfection which he witnessed at Camp Wikoff as "obsolete, inefficient and farcical." On the other hand, Dr. Benjamin Lee, of Philadelphia, who visited the camp at about the same time and published a report of his visit in the Philadelphia "Public Ledger," said: "In the hospitals great care is taken in the disinfection of the excreta of typhoid patients." Here is a disagreement of doctors. The truth probably lies between the two extremes. It would be equally wrong to draw a wholesale indictment of the sanitary conduct of the hospitals or to declare that they were all conducted in a faultless manner. Knowing, as we do, that the nurses were largely men inexperienced in the care of the sick, that frequently both doctors and nurses had twice as many patients as they could properly care for, and that medical supplies were too often found inadequate to the demands, bearing these facts in mind, it seems altogether probable that at many, if not all, of the camps, at times, the discharges of typhoid patients in the hospital have been thrown out untreated, and the germs in them have been scattered broadcast by rains, dust and flies, have polluted food and water supplies by the wholesale, and thus have caused the remarkable spread of the disease that has been witnessed.

We view the vast total of death and suffering, the grief and anxiety in thousands of homes, and wonder that it was not foreseen and guarded against. But it is no wonder after all. Who, among sanitarians even, would have predicted six months ago that some carelessness in permitting cases of "walking typhoid" to stay outside the hospital and more carelessness in neglecting the well-known sanitary precautions in the care of typhoid patients in the hospitals, would have produced such terrible results? It is easy to be wise after the event. In the light of our present knowledge, we can easily say that vigilance in isolating and caring for cases of typhoid should be the very first duty of those in charge of troops; but who appreciated to the full importance of this precaution six months ago? Some did, unquestionably. The army surgeon in charge of one of the hospitals at Chickamauga is quoted as saying that it was an ideal site for a camp; that its soil and sanitary surroundings were excellent, and that the sole cause for the epidemic of typhoid which has raged there was the disregard, by those in charge of the troops, of the rigid sanitary regulations which the medical staff of the army promulgated at the opening of the campaign.

Experience shows, however, that not all the surgeons in charge by any means were sufficiently well posted in sanitary matters to appreciate and insist upon the care necessary to stamp out and prevent the spread of typhoid. Even when surgeons were competent and faithful, their efforts, it is feared, were often neutralized by lack of cooperation on the part of line officers and lack of military discipline and strict obedience to orders on the part of the soldiers who had to do the actual work of keeping clean the camps and hospitals.

The fact is that the nation improvised an army on short notice from a mass of raw recruits, some of whom knew something of military drill, but nothing else of the things which an efficient private soldier must know. The officers over these men were for the most part as ignorant of military matters, aside from the mere matter of tactics, as their men. Camp sanitation, camp cooking, and the provision of food, clothing and other supplies to large bodies of troops in camps or traveling from point to point by rail or transports, was a matter in which all alike were wholly inexperienced. To what extent this condition has been aggravated by the selection of inefficient youths as officers, because of political influence exerted on their behalf, we cannot say; but it would be strange, indeed, if in selecting some thousands of officers, a large percentage of incompetents did not manage to secure sufficient backing to enable them to creep in.

The inexperience of the officers alone, however, is quite sufficient to account for all the soldiers have suffered in the way of bad rations, improper clothing, and illness and death from bad sanitary conditions. In fact some contrasts in the condition of regiments which had the good fortune to have an experienced soldier at their head and those in charge of volunteer officers furnishes additional proof as to where the fault lies for the illness and loss of life in the war from what are well called "filth diseases."

We are aware that a great deal has been said about "military red tape" being a chief cause of the troubles experienced in the army. But it is too often overlooked that "red tape," as it is commonly called, is an absolute necessity in any large organization, civil or military. There must be a definite system for the performance of duties, and a definite assignment of duties and responsibilites throughout every grade of the service, in order to secure proper co-operation, and the orderly prosecution of business. It is probably true, however, that too many hampering and embarrassing restrictions have been embodied in the army regulations, and it should be one of the earliest duties of an investigating commission to determine to what extent those restrictions can be removed and the army routine methods can be amended so as to promote efficiency. The tendency in the framing and amending of such rules is all the time to prevent the wrong thing being done, and to overlook the fact that it is more important after all to ensure that the right thing is done. Rules should be found to facilitate action and not embarrass it.

In conclusion, then, we would emphasize the fact that the illness and deaths from typhoid in the army have been primarily due, not to the camp sites as has been alleged, but to the neglect of simple sanitary precautions on the part of those in charge of the troops, chiefly through ignorance of their importance.

With the dearly bought experience that the nation has now had, such epidemics of typhoid as have raged in the army should hereafter be impossible. The means of preventing the spread of this and similar filth diseases are so simple and so widely known that they should be familiar to the officers in every grade; and their neglect should receive punishment proportionate to the loss of life and suffering which such neglect will cause.

LETTERS TO THE EDITOR.

Moving Electric Cars Across a Weak Bridge.

Sir: Your issue of Sept. 15 contains a short article on "A Plan for the Safe Movement of Electric Cars Across a Weak Bridge," according to which, after an examination and report by me on Sept. 3, 1897, in which the structure was pronounced unsafe and after a further examination and report by an unnamed engineer representing the Capital Railway Company, whose tracks crossed the bridge, in which it was declared to be safe, the final result was "that the railway company has now obtained a permit to construct a double-track trolley line over the bridge." The clear inference of the article is that a difference of opinion between the District Engineer Department and the Capital Railway Company as to the structural sufficiency of the Navy Yard Bridge was resolved by the issuing of a permit to the railway company in accordance with their expert's contention that the bridge would safely carry the loads, and in contradiction of the office's contention to the contrary. The circumstances really are that the company received the charter right to cross this bridge with its cars from Congress prior to the date of my investigation and report which you quote. This right could not be denied them, and has been exercised by them for some time past, the cars being hauled across the bridge by horses. By subsequent legislation of Congress the right to construct a trolley on the bridge to supplant the horse traction, subject to approval as to details by the Commissioners of the District, was granted the company, and the permit for putting up these wires is the one your article refers to. The details employed in this trolley construction were calculated to accomplish the result of preventing cars passing on the bridge, but to publish the circumstances as they appear in your article without such an explanation as the foregoing would make a presentation unfair to the Engineer Department of the District of Columbia and to myself.

Very respectfully,

C. B. Hunt.

Office of the Engineer Commissioner of the District of Columbia, Washington, D. C., Sept. 17, 1898.

(We did not intend, in the article referred to, to imply that in the disagreement between experts, the railway company's expert was sustained. On the contrary, it was our understanding (and the above letter makes it entirely clear), that the exact opposite was the case. We regret that some of our readers may have been misled by the ambiguous wording of the article referred to. It appeared to us that the engineer had contrived a very ingenious scheme for preventing the bridge being overloaded by two cars crossing in opposite directions at the same time, and our readers will now understand what was not clear before, why a double-track was laid across the bridge.—Ed.)

Tests of the Stress in Plate Girder Stiffeners.

Sir: I have read with considerable interest the discussions which have appeared in several of your recent issues on the subject of web stiffeners in girders. It seems to me that there are two distinct conditions of a girder to be kept in mind: First, a girder in which incipient failure, by buckling or otherwise, has not even begun; and, second, a girder in which certain parts have partially or wholly failed. The model shown by Mr. Wilson exhibits the girder in the second condition, and I agree with "E. M.," and with Mr. Buel, that from the behavior of such a model, correct conclusions cannot readily be drawn as to the stresses which exist when the same is in perfect condition.

I take it that the question of chief interest relates, however, to a girder in the first-named condition. In such a girder with vertical stiffeners, it appears to me that the character of the web stresses are, so far as the intermediate stiffeners are concerned, exactly the same as in a girder without stiffeners; and for the following reasons. 1. In a girder without stiffeners (assuming no buckling to occur), the web is subjected to stresses which are tensile or compressive on surfaces inclined at 45° with the axis, and pure shearing stresses on surfaces parallel to, or at right angles with, the axis. 2. Granting 1, it follows that in such a girder the longitudinal distortion of a vertical strip of the web is zero, there being no tensile or compressive components in a vertical direction. 3. An angle riveted to a vertical strip of the web in which there is no longitudinal distortion produced will not itself be distorted, and therefore will receive no strain.

The above may be objected to on the ground, that, while it may apply to girders with thick webs, it may not apply to those with thin ones; but I see no reason why the general distribution of stress should be any different in girders with thin webs and stiffeners, than in those with thick webs and stiffeners, provided always that incipient failure has not occurred. End stiffeners, and others attached in the vicinity of heavy concentrations, will receive more or less stress; as the tensile and compressive stresses in the web at such points vary more or less from a 45° inclination.

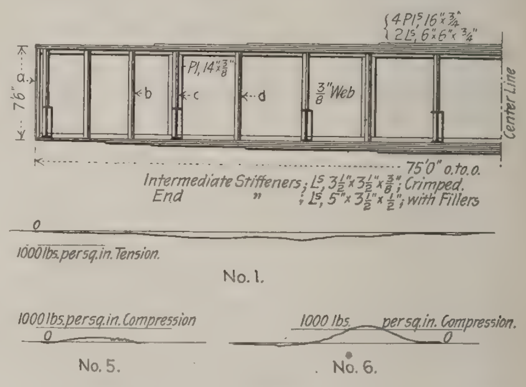
In applying Professor Johnson's proposition regarding the distribution of a load over several paths, there appears to be some confusion in the use of the terms "rigidity" and "strength." A web plate, no matter how thin, is just as rigid in compression as in tension so long as buckling does not actually take place, though it is of course ultimately not as strong. In a girder, then, in which buckling is prevented, there is as much reason to suppose that the web stresses follow down the web and up the stiffeners, as in a Howe truss, as to suppose that they follow the lines of a Pratt truss. The stresses are, indeed, all provided for without distorting the stiffeners at all, as I have attempted to show.

The behavior of a girder after partial failure has occurred is very clearly illustrated by Mr. Wilson's model; and it is readily seen that as soon as buckling begins and the distortion of the web in compression is greater than in tension, compressive stresses will be developed in the stiffeners and total failure cannot take place by the buckling of the web alone.

I have recently made some observations on the siffeners of a through girder of 75-ft. span by means of a Fraenkel extensometer, and the results are given herewith, together with a sketch of the bridge, on which are indicated the position of the stiffeners tested. Stiffeners b and d were on the inside, as shown, while a and c were on the outside of the girder:

No. of experiment.	Stiffeners tested.	Observed max. stress. (Lbs. per sq. in.)	Calculated shear on girder. (Approx.) (Lbs.)
1	d	500, tension	50,000
2	c	600, "	57,000
3	b	300, compression	62,000
4	b	300, "	62,000
5	b	300, "	62,000
6	a	1,200, "	72,000

The extensometer was adjusted in each case to measure the distortion of a meter's length of the stiffener about midway between top and bottom. The calculated shears are for sections taken at the stiffeners in question; they indicate what the small column, consisting of two stiffeners and a narrow strip of web, would have to carry under the assumption that the web acts as a Pratt truss.


4 Pl^s, 16"×3/4"
2 L^s, 6"×6"×3/4"
Pl, 14"×3/8"
a
b
c
d
3/8" Web
7'6"
Center Line
75'0" o.to.o.
Intermediate Stiffeners; L^s, 3 1/2"×3 1/2"×3/8"; Crimped.
End " ; L^s, 5"×3 1/2"×1/2"; with Fillers
0
1000 lbs. per sq. in. Tension.
No. 1.
1000 lbs. per sq. in. Compression
0
No. 5.
1000 lbs. per sq. in. Compression.
0
No. 6.

Extensometer Curves from Stiffeners on 75 ft. Plate Girder Bridge.

The small stresses actually observed in the intermediate stiffeners, some tensile and some compressive, are, no doubt, secondary stresses due either to the effect of local loading or to some slight lateral bending in the girder. The considerable compression in the end stiffener shows the effect of concentrated loads.

I enclose also a tracing of three of the curves obtained. No. 1 was caused by the passage of two locomotives and caboose, while Nos. 5 and 6 were in each case produced by a locomotive running light. The diagrams were drawn from left to right.

Yours truly,

F. E. Turneaure.

University of Wisconsin, Madison, Wis., Sept. 14, 1898.

Notes and Queries.

Concerning the casting of large size wheels for locomotive and car trucks, discussed in our issue of June 9 and Sept. 8, Mr. Andrew J. Vaughan, of Providence, R. I., who was at one time foreman of the old Hinkley Locomotive Works at Boston, writes us that chilled wheels as large as 42 ins. were successfully cast at those works.

E. D. S. asks whether brass pipe laid underground would be affected by electrolysis, or would be liable to corrosion from other causes?

It is now definitely established that pipes of any material, or metal covered cables are subject to electrolysis when in the vicinity of electric street railway systems or lighting plants using a ground return. Corrosion occurs independent of any electrolytic action in nearly all localities, and especially in cities and places where the soil contains chlorides, sulphates and nitrates, together with any moisture. Temperature of the pipe also plays a part in the corrosive action, there being what may be termed a "critical temperature" at which the action is most rapid. In other words, a pipe conveying steam will be corroded more rapidly than one carrying water.

Regarding the amount of eating away by either electrolytic action or corrosion, or both, of brass pipe in comparison with other materials, such as iron, copper or lead, we know of no positive data. A study of the chemical equivalents of the various metals used in underground construction will, however, indicate that common brass pipe, containing about 70% of copper and 30% of zinc, would suffer from electrolysis somewhat more than iron pipe and not so much as lead. Approximately, a current of one ampere flowing steadily from an iron plate of ample proportions will remove about 20 lbs. of iron per year. Under the same conditions 75 lbs. of lead could be removed and brass would suffer a loss somewhere between these figures.

◆

MUNICIPAL ASPHALT PLANTS are recommended by Mayor Van Wyck for New York city, to meet an alleged combination among asphalt paving companies. This resolve is a result of the late bidding for laying asphalt strips for bicycles on streets connecting the Borough of Queens and Long Island City. The engineer's estimate was $22,000, but the bids received were $14,000 in excess of this estimate. The comparative narrowness of the strips may have something to do with the excessive price.

◆

THE ORIGINAL PAIGE TYPE-SETTING MACHINE, one of the most ingenious and intricate pieces of mechanism ever invented, has been presented to the museum of Sibley College, Cornell University, by Mr. P. P. Dodge, President of the Merganthaler Linotype Co. of New York city. The Paige machine was the invention of a mechanic in Hartford, Conn., and while it was a marvel of mechanical ingenuity, it was so complicated and of such delicate and intricate and expensive construction that it never had a chance of commercial success. The patent upon the machine is one of the most voluminous that was ever granted by the U. S. Patent Office, and it is said that the patient attorney who prepared the specification and claims was made insane by the work. Over $2,000,000 is said to have been sunk in developing the invention. The chief contributors were business men of Hartford, Conn., among them being Mr. Samuel L. Clemens (Mark Twain).

◆

THE THREE BATTLE SHIPS ordered by the last Congress were let on Sept. 14, one each to the Cramps, Newport News Shipbuilding Co., and to the Union Iron Works of San Francisco. These contracts call for ships of 12,500 tons displacement, a coal capacity of 2,000 tons and a speed of 18½ knots. Within the next few weeks contracts will be let by the Navy Department for four coast-defence monitors; 12 torpedo boats and 16 torpedo boat destroyers. Commodore Watson announced to the Navy Department that the Spanish cruiser "Maria Teresa," sunk at Santiago on July 3, will be floated. Ten 6-in. rapid-fire guns have already been removed from this vessel and placed on the collier "Leonidas."

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ANNUAL CONVENTION OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

(Concluded from page 181.)

A paper, by Mr. D. F. Carver, Brooklyn Heights R. R., Brooklyn, N. Y., was the next on the list, and from it we have taken the following points of interest:

Track Construction.

The development of street surface railways from their operation by animal power to their operation by cable or by electric power has made many changes in track construction a necessity. The first essential of good track construction and good pavement is a good foundation. In a majority of cases this exists naturally at the depth at which ties are laid. If the natural foundation is not suitable, it can be made so by the use of broken stone or gravel. The ties should be of the best quality of yellow pine, sawed four sides, and of a size sufficient to give a bearing on foundation of not less than 4½ sq. ft. per tie. A very excellent and economical spacing has been found to be 24 ties to a 60-ft. rail. All ties should be thoroughly tamped near the rail, and the joint ties tamped throughout their lengths. The dirt under the base of the rail should also be thoroughly tamped, otherwise there will be a settlement which will allow the paving stones next the rail to be forced down.

The rail used should be of hard steel, and of a section that will give it great stiffness. The tread should be either level, or, as is becoming common practice, should bevel, so that the wheels will have a bearing for the width of the tread. This latter arrangement gives greater contact for traction and stoppages, and also causes less damage to wheels that are skidded in an emergency stop. As the lightest section of 9-in. rail is more than amply strong to stand the strain of carriage, provided, of course, that every tie has a first-class bearing, it has been found desirable to roll the web down to the thinnest section possible, and accept the small losses due to rails splitting along the web from the tension caused by the very unequal distribution of metal. The breakage above referred to has been found to be, throughout a year's work, about 0.25% of all rail laid.

The problem of the rail-joint has been a very trying one, but it is fast approaching a successful and satisfactory solution, the essential features of which are either a welded joint, which makes a rail practically one continuous mass, or the mechanical joint, which avails of the bearing surfaces beneath the head and tram, and beneath the base, and of the upper surface of the base of the rails which it connects. Either joint, to be entirely successful, however, must be laid with tight joints, so that passing wheels will have a continuous bearing.

This method of construction will, in time, force the track out of line, and where the line is curved to any extent will push the curve out of line; and also in renewing any portion of the track in warm weather, it will be found almost invariably impossible to put in new pieces of the same size as the old removed, because the great compression strain closes up the opening. Still, with all these objections, the added length of life of joints gained, is of decided advantage.

In paving the street, the portions outside the outside rail and between the tracks should be paved and thoroughly rammed before the sections between the rails are paved. This prevents the crowning of the stones between the rails from forcing the track out of gage.

A bed of concrete between ties has been tried to prevent the paving blocks from sinking, but such experience as the writer has had with this construction has not been very satisfactory, and as its first cost is great, and also as the interest on this extra investment is, in many cases, greatly in excess of the maintenance charges which it is intended to prevent, he is led to doubt very greatly its utility.

The question of track bonding was considered in a paper presented by Mr. R. P. Brown, Electrical Engineer, Brooklyn Heights R. R., Brooklyn, N. Y., which is abstracted as follows:

Track Bonding.

Several systems of track bonding have been tried upon the Brooklyn Heights R. R. since its operation by electricity. Originally the familiar supplementary ground wire with branches to the track and copper ground plates were employed, no dependence being placed upon the rails for returning the current.

The next step was to install return feeders with frequent taps to the supplemental wires. Increasing traffic caused an excessive return feeder outlay, and in 1895, when it became necessary to relay the tracks, it was decided to use the rails for at least part of the return circuit. The bond adopted was a short cast-copper plate (5 × 1-16-in.) the full width of the base of the rail, with about 12 sq. in. contact between the bond and the end of each rail.

The connecting piece of metal was curved so as to allow for expansion. To secure good connection, a re-enforcing plate of cast iron was placed underneath the area of contact and the bond pressed firmly against the rail by ½-in. bolts passing through the base of the rail. No machine work was necessary other than grinding the contact face on the bonds and removing the scale from the rail where the bond was to be applied by grinding with a portable emery wheel.

Recent tests show these bonds to be practically of the same resistance as when first installed, three years ago. The cost of these bonds was not greater than that of the No. 0000 bond going completely around the fish-plate, and having two or three times the electrical resistance of this connection. The difficulty of attaching a bond underneath the base of the rail, however, was considerable, requiring careful supervision to insure good results. This trouble led to further investigations, with the result that a bond electrically brazed to the rail was adopted the following year. This bond was somewhat cheaper than the plate bond and good work was more easily obtained on account of the better chance of inspection.

At present the bond which has been adopted as standard on all lines of the system having heavy traffic is made in two parts and brazed on the rails before they are removed from the yard. The shape of this bond depends on whether it is to be placed on the web of the rail, so as to come underneath the fish-plate, or as they are now applied, on the base and upper flange of the rail, outside of the joint plate. All forms of the bonds, however, are made up of 10 or 12 leaves of 1-64-in. soft copper, the carrying portion of the bond being 1¾ ins. wide, and the brazed contact having an area of about 1 sq. in. Soft spelter, with suitable flux, is used in brazing the copper to the steel rail. The bond is divided longitudinally into three parts, so as to give greater flexibility. When the rails are in position, the ends of these bond leaves are interlaced and fastened together by rivets and also by solder. The length of the bond between center of contacts is 5 ins., and its cross-section is equal to 350,000 circular mils.

On the lines having light traffic the short "horseshoe" bond has been placed underneath the fish-plate. These bonds are 3¼ ins. in length, of 0000 cross-section, and have ¾-in. diameter terminals. As a measure of safety, as well as to lower the resistance of the joints, all rails are double-bonded whether the brazed or horseshoe bonds are used. The holes for these bonds are drilled by the makers of the rail, and they are reamed out with emery paper to remove the rust that may have formed during shipment. If care is used in compressing the terminal of those bonds, there is no necessity for drilling or reaming of holes on the ground, as any slight irregularity in the drilling fills up when the soft copper is thoroughly upset.

Curved rail, switches and other special work are often difficult to bond satisfactorily in the yard, and the joint plates are of such section that the bond cannot be placed underneath. In such work long bonds going round the fish-plates are used. On account of the excessive wear on special work the joints are particularly liable to loosen, so that the bond must be extremely flexible.

It has been found that if a simple bond is used, it should be placed at the center of the web of the rail if sufficient contact can be obtained at that point. If contact is made at either the base or upper flange, the length of the circuit is increased by the height of the rail.

Contrary to the former practice of tinning the bonds and supplementary wire, the bonds and their exposed copper surfaces are carefully coated with an insulating paint, so that if there is any flow of the current in the track to the surrounding soil it must leave from the steel and not from the copper. This prevents the bonds being destroyed by electrolysis or other corrosive action.

To guard against imperfect workmanship, a system of testing bonds has been practiced. Usually only the joints on one line of rail are tested, though in sections of high current density, as in the vicinity of power houses, the resistance of each joint is obtained. The test is a simple comparison of the fall of potential across the joint and on a measured portion of an unbroken rail. Two Weston milli-voltmeters, with scales ranging from 0.001 to 0.3 volt are used; the readings being taken simultaneously. Contact is obtained by pressing hardened steel points on the surface of the rails. These points are set in wooden blocks and placed 6 ins. apart if used on the joints and 2 ft. apart for tests on solid rail. The distance on the rail is taken for 2 ft. instead of 1 ft., on account of the small amount of current flow in the rail on some of the lighter lines. These testing terminals are provided with handles of convenient length so that the person using them can stand upright and apply the necessary pressure with one foot. Two men can test joints very rapidly with this outfit. The current density of some of the rails was too low to give reliable readings with these instruments, so a portable resistance was arranged on a wagon and the necessary current readily obtained from the trolley wire. This resistance allowed about 300 amperes to flow from the line to the rail, and as it could be very quickly applied, rendered it a comparatively easy matter to test the joints in any section of the city.

Although the bonds are less than 6 ins., that length was selected for the distance between terminals of the voltmeter used in testing joints, because it gives a convenient fraction to subtract from the length of each rail in arriving at the total resistance in line of track. The drop on this 6 ins. was considered as increasing the length of the rail by an amount proportionate to the drop in the rail itself. From this the percentage that the rail of any line approached the conductivity of the solid steel rail could be easily determined.

The following results were obtained from different joints:

—Drop in volts.—			% of conductivity of solid rail.
Rail.	Joint.		
1 ft.	1 ft.	Falk Joint.	
0.00215	0.00355	(30-ft. rail)	98%
		(60-ft. rail)	99%
		Double Brazed Bond.	
0.00725	0.00758	(30-ft. rail)	99.8%
		(60-ft. rail)	99.9%
		Johnson Bond.	
2 ft.	6 ins.		
0.00364	0.00342	(30-ft. rail)	95.6%
		(60-ft. rail)	97.8%
		Plate Bond.	
0.0109	0.0233	(30-ft. rail)	89%
		(60-ft. rail)	94%

It will be seen by the foregoing that it is a comparatively easy matter to get a conductivity of over 90% of a continuous steel rail. As high as 600 amperes can be safely carried on any of the bonds mentioned, and the cost of double bonding in a satisfactory manner should not exceed 75 cts. per joint. The conductivity of steel varies with the amount of carbon in its composition, but, generally speaking, it is about ⅛ of the conductivity of commercial copper. Bearing these facts in mind, it will be readily seen that it is much cheaper to make the return circuit wholly of well-bonded steel rails, supplementing the track in the vicinity of the power house with worn-out rails carefully bonded.

Other papers of interest were read on "Individual Fare Boxes: Are They Practicable," T. J. Nicholl, Rochester, N. Y., and "The Relation Between the People and the Street Railways," J. T. Little, Jr., Metropolitan St. Ry. Co., New York.

After the close of the afternoon session, the visiting railway men were treated to a special exhibition of fireworks at 8 o'clock, which included several special features. Immediately afterward the banquet was held in the dining-room of the Manhattan Hotel, with Hon. Tom L. Johnson as toastmaster.

The morning session on Sept. 14 was devoted to the consideration of such topics as "The Repair Shop," "Municipal Ownership," "The Care of Dynamos," "General Track Construction," "The Use and Abuse of Transfers," "Pointers on Store-Room Accounts," "Long-Distance Power Transmission," "Pleasure Resorts: Are They Profitable?" "The Use of Air and Power Brakes on Street Cars."

At 11 o'clock, the members and visitors took trolley parlor cars at Sheepshead Bay bound for the navy yard, where some time was spent. Later, a steamer was taken, which left from the Bridge Dock and sailed down New York Harbor, up the Hudson, through Spuyten Duyvil and down East River to the Battery landing. On the way luncheon was served, and the following officers were elected to serve for the ensuing year: Pres., G. Tracy Rogers, Pres. Binghamton R. R. Co., Binghamton; First Vice-Pres., W. Caryl Ely, Pres. Buffalo & Niagara Falls Ry. Co., Buffalo; Second Vice-Pres., Albert L. Johnson, Pres. Nassau R. R. Co., Brooklyn; Secy. and Treas., Henry A. Robinson, Solicitor Metropolitan St. Ry. Co., New York; Members of Executive Committee, H. H. Vreeland, Pres. Metropolitan St. Ry. Co., New York; John W. McNamara, Treas. Albany Ry., Albany; Henry M. Watson, Pres. Buffalo Ry. Co., Buffalo; Clinton L. Rossiter, Pres. Brooklyn Heights R. R. Co., New York.

ANNUAL CONVENTION OF THE ROADMASTERS' ASSOCIATION OF AMERICA.

The sixteenth annual convention was held at Denver, Colo., Sept. 13, 14 and 15, the headquarters being at the St. James' Hotel. The meetings were held in the hall of the Chamber of Commerce, and the exhibits of the Road and Track Supply Association were in an adjoining building. It was a very successful meeting, and the attendance was exceptionally large. The opening session was called to order at 9 a. m. on Sept. 13, when the president, Mr. A. M. Hawkins (Norfolk & Southern R. R.) delivered a brief address. A few brief remarks were then made by Mr. Burnett, the founder of the association, after which the Secretary and Treasurer, Mr. J. B. Dickson (Chicago & Northwestern Ry.) read his report. The financial report showed the following summary: Receipts, $2,287; expenditures, $1,523; balance on hand, $764. The Hon. Alva Adams, Governor of the State of Colorado, then delivered a short address of welcome, in which he referred to the important relation of railways to the development of the country, and spoke of George Stephenson as having been the original "railway man," as he was at once a civil engineer, mechanical engineer, locomotive engineman, roadmaster and superintendent. Another short address by Hon. T. S. McMurray, Mayor of Denver, closed the formal part of the procedings.

The election of officers was next taken up and resulted as follows:

> President, T. Hickey, Michigan Central R. R.; First Vice-President, J. M. Meade, A., T. & S. F. Ry.; Second Vice-President, C. B. Teller, Denver, L. & G. Ry.; Secretary and Treasurer, J. B. Dickson, Ch. & Northwestern Ry.; Member of Ex. Com., C. E. Jones, C., B. & Q. R. R.

A paper on "Discipline, in Its Practical Application to Track Forces," by Mr. H. W. Church (Lake Shore & Michigan Southern Ry.), was then read by the Secretary. Its object was to advocate the so-called "Fall Brook" or "Brown" system. The paper was printed, slightly condensed, on page 173 of our last issue. In the discussion two or three members reported the system as in use in the track departments of their roads (including the Toledo & Ohio Central R. R.), taking in the roadmasters, supervisors and foremen. It was further stated that a roadmaster ought to try to educate his men and make something of them, instead of arbitrarily punishing them by suspension or dismissal.

The first business of the afternoon session was the discussion of a proposed amendment to the constitution changing the name of the association to the "Railway Maintenance of Way Association," but this amendment was lost by a vote of 24 to 45. Two minor amendments were adopted, one referring to the rights of honorary members and the other giving associate members (former members who have left railway service), the right to speak on the floor only by permission of the chair.

The report of the committee on "The Best Method of Preventing the Creeping of Rails," (p. 171 of the last issue of Eng. News), was then read, and brought out a little desultory discussion in which a few members presented their individual experience.

The next committee report taken up was a very long and elaborate discussion of the merits of tie-plates, and was, it may be remarked, one of the most complete studies of the subject that has appeared in engineering literature. We condense it as follows:

Tie Plates—Benefit and Results Obtained by Their Use.

This Committee was called upon to report on:

> Tie Plates; The Benefits and Results Obtained from Their Use; which is the best, most easily applied, and most effective; a tie-plate having a projection which runs parallel with the grain of the wood, or one which has a projection which cuts across the grain of the wood; and that as many plates of each kind as have been in use be obtained, and also a portion of the ties in use, be brought to the meeting for actual observation, not removing the tie from the plate.

We feel that this committee has been asked to decide upon too much; for, in connection with "tie-plates, the benefits and results obtained from their use, etc.," must be considered the conditions as to differences in the kind of ballast and of the tie, the weight and the size of the rails used, the number and effectiveness of track men to a certain section, the various climatic conditions; besides, also the amount and weight of traffic and the kind of motive power and rolling stock. All these different conditions and forces have to be taken into consideration in each case, both individually and severally, and in different parts of the country. It is thus clear that a large number of facts and conditions, in each case, must be collected, segregated and analyzed, to obtain the facts as to which is the best plate, and each case must then be considered in relation to the other cases under consideration, and as this entails a vast amount of labor and careful study it is clearly beyond the ability of any body of busy railroad men to so consider these cases in one year as to point out positively and definitely to one plate and say, "That is the best plate." This is made the more difficult also from the fact that through the experience gained by manufacturers in the use of their plates they are enabled from time to time to improve them, which necessarily means a constant change in the form and type of the tie-plate. However, considering the cases which have come under the personal observation of this committee in connection with the answers to inquiries which we have sent out to many experienced railroad men who have used the various types of tie-plates, we beg to submit recommendations as to the general construction and use of tie-plates, which we herewith submit, together with the facts and general information from which we have drawn these recommendations:

1. That tie-plates be used always in preference to rail braces for greater safety and higher economy.
2. That tie-plates be used on all ties where the life of the tie is limited by the cutting or sawing action of the rail.
3. That tie-plates be used on all ties whose life is limited on account of the destruction caused by spike killing.
4. That tie-plates with soft ties be used in preference to hard ties without any plates, when the natural life of the soft tie is equal to or greater than the natural life of the hard tie, cost being equal.
5. That the only plate used be one which becomes practically part of the tie.
6. That as a tie-plate is intended to prevent the cutting action of the rail flange across the wood fibers of the tie, the plate used should not itself cut such fibers and should prevent the rail from cutting them.
7. That a tie-plate having sufficient thickness to resist buckling, sand wear and rust, during the natural life of the tie, should be used.

General Considerations.—A tie-plate is a thin piece of metal placed beneath the rail and on top of the tie, with the object of preventing the latter being destroyed by the action caused by the movement of the former. It is not a rail chair, but is distinguished from the latter in being thin and light and often having a less bearing surface on the tie than the base of the rail would did it bear on the tie. The chair is a heavy piece of metal supporting the rail, and gives a greater bearing on the tie than the rail would if it rested on the tie.

In 1871 the first patent on a tie-plate proper was obtained. This was circular and had three teeth below it, but it did not come into extensive use. Several other patents were issued from time to time, but none of them, so far as we are aware, was ever put into practical use. In the '80's the first Servis tie-plate was invented and shortly afterwards put into use on a small scale.

This was abandoned for an improved one, and this latter was soon put into use on the Manhattan Elevated R. R., in New York, where such a device was badly needed to preserve the expensive ties in use and to economize the difficult tie renewals. Later came the C. A. C. Then the Goldie two-flanged. And shortly afterwards the Servis four-flanged, and the shoulder plate was put on the market. Then the Goldie claw, the Wolhaupter arch and girder tie-plate, and the Fox tie-plate were put into commercial use. Many patents have been secured on tie-plates, but the aforementioned plates are those which have been in use extensively, or are now in practical use.

The forces and strains to which plates are subjected are as follows:

1. As a wheel rolls over a rail each tie is loaded consecutively, and the ballast is compressed. The rail bends and takes an undulatory, wavy motion, or lever motion; the portion ahead and behind the wheel being higher than at the wheel. When the loads are heavy and the rails light, and ballast poor, the action is excessive.

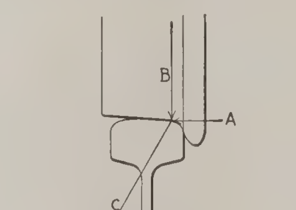

Fig. 1.

When the wheel is between two ties having plates on them, one edge of each plate is loaded. This has a tendency of raising or loosening the other edge of the plate, and at the same time causing the tie to churn—the wider the plate the greater this tendency is—and it is, therefore, apparent that a narrow plate is the best to resist these forces. This rising and falling of a light rail on a plate allows also small particles of sand to enter between the rail and the plate, which thus become an abradant, producing an injurious action on both rail and plate, if continued for any long period, and it would, therefore, appear that particularly where the rails are light some means should be provided for the excluding of this sand.

2. Another loading comes directly from the rail, and is of a compound nature, which is the chief source of tie destruction. This load is illustrated in Fig. 1.

The wheel flange is bearing sideways against the rail head, caused by the centrifugal force when it passes around a curve, or from the sway of the train. This force is shown by arrow marked A. The tread of the wheel is also bearing vertically down upon the head, shown by arrow marked B, and these two forces applied to the head of the rail produce a resultant force, shown by arrow marked C, through the rail which strikes the plate at a point marked D, near the outer edge of the rail flange. At D it is resolved into its two components again, with the result that there is a lateral force equal to A tending to slide the rail on the plate and widen gage, and with the vertical force B tending to press the plate into the tie and crush the fibers. This vertical force, B, will be found to be always much greater than the lateral force A.

Considering now the relative merits of a tie-plate and a rail brace to withstand these forces on a curve, it will be seen that in the case of the rail brace the small lateral force against the head is resisted by the upper portion of the rail brace and is taken care of by it, but as the vertical force is applied near the edge of the outer flange of the rail, this flange soon cuts into the wood and abrades it and allows the outer flange to become lower than the inner one and carries down with it the upper edge of the rail brace, tilting up the outer end, as shown in Fig. 2. It will be, therefore, seen that while a rail brace may take care of a small lateral force, it does not take care of the greater vertical force applied near the edge of the outer flange of the rail.

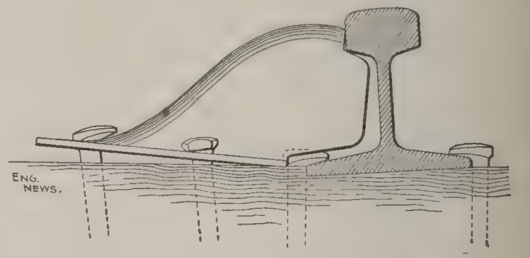

Fig. 2.

Considering now a properly designed tie-plate in place of a rail brace, we find that the great vertical force applied near the edge of the outer flange of the rail is taken care of by the plate and distributed over the tie beneath the plate and prevents the outer flange from cutting into the tie and canting the rail; but it is clear that to properly distribute this loading from the edge of the outer flange there should be more metal in the plate beyond the outer flange than beyond the inner one. The small lateral force causes the rail to slide outwardly on the plate, but this is prevented by the spike or shoulder outside of the rail, and as the plate ties the inside spike to the outer one the inside spike therefore also resists this tendency of the rail to widen gage; consequently, if there are as many spikes through the tie-plate as there would be through the rail brace, the tie-plate will prevent this lateral motion of the rail just as thoroughly as the rail brace would; but, as shown above, it also prevents the rail canting, which the rail brace cannot do. It is, therefore, very clear that a tie-plate is much better than a rail brace, and a tie-plate with more metal beyond the outer flange than beyond the inner one, is better than one which is equal at both ends. It is evident, of course, that the more metal, or shoulder, there is placed on top of the plate outside the outer flange of the rail the longer such metal will resist the wear from the lateral force, and as a continuous flange from edge to edge of the plate will give the most metal, such a flange would appear to be the most desirable, other things being equal, than a single spike, or even two spikes, particularly where the lateral force is extreme. However, there are many millions of plates in use, doing excellent service, without any shoulder, and there are difficulties, also, in shimming such shoulder plates in winter.

The above excellent features of a tie-plate on a curve also exist on tangents, but to a smaller degree. On tangents there is not only the great vertical force from the wheel, but there is more or less lateral force produced by the swaying of the train, trucks skewed out of level, etc., so that the tendency of all rails on tangents is to take an outward cant as well as on curves. This outward cant means widening of gage. This again means increased sway of the train, which again reacts upon the rail. If rail braces are used the tie must be constantly adzed to bring the rail to the perpendicular, thus destroying the tie and destroying the compact bed of the ballast. The rail brace must be removed and again respiked, thus spike-killing the tie, and all necessitating the spending of a great deal of time and labor.

Reports from Practical Experience.—In order to obtain, as far as possible, reports from practical experience, of the comparative merits of the different tie-plate used side by side in track, as well as the general experience with the use of any one kind of tie-plate, a circular letter was sent out to a large number of roadmasters and supervisors of our important railways in different portions of the country.

The following were the questions asked and answered:

> 1. Kind of tie-plate in use? 2. How long in use? 3. How do you apply them? 4. What is the average cost of applying a plate? 5. Have you the different kinds of plates under nearly the same traffic? 6. Kind of tie used? 7. Do you use them on curves only; if so, give the minimum of curvature? 8. Do you use them on every tie? What is your practice in regard to this? 9. Do they move longitudinally; if so, under what conditions? 10. What kind lengthens the life of the tie the most? Remarks.—Under this head state the amount of labor saved in respiking and other work incident to cutting ties, including any other information of interest.

We received a report from only one supervisor who had all o fthe different types of plates in use, but as this supervisor has nearly three-fourths of a million plates of the different kinds in use, about half of them having flanges across the grain of the wood and the other half with flanges parallel with the grain of the wood, and "has been using plates for the last six years," and as he has been studying them with care, his report is of great value. These plates were used on "yellow pine, chestnut and cedar ties," and he "drives them home with a heavy sledge," and says the cost of application varies from ⅜ to 9-16 ct. per plate. The plates are all used under the same kind of traffic and on curves "from two degrees up," and on "every tie on curves." They do not move longitudinally. His experience is that the plate which lengthens the life of the tie most "is the one with longitudinal flanges." Under "remarks" he states that at some curves where it was necessary to roll the rail and regage the track each year, "since plates have been put on these curves they have been kept in perfect gage and it has not been necessary to roll the rail in the last two years, and the rail lays perfect at the present time." "I have just as good results without a shoulder as with one. A plate with a longitudinal flange adheres to a tie better than one which cuts across the grain." In addition to this report he writes further as follows:

> I have had experience with the plates for the last six years under almost all conditions and have found that most of the talk about the spike shearing when it is not protected with a shoulder, is all nonsense. I find that if you keep the rails level so that they conform to the wheel base there will be no spread track, with or without shoulders. I have found that a tie-plate will lengthen the life of yellow pine ties from two to three years, and cedar and chestnut from three to five years. On curves where fast and slow trains are run the tie-plate will double the life of any kind of a tie, and when plates are properly applied they will stop the rolling of the rail, thus saving the adzing of ties to roll rail to gage and level. The plate should be so formed that the track can be shimmed without removing the plate. It should not be removed until the tie or rail is changed. I find that the plate with longitudinal flange adheres to the tie better than plates which cut across the grain. It should be formed so that it will adhere to the tie and become part of the same without injuring the fibers of the wood, and when once applied should not become loose and rattle. At the present time I have found none but the ones with long longitudinal flanges would adhere closely to the tie after they have been in track for a few years. The others will adhere to the tie for a short time, but will soon become loose and rattle.

He also writes relative to plates used in a heavy switch yard:

> These plates have been in track for eight months and have saved one set of ties. Before we used plates on this track it was necessary to renew the ties once every year, and some of them every six months. The cause of ties cutting out so fast is on account of the yard being damp and quite a lot of sand being used. Since tie-plates have been used in this track the ties are good for three or four years. This is one of the cases where plates pay if they wear out every six months, but the longer they last the better they pay.

2. A division engineer who has used some of the Servis, Wolhaupter and Goldie plates, writes as follows relative to his experience with thes different styles: He used them on every tie on curves of 6° and over, and at road crossings, and they are under the same kind of traffic. The ties are white oak and he applies them by "pulling the spike and raising the track high enough to allow adzing of tie level. Place plate under rail and spike to gage. Put plates into tie by striking lightly on edge of plates. After a few trains have passed over, tighten down spikes." In this manner it costs him between 1¼ and 2 cts. to apply these plates, and he finds they do not move longitudinally and "he has not noticed any difference to amount to anything," as to which kind lengthens the life of the tie most.

3. A roadmaster who is using Servis and Goldie tie-plates reports as follows: He uses them on white oak bridge ties only, and drives them into the wood with a 12-lb. sledge, which costs "about 1 ct. per plate." They are used "on every bridge tie," and "do not move longitudinally." He finds that the labor saved is about 50%, and says that he considers the Goldie lengthens the life of the tie most and gives better service than the Servis. The latter buckles.

4. An old, experienced roadmaster, who has about 70,000 Servis plates in track, reports as follows: He has used them on "2½° curves with oak, on cedar switch sets, and on center joint ties, where three ties are used." He applies them "by the aid of Ware's tie-plate surfacer and gage," and cost of applying is ½-ct. in ties out of track and less than 1 ct. when ties are in track. Oak ties used in both cases. He uses them on every tie, and finds they do not move longitudinally, and does not know which plate lengthens the life of the tie most. Under "remarks" he says:

> Having had 45,000 in use since 1892, on oak ties and on curves of 5° to 7½°, have not had to regage any part of it, and as the surface of the plates has not gone below the surface of the tie, and work of surfacing and regaging, caused by the rail cutting into the ties, has been entirely eliminated by their use. As an element of safety they are invaluable.

5. A division roadmaster, who is using the Wolhaupter and Servis plates, reports as follows: He has used these plates on white oak ties, on curves, since 1893-4, and he applies them by "pulling the spikes on every other tie, adzing the tie, and then driving the plate under the rail, which partly beds the plate in the tie. After a few trains pass over I then go back and apply them on the other ties." He says the average cost of applying them is "about 1 ct. per tie-plate." He uses them on curves "only 5° the minimum; under same traffic over both kinds of plates." He says, "I have had no trouble with them moving longitudinally." As to which lengthens the life of the tie most, he says, "The Wolhaupter Arch and Girder will give the best satisfaction. The Servis plates I have in use buckle; that is, turn up at sides of the rail." Under "remarks," he says: "I have used the plates on 5° to 10° curves. Before I put plates on these curves I had to adze the ties and regage the track once a year. Cost of doing this work, about 2 cts. per tie. I have had tie-plates on part of these curves for the last four or five years, and have not had to regage the track since the plates were put in. Before using the plates on these curves the ties would last four to five years, but by using plates we can get the full life of the tie, eight and nine years."

An engineer who has a large number of Servis and less than 100, each, of Wolhaupter and Goldie plates, says he uses the plates under the same kind of traffic and on oak and cedar, and merely "lays them on the tie." The cost of application is "practically nil." He uses them on both curves and tangent, on curves up to 18°. As to longitudinal movement, "under light rails and heavy traffic they move."

7. A railroad man who has a few of both Goldie and Servis plates in use on oak and pine ties, on joints only, states that they do not move longitudinally; that he prefers the Goldie, and that he finds considerable labor saved in the course of a year in re-spiking, adzing, etc.

8. Another roadmaster who is using a few of the Goldie and quite a number of the Servis, says he uses them on every tie, white oak, and on curves from 3° to 7°; that he applies them by "adzing to true gage, put heavy plate on top of tie-plate and sledge to close." The average cost to apply, "about 4 cts. per tie, when we have twenty to thirty trains in working hours, for the Servis, and about half that price for the Goldie." They do not move longitudinally "until the life of the tie is about gone." As to lengthening the life of the tie, "both kinds on a curve give longer life to a tie, neither kind will lengthen the life of a white oak tie on tangent." Under "remarks" he says, "The Goldie is a good, strong tie-plate, but will get loose on the tie sooner than the Servis, but the life of the Goldie will be much longer than the Servis. On a 3° curve and over, one-third labor is saved when the curve is well plated and the curve is safe. Our trains make 60 miles per hour on these curves. We use them under 80-lb. rails; 5-in. base. Have used Servis plates seven years. Like the last style of pattern best; it has a good outside lug that saves track spike and do not crack, but all plates will buckle when placed on poor ties."

9. An engineer of maintenance of way of a large traffic line, which has been one of the most extensive users of tie-plates for years, writes: "We have been using Servis tie-plates for several years past," and says, "that a great saving in the cost of tie renewals, and consequently in the expense of track maintenance, will be secured by their use. The kind of ties particularly used by us are redwood, the natural life of which (under heavy traffic) is seven years. With the use of tie-plates we hope to at least double this period."

10. A superintendent, who has had extensive experience with the use of different kinds of tie-plates, writes: "I am of the impression, however, that the Wolhaupter plates and well treated ties, with chloride or zinc solution, should give at least 30% of increase in life."

11. A superintendent of a road which uses plates extensively writes: "We believe that tie-plates materially lengthen the life of the ties, where ties are destroyed by the cutting of the rail, or by frequent spiking to maintain gage. With ties of soft wood, such as pine and chestnut, tie-plates are essential to secure the full life of the timber, and are especially so for bridge ties or switch ties. The gage is maintained easier and better when tie-plates are used, and we can maintain much firmer bearings between rails and ties than would be possible without the use of tie-plates. Tie-plates practically eliminate the labor of regaging or adzing to turn rail. Where sand is used freely the particular damage is due to softening of the wood, caused by the moisture held by the sand around the ties at the rails. In order to get the full benefit of the plate at such places it is important that the sand be kept below the base of the rail and the top of the tie be kept dry"

It might be well, before closing this report, to state in general the benefits to be obtained from the use of tie-plates:

(1) They prevent the tie from being cut by the rail and thus preserve the tie. a. Renewals in ties are reduced. b. Level of track is maintained. c. Adzing to maintain rail vertical is avoided. d. Cost of track labor is reduced.

(2) The rail is held vertical, and thus—a. Safety of operation is increased. b. Gage is maintained.

(3) The inside spikes help to maintain gage in addition to the outside spikes. a. They dispense with rail braces. b. Prevent the rail rolling. c. Maintain gage by preventing the rail rolling.

Thus, in general, it will be seen that a properly constructed tie-plate maintains good track and thus makes a large saving in the labor of track maintenance and in the cost of repairs to rolling stock through the more perfect track which it produces. It increases the life of the tie and thus decreases the cost of tie renewals. It saves in the cost of operating, through the possibility of carrying heavier loads with the same amount of motive power.

W. J. Prindle, J. L. Single, Henry Ware, Edward Marshall, committee.

In previous years the tie-plate report has provoked much discussion; but this year the report was received with little objection, and the seven recommendations of the committee, given above, were formally approved by the association.

In the afternoon and evening there were trips to the Elitch Gardens, a pleasure resort, where a theatrical entertainment was provided.

The morning session on Wednesday was called to order at 9.30 a. m. There was no report from the Committee on Rail Joints, but Mr. Hickey exhibited a model of the joint with an inverted piece of rail for a base support, invented by Mr. A. Torrey, Chief Engineer of the Michigan Central R. R., and recently described in our columns.

Two reports were presented by the committee on "The Advisability of Increasing the Length of Rails, and the Advantages to be Derived from the Use of Rails with Miter Cut Ends." Both the majority and minority report were printed on p. 172 of our last issue. The discussion turned largely on the expansion and contraction of light and heavy, long and short rails, and the opinion was expressed that heavy long rails take up more of this movement in themselves by internal stresses, while they take longer to heat up to high temperatures. Both reports were accepted as information, on the ground that comparatively few roadmasters have had experience with long rails or miter joints, and cannot therefore vote intelligently upon their wants. The report of the committee on "Widening Gage on Curves" was then read and was probably the report of greatest practical value read at the convention. We print it substantially in full as follows:

Widening Gage on Curves.

The question of widening gage on curves naturally divides itself into two heads: First, the reason, if any, for widening; and, second, the proper amount that the gage should be widened. There is no question but that the majority of roads in the past have widened the gage on curves too much, and without any thought of the reasons for doing so. The present method of gaging wheels gives a clearance of from ⅝ to ⅞-in. on tangent, and it is evident that no good reason whatever can be assigned for widening the gage on the curve, so long as there is sufficient clearance between the flange of the wheel and the rail to permit of the wheel taking a natural position in going around a curve. In other words, so long as the wheel is not forced out of normal position by the rail, or so long as the rails are not disturbed or forced out of their position by the wheels of the truck in passing around. If this be the case, then the second part of the question is simply to find out at what degree of curvature this play would be absorbed by reason of the sharpness of the curve. As in all questions of this nature, there are two factions who do not agree upon the fundamental principles involved in a mathematical discussion. The only two authors who have ever discussed this question thoroughly are Trautwine and Searles. Trautwine's discussion of the problem is based upon the theory brought out by the late A. M. Wellington, whose experiments upon a kindred subject involving the action of trucks in passing around curves, are very elaborate, being made with large-sized models and full-sized trucks. The theory deduced by him from these experiments upon the action of a truck in passing around a curve would be expressed as follows: In any truck system the flange of the forward wheel is invariably pressed hard against the outer rail, all the other wheels standing away from the rail and the rear axle always being normal to the curve except when forced out of that position by the rear inner wheel coming in contact with the inside rail, as shown in Figs. 1 and 2.

The followers of Mr. William H. Searles oppose the Wellington theory and hold his proposition is not proven. Mr. Searles takes the position that when a truck is passing around a curve, the flange of the forward wheel is invariably pressed hard against the outer rail and that the other wheels ordinarily stand away from the rail, and that the rear axle may or may not assume a normal position. Various positions are shown in Figs. 1, 2, 4, 5 and 6. When a truck has but four wheels the other three flanges are not usually in contact with the rails, the rear wheels dividing the play between in some unknown ratio. The sharper the curve the nearer the flange will approach the inner rail, and when by reason of the sharpness of the degree of the curve the rear inner wheel comes in contact with the rail, then the middle ordinate to twice the wheelbase will be just equal to the play allowed in setting the flanges. The rear axle will then be normal to the curve at the point of contact with the rear wheel. The sharpening of the degree of the curve beyond this point will force the rear axle into a position as shown in Fig. 2, and the flange of the rear inner wheel will then be grinding against the inner rail. In a six-wheeled truck, all flanged and with equidistant axles, the same is true as in the four-wheeled truck, up to the time that the rear inner wheel comes in contact with the rail, as shown in Fig. 4. If the curvature is then sharpened, the track will finally assume the position shown in Fig. 5, and the truck will then be wedged tight in the track, the points of contact being the outer front and rear wheel and the middle inner wheel. This happens when the middle ordinate to the chord of the wheelbase equals the play originally allowed in setting the wheel, and of course would indicate the limit of curvature of track at which the truck would go around without spreading the rails. This limit of curvature is expressed by the following formula propounded by Mr. Searles:

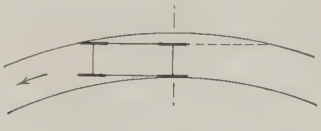

Fig. 1.

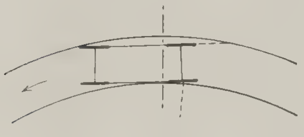

Fig. 2.

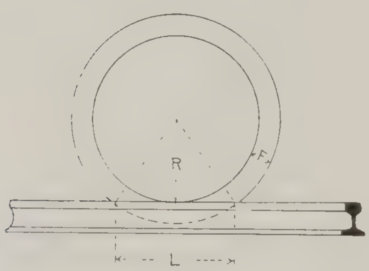

Fig. 3.

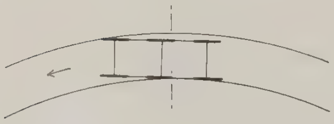

Fig. 4.

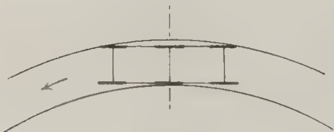

Fig. 5.

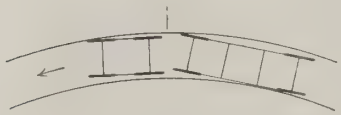

Fig. 6.

$$D = \frac{3825\ p}{I^2}, \qquad (1)$$

in which D = the degree of curve sought, p = the original flange play in inches, and I = the rigid wheelbase in feet.

If the middle axle is not equidistant from the others, let the distances be expressed by a and b in feet, then the formula becomes:

$$D = \frac{956\ p}{a\ b}. \qquad (2)$$

This is a general formula and applies to trucks of eight wheels, all flanged, as well as six wheels or more, and consequently is true for rigid locomotive wheelbases. Applying this formula to an engine with ⅝-in. clearance and maximum rigid wheelbase of 22 ft. 6 ins., the point at which gage should be widened is 5° 30′ curve; but if the swiveling device in the leading truck of locomotive is to be called into play in passing around a curve, Mr. Searles proposes the following equation:

$$D = \frac{956}{a\ b}\left(p + \frac{b\ s}{a + b},\right) \qquad (3)$$

in which b is the driving wheelbase, a the distance from the center of the forward driving axle to the center pin of the pilot truck, s the side motion of the center pin in inches, and p the play allowed by the flanges in inches, D the same as in the other equations. Use coefficient 955 up to 16°. For D = 20° use 960; for D = 30° use 966, and intermediate degrees in proportion.

This formula is based on the conditions that the center pin has exhausted its full side motion. The forward flange driving wheel is in flange contact with the inner rail, and the rear driving flange is in contact with the outer rail. Taking the same example as in the preceding problem, and supposing that the leading truck has a side motion of 1¾ ins., that the distance a is 7 ft., then b would be 15½ ft., and applying the equation (3) we find that D is equal to 16° 12′. With all the conditions assumed in this problem then, the gage would not have to be widened for such an engine up to a curve a fraction over 16°. If it were wished to determine how much a given sharper curve should be widened, it is only necessary to solve equation (3) for p, but write P to indicate the total clearance required, and then

$$P = \frac{D\ a\ b}{956} - \frac{b\ s}{a + b}, \qquad (4)$$

which, if the original clearance is subtracted, will give the amount that the gage should be widened for a given wheelbase.

A question which Mr. Searles has not taken into consideration is that the point of the flange where the wheel would come in contact with the rail in passing around a sharp curve is not vertically under the center of the wheel, as he assumed, but is a point on the wheel flange which is $\sqrt{(R+F)^2 - R^2}$ distant from the vertical through the center of the wheel. This, of course, for small wheels, could be ignored, but for large drivers on sharp curves it becomes an important factor.

Experiments having been made by your committee, they find that curves up to 6° can be laid to gage. Also, that allowance has to be made for the swiveling device on the pilot truck, owing to the fact that in a great many cases the full play is not secured. From tests this should be taken at one-half the amount. Owing to the great variety of wheel gages which pass over a road, allowance has to be made in gaging the track, consequently your committee does not recommend taking up the entire amount of clearance on curves, but rather of allowing one-half inch for any variation. Therefore, your committee would modify the Searles formula and recommend formula (3), modified as follows:

$$D = \frac{956}{a + b}\left((P - \tfrac{1}{2}) + \frac{\tfrac{1}{2}\ b\ s}{a + b}\right) \qquad (5)$$

and in place of formula (4) the following:

$$P = \left(\frac{D\ a\ b}{956} - \frac{\tfrac{1}{2}\ b\ s}{a + b}\right) - \tfrac{1}{2}. \qquad (6)$$

In view of the fact that allowance has been made for variations of wheel gage, your committee does not consider it necessary to take into account the formula

$$\sqrt{(R + F)^2 - R^2}.$$

The limit of widening the gage, in the committee's opinion, should be 1 in.

As the various roads have different clearances and a variety of wheelbases, it is impossible to give a table which would be applicable everywhere; but by substitution in the formula given, a series of tables could be gotten up by the different roads which would meet all their requirements.

As an example, in the use of formulas 5 and 6, a New York, New Haven & Hartford consolidation locomotive is taken, of which the following are the figures to be used:

Wheelbase equals 22½ ft., of which 7½ ft. is the distance from the center of the forward driving axle to the center pin of the pilot truck, and equals a in the formula. The rigid wheelbase is 15 ft., and equals b. The side motion of the center pin in inches equals 1¾ and is represented by s. The play allowed by the flanges in inches equals ⅝, and is represented by p. D equals degree of curve after which widening should begin. Substituting in formula (5), we have:

$$D = \frac{956}{7.5 \times 15}\left((\tfrac{5}{8} - \tfrac{1}{2}) + \frac{\tfrac{1}{2} \times 15 \times 1\tfrac{3}{4}}{7.5 + 15}\right)$$

$$D = \frac{956}{112.5}\left(\tfrac{1}{8} + \frac{13.125}{22.5}\right) = 8.5\ (\tfrac{1}{8} + .583).$$

$$D = 8.5\ (.708) = 6.018 = 6°\ 1'.$$

or widening should begin on curves of over 6°.

Substituting in formula (6) and calculating for a 16° curve,

$$P = \left[\frac{16 \times 7.5 \times 15}{956} - \frac{\tfrac{1}{2} \times 15 \times 1\tfrac{3}{4}}{7.5 \times 15}\right] - \tfrac{1}{2} =$$

$$\left[\frac{1{,}800}{956} - \frac{13.125}{22.5}\right] - \tfrac{1}{2} = (1.883 - .583) - \tfrac{1}{2} =$$

1.3 — .5 = .8-in., or, for all practical purposes, P = ¾-in. In other words, from 6° to 16° the widening will be ¾-in., for the example in question.

If D equals 18° 30′, we have by substitution in formula (6),

$$P = \left[\frac{18.5 \times 7.5 \times 15}{958} - .583\right] - \tfrac{1}{2}$$

$$\left[\frac{2{,}081.25}{958} - .583\right] - \tfrac{1}{2} =$$

(2.172 — .583) — ½ = 1.589 — .5 = 1.089 ins., or, for practical working, P = 1-in.

As previously stated, it is impossible to give one table which would cover all roads; but your committee would suggest for use on those having engines about of the type mentioned in the examples, a table which is practically taken from the above results:

Degree of curve.	Amount of widening, ins.	Gage of curve, ft.	ins.	Degree of curve.	Amount of widening, ins.	Gage of curve, ft.	ins.
1	0	4	8½	10	¼	4	8¾
2	0	4	8½	11	⅜	4	8⅞
3	0	4	8½	12	½	4	9
4	0	4	8½	13	½	4	9
5	0	4	8½	14	⅝	4	9⅛
6	0	4	8½	15	¾	4	9¼
7	⅛	4	8⅝	16	¾	4	9¼
8	⅛	4	8⅝	17	⅞	4	9⅜
9	¼	4	8¾	18	1	4	9½

Therefore for types of engines as mentioned, the widening of the gage should begin on curves of over 6°, and increases 1-12-in. for each degree of curvature over 6°.

F. R. Coates, A. S. Westin, R. P. Collins, J. W. Shanks,
H. B. Dick, Committee.

In the afternoon of Wednesday the concluding session was held. The last report presented was that of the committee on "The Latest Improvements in Frogs and Switches" (Eng. News, Sept. 15, p. 173). There was but little discussion and the report was accepted.

The vote on the place for holding the next convention resulted in the selection of Detroit. After this, resolutions of thanks to local committees, etc., were passed, and the new officers were installed.

During the afternoon there was an electric railway trip of some 20 miles for the ladies, and in the evening Mr. C. M. Hobbs, of the Denver & Rio Grande R. R., delivered a lecture on "Switzerland and Colorado," illustrated by beautiful stereopticon views.

On Thursday there was a trip over the narrow gage Union Pacific, Denver & Gulf Ry. to Georgetown and around the famous "Loop" to Silver Plume, where the railway winds up both sides of the valley, crossing from side to side, and rises 700 ft. in four miles.

On Friday the party left Denver at 7.30 a. m. for Colorado Springs and Manitou, visiting the Garden of the Gods and ascending Pike's Peak by the Abt rack railway. The night was spent at Manitou, and on Saturday there was a trip over the Denver & Rio Grande R. R. to the Royal Gorge, returning to Pueblo for dinner. In the afternoon the party visited the works of the Colorado Coal & Iron Co., after which they returned to Denver.

The Road and Track Supply Association, made up of the supply men in attendance upon the convention, elected officers as follows: President, Wm. Goldie (Dilworth & Porter Co.); Vice-President, J. A. Ingalls (Buda Foundry & Mfg. Co.); Secretary J. A. Brown (Pocket List Publishing Co.); members of the Executive Committee, Messrs. Bray and Fisher.

ANNUAL MEETING OF THE TRAVELING ENGINEERS' ASSOCIATION.

The sixth annual meeting of the Traveling Engineers' Association was held at Buffalo, Sept. 13 to 16. President D. R. McBain, in his address, said that the competition of electric railways must be met by greater economy in locomotive operation. He believed hard steaming locomotives to be the most fruitful source of waste in the motive power department.

The report of the Secretary showed a total membership of 235 railway companies. The receipts were $1,246 and the expenses $1,196. The first committee report was on the question:

What Is the Best Method to Be Pursued by Traveling Engineers in Giving Air Brake Instructions While on the Road?

The report was a very long and detailed one. Space permits an abstract of only a few points touched upon. Holding the brake set too long on passenger trains at the instant of stopping gives a disagreeable surge to the train, and may throw passengers off their feet.

When coupling an air brake engine to her train, the auxiliary pressure on engine and tender can be held down close to the train pipe pressure on the train by not charging auxiliaries up to the full pressure after each release of the engine brake, till hose is coupled ready for air to pass back to train. This will allow you to move the engine if it is necessary to do so to make any more couplings in the train. Do not test the brake until you have the standard pressure. Then make the reductions for a station stop; the first one just hard enough to be sure that all the leakage grooves are covered, and successive light ones afterward, till the train line pressure is reduced 20 to 25 lbs. On no account make an emergency reduction when testing the brake unless it is especially called for after the first test.

Take up the matter of listening for the length of the train pipe exhaust so as to judge of the number of car lengths of train pipe attached to the brake valve, and thus be able to judge whether they have all the angle cocks open. A partially closed angle cock can be detected by the intermittent flow of air from the train pipe discharged at the first reduction. A partially closed angle cock will allow the brakes behind it to set with a service application, but unless all the triples are in good order, some of them will be sure to release slow enough to jerk the train or stick altogether.

In coupling up hose, the angle cock next engine should be opened first so that the hose will be filled with air from the engine instead of from train pipe of the rear cars. Never open the angle cocks suddenly when the train pipe and auxiliaries are charged with air. It is certain to set all the brakes on that side of the empty hose with the emergency action. If the cocks are opened gradually so air will fill into hose and empty the train pipe, it is only a few seconds before it will equalize with the air in the already charged cars, and then the angle cock can be opened full. Show the trainmen how to couple onto an uncharged car or cars in a siding, and at the same time leave brakes on head end of train free, so that they can at once pull out to couple on the train and utilize the time while moving out of the side track to charge up the empty cars. In the majority of cases the last cars taken on will be fully charged by the time the stop is made for coupling on, and the test of brakes may be made then.

Take up with the trainmen the proper method of using the hand brakes in connection with the air brakes on a partially equipped train. Show them that the hand brakes should be set on the cars immediately behind the air braked cars, as that is the place where the slack in the train can be most easily taken care of, whether air or hand brakes are set or released. When releasing air brakes after hand brakes have been set on rear cars of train, it is absolutely necessary to have hand brakes next the air let off last of all. When backing out of a siding, show that hand brakes should be set on rear cars to hold the slack.

A very important point to take up with the engineers is the wasting of air in the auxiliaries by repeated applications and releases, and the still greater waste by setting the brake full on and then still further reducing the train pipe pressure below the proper amount. On a long train this may become criminal carelessness and cause a wreck by getting out of air on a bad hill.

If an engine is fitted with independent driver brakes, do not tolerate using this for bunching slack in train prior to use of train brakes, especially with all or nearly all air braked cars. These independent engine brakes should only be used independently when releasing the train brakes at slow speeds (when handling freight trains) or in bunching slack in train when going over uneven roads, "hog backs" and sags in track.

The use of pressure retaining valves on driver brakes of freight engines avoids lots of rough handling and prevents breaking in two. When stops are made for stations, water tanks and coal chutes, should the engineer see that he is going to stop too soon, and has to release the brakes, he turns up the pressure retaining valve before doing so, and thus holds the train bunched, as the retaining valve prevents the engine and front cars from running ahead. When the second application is made, there is very little chance of breaking the train in two and very little shock is felt at the rear end.

How Can the Traveling Engineer Best Instruct and Assist the Fireman in the Economical Firing of the Locomotive?

In this report stress was laid on the selection of men of some intelligence and ambition for firemen. In endeavoring to secure economy of fuel, it must not be allowed to interfere with the requirement that the engine shall hold its load and make its time. Good results can be secured by giving firemen elementary treatises on combustion, and seeing that they study and understand them. It is absolutely necessary to economy of fuel that the engine runner and the fireman should work in harmony, and the Traveling Engineer should have authority in the making up of engine crews to see that this is effected.

The Uniformity of Cab Fittings and Their Arrangement with a View of Accessibility and Utility.

The great variety in locomotives which now exists makes uniformity impossible; but whatever the type of locomotive, no pains should be spared to arrange the cab fittings where they will be most convenient for the engineer. A combination stand or turret supplied from a dry pipe in the dome, and fitted with an inside closing valve, was favored. The convenient location of the brake valve is the most important matter. It should not be so close to the boiler that the heat will injure the gaskets, and the handle should be where the engineer can reach it when he has his head out of the window looking for signals. The grouping of gages is an excellent plan, and uniformity in the diameter and graduation of the same gages on different locomotives in the same "pool" is much to be desired.

Lubrication of Locomotives; the Best Method of Reducing Hot Bearings to a Minimum with the Least Amount of Oil.

The report on this subject gave a large number of practical hints of much value, including answers to a long list of questions sent out by the committee.

The Use of Water on Hot Bearings of Engines and Tenders. Is it Advisable, and to What Extent Used? In Using Water for Hot Driving or Engine Truck Boxes, is it Used on Top or Side of Boxes?

It appeared from the report of this committee that on heavy locomotives in fast passenger service it has become quite common to fix pipes from the tender or injector pipe connections so that water can be turned on tender or engine truck journals or the driving boxes if they get hot on the road. On some roads, it is stated, that the fastest trains are only able to keep to their schedule by this means. One member stated that, besides his locomotive experience, he had been eight years in marine service, and had been in vessels where engines ran without stopping for 30 days with nothing but water as a lubricant in some of the heavier bearings.

Does the Location of Track and Station Signals in Any Way Affect the Safe and Economical Operation of Locomotives?

The following is an extract taken form the report of this committee:

> Every time a train is stopped or its speed reduced, there is not only more fuel used, but there is also more strain on the machinery of the locomotive, and on the draft rigging of cars getting the train into speed again, than there would have been had the speed of trains not been checked. This means not only increased cost of fuel, but also greater cost for repairs. Track and station signals are intended to indicate to engine and trainmen whether the track ahead is clear or blocked. They should be so located that engine and trainmen can distinguish them at a sufficient distance without having to reduce speed if the track is clear or be in danger of overrunning the signal if the track is blocked. Signals located where they cannot readily be seen or distinguished, or placed where their meaning may be wrongly interpreted, are neither safe nor economical. They require every train that passes them to slacken speed and the extra expense this causes in the course of a year is a large item. In addition to this expense, there is also an element of danger connected with such signals that should not be overlooked. With the high speed at which trains are run, and the heavy tonnage hauled, engineers are compelled to take every advantage possible to keep their trains on time. With signals properly located they have no difficulty in doing this; but where signals are located obscurely, it is often a question with him whether he will reduce speed to a safe limit, or take chances on the signal showing clear track. He may do this for a number of times with safety, but sooner or later the inevitable will happen and the wrecking crew will be needed.

In addition to the reports abstracted above, the following report of a special committee appointed at the meeting met with general approval:

The bearing at the back end of main rods is a very important and often a very troublesome one, and it is necessary that the brasses of these bearings be carefully fitted—that is, filed so as to be free of bearing at the joints of brasses and for a distance not less than a ½-in. from that point. The fitting of brasses to back end of main rods should be done so as to leave them free from the pin at all points. The size of the oil hole in all rod brasses should be as large as the oil hole in the strap. When the temperature of a brass bearing has been sufficiently raised to cause a discoloration it will ever afterwards be found unreliable.

With proper mechanical conditions existing, engine oil is the proper lubricant for all rod bearings. In the event of a pin becoming heated, valve oil (owing to its higher fire test) should be used. Engine oil should also be used for the lubrication of eccentrics. These should be supplied through a cup similar to that used on rod bearings. There should be a cellar in eccentric straps, oil cups on rocker boxes, also packing in link block oil holes. A link motion judiciously oiled can safely be run from 75 to 100 miles with one oiling. Oil cups which can be shut off at the end of each trip should be used for the guides. Oil applied by hand is wasted.

It will be found a valuable aid towards keeping cylinders, pistons, piston rod packing, valves, valve seats and valve stems in good condition to keep the main throttle valve slightly open when going into stations or down long grades, as it overcomes the vacuum forming tendency of the main pistons and prevents the drawing into the cylinders and steam chests of the smoke-box gases.

It is a good practice to groove the face of the piston packing rings, with the object of reducing the area of the surface of the ring in contact with the cylinder surface, as well as forming a partial balance to the piston and a receptacle for oil. The best point to have oil reach the driving and engine truck journals will be found to be as near the horizontal center of the journals as is possible. The use of a driving box cellar which will permit of the inspection or renewal of the packing without taking the cellar down is advisable. Enginemen should be instructed not to stir up the packing on the top of driving boxes, as it has been found to result in the heating of those journals, owing to the dirt which accumulates there being carried with the oil into the oil holes and onto the journals.

It is a necessary requisite for engine or car oils to be of such a consistency as will permit a free flow at atmospheric temperature. Tender truck journals should be lubricated by roundhousemen, who should be instructed to inspect these parts each trip to see that the packing is saturated with oil and kept in close contact with the journals. The best results are obtained by assigning this work to special men. Where engines are not equipped with a device which assures a constant feed of oil to the valves and cylinders of high pressure engines at all times, the enginemen should be instructed to vary the main throttle opening at intervals to permit the oil which has lodged in the oil pipes to flow into the steam chests.

Officers for the ensuing year were elected as follows: Pres., D. R. McBain (Mich. Cent.), Jackson, Mich.; First Vice-Pres., P. H. Stack (U. P.), Council Bluffs, Ia.; Second Vice-Pres., Charles Davies (Erie), Buffalo, N. Y.; Third Vice-Pres., C. P. Cass (St. L. & S. F.), Monett, Mo.; Secy., W. O. Thompson (L. S. & M. S.), Elkhart, Ind.; Treas., C. A. Crane (A. T. & S. Fe), Fort Madison, Ia. Executive Committee, J. R. Belton (C. & O.), Covington, Ky.; C. B. Conger (C. & N. W.), Grand Rapids, Mich.; I. A. Brown (C. & O.), Covington, Ky.

The next meeting will be held in Cincinnati, O., the 3d Tuesday in September, 1899.

Any of our readers desiring to secure the complete reports above abstracted should address Mr. W. O. Thompson, Elkhart, Ind., the Secretary of the Association.

ANNUAL MEETING OF THE NEW ENGLAND WATER-WORKS ASSOCIATION.

The seventeenth annual convention of the association was held at the Hotel Wentworth, Portsmouth, N. H., Sept. 14 to 16, inclusive. Mr. Willard Kent, President of the association, delivered an address after the usual opening exercises. He stated that the membership of the association had increased from 27 at its organization to 570 on June 1, 1898. During the past year the average attendance at the winter meetings was 84, the minimum having been 75. The report of the Treasurer showed a balance of $2,937, a gain of about $200 during the year. The Secretary stated that the 570 members were divided as follows: Active, 488; honorary, 5; associate, 77. The gain in membership during the year was 21.

Method for the Determination of Color and the Relations of Color to the Character of the Water.

The first paper read had the title given above, and was by Mr. Frederick S. Hollis, Biologist, Metropolitan Water Board, Boston. The author stated that the color of surface water varies with the amount of carbonaceous matter present. In unpolluted surface waters there is a pretty close agreement between the amount of color and the oxygen consumed, loss on ignition and albuminoid ammonia in solution. In contaminated waters there is no direct relation between the color and the chemical constituents. The color of water increases with stagnation. At the deepest part of Lake Cochituate the color at the surface has been observed to be 0.22, against 1.20 at the bottom. After standing, however, the color of the bottom sample increased to 3.70, by the oxidation of iron. The high color of this sample is no indication of the character of the whole lake, as the deep place from which the sample was taken has only a limited area. Much of the color of water is due to peaty materials, and much of that of surface water is caused by leaves. The author concluded his paper by describing the various color standards in use, including the Neslerized ammonia of Leeds, the platinum-cobalt of Hazen and the device designed by FitzGerald and Force.

Some Things that Should be Done in Constructing a Distributing System of Water-Works.

This paper was by Mr. Wm. R. Hill, M. Am. Soc. C. E., Chief Engineer and Superintendent of the Water-Works of Syracuse, N. Y. Attention was first called to the necessity of rigid inspection of pipe during its manufacture, including both material and workmanship. The joining of three or four lengths of pipe before lowering into the trench may be a little cheaper, but there is liability of injuring the joints. A block of masonry should be built back of all bends, hydrants and ends of all lines more than 6 ins. in diameter, to take up the pressure. The pipe should be tested after it is laid, to a pressure at least 100 lbs. in excess of the ordinary pressure the pipe is to withstand in service. Good castings for corporation and curb cocks may be made from a mixture of 88 parts refined copper, 6 parts tin, 3 parts lead and 3 parts zinc, but the zinc should be omitted if there is alkali or salt in the soil, or corrosion will result. Regarding service pipes and the use of fire hydrants for filling sprinkling carts, Mr. Hill may be quoted in full, as follows.

> Service pipes should be laid in straight lines at right angles to the axis of the street so that at a time of a leak the location of the corporation cock could be easily determined from the position of the curb cock. This, together with the fact that the main is laid at a fixed distance from the center of the street, will enable the repair to be made with the least possible disturbance to the pavement. If the service pipe is of lead all the solder joints between the main and curb should be made in a shop, as better work can be done there than in a trench. To one end of the pipe the tail piece of the corporation is soldered, while to the other end is the curb cock and a piece of pipe about a foot long is attached. The pipe is then coiled up and taken to the trench where it is to be used. The tail piece is attached to the corporation and the service is complete to a point one foot beyond the curb cock, where the joint connecting with the service to the building is made. None but the best of solder for the purpose should be used. The service pipe between the main and the curb should be made of one piece, and no unnecessary joints should be permitted. All short

pieces of lead pipe can be melted up and used for calking joints in cast-iron pipe. A service pipe should not be laid in the same trench or close to a sewer. It would be hard to discover a leak should one occur in such a service, as the water would not appear on the surface of the ground, but would find its way to the sewer. Where a sewer or other trench is excavated crossing under a lead service pipe, the pipe should be properly supported, as when the trench settles it would carry the pipe with it and would be apt to cause a leak at the nearest joint.

Fire hydrants should not be used as fixtures to fill sprinkling carts with water, unless they are provided with a special valve and nozzle for that purpose. Such a valve and nozzle can be made in the dome or cap of the hydrant. During the season when sprinkling is done the drip is closed and main valve in the hydrant is slightly opened, so that there is a constant supply of water in the barrel of the hydrant. The men who sprinkle cannot interfere with the main valve or nozzles, as their wrench will not fit them. To use these hydrants for fire purposes the firemen first close the main valve with three turns of the valve rod. They cannot make a mistake and take off the upper nozzle, as that requires a smaller wrench. No one but a fireman or an employee of the water department should be permitted to have a wrench that will open the main valve. These special hydrants should be placed at points convenient for the purpose of sprinkling. In the city of Syracuse, N. Y., there are 200 that have been in use two years, and have been very satisfactory, both to the water and fire departments. A frequent cause of trouble with hydrants is because they are not properly drained to a sewer. If this connection were made with a lead or wrought-iron pipe there should be no liability of the hydrant becoming frozen.

In answer to questions Mr. Hill stated that the special nozzles for filling sprinkling carts, described above, are on Eddy hydrants. He liked to see the lead driven ⅛-in. inside the bell. If that is done and the pipe tested to 100 lbs. above what it is to bear, he felt safe. On the Skaneateles Lake pipe line, at Syracuse, no leaks have been discovered since the pipe was put in use, some four years ago, and it is patrolled daily.

Mr. Fuller stated that on some systems under heavy pressure he had used cast lugs and rods to hold hydrant in place, instead of masonry supports.

Mr. Crandall expressed the opinion, with which several members afterwards agreed, that very poor coating had been put on cast-iron pipe of late, and that, in general, the pipe has been of poorer quality since the fall in prices. Mr. Coffin thought one cause for the poor coating is that the pipe is not left long enough in the bath, owing, perhaps, to rush of work at the foundries. He had been considering the advisability of lining cast-iron pipe with cement. Theoretically, a 6-in. cast-iron pipe reduced to 5¼ ins. by a cement lining would discharge as much water after 15 years as a 6-in. cast-iron pipe at the end of that period. Mr. Richards thought it would be cheaper to make the cast-iron pipe larger at the start.

The Water-Works of Portsmouth, N. H.

An informal talk on these works was given by the Superintendent, Mr. Ayers. They were built in 1798, by a company, and sold to the city in 1890. The first supply was by gravity from a spring which is still in use, delivering 300,000 to 400,000 gallons a day. In 1798 there were 127 water takers, paying a total of about $700 a year for water. In 1840 there were 459 takers, paying $3,800, and in 1890, when the city took the works, some 1,900 takers paid $23,000 a year.

The last of the wooden logs laid in 1798 were taken up in the 70's, when it was found that the 5-in. bore had increased to 8 ins., save for projecting knots, and the interior was polished as smooth as mahogany. All sorts of service pipes have been used during the last hundred years, including 1½-in. cast-iron pipe lined with ½-in. glass tubes, and wrought-iron pipe, enameled inside and outside with glass.

The Occurrence of Cristatella in the Storage Reservoir at Henderson, N. C.

This paper was presented by Mr. Robt. S. Weston, C. E., of Brockton, Mass., who was called to Henderson last July to ascertain the cause of a bad odor in the water furnished by the Henderson Water Co. The source of supply for these works is from spring-fed brooks, impounded in a shallow reservoir having a maximum depth of 10 ft., while most of it is only 4 ft. deep. The drainage area is 2.32 sq. miles, composed mostly of arable and pasture land, with some swamps and peaty matter. There is a population of 509 in the drainage area, or about 220 per sq. mile. There are 87 privies in the drainage area, but none are within less than 100 ft. of any stream, and the soil is so sandy that all the water is subjected to natural filtration, except during freshets. The cristatella develops in the reservoir every year, between July 1 and Sept. 15, giving rise to an odor like heaps of old oyster shells. The organism is a polyzoan, or moss-like animal, which attaches itself to the sides and bottom of the reservoirs, grows only in the light, and spreads by a budding process. It occurs at Henderson in greatest numbers when the temperature of the water is at the maximum, which was 85° F. this year. The temperature of the water in the feeders was lower, and few or none of the organisms developed there. They grew in greatest numbers near the intake, where the water was shallow and the temperature highest. If the reservoir was deeper, so the temperature would not rise so high, doubtless there would be no trouble. To remove the odor, as well as the turbidity which occurs at times, Mr. Weston recommended aeration, with subsequent filtration through a Warren filter. The aerator is placed over a small settling tank. Water passes upward to and through a ball nozzle, above which is a hood which deflects the water downwards over four steps, or weirs, one above another, pyrimidal in form, the lower step being 5 ft. sq. The daily capacity of the plant is to be 300,000 gallons. The daily consumption averages about 75,000 gallons. The plant is now being built. Questions put to Mr. Weston by members brought out the statement that he believed mechanical filtration to be cheaper than slow sand filtration in this case, since for taking out these comparatively large organisms a higher rate of filtration was permissible than where bacteria are to be removed.

The Water-Works of Monson, Mass.

A description of these works was read by Mr. F. L. Fuller, M. Am. Soc. C. E., of Boston. The plant was built in 1894-5, with Mr. Fuller as engineer and Mr. E. E. Eglee, of Flushing, N. Y., as contractor. The supply is taken from a large well located near a stream with a drainage area of about 6 sq. miles above the location of the well. The well is over 300 ft. above the village, thus giving a good gravity pressure, a very unusual thing for a ground water supply. The well has an inside diameter of 73 ft. at the top and 69 ft. at the bottom, the water generally being 19 ft. deep. Its storage capacity is about 675,000 gallons. The wall is of dry rubble, packed on the outside with broken stone, which gives some additional storage capacity. An iron roof covers the well. About 19 acres of land surrounding the well have been bought by the town.

Since these works were built the state of Massachusetts has built an extension of them to supply the Hospital for Epileptics, located in Monson. The chief feature of the extension is a distributing reservoir, 41 ft. in diameter at the top and 39 ft. at the bottom, having a concrete roof. A band of soft steel encircles the outer wall of the reservoir, to take up the thrust of the roof. The roof has a 4-ft. rise, and the concrete is 10 ins. thick at the springing line and 8 ins. at the top, the whole being covered with earth. The concrete is composed of 1 part Alsen's Portland cement, 2½ parts clean, sharp sand, and 4½ parts broken stone, not exceeding 2 ins. in size. Centering was placed for the whole roof, instead of for section after section. This method Mr. Fuller prefers for circular roofs. The reservoir has a concrete bottom 1 ft. thick, beneath which are drain tiles laid in broken stone, to prevent an upward thrust of the ground water on the bottom of the reservoir. In the driest weather there is some flow from the drains. Two small pipes extend up through the bottom of the reservoir. These are for the admission of ground water, in case of excessive pressure, and are provided with check valves to prevent loss of water from the reservoir.

Man's Imitation of Nature in the Purification of Water.

A paper with the above-named title was read by Dr. Gardner T. Swarts, Secretary of the Rhode Island State Board of Health, Providence, R. I. Slow sand filtration, the use of coagulants and subsiding reservoirs, the author showed, all have their prototypes in nature. These various systems were described by the author in an entertaining manner. Special inquiries addressed to health officers seemed to him to disprove the assertions sometimes made that the alum used in mechanical filtration is injurious to the human systems. Of 40 cities responding to his inquiries the health officers of only three or four stated that alum had been found in the filtrate. The amount of alum used in the various cities ranged from 0.1 to 7.0 grains per gallon of water. Dr. Swarts stated that slow sand and mechanical filtration may each be relied upon to give satisfactory bacterial results, but his remarks showed that he prefers mechanical filtration. Speaking of ordinary dug surface wells and of cemeteries located near sources of water supply, he said he thought the dangers from these had been overrated. Excavations near old cesspools and graves showed a discoloration of the soil for but a few inches from their limits. If the adjacent material had fissures the danger might be greatly increased.

Mr. Robt. Weston, having been asked to give some information regarding the Louisville experiments on water purification, said that the problem there, at times, was to remove 40,000 bacteria per cu. cm. and from 40 to 100 tons of mud from each day's supply. At New Albany, which is across the river from Louisville, and takes its supply from the same source, the Ohio River, the benefits of sedimentation are apparent. Although the water for New Albany receives the sewage of Louisville, which the Louisville supply does not, New Albany has only about 30 deaths from typhoid fever per 100,000, while Louisville has from 70 to 80. The New Albany water has about 30 days' sedimentation. Bids have already been received at Louisville for a filter house and clear water basin beneath it, but not for the filters themselves.

Results of Tube Well Experiments in Lowell, Mass.

These results, as set forth by Mr. Geo. Bowers, City Engineer of Lowell, are three driven well plants, with a combined normal capacity of about 10,000,000 gallons a day. The water is of good quality, and the quantity seems ample in view of the fact that the average daily consumption in 1897 was 6,594,000 gallons, and the average for January, the month of maximum consumption, less than 7,500,000 gallons. The third plant, recently completed by B. F. Smith & Bro., of Boston, as contractors, has a capacity of about 450,000 gallons a day. It includes 169 driven wells, each 2½ ins. in diameter and from 28 to 42 ft. deep, depending upon the thickness of the water-bearing stratum, the top of which is uniformly about 25 ft. below the surface of the ground. Lead pipe is used to connect the individual wells with the suction mains, as it can be made to conform more readily to the inevitable slight differences in elevation of the well tubing. The suction main and branches were tested with air in the field, and leaks were discovered where none were apparent on the water test. An air receiver is provided on the suction main, and there has been little trouble with air in the pipes thus far. The cost of the three plants has been about $265,000, or $26,500 per 1,000,000 gallons per day. Generally only two of the driven well plants are in operation, leaving one for emergency use or repairs.

Surface Water Supplies.

This paper was presented by Mr. John C. Haskell, of Lynn. It was devoted to the sanitary phases of the subject, calling attention to the dangers from typhoid fever due to sewage pollution and disagreeable tastes and odors caused by the lower forms of organic life in the water. Assuming that 400 microscopic organisms per cu. cm. will give rise to offensive tastes and odors, Mr. Haskell showed by figures from the report of the Massachusetts State Board of Health for 1896 that most of the surface supplies of the state were unsatisfactory during one-fourth of the year. The Laurence experiments show that surface waters may be made satisfactory in every respect by slow sand filtration; supplemented by aeration if necessary. A proper system of filtration, the author believed, is as necessary for surface supplies as are storage reservoirs. In conclusion, he expressed the belief that the surface waters of Massachusetts are as good as those of any other state, and with filtration may be made superior to underground waters.

Mr. Clark said he, agreed with Mr. Haskell regarding the advisability of filtering surface supplies, but even then they do not always have as good a color as ground waters. Regarding the Lowell well system, previously described at this meeting,no one knows how long it will be ample to meet the demands of increasing consumption, nor when iron will develop. He believed Lowell would eventually have to put in a filter plant, either to supplement the well supply from another source, or to remove iron from the water.

Mr. Richards pointed out the difference between disagreeable and dangerous waters. He thought it unfair to say that all surface supplies ought to be filtered, believing that some water from sparsely settled drainage areas was perfectly safe in its natural condition.

The Separate High Pressure Fire Service System of Providence, R. I.

In the absence of the author, Mr. Edmund B. Weston, M. Am. Soc. C. E., this paper was read by Mr. D. V. French, of Boston. In an appendix to the paper the author described a service used for thawing the ground to a depth of 12 to 24 ins. for trenching over 4,000 ft. in winter, the street being macadamized. Wooden boxes without bottoms were used, having a length of 72 ft. and a combined width of 4 ft. Steam from a boiler was admitted to the boxes. The boxes cost less than $20 and the thawing cost only 6.7 cts. per lin. ft. 4 ft. wide.

Mr. French said, in discussing the paper, that it was of great interest to insurance men, who were in favor of gravity supplies. A pressure of 100 lbs. is sufficient and preferable, except for high buildings. The proprietors of locks and canals at Lowell recently dug up some 12-in. uncoated cast iron pipe laid in 1849. It was so badly corroded that tests showed its carrying capacity to be no greater than that of a clean 8-in. main.

Tests of a Pumping Engine at Indianapolis, Ind.

A communication from Mr. F. A. W. Davis, of Indianapolis, was received and ordered printed, giving the results of a test of a Snow pumping engine. The test was made by Prof. W. F. M. Goss, and showed a duty of 150,000,000 lbs. on the British thermal units basis.

Closing Business.

The constitution was amended, without opposition, so as to permit meetings to be held outside of New England. There is a large membership in other sections of the country. An invitation to hold the next annual meeting at Syracuse, N. Y., was received from Mr. Wm. R. Hill, M. Am. Soc. C. E., of that city, and referred to the executive committee. The following are the principal officers elected for the ensuing year, all but the president being re-elected: President, F. F. Forbes, Brookline, Mass.; Secretary, J. C. Whitney, Newton, Mass.; Treasurer, Geo. E. Batchelder, Worcester, Mass.; Editors of the Journal, Jos. E. Beals, Middleboro, Mass., and Wm. H. Richards, New London, Conn.

Excursions.

On Thursday afternoon a boat ride was taken to the Portsmouth Navy Yard and around the harbor. On Friday, after the morning session, there was a drive about Portsmouth and vicinity.

Exhibits.

The exhibits by associate members were in charge of Mr. H. F. Jenks, of Pawtucket, R. I. A list of them is given under Industrial Notes.

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THE LARGEST SINGLE CONTRACT ever let for an open-hearth steel furnace plant was closed on Sept. 24 between the Riter-Conley Co., of Pittsburg, Pa., and the Alabama Steel and Shipbuilding Co., Ensley, Ala. The contract calls for ten 50-ton "Wellman" rolling furnaces; the general dimensions being approximately 21 ft. wide, 37 ft. 6 ins. long, with a total height above foundations of about 22 ft. The contract embraces everything complete above foundations, including steel castings, hydraulic cylinders, and all plate and structural work for casings, bindings, pedestals, etc. The work requires approximately 400 tons of steel castings alone, while the total tonnage of steel work and all is nearly 2,000 tons. The work is to be erected complete at the new steel works at Ensley, the foundations being already finished. A gas producer house and a storage bin, 18 ft. wide by 343 ft. long, both of steel construction, are also included in the contract. The work was all designed by the Wellman-Seaver Engineering Co., Cleveland, O.

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A VERY LARGE ENGINE SHAFT is being constructed by the Bethlehem Iron Co., of South Bethlehem, Pa., for the Corliss Steam Engine Co., of Providence, R. I. This shaft will be 27 ft. 10 ins. long, with a maximum diameter of 37 ins., a bearing diameter of 34 ins., and a diameter of 32 ins., where the crank-disks fit on. Throughout its length is a 17½-in. hole. It is estimated that the finished shaft will weigh about 63,000 lbs. The specifications call for an elastic limit not less than 50,000 lbs. per sq. in., and an elongation of 18% in a round test piece 1×10 ins.

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A NEW PLANT FOR MAKING LARGE GUNS is about to be erected by the Carnegie Steel Co., at Homestead, Pa., according to a press despatch. A plot of ground of 35 acres on the Monongahela, within half a mile of the armor-plate mill has been purchased, and four buildings will be erected with a capacity for employing 2,000 hands. The new plant will probably contain only turning and other finishing machinery, as the open-hearth plant and hydraulic forging machinery now at the Homestead works are well adapted to produce gun forgings.

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THE NEW 12-IN. GUN FOR THE NAVY is intended to take the place of the old 13-in. gun. With this object in view, it has been increased in weight from 46 to 52 tons; but the 13-in. weighed 61 tons. The new 12-in. is designed to use a powder charge giving a velocity of 3,000 ft. per second to its projectile, says the Washington correspondent of the New York "Sun," as compared with 2,000 ft. for the old 13-in. gun.

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A 12-IN. KRUPP PROCESS ARMOR-PLATE, made by the Carnegie Co., was tested at Indian Head on Sept. 12. A 6-in. plate had previously been tested by a 6-in. shell with surprising results, and the government demanded the thicker plate now tried. The new plate was slightly under 12 ins. in thickness, and was substantially bolted to braces and backed by about 7 ft. of wood. The gun used was a new navy 12-in. gun, at 300 ft. range. Three shots were fired with armor-piercing projectiles. The first had behind it 380 lbs. of powder, imparting a velocity of 1,833 ft. per second; this projectile penetrated 8½ ins. and remained imbedded, with signs of being badly distorted at the point; but there were no radial or other cracks in the plate. The second shot had 417 lbs. of powder, giving a velocity of 2,022 ft. per second; as expected, this shot passed clear through the plate and backing, but what was found of the shell was badly broken and distorted. With the third shot only 370 lbs. of powder were used, with a velocity of 1,720 ft. per second; this shell penetrated about 5 ins. and stuck in the armor. But at the end there were no opening cracks in the plate, such as would be expected under so severe a test. The experts estimated that this plate had as much resisting power as a 13½-in. plate treated by the ordinary Harvey process. The test was so satisfactory that the Krupp process will probably be used for the armor on the new warships now contracted for. The maximum thickness of armor will probably be 15 ins., instead of 18 ins.

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A 35.2-KNOT SPEED, for the torpedo-boat destroyer "Hai Lung," is claimed by the "Kolnische Zeitung." This boat was built at Elbing, Germany, for the Chinese government by the Schichau Co., and the trial runs were made in the open sea over a 19-knot course, with a fresh wind and considerable sea. The boat traversed this course several times, the average time being 32 m. 28 s.; or the equivalent of a speed of 68 kilometers, 35.2 knots, or 40.8 statute miles. This is claimed to be in excess of any speed heretofore made on the water, surpassing that of the "Turbinia."

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THE SPANISH ARMORED CRUISER "INFANTA Maria Teresa," sunk at Santiago on July 3, has been finally raised and towed into the harbor of Guantanamo, Cuba. This ship was built at Bilboa in 1890, and is a twin-screw steel vessel, 364 ft. long over all; 65 ft. 2 ins. beam; 21 ft. 6 ins. mean draft; with a displacement of 6,890 tons. She has two sets of vertical, triple-expansion engines, and under natural draft these engines developed 9,500 I. HP., giving a speed of 18½ knots; under forced draft the power developed was 13,700 I. HP., with 20.2 knots speed. She will carry 1,050 tons of coal, giving her a steaming radius of 9,700 miles at 10 knots. Her water-line steel armor belt is 5½ ft. deep, 315 ft. long, and from 10 to 12 ins. thick. Her two turrets have 9-in. armor; the conning tower is 12 ins. thick, and the protective deck is from 2 to 3 ins. thick. Each turret contains one 11-in. Hontoria gun; and she had ten 5.5-in. Hontoria rapid-fire guns, eight 6-pdr. and ten 1-pdr. rapid-fire guns, with eight Nordenfeldt and two Maxim machine guns, and eight torpedo tubes. Her complement of officers and men was 484. The work of raising the "Infanta Maria Teresa" was performed by the Merritt-Chapman Wrecking Co., under the direction of Naval Constructor Hobson.

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THE FOUR COAST DEFENCE MONITORS for which bids will be received this week, are already named the "Arkansas," "Connecticut," "Florida" and "Wyoming." These monitors are limited in cost to $1,500,000 each, and the general plan includes a single, balanced Hichborn turret on the center-line forward, armed with two high-power 12-in. rifles for smokeless powder, and four 4-in. rapid-fire guns will be mounted on a raised superstructure aft of the turret. There will also be a secondary battery of three 6-pdr. and four 1-pdr, automatic rifles. The length of the monitor on the load water line will be 225 ft.; extreme beam on the water line, 50 ft.; mean draft at normal displacement, 12 ft. 2 ins.; normal displacement, about 2,700 tons; total coal capacity, loose stowage, 200 tons. The hull will be unsheathed steel, with double-bottom and water-tight subdivision; there will be one military mast. The side armor belt will have a maximum thickness of 11 ins., tapering to 5 ins., with a depth of 5 ft. The barbette will be 10 ins. thick, and the turret will have 10-in. inclined front plates at an angle of 42°, with side plates 9 ins. thick. Two vertical, triple-expansion engines, with 17.26¼ and 40-in. cylinders and 24-in. stroke, will drive twin screws. Four water-tube boilers will furnish steam at a working pressure of 250 lbs. The speed called for is only 12 knots.

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SMOKELESS POWDER for the navy is to be made in a government factory now being established within two miles of the proving grounds at Indian Head. The factory is being built under an appropriation of $97,000 made by the last Congress, and the work of construction will be under the charge of Lieutenant Bernadou, U. S. N., an expert in the development of smokeless powder. The plans call for a plant capable of making from 3,000 to 5,000 lbs. of powder per day, and to this must be added the Newport government plant, with a capacity of 1,000 lbs. per day. The Duponts and the California Powder Co. are now each under contract to furnish 500,000 lbs. of smokeless powder.

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U. S. NAVAL ESTIMATES for the coming fiscal year aggregate about $20,000,000 in four bureaus alone. The Ordnance Bureau asks for $6,475,358, to meet ordinary expenses and the amount necessary to pay for guns and armor on ships under construction or contracted for. An additional sum will be required for the torpedo boats and destroyers soon to be contracted for. The Bureau of Construction and Repair wants $6,000,000 for vessels building, and $3,500,000 to make necessary repairs on ships in service. The Bureau of Steam Engineering asks for $1,000,000 for repairs to the machinery of ships. The Bureau of Yards and Docks wants $1,500,000 for a large dry dock at the Norfolk Navy Yard; $612,000 for the Brooklyn Navy Yard; $306,000 for Portsmouth; $367,000 for Boston; $755,000 for League Island; $2,000,000 in total for Norfolk; $25,000 for New London; $148,000 for Port Royal; $112,000 for Key West; $871,000 for Mare Island, and $53,000 for Puget Sound.

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THE POST-GRADUATE COURSE IN NAVAL ARCHITecture, commenced at Annapolis last year, under Naval Constructor Hobson, is abandoned by order of the Secretary of the Navy, on the recommendation of Chief Constructor Hichborn. The latter does not deem it practicable for the student to receive from one instructor the advantages or attention necessary for a thorough training. After examining the leading technical schools of the country, he recommends that the cadets selected each year for this post-graduate course be sent to the Massachusetts Institute of Technology, at Boston. This eminently sensible plan has been approved and eight cadets have been ordered to report there on Oct. 1 for a course covering three years. This includes practical instruction during the summer at shipyards and naval stations. The present class will be the largest ever instructed in naval architecture at one time. The practice, for the last 15 years, has been to select the three cadets graduating with highest honors each; and, until recently, these were sent for two years to leading technical schools in England and France. For the first five years the American cadets were educated at the Royal School at Greenwich; but this privilege was later refused by the British government. It will cost the government about $800 per year for the education of each cadet, exclusive of their pay.

◆

TORPEDO BOAT AND DESTROYER AWARDS were made as follows on Sept. 23, by the Navy Department:

No. boats.	Contractor.	Class.	Plan.	Price for each.
3	Neafie & Leavey, Philadelphia.....	D.*	D.§	$283,000
2	Trigg Co., Richmond, Va.	"	"	260,000
2	Harlan & Hollingsworth, Wlmgton	"	B.‡	291,000
2	F. C. Wellington, Weymouth, Mass.	"	"	281,000
3	Union Iron Works, San Francisco.	"	D.§	285,000
1	Gas Eng.& Power Co.,MorrisH'gths	"	...	Not stld.
3	Maryland Steel Co., Baltimore, Md.	"	B ‡	286,000
1	Lewis Nixon, Elizabethport N.J...	T.†	"	161,000
2	Bath Iron Works, Bath, Me......	"	"	161,000
2	Lawley & Sons, Boston, Mass.....	"	D.§	159 400
2	Lewis Nixon, Elizabethport, N.J...	"	B ‡	165 000
3	Trigg Co., Richmond, Va.........	"	D.§	129,750
1	Columbia Iron Works, Baltimore.	"	"	168,000
1	Gas Eng.& Power Co.,MorrisH'gths	"	...	Not stld.

* Destroyers. † Torpedo boats. § Department. ‡ Bidder.

◆

SEGMENTAL WIRE GUNS, to the number of 50, and costing $500,000, have been ordered by the War Department from the Brown Segmental Gun Co., of Reading, Pa. They include 25 5-in. and 25 6-in. guns. "The Army and Navy Journal" says that army ordnance officers protested against the contract on the ground that "there never had been a successful test of this gun." The Brown Segmental Gun Co. answers this charge by saying that a 5-in. segmental tube wire gun, 44 caliber long, was some years ago turned over to Gen. Flagler for test. Though the contract called for a maximum chamber pressure of 50,000 lbs. per sq. in., 192 rounds were fired from this gun, with 43 rounds at pressures from 50,000 to 60,000 lbs., and six rounds with pressures ranging from 60,000 to 82,850 lbs. per sq. in. The gun survived this severe treatment, though the lining tube finally yielded; and this tube was only considered good for 150 rounds at 50,000 lbs. pressure, instead of 192 shots. The company considers this a very successful and thorough test of the qualities of the wire-wound gun.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Sept. 22 on the Wisconsin Central R. R., close to White River, a small station near Ashland, Wis. A freight train broke in two while going down grade and the rear portion ran into the forward cars, killing one man and seriously injuring another.

◆

A CYCLONE passed over the strip of land between Lakes Ontario and Erie on Sept. 26, almost parallel to the Welland canal. In its progress a swath, about 300 ft. wide, was swept over and a branch took in a portion of Tonawanda, N. Y. Six persons were killed and 9 are reported seriously injured.

◆

A GRAIN DUST EXPLOSION, on Sept. 23, wrecked the granary of the Eastern Distilling Co., at Blissville, Long Island, caused the death of one man and injured four others. The granary was three stories high, built of brick and timber, with wooden partitions covered with corrugated iron. The force of the explosion blew parts of the building 100 ft. into the air, and buried part of the Long Island track with wreckage and twisted machinery, and flames spread like a flash through the steam grain conveyor connecting the granary with the docks.

THE PLANT OF THE PENCOYD IRON WORKS, PENCOYD, PA.

(With double-page plate.)

The Pencoyd Iron Works is one of the best-known of the several plants in this country which combine the design and construction of steel bridges and buildings with the manufacture of commercial steel in the form of castings, forgings, bridge steel and structural shapes of all kinds. The works were started in 1852 by Algernon and Percival Roberts, and until 1887 they manufactured puddled iron. In that year the product was changed from iron to open-hearth steel, a change which, of course, necessitated a complete modification of the plant and of the methods of handling and manipulating the metal in all of its stages of manufacture. Since first starting work as a steel plant, many improvements and extensions have been made in all departments until the works have reached their present great size and complete equipment.

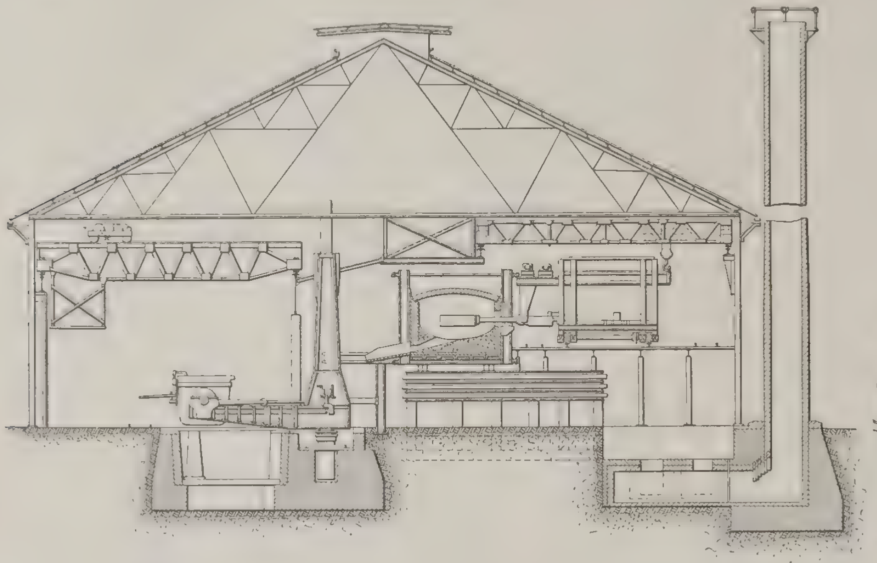


FIG. 3.—SECTION OF STEEL MILL SHOWING INGOT-CASTING PIT.

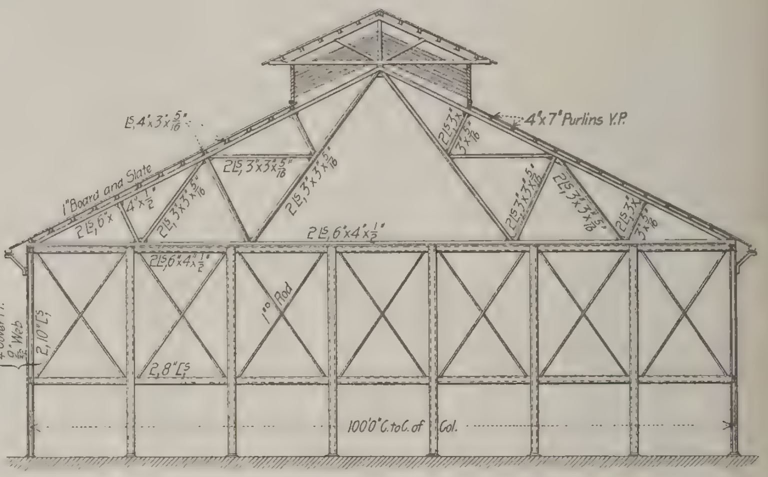


FIG. 5.—SECTION OF MILL BUILDING.

Before commencing the detailed description of the plant as it now exists, however, a brief explanation of the drawings which are shown herewith and on our inset sheet will be advantageous. The works are located on the west bank of the Schuylkill River, a few miles north of the business center of the city of Philadelphia, Pa., and occupy a narrow strip of land between the tracks of the Philadelphia & Reading R. R. and the river bank. Figs. 1 and 2 show the arrangement of the shops to fit this narrow tract. The material is delivered by rail at the south end of the works, and at the north end is located the foundry building. The other mills and shops are arranged between these two in the manner shown. It will be noted that the plans of the different buildings show the location of the furnaces, roll trains, hot beds, and all the various larger stationary machinery and tools with which they are equipped. Figs. 3, 4 and 5 show the arrangement for handling the metal at the furnaces and typical sections of the mill building and bridge shop. The half-tone views of special tools and machines which comprise the remainder of the illustrations are explained by the captions underneath each. With this explanation the various drawings and other illustrations can be studied intelligently in connection with the descripton which follows.

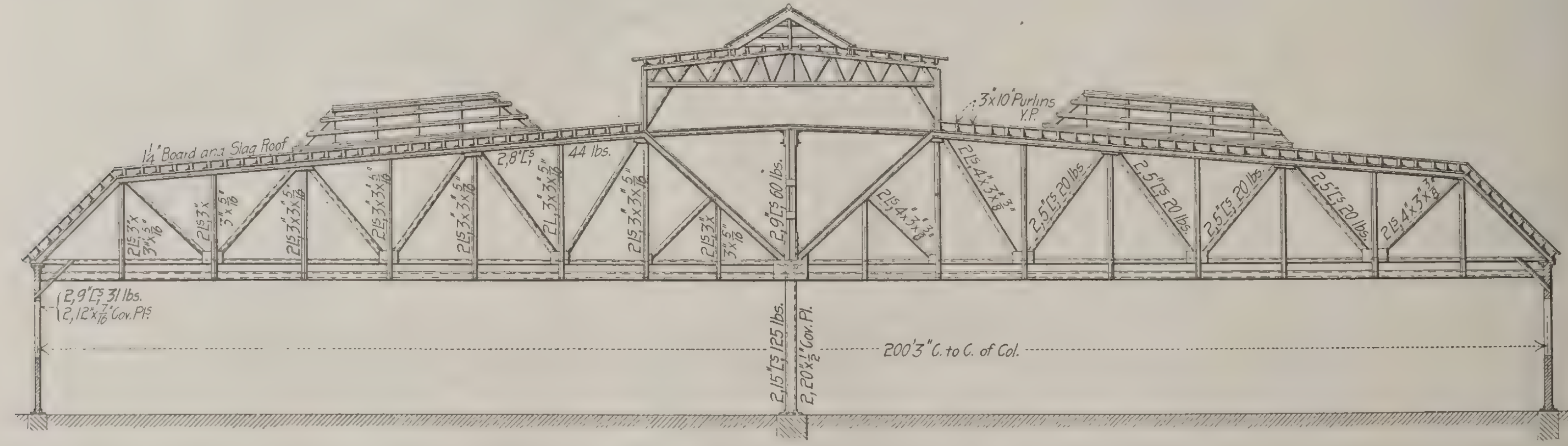


FIG. 4.—SECTION OF BRIDGE SHOP.

Shortly after beginning the manufacture of steel it was foreseen that open-hearth steel would be demanded in structural work, and the Pencoyd works, escaping the difficulties which were encountered by some of their contemporaries who put in Bessemer converters, adhered exclusively to the open-hearth process for their steel product. There are now nine 30-ton furnaces in operation, each producing about 450 tons per week, and a tilting furnace of 75 tons capacity is under construction. All of these furnaces are basic lined. The general arrangements for handling the metal are shown by Fig. 3, which is a section in elevation of the open-hearth works.

The raw material, pig iron, scrap and basic additions used, are placed in boxes in the yards, and shifted on cars to the furnace floor, where they are handled by a Wellman electric charging machine The molten steel is handled over the pits in ladles supported in radial hydraulic cranes, each furnace having its own ladle crane. The ingots are stripped and delivered by electric traveling cranes and cars to the pit furnaces of the blooming mill (Fig. 1), thence being reduced by the blooming mill to blooms and billets of the various sizes required by the finishing mills.

The blooming mill is a 36-in., two-high reversing mill, driven by a pair of 40-in. × 60-in. engines geared two to one to the mill. These engines have piston valves and a Marshall reversing gear operated by a hydraulic ram. The spur gear is 7½ ins. pitch and 30 ins. face and is cut from solid steel. The tables of this mill are equipped with hydraulic manipulators, so that all the operations are directed from a central station. The mill and engine are surmounted by a 30-ton electric traveling crane, and provided with a floor carriage for changing the rolls. This mill is fed by four vertical pit furnaces of the regenerative type, fired with producer gas. The products of the blooming mill supply three finishing mills and the axle forge. The principal part of the product goes to the beam mill, which is supplied with hot blooms. All the other mills receive their charges cold.

Beam Mill.—The beam mill is placed in the line of delivery of the blooming mill and is served with three regenerative heating furnaces for restoring full working temperature to the blooms on their passage from the blooming mill. Each of these furnaces is of very large capacity, being capable of receiving about 30 tons of steel blooms and is worked continuously, being charged and drawn at the same time. The mill furnaces are served with electric charging machines (Fig. 6), receiving current from an overhead trolley and operated by two motors, one for the traveling truck, the other for the longitudinal motion of the billet. This movement being effected by frictional contact of a heavy ram on moving rollers gives a desirable working freedom to the machine. This machine is so arranged that the billets pass over it and are pushed into the furnace by the ram, and also withdrawn by the same action by tongs, the billets passing directly over the table.

The beam mill consists of two distinct mills, for roughing and for finishing. The roughing mill is a 28-in. two-high reversing mill with a single pair of rolls, and the finishing mill is a 23-in. three-high mill with two stands of rolls. A notable feature is the absence of a flywheel from the three-high mill which allows of instantaneous stoppage or reversal in the case of accidents and places the mill under full control of the operator, thus avoiding those annoying accidents which have heretofore been so common in rolling mill practice. The engines are fitted with the Marshall reversing gear, the reversing levers being controlled by a hydraulic ram. The valves are double-ported balanced slide valves. The engines are of very substantial construction and have run at a piston speed of 1,500 ft. per minute without difficulty.

A roll changing house is located in the line of the mill, and the whole area is covered with a 40-ton traveling crane, which lifts a complete stand of rolls and fixtures, and permits the adjustment of rolls to be made while the mill is in operation.

The roughing mill is served with reversing tables and hydraulic manipulators, while the three-high finishing mill has traveling tables which have also a lifting movement operated by a hydraulic ram which raises or lowers the end of the table next to the mill, the opposite end being hinged. These tables are each operated by a single attendant. the horizontal movements are effected electrically under the Ward-Leonard system of control. The mill handles with ease the heaviest sections of structural steel up to and including 24-in. I-beams.

Not the least advantage of having the rolling mill equipped with tables is that much higher speed can be maintained and longer lengths can be handled than is otherwise practicable. In this mill the material is delivered at a speed approximating 1,000 ft. per minute and is regularly rolled in 150-ft. lengths and can be rolled much longer. The product of the finishing mill is delivered by live rollers to the saws or at the end of the tables to a shear (Fig. 7) for cutting up small billets and similar work. The finished material is transferred to cooling beds in the usual manner and then passed through straightening machines and suitable shears for cutting to lengths. Angles and similar sections are all straightened by roller straightening machines (Fig. 8), while gag presses are used for beam straightening.

The receiving yard for finished material at the end of the mill is covered by four parallel electric traveling cranes, each of 6 tons capacity. The floor of this stock yard is fitted with tables of live rollers, electrically driven, and with devices for transverse movement of the material.

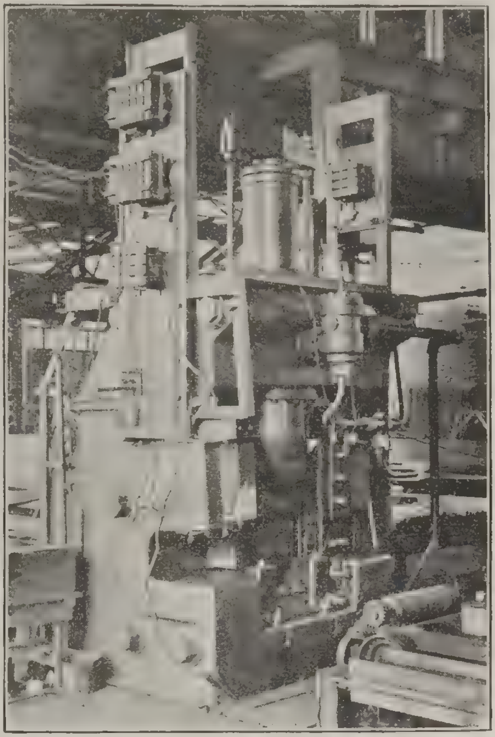


FIG. 7.—HYDRAULIC BILLET SHEARS.

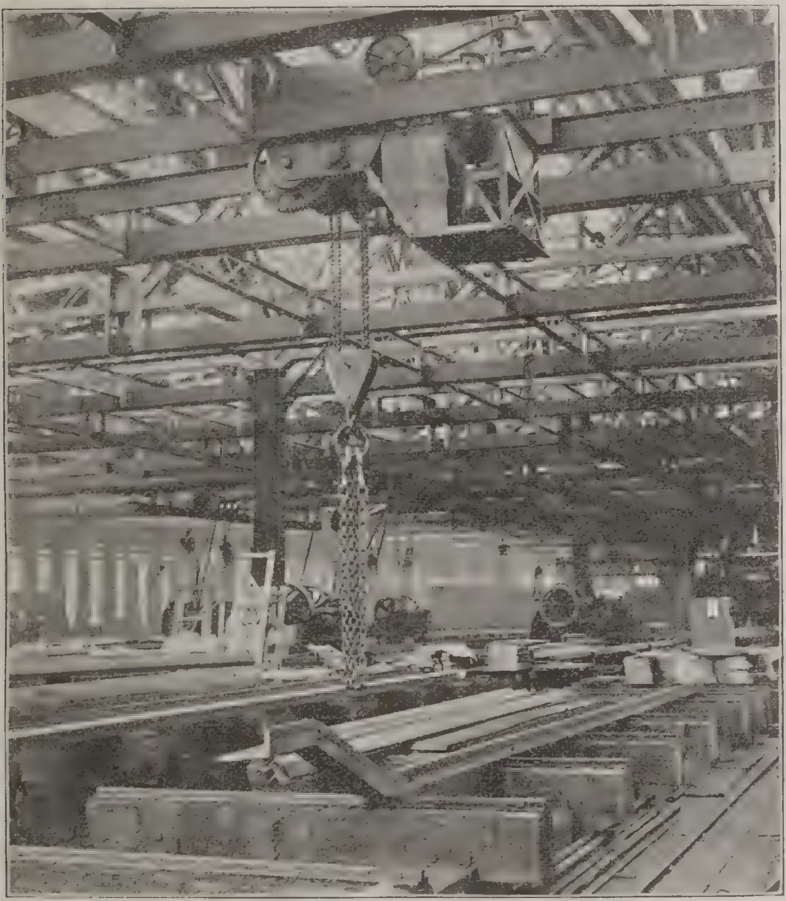


FIG. 9.—TEN-TON ELECTRIC TRAVELING HOIST, BRIDGE SHOP.

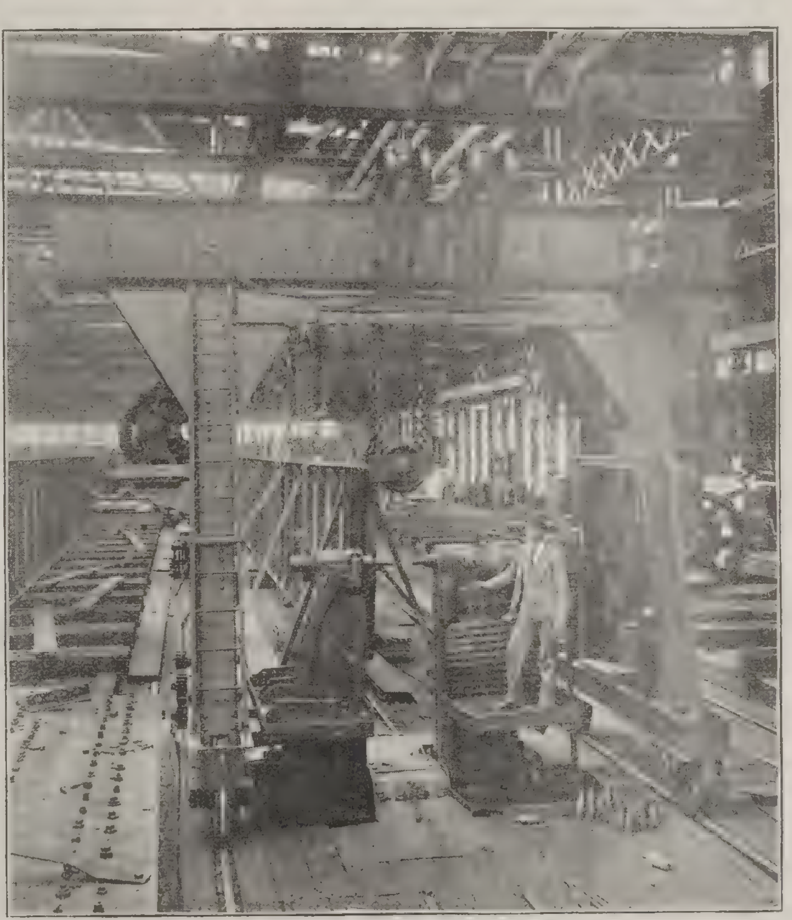


FIG. 11.—HYDRAULIC RIVETER WITH ELECTRIC TRAVELING GANTRY, BRIDGE SHOP.

Axle Shop.—At the lower end of the blooming mill building is located the axle-forge and shop. This contains a 20-ton steam hammer with a stroke of 8 ft., served with two hydraulic, fixed mast cranes, each of 20 tons capacity and two gas furnaces. This hammer, which was originally used for blooming, is now used for miscellaneous forge purposes. Three steam hammers are used for forging car axles. The steel billets for axles are delivered from the blooming mill about 6½ ins. square in the rough, and are finished at a single heat, into car axles. The axles as forged are delivered to the axle shop on the east side of the building, where they are cut, centered, turned and finished, as required. This department uses 14 lathes and turns out about 2,000 axles per week. Immediately outside this building are two drop-testing machines. In both machines the drop weighs 1,640 lbs., and the anvils upon which the axles are placed are 3 ft. between centers. The first has a maximum drop of 31 ft. and the anvil is on a solid foundation, while the second anvil weighs 17,500 lbs. and is supported on springs to conform to the specifications of the Pennsylvania R. R. Co. This fixes the inertia of the anvil and renders it independent of the foundation. It may be noted in passing that the specifications for axles are now more definite and the inspection more rigid than formerly. The chemical and physical requirements are insisted upon without much latitude for variation, the general tendency being to require a higher carbon limit and all other components lower than previously.

Steam Boiler Plant.—There are at present three principal steam boiler plants at the works. Boiler house No. 2 consists of twelve 156-HP. Babcock & Wilcox boilers; boiler house No. 3 contains four 250-HP., four 140-HP. and four 156-HP. Babcock & Wilcox boilers equipped with mechanical stokers; boiler house No. 2 is also being equipped with mechanical stokers. Bituminous coal is used throughout the works. The use of the mechanical stoker, especially when supplemented by coal and ash handling appliances, results in some economy of labor in extensive boiler plants and an abatement of smoke. An extensive series of tests run at the works indicate little economy other than that mentioned over hand firing.

Boiler houses Nos. 2 and 3 are connected by a 16-in. steam pipe and supply steam for all parts of the works, excepting the bridge department. There is a main trunk line for exhaust steam throughout the works, which collects the exhaust steam and conveys it to feed water heaters or for heating purposes in winter. The principal engines of the works, however, are supplied with condensers.

Boiler house No. 4 has one 250-HP., and two 156-HP. Babcock & Wilcox boilers. These are furnished with the chain grate stokers of the Babcock & Wilcox Co. and with the ash and coal conveyors of the Link Belt Engineering Co. Their operation is shown by the drawings Figs. 1 and 2. The coal is dumped from the cars between a pair of crushing rolls. These deliver to the conveyors which carry the coal to bins above the boilers, from which it falls to the stoker hoppers. The ashes are conveyed from ash pits to a bin over a car track and are dumped into empty cars run under the bin. This boiler plant supplies all steam used for power purposes at the bridge department, the prominent uses being that demanded by air compressors and hydraulic pumps.

The water supply for the steam boilers is largely obtained from dams constructed in the adjoining hills which collect the surface drainage and spring water and yield a supply well suited for boiler use.

Office and Machine Shop.—Fronting on the river are located the main office and the machine shop. The machine shop building is 35 ft. × 230 ft., and is equipped with tools for construction and repairs. Machinery and tools of special design are continually under construction as the development of the work requires. The upper part of the machine shop has a second floor which is used for a tool-room, the remainder being a templet shop. The templet and pattern shop proper is a three-story building located just west of boiler house No. 3 and across the railway tracks from it. These shops are thoroughly equipped with the necessary wood-working machinery. Material is laid out in the shops—both to templet, and also by mechanical spacing—according to the character of the work.

Bridge Shop.—The stock yard for the bridge works is located between the rolling mills and the bridge shop. Its whole area is covered by a system of traveling cranes, each of 6 tons capacity. In the yard are several bending and straightening machines for preparing the material for the shops.

The bridge shop proper is a building of steel skeleton construction 200 ft. wide and 460 ft. long. The walls, excepting where the windows, which form a large part of the sides, are located, are filled with concrete (Fig. 4). The plan of the building consists of a system of central longitudinal girders resting on posts 80 ft. apart. These girders sustain the interior ends of the roof trusses of 100 ft. span, thus leaving a clear transverse opening of 200 ft. wide, except where the few central posts occur. In addition to the usual wall lights, this building is well lighted in its center by a liberal provision of skylights in the roof. Each roof truss is designed to carry a rolling load of 10 tons. There is a complete system of electric traveling hoists suspended on runways, from the roof trusses. Some of these travel the entire width of the shop (Fig. 9), while others travel longitudinally. These hoists are of various designs, adapted to their intended uses, ranging from the light active machine, capable of handling 1 ton, up to one handling a 100-ft. girder weighing 60 tons. The shop contains 16 punches, six shearing machines, and a complete equipment of drills. Notable among these latter are three gantries, each carrying eight radial drills (Fig. 10). These gantries travel longitudinally through the shop, passing over the work operated on. There are also in use numerous portable pneumatic reaming machines and chippers, a hydraulic riveter, two fixed pneumatic riveters and twelve portable air riveters. Two of the riveters are mounted on hydraulic rams which allow a vertical movement of 6 ft. The work is carried through the riveter on an electric traveling gantry (Fig. 11). Besides the compression riveters referred to, there are also several impact air riveters used in places where it is impossible to use the compression riveter. The rivets are heated by petroleum furnaces operated by compressed air.

Planers and milling machines for finishing edges and ends of material are located at convenient points, also boring machines for finishing chords and posts. A pair of rotary planers, each with a 5-ft. cutter head mounted on a bed-plate 70 ft. long, are used to surface both ends of bridge members simultaneously (Fig. 12). The equipment in the bridge shop has been still further perfected by the addition of a multiple beam punch and a spacing punch (Figs. 13 and 14). The beam punch (Fig. 13) carries clusters of punches which at a single stroke perforates for the standard spacing for beam attachments and has also outside punches for the flange punching. The spacing punch is designed especially for punching plates and angles, punching up to ten holes at a stroke and automatically spacing by sixteenths of an inch up to 8 ins.

Electric motors are used for power transmission throughout this shop, the motors in some cases being a unit with the tool driven and in other instances the motor is bolted to a group of tools. The shop is heated in winter by exhaust steam in radiator pipes suspended from roof trusses. The circulation of the steam is promoted by an exhausting pump which draws out all the water of condensation and returns it to the boilers.

The average capacity of the bridge shop is about 5,000 tons per month, requiring 120,000 holes to be punched and 30,000 rivets to be driven per day. The storage yard for finished work is at the upper end of the bridge shop. The material is inspected and painted here. This yard is covered by two traveling cranes of 60 ft. span, each of about 40 tons capacity. These cranes pass over the tracks of both the Pennsylvania R. R. Co. and the Philadelphia & Reading R. R. Co.

Electrical Plant.—The electric motor has acquired an extensive application in the modern steel works. Considering the severity of the work, and the exposed situations in which the electrical appliances must necessarily be placed, as well as the delicacy of the electrical mechanism, the successful adaptation of this method of distributing power is somewhat surprising. These electric motors run successfully close to heated or molten steel, and in the dust and grime of the mill. A class of locomotive machinery has come into service which would be almost impracticable without the aid of electric power.

The general plan of the electrical system consists of a 220-volt distribution used for power purposes, for incandescent and enclosed arc lights, and a constant current system used in the series arc lighting. The electrical generating plant is located just west of the template shop and contains one 200-K-W., 220-volt. generator direct-connected to a 12 × 22 × 42 ins. tandem compound condensing Greene engine, and two 100-K-W., 220-volt generators, each direct-connected to a cross compound condensing vertical engine 10 × 19 × 16 ins. The series arc lighting lamps are of 2,000 c. p. (nominal), and are supplied with current by three 50-light and one 35-light General Electric dynamos belted from Westinghouse engines. The present power plant is being enlarged by the addition of a 500-K-W. generator and direct-connected engine.

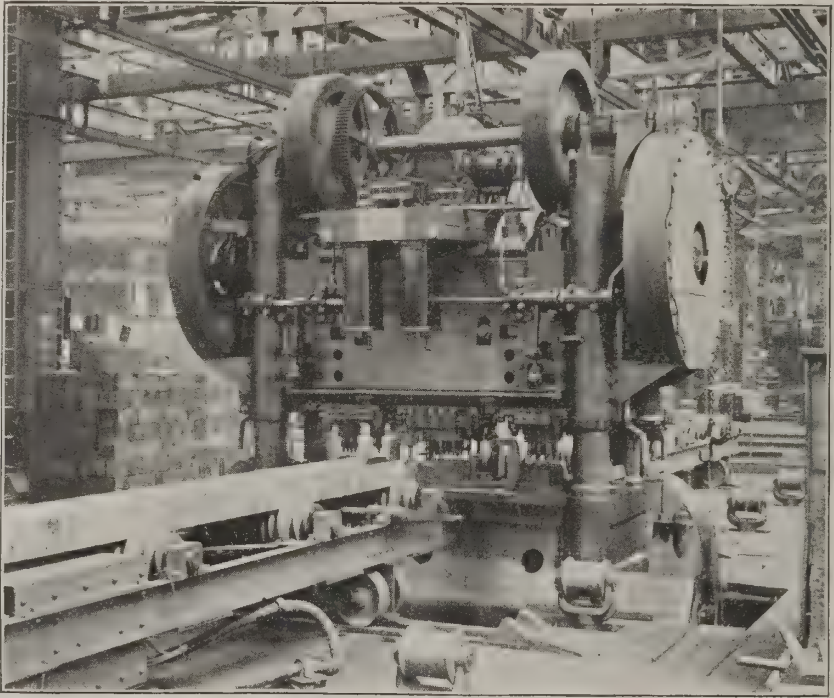


FIG 13.—MULTIPLE BEAM PUNCH, BRIDGE SHOP.

The switch-board contains the usual complement of instruments and a recording watt-meter. From the switch-board bus-bars there are 5 distinct circuits running as follows: One to the bridge shop, one to the beam mill, one to the beam mill yard, one to the steel mill, and one to the 20-in. mill. Each circuit and each generator has a separate automatic circuit breaker. In order still further to localize faults as much as possible, automatic circuit breakers are extensively distributed around the principal machines. On these circuits there are over 200 motors aggregating 2,500 HP., and distributed as follows:

	No. of motor.	Total HP.
Electrical repair shop	1	5
Boiler house	1	10
Blooming mill	4	35
Laboratory	3	5
Steel mill	27	355
Bridge shop	74*	860
20-in. mill	16	155
Beam mill	65	930
Two generators	..	50

*32 of these are on cranes.

The two generators last mentioned are driven by an 80-HP. motor and form the Ward Leonard system previously referred to as controlling the tables of the 23-in. mill. The gantry in the bridge shop carrying the work through the 100-ton riveter is also similarly controlled. There are numerous other small motors throughout the works which are not enumerated. At the stock yards at the extreme upper portion of the works there is a 15-K-W. generator, and on the circuit with it are five motors aggregating 35 HP.

The incandescent and inclosed arc system of lighting is run on the power circuit and requires 1,000 incandescent lamps run two in series and about 40 220-volt inclosed arc lamps. The tendency is to increase the incandescent arc system in the central area of the works, partly owing to the better diffusion of light from the inclosed lamp and also because this lamp allows the use of constant voltage current from the power system. In the outlying areas the series arc lamps continue in use, but it is proposed to drive their generating dynamos from direct-connected motors, the current for the latter being derived from the central power generating system, thus making the power generators a unit for electrical distribution for all purposes.

Air and Hydraulic Systems.—Above the storage yard are the air compressors and pumps supplying the air and hydraulic pressure required at this part of the works. There are two supplies of compressed air, one of 10 lbs. pressure used in oil furnaces, and the other of 80 lbs. pressure for riveters, chippers and reamers in the bridge shop. The air is compressed by a number of piston engines of various makes. The Norwalk machines are used for the high pressure and have both steam and air systems compounded.

The hydraulic power is also supplied at two pressures of 600 lbs. and 1,300 lbs., respectively. Where required at the individual machines intensifiers which increase the pressure to any desired amount are used. The pumps are all of the duplex Worthington type, with compound condensing steam cylinders.

The hydraulic pressure required at the lower portion of the works is obtained from the pump-house marked "K," Figs. 1 and 2. This system works at about 500 lbs., and requires two pumps. These are both compound duplex pumps and have two, 18 ins. x 10 ft. accumulators. From this station the pressure is taken down the river to the steel mill, where the ladle cranes, furnace doors, and the gas and air reversing valves are operated by it, and up the river through the blooming mill, beam mill and stock yards, where it actuates furnace doors, manipulators, transfer tables, turntable, screws on mill boxes, shears, etc.

The billet shear at the end of the blooming mill table, where great rapidity of action is essential, is worked by a steam driver. The steam cylinder is 50 ins. in diameter, the ram 8 ins. in diameter, and the stroke is 9 ft. 4 ins. The steam cylinder has the cut-off controlled by the operator.

Eye-bar Shop.—The eye-bar shop adjoins the bridge shop stock yards and the Compressor and Pump House. It has at present facilities for upsetting 8-in. bars to heads of 18½ ins. diameter, and a new machine is under construction capable of upsetting 14-in. eye-bars with heads of 33 ins. diameter.

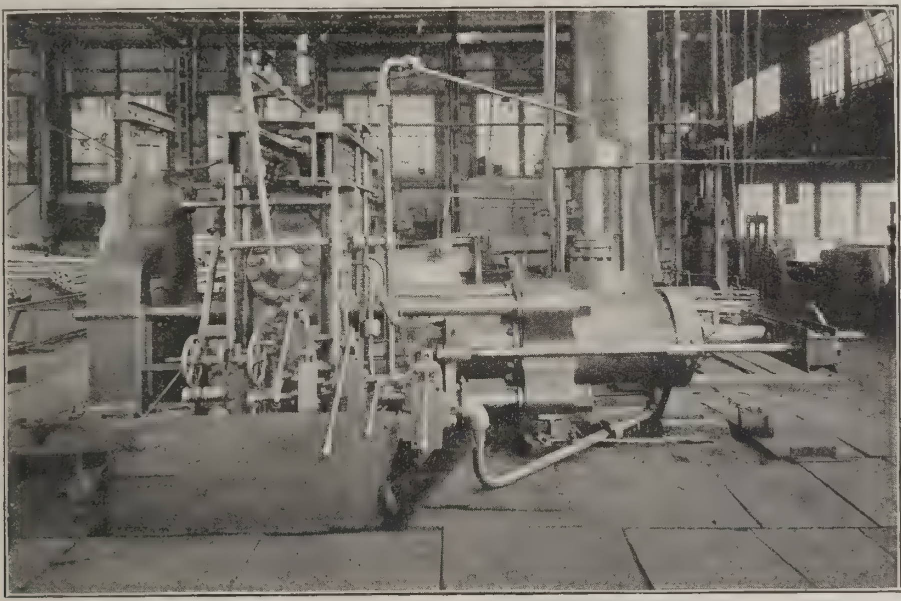


FIG. 15.—HYDRAULIC EYE-BAR UPSETTING MACHINE, EYE-BAR PLANT.

The shop contains four oil furnaces, one heavy hydraulic shear for cutting bars to length, five hydraulic radial cranes, one hydraulic punch for punching eyes, one set of rolls run by hydraulic power for flattening heads after being upset, two boring mills set on the same bed 70 ft. long and used to bore both eyes of a bar at the same time, and an annealing pit of sufficient length to take in the longest eye-bars and having the temperature controlled by oil-burners. A larger annealing furnace and muffle is contemplated in connection with the new eye-bar machine. The present eye-bar machine (Fig. 15) consists of a hydraulic grip which clamps the bar in position in the machine, a second press which lowers and holds the dies in place over the bar, and a third massive press which pushes in the rear die and upsets the bar. An intensifier is used on this machine, which increases the hydraulic pressure from 1,300 to 3,000 lbs. per sq. in. There is also a hydraulic press used for straightening bars.

In this shop is also the hydraulic crimping and forming press (Fig. 16). This is used in crimping angle stiffeners and in bending or curving. It consists of a vertical press carrying a clamping die and a horizontal press containing the crimping or forming die. This machine is coupled to a multiple intensifier, by means of which the pressure is graduated for light or heavy work.

Testing Laboratories.—The chemical laboratory is located near the steel mill. All the analyses of ores, metals, coals and gases for the works are made here. When making soft steel, samples are taken from the furnace before tapping. The samples are forged and fractured and from the appearance of the fracture the melter judges if the phosphorus is as low as required. When the metal is cast a sample is taken, and before the metal is rolled a chemical analysis is made and the carbon, sulphur manganese and phosphorus determined. When hard steels are made, samples are taken and analyzed for carbon before the furnace is tapped. In all cases complete records are kept of the charge, duration of heat, product, analysis and melter. All ingots are given a number which locates the furnace and heat, and these numbers are marked on the finished product.

The physical tests are made in the same laboratory. The apparatus for testing the steel consists of a 150-ton Olsen testing machine and two smaller machines. The material tested is taken from the finished product, pieces 18 ins. long being cut from the webs of channels and beams, the legs of angles and tees and the flanges of Z-bars. The cross-section of these test bars run from ½-in. to 1 in. square, excepting the following sections, which are tested full size: Flats up to 3 ins. in width, rounds up to 2½ ins. in diameter, and squares of 2 ins.

A section of this department is equipped with apparatus for making experimental investigations throughout the works. These comprise boiler and engine tests, electrical measurements, the quality of supplied material, etc., and are made periodically to aid in maintaining a high standard of efficiency.

Bolt and Forge Shop.—Above the eye-bar shop is the bolt and forge shop. All the bolts and rivets required by the works, also sleeve nuts and clevises are made in this shop. Small forgings required for bridge work are also made here. A notable feature of modern smithery is the absence of welding which is becoming a lost art. Clevises, sleeve nuts and similar connections are now made from solid steel.

The shop contains two steam hammers, two acme rivet machines, one bolt machine, one triple acme screw cutter, one machine for upsetting clevises, five smith's fires, two spring pointing machines, two hydraulic benders, one power shear, one air compressor furnishing air for the oil furnaces, several drills, lathes and shapers, and a Westinghouse engine driving the shop. The product of this shop is entirely consumed by the bridge shop and amounts to 9 tons of rivets and 4,000 bolts per day.

Stock Yards, etc.—At the extreme upper end of the works is located the iron foundry, now being rebuilt on a more comprehensive scale. On the side near the river lies the mill stock yard and store house for lumber, erectors' material, and finished patterns. In the stock yards are located the saws and shears for cutting material to lengths. The sections are handled throughout the yard by locomotive cranes.

The various departments of the works have a complete telephonic communication through a central station, and the works have communication with the main office and the various branch offices by long distance telephones.

For the information from which this article has been prepared we are indebted to the A. & P. Roberts Co., Philadelphia, Pa., the proprietors of the Pencoyd Iron Works.

THE FRENCH SOCIETY OF CIVIL ENGINEERS.

The French Society of Civil Engineers, according to a long illustrated article in "Engineering," was founded in 1848, by some of the graduates of the Ecole Centrale. The purposes of the society were to throw light upon obscure questions in civil engineering; to assist in developing the applied sciences; to extend professional teaching among workmen and shop-foremen; to insure closer relationship among members; to conduct an employment bureau for members, and to establish a benevolent fund in case of necessity.

The beginning of the society was very modest, and for 22 years a hall capable of seating only 60 persons answered all the purposes of the meetings. In 1872, however, the society numbered 1,000 members, and it built its own house with a lecture room large enough for 200 persons. This house, in the Rue Rougemont, cost about $52,000 for land, building and fittings. The annual revenue of the society, in 1887, was $20,600, with expenditures of $14,520 per year. In 1897 the treasurer reported secured investments of $17,200; balance on hand, $1,200; $12,800 of various debts; $2,000 in literary account; $1,300 in furniture and $208,800 invested in the new house; against this was a loan of $103,000 on the building.

The growth in membership may be summarized as follows: In 1848 there were 134 members; in 1860, 525; in 1872, 1,038; in 1882, 1,984, and in 1897, 3,054. The published transactions and minutes now form 65 volumes, containing more than 800 papers with discussions. The society library numbers 18,000 volumes; and the "Bulletin" of the society is published monthly, with full "Minutes" issued every two weeks.

The first meeting in the present society building was held on Dec. 17, 1896, and it was officially opened in January, 1897. The general arrangement of the house is simple. The basement contains the heating and lighting appliances and vaults for the archives of the society; the ground floor is occupied by the vestibule, the main lecture room and some small rooms; and the main hall was placed on this floor, entering directly from the street, as it is the practice to rent it for concerts and other meetings. In the entresole is a suite of rooms used as a member's club; on the first floor, or the one over the entresole, are the offices and principal committee room, and the second floor is entirely devoted to the library. On a third floor are the living apartments of the secretary.

THE JACQUES PROCESS FOR CONVERTING HEAT INTO ELECTRICITY.

In the summer of 1896 Dr. W. W. Jacques, of Boston, announced that he had solved the problem of the direct conversion of heat into electricity, and had made an apparatus which effected this conversion with the astonishing efficiency of 88%. The genuineness of the invention was said to be vouched for by such excellent authorities as Prof. Cross of the Massachusetts Institute of Technology, Prof. Rowland of Johns Hopkins, Messrs. Stone and Webster of Boston, and others. In an article in "Harper's Magazine" Dr. Jacques described his invention and assured his readers that its success was beyond doubt, and that henceforth power could be generated from coal by his process with vastly better economy than by the steam engine.

In our issue of May 21, 1896, we discussed Dr. Jacques' alleged invention and suggested that it would be a good plan to learn something more about the invention before passing judgment upon it. More than two years have elapsed, however, and the steam engine still turns round, nor is there any present indication that Dr. Jacques' "electricity-direct-from-coal" apparatus will supplant it.

Quite a number of experimenters have studied Jacques' apparatus, but the best explanation of its real character that has thus far appeared was given in a paper recently read by Prof. Langley, of the Case School of Applied Science, before the Electric Club of Cleveland. We abstract the paper as follows:

In its best form the Jacques battery consists of a closed cylindrical iron cell about 6 ins. in diameter and 2 ft. high, forming one terminal in which is suspended a carbon rod 3 ins. in diameter and some 20 ins. long, forming the other terminal. The intervening space between the sides of the cell and the carbon is filled with caustic soda or potash (NaOH or KOH) kept in a molten state by heat applied by some form of external furnace.

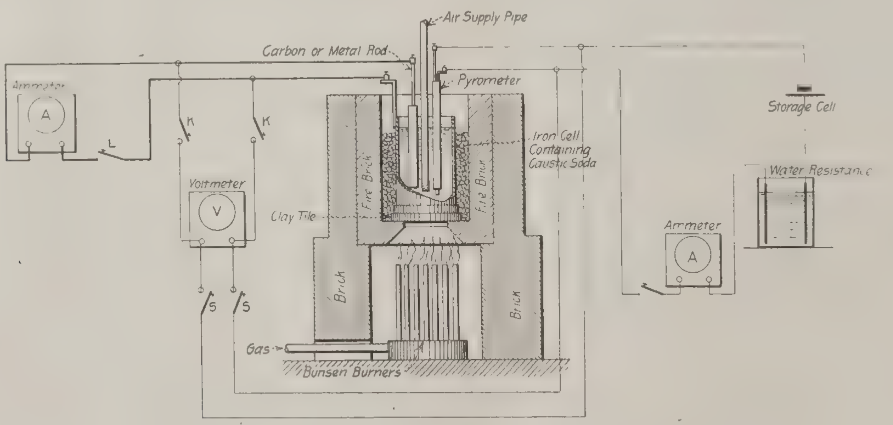
An iron pipe is run down below the surface of the molten potash, and terminates in a rose nozzle. Through this air is forced which rises in fine bubbles through the molten mass and comes in contact with the carbon rod. It was claimed by Dr. Jacques that chemical combination took place between the oxygen of the air and the carbon rod under these conditions resulting in the generation of a current of electricity. With this apparatus it is claimed that a current of 150 amperes at 1 volt was obtained, and the efficiency was about 32%, as compared with the present efficiency of about 9% as obtained in the ordinary way, using furnace, boiler, engine and dynamo. In a special test, in which 100 cells 12 ins. deep and 1½ ins. in diameter was employed, 30 16-c. p. lamps were lighted for 18¾ hours. During this time the average pressure was close to 90 volts, the current 16 amperes and about 8 lbs. of carbon were consumed in the cells. That is to say: 90 × 16 = 1,440 watts = 1.93 E. HP. were generated for 18.75 hours at an expense of 8 lbs. carbon or $\frac{8}{18.75} = 0.427$ lbs. per hour or 1 HP. hour was produced for 0.221 lbs. of carbon. Since in a perfect thermo-electric generator 1 HP. hour is produced by the combination of 0.175 lbs. of pure carbon, the efficiency may be given as

$$\frac{.175}{.221} = 79 + \%.$$

It will be noticed, however, that no account whatever is taken of the heat required to maintain the solution in a molten state.

The exact source of the electric current in the Jacques cell has been, as already stated, a mooted question, Dr. Jacques claiming that the chemical action between the oxygen of the air and the carbon of the rod formed carbonic acid and the electro-motive force obtained (1.04 volts) agreed with that theoretically obtainable when oxygen and carbon combined to form CO_2.

To determine the action taking place in the cell and thus afford a final settlement of the dispute a test was undertaken in which the specifications for the Jacques cell in the inventor's patent were followed exactly and the data obtained during a series of experiments forms the basis of a thesis presented by Messrs. H. S. Rosewater and W. H. Oldham, of the Case School. These experiments are described as follows:



APPARATUS USED TO TEST THE PRINCIPLE OF THE JACQUES' CARBON BATTERY.

A fire brick furnace was constructed to protect the gas flames used in heating the cell. This was 2 ft. 11 ins. × 2 ft. 6 ins. by 2 ft. 6 ins. deep. In the upper position was placed the cell made of a section of 4-in. iron pipe 12 ins. long, with a cap over the lower end. The carbon rod and pyrometer were suspended in this and later rods of other materials, such as copper, iron, etc., were substituted. The necessary heat was supplied by a special gas burner made by mounting 15 ordinary Bunsen burners on a circular base. Air was supplied through a piece of gas pipe, closed at its lower end and drilled full of holes, which was dipped into the solution. The blast was regulated by throttling until no splashing occurred. To measure the temperature of the solution a pyrometer was constructed and carefully calibrated. This consisted of a 24-in. piece of ¾-in. pipe, at the lower end of which was placed a coil of platinum wire wound upon a clay pipe stem arranged to project partly through the asbestos plug. By keeping the current constant a direct measure of temperature changes was given by the voltage of a circuit of which the coil was part. Calibration was done in an oil bath, using accurate mercury thermometers. The other instruments were a milli-ammeter, an ammeter reading to 5 amperes and a voltmeter reading to 5 volts.

The accompanying cut represents the apparatus used. In this it will be noticed that the voltmeter V is arranged to read either the electro-motive force of the cell or the difference of potential at the terminals of the pyrometer, the former obtained by opening S S and closing K K, the latter by opening K K and closing S S. The current flowing in the battery circuit when L was depressed was measured by the ammeter A, and that flowing in the pyrometer circuit was indicated by the ammeter A_1, the current being obtained from a storage cell and regulated to about 0.25 amperes by means of an acidulated water resistance.

The readings were taken in a regular order throughout the seven experiments, which were as follows: A copper rod suspended in the solution without air blast; same with air blast; an iron rod without blast and again with; a carbon rod with air blast, then without; and, lastly, a carbon rod without blast but with about an ounce of $NaNO_3$ added to the solution to accelerate the oxidization of the carbon.

Each experiment extended over a period of something over four hours. The figures resulting from these tests were plotted on cross-section paper with the time as abscissas and the temperature and voltage as ordinates, and a study of the curves thus obtained developed a number of interesting facts. In every instance the curves resembled thermal curves. At the start, with no air blast, when the solution is cold and the iron cell hot, the difference of potential between the cell and rod is greatest. As the heat is transmitted through the solution and the whole cell becomes nearer an average, but higher, temperature the difference of potential falls off. Toward the end of the run, when the heat was shut off, the curves show the opposite effect, the temperature of the cell being less than the solution, and at the same time the difference of potential again increases. In other words, the maximum difference of electrical potential occurs when the temperature difference is greatest. The addition of air, tending as it does to cool the solution and rod, would increase the difference of temperature and therefore the difference of electrical potential, a fact noticed in the experiments. The same effect would also be noticed with any gas. On the other hand, if the action were chemical or galvanic, as claimed by Jacques, and the oxygen present in the solution produced negative curves, it would be expected that the addition of oxygen by supplying air would make the curves still more negative. This, however, did not occur.

These conclusions are borne out by a paper read by Mr. C. J. Reed before the American Institute of Electrical Engineers, at its meeting on April 27, 1898. In this, what is termed thermo-electric battery is described, in which the elements are much the same as those used by Dr. Jacques, i. e., an iron cell using sodium or potassium hydrate (NaOH or KOH) and iron or carbon rods. Mr. Reed, however, uses two rods as the elements. In conclusion, Mr. Reed devoted considerable space to a series of curves, which are plotted from values obtained by Liebenow and Strasser,* in a series of experiments in which they used metal cups, iron and nickel, and alkali hydrates with carbon, iron, nickel, steel and silver rods. The results obtained were plotted in the form of curves. Unfortunately, Liebenow and Strasser did not perceive the full force of these experiments, and the relation between the curves of temperature and electro-motive force was not apparent because of their manner of plotting the data. Speaking of this, Mr. Reed says:

> When the intensity of the electromotive force is compared directly with the temperature, instead of inversely (as was done by Liebenow & Strasser), the relation becomes apparent and a diagram thus constructed shows decidedly that the electromotive force increases and decreases with the temperature of the electrolyte. From the nature and arrangement of the apparatus we know that the difference of temperature between the electrolyte and the rod will also increase and decrease with the temperature of the electrolyte. * * * * In the same paper the further statement is made, still considering the work of Liebenow and Strasser:
>
> A second group of most instructive experiments with metal rods substituted for the carbon rods demonstrate in an equally convincing manner that a change in the temperature of the electrolyte produces corresponding change in the electromotive force.

It appears to be quite clear from the foregoing that Dr. Jacques' electric generator, which was to revolutionize the art of obtaining power from coal is really an ordinary thermo-electric battery with an efficiency which is probably as low as that of most thermo-electric batteries. One wonders how the eminent men who vouched for the Jacques battery two years ago failed to discover this fact.

RAILWAY CROSSING COMPUTATION.

Several articles upon railway-crossing computation having recently appeared in this journal, our attention has been called, in this connection, to a short method proposed and used by Mr. L. K. Vial, late Chief Engineer of the Ajax Forge Works, of Chicago, and Prof. R. B. Ketchum, of the University of Illinois. The method is given in full in the "Technograph," for 1897-98, published by the engineering societies of the University of Illinois, but the following abstract will sufficiently explain the process proposed:

The three general cases considered are: (1) The crossing of two tangents; (2) the crossing of one tangent and one curve, and (3) the crossing of two curves. The solution requires the finding of the frog angles and the chord lengths between the frog points, with the angle of intersection of the center lines of the two tracks and the degree of curvature, or the radius, given. The basis of the advantages claimed for the new solution is embodied in the statement that: Any chord length equals the product of the gage and the cosecant of the mean of the adjacent frog angle. This is expressed algebraically, as follows:

$$\text{chord} = g \csc \frac{A + A'}{2}. \qquad (1)$$

Where g is the gage and A and A' are the frog angles adjacent to the chord. This equation is rigidly true for all chords in the crossing of two tangents, and the chords connecting the two tangents, in the second case; but is approximate only for the other chords of Case 2 and for all the chords in the crossing of two curves. The equations given are as follows:

Case I.—Crossing of Two Tangents.

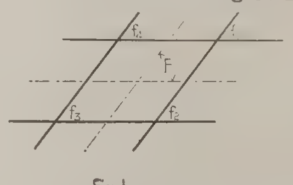


Fig. 1.

For the frog angles we have $F = f_1 = f_2' = f_3 = f_4$; for the "chord" lengths, we have $f_1 f_2 = g \csc F$; or, for sake of analogy to equation (1), $f_1 f_2 = g \csc \frac{f_1 + f_2}{2}$. Similarly for the other three chords.

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*Zeitschrift fur Elektrochemie, Feb. 20, 1897.

Case II.—Crossing of One Tangent With One Curve.

For the frog angles we have, noting that $M = R \cos F$ and m_1, m_2, m_3 and $m_4 = M = \frac{1}{2} g$:

$$\cos f_1 = \frac{m_1}{r_1} \quad (2) \qquad \cos f_2 = \frac{m_2}{r_2} \quad (3)$$

$$\cos f_3 = \frac{m_3}{r_3} \quad (4) \qquad \cos f_4 = \frac{m_4}{r_4} \quad (5)$$

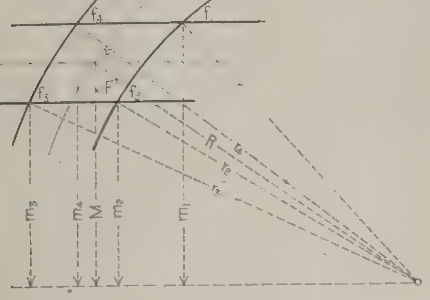

Fig. 2

For the chord lengths we have from equation (1),

$$f_1 f_2 = g \csc \frac{f_1 + f_2}{2},$$ and similarly for the other three chords.

Case III.—Crossing of Two Curves.

Frog Angles.—After solving triangle $OO^1 F$ for OO^1 (= D), we have from triangle $OO^1 f_1$,

$$\tan \frac{f_1}{2} = \frac{1}{S_1 - D} \sqrt{\frac{(S_1 - D)\ (S_1 - r_1)\ (S_1 - m_1)}{S_1}} \quad (6)$$

from triangle $OO^1 f_2$,

$$\tan \frac{f_2}{2} = \frac{1}{S_2 - D} \sqrt{\frac{(S_2 - D)\ (S_2 - r_2)\ (S_2 - m_2)}{S_2}} \quad (7)$$

from triangle $OO^1 f_3$,

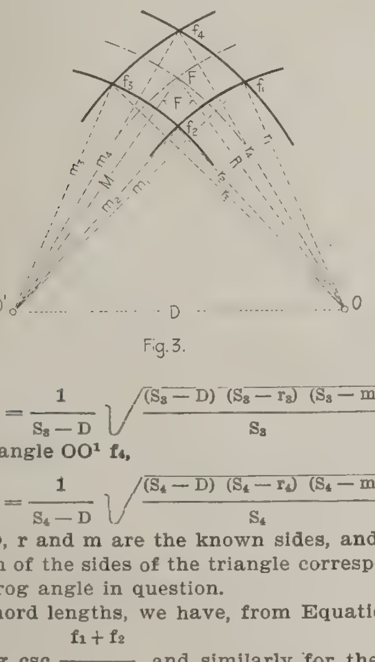

Fig. 3.

$$\tan \frac{f_3}{2} = \frac{1}{S_3 - D} \sqrt{\frac{(S_3 - D)\ (S_3 - r_3)\ (S_3 - m_3)}{S_3}} \quad (8)$$

from triangle $OO^1 f_4$,

$$\tan \frac{f_4}{2} = \frac{1}{S_4 - D} \sqrt{\frac{(S_4 - D)\ (S_4 - r_4)\ (S_4 - m_4)}{S_4}} \quad (9)$$

where D, r and m are the known sides, and S the half sum of the sides of the triangle corresponding to the frog angle in question.

For chord lengths, we have, from Equation (1),

$$f_1 f_2 = g \csc \frac{f_1 + f_2}{2},$$ and similarly for the other three chords.

The original article shows the degree of accuracy and the limitation of the application of Equation (1), and also gives two tables for corrections to be applied only in extreme cases. As a general statement, Equation (1) is practically correct in all cases where either or both curves have radii exceeding 700 ft., and it is practically universal in its application to general railway work.

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ARE HIGH STEAM PRESSURES ECONOMICAL FOR STATIONARY ENGINES?

In April last an interesting ceremony took place at the Bellevue Hotel, in Philadelphia, when a bust was unveiled of Chief Engineer B. F. Isherwood, U. S. N., in the presence of a large party of well-known engineers, including many who were formerly connected with the Navy. A complete report of the speeches made on this occasion was given in the "Journal of the American Society of Naval Engineers" for May. Among the speakers on that occasion was Dr. Chas. E. Emery, whose sudden death only two months later our readers will recall. Dr. Emery, in his address, gave some interesting reminiscences of his services under Chief Engineer Isherwood during the war, and then followed with a discussion of some of the principles which Isherwood's investigations first established, which is of much interest and deserves careful thought and consideration by all interested in steam-engine design. We quote this portion of Mr. Emery's address in full as follows:

> It appears probable that investigations, of the character early made by Mr. Isherwood, may reveal results in relation to our modern steam engineering somewhat similar to those he early established. He showed that, under the conditions obtaining in the engines he tested, it was most economical to limit the expansion of steam, and consequently the size of engines, more than had previously been the custom. We can now see that the proportions adapted for low pressures were not the most economical for higher pressures, but it is a grave question if any actual loss during average working resulted from this. We had in our practice for the first time boilers which would supply all the steam the engines could work off, consequently the maximum speed could be obtained at any time and continued indefinitely. This was something new for a steamship. It was something to be sought for and not readily found, even in the present. Undoubtedly the economy was not the maximum, when the machinery was forced to its utmost, but this occurred very rarely, probably not 1% of the time, whereas the engines were of proper size to secure the maximum economy possible during the long periods requiring moderate power, so the average results were as good and generally better than would have been obtained with any other adaptation of simple machinery using the steam pressure available.
>
> It is evident to me that the same principle can be applied in the proportions of our modern compound engines. Some have realized it, and it is not uncommon on the more noted of the transatlantic steamers to hear the safety valves blow for a short interval after changing watches and cleaning several fires, showing the close adaptation of the engines and boilers. On the contrary, I was on a yacht recently, designed to run with 200 lbs. of steam, which had engines so large that when linked up and running at full boiler power it was necessary to keep the throttles nearly closed. The advantage of keeping the engines rather small for the work and the boiler power ample, as in Mr. Isherwood's practice referred to, will be evident to all, on account of the very superior economy obtained in running during the greater part of the time at reduced power.
>
> Further than this, I believe that the limit of desirable steam pressure has been reached, and that possible economy in a scientific rather than a theoretical sense would be attained by not attempting the higher pressures now found practicable. I recently had occasion to investigate a number of compound engine plants operating factories in the East. The one that was most vaunted and claimed to be securing a horse-power for 1.3 lbs. of coal, required 2⅓ lbs. Several others required over 2 lbs., and in only one case did the cost fall as low as 1¾ lbs., and this was one of the earlier engines designed as the immediate results of the analysis I published of experiments with compound and non-compound engines, made, under the direction of Mr. Loring and myself, with engines of different kinds on revenue cutters, which I designed so as to make such a test practicable 24 years ago, and before the revival of the compound engine here and its application to vessels of the U. S. Navy. The proportions of the cylinders of the factory engine referred to were more nearly like those I had used for lower pressures and set forth in my analysis, and the water consumption for this long-stroke engine, small clearances and a steam pressure of 125 lbs., was 16 lbs., the chief economy being in the boilers, whereas the compound engine of the series I designed so long ago gave a horse-power for 18.4 lbs. of water per HP. per hour with only 70 lbs. steam pressure. It is certain that these modern engines with high steam pressures will, under experimental conditions, do 25% to 33% better than the figures stated, but it is equally certain that they do not do it under the conditions of ordinary practice. The same general results are shown on shipboard, notwithstanding there is the same talk about getting a horse-power for 1.3 lbs. The fact is that few steamers use less than 2 lbs. per HP., and the average is higher than that. In some cases, with particular provisions for securing economy from the boilers, better results have been obtained, but it is a question whether any special mechanism is proper for use on a naval vessel liable to the exigencies of war.
>
> Since the average cost of a horse-power is already considerably above 2 lbs., and as this is as true for engines carrying 200 lbs. of steam as for those carrying 125 lbs., the general result, independent of particular cases, is that it is not desirable to carry the higher pressures, with their attendant increase of radiation, liability to external leakage, and particularly the liability to large wastes by inconsiderable leaks in the cylinders and valves and the increased wear and friction of high-pressure packings. If this general proposition be true, another incidental advantage follows to which I have already called attention in the Journal, viz., the possibility of abandoning the intermediate cylinder of a triple-compound engine and the restoration of the 2 or 3-cylinder compound engines, properly proportioned to do the work economically. The triple-compound engines are particularly unfitted for variable powers. This is recognized in the Eastern mills, and compound engines are used exclusively to assist water-wheels even for pressures up to 180 lbs. The compound engine with pressures exceeding 150 lbs. would not be desirable on shipboard, as proper results could not be secured with a simple valve gear, but with lower pressures there would be no trouble whatever in using such engines even with simple lap-valve cut-offs, and the worst penalty to secure best economy would be an independent cut-off for the small cylinder, as in my design of 24 years ago. These suggestions are not criticisms of the policy of any-one. We desire to compliment the present management of the Bureau and express our love for its Chief, but only by suggestion, discussion and investigation can the truth be known. The suggestions are made here because they are in the line of Mr. Isherwood's earlier work, and a correct principle lives through all time.
>
> I have, however, thus far neglected to state that, although the high steam pressures do not give increased economy in practice, they have enabled the mean pressure, referred to the large cylinder, to be increased from 25 up to 40 lbs., and in small engines up to 50 lbs., which, with higher speeds, better material and closer design, has so greatly decreased the size and weight of steam machinery. This has been partially defeated in many cases by attempting with higher pressures greatly increased expansion, which, though economical on a test, is a blunder for variable power and long continued use where minor repairs cannot be promptly made. We must recognize that, in the suggested decrease of pressure, which can certainly be obtained without decreasing the economy in actual practice, we must not increase the size of engines so that, even without the intermediate cylinder, they will be heavier than those for which they are substituted. Just where the limit is, cannot be determined in a hasty discussion of this character. I only wish to call attention to the fact that apparently such a limit exists and that the efforts of thinking engineers can well be directed to its exact definition under particular conditions.

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RATIONAL FORMULAS FOR THE STRENGTH OF COLUMNS.

A paper by Mr. Carl G. Barth, entitled "An Investigation into the Strength of Columns, Leading to Some New Formulas," read before the Engineers Club, of St. Louis, Mar. 16, 1898, and printed in the "Journal of the Association of Engineering Societies" for April, contains a long mathematical investigation of the subject, and presents some working formulas both for concentric and for eccentric loads. The basis upon which the work proceeds is stated as follows:

> Evidently all we can look for in a rational column formula is that it shall enable us to determine a load that will subject a fairly well-made and properly arranged column to no undue stress, even if that load should accidentally be applied at some reasonable distance out of center.
>
> The formula herein to be proposed is of that nature, and has been derived by considering all the uncertainties of a practical column (such as possible imperfections in its material and form, and any possible eccentric displacement of the load) as equivalent to a certain amount of initial eccentricity of the load on an otherwise ideally perfect column.

The author's final formula for concentric loading, reached after making some approximations for the purpose of simplifying a much longer formula, is:

$$p = \frac{f}{1 + \frac{9}{\pi^2} \frac{f}{E} \left[\frac{l}{r}\right]^2} = \frac{f}{1 + 0.912 \frac{f}{E} \left[\frac{l}{r}\right]^2},$$

in which p = permissible working load per square inch of cross-section of the column, f = permissible working stress per square inch of section of an exceedingly short practical column, E = modulus of elasticity of the material, l = length, and r = least radius of gyration, both in the same units.

For eccentrically loaded columns he obtains:

$$p = \frac{f}{1 + \frac{w\,a}{r^2} + 0.912 \frac{f}{E} \left[\frac{l}{r}\right]^2},$$

in which w = distance from the center at which the load is applied, and a = distance from the center of the section to its most remote fiber.

We cannot spare the space for even an abstract of the analysis by which the formulas are derived, but must refer those who are interested in the subject to the original paper.

This has been reprinted in a separate pamphlet, copies of which can be obtained, we presume, by addressing Mr. Barth, at 337 Harrison Ave., Scranton, Pa.

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The entire success of the conduit electric railway system in New York city and in Washington is likely to lead to demands upon electrical railway companies in other cities to remove their poles and overhead wires and substitute the conduit system. As it happens, the franchises under which not a few street railway companies are operating, contain a provision that when any system of electric street railway operation is perfected and proved to be practicable which dispenses with the use of overhead wires, the company may be required by the municipal authorities to alter its lines to that system. The rigid enforcement of this requirement would generally be a serious thing for the street railway companies; and in many cases we believe the real interests of the city which has the right to require such action by its street railway companies can be better served by a more conservative course. It must be remembered that the cost per mile of the electric conduit construction is very high. It may be roughly estimated at about double the cost of the ordinary overhead trolley system. Many street railway companies would be forced into receivers' hands if required to duplicate their investment in their tracks, with no additional income resulting. It may be said, that that is no affair of the city authorities, their sole duty is to see that the railway does everything which it is obliged to do for the city by the terms of its franchise. This, however, we believe to be a narrow view of the question. If the size of a city and the volume of traffic on its street railways is sufficient to justify the conduit system, then it may be all right to compel the company to install it; where the city has the power. But to bankrupt a city's railway companies will in the long run injure the city and the patrons of its railways, as well as those who own the railways. The prejudice against the overhead trolley system has almost disappeared. The "deadly overhead wire," which was what the public feared most, has an astonishingly small record of accidents against it, as it is now installed in street railway practice. The trolley wires being located in the middle of the street are no such obstacle to the work of firemen as are the electric light, telephone and telegraph wires, which are strung on high poles next the curb. Really, except where streets are so narrow and crowded that the room taken up by the poles is a serious matter, the only objection to the overhead trolley system for street cars is the objection to the disfigurement of the streets. And this disfigurement is by no means so serious as is sometimes claimed. If the street railways were owned by the city, how many taxpayers would be in favor of expending an additional $25,000 per mile of track merely to improve the aesthetic appearance of the streets by dispensing with overhead trolley wires? Certainly the gain to the average citizen from the removal of the overhead construction would not compensate for the loss that will inevitably result from throwing the company into bankruptcy.

Suppose, however, that a company can well afford to introduce the conduit system. Even then we believe that in many instances something better can be done than to force the company to adopt it, where the city has the power. Concessions in the form of reduced fares, especially to school children and workmen, increased transfer privileges, extensions to outlying suburbs in need of better communication, or even increased cash payments to the city as rental for the use of the streets, would, in most cases, be of much more real value to the citizens than the removal of the poles and overhead wires.

Of course, we are not speaking now of the largest cities. In several of these, space, light and air in the streets have become so valuable that the substitution of the conduit in place of the overhead system ought to be made, and doubtless will be in the near future.

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The smoke nuisance, due to the use of soft coal, has reached Scranton, Pa., the chief center of the anthracite region. An ordinance has been adopted in the select council directing the city engineer, building inspector and plumbing inspector to "acquire a knowledge of methods and devices now in use for the purpose of reducing to a minimum the smoke and dust annoyances resulting from the use of bituminous coal, and report to councils at the earliest date possible." The burning of soft coal in Scranton is worse than "carrying coals to Newcastle." About two years ago the Scranton papers were full of claims that the anthracite culm piles in and near that city were a storehouse of the cheapest fuel in the country, that the culm could be made into gas, and the gas used to generate power at a cheaper rate than water power could be furnished at Niagara Falls. And now it appears that it is found cheaper, by some of the Scranton people at least, to burn soft coal obtained from a distance of say 200 miles, than to burn the culm which may be had in the city for 25 cts. a ton. We in New York city can sympathize with Scranton in this matter, for the use of soft coal here is increasing steadily, and complaints of the smoke nuisance have become quite common. One method of getting rid of the nuisance has occasionally been tried here with success, which may be commended to the attention of the Scranton officials who have been directed to "acquire a knowledge" of the subject. It is an ordinary suit in court brought by any individual who is aggrieved, praying for an injunction restraining the offender from using it in such a way that it will emit smoke and cause a nuisance. Such injunctions, we understand, have been granted on the ground of the common law respecting nuisances, that no man has a right to maintain a nuisance that injures his neighbor's property or destroys his comfort, and offenders have been compelled to abandon the use of soft coal and return to anthracite.

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PIONEER RAILWAY CONSTRUCTION IN NEW COUNTRIES.

The course of recent events appears to indicate that within a few years the great empire of China may offer a new field to the American engineer and merchant, and that the overthrow of Spanish misrule and medievalism in the West Indies and the "Far East" will also lead to possibilities of rapid development of American interests in these smaller fields. Development in such cases means, first of all, the introduction or extension of the railway. While the American engineer in his own country has shown his ability to build light and inexpensive railways for development purposes, and to improve these lines in proportion as the traffic increases, he has so far had but little opportunity to exercise this ability in other countries, with the exception of Mexico. It is true that he has built railways in the West Indies, in Central and South America, and in the Hawaiian Islands, and is building one in Korea, but most of these have been short lines, built to accommodate an existing traffic from mines, or along established routes of travel, rather than to serve as lines of general development. Already American engineers have been established as advisers in railway affairs in China, and should the recent war with Spain result in giving the United States a permanent foothold in what is termed in Europe "the East," there is little doubt but that American interests in China will experience considerable benefit. It seems appropriate at this time, therefore, to give some consideration to the general question of the construction of pioneer railways in new countries, and particularly in China.

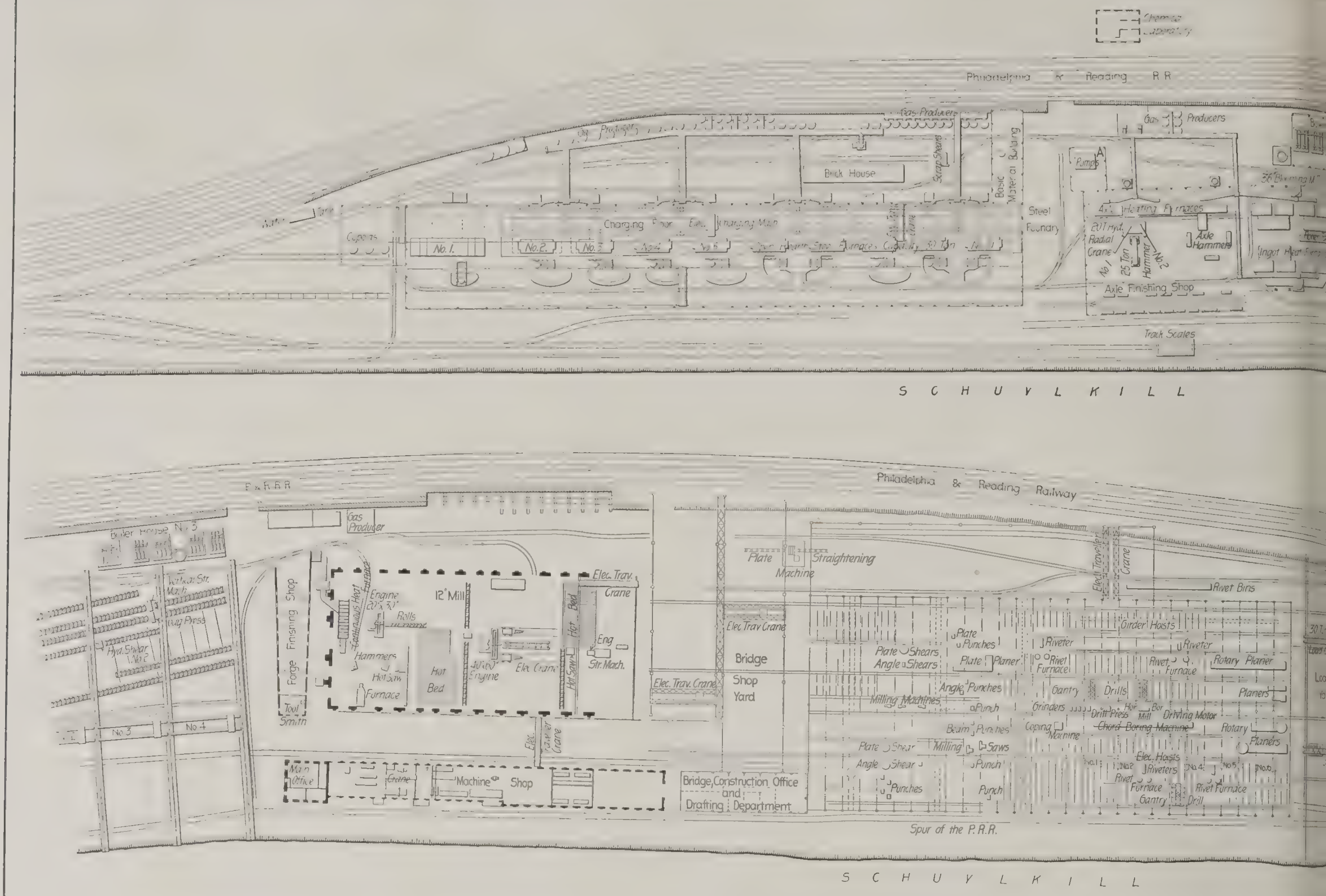
For many years past there has been a great deal of energy expended in promoting railway schemes in China, most of which had practically no result. Every large European country has tried to force railways upon China, and there have been not a few American schemes for this purpose. For a long while the Chinese have stolidly and steadily rejected all propositions, and the most that has been done has been gradually and very slowly to build the lines now known as the Imperial Railways of North China, less than 300 miles in length, and extending from Tientsin to Pekin, and northeast to a point beyond Shan-Hai-Kwan. Two other short lines are also making slow progress.

Within very recent years, however, and especially since the war with Japan, there have been signs that the Chinese will eventually permit their country to be opened up by railways, and the result has been that renewed efforts have been made by professional promoters and by representatives of various foreign governments to obtain important concessions. At the present time a great number of lines are projected, but little is known as to the probabilities of their construction, although the appointment of an American consulting engineer to the Director General of Railways may be assumed to indicate that there is already some appreciation of American skill in railway construction.

In India, Australia, and Siberia, the railways have been introduced by one nation, and that the dominant nation, and the work has, therefore, not been subject to the interference of outside influences. The same is in the main true of Africa, although the number of petty states bordering upon the great territory held by the British have caused some political complications.

In China, however, the conditions will be very different. That nation will do none of the work itself; in fact it has no men competent or experienced enough to plan or direct such work, and it must, therefore, rely almost entirely upon foreigners for its railway system. As a result of this the Chinese government has already been subjected to severe pressure from various other nations, each of which will probably get some share in the distribution of concessions, and it is impossible that all these varied interests should work harmoniously together. Already a war cloud has been raised in Europe by differences over the diplomatic negotiations for railway concessions in China. The government apparently cannot foresee that which seems to outsiders to be the inevitable outcome of this sort of competition. It has evidently no determined policy on the railway question, and is seeking to play off the various Powers against each other, which is a dangerous practice.

In the various discussions upon this subject, one very important point seems to have been almost entirely ignored, and that is the relative character and competence of men of the different nationalities interested to build railways suitable to the conditions prevailing in China. It is essential that the lines should be made as cheaply as possible



FIGS. 1 AND 2. GENERAL PLAN OF PLANT.

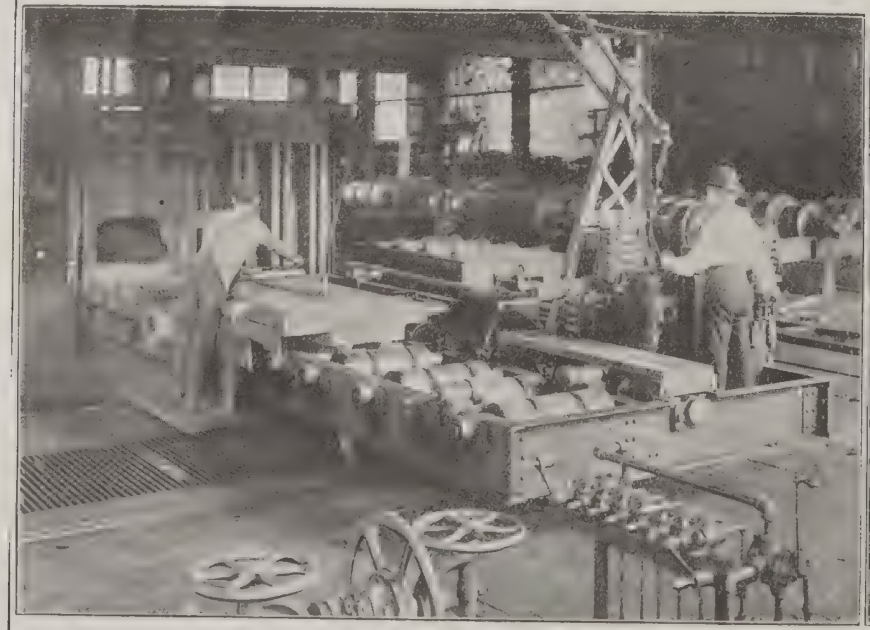


FIG. 6. ELECTRIC CHARGING MACHINE AT REHEATING FURNACE, BEAM MILL.

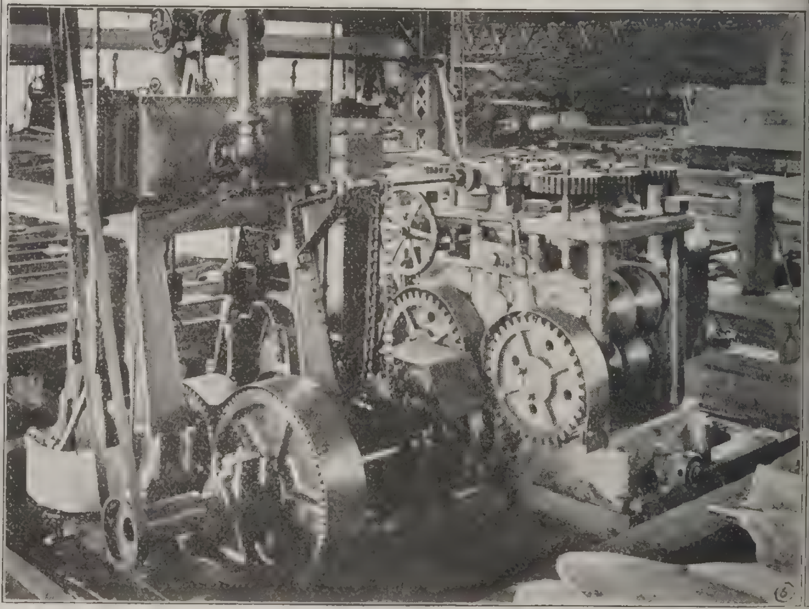
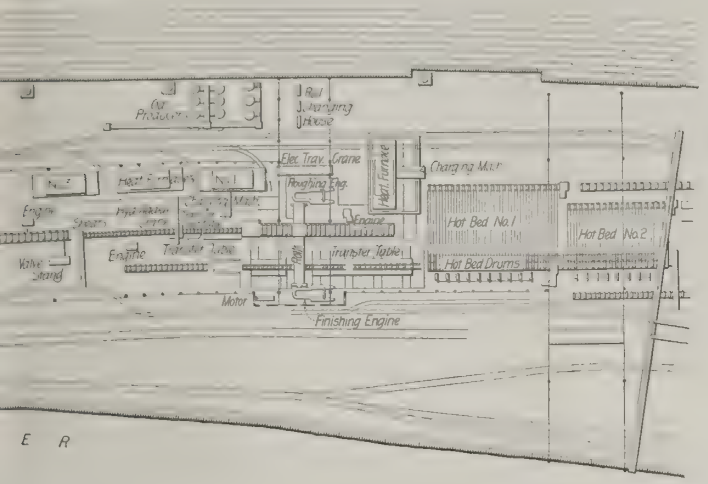


FIG. 8 ANGLE STRAIGHTENING ROLL.

PENCOYD IRON WORKS, PENCOYD, PA.
(A. & P. Roberts Co., Philadelphia, Pa.)



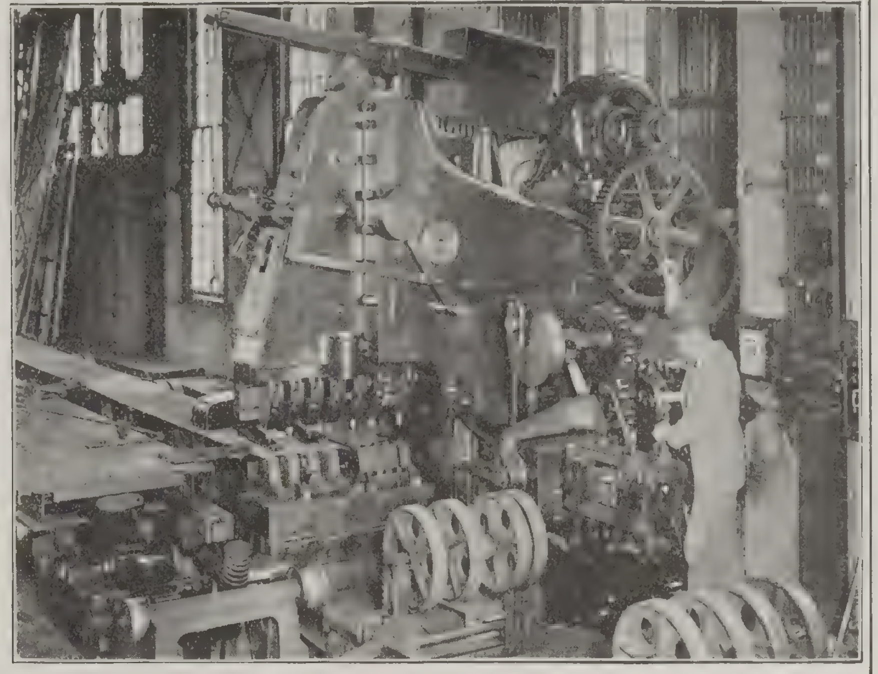
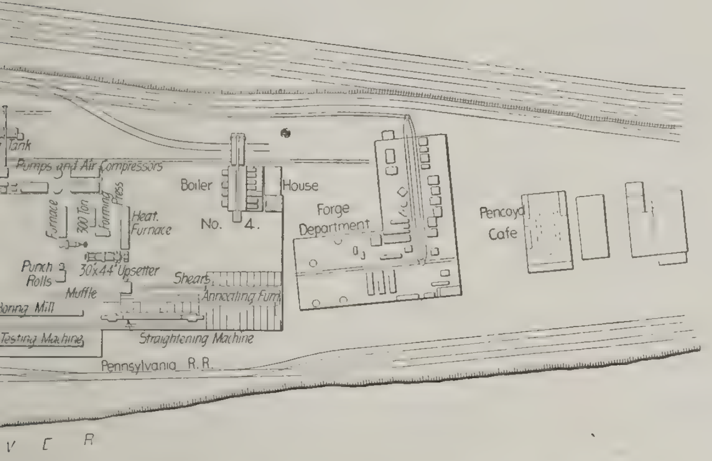


FIG. 14. AUTOMATIC SPACING PUNCH, BRIDGE SHOP.



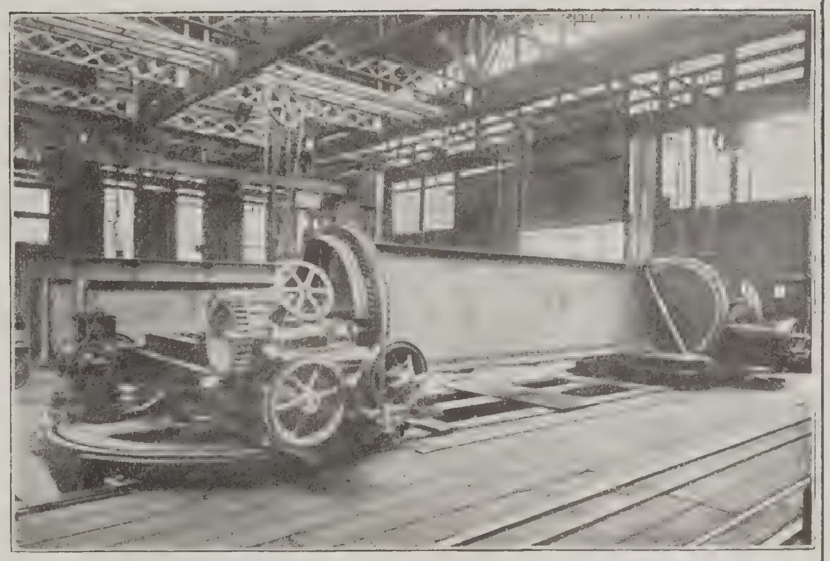


FIG. 12. DOUBLE HEAD ROTARY PLANER, BRIDGE SHOP.

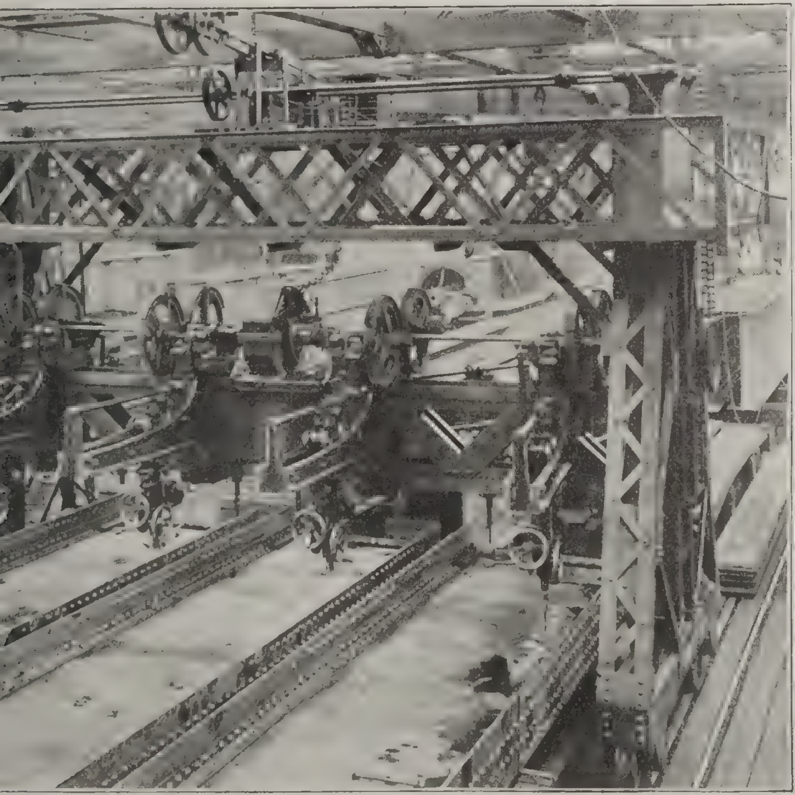


FIG. 10. GANTRY CARRYING EIGHT RADIAL DRILLS, BRIDGE SHOP.

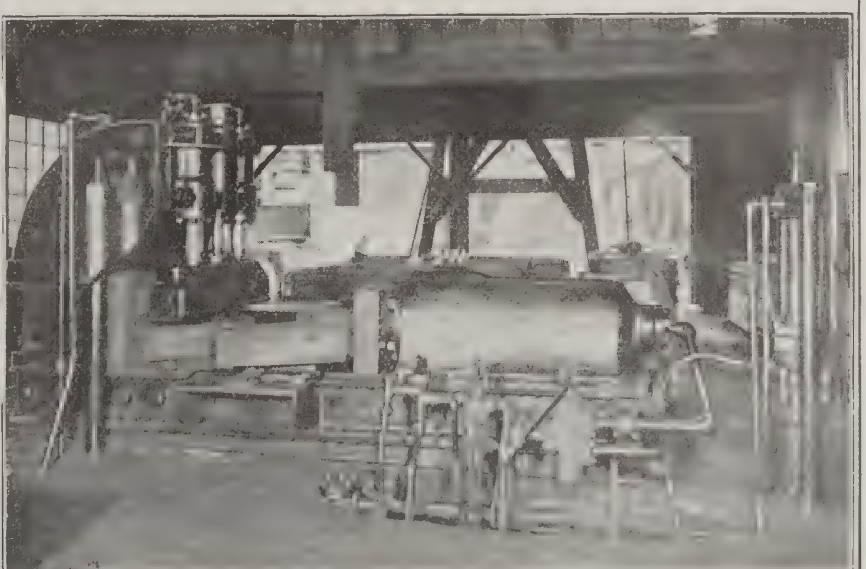


FIG. 16. HYDRAULIC FORMING MACHINE, EYE-BAR PLANT.

[illegible]

[illegible]

with due regard to efficiency and safety, since the vast majority of the people are extremely poor, and most of the railways will be lines of development, the fundamental principle of which is that the greatest length of line should be built in the shortest time and with the least expenditure of money. It is, we think, not too much to say, that American engineers are pre-eminently qualified to undertake this character of construction, since they have shown by their works that they understand and can act upon this principle, avoiding, on the one hand, the Scylla of unnecessarily good lines built at large cost and great expenditure of time, and, on the other hand, the Charybdis of purely cheap lines, as speculative enterprises, which can hardly be included in the term engineering works.

The greatest amount of railway building in new countries has been done by English engineers, but while their work has been good, it has in very many cases been much more expensive than the existing conditions have warranted, and they have shown a tendency to build a limited mileage of first-class railway, rather than an extensive mileage of railway of a character more suited to the traffic. This matter was discussed in our issues of Aug. 4, 1892; Dec. 22, 1892; and April 6, 1893. For lines intended to develop and open up a new country this system is essentially wrong.

In India and Australia the policy of slowly building lines of the most substantial character, and with handsome and costly structures, was followed for several years. In this connection it is interesting to note that in the early days of railways in India, Col. Kennedy, a military engineer who was sent out to report on the introduction of railways, proposed that the Bombay, Baroda & Central India Ry. should cross the flat alluvial districts on its line by means of iron viaducts with 60-ft. spans of through Warren girders on screw-pile piers, each pier to consist of three vertical piles, with batter piles on one or both sides at the crossings of non-tidal or tidal rivers, respectively. This system has been much used in India, but the fact of its recommendation for the first lines in a new country, requiring the importation of thousands of tons of ironwork from England, seems to show that Col. Kennedy was not the right sort of engineer for pioneer lines. In fact, it was this gentleman who, in 1851, prepared a report in which he laid down a series of rules for railway construction in India, which is remarkable for its complete disregard of economical considerations. In this report he recommended that the new Indian railways should have maximum grades of 1 in 2,000 for main lines, and 1 in 330 for branch lines, with "impulsive planes" to assist the ascent. The consulting engineers, however, disapproved of "impulsive planes," and recognized the fact that such limitation of grades was uttterly impracticable, since it would often be far more economical to build a short line with heavy grades than a long line practically level, especially in mountainous districts.

In India some of the trunk lines were of very expensive and permanent construction, and some of the large flood areas are crossed by railways on high embankments with immense high level bridges and an extraordinary number of flood openings, entailing enormous cost. It must be remembered, however, that the conditions there existing differed very considerably from those of Australia, Japan and Africa. The military and strategic necessity for railways in India was a most important consideration, fully equal to that of their necessity for development purposes, and in many cases this fully warranted the enormous expenditures involved in the great works which were required to ensure uninterrupted communication. Still, there are many railways in India which have been built in an unnecessarily expensive manner. In fact, the type and cost of construction of the early railways in general, in that country, was far beyond what was necessary, and an enormous loss of life in the terrible famines has been attributed largely to the fact that the authorities devoted their attention to building short lengths of excellent and costly lines rather than to building a comprehensive system of lines of communication.

In Australia the special advantages of the construction of light and cheap railways for development purposes are being more generally recognized, and in 1893-97 Mr. M. C. Kernot, Engineer in Chief for the Government Railways of Victoria, had several such lines built in that colony at a cost of less than $10,000 per mile. These were in districts where the ordinary passenger and freight traffic was light, and the railways carried wheat and agricultural produce to the seaboard. Seven lines, aggregating 192 miles in length, showed a cost per mile ranging from $6,690 to $10,805, the average being $8,840 per mile. These were of the standard gage of the colony, 5 ft. 3 ins., and had 60-lb. T-rails on eucalyptus ties 9 × 4½ ins., 9 ft. long, lasting 25 years. The bridges and box culverts were of timber. Even this low cost could have been further reduced by the use of plows, scrapers and grading machines; but in order to furnish work for the unemployed of the large towns, all the grading was done by pick and shovel, wheelbarrows and teams. Small contracts were let to gangs of men, each gang appointing its own foreman, but the entire gang shared equally in the earnings. The work was mainly in level country with occasional sand hills and ridges. The annual rainfall of the district is but 14 ins., and the water is quickly absorbed by the sandy loam. As the question of floods did not enter into consideration, the line was built on low embankments, the earth being compacted by means of water-ballast rollers hauled by bullocks. In New South Wales, also, somewhat similar pioneer lines have been introduced, on which trains are run at low speed, and in order to save the expense of fencing it was determined to run trains only by day. On one line, however, this latter arrangement has been rendered unnecessary by the use of an electric headlight, this being done in order to allow of making certain connections with the main line trains.

It seems not improbable, in view of the actions of the Chinese in the past, that procrastination and obstruction will for many years be the great hindrance to railway construction and will of necessity greatly increase the cost of such construction. There will probably be special boards or commissions on railway affairs, composed of native officials who cannot be expected to understand their duties, or to be competent to direct or advise, all of which will tend to complicate matters and introduce delay and extra expense. These hindrances, too, will be increased materially by red tape methods similar to those which have tried the souls of professional engineers in India for the last fifty years. Sir Arthur T. Cotton, R. E., in his "Public Works in India," 1853, makes the following remarks upon the course of officialdom in that country:

> The motto hitherto has been: "Do nothing; have nothing done; let nobody do anything. Bear any loss, let the people die of famine, let millions be lost in revenue for want of water or roads, rather than do anything." It is not the loss of money that we mind, that is nothing. We can afford to lose millions every year for want of hydraulic works, and therefore to spend thousands on such works would, of course, be nothing. But nothing must be done.

The delays and contingencies due to government regulations and red tape are by no means the only hindrances to rapid and economical construction. The provincial and local authorities will all have more or less power for interference and will cause embarrassments which can only be dealt with by the expenditure of time and money. The character of the people, too, must be taken into consideration, and this is such as to undoubtedly lead them to put many practical obstructions in the way of the work and harass its execution.

While much of the projected work will be in flat and easy country, as on the Shansi and Hankow lines (Eng. News, Aug. 12, 1897, and March 31, 1898), yet, under the conditions already noted, no accurate estimate of cost can be made. Even supposing that a careful estimate is made, with a full knowledge of the character of the country, the style of construction, the labor conditions, and the cost of material, then liberal but indeterminate allowances must be made for contingencies incident to the difficulties of work in new countries, with little skilled labor, and with inadequate facilities for transportation or for replacing material lost or damaged in transit. Furthermore, the general evidence is to the effect that, in China at least, provision must be made for certain payments to a long list of officials. Under these circumstances, estimates based on the cost of construction in other countries are of little value.

The character of construction will, of course, depend largely on local conditions. In a new country the question of gage is one of the first considerations, but the cases are rare in which the standard gage of 4 ft. 8½ ins. will not be the most advantageous, for trunk lines at any rate. The troubles due to lack of uniformity in gage, which are so seriously felt in India and Australia, seem not unlikely to arise eventually in China. The lines now in operation are of the standard gage, as are the two short lines under construction, but the Manchurian railway, which is an extension of the Trans-Siberian Ry., will have the Russian gage of 5 ft. In China, as already stated, the country is largely flat or rolling, so that there will be but little reason for bringing up the stock arguments in favor of a narrow gage.

One important point, however, is that much of this flat country is subject to inundation, and that the railway must either be kept above the flood level by diverting it around on the higher ground and carrying it on viaducts and embankments with flood openings, or must be carried boldly across as a low-level line, traffic on which may be stopped occasionally during periods of high water. This is largely a question of expediency, but though it is a very important question, it is not unfrequently overlooked. For example, we may mention a treatise on "Pioneer Engineering," by Mr. Dobson, an English engineer, in which the question of the relative merits and expediency of high-level and low-level lines is not considered at all. In many cases it will probably be a wise plan to boldly cross the district by a low-level line, conforming as closely as possible to the surface of the ground, and allow traffic to be temporarily suspended during flood times. Of course, if the traffic is heavy enough to warrant the cost it may be better to keep the line as far as possible on high ground and to cross the flood district by trestles or viaducts. An interesting article in relation to the building of high-level or low-level railway lines across districts subject to inundation will be found on another page of this issue.

Under the conditions which prevail in China, it is practically impossible to lay out a system of railways suitable to the general development of the country, but the engineers will have to deal with individual lines along routes prescribed and limited by the concession for each line, and it is not at all improbable that some of these will conflict and be in competition, thus involving an expenditure of money and work which might better have been devoted to the extension of a complete system of railway.

To encourage traffic in a country where wages are so small, the rates must be extremely low, and the cost of construction and equipment must equally, therefore, be kept at a minimum. The improved facilities will undoubtedly induce travel on the part of merchants and others, and the social system is such that it will be impracticable to introduce the American system of uniform rates and accommodation. The increased intercourse, however, will tend to weaken the existing class distinctions, as has been the case in India.

One of the great economic purposes of railways in a new country, is to reduce the cost of transportation far below the enormous cost of slow transportation of small quantities in native wagons and on native roads. This aim can only be attained if the railway is built with a view to the lowest possible charges. Steam navigation on rivers and canals also tends to increase traffic and reduce the cost of transportation, and it is probable that China, like India, will offer a field for this system of transportation. In fact, in April last the Chinese government determined to abolish the restriction on the use of steam power, and to permit foreigners to use steam vessels to navigate the rivers and lakes instead of using only native boats. This will probably prove to be an important concession.

In the planning of a system of transportation, one of the prime considerations is the time in which the means of communication can be completed and put in operation, as the more rapidly it is built and extended the more rapidly will the traffic be developed. Any delay in completing the line will, on the other hand, be a cause of serious loss. Sir Arthur Cotton estimated that for the construction of 760 miles of development railways in India, there would be a saving of $75,000,000 in cost of transportation by building the line in 15 years at $50,000 per mile, rather than in 30 years at $25,000 per mile, the greater expense being allowed for difficulties in construction, and not for heavier works. In other words, if the cost of transit of the existing traffic, including what is brought to the line in consequence of the improved facilities which it offers, was $12,000 per mile, and could be reduced to one-fourth of that sum by a railway, there would be a loss to the country of $9,000 per mile for every year the opening of the line was delayed.

Train speed is a matter of very minor consideration, the traffic accommodation and capacity of the slowest railway being far and away beyond that of road transit. It will be evident that traffic can be better served and at far less cost by being handled on 500 miles of railway at 10 miles per hour, than on 100 miles on the railway cars at 30 miles an hour, and 400 miles on wagons at 3 miles an hour. What is needed, in the interests of the development of the country, is not speed in operation, but speed in construction, thus giving a system that will naturally reduce the cost of transportation over a larger area of country, rather than one requiring a large expenditure for a small extent of excellent communication. This has been the fundamental principle of railway construction in the United States, and when once the line of communication is completed it can be improved in accordance with the growth of the traffic.

Under such a system, districts having mineral or agricultural resources which are at present practically unavailable on account of the difficulties and cost of transportation, may be quickly developed, and bring a heavy traffic upon the line.

The eminent Indian engineer, Sir Arthur T. Cotton, R. E., who has already been referred to, strongly advocated the construction of cheap railways which could be built rapidly and carry traffic at low speed, the primary object being to open up communication. The following quotation sums up his principles in brief:

> Nothing can compensate for loss of time in opening up the country. What is most wanted is speed, not in traveling on the railways or canals when executed, but in executing them. What is the use of going a hundred miles at the rate of 34 miles an hour, if we must then go on at 3 miles an hour for thousands of miles. To throw open the country 20,000 miles of good common road, to be traveled at 7 miles an hour, and costing only $2,500 per mile, would be of immeasurably greater value than 800 miles of first-class railway at $60,000 a mile, with a speed of 34 miles per hour; since the former could give an average speed through the country more than double that of the latter. Speed is indeed what is wanted, but speed in forming communications, not speed in traveling upon them.

He opposed the government policy of building magnificent roads, and the railway policy of slowly building lines of first-class construction, but strongly advocated cheap railway construction, considering that in regard to the important point of completing a system of communication, such railways have an enormous advantage over common roads, and would cost but little more. The cost of works for a cheap railway, complete to subgrade, would be but about one-fifth that of a good road, and the work could be done in one-fifth of the time, while the laying of track would be done very rapidly. He claimed, and supported his claims by careful calculations, that the time saved in laying such a railway, as compared with making a road, would, on main lines, much more than pay for the railway, and held this up as an argument against going on with the construction of common roads on main lines of travel.

The conclusions arrived at fifty years ago in regard to India, seem to be very directly applicable to China at this time, and may be summarized as follows:

Cheap railways and good common roads will greatly reduce the present cost of transit. In a rich country already provided with a complete system of cheap transit, high speed of transit is a prime consideration, but in a very poor country, with no adequate means of transit at moderate cost, the prime consideration is to provide a general system of cheap transit. The great point, therefore, is to adopt a system of communication which will greatly reduce the cost of transit, and to execute this throughout a large extent of country in the shortest possible time, rather than to make the most perfect communication possible on a few hundred miles in the course of 20 or 30 years.

LETTERS TO THE EDITOR.

The Litigation Over Air Brake Triple-Valve Patents.

Sir: It is reported to us that a statement is being circulated to the effect that the decision of Judge Wallace, of the United States Circuit Court, in our suit against the New York Air Brake Co. for infringement in the manufacture and sale of its present form of triple valve, is a final one. Such a statement is utterly without foundation, as the case in question will not be finally decided until after it has been heard by the Court of Appeals. The hearing before the Court of Appeals is set down for the next term, which opens about the last of October, and the merits of our case are such that we have good reason to believe that the decision of the Court of Appeals will be favorable to us. Very truly yours,

The Westinghouse Air Brake Co.

Pittsburgh, Pa., Sept. 24, 1898.

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The Accident at the New York and Ottawa R. R. Bridge.

Sir: In your interesting account of the failure of the New York & Ottawa R. R. bridge over the St. Lawrence River, it is not clearly stated as to what depth, if any, the crib foundation was sunk below the natural bed of the river. From the description I take it that the crib simply rested on the bed of clay and boulders. If this is true, it would seem a most serious fault of design for so important a structure. The sinking of the crib would increase the erosive effect of the current to some extent and would lead one to expect quite possibly, if not probably, what apparently did actually happen.

I do not believe, and think most engineers will agree with me, that any material other than solid rock is to be trusted for a foundation for a bridge pier in a river having so great a velocity of current, unless excavated so far below the natural bed of the stream, or so thoroughly protected by riprap or otherwise, as to make the undermining of the structure by the scouring action of the current practically impossible. Yours respectfully,

E. W. Lewis.

Duluth, Minn., Sept. 20, 1898.

(Doubtless the engineers in charge of this piece of work considered that the bottom on which the crib rested was sufficiently stable to justify them in founding the crib directly upon it. They believed that the swift current of the river had in the course of centuries so scoured the bottom that no further erosion need be feared; and we are informed that the divers who went down inside the crib found the boulders on the bottom so firmly imbedded in the hard pan as to be very difficult of removal.

The protection of cribs by heavy rip-rap is always a good precaution, and the result in this case shows that it would have been wise to have made use of it; nevertheless, in fairness to those responsible for this structure, it should be said that rip-rap is frequently omitted on river bottoms of cobble-stones and boulders, where the engineer feels sure that the bottom will safely withstand the increased scour.—Ed.)

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Differentiation in Professorships of Civil Engineering.

Sir: It is taken for granted that the title "Professor" will always be used to officially designate the heads of collegiate departments of civil engineering, although in social life it may be considered more desirable and refined to use the simple prefix "Mr." The indiscriminate prodigality manifested in appropriating the title (extending even to the signboard "Virgil Greene, Professor of whitewashing," swinging in a Southern alley, or "Professor Gray, dyer and cleaner," insinuating an academical interest in collegiate clothing) may approach the humiliating until one remembers that the man graces the title—the title does not make the man. After all, there is no other word that will so thoroughly designate and describe the professional duties under consideration.

The universal title of professor may, then, be considered as fixed. It may also be held as perfectly settled that American custom has become too well defined to consider favorably the system of many technical schools of continental Europe, which give to each member of its faculty simply the general title of professor without combining in that title the designation of his particular branch of instruction. Where a college charges one man with the responsibility of all the civil engineering instruction, there can be no question but that he should be the "Professor of Civil Engineering." This term in its fundamental meaning covers the whole field of engineering, except military, and therefore is most fitting. It is where the institution has grown to require a differentiation of instruction in civil engineering that confusion follows. Its cause is partly of classification and partly of administration; but the results, as exemplified by present practice, it may be hoped, are, in some respects, only tentative.

One college has a "Professor of Mathematics, Surveying and Astronomy," and at the same time a "Professor of Civil Engineering, Mining and Metallurgy,' and another has its "Professor of Mathematics and Geodesy," while still having its "Professor of Civil Engineering." Other institutions, while combining in a title courses more closely allied, still display a combination of branches not the most intimate in character, or a prolixity of terms quite subversive of a simple directness; as the "Professor of Civil Engineering in charge of Railroad Engineering and Geodesy." Several universities have a professor of civil engineering, and also professors of branches universally understood to be embraced by the general term of civil engineering. One college has its professor of civil engineering and associate professors of several of the subsidiary branches. Two universities have abandoned the title of professor of civil engineering, and have their professorships differentiated by titles distinguished by engineering designations which the term civil engineering broadly includes.

When there comes a marked increase in the instructional force, should one still be a professor of civil engineering with all the others subordinated, should the stronger men of this force be designated as professors of differentiated branches of civil engineering while still retaining this general professorship also, or should the latter proposition be adopted, but dropping the professorship of civil engineering?

The first mentioned plan is one adopted by British colleges, which usually have a professor of civil engineering, lecturers, demonstrators, assistants and instructors. Apart from the fact that this would involve a change in the prevaling American tendency and practice, there remains the situation that this plan would be hardly applicable to our colleges where the system of apprenticeship has no part in engineering education, and which are often situated in the smaller cities where eminent lecturers cannot be readily called upon as occasion demands. With us such men must be on the permanent staff of the institution if their services are secured; and in expanding to cover the ever broadening field of instruction and to keep pace with the demands of active engineering practice, men of recognized ability could not be expected to be made subordinates.

Moreover, there remains the most important consideration of all, the close touch that exists, the intimacy that must be fostered between engineering practice and engineering education. Civil engineers have differentiated as mechanical engineers, mine engineers and electrical engineers, so that now in America these last are rarely thought of as civil engineers; specialization has further given us railroad engineers, hydraulic engineers, sanitary engineers, bridge engineers, municipal engineers, geodetic engineers, topographical engineers, structural engineers and irrigation engineers—terms scarcely less fixed and characteristic than the previous ones; and it has coined and is adopting more or less well-known designations of similar style.

Profiting from this practice, mindful of the spirit of the usage of the universities, and aiming to secure titles that will be at once definite, distinctive and terse, it would seem no very difficult task to formulate a system applicable to any situation. The keynote to such a plan would be the use of the more general and inclusive designations where the number interested is few; the application of the more restricted and specific terms where those concerned are greater in number; and the passing from the former class to the latter with the growth of the institution by adopting the latter character of titles while abandoning the use of the former as circumstances permit.

Suggestive of development under this plan may be considered the adoption of the titles "Professor of Railroad Engineering" and "Professor of Municipal Engineering" where there are established two professorships. The former designation is already considerably used, but the merits of the latter term seem to have been overlooked by all but one of our universities. "Municipal Engineering" characterizes the title most fittingly, particularly where there are but two or three co-ordinated professorships; in style it is direct, simple and expressive; in significance it carries undoubted distinction; in scope it includes a large proportion of the civil engineering branches, while still being sufficiently elastic in application to embrace allied branches, or not, as circumstances make advisable; moreover, the term signalizes a line of labor that engages the attention and interest of a large number of our engineering graduates. In a large measure the same reasoning applies to the other title already mentioned, and together they would comfortably cover the whole field. Or, if three responsible heads were deemed advisable, the third appellation might, for similar reasons, be found in "Professor of Structural Engineering." Other professorships would find their appropriate designation in the list of engineering specialties already given or implied, always tending from the more inclusive terms to the more specific as the field expands. In special situations certain titles would naturally be adopted earlier than in the general case; as, in the arid states, the universities would probably find the "Professor of Irrigation Engineering" of the first importance.

With co-ordinate professorships established to conform to the trend of engineering practice, with the covering of the field by these subsidiary titles, and with several correlated professors placed in responsible charge of the work, what reason remains for continuing the professorship of civil engineering? One who holds the latter title may readily object to assuming a less comprehensive one, or executive details may, in a certain case, interpose; but these will not permanently interfere with merging such a condition into the differentiating system of co-ordinate titles, and so giving free scope to a thorough education of the specializing engineer. As Mr. George S. Morison said in his Presidential address before the Am. Soc. C. E., 1895, "the civil engineer of the new epoch must be a specialist, . . . but his specialty must not be of a narrow kind; he must have that general knowledge and training that marks the liberally educated man."

The educational development of the immediate future involves specialization. Whether a thorough differentiation, meeting the needs and embodying the genius of the coming age will ultimately require (as sometimes with nations) the impulse of an all-embracing, supreme system, the future will disclose. If this occurs the professorship of civil engineering may well be reinstated, but with an enlarged significance. For it must follow differentiation to reunite all its branches, some of which are, in this country, already all but divorced, and others are in course of separation. Such an adjustment would mark the complete realization of the statement of the authority already quoted, that "it is a common error to think of civil engineering as a co-ordinate branch of a general profession with many other branches; to class it with mechanical engineering, with hydraulic engineering, with sanitary engineering, with mining engineering, with electrical engineering, or with any other specific branch. The name of every special branch of engineering has a distinctive meaning. . . . . Civil engineering, in its true meaning, embraces every special branch of engineering." However, our immediate concern is not affiliation, but differentiation. J. L. Van Ornum,

July, 1898.

Captain Third Regiment U. S. V. Engineers, Camp Hamilton, Lexington, Ky., Sept. 25, 1898.

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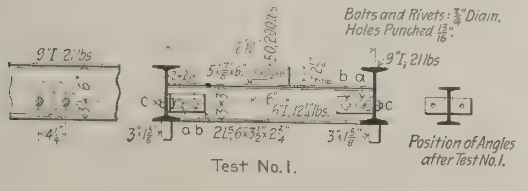
Erroneous Data in Manufacturers' Hand-Books Concerning Structural Beam Connections.

Sir: The letter of May 6, 1898, addressed to you by Mr. Henry S. Prichard, of Trenton, N. J., is duly noted. In this letter Mr. Prichard criticises the data relating to beam connections in hand-books issued by the Cambria Iron Co. and others. In order to ascertain the actual facts in this case we had tests made of our standard beam connections with the results shown below: The details of the arrangement of the beams for test are shown on the accompanying sketches:

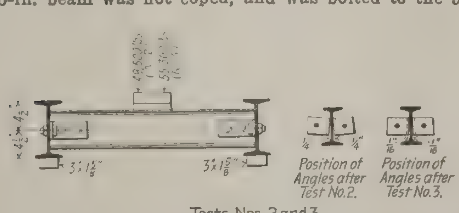
Test No. 1.—Connection angles were riveted to the 6-in. I-beams and bolted to the 9-in. beams with rough ¾-in. bolts and the 6-in. I-beam was coped in our usual manner flush with the bottom of the 9-in. I-beams. The pressure of the testing machine was distributed over a space of 6 ins. at the middle of the 6-in. I-beam, as shown on sketch, and was applied by the downward pull of the moving head of the testing machine, which travels at the rate of about ¾-in. per minute. In this test the 9-in. I-beams were braced at both ends, as shown in the sketch. Pressure was applied up to 50,200 lbs., and the test was stopped as the 9-in. girder beams were bending outward and began to buckle. At the conclusion of the test the bolts, rivets and angles were found to be intact.



Test No. 1.

Fig. 1.—Test of 6-in. I-Beam With Riveted Angle Connections Bolted to 9-in. I-Beam Girders and Coped to Fit Bottom Flange.

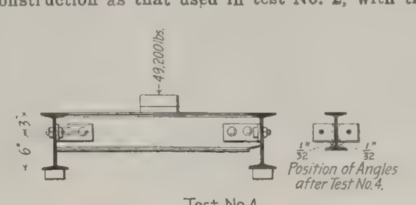
Test No. 2.—This test was arranged in a manner similar to that used in test No. 1, the only exception being that the 6-in. beam was not coped, and was bolted to the 9-in. beams at the middle of their webs. At a pressure of 47,000 lbs. the connection angles began to spread and at 49,500 lbs. they had assumed the position shown in the sketch, when one bolt sheared at the connection with the 9-in. I-beam. The position which the angles assumed in this case was apparently due to the fact that the bolt holes in the connection angles were more than a quarter of an inch further apart than those in the 9-in. I-beam to which the angles were secured, and as the pressure was applied the slack was taken up with the result shown. This also caused a severe pressure to come upon the bolts, owing to the leverage or knuckle-joint action of the connection angles after they had assumed a position out of line. In this case the leg of the angle between the point of the connection to the 9-in. beam and the first rivet which secured it to the 6-in. beam was bent into a warped surface. After this test the rivets were intact.


4½"
4½"
3"x1⅝"
3"x1⅝"
¼
¼"
1/16"
1/16"
Position of Angles after Test No.2.
Position of Angles after Test No.3.

Tests Nos. 2 and 3.

Fig. 2.—Test of 6-in. I-Beam With Riveted Angle Connections Bolted to Middle of Web of 9-in. I-Beam Girders.

Test No. 3.—This test was made on a 6-in. I-beam of same construction as that used in test No. 2, with the exception that the 9-in. I-beams were not braced together at either end. The ultimate strength developed was 55,300 lbs. when the 6-in. I-beam bent and buckled. The test was continued until the load dropped to 40,000 lbs., when the I-beam was very badly distorted. At the end of the test the connection angles were spread at their lower edge about 1-16-in., as shown on the sketch, but the rivets were intact. The four connection bolts were slightly distorted by the shearing strain due to the spreading of the connection angles, but they did not shear.



Test No. 4.

Fig. 3.—Test of 6-in. I-Beam With Riveted Angle Connections Bolted to 9-in. I-Beam Girders and Coped to Fit Top Flange.

Test No. 4.—This test was made on a 6-in. 12¼-lb. I-beam, which connected to the 9-in. I-beam and coped flush on top. One of the ends of the 6-in. beam was also coped on the bottom, as shown in the sketch. In this test the 6-in. I-beams bent and buckled in the center at a maximum load of 49,200 lbs., and the connection angles did not bend away from the web of the beam more than 1-32-in. In this test also the rivets were intact, but the bolts were slightly distorted as in test No. 3.

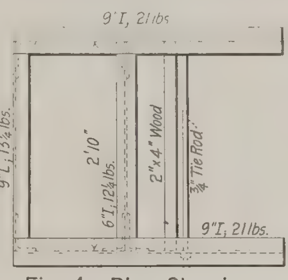


Fig. 4.—Plan Showing Arrangement Used for Making Tests Nos. 1 and 2.

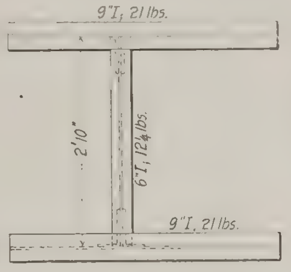


Fig. 5.—Plan Showing Arrangement Used for Making Tests Nos. 3 and 4.

The material of which the beams and connections were composed was ordinary medium Bessemer steel taken from stock without any selection, and the workmanship was of the ordinary commercial character.

Although Mr. Prichard's remarks relate to the strength of the beam connection under uniform load the arrangement of testing machine did not permit of the introduction of a load of this character, and in consequence the tests were made with a central load on a beam of about half the length of that to which Mr. Prichard refers, in order that the conditions might be similar as nearly as possible under these circumstances.

As stated on page 39 of the book entitled "Cambria Steel," the minimum span for which standard connection angles may be safely used with a 6-in. 12¼-lb. I-beam uniformly loaded to its full capacity in accordance with table of safe loads corresponding to a fiber stress of 16,000 lbs. per sq. in. is 5.7 ft., and the uniform load corresponding to this length is 13,600 lbs., as shown by table on page 74. The average ultimate load on the beams as shown in tests 2, 3 and 4 is 51,333 lbs., and these loads were approximately central, and if we assume a safety factor of four, this practically corresponds with the safe load, which is 13,600 lbs., as stated in the Cambria book. The load in test No. 1 did not come upon the connection angles, but was transmitted to the flange of the 9-in. beam. It should also be considered in all of these tests, with the exception of No. 1, that the full capacity of the connection was not reached, as the beam failed by bending and buckling without destroying the connection.

If we should carry Mr. Prichard's statements to their logical conclusion in view of the figures which he presents and the above tests, the shear on the rivet would be about 268,000 lbs. per sq. in., notwithstanding which the facts are that they did not fail, thus showing the entire fallacy of his reasoning, as no rivet could be expected to withstand any such stress.

The tests which were made on the 6-in. 12¼-lb. I-beams show that the strength of the connection for this size, as stated in the Cambria tables, is correct, but at the same time the strength of this same connection when used on heavier sections of 6-in. beams might not be sufficient for the short spans stated in the tables. Very short spans are not ordinarily used in building work, and if used are not likely to be loaded to the capacity of the beams. For the reason, however, that none of the tests (with the exception of test No. 2, which was not representative on account of the differences in spacing of the bolt holes), developed the strength of the connection, but bent and buckled the beams themselves, the actual ultimate strength of the connection was not fully demonstrated. The statements made by Mr. Prichard relating to the connections for 6-in. 12¼-lb. I-beams are fully disproved by the actual results of our tests. We must thank Mr. Prichard for giving us the opportunity of demonstrating the correctness of our figures with regard to the particular connection in question. Yours truly, Geo. E. Thackray.

Johnstown, Pa., June 3, 1898.

(When we received Mr. Thackray's letter, Mr. Prichard had already notified us that he proposed to reply to Mr. Christie's letter in our issue of July 21. In order that the whole remaining correspondence might be presented to our readers together, therefore, we furnished a proof of Mr. Thackray's letter to Mr. Prichard, enabling him to reply to both communications in one letter.—Ed.)

Sir: The replies of Mr. Christie, writing for the A. & P. Roberts Co., and Mr. Thackray, writing for the Cambria Iron Co., to my criticism of the table giving the strength claimed for standard beam connections (Eng. News, July 21), leaves the discussion of the point at issue in a condition which makes further discussion and investigation desirable.

As a preliminary, it is well to state the requirements for safe connections. At 16,000 lbs. extreme fiber stress, a steel beam has a factor of safety of about 2, as regards the beginning of failure, and about 4, as regards complete failure; supposing it to fail by bending. The factor of safety required for the connections should be equal to or greater than that required for the beams, both as regards the beginning of failure and complete failure. A table giving the strength of standard connections should state as the strength of each connection an amount no greater than should be used under the most unfavorable conditions to which the table can be reasonably understood to apply from a consideration of its title and the descriptive matter accompanying it.

The table criticised is based on uniformly distributed loads; but the tests of 6-in. and 8-in. beams, quoted by Mr. Christie, were made with concentrated loads applied at the middle of each span, the 6-in. beams being rolled-up sections having about 50% greater rivet bearing than the minimum size to which the table applies, and the 8-in. beams being of shorter span than called for in the table. The loads were, therefore, less than half what should have been used to test the accuracy of the table and the rule by which it was calculated.

In the tests made by both the A. & P. Roberts Co. and the Cambria Iron Co. the connection angles were riveted to the webs of the beams tested. This corresponds with the illustrations in the Roberts' hand-book, as they show the connections riveted and make no mention of bolts. In the Cambria book, however, and in the books of the other companies referred to in the criticism, the connections are shown with holes which are stated to be for either bolts or rivets. As bolts are generally conceded to be weaker than rivets, they should have been used by the Cambria Iron Co. in testing the accuracy of their table and the rule by which it is calculated.

Neither the A. & P. Roberts Co. nor the Cambria Iron Co., in the published reports of their tests, have noted the points at which failure of the connections began, and consequently they do not give full data from which to determine the safe loads. The data published, however, are sufficient to show a marked discrepancy between the results obtained and the amounts given as the safe loads by the method advocated in the criticism. In accounting for this discrepancy, Mr. Christie takes no exception to the reasoning employed in the criticism, but attributes it to the neglect of "two elements of resistance" in the premises on which the reasoning is based. Mr. Thackray, on the other hand, takes no exception to the premises in which three elements of resistance are neglected; to wit: the frictional resistance from the grip of the rivets, the partial fixedness of the ends, and another element hereinafter described, but claims that the discrepancy shows the entire fallacy of the reasoning. In view of this difference of opinion between the author's critics and the insufficiency of the published reports of the tests which they quote, some additional tests seemed desirable and have been made.

Six beams were tested, the ends in all cases being simply supported. The sizes and arrangement of the beams and connections are illustrated in the accompanying cuts. The outstanding legs of the connecting angles were riveted to the flat connecting each pair in all cases except No. 6, in which they were bolted. The connection angles were 6 × 4 × 7-16 ins. for Cases 1, 2 and 6, and 6 × 6 × 7-16 ins. for Cases 3, 4 and 5. The beams were 6-in., 12¼ lbs. per ft. with webs 0.23-in. thick for Cases 1, 2, 5 and 6, and were 6-in., 17¼ lbs. per ft. with webs 0.46-in. thick for Cases 3 and 4.

In Case 1 the connection angles were bolted to the beam with rough bolts, forced to a bearing before the test, and the nuts were screwed up to a gentle touch only. In Cases 2 and 4 the connection angles were riveted to the beams. In

Case 3 the connection angles were bolted to the beam with turned bolts, which fitted the holes, and the nuts were screwed up to a gentle touch only. In Case 5 the connection angles were riveted to the beam, but the holes in the beam were made ½-in. larger than the diameter of the rivets to prevent the rivets from getting any bearing on the beam, the object being to test the frictional resistance from the clamping power of the rivets. In case 6 the connection angles were bolted to the beam with rough bolts forced to a bearing before the test, and the nuts were screwed up tight so as to give all the frictional resistance practicable. The rivets and bolts were all ¾-in. in diameter, the rivets were machine driven, and the holes were punched 13-16-in. diameter, except those for the turned bolts and those in the web of the beam in Case 5.

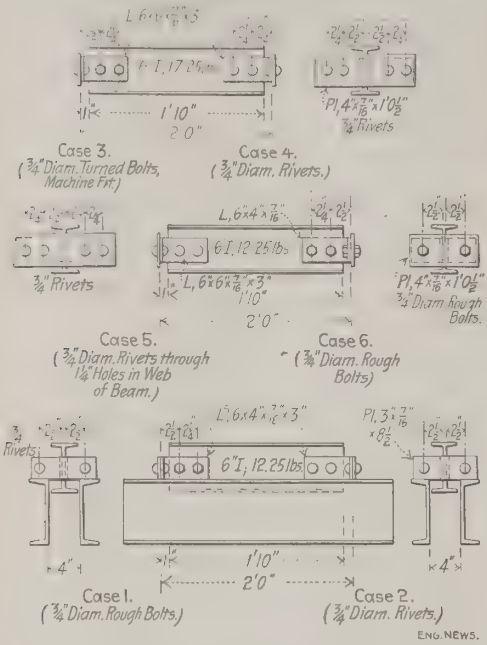


Fig. 1.—Diagrams Showing Sizes and Arrangement of Beams and Connections Tested by Mr. Henry S. Prichard, New Jersey Steel & Iron Co.

It was intended to test the connections only and not the beams, and to insure the beam from failing, distributing flats were placed between the top flange and the pressure edge of the testing machine. In Cases 1 and 2 the flats were not added till the beam began to fail.

The results of the tests are given in the table below, to which is added a comparison between the calculated safe loads for the connections and those indicated by each test separately considered.

In calculating the safe loads by the usual method (that on which the table criticised is based), the bearing value for both rivets and bolts was taken at 20,000 lbs. per sq. in. as stated in the tables criticised. In calculating by the writer's method, the bearing for bolts was taken at 18,000 lbs. per sq. in. and for rivets 21,600 lbs. per sq. in., to agree with the article on beam connections in Engineering News of May 16, 1895. In obtaining the safe load indicated by each test a factor of 2 was used with regard to the beginning of failure, and of 4 with regard to complete failure.

The point at which the connections began preceptibly to rotate with reference to the web of the beam was taken as the beginning of failure. In Case 5 it was possible to obtain this point easily and accurately because after the point was reached the pressure on the machine remained stationary for a few moments. In the other cases, however, it is probable that the results are a little high, as it is difficult to perceive by simple observation the very slight movement which accompanies the beginning of the crushing of the bearing surfaces.

In arranging for the tests the beams were first supported at the ends by resting the flats connecting the outstanding legs of the connection angles on a pair of channels. After the connection at one end of a beam had failed, a support was placed under the beam at that end.

The load was applied midway between supports in each case, and one-half the pressure indicated by the machine was taken as the load on a connection. In each case the connection angles rotated about an axis perpendicular to the web of the beam, as shown in the photograph, bringing pressures in opposite directions on the two bolts or rivets connecting the clips to the beam. That the pressure on the bolt or rivet nearest to the edge of the beam was much greater than on the other one was shown by the amount the holes enlarged and by the shearing of the bolts and rivets. The connection angles at each end of each beam also rotated in a plane perpendicular to the web of the beam, and in opposite directions, as shown in the photograph, so that their tops approached each other, producing a toggle joint action, and firmly clamped the beam. The effect of this was to weaken the connection of the outstanding legs to the flat and strengthen the connection to the web of the beam. The clamping pressure developed was in some cases so great that the webs of the beams were crushed a full 1-32-in., and a bearing thus secured at the upper edges of the clips. Mr. Thackray mentions a similar "knuckle-joint action," as he terms it, in one of his experiments, but he mentions it only as a source of weakness. The strength added to the connection to the web of the beam by this toggle-joint action was not mentioned by either Mr. Christie or Mr. Thackray, and was neglected in the writer's theory, but it appears to have been the chief element in causing the high ultimate strength which most of the connections developed. It is probable that it also added considerable strength to some of the connections before failure began. This is indicated by the fact that in Case 2, in which the chance for toggle-joint action was greater and the bearing surface of the rivets less than in Case 4, the point at which failure began was higher than in Case 4. The writer's theory also neglected the partial fixedness of the ends and the frictional resistance from the clamping effect of the rivets and bolts. If the ends were partially fixed it would have some indirect as well as direct effect on the strength of the connections by modifying the toggle-joint action, but the writer's experiments have not covered this point. The frictional resistance from the clamping power of the rivets and bolts amounted to 2,000 lbs. in Case 5. In Case 4, by comparison with Case 3, in which the nuts simply touched, it was probably about 3,000 lbs., and in Case 6, by comparison with Case 1, about 2,000 lbs.

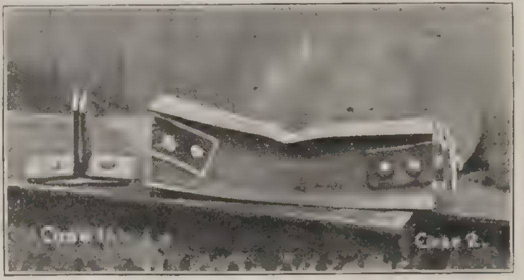


Fig. 2.—View of Angle Connections Showing Manner of Toggle Joint Action.

That the loads at which failure commenced in Cases 1 and 6 were small as compared with the other cases, is probably due to the fact that the bolts did not fill the holes and consequently had very little bearing at the start (theoretically only a line of bearing). As the bolts would get their full bearing before failure had progressed very far, the safe load indicated by the tests can hardly be regarded as a fair criterion. That Case 4, in which rivets were used to connect the clips to the beam, developed so much greater ultimate strength than Case 3, in which turned bolts were used, was due partly to the fact that the rivets were initially tight, while the bolts were not, partly to the fact that the rivets were steel while the bolts were iron, and partly to the fact that the greater strength of the rivets made them last longer and thus enabled a greater toggle action to be developed.

The most seemingly astonishing fact was that in Case 1 the ultimate strength was much greater than in Case 3, notwithstanding the fact that in Case 1 rough bolts were used, against turned bolts in Case 3, fewer rivets connected the outstanding legs of the clips to the flats, and the bearing surface of the bolts was 50% less. This fact is probably explained by the greater toggle-joint action permitted by the construction in Case 1.

Mr. Christie's, Mr. Thackray's and the writer's experiments, considered together, show conclusively that the strength of a connection cannot always be obtained by simply multiplying the nominal strength of one rivet (or bolt) by the number of rivets in the connection, as the authors of the table criticised assumed, and that the strength of a connection depends not only on the bearing and shearing strength of the rivets (or bolts), but also on a number of other elements. Whether or not it is good practice to rely at all on these other elements of strength is an open question. The authors of the table criticised do not appear to have thought that it was, because in the descriptive matter accompanying the table they claim that it is based on the bearing and shearing values of the rivets. If it is proper to rely on these other elements of strength, then the writer's theory gives results which in some cases err considerably on the side of safety. On the other hand, even if these elements of strength are relied on, the method of calculation on which the table criticised is founded gives results which in some cases are dangerously high.

Respectfully, Henry S. Prichard.
Trenton, N. J., Sept. 3, 1898.

Results of Tests for Strength of Standard Beam Connections.

Case.	Load at the beginning of failure, lbs.	Ultimate load, lbs.	Safe load: Indicated by test, lbs.	Safe load: Calculated by: Usual method, lbs.	Safe load: Calculated by: Writer's method, lbs.	Remarks.
1.	2,000	24,900	1,000	6,900	1,470	Beam split from hole "a" to edge at 22,800 lbs., after ultimate had been reached.
2.	13,000	......	6,500	6,900	1,765	Did not fail under load of 24,900 lbs.
3.	9,500	17,790	4,450	13,800	2,940	At 17,790 lbs. bolt "a" sheared off.
4.	12,500	40,310	6,250	13,800	3,530	At 35,000 lbs. cracking noise; cause not discovered. At 40,310 lbs. rivet "a" sheared off.
5.	2,000	.....	1,000	......	.....	Frictional resistance test, carried to slipping point only.
6.	4,000	24,700	2,000	6,900	1,470	At 22,000 lbs. one clip began to crack; at 24,700 lbs. bolt "a" sheared off.

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Notes and Queries.

In our issue of Sept. 1, p. 143, we published an abstract of a paper read before the American Association for the Advancement of Science, by Prof. L. G. Carpenter, of Fort Collins, Colo., on "The Energy received from the Sun." In this abstract the energy was given as "½ to ¼-HP. per sq. yd." These figures should have been 0.5 to 1.4 HP. The statement of the energy in calories (7 to 17) in the abstract was correct.

In the article on "Metal Trucks for Freight Cars," in our issue of Sept. 15, it was stated in reference to the Cloud truck that about 2,600 are now in use. The Cloud Steel Truck Co. now informs us that since furnishing us the figures used in the preparation of that article they have done a large amount of business. Up to the present time they have sold some 5,000 Cloud truck frames and 15,000 of the Bettendorf I-beam steel bolsters.

D. B. McK. asks if a beam or column whose cross-section is an equilateral triangle can be strengthened by cutting off a certain portion of each of the three corners? He says that the strength varies as $\frac{I}{c}$, (I) being the moment of inertia and (c) the distance of the farthest fiber from the neutral axis, and that while (I) is reduced by trimming the corners, (c) is diminished more than (I), and therefore the beam is really strengthened. This is correct, according to the accepted theory of flexure, and on page 180, of Wood's "Resistance of Materials" (second edition), will be found a solution of the problem. In the case of a triangular section, if one of the corners be taken off for 0.13 of its depth, the remaining trapezoidal beam will be 1.091 times as strong as the triangular beam. In other words, there will be a gain of 9%. It is also true that the other corners can be trimmed off slightly without causing any appreciable weakening.

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RAILWAY CONSTRUCTION IN DISTRICTS SUBJECT TO INUNDATION.

In describing the new railways to be built in the province of Shansi, China, in our issue of March 31, we mentioned that the crossing of the wide alluvial plains bordering upon the rivers presents a somewhat difficult problem, as these plains are subject to inundation during the rainy season, when the rivers overflow their banks. To build a high-level line would be costly, especially in view of the amount of waterway to be provided by bridges or trestles, and it is intended, therefore, to build a low-level line which will be covered during the floods, but will be left practically uninjured when the water subsides.

This same problem has been encountered in Australia, more especially in Queensland, where the economic value of the low-level system, in spite of a short interruption to traffic, appears to have been abundantly proved. In an interesting little book on "Pioneer Railways for Queensland," by Mr. George Phillips, a civil engineer who has had extensive railway experience in that colony, this particular subject is discussed, and the advantages of the low-level system of construction in that colony are shown by practical experience. The illustrations show some of the low-level river crossings during and after the floods, the latter showing that the small short bridges are practically uninjured, and only blocked by dirt and drift which can easily be cleared away. On the other hand, the views show that longer and more substantial bridges built on high-level lines in the same district have been practically wrecked, some of the costly metal spans having been carried away. The low-level system requires a minimum amount of expense for general construction and for bridging, while the bridges can usually be renewed promptly and at small expense if they should be washed out. The high-level system involves more expense in construction for embankments and waterways, while the bridges are larger and considerably more expensive, involving a much greater expenditure of money and time in renewal. With the low-level bridges, the higher the flood the less is the danger of damage by drift, etc., but with high-level bridges any rise in the water increases the danger.

An illustration of this is afforded by the experience with two bridges in Queensland. It is stated that the low-level deck bridge over the Burdekin River withstood several floods, the maximum depth of water being 50 ft. above the floor. The Logan River bridge, with two piers and three metal through spans, was built with its rail level 6 ft. above the level of the highest recorded flood, but in 1887 the flood rose 11 ft. above the rail level and the piers and spans were swept away.

We have had occasion before to point out the expense which has attended the endeavors of European engineers to introduce European methods of practice in the colonies, and their failure fully to recognize economic considerations or the influence of local conditions. This conservatism and adherence to old-world customs naturally led to considerable opposition to Mr. Phillips' plans for low-level railways, economical in cost, but the practical results appear to have fully substantiated his claims. For about 90 miles the Normanton & Croydon Railway crosses black-soil plains, and here Mr. Phillips used timber and steel-trough ties, bedded to half their depth in the soil and with earth filled in round the ends. After the first heavy rains the road settled down uniformly, leaving the surface slightly higher than that of the surrounding country, but not enough to interfere with the natural drainage. After a flood the line was easily and quickly put in condition for traffic, even when the ground was for weeks too wet and boggy for wagon traffic. Subsequent attempts at improvement by other engineers who failed to grasp the principles of construction of this line, had unsatisfactory results. It was thought that even a pioneer line could not be permitted to exist on the surface of the ground, and, therefore, the track was raised above the ground level, with the result that the floods turned the dirt ballast into mud which washed out and left the line in bad condition. The remedy then suggested was to use stone ballast, which was not obtainable for a long distance. The Railway Commissioners feared that it would be only a "fine-weather" line, and that the cost of maintenance would be higher than for a road "properly ballasted and drained," but, as a matter of fact, the low cost of construction more than compensated for the slight interruptions to traffic, while the cost of maintenance was very much less than the average for the Queensland Government Railways, although wages were higher on this line.

Mr. Phillips quotes from the article on "English Railway Practice in India and the Colonies," in our issue of Aug. 4, 1892, and we give below some extracts from his discussion of the question of low-level lines:

> As a rule, natural drainage is only applicable to pioneer railways, and chiefly in even country within tropical or subtropical regions, where its adoption in lieu of the artificial method means all the difference between a high cost and a low cost road.
>
> In mountainous country there is practically no choice, and sufficient provision must be made for artificial drainage below the level of formation, but in uneven country very considerable economies can be safely practised by adopting in a modified form the principle of natural drainage at the crossings of the larger watercourses. The instances in which a high-level bridge will practically cost no more than a low-level bridge at the same place are comparatively rare, and only occur where the whole of the flood water is confined to one well-defined channel with banks of the same or very nearly the same height. Very frequently the broken portion of the channel of a river can be spanned in a few hundred feet, whereas in times of extreme flood the water may cover low-lying land on one or both sides of the main channel to a width of thousands of feet, or even of several miles. Now, these are precisely the places where a large expenditure may be incurred under the high-level or artificial system of drainage, or great economies may be effected under the low-level system, and it should be remembered that in the case of pioneer railways the value of the traffic to be carried in any one year will not be increased under the first system, nor diminished under the second system.
>
> The necessity for, or the adoption of, artificial drainage in even and uneven country, rules to a very great degree the selection of route, and determines the extent and cost of the work. No one who has not been professionally engaged in the selection of railway routes in new, uncharted, and thinly peopled countries, can form any idea of the extent to which the question of artificial drainage dominates almost every other consideration. The crossing of and the providing passage for, or the avoidance of water, are very frequently the chief items of expense, more especially in even country, where the surface of the ground offers every natural facility for the laying down of inexpensive pioneer railways, the cost of which need not greatly exceed the value of the rails, fastenings, and sleepers; but the difficulty of providing artificial drainage below the level of formation stands like a lion in the path of the engineer, who considers that artificial drainage is a necessity.
>
> Under the European, or high-level system, it not infrequently necessitates great detours to avoid low-lying and flooded areas, thus thrusting the lines back into broken and hilly country, when much easier gradients could often be secured at far less cost over the flooded flats, but the fear of injury to embankment or occasional delay in the running of trains is ever active with the engineer who is wedded to the high-level system.
>
> It seems almost incredible that while settlers may dwell, cultivate, and carry their produce to market on even country, which is occasionally inundated, it is deemed by some engineers that to lay inexpensive railways on the surface of such country, is so unprofessional as to be almost immoral, so that the very munificence of nature is regarded as sufficient reason for depriving the settlers of those modern facilities which alone can enable them to turn the bounty of nature to the fullest account.
>
> Until a more common sense system be generally adopted, the extension of railways in such countries as China. Africa, South America and Australia, will progress but slowly and intermittently.
>
> The European, or high-level method of building railways prescribes that all water crossing the route of a railway must be provided passage below formation. This may not be so serious a matter in Europe, where the rainfall is usually well distributed throughout the year, and in any case the extent of traffic to be served justifies expensive and high-class lines of communication.
>
> In the tropics, and regions adjacent thereto, the rainfall is usually confined to a period of a few weeks at certain seasons of the year, and the body of water to be provided passage for under the high-level system is sometimes enormous in volume and extent.
>
> In Australia, there are many rivers which occasionally overflow the banks of their usual channels, and cover areas of adjacent country to a width of from 1 to 20, and even 30 miles. These exceptional floods are not frequent, and in any given locality their periodicity is so uncertain that intervals of 5, 10, 15, and 20 years may, and sometimes do, elapse between them.
>
> In passing, I may say that while I have known several high-level bridges to be destroyed by floods, I do not know an instance in which a low-level railway bridge has been seriously injured from the same cause, although numbers of such bridges have been submerged time and again to depths ranging up to 50 ft. The reason for this immunity is that logs, trees, and floating debris are only brought down in any great quantity whilst floods are at or near their full height, so that the floating material is safely carried over the low-level bridges; on the other hand, should a flood rise a few feet higher than usual, or than is anticipated, the debris is apt to lodge against the girders of high-level bridges, and thus subject them to severe lateral stresses.
>
> I have not enjoyed the privilege of visiting China, but I have a theory that the conservative Chinese will not favor the construction of railways with high embankments over the even cultivable plains adjacent to their great river systems, as such embankments would necessarily derange their complicated system of boundary ditches by gathering the drainage of many ditches to a focus, and discharging the accumulated water at new and unaccustomed points. I feel confident that this is a question which engineers constructing railways in China would do well to take into serious consideration.
>
> There are many places in Australia where the raising of an embankment five or six feet in height across long stretches of even country, through interference with natural drainage, result in serious loss to the occupants of the adjacent country, whether they be engaged in pastoral or agricultural pursuits. I have taken sections across 15 or 20 miles of plains, bounded on either side by rivers, where the difference in level was very trifling throughout the entire length of the section, and it is not difficult to conceive that what would only be an inconvenience when the plains were covered with a few inches of surface water, might, under the retarding influence of a railway embankment, become a serious source of loss where sheep are pastured or valuable crops are grown.
>
> As an illustration, take the case of the railway from Sydney to the town of Bourke, in New South Wales. For several hundred miles this railway traverses even country very similar to that on the lower Flinders River in North Queensland; for the last 13 miles before entering Bourke the railway is within the high flood area of the Darling River, and is constructed on the high-level principle, with an embankment some 5 or 6 ft. in height, pierced by many flood openings. It should be observed that the railway does not cross the river, but merely intrudes upon the flooded area.
>
> In April, 1890, the last 13 miles were washed away during a high flood, so that communication with the town could only be maintained by boats. This portion of the railway probably cost $40,000 per mile, but I have no hesitation in saying that a surface line, costing not more than $10,000 per mile, would have proved equally serviceable, and would not have needed reconstruction after the flood subsided. In addition to this, it is evident that the embankment (despite the numerous flood openings) must to some extent have retarded the escape of the flood water, and thus have caused it to rise to a greater height in the town of Bourke, the inhabitants of which ineffectually attempted to protect their homes by means of a rampart of earth encircling the town and abutting in two places upon the railway embankment.
>
> When the railway engineer comes to deal with even country, more especially if he has been chiefly accustomed to construction in uneven country (as is almost invariably the case with European engineers), he is a good deal puzzled as to the best methods of procedure. If he consults the standard works on civil engineering he will learn that the approved method of crossing a great plain is to throw up an embankment from side-cuttings, which are ultimately intended to serve as ditches. Probably his author makes no comment upon the necessity for cross drainage through the embankment, or, even so, gives no clue as to the amount to be provided.
>
> The engineer looks with anxious eye upon the vast expanse of plain, which his levels tell him rises or falls on either side of the proposed line of railway, and he commences to wonder what the effect will be when those plains are submerged, 1, 2 or 3 ft. deep with water, and he realizes that the higher the embankment the deeper the accumulated water will be, and the greater the destruction if it should overflow the embankment.
>
> Evidently there are only two courses that can be wisely adopted. The first, and the most usual method, is to throw up an embankment of sufficient height, and at the same time provide sufficient openings to carry off the intercepted water before it has time to rise above the level of the formation. The second method (as advocated by me for pioneer railways in Queensland), is to keep the line right down on the surface and permit the water to follow the lines of natural drainage even if those lines take the water over and across the railway. An intermediate course is sometimes pursued by throwing up a low embankment from soil obtained from side ditches, supplemented by a few box-drains put in very much at haphazard. The fallacy of this method is generally demonstrated upon the first heavy rainfall sufficient to scour out the shallow formation and ballast, thus leaving the road in an impassable or dangerous condition.
>
> The first, or high-level method, if carried out in a scientific manner, entails a great deal of trouble and additional expense in the survey, as the areas to be drained must be ascertained, with approximate accuracy at all events, whilst the water sheds of even country cannot be easily defined, and they are often very remote from the railway.
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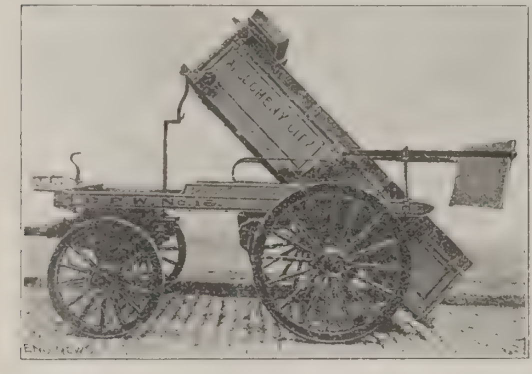
> The following is an extract from "Engineering," London, Nov. 22, 1889:
>
> > From Amballa to the Sutlej River the line crosses an immense number of waterways, many of which are the so-called lost rivers, whose water ultimately disappear in the great Indian Desert. For some reason that is not quite evident, the former effluents of the Indus system that debouch from the hills to the eastward, do not now carry anything like the steady quantities of water they formerly did—although at times, with heavy rains in the foothills, they still come down in tremendous spates that last but a few hours, and bring with them, as all-hill torrents do, immense volumes of silt. At some point or other in the course of each such waterway a bar has silted up the defined channel, and just above it the water of a spate fans out and covers a wide tract of country. While it lasts this is a very profitable form of natural irrigation. But, unfortunately, each spate brings with it a share of debritus, and as it cannot force this over the bar, it necessarily deposits it higher up the channel, and thus the bar, which forms the root of the fan, is perpetually retreating upstream and nearer to the hills. Of late years the consequences of this action have been very disastrous for the railway line between the Jumna and the Sutlej, for the rivers, as they once were, with fairly defined and deep channels that were bridged 25 years ago with perfect success, now "spill" or fan out their waters over the lands above the line, and for several years past, in spite of the addition of immense lengths of flood openings, each recurring July and August has seen the railway breached and communication jeopardized, if not entirely cut off. As the cheapest and best way out of this class of catastrophe, Col. Conway Gordon, the present Director-General of Railways in India, has proposed to lower the level of the rails for, perhaps, miles together, till flush with the natural surface of the absurdly slight depressions that scarcely differentiate one "spill" from another.

A NEW DUMPING WAGON FOR HANDLING GARBAGE AND OTHER MATERIAL.

Two of the essentials of a good dumping wagon are that the load be well distributed over front and rear wheels, so as to haul easily, and that the dumping mechanism be strong and simple These qualities are both claimed for the wagon illustrated herewith. The load is carried well forward, while in transit, and is shifted backwards, when it is desired to dump, on rollers, running in guides, as shown in the view. The trunnion-plate is fastened to the body of the cart. The rolling motion is secured by pushing or pulling, or by means of the lever shown in the view. The end gate is lifted automatically, as shown. The wagons are furnished with metal covers, if desired, and the box is of steel. Where desired, an inclined fixed end is substituted for the tail board, which some would prefer where garbage and some other materials are being hauled. The wagons are made in various sizes by Wm. Becker, 340 Ohio St., Allegheny, Pa.

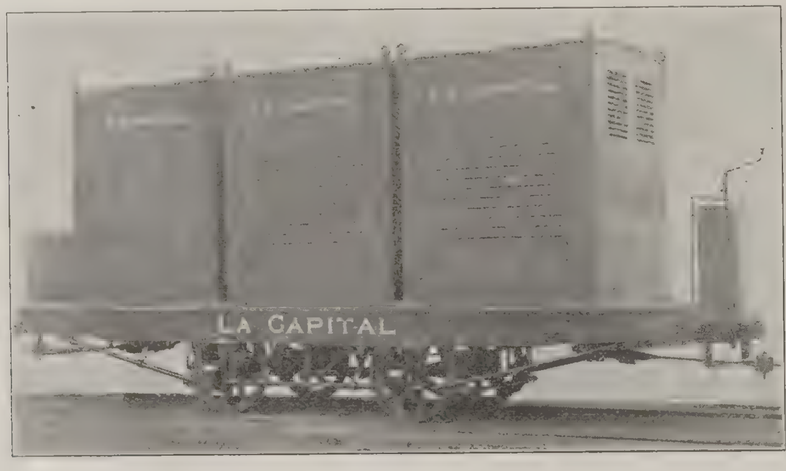


A Dumping Wagon for Garbage or Other Material, with Automatic Tail-Board.

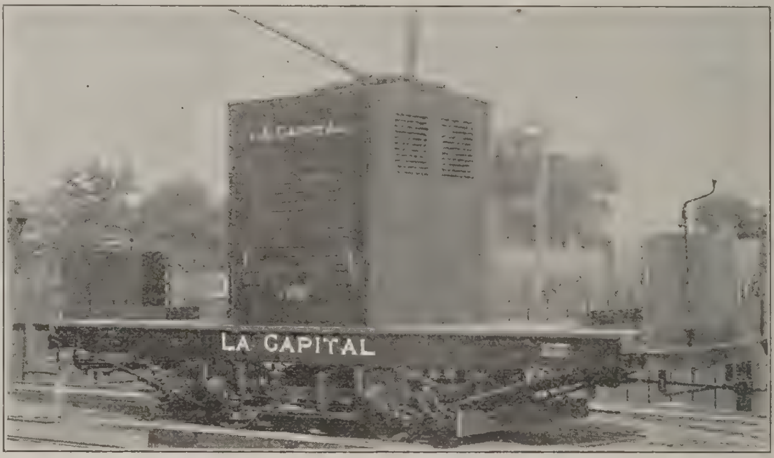
William Beckert, Manufacturer, Allegheny, Pa.

DISTRIBUTING MEAT BY ELECTRIC CARS IN BUENOS AYRES.

In Buenos Ayres, Argentina, the government owns and operates the abattoirs, and no slaughtering of cattle is permitted elsewhere; the purpose being to permit government inspection of all animals used for food, and to prevent the use or export of unhealthful meats. The abattoirs are located 14 miles from the city, and provide meat both for local use and for export in cold storage.



View of Trailer.



View of Motor Car.

DISTRIBUTING MEAT BY ELECTRIC CARS IN BUENOS AYRES.

The dressed meat is distributed to markets and butcher shops by special cars operated on a railway connecting the city and the abattoirs. In 1885 the J. G. Brill Co., of Philadelphia, built special meat cars for Buenos Ayres, Santiago, Montevideo and other South American cities. These cars were hauled by horses and were of necessity small and carried light loads. The carcasses were carried to the cars; hung up inside; hauled to the city, and at any point where meat was wanted the quarters of meat were taken down and carried into the market. This plan was laborious and slow, and involved considerable exposure of the meat to heat and dust.

The introduction of electric traction greatly improved the previous facilities for handling meat; and the illustration here given shows the latest cars built for this purpose by the J. G. Brill Co

By this arrangement the meat is taken from the refrigerators and placed in specially made boxes. These are placed by a crane upon a flatcar, which is hauled by a motor-car directly to the markets without exposure. Upon their arrival at their destination a powerful crane, at the curb line, lifts each box from the trailer and deposits it upon a strong three-wheeled truck, which takes it directly into the ice-box; the trailer then goes on to other points of distribution.

Two styles of car are used; a motor-car and a trailer, the latter may also be attached to a passenger or ordinary motor-car. These trailer-cars weigh 6,820 lbs.; and when loaded with three full boxes they weigh 23,250 lbs. The city has ordered 75 cars of this class. Of motor-cars there will be twenty mounted on 21 E trucks and weighing, with trucks, 8,600 lbs. In this type the center box is stationary and the top supports the trolley board and pole.

The meat boxes are 5 ft. 11 ins. square outside and 7 ft. 3 ins. high. They have double sides, are lined with zinc, and are provided with slat ventilators in the two sides and in the door. The door lifts upward; and to economize space in front, the part below the door lifts out. Inside the boxes have pipe racks in the center and along the sides and stationary racks in the roof; all of these are provided with sliding hooks for meat. As shown each outside corner of the box is fitted with a heavy iron strap terminating in a strong eye, by means of which the boxes are handled. The boxes carry 6,000 lbs. of meat, and weigh when filled 7,750 lbs.

The advantage of such a systematic handling and distribution of dressed meats for the supply of a city will be obvious. Those who will later have the charge of administering city governments in our new tropical possessions may do well to take a leaf from South American practice.

A NEW HIGH DUTY RECORD FOR PUMPING ENGINES.

We have received a copy of a report made by Prof. W. F. M. Goss, M. Am. Soc. C. E., of Purdue University, of a test of a 20,000,000-gallon triple expansion pumping engine, built by the Snow Steam Pump Works, Buffalo, N. Y., for the Indianapolis Water Co., under the superintendence of Mr. L. K. Davis, consulting engineer, 220 Broadway, New York city. The results give the remarkable figures of 150.1 million foot pounds of work per million British thermal units, and 11.26 lbs. of dry steam per I. HP. per hour. This duty figure, we believe, is the highest ever recorded on the heat unit basis, although the steam consumption per I. HP. per hour is not quite so low as that obtained by the Leavitt triple expansion engine at Chestnut Hill station, Boston, viz., 11.2 lbs. (Peabody's Thermodynamics, 4th ed., p. 355). That the figures are open to some question is apparent from the comments on them made by Prof. Goss himself, which we quote below, and it is to be hoped that another test of the engine may ere long be made, in which the water consumption may be measured by the feed water used in the boiler as well as by the water discharged from the hot well, the latter method being the only one used in Prof. Goss's test.

The test was made on July 8 after a preliminary run to give practice to the observers had been made the day before. The engine was in charge of Mr. E. C. Sornberger, representing the Snow Steam Pump Works, and the Indianapolis Water Co. was represented by Mr. John Rail. Some of Prof. Goss's comments on the test given in his report to Mr. F. A. W. Davis, vice-president of the Water Co., are as follows:

> Viewed as a piece of experimental work, the test was a most satisfactory one. The methods followed were carefully chosen, the apparatus employed was known to have been in excellent order, the desired conditions of running were well maintained, observers were employed in such number as to allow the work of each one to be easily performed in the time assigned, all observers were skilled engineers, and they were especially drilled by a trial run. It would appear, therefore, that the results as presented, possess a degree of accuracy which is fully equal to that usually attained in the course of such work.
>
> The duty disclosed by the data exceeds by a liberal margin that obtained in any test, the results of which have thus far been published. It justifies the conclusion that no engine exists which can equal the performance of the engine tested. The famous Milwaukee engine, known to engineers the world over, gave a duty of 127.1 million which is to be compared with the 150.1 million delivered by the Indianapolis engine.
>
> The plan of the tests was not sufficiently extensive to permit a complete analysis of all the conditions affecting the work of the engine, but it would appear that the high performance is due to good work by every part of the machine. Not only is the cylinder economy exceptionally fine but the frictional losses are extremely low.
>
> Leakage.—Very careful tests were made by the undersigned, and later by Mr. Rail, to determine the amount of water leaking past valves and plungers. It was found that leakages from all sources combined amounted to but a few thousandths of one per cent. of the water pumped, justifying the conclusion that for all purposes, either practical or theoretical, the pump is tight. The significance of this statement will be better appreciated when it is considered that the pump contains 540 suction-valves and 540 delivery valves, or a total of more than a thousand valves. A defect in a single one of these would have been disclosed by the tests which were made.
>
> Capacity.—During the eight-hour test, the lowest rate of speed for any five-minute interval was 17.6 revolutions per minute, the highest was 23.4 revolutions per minute, and the average speed for the whole eight hours was 21.46 revolutions per minute. This speed gives the pump a capacity of 20.6 million gallons per 24 hours.
>
> Friction.—The difference between the work done by the steam on the pistons and that delivered by the plungers is the work absorbed by the engine in the form of friction. The data show that but 4.6% of the indicated power was lost in this way. This is unprecedentedly small. It is altogether probable that a more elaborate test, in which special attention is given to the indicator work, may change this figure, since the relation is such that a change of 1% in the indicated power would produce a change of 20% in the value of engine friction. For the present, however, the figure given represents the best information that is to be had, and there is nothing in the data to discredit it.
>
> Steam Consumption per Horse-Power per Hour.—The performance of steam engines is often expressed in terms of the weight of dry steam required per horse-power per hour. A determination upon this basis for the engine tested gives a consumption of 11.26 lbs. This, so far as the undersigned knows, is less than is required by any engine the results of which have ever been reported. It is evident, therefore, that the engine excels both in the domain of hydraulic engineering and in that of steam engineering as well. [11.2 lbs. has been reported for the Chestnut Hill engine.—Ed. Eng. News.]
>
> Conclusion.—The preceding paragraphs prove the engine tested to be a very unusual one, and that a definite determination of its performance will demand unusual skill and care. The test herein described was undertaken upon

the supposition that the engine could be tested by methods usually employed in such work, and that its performance would fall within the range of ordinary results. It has been advanced by careful, painstaking and conservative methods, and it is believed that the facts disclosed may be accepted with as much confidence as those ordinarily resulting from such work. It appears, however, that these facts tell a story so unusual as to give rise to a question concerning their accuracy. It goes without saying that processes which would stand unquestioned when they lead to commonplace results are carefully scrutinized when they point to an exceptional result.

The undersigned is not disposed to question unduly or to discredit in the least degree the material facts which are herein presented, but, for reasons stated, he would earnestly recommend that they be looked upon as tentative until they can be verified by a test conducted on a broader plan. What is needed is an array of data so elaborate that the action of every part of the machine may be completely analyzed, so that the facts as stated can be reinforced by evidences of such a character that it cannot be questioned. I hope, therefore, that your company may see its way clear to undertake at an early date an investigation which will comport with the high efficiency which will be disclosed by it.

The results obtained in the test are condensed as follows from Prof. Goss's report:

Cylinder diams., ins.; h. p., 29; int., 52; l. p.	80.
Pump plunger diameter, ins.	33.
Stroke of all pistons and plungers, ins.	60.
Duration of test, hours	8.
Revs. per min.	21.46
Steam pressure at engine, gage, lbs.	155.6
Barometric pressure. lbs.	14.3
Temperature of water pumped, deg. F.	56.5
Temp. of discharge from condenser, deg. F.	79.5
Temperature of discharge from hot well, assumed as temperature of feed, deg. F.	111.7
Observed weight of water that passed weighing barrels, lbs.	68,648.
Weight of water discharged from hot well, assuming that 3% was vaporized, before reaching weighing barrels	70,771.
Weight of water that leaked through condenser during test. To be subtracted, lbs.	60.
Moist steam used by engine, lbs.	70,711.
Moisture in steam, %	1.2
Dry steam used by engine, lbs.	69,862.
Water pressure against which pumps delivered, lbs.	80.
Total pressure against which pumps were operated, suction lift included, lbs.	88.7
Total HP. delivered by pumps	740.
Water shown by leakage test to have leaked by plungers and valves during test, lbs.	31.4
Horse-Power, by Indicator:	
h. p. cyl., head-end	143.5
h. p. cyl., crank-end	132.1
int. p. cyl., head-end	125.5
int. p. cyl., crank-end	121.2
l. p. cyl., head-end	129.9
l. p. cyl., crank-end	125.3
Total	775.5
Dry steam per I. HP. per hour, lbs.	11.26
Total heat in 1 lb. steam, at a gage pressure of 155.6 lbs. and containing 1.2 % of water, B. T. U.	1,184.1
Heat in 1 lb. water at temperature of hot well, 111.7° F., B. T. U.	79.7
Heat taken from each lb. of steam, B. T. U.	1,104.4
Heat consumed by engine, B. T. U.	78,093,000.
Results:	
Duty per 1,000 lbs. of dry steam used, as defined by contract, ft. lbs.	167,800,000.
Duty per million B. T. U., ft. lbs.	150,100,000.
Capacity per 24 hours, gallons	20,600,000.

Notes Concerning Methods Used in Test.

Duration of Test.—As the test did not involve measurements at the boiler, 8 hours were considerd a sufficiently long period to give results possessing a high degree of accuracy.

Temperature of discharge from condenser is the average of readings, taken at 10-minute intervals, from a thermometer placed in the pipe between condenser and air pump.

Temperature of discharge from hot well is the average of readings, taken at 10-minute intervals, from a thermometer placed in the hot well. The increase in temperature of the hot well over that of the condenser is due to the discharge of hotter water from the jackets into the hot well.

Water from the hot well is, under normal conditions, led to a feed pump attached to the plunger of the low pressure engine, which forces it back to the boiler. For purposes of the test the feed pump was disconnected and its supply pipe blanked so that no water could pass it. It was assumed, however, in calculations incident to the test, that the temperature of the water delivered from the hot well was the temperature of the feed.

It has previously been noted that all water leaving the hot well is assumed to represent steam used by the engine. It came from three general sources, namely: From within the cylinders, from the jacket of the cylinders and the coils of the intermediate receivers, and from the drainage pockets between the cylinders. No effort was made to separate the steam from these several sources. There were no drains or pipes leading steam or water away from the engine which were not connected with the hot well.

The hot well is, however, provided with an overflow and a suction pipe leading to the boiler feed pump, but, as already noted, these were blanked in anticipation of the test. A small vent pipe leading from the top of the hot well was not blanked, but it was observed during the test that nothing escaped from its outer end.

Again, there was a small cold water pipe, the exhaust of a cellar pump and the exhaust of an air pump connected with the hot well; but, for purposes of the test, joints were broken except in the case of that of the air pump, which machine was not used during the test.

It is thought that these precautions were sufficient to ensure the delivery of all steam, chargeable to the engine, to the weighing barrels placed beneath the hot well.

Finally, the scales upon which the weighings were made were calibrated with 50-lb. standard weights and found to balance perfectly. There seems, in fact, to have been no possible chance for error in the observed weight of steam used by the engine, unless there was vaporization of water as it passed from the hot well to the weighing barrels, or a leak through the condenser. The extent of errors arising from these sources is next considered.

Weight of Water Discharged from Hot Well, Assuming that 3% was Vaporized Before Reaching the Weighing Barrels.—Any loss of water between the hot well and weighing barrels would apparently improve the performance of the engine. That there was some loss by vaporization cannot be doubted, since a slight amount of steam was always to be observed about the barrels. As, however, the temperature of the water delivered was but 111° F., it was thought at the time of the test that the effect of such losses would be entirely negligible. A review of the data, however, indicates the probability of a measureable loss from this cause, and it has been decided to fix its value at 3%. It could not have been greater than this, and if less it will be safe to reserve the establishing of this fact for a later test. This conclusion has the effect of raising the observed weight of steam used by the engine (68,648 lbs.) to 70,771 lbs.

Weight of Water Leaking Through Condenser.—Any leakage of cooling water into the steam of the condenser would apparently impair the performance of the engine.

The water space of the condenser constitutes in effect a portion of the main suction pipe of the engine. Under the conditions of the test there is a difference of pressure tending to produce leakage of about 10 lbs. As a preliminary to the main test, a man-hole in the lower part on the steam side of the condenser was opened; a valve in the main suction outside of the condenser was closed; and a primer delivering water from the force main to the suction was opened by such an amount as would maintain a water pressure on the condenser of 10 lbs., thus producing for the purposes of a leakage determination the same difference of pressure which exists where the engine is under normal working conditions. The amount of leakage thus determined amounted to but 7.5 lbs. per hour, an amount which, while insignificant, has nevertheless been carried forward in the calculations as a correction, its value for the 8-hour test being 60 lbs. The results prove the condenser to be exceptionally tight.

Percentage of moisture in steam was determined by a calorimeter applied to the main steam pipe close to the throttle of the engine.

Leakage by Plunger and Valves.—The sum of the various leakage amount to but 31.4 cu. ft. for the whole test, or about 0.003% of the total volume pumped. It is evident that so small a leakage is entirely negligible, and it is so recorded under the head of results.

Results.—Duty as defined by contract is the number of foot pounds of work done "per 100 lbs. of coal, assuming an evaporation of 10 lbs. of water per pound of coal." This statement is indefinite, but for the purpose of this report is is assumed to be equivalent to the foot pounds of work done by the pumps per 1,000 lbs. of dry steam under the conditions of pressure prevailing during the test. That is, the duty as defined by the contract is assumed to be the area of plunger in square inches multiplied by total pressure against which engine was used multiplied by length of stroke in feet multiplied by total number of single strokes multiplied by 1,000, divided by pounds of dry steam used.

Duty on basis of a million B. T. U., as defined by the American Society of Mechanical Engineers in their Transactions (Vol. XII., p. 534), is area of plunger in square inches multiplied by total pressure against which pumps were used multiplied by length of stroke in feet multiplied by total number of single strokes multiplied by 1,000,000, divided by heat consumed by the engine.

◆

A MINE EXPLOSION at Brownsville, Pa., on Sept. 23, entombed 70 men and killed 8. The accident is said to have resulted from a gas pocket which was opened by the loosening of a large block of coal and took fire from the open lamps. This was followed by a fire damp explosion. No general cave-in occurred and it is expected that the casualties will be limited to the number given.

◆

A DUST EXPLOSION, followed by a fire, totally destroyed the Union Elevator, at Toledo, O., on Sept. 20. The explosion had not sufficient force to tear asunder the bins and shafts, constructed of heavy planking well bolted together, but it blew off the whole roof and blew out every window. According to the Toledo "Blade," of Sept. 21, the chief of the fire department had only a few days before called the attention of the superintendent of the elevator to the fact that the building was full of dust and was therefore in danger of a dust explosion, and was told that fans were then being put in to remove the dusty air, but the work was not finished when the explosion took place.

◆

A SERIOUS DERAILMENT from a most unusual cause occurred at Wellingborough Station, on the Midland Ry. of England, Sept. 2, and resulted in the death of six persons and the injury of many others. The train was a through express, which runs past the station at 60 miles per hour. Just as it was due a light baggage truck on the platform rolled off onto the track, and the station attendants were unable to remove it before the train struck it. The moral of this accident, to American engineers, is that station platforms should never be made with a grade, save a very light inclination to shed water. The lesson to English engineers (but one which they will doubtless be blind to) is the value of the locomotive headlight and pilot as safety devices. Had the English locomotive been equipped with a headlight, the engineer would probably have seen the obstruction on the track in time to at least partially check his speed. A pilot on the locomotive would in nine cases out of ten have thrown the obstruction clear of the track.

◆

THE CHANGE FROM STEAM TO ELECTRICITY on the Manhattan Elevated R. R. is likely to be made at an early date, according to public statements by President George Gould. It is also reported that two Chicago railways—the Illinois Central and the Chicago & Eastern Illinois—will adopt electricity for their suburban traffic. The same report has so often been circulated before that undue importance will hardly be attached to it now. It is probably true, however, that both these companies are continuing the careful investigations which they have long had in progress respecting the merits of electric traction. On the Brooklyn Elevated R. R., the matter of substituting electricity for steam is to be submitted to the Board of Directors at their next meeting.

◆

THE READING RAILWAY SUBWAY, in Philadelphia, has been lately officially inspected by the Director of the Department of Public Works and other officials. This work was authorized in 1894, and construction was commenced, on Sept. 10 of that year, in the preliminary change in sewer location made necessary by the subway; which was completed in 1895, at a cost of $427,888. Work was commenced on the subway proper in August, 1895. The total work contemplated includes an elevated structure 959 ft. long; 4,180 ft. of open subway; a tunnel of 2,711 ft., and an open subway of 2,150 ft.; the total length of the work covering nearly two miles. At the present time most of the street bridges are open to traffic; the western half of the new freight houses, in the depressed yard at Broad St., and the track to operate them, are finished; work on the tunnel is rapidly progressing from the west end; in the open subway west of the tunnel the north retaining wall is finished and much of the excavation is done. The most difficult work called for was the underpinning of a number of great factory buildings alongside the subway; these included part of the Baldwin Locomotive Works, Wm. Sellars & Co., the Twentieth St. Grain Elevator, and other large establishments.

◆

THE AMOUNT OF UNDERGROUND ELECTRIC CONduit in Washington, D. C., is, according to Mr. Walter C. Allen, Chief Electrical Engineer, D. C., 459,393 ft. of conduit, with 2,745,050 ft. of ducts used in carrying light, power and telegraph wires, distributed as follows:

	Conduit, ft.	Ducts, ft.
U. S. Electric Lighting Co.	229,194	825,755
Potomac Elec. Power Co.	56,120	598,144
Postal Telegraph Co.	14,663	18,944
Chesapeake & Potomac Telephone Co.	79,781	698,216
Metropolitan Railroad Co.	31,417	204,140
Capital Traction Co.	48,218	399,851
	459,393	2,745,050

◆

A NEW INCANDESCENT FILAMENT for electric lights has been announced by Dr. Auer von Welsbach, the inventor of the incandescent gas light. He uses a filament of osmium, a rare metal, coated with a refractory oxide, like thoria. Osmium is found as an alloy of certain ores of platinum and iridium; it is a bluish-gray metal; 191.1 in atomic weight, and has the enormous specific gravity of 22.477, making it the heaviest substance known. It is practically infusible and resists temperatures in which platinum and iridium volatilize. It is well known that the intensity of light emitted by incandescent substances increases rapidly with their absolute temperature; hence, when osmium is heated in a vacuum by an electric current, strong enough to volatilize platinum, it emits a white light of agreeable color, but of great intensity. By coating the naked filament of osmium with the highly refractory oxide, it stands a greater temperature still. Economy in the production of electric light is the end sought by the use of this new metal; but osmium now costs $1.10 for 20 grains, hence the new light is likely to be only a scientific curiosity.

◆

STREET RAILWAY STATISTICS of an interesting nature are given in the last issue of the American Street Railway Directory. From these it appears that there is a total of 1,074 street railways in the United States, made up of 909 electric, 21 cable, 31 steam and 113 horse lines. These have a total capital stock of $975,625,827, and are bonded for $527,970,220. The total track mileage amounts to 16,466.78, of which 14,673.71 is electric, 485.68 cable, 618.54 steam, and 688.85 horse. In their operation are required 48,209 cars, 32,696 of which are motor cars, 7,824 trailers, 2,920 cable, 1,887 steam, and 2,882 horse. In addition, there are 610 steam locomotives and 3,504 horses. The four leading street railway states are as follows:

	No. roads.				Cars.		Track miles.	
	Total.	Electric.	Stock.	Bonds.	Total.	Electric.	Electric.	Total.
Pennsylvania	170	165	$234,960,000	$107,360,820	5,488	5,078	1,806	1,824
New York	120	88	198,857,600	105,901,100	10,291	5,537	1,600	2,102
Massachusetts	86	84	31,350,200	15,703,600	5,323	5,024	1,450	1,461
Illinois	55	51	119,053,000	64,210,900	4,401	2,107	1,024	1,138

ACETYLENE GAS FOR STREET LIGHTING is to be tried in Wabash, Ind. This is said to be the first attempt to use acetylene for this purpose.

◆

THE DISCOVERY OF CHEMICAL ELEMENTS hitherto unknown has made great progress during the present year. No less than six have been reported, to which names have been given, as follows: Krypton, neon, metargon, coronium, polonium and etherion. The evidence that these new elements have been discovered is rather meager, as yet, and the existence of some of them may be open to doubt. The three elements first named were discovered by Prof. William Ramsay, of London, who, in 1895, in conjunction with Lord Rayleigh, had discovered argon. The three substances were all found with argon, after it had been isolated from liquid air. Taking the density of oxygen as 8, that of krypton is estimated at 40, that of neon at 10 or 11, and that of metargon, the same as argon, 20 or 22. The spectra of all these elements differ. Polonium is the name of an element not yet isolated, but which M. and Mme. Curie report to the French Academy of Sciences they have discovered in the form of a sulphide in pitchblende. The new element is said to resemble bismuth, chemically, and its radiating power is placed at 400 times that of uranium. M. Becquerel reported two years ago that salts of uranium threw off an invisible radiance much like that of the Rontgen rays, and a variety of pitchblende has been found by M. and Mme. Curie to possess that property to a much greater degree. Coronium is an element shown only; thus far, by the spectroscope, and only in the solar atmosphere. It has been found 300,000 miles from the sun's surface, and is believed to be much lighter than hydrogen. Etherion is the name given by Mr. Charles F. Brush, the well-known electrician, to an element which he thinks he has discovered in the atmosphere. He reported it at the recent meeting of the American Association for the Advancement of Science, in Boston. It is far lighter than hydrogen, and its heat conductivity is a hundred times as great as that of hydrogen. He estimates that its molecules vibrate with a velocity of a hundred miles a second, and thinks that it is not confined to the earth's atmosphere, but extends indefinitely out into space.

◆

BISMUTH IN BRASS, even in minute percentages, is a cause of fire-cracks, according to a paper by Mr. Erwin S. Sperry, of Bridgeport, Conn., which will be presented at the meeting of the American Institute of Mining Engineers, at Buffalo, next month. As the result of a series of experiments on brasses containing various percentages of bismuth, Mr. Sperry reached the following conclusions:

> 1. Bismuth renders brass cold-short, and is similar in this respect to antimony, although the effect is not as marked.
> 2. Bismuth is a cause of fire-cracks in brass.
> 3. High brass intended for cold-rolling should not contain over 0.01% of bismuth.
> 4. Bismuth produces hot-shortness in brass.
> 5. Bismuth is a cause of latent fire-cracks in brass.
>
> In the use of the term latent in connection with fire-cracks it is the author's belief that while annealing is the cause of their existence, they do not exist as cracks in the metal after annealing, but as lines of inferior cohesion in an apparently homogeneous mass; rolling, however, develops them, and to all appearances they then partake of every characteristic of true fire-cracks. It seems advisable, therefore, to apply such a distinguishing term, especially as latent fire-cracks are liable to be mistaken for rolling-cracks.

◆

DRYING THE MOISTURE OUT OF IRON ORE at the mines is a new project which is reported to be under consideration by the Carnegie Steel Co. and the Oliver Mining Co., of Pittsburg. An article in the "Pittsburg Times" states that experiments have been made by Dr. N. P. Hulst, manager of the Oliver Mining Co., on drying the ores of the Mesaba range, which contain from 7.5 to nearly 14% moisture. It has been found that on an average 10% of water could be dried out. It is estimated that the saving in freight on the moisture in 3,000,000 tons of ore would amount to $700,000 per year. It is said that the ore will not reabsorb the moisture after it has been driven off. No plans have yet been prepared for carrying out the experiment on a large scale, and the difficulties of doing the work on a commercial scale, without too great cost for fuel and labor, are no doubt formidable.

◆

TIN PLATE STATISTICS, compiled by the Bureau of Statistics, give some interesting figures relating to the production in the United States. Previous to 1891 tin plate was not produced to any considerable extent in the United States. On Oct. 1, 1890, a duty of 2.2 cts. per pound was imposed on tin plate, and the manufacture was commenced here. In the year ending June 30, 1892, 13,646,719 lbs. were produced; in the next year this rose to 99,816,202 lbs.; in 1894 it was 139,223,457 lbs.; in 1897 it was 446,982,063 lbs., and the estimate for 1898 is 640,000,000 lbs. The imports of tin into the United States in this period have fallen from 1,036,489,074 lbs. in 1891, which was much above the average, owing to anticipation of duty, to 171,662,345 in 1898. The former owners of one of the largest tin plate establishments in the world have sold their works at Swansea, Wales, and propose to establish a factory near Pittsburg, Pa. The value of the tin plate imported into the United States in 1889 was $21,222,653; while the value of the import of 1898 was only $3,309,148. The average price per pound has fallen from 2.9 cts. in 1889, and 3.5 cts. in 1891, to 2.2 cts. per lb. in 1898. The U. S. law permits a rebate of 99% on the duty paid on imported tin plate where the article manufactured from it is to be exported. This applies to coal oil cans for foreign trade, canned meats for export, etc.; and deducting the foreign tin plate re-exported in this way, the Bureau finds that only about 33,764,775 lbs. of foreign tin plate went into domestic consumption in the United States in 1898.

◆

THE EXPORT OF U. S. MANUFACTURED GOODS increases rapidly, and the Bureau of Statistics says that the exports of this class in July last amounted to $25,983,115 and formed 36.47% of the total exports. No previous July has shown such a record, and in no month have manufactures shown so large a percentage of the total exports. As compared with July, 1888, the exports have doubled and the percentage nearly so. The steady gain in percentage of total exports, for manufactured goods, is shown as follows: July, 1890, 24.82%; same month, 1894, 28.16%; 1895, 31.38%; 1896, 32.80%; 1897, 33.78%, and in July, 1898, 36.47%. This gain extends to nearly all the important industrial interests in the country, and must be read in connection with the general enormous increase in total exports. The exports of agricultural implements, in July, 1898, were about 50% above the previous July; the gain for the same month in cars and carriages was over 33%; there was also a marked gain in cotton goods and copper products. The exports of iron and steel, for July, 1898, were $7,012,977, as compared with $4,918,107 in July, 1897.

◆

A BOTANICAL EXPLORATION OF PORTO RICO will be undertaken by Dr. N. Z. Britton, Chief Director of the New York Botanical Garden, and Mr. Cornelius Vanderbilt will bear the cost of the expedition, which is to study and bring back specimens of the flora of the island. Dr. Britton will probably start in November next, at the close of the rainy season. There is very little known of the flora of this island, and the results will much enrich the general knowledge of the natural resources of Porto Rico.

◆

ROAD-BUILDING IN PORTO RICO, says Gen. Roy Stone, is easy and inexpensive; but the whole future of the island depends on the development of internal means of communication. Gen. Stone in six days converted into a road fit for army wagons a goat-path hugging the steep hills lying between Adjuntas and Utuado, ten miles apart. In this section there is an abundance of rotten granite which yields readily to the pick and shovel and forms an excellent road material. There is no frost to interfere with road construction, and Gen. Stone estimates that roads could be built almost anywhere in the island for from $750 to $1,000 per mile with native labor, which is satisfied with 20 cts. per day in American money. A marginal railway, about 300 miles long, will probably soon skirt the island, as 150 miles of this is now in operation between certain coast towns. The military engineering staff in Porto Rico is now investigating harbors, possible railway routes and centers, and are locating roads, and building some of the latter. Two mountain ranges extend through the entire length of the island and interior railways may be difficult and expensive to build; but owing to the density of the population electric roads could be profitably built to connect the interior and the coast towns.

◆

THE VOLUNTEER SIGNAL CORPS, under charge of Gen. Greely, has done good work in Cuba and Porto Rico, according to that officer's report. It destroyed submarine cables under fire from the enemy, and repaired cables useful to our forces; and it arranged and maintained a system of cable and land lines that enabled messages to be sent in 20 minutes from army lines near Santiago to Washington. In Porto Rico it was always in the advance, and kept each important command in telegraphic or telephonic communication with corps headquarters and the base of operations; the same was true in the army operations before Manila, and this corps connected by cables the principal forts in our great harbors and initiated and installed an entirely new electrical fire control system at these forts.

◆

NEW ATLANTIC STEAMSHIP ROUTES, to avoid the dangers of the Grand Banks off Newfoundland, are proposed by Capt. W. H. Smith, the Canadian Wreck Commissioner. The present routes are subject to fog in this region from May to August, inclusive, just when travel is heaviest. Capt. Smith suggests that steamers leaving this coast in the summer months shall sail due East on the parallel of 40° North, until they reach longitude 47° West, and thence sail on a great circle track to the point of destination. This route is safe from fog, but longer than the present routes nearer to the pole. Short passages save coal, and good time records advertise the company; consequently, nothing but a general agreement among steamship companies to use the new route, or the passage of laws punishing captains who meet with an accident by reason of being outside of prescribed routes, can turn the line of travel further south.

◆

A MEMORIAL TO GEN. RUFUS PUTNAM, one of the principal engineers of the Revolutionary Army, has been placed upon the old Putnam house at Rutland, Mass., by the Massachusetts Society of the Sons of the Revolution. Gen. Putnam, who must not be confused with Gen. Israel Putnam, was the engineer who planned the works which compelled the British to evacuate Boston and the fortifications at West Point. He also organized and assisted in carrying out the scheme of the Ohio Company, which, in 1788, commenced the settlement of the Northwest Territory. U. S. Senator George F. Hoar, in his dedication address, remarked that Washington classed Putnam as "the best engineer in the army, whether French or American." A bronze tablet, setting forth the services of Gen. Putnam, was placed upon the old house where he lived from 1781 to 1788, and in which he planned and matured the scheme that prevented slave holding in the great West and opened up that country to settlement. Gen. Putnam was born in Sutton, Mass., in 1738, and was a millwright by trade; he served in the French and Indian War in 1757-60, and later obtained a good knowledge of mathematics and surveying, and, in 1773, he was Deputy Surveyor of the Province of Florida. At the beginning of the Revolution he was a lieutenant-colonel of a regiment, and later commanded a regiment in Gen. Wayne's brigade. At the close of the Revolution he was made a brevet Brigadier General. He formed the Ohio Company and founded the town of Marietta. He died at Marietta in 1824.

BOOK REVIEWS.

MANUAL OF TOPOGRAPHIC METHODS.—Published by the U. S. Geological Survey. Sheep and paper; pp. 300; 18 plates. Sheep, $2.15; paper, 65 cts.

This excellent manual upon the government methods of making topographical surveys is again listed among the publications for sale by the Superintendent of Documents, at Washington, D. C. Remittance should be made by postal money-order payable, in this case, to the Director of the U. S. Geological Survey.

LIGHTING BY ACETYLENE. — Generators, Burners and Electric Furnaces. By William E. Gibbs, M. E. New York: D. Van Nostrand Co. 12mo.; cloth; pp. 141; 66 illustrations. $1.50.

The literature of acetylene has grown to vast proportions in the form of patent specifications, articles in the newspapers, etc., but the book before us is, as far as we know, the first book in the English language upon the subject. The author's reason for writing it appears in the following extract from the introduction:

> A recent serious explosion of liquid acetylene prompts the writing of what follows, since it would seem that ignorance or neglect of the admonitions of earlier experimenters was to blame for an accident which cannot but prejudice many against the use of a valuable and safe illuminant.

The book is an ably written, brief and plain treatise on acetylene, its history and its dangers, and on electric furnaces for the generation of carbide of calcium acetylene gas generators and lamps. In regard to the explosiveness of acetylene the author bolds that at atmospheric pressure it is no more dangerous than any other illuminating gas. While it is under certain conditions an unstable body, tending to resolve itself into its component elements, carbon and hydrogen, yet this dissociation can be effected at atmospheric pressure only by the detonation in the body of the gas of a small quantity of fulminate of mercury or other violent explosive "and by no other means." The author here seems to neglect the rule of logic that a negative cannot be proven, but he comes as near to attempting a proof as is possible in his next sentence:

> Heat, flame, the electric spark, or the electric arc itself will not, according to the most careful experiments, produce an explosion under these conditions.

Of course a mixture of air with acetylene is highly explosive, as is a mixture of air with any other hydrocarbon gas. The pure gas itself if condensed to a high pressure is also explosive, and the author says that it becomes more unstable with each increment of pressure,

> and in consequence more easily exploded, until the point of liquification is reached, when it becomes as dangerous as the high explosives. The disastrous results which have invariably followed the attempts to liquify acetylene on a commercial scale should be sufficient warning against this procedure. The onlv place where there is any excuse for compressing acetylene is in the chemical laboratory, where its properties are being studied by those dealing in unstable compounds, and where explosions are expected and provided for as a matter of course.

Another danger consequent upon the use of acetylene is the formation of the explosive salt, acetylide of copper. The use of copper and copper alloys should therefore be avoided in acetylene generators or holders.

The book contains the rules of the New York Board of Fire Underwriters for the installation of acetylene gas generators and for the storage of calcium carbide, and a list of United States patents on calcium carbide and acetylene apparatus, including carbide and electric furnaces. It describes a great variety of generators for making the gas from carbide of calcium, and of lamps and burners. We commend the book to all who desire to inform themselves on actylene, its generation and use.

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THE U. S. BATTLESHIP "ILLINOIS," launched this week at Newport News, has the following dimensions: Length on load water line, 368 ft.; extreme beam, 72 ft. 2½ ins.; normal displacement draft, 23½ ft.; maximum displacement, with all ammunition and stores on board, 10,000 tons; estimated speed, 16½ knots; normal coal supply, 800 tons; loose storage, 1,200 tons; full bunker capacity, 1,500 tons; complement, 40 officers, 449 men. The main battery will include four 13-in. guns in Hichborn balanced turrets on center line, and 14 6-in. rapid-fire guns. The secondary battery will include 16 6-pdr. and four 1-pdr. rapid-fire guns, two Colt and two field guns. The armor-belt is 16½ ins. thick at the top, 9½ ins. at bottom, tapering to 4 ins. at the stem; it extends from 4 ft. below the normal water line to 3½ ft. above this line. Diagonal 12-in. armor connects the belt armor and the barbettes, and abaft the after turret the protective deck is 4 ins. thick on slopes and 2¾ ins. thick on the flat; this deck forward is 3 ins. and 2¾ ins. thick. The armor on the 13-in. gun turrets is 17 ins. thick on the front and 15 ins. on the rear and sides; on the barbettes the thickness is 15 and 10 ins. Above the armor-belt the sides of the ship, and diagonals connecting these sides, will be 5½ ins. thick. Coffer-dams, generally 3 ft. thick and extending the length of the ship, contain about 12,500 cu. ft. of corn-pith cellulose, as a protection against the entrance of water. Independent of the cellulose pockets, there are nearly 300 water-tight compartments, for containing the motive power, coal, stores, ammunition, etc. Any of these may be flooded or pumped out. There will be about 80 auxiliary engines in the vessel; and there will be two sets of triple-expansion, twin-screw engines, with a total of 10,000 I. HP. at 120 revolutions per minute. There are eight single-ended cylindrical boilers, each 15½ ft. diameter by 9 ft. 11½ ins. long; with a total grate surface of 685 sq. ft. and 21,200 sq. ft. of heating surface; the working pressure is 180 lbs. per sq. in. The characteristic of this ship is her high freeboard—20 ft. forward and 13¼ ft. at the stern. The axis of the 13-in. forward gun will be 26½ ft., and the after 13-in., 19 ft. above the water surface. The 6-in. guns will be from 15 to 22½ ft. above the water. The first keel plate of the "Illinois" was laid Feb. 10, 1897, and from 53 to 54% of the work is now done. The contract price was $2,595,000, and she is to be completed by Oct. 5, 1899.

◆

BIDS FOR THE FOUR HARBOR-DEFENCE MONItors were opened on Oct. 1, under the limit price of $1,250,000 each. The bids were as follows: Lewis Nixon, $825,000, to be finished in 24 months; Newport News Co., $860,000, in 27 months; Bath Iron Works, $862,000, in 27 months; Union Iron Works, $874,000, in 27 months; Maryland Steel Co., $876,000, in 26 months; Wolff & Zwicker, $937,500, in 27 months; The W. B. Fletcher Co., $927,000, in 21 months; Columbian Iron Works, $1,015,000, in 27 months; and John Dialogue, $1,171,000, in 26 months. The four bidders first named are likely to get one monitor each.

◆

SHIPBUILDING IN THE UNITED STATES, for the year ending June 30, 1898, is reported upon by the Navigation Bureau. There were built and documented in that year 952 merchant vessels of 180,458 gross tonnage, compared with 891 vessels of 232,233 tons in the preceding year. The decrease is almost wholly in the Great Lakes; the construction on the Pacific Coast amounted to 49,789 tons, as compared with 7,495 tons in the preceding year. This Pacific increase was chiefly in ships built for the Alaskan-Pacific and Alaskan river trade. On the Atlantic and Gulf Coast the returns show 514 vessels of 63,090 gross tons for the last fiscal year; on Western rivers, 123 boats of 13,495 tons were built. In the last year the returns show 359 sailing vessels of 180,458 gross tons; 343 wooden steamers of 57,337 tons; 51 iron and steel steamers of 48,501 tons; 20 canal boats of 2,386 tons; and 169 wooden barges and 10 steel barges of 37,818 tons in all.

◆

THE ATLANTIC TRANSPORTATION CO. OF NEW York has chartered some 35 vessels from the Lake fleets, having a total carrying capacity of over 50,000 tons of cargo. In addition, this company will build 12 or 15 new barges, with a combined cargo capacity of 36,000 to 45,000 tons. The total fleet of the company will eventually comprise about 70 craft of all kinds, with room for over 100,000 tons of cargo. Mr. Walter S. Bosse, of New York, is the General Manager of the Atlantic Transportation Co. It is a New Jersey corporation, with $3,000,000 capital, and has its headquarters at No. 1 Broadway, New York city. The lake vessels chartered will come down the St. Lawrence; and existing contracts call for the movement of more than 4,000,000 tons of coal annually from Newport News to New York, Boston and New England.

◆

A SELF-PROPELLING PUMP DREDGER, designed by Mr. Lindon W. Bates, is being built in Belgium for the use of the Russian government on the Volga River, says the "N. Y. Commercial." This dredger is double-hulled, each hull being the largest that will pass through the canal system uniting the Baltic Sea with the Volga. They can be operated together, making a single cut 62 ft. wide, or singly with a 31-ft. cut. The draft in working trim will be 4½ ft. and the hulls are built of steel. Each half is 216 ft. long by 31½ ft. and 9 ft. deep. They will be propelled and operated by electricity, each half-hull having its own generating plant, with four motors of 125-HP. each. There will be a stern-wheel tender connected with the dredging plant for use in towing, surveying, setting anchors, etc. No test has been made of this dredger as yet, but Mr. Bates expects an output of 7,000 cu. meters per hour under the conditions prescribed by the Russian government.

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THE DISMAL SWAMP CANAL may be completed by Jan. 1, next, in the widening and deepening work now going on, says the Baltimore "Sun."

◆

THE PROTECTION OF SANDY HOOK against wave encroachment is to be undertaken by building sand-catching dikes and planting soil-binding grass to preserve the beach made. The Sea Lyme and Marram grasses are best for this purpose, according to the long investigations of Prof. F. Lamson-Scribner, the agrostologist of the Agricultural Department. The Sea Lyme grass flourishes best along the Maine coast, but will grow as far south as Cape Hatteras, where it is replaced by the creeping bitter panic grass. The Marram grass does well from New Jersey to Florida. The Rolling Spinifex, of Australia and New Zealand, is being introduced in this country with a like purpose by the U. S. Agricultural Department. Japanese lawn grass is another variety which is being tried.

◆

A 2,000-C. P. SUBMARINE ARC LAMP for use in connection with raising sunken vessels, examining existing work or constructing bridge piers, coffer-dams and the like, has been undergoing a test at the Brooklyn Navy Yard, with apparently considerable success. The lamp is the invention of Messrs. Irving E. Burdick and Francis G. Hall, Jr., who were employed by the government in connection with torpedo and mine work in several of the Maine harbors. The idea of perfecting such a lamp occurred at that time. Later the Navy Department granted them permission to experiment. The result is the lamp before mentioned, which consists of an outer cylindrical casing ending in a straight glass globe, protected by a wire guard frame. Inside is the operating mechanism and what is termed an enclosed arc, a small opalescent globe surrounding the carbon ends, thus excluding the air. The lamp burns from 100 to 150 hours with one set of carbons. The wires carrying the current pass through a water-tight bushing in the top of the casing. A check valve is also provided to permit the escape of any gas which may form inside.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred, Sept. 28, on the Pictou branch of the Intercolonial Ry., near Stellarton, Nova Scotia, in which five persons were killed, and several were injured. The accident is attributed to a misunderstanding of orders, which caused a special excursion train and a work train carrying 60 miners to meet in a butting collision on a sharp curve.

◆

HEAVY WINDS raged along the Southern Coast on Oct. 2, doing a large amount of damage. The wind velocity is reported to have been from 50 to 75 miles per hour, and the conditions much the same as in the tidal storm of 1893. The abnormally high tide inundated large tracts of low land along the Georgia and Carolina coast. The loss of life is not at present known, but appears likely to reach a hundred or more.

FATAL FOREST FIRES are reported from the northern part of Wisconsin. The town of Cumberland and a number of towns in that vicinity are surrounded by fires and in danger of destruction. Reports from Denver, Colo., state that Colorado timber reserves are fast being depleted by forest fires which have destroyed many ranches and farms.

◆

TIMBER STANDING in the western part of Washington is, according to Mr. Henry Gannett, of the U. S. Geological Survey, 103.504,376,000 ft. B. M., made up as follows: Fir, 66,208,861,000 ft.; spruce, 6,403,405,000 ft.; cedar, 16,192,276,000 ft.; hemlock, 14,699,834,000 ft. The report states that about 45% of the timber district has been cleared, 23% having been cut and 22% burned. Only merchantable timber is considered, and the estimates are based upon present wasteful methods of logging.

◆

EXPERIMENTAL TREE PLANTING IN THE PLAINS is reported upon, in a pamphlet of 94 pages, by Mr. Charles A. Keffer, Assistant Chief of the Division of Forestry, in the Department of Agriculture. This experiment was commenced by the government in 1896, in Minnesota, South Dakota, Nebraska, Kansas, Colorado and Utah, and new stations are being established in Texas, Oklahoma and Montana. About 13 varieties of pines and 26 other and broad-leafed species are being tested at these stations. It is yet too early to arrive at and definite conclusions, and the present report of Mr. Keffer deals rather with the principles underlying such plantations and the best methods to be pursued.

◆

THE SMALL WATER CONSUMPTION of European cities is a standing wonder to those in charge of water supplies in American cities. The following is an official statement of the average daily consumption per capita in a number of the leading English cities, including also the average for the several water companies which supply London:

	Gallons per head.		Gallons per head.
Grand Junc. (London)	.55½	Liverpool	.31½
Chelsea (London)	.47	Croydon	.31
Southwark and Vauxhall (London)	.45	Manchester (aver. 27)	.30
		Halifax	.29
Brighton	.43	Swansea	.28
Plymouth	.43	Blackburn	.25
Hull	.43	Bristol	.23½
London (average)	.41	Bolton	.23½
Lambeth (London)	.40	Birmingham (average)	.23
West Middlesex (London)	.39	Huddersfield	.23
		Burnley	.23
New River (London)	.35½	Oldham	.22
Bradford	.35	Cardiff	.22
Leeds	.35	Sheffield	.21¾
East London (London)	.34½	Nottingham (aver. 17½)	19
Preston	.34	Birkenhead	.18
Kent (London)	.33½	Leicester	.18

◆

A PRIZE FOR THE BEST ESSAY on the economic arrangement and construction of subways, for carrying the sewers, water, gas, etc., in great cities, is offered by the "Cosmopolitan Magazine," of Irvington-on-Hudson, N. Y. The amount of the prize is $250.

◆

THE BUSK-IVANHOE TUNNEL on the Colorado Midland Ry. has been abandoned. The railway as originally built crosses the range at Hagerman's pass, 11,528 ft. above sea level. The tunnel was built by a separate company (The Busk Tunnel Co.) in 1892-3. The railway company made a contract to pay 25 cts. per ton of freight and 25 cts. per passenger for the use of the tunnel, and guaranteed the principal and interest of the 7% bonds which the tunnel company issued. All went well for the tunnel company until the railway company became bankrupt and the road was sold under foreclosure. Under the plan of reorganization the bondholders of the tunnel company were offered 4% bonds in exchange for their 7% bonds; but they refused to accept them. The sale under foreclosure, of course, wiped out the old railway company and rendered void its traffic contracts. The managers of the new company asked the owners of the Busk tunnel to accept lower tolls on traffic through the tunnel; and when they refused, the connections were torn up and the old line over the summit of the mountain was put in condition for operation, and trains were turned over it. Passengers greatly prefer the old line on account of the scenic attractions and because it avoids the smoke and gas of the two-mile long tunnel. In winter rotary snow plows will be used to keep the line open. Meanwhile the owners of the Busk tunnel have a tunnel for sale or to let and no customers in sight.

◆

FOREIGN PATENTS IN JAPAN, since 1897, are issued with the same rights as are accorded to Japanese. The Japanese Patent Regulations are avowedly modelled on those of the United States; but the following are not patentable: Articles of food, drink, or fashion; medicines, or methods of compounding them; and articles which have been in public use before the application for the patent. The latter exception is rigidly enforced by the Japanese examiners; and if a foreign patent has been issued one day before the Japanese application, and though there can thus be no public use, the application is rejected. For the year ending March 1, 1898, 104 foreign applications for patents were made in Japan; of these 10 had been finally rejected, and only one was granted. Of trademarks, 2,133 had been applied for in this year and 1,594 were registered.

THE PRESENT STATUS OF THE PANAMA CANAL.

By General Henry L. Abbot, Corps of Engineers, U. S. A.

After the failure of the old Panama Canal Company in February, 1889, the property passed into the hands of a receiver, who, seeking to save from ruin the vast number of subscribers of moderate means, referred the technical problems to a "Comite d'Etudes" selected from among the best engineers of France. In May, 1890, this commission made an able report, indicating the numerous points which demanded further investigation before final plans could be judiciously adopted, but suggesting the general features of such a plan, based on a study of all existing data. To make these further investigations a new company was organized in October, 1894; and since that date it has quietly prosecuted its labors and has now collected all the information needed to command the confidence of engineers in its definitive project. It is to set forth this project, and to indicate its superiority to anything possible in Nicaragua, that the present article is written. It may be proper to add that the writer, as a member of a technical commission of engineers, made last spring a careful examination of the entire route of the Panama Canal, and is thus possessed of definite personal information, in some degree assisted by having formerly traversed Nicaragua. The following are the essential features of this project, endorsed, with some possible future modifications in details, by a Comite Technique, containing French, English, German, Russian and American engineers. Among them the chief engineers of the Manchester and of the Kiel ship canals.

The original plan contemplated placing the canal in the bed of the Chagres, and conducting the river to the sea through artificial channels. This project was long ago definitely abandoned, being replaced by the familiar system of locks and dams which has been so often successfully applied to other rivers. Careful measurements and studies of the regimen of this torrential stream have shown the system to be entirely applicable to it, and that none of the constructions demanded will exceed the limits of recognized engineering practice. To these advantages it should be added that two good harbors already exist at the Atlantic and Pacific terminals; that an American railway is in active operation parallel and in close proximity to the line of the canal throughout its entire extent; that about 40% of the whole length has been actually excavated, and that great progress has been made on the intermediate portions; and finally, that extensive proparations have already been made for accommodating the army of laborers which will be required on any Isthmian canal. These reasons certainly demand that the comparative merits of this route should be considered before adopting any other location for the canal now generally believed to be essential to meet the needs of our Atlantic and Pacific coasts.

In Nicaragua the general conditions are distinctly inferior. Two ports must be artificially prepared; one at least of great practical difficulty, since nature has already closed the old harbor. About 120 miles of railroad must be built, mostly traversing a wilderness. Almost nothing has been done in the way of construction or of preparation for the work. Of the whole length of 176 miles, 68 miles follow the bed of a crooked river, where the prevailing trade winds and the currents resulting from the whole outflow of Lake Nicaragua will unite to aggravate the difficulties of shipping in transit. The length of the route is about four times that of the Panama canal, adding proportionately to the time of passage; finally, at least one dam is demanded, quite without precedent in our canal construction, besides several miles of huge embankments in the San Francisco basin, where the foundations are extremely bad, and where a rupture at any future time would entail veritable disasters.

But passing from generalities, the details of the Panama project will first be considered.

The Canal Proper.—The total length is 75 kilometres (46.5 miles), of which five (3.1 miles) lie in the Bay of Panama, between Isle Naos and La Boca. Of the 70 kilometres (43.4 miles) of inland construction, 24 kilometres (14.88 miles) on the Atlantic side (between Colon and Bohio) and 7 kilometres (4.34 miles) on the Pacific side (between La Boca and Miraflores) will be at the sea level, and of this distance about 25 kilometres (15.5 miles) are now essentially excavated, thus there remains only 38 kilometres (23.5 miles) to be traversed by the aid of locks; and here also so much actual work has been done that no visitor can pass over the line without appreciating that the canal can no longer be regarded as an experiment.

Of these 38 kilometres between Bohio and Miraflores, the first 22 (13.64 miles) extending from Bohio to Obispo will traverse a vast lake 5,500 hectares (13,585 acres) in extent, created in the valley of the Chagres by a dam at Bohio. Its level above the sea will range between a minimum of 16 metres (52.48 ft.) and a maximum of 20 metres (65.60 ft.), the normal level being 17 metres (55.76 ft.). A reservoir of 150 million cubic metres (52,950 million cu. ft.) is thus provided to control in part the floods of the river. Access to the lake will be furnished by two double locks at Bohio.

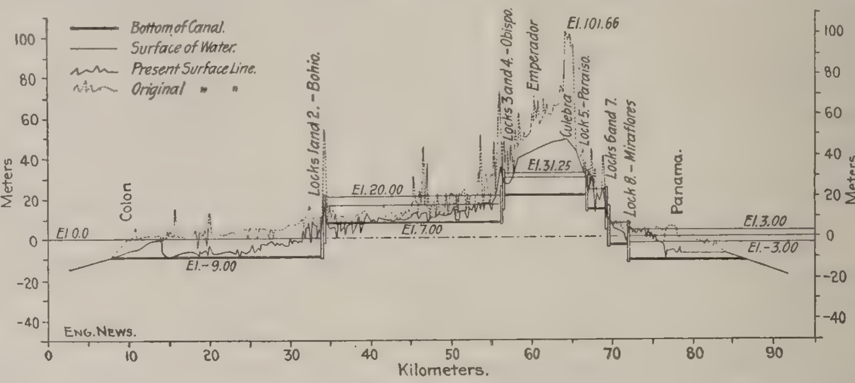


FIG. 1.—PROFILE OF THE PANAMA CANAL; BOTTOM OF SUMMIT LEVEL, AT ELEVATION 20.75 M., OR 68.06 FT. ABOVE DATUM.

LIFT OF LOCKS.

Atlantic Side.

Location.	Order, No.	Lift, ft. Maximum.	Lift, ft. Minimum.
Bohio	1	32.80	26.24
"	2	32.80	26.24
Obispo	3	25.02	16.00
"	4	25.02	16.00

Pacific Side.

Location.	Order, No.	Lift, ft. Maximum.	Lift, ft. Minimum.
Paraiso	5	29.52	21.32
Pedro-Miguel	6	29.52	26.24
"	7	29.52	26.24
Miraflores	8	30.34	7.38

There thus will remain to be considered only the 16 kilometres (10 miles) lying between Obispo, where the canal leaves the Chagres River and Miraflores, where sea-level is reached. This section includes the continental divide at the Culebra, approached on the side of the Atlantic by the valley of the Obispo, a tributary of the Chagres and on the Pacific by the valley of the Rio Grande. The great economic problem to solve has been to determine the most advantageous level for the bottom of the canal between these two points, with a view to afford the best balance between the cost and the time of constructing the locks and dams on the one hand and deep cutting on the other.

This problem, with its adjuncts of how to best supply the summit level during the dry season, how to regulate the floods of the Chagres during the rainy season, and how to provide hydraulic power for lighting and operating the canal at all seasons, has been most thoroughly studied on the spot by the new company since its organization in 1894. Space is lacking to detail the trial excavations, aggregating 3 million cubic metres, the surveys, the borings, the gagings of the water courses and the many other details which have been investigated in the most elaborate manner. Suffice it to say that, after comparative estimates of 16 variants, the Comite Technique has advised the adoption of a level of 20.75 metres (68 ft.) above mean tide, which, should experience in the active prosecution of the work render it expedient, will admit of modification, either by adding two more locks, raising the level of the cut to 29.5 metres (97 ft.), or of suppressing one or perhaps two locks, and thus reducing it to 10 metres (33 ft.).

This definitive plan, placing the bottom of the canal at a level of 20.75 metres, involves two double locks at Obispo, raising the water surface at the summit level to a maximum of 31.25 metres (102.5 ft.) and a minimum of 29.75 metres (97.58 ft.); one double lock at Paraiso dropping these levels to 23.25 metres (76.26 ft.) and 22.25 metres (72.98 ft.); two double locks at Pedro-Miguel, dropping them to 6.25 metres (20.5 ft.) and 5.25 metres (18.22 ft.); and a tidal lock at Miraflores, where the water level varies between 3 metres, or 10 ft., above, and 3 metres below mean tide. (On the Atlantic side the tidal oscillation is only a few inches, and no such provision is needful.) The length of these levels in every case exceeds 2 kilometres (1.24 miles), thus avoiding trouble from oscillations due to lockages. In reference to the deep cutting at Culebra—the bugbear of former days—it is only needful to say that the excavation has already been carried below the level of the soft upper strata, which gives so much trouble by sliding, and is now and will continue to be in an indurated clay schist, requiring blasting, and passing to veritable rock. Serious trouble need no longer be apprehended here. This problem has been studied most thoroughly by the new company—involving the removal of about 2 million cubic metres of material, the sinking of many pits and borings, and the construction at the worst point of a tunnel 210 metres long (689 ft.) at a level of 41 metres (134.5 ft.).

In locating the line of the canal, great care has been taken to avoid abrupt curves. A minimum radius of 2,500 metres (8,200 ft.) is adopted for the central cut, and of 3,000 metres (9,840 ft.) for the rest of the line, except near Bohio, where radii of 2,500 metres and 2,000 metres (6,560 ft.) occur in enlargements having a bottom width of 62 metres (203.4 ft.), and near Obispo, where one radius of 1,700 metres (5,576 ft.) occurs with a bottom width of 80 metres (262.4 ft.). Even with the large standard curves adopted, suitable enlargements will be provided to render the route perfect in this important detail, in respect to which it is more favored by nature than either Kiel or Manchester, as appears from the following figures.

	Canals Manchester.	Kiel.	Panama.	Nicaragua.
Total length, kilos	54	98.6	74.5	284
Minimum radius, meters	571	1,000	1,700	.....
Normal radius, meters	..	..	2,500* 3,000†	1,220§ 1,311‡
Length, straight	63%	63%	57%	.....
Curvature:				
2,500 meters or more	15%	..	41%	.....
Less than 2,500 meters	22%	..	2%	.....
2,000 meters or more	27%	29%	42%	.....
Less than 2,000 meters	10%	8%	1%	.....

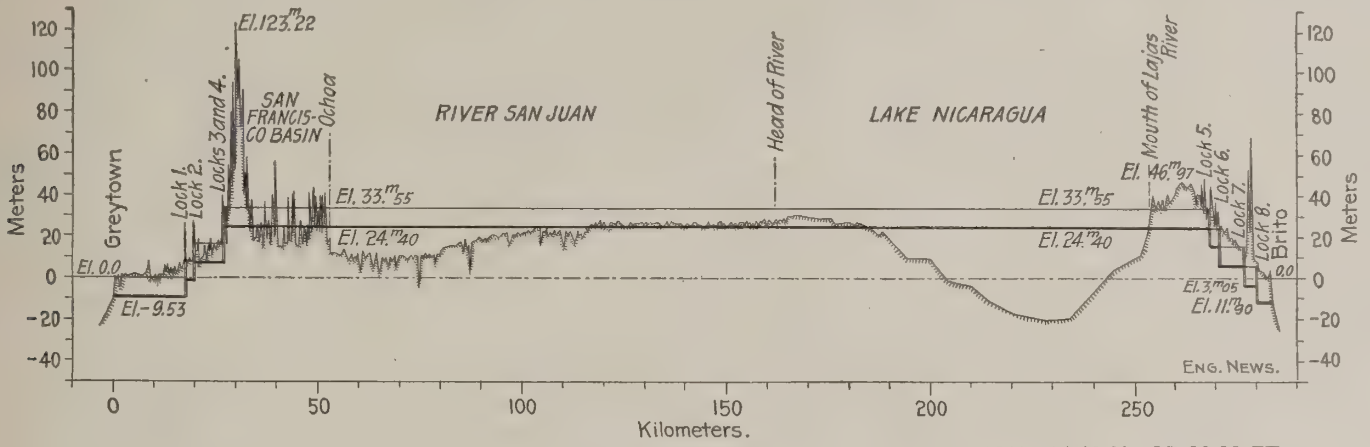
*Central. †Elsewhere. §Eastern divide. ‡Western divide.

The cross section to be given the canal varies in different localities, as shown in the following table: The depth is uniformly 9 metres (29.52 ft.); and the side slopes usually 3 base to 2 height in earth, and 2 base to 3 height in rocky cuts. In respect to berms and revetments, the latest practice, as recommended by the recent International Congress of Engineers at Brussels, will be followed.

	Earth Section, sq. m.	Earth Bottom width, meters.	Rocky cuts Section, sq. m.	Rocky cuts Bottom width, meters.
Colon to Bohio	406.5	30	380.2	34
Lake Bohio (minimum)	571.5	50	531.0	53
Summit level	379.5	36	379.5	36
Paraiso to Pedro Miguel	406.5	30	380.2	34
Pedro Miguel to Miraflores	406.5	30	380.2	34
Miraflores to La Boca.*	720.0	30	...	..
Bay of Panama (low tide)	693.0	50	...	..

*Low tide.

Enlargements 600 metres (1,968 ft.) long and 60 metres (196.8 ft.) wide at bottom, to enable vessels to pass each other, will be provided in the canal at intervals of about 8 kilometres (4.96 miles); but immediately above and below the locks these dimensions will be raised to 700 metres (2,296 ft.), and 62 metres (203.4 ft.).



PROFILE OF THE NICARAGUA CANAL; BOTTOM OF SUMMIT LEVEL AT ELEVATION, 24.40 M., OR 80.03 FT. ABOVE DATUM.

LIFT OF LOCKS.

Atlantic Side.

			Normal level of bottom of canal above mean tide, ft.	
Location.	No.	Normal lift, ft.	Lower.	Upper.
17.70 kilos.	1	26.00	0.0	26.00
19.83 "	2	28.00	26.00	54.00
26.95 "	3	28.00	54.00	82.00
27.15 "	4	28.00	82.00	110.00

Pacific Side.

			Normal level of bottom of canal above mean tide, ft.	
Location.	No.	Normal lift, ft.	Lower.	Upper.
268.60 kilos.	5	30.00	110.00	80.00
271.10 "	6	30.00	80.00	50.00
276.90 "	7	30.00	50.00	20.00
280.00 "	8	20.00	20.00	0.0

Note.—The height of tide being 1.25 ft. on the Atlantic side and 8.9 ft. on the Pacific side, the maximum lift of the locks at each end must be increased accordingly.

The Locks.—The locks, all founded on rock, are to be double, the larger chamber having a serviceable length of 225 metres (738 ft.), a width of 25 metres (82 ft.), and a depth of 9.5 metres (31.16 ft.) at the sides, and 10 metres (32.8 ft.) at the middle. The smaller chamber has the same serviceable length, with intermediate gates to reduce it to 130 metres (426.4 ft.) when desired; a width of 18 metres (59.04 ft.); and the same depth as the other. The larger will be constructed first, together with the foundations and head of the smaller, thus permitting the latter to be completed after opening the canal to traffic. The maximum lift has been fixed at 9 metres (29.5 ft.), except at Bohio, where provision for 10 metres (32.8 ft.) will be made, for use during extreme floods of the Chagres, which last only for a few hours.

The gates will be of the pivoted single leaf type. and water will be supplied by pipes buried in the lock floors and delivering on each side and throughout the whole length of the chamber. the flow being regulated by valves of the low level cylindrical pattern. Entrance to the chambers from either direction will be facilitated by crib piers, 60 metres long, with detached heads to protect the structure against shocks.

The Dams.—There will be six dams, five located on the line of the canal at Bohio, at Obispo, at Paraiso, at Pedro-Miguel and at Miraflores, and one at Alhajuela, 16 kilometres (10 miles) above, on the upper Chagres. Of these only the first and last need be considered, as the other four are minor affairs presenting no engineering difficulties (three of them are to be of masonry and one of earth).

The dam at Bohio will be of earth, abutting on conglomerate rock at the sides, and founded on a compact bed of clay, believed to be diluvial. The length of the crest will be 392 metres (1,286 ft.); the extreme height above the bed of the river, 23 metres (75.4 ft.), and above the foundation 28.5 metres (93.5 ft.). The width at the crest which rises 3 metres (10 ft.) above the highest level of the lake will be 15 metres (49.2 ft.); the upstream slope has a height of 1 on a base of 3, with four berms each 3 metres (10 ft.) wide, the whole riveted with stone laid dry; the downstream slope has a height of 2 on a base of 3, with one berm 3 metres wide, and is supported by a mass of loose rock rising to a sufficient height to protect the dam if, in spite of all precautions, it should chance to be overtopped by a sudden flood during construction. A puddled core, and a concrete wall at the upper toe, will cut off any possible leakage. The mass of the dam will be of excellent material found in the close vicinity. During construction the river will be diverted through the rock cut for the locks, with ample provisions by deversoirs for combatting larger floods. All the details have been carefuly studied and the project has received the unanimous approval of the Comite Technique

The dam at Alhajuela will be of concrete masonry founded on and abutting against compact rock. The length of crest will be 285.5 metres (936.4 ft.); and the height, 41 metres (134.5 ft.) above the bed of the river and 50 metres (164 ft.) above the deepest part of the rock foundations. The cross section conforms to the conditions of recent engineering practice.

To facilitate construction, a tunnel 300 metres (984 ft.) long and 75 square metres (807 sq. ft.) in cross section will be driven through the ridge to a bend of the river below, and a temporary dam will divert into it the minor flood discharges of the river. To meet the case of larger floods, the dam will be raised alternately on the two sides, thus allowing space for a portion to be overflowed without interrupting the work. These details have been carefully studied, and met the approval of the Comite Technique.

Engineers will recognize the immense advantages possessed by the Panama route, in the matter of dam construction, over the conditions found in Nicaragua, where the diversion of the San Juan river is admitted to be impracticable, and where the foundations present extraordinary difficulties and demand an unusual structure quite without precedent for canal purposes.

Regulation of the Chagres River.—This subject, comprising the control of the floods and the supply of the summit level, has received the elaborate investigation demanded by its importance. Space is lacking for details, but the general features are the following.

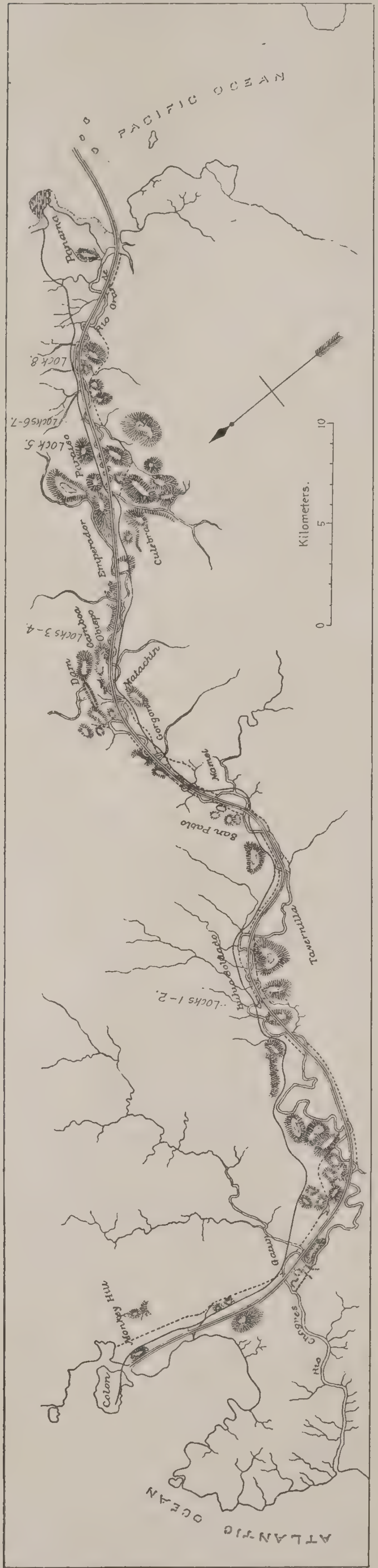
At Alhajuela the low water surface of the river is 28 metres (91.84 ft.) above sea level; at Gamboa, 14 metres (46 ft.); and at Bohio, 0 metres. The mean annual discharges at these three points respectively are 68 cubic metres (2,224 cu. ft.), 84 cubic metres (2,965 cu. ft.), and 121 cubic metres (4,261 cu. ft.) per second. During the three low water months (February, March and April) these mean volumes fall to 27 cubic metres (953 cu. ft.), 31 cubic metres (1,094 cu. ft.), and 39 cubic metres (1,376 cu. ft.), the minimum being 9 cubic metres (318 cu. ft.), 10 cubic metres (353 cu. ft.) and 14 cubic metres (459 cu. ft.). The maximum flood volumes, closely estimated on the basis of the floods of 1879, the largest within the memory of the inhabitants, is at Gamboa 1,630 cubic metres (57,539 cu. ft.) per second, and at Bohio 3,100 cubic metres (109,410 cu. ft.). The floods of the river, great and small, are all of the torrential type, resulting from the heavy and widespread tempests of the rainy season. Their duration is extremely short, rarely exceeding in the greatest floods 48 hours at Gamboa and 96 hours at Bohio. The maximum heights ever attained above the low water stage are about 11 metres (36.1 ft.) at Gamboa, and 12 metres (39.36 ft.) at Bohio. These figures, resulting from years of patient and careful observations, have furnished the basis for solving the two great questions of river regulation presented by the problem of the canal.

Upon an estimate, known to be safe, of allowing 1,000 cubic metres (35,300 cu. ft.) per second to freely pass Gamboa and 1,200 cubic metres (42,360 cu. ft.) to freely pass Bohio, reservoirs to contain 1 million cubic metres (35,300,000 cu. ft.) above Alhajuela, and 1.5 million cubic metres (52,950,000 cu. ft.) above Bohio are needful to restrain the greatest known floods; and these reservoirs are provided by the dams already described. In no other than the flood of 1879 would so large volumes be demanded.

The level of these lakes to be regulated by overflow weirs of the Stoney type, which have given perfect satisfaction on the Manchester canal, and which have the great merit of allowing the sills to be placed below the water surface without serious leakage.

The volume of 1,000 cubic metres (35,300 cu. ft.) per second permitted to pass Alhajuela will follow the bed of the Chagres to Lake Bohio. The volume of 1,200 cubic metres (42,360 cu. ft.) allowed to escape from the latter, will pass by two overflow weirs—one to the left of the canal discharging 500 cubic metrese (17,650 cu. ft.) per second through the bed of the Chagres and its derivations; and the other at the sources of Rio Gigante discharging 700 cubic metres (24,710 cu. ft.) by a route also separated from the canal.

To supply the summit level during the season of low water, the inflow of 20 cubic metres (706 cu. ft.) per second will be required. To provide 7,000 horse-power for lighting the canal and operating the gates, 15 cubic metres (530 cu. ft.) per second are demanded, falling 32 metres (105 ft.) at Alhajuela, and 16 metres (52.5 ft.) at Bohio, and acting on turbines driving dynamos to transmit the power in the form of electricity. The reservoir capacity, in excess of the low water flow of the Chagres, to supply these two needs, is 130 million cubic metres (4,589 million cu. ft.). The area of the lake above Alhajuela is 2,300 hectares (5,750 acres) at the level of 61 metres (200 ft.) above tide water and 3,000 hectares (7,500 acres) at the level of 65 metres (213 ft.), the crest being 69 metres (226 ft.), calling for a layer of water 9 metres (29.5 ft.) deep to contain 1 million cubic metres for flood storage and 130 million for low water supply. Upon this basis the capacity of the lake has been regulated.



MAP OF THE PANAMA CANAL.
(Reproduced from a map published in 1886.)

To transport the needful volume of water (20 cubic metres per second) from Alhajuela to the summit level, a feeder 16 kilometres (10 miles) long will leave the lake at a level of 58 metres (190.3 ft.) above tide, and follow the left bank to a lateral valley, discharging gently into the summit level about a kilometre (0.62 miles) from the locks at Obispo. The fall between the lake and point of delivery will be 17 metres (55.8 ft.), and the cross section is established to carry from 25 (882) to 40 cubic metres (1,412 cu. ft.) per second, with a view to meeting all possible contingencies of a largely increased traffic. At these heights water will flow into the canal even if the higher summit level should finally be found to be the more advantageous. The feeder traverses a difficult region and will be costly, but all details of construction have been successfully elaborated.

At Lake Bohio, as already stated, a capacity of 1.5 million cubic metres is needed for storage during great floods, and to assist the overflow weirs in regulating the level during the sudden influx of smaller floods. This volume calls for a layer of water 3 metres (10 ft.) deep; and another metre has been added, to contain a reserve for supplying evaporation in the lake during the dry season.

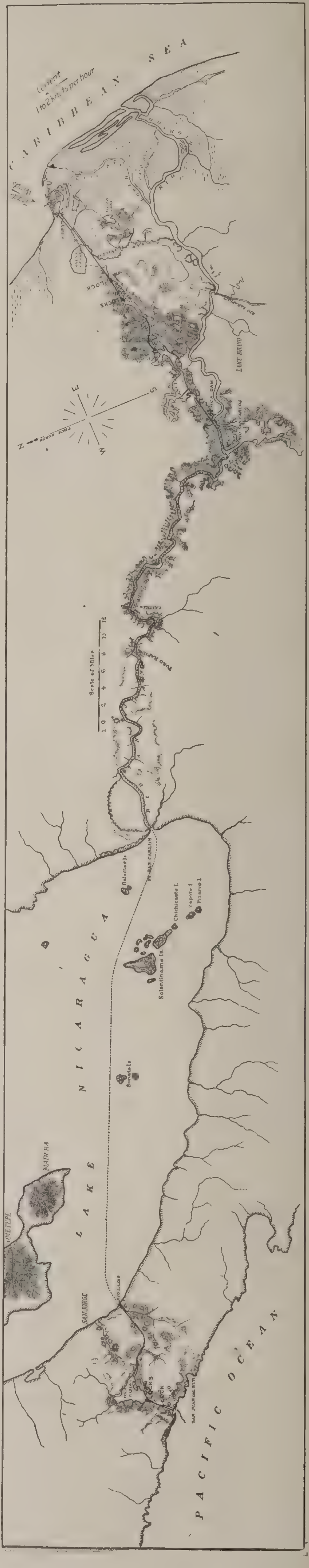
From the foregoing it will be seen that the hydraulic problems presented by this turbulent river—at one time regarded as so serious—admit of satisfactory solution. This is hardly the case in Nicaragua, where one of the great difficulties of project is the regulation of a summit level depending on that of an immense lake 2,700 square miles in extent, receiving directly the drainage of 8,700 square miles of territory, together with that of 2,250 square miles more through the tributaries of the San Juan river above the dam at Ochoa; conditions which render the ordinary method of storage reservoirs wholly inapplicable. Nevertheless a delicate regulation of this level, and at an artificial height, is essential to avoid on the one hand drowning a cultivated district on the west shore, and on the other hand exposing rocks in the navigable bed of the San Juan. These difficulties are aggravated by the necessity of placing the overflow weirs near Ochoa, at a distance of more than 100 kilometres (62 miles) from the lake.

In this connection it may also be noted that in the matter of rainfall the Panama canal is the more fortunate. All the difficult excavations and works of construction, except those near Bohio, lie in the interior where the annual downfall, as determined by 32 years of observation, is 93 ins., or only about 50% more than on our Gulf coast; while in Nicaragua, the most difficult constructions, including the Ochoa dam and the San Francisco embankments, lie in a district where the downfall, as determined from the data collected by the Nicaragua canal company (about 7 years observations), is 256 ins., or nearly three times as much.

Estimates.—This subject has received the most careful study, both in determining quantities and unit prices. Much valuable data as to the latter, based on actual experience on the Isthmus, has been available. The cost of each different project, and there have been 16 different variants, has been estimated in detail, and a selection between them has thus been reached intelligently. The sum needed for the work of construction proper is, in round numbers, one hundred million dollars. The element of time is more difficult to determine, but the volume remaining to be excavated at the Culebra being a little less than 12 million cubic metres (15,600,000 cu. yds.), it is believed that ten years is a conservative estimate.

The Nicaragua Canal.—To the general relative merits of the two canals already considered may be added that the Panama route lies in the interior of Columbia, while that by Nicaragua lies near the Costa Rican boundary; where hostilities are liable at any time to cause difficulties, as they already have done during the canal examination by the Walker commission last spring. Also that in respect to danger from possible earthquakes, which might easily cause trouble at the great locks, Panama is by far the more safe, because no active volcano is found within a distance of at least 200 miles from it, while three lie in the close vicinity of the route of the Nicaragua canal, and one within only 40 miles of its western locks. Last April an earthquake destroyed substantial masonry buildings at Leon, only 100 miles distant from these lock sites.

But while it is thus easy to compare the two



MAP OF THE NICARAGUA CANAL.
(Reproduced from a map accompanying the Report of the Ludlow Commission of 1895.)

canals in their general features, and to see that the route by Panama is much superior to that by Nicaragua, when details are considered, we are confronted by the fact that really no definitive project can be claimed for the latter. The company's project, as revised by the Government Commission, of which General Ludlow was president, is shown on the accompanying drawing; which may be compared with that given to illustrate the Panama project, but it should be noted that the latter has double the horizontal scale, thus failing to impress the eye, by fifty per cent., with its relative merit in respect to length. The data upon which this project was based were so unsatisfactory to the Ludlow Commission that they reported for obtaining the necessary data for the formation of a final project, eighteen months' time, covering two dry seasons, and an expenditure of $350,000, will be required." A new commission has been appointed, and new surveys inaugurated; and it appears from the views of the individual members, as given before the select committee of the Senate in June, 1898, that the changes undergoing study are radical in their nature, and that, although some at least of the engineering difficulties which impressed the former Government Commission are recognized as grave, no means of avoiding them have yet been discovered. Under these conditions it is apparent that confidence cannot be accorded to such a project; and that really there is only one canal, that of Panama, whose construction could be judiciously undertaken at the present time. It to to be hoped before the Govermnent embarks on so important a work that the relative merits of the two routes will be examined and judged by a commission of expert engineers, for it is certain that only one canal is now needed, and that that one should be the best possible.

(We are indebted to Gen. Abbot for the profiles accompanying the above article. The two profiles have the same vertical scale; but the horizontal scale of the Panama profile is double the horizontal scale of the Nicaragua profile. The map of the Nicaragua Canal is reproduced from the map accompanying the report of the Ludlow Commission of 1895. The map of the Panama route is reproduced from a paper by Mr. Chas. D. Jameson, M. Am. Soc. C. E., in the "Journal of the Association of Engineering Societies" for August, 1886.—Ed. Eng. News.)

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THE NATIONAL ACOUSTIC CO. has been organized, in Buffalo, N. Y., to carry out the ideas of Mr. E. Henri Kelly regarding the best form for churches and public halls with regard to their acoustic qualities. Mr. Kelly believes that these buildings should be so constructed that the interior should be shaped like the inside of an eggshell, and a church of that form has just been completed in Buffalo. Mr. Kelly's idea, however, was long ago adopted in the old Mormon temple at Salt Lake City; and it is a fact that this building has wonderful sound carrying qualities.

NOTES FROM THE ENGINEERING SCHOOLS.

Purdue University.—The engineering laboratory has, during the summer, been supplemented by the addition of a room 50 × 100 ft., known as the "Railroad Laboratory." In this room the equipment of machines for testing strength of materials, and the brake-shoe testing machine of the Master Car Builders' Association are already in place. There is also a full-sized model of the front end of a Richmond compound locomotive, and an exhibit of typical steel car trucks. The equipment of this room will be completed during the Fall by the installation of the air-brake testing rack of the Master Car Builders' Association. The number of students matriculating for the new year is larger than for several years past. The freshman class will number about 200, nearly two-thirds of whom are in the engineering courses. There are but few changes in the corps of instructors in the engineering department. Mr. Leopold O. Danse, for several years senior instructor in mechanical engineering, Lehigh University, has been appointed an instructor in machine design, and Mr. Robert S. Miller, assistant in the engineering laboratory, has been made instructor in the mechanics of machinery.

Public Appreciation of the Value of Engineering Education.—We frequently have complaints to the effect that the engineering profession is not as highly appreciated by the general public as it deserves to be, but there are indications that the public sentiment in this regard is gradually changing. We take pleasure in reprinting, as an evidence of this change, the following extracts from an editorial on "Progress in Education," in the "New York Tribune" of Sept. 27:

> The increase of students in colleges and universities during the last 25 years has been very marked. In 1872 only 590 persons in 1,000,000 were enrolled as college students, while in 1897 the number had risen to 1,216 in 1,000,000, being more than double the number. Moreover, during the same period the standard of admission to colleges and universities has been raised to such an extent as to require an average of an additional year's work in preparation for the freshman class.
>
> But it is in the remarkable multiplication of scientific and technical schools that education in this country best shows its value in fitting pupils for the duties of modern life. These schools have already gained a world-wide reputation. Pupils are sent to them from South America, Europe, and even from Asia, and their graduates are employed for difficult feats of engineering, mining and railroad building in every civilized country of the world. In the numerous developments of electrical science Americans now hold a position of unchallenged supremacy, and their future work in this fruitful field is likely to be still more important. Mechanical and electrical science is to-day revolutionizing the world, and is calling into its service a great army of able and brilliant men. The learned professions, important and honorable as they are and always will be, no longer dominate life. The real leaders of the world to-day, we may almost say the real builders of civilization, are the engineer, the electrician, the inventor, the man who, ignoring the barren logomachies of the philosopher, devotes his life to the discovery of some hitherto unknown law of Nature in order to make it serve the needs of the human race.

The only amendment we would make to "Tribune's" statement is to add the words "of law, medicine and theology" after the words "learned professions," for the words as they stand tend to give countenance to the idea that engineering is not a "learned" profession. No other profession has a stronger right to the title "learned." The engineering schools require of their entering students a higher standard of preliminary education, and their four years' courses are more severe, requiring longer hours of study, more intense application, and a stronger equipment of health of body and of brain to complete them, than do the professional schools of any other of the learned professions.

University of Wisconsin.—The Department of Electrical Engineering, which is under the charge of Prof. Dugald C. Jackson, has issued a circular giving the names of students who have taken degrees in electrical engineering during the last six years, with the positions now held by them. It states that over 20% of the members of the first five classes that graduated from the course have already become managers, chief engineers or superintendents in important industrial enterprises, and approximately 15% are teachers of engineering and science.

Rensselaer Polytechnic Institute.—H. H. Rousseau, of the class of 1891, Principal Assistant Engineer of the Pittsburg Bridge Co., stood first among the candidates in the recent examination held in Washington for civil engineer in the United States Navy. About 50 men started and 18 finished the examination. All these 18 were graduates of engineering schools. Last year at a similar examination, the papers of which were afterwards published in Engineering News, two other graduates of the Institute, Messrs. Chambers and Parks, stood at the head of the list. Another graduate, Mr. Arnold Sutermeister, of the class of 1892, recently passed first among the candidates for the position of Superintendent of Grade Crossings under the Railroad Commission of this state, and was appointed to that position.

Syracuse University.—The departments of civil and electrical engineering, physics and biology have moved into the new hall of physics, which is named after Mrs. Esther Baker Steele. Mrs. Steele will furnish the physical laboratories with a complete equipment of modern apparatus. The laboratories of the engineering departments have also been furnished with the best apparatus procurable.

Columbia University.—The list of appointments made since July 1 includes the following: Earl B. Lovell, C. E., adjunct professor of civil engineering. Richard S. McCaffrey, M. E., assistant in metallurgy. William A. Anthony, Ph. B., lecturer in electrical engineering.

Cornell University.—A portrait of John Fritz, the famous metallurgist and engineer, founder of the Bethlehem Iron Works, has been added to the portrait gallery of Sibley College.

George H. Shepard, Assistant Engineer, U. S. Navy, has been added to the staff of Sibley College and will have charge of the work pertaining to elementary steam engines.

Dexter S. Kimball, Stanford, '96, has been appointed instructor in machine design.

The new hydraulic laboratory of the College of Civil Engineering in Fall Creek has been formally transferred to the custody of that college. The laboratory will be in charge of a new professor, G. S. Williams, Michigan, '89, whose chair has just been created. Professor Williams has spent the nine years since graduation in the city waterworks construction, on the U. S. Lighthouse Board, and as civil engineer to the Detroit Board of Water Commissioners.

Fifteen graduates of Cornell are serving in the Volunteer Engineer Corps of the army. Forty Cornell men tried the examinations and all passed and were put on the eligible list, but 25 did not receive appointments because the lists were full when the war closed.

THE METROPOLITAN AND BELT RAILWAYS OF BERLIN.

(With two-page plate.)

In the May number of the "Revue Generale des Chemins de Fer" is a lengthy illustrated description of the Metropolitan Railway of Berlin, from which we abstract the following:

As long ago as 1872 the Deutsche Eisenbahnbau-Gesellschaft asked for a concession for building a railway through the city of Berlin; but as the cost was then estimated at 150,000,000 marks, the scheme was abandoned. The project was taken up again in 1873-74 by the Berliner Stadt-Eisenbahn Gesellschaft, and a contract was made with the city on March 20, 1874. The capital was fixed at 48,000,000 marks; and of this amount the state was to pay 21,000,000 marks, the construction company 12,000,000, and the three railways interested the remainder. A beginning was made; but a new agreement was entered into in 1878, raising the required capital to 65,100,000 marks, and modifying the original project by providing four tracks throughout. After much debate it was finally decided that no goods should be transported on this line, and that the four tracks should be devoted solely to the service of passengers; that the line should not be independent of the railways entering the city, but intimately united at all points with them; for the convenience of passengers arriving in the city. It was also decided that the tracks must be elevated in every part, so as not to interfere with surface traffic.

While work was actually commenced on the viaduct in the autumn of 1875, the slowness of appropriations and the modifications of plans found necessary delayed progress to such an extent that at the end of 1877 only about 3,000 lin. ft. of the viaduct were completed. In 1878 the Government actually took hold of the construction, and in this one year finished 9,184 ft. of the line and had half as much more under construction. Work now progressed rapidly and the line was opened, for city travel at least, on Feb. 7, 1882; and on May 15, 1882, it was ready for the terminal traffic of the great railway lines. The line was generally built by contract under State supervision, the State itself only building some special parts of the work. The operation of the railway was placed under the direction of the State Railways, Berlin System, by a decree of Aug. 18, 1881.

The actual cost of the construction of this system was 68,129,000 marks, or $17,032,250. This sum includes a portion of the cost of the terminal station at Charlottenburg, and the reconstruction of the other terminal station at Silesia. The whole cost was divided as follows, figured in marks, worth 25 cts. each:

	Marks.
Land acquired	33,305,184
Viaduct construction	18,602,212
Earth work	198,000
Superstructure, including falseworks	2,191,573
Signal system	281,740
Stations	7,870,869
Rolling stock	2,424,449
Engineering supervision	2,131,812
Miscellaneous expenses	737,898
Interest on capital during construction	384,062
Total	68,128,699

Since the completion of the work in 1882, little of any importance has been done; the additions only include new posts for the block system used and two new stations, opened in 1885 and 1896, for city service.

A general description of the Metropolitan Railway can be given as follows: The total length of the system, including the terminal stations of Charlottenburg and Silesia, is 39,835 lin. ft., or nearly 8 miles. Of this length, 16,038 ft. is curvature with radii of from 918 to 1,640 ft.; the grades are light, and the difference in level between the two ends is only 2.3 ft. In the central part of Berlin the viaduct is generally masonry, with the streets crossed by girder bridges, with a minimum clearance of 14.43 ft. under the lower chord. In only a few cases was it necessary to change the grade of the streets crossed. At the extreme ends the tracks rest upon simple earthen embankments, for lengths of 2,214 and 5,520 ft., respectively; but the remainder of the system is divided into 26,122 ft. of masonry viaduct, including masonry bridges, and 5,979 ft. of metallic viaduct and bridgework. The free space beneath the masonry viaducts is utilized for shops and storehouses near the streets crossed and wherever the viaduct borders on parallel streets.

The system has four tracks throughout; with the two northern tracks reserved for city service and the secondary stations, and the other two tracks are set aside for the service of the trunk line railways and the great stations. These two sets of tracks are separated by a central space generally 4 m., or 13.12 ft. wide. The rails were originally placed upon steel ties of the Haarmann type; but owing to rapid deterioration these ties were only retained upon the bridges and some other places where it was difficult to replace them, and heavy wooden ties were substituted, with eleven ties to every 27.5 ft., or one rail length. The first rails used weighed about 54 lbs. per yard; but those now laid weigh about 70 lbs. per yard, and to add to the security of the line an interior guard-rail is laid on all curves. The eleven stations vary in distance apart from 2,263 ft. to 5,543 ft.

There are five main stations open at all times to both city service and that of the trunk railways; while the intermediate stations are used only for city traffic. The general plan of the main stations is as follows: The station itself is formed by a widening of the viaduct, as indicated in the plan, with the two central tracks preserving their normal alinement and the two outer tracks widening out sufficiently to permit the establishment of the two platforms between them and the straight inner track. These platforms have a width of from 32.8 to 49.2 ft., and a length varying from 656 to 820 ft.; they are provided with six spacious stairways, three to each platform. The stairs for city service are divided into two parts by a central railing, one side being used for ascent and the other for descent; the entrance upon the platform is through a gateway where one employee receives the tickets of descending passengers, and another punches the tickets of ascending passengers. The public were formerly freely admitted to the platforms of the main stations; but admission is now only possible on the payment of 2½ cts., or the lowest fare. Beneath these platforms is a large room enclosing the stairways and accessible from two sides, extending the full width of the viaduct; and in this room are the ticket offices, distinct for the two services, placed near the stairways. There are also rooms for the reception and distribution of baggage, waiting rooms for the separate classes of passengers, a restaurant or buffet, water-closets and a police station. There are also offices for the operators of the line and storehouses, for tools, oil, etc.

On the level of the rails the entire space, including the platforms and lines of rails, is covered over by one corrugated, galvanized iron roof, generally semi-circular in form, and closed at the sides by light walls about 23 ft. high. This upper station varies in length from 475 to 538 ft., and in width from 115 to 131 ft.; it is lighted by a monitor running the length of the top and by side windows. At each end of the platforms of main stations are installed hydraulic elevators for handling baggage; indicator arms announce the destination of the coming train, for both tracks, and between the central tracks a fence completely isolates the two services, with a passage through it for the use of employees only.

The lower part of the station is warmed by steam heat to a nearly uniform temperature of + 20 C. when the outside temperature is — 20 C. The lighting is assured in the daytime by windows and a glass pavement between the central tracks, and at night by arc lamps. Advertising was at first prohibited in these stations; but a recent decree permits the placing of advertisements in the waiting rooms and vestibules and also on the curved ends of the platforms, an annual revenue of about $25,000 being now secured from these privileges. The writer of the article trusts that the administration will not be led into temptation by this revenue and permit such abuse of the available space as to make these advertisements a nuisance to the public—"as in England."

At the smaller stations the structure only covers the tracks for city service; or the two northern tracks. The outer track is widened out as before for the reception of one platform having a width of 23 or 30 ft. and a length varying from 426 to 558 ft. The lower story is usually raised about two steps above the street, and includes a large hall, waiting rooms, two water-closets, and offices for the employees. There are usually two stairways, and on the level of the rails is a glazed kiosk at the head of the stairs for shelter from the wind, and another kiosk for the stationmaster, telegraph, signals, etc. The platform and two tracks are roofed over for a length varying from 164 to 492 ft. and for a width of 39 to 52 ft. This shed is lighted by a monitor in the roof and by windows in the lateral walls.

The Belt Line Railway, which with the Central Metropolitan Railway makes up the city system, has replaced the so-called Junction Railway, built in 1851 to unite the stations of the trunk railways existing at that time. The definite plans for the belt line were adopted and the first work was commenced upon it in 1867. It was constructed entirely by the State, the first section being opened in 1871 and the circle finished in 1877. It was generally upon embankment, with some parts in cutting and a small part on the level of the surrounding country; it was built for double track, and the original completed cost was $6,948,500. The connection of this belt line, in 1887, with the central rapid transit system, gave it a greater importance than before, and the line now has four tracks, the stations have been remodeled and increased in size, and a number of new stations have been built; all grade crossings have also been removed. These improvements represent an expenditure of about $5,348,000.

This Belt Railway forms a continuous line, 23.37 miles long, completely surrounding the city. But since the opening of the Metropolitan line it has been divided into two sections, the North and the South Belt, each of which, with the great diametrical artery, forming a complete circuit about the two semi-circular parts of the city, north and south. Upon these two circuits are located 22 stations. The details of construction on the central viaduct and upon the belt line are not entered into, but the illustrations given sufficiently indicate the character of the Metropolitan viaduct, the more important of the two in this connection.

STRESSES IN RAILWAY RAILS UNDER MOVING TRAINS.*

Our present railway rails are in reality girders supported at many points, more or less elastic, upon which the weight of the locomotive or train is concentrated at a few points, i. e., the points of contact between the wheels and rails. There is a great diversity of opinion respecting the proper weight and shape of rails. In assuming that the rail acts as a girder, a perfectly proper assumption, and in making calculations on that basis the uncertain factor is that the point of support is indefinite, owing to the compressibility of ties and ballast. As the load rolls onto any section, the rails deflect, Fig. 1, and the ties, ballast and roadbed are compressed until action and reaction are equalized, or until the resistance of the roadbed equals the load imposed, the greatest deflection, as would be expected, occurring directly under the points where the load is applied. There is an unmistakable compression of the fibers in the head of the rail under the rolling contact, Fig. 2, a tension on the lower or base side of the rail and a shearing stress across the rail section at or near the ties which at that instant are bearing the load. The span of the deflection of the rail under the wheel is as a rule longer than the tie spacing. At a point a little distance on either side of the wheel the stresses are reversed, the head of the rail becoming in tension and the base in compression. The general effect of the weight of a locomotive and tender upon the track and the distribution of this weight from the track to the ties, ballast and roadbed, as just described, is shown in Fig. 1, which represents the base and wheel loads of a 100-ton Boston & Albany locomotive standing on 95-lb. rails. In plotting this the vertical scale was enlarged to make the depressions more distinct. The engine truck wheels carry 20,350 lbs. per pair; the drivers 37,500 per pair; the front tender truck wheels 18,500 per pair, and each pair of wheels in the rear truck, 23,500 lbs.

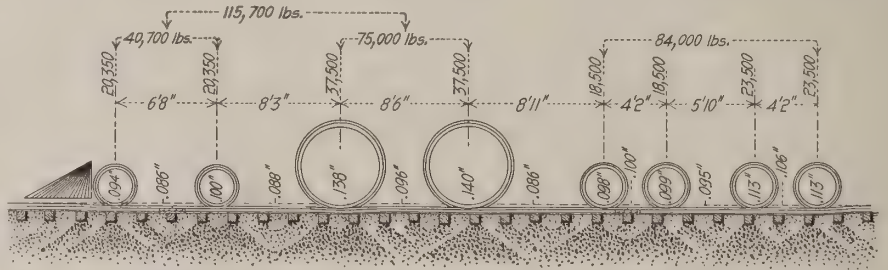

FIG. 1.—DIAGRAM SHOWING DISTRIBUTION OF THE WEIGHT OF 100-TON LOCOMOTIVE AND TENDER, BOSTON & ALBANY R. R.

The depressions of the rail were found to be 0.094-in. under the front truck wheel of the engine; 0.086-in. between the wheels and under the rear truck wheel 0.100-in. In the wheel space between the truck and the drivers the depression was 0.088-in. Under the front driver it was 0.138-in.; be-

TABLE I.—Maximum Fiber Stresses in Base of Rail.

Weight of rail per yd.	Ballast.	Locomotive.	Weight in lbs.*				Tensile fiber stress, per sq. in.		
				Engine.					
			Total.	Pilot.	Drivers.	Tender.	Pilot.	Drivers.	Tender.
60 lbs.	Broken stone	Freight, No. 557 R.	188,600	11,000	113,800	63,800	11,160	16,050	9,770
70 "	" "	" "	188,600	11,000	113,800	63,800	6,470	11,510	6,470
85 "	" "	" "	188,600	11,000	113,800	63,800	4,300	10,030	5,020
100 "	" "	" "	188,600	11,000	113,800	63,800	3,510	8,430	4,220
60 "	Stone	Passenger, No. 809 R.	197,050	39,750	87,300	70,000	11,860	19,540	9,770
70 "	"	" "	197,050	39,750	87,300	70,000	10,070	14,390	7,910
85 "	"	" "	197,050	39,750	87,300	70,000	7,160	10,750	4,300
100 "	"	" "	197,050	39,750	87,300	70,000	6,320	9,840	5,620

*To obtain weights on one rail these values must be divided by 2.

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*Abstract of a paper read by P. H. Dudley, C. E., before the New York Academy of Science and printed in the Academy Annals for 1898.

tween, it decreased to 0.096, while under the rear driver it increased to 0.140-in. These and the depressions found under the tender are shown in the figure. The amount of tension and compression in the different portions of the rail were measured by the Dudley "Stremmatograph," a device which is clamped to the rail at any desired point and records on a moving metallic strip the compression or elongation of the metal in a given length of the rail base. The section included is 5 ins. and the changes induced in this by the load rolling over the rail or standing above moves a system of multiplying levers which shifts a scriber which in turn traces a curved or wavy line upon the record plate. The departure of this line from a datum line, ruled when the track is not loaded, affords a direct measure of the tension or compression induced.

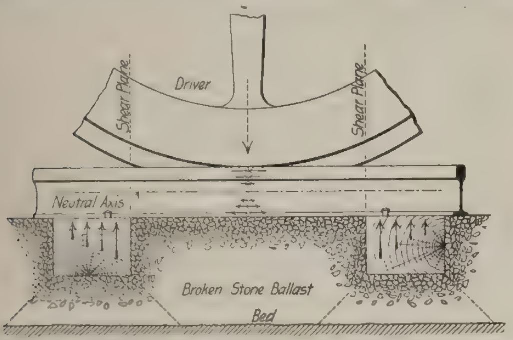

Fig. 2.—Sketch Representing the Rail as a Beam with Load Concentrated Between Ties.

In the case under consideration the following results were obtained, the values being reduced to apparent stresses per sq. in.:

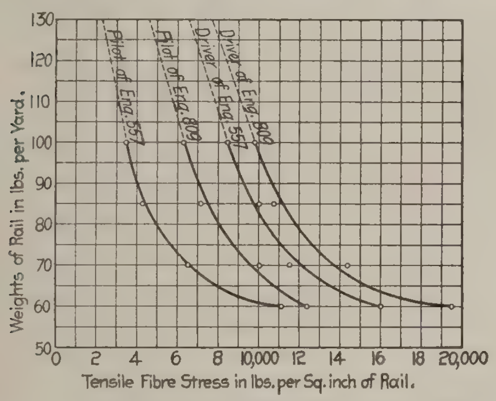

Fig. 3.—Curves Showing Maximum Fiber Stress in Base of Rail; Plotted from Values in Table I.

	Tension, lbs.	Compression, lbs.
Front engine truck wheel	6,780	.....
Center of wheel space	.....	1,530
Rear engine truck wheel	5,340	.....
Center space bet. rear trk whl & driver	.....	3,050
Front driver	9,160	.....
Center of space between drivers	.....	3.050
Rear driver	9,920	.....
Center space, drivr & front tendr whls	.....	2,290
Front truck front tender wheel	3,820	.....
Center of space between wheels	.....	760
Front truck rear tender wheels	3,820	.....
Center space between tender trucks	.....	1,530
Front wheel rear tender truck	6,100	.....
Center of space between wheels	.....	0000
Rear wheel of rear tender truck	6,870	.....

Further experiments along these lines were conducted since 1895 by Mr. Dudley and Mr. James E. Howard, Engineer of Tests at the Watertown Arsenal, Watertown, Mass., and the results of some of these tests are given in Mr. Dudley's paper. In Table I., which has been prepared from these data, it will be noticed that records were taken with two locomotives, a freight and a passenger, running on different weight rails (described in Table II.), using stone ballast in both cases. The curves in Fig. 3 are plotted from the figures given in Table I. for the tensile stress per sq. in. in the base of the rail due to the trucks and the drivers. While there are too few points to make these curves more than approximate, their general agreement in direction affords a sufficient check to permit their use to present to the eye the results obtained by the use of the Stremmatograph.

TABLE II.—General Dimensions of Rails.

W'ght, pr yd., lbs.	Height, ins.	Width, Base, ins.	Width, Head, ins.	Thickness, web, in.	Moment of Inertia, I.	Moment of Resistance, R = I/n'	Distance neutral axis to outside fiber. Head, n.	Distance neutral axis to outside fiber. Base, n'.
60	4¼	4¼	2⅜	½	14.222	6.693	2.125	2.125
70	4½	4½	2 7/16	½	18.055	8.282	2.32	2.18
85	5	5	2 9/16	17/32	26.374	10.853	2.57	2.43
95	5 1/32	5½	3	⅝	32.280	13.563	2.65	2.38
100	5½	5½	2 13/16	⅝	38.957	14.812	2.87	2.63

With the two locomotives used in the tests it will be seen that in rails below 70 lbs. per yd. the stress increases very rapidly. Tracing the curves in the other direction they are seen to become much steeper and straighter, showing, from about 90 lbs. on up to 125 or 130 lbs. per yd., almost a straight line with a slope of approximately 1 to 40, or a decrease of 40 lbs. per sq. in. in tensile stress for each pound increase in weight of rail per yd.

The fact that the Stemmatograph records directly with a considerable degree of accuracy the extension and compression of rails under moving loads, and hence, though indirectly, the stresses induced by the moving loads suggests its use for solving the mooted question of locomotive balancing and just what shape and disposition of counterbalance produced the least shock to track and bridges. It would settle once and for all the dispute as to the pounding produced by the present method of counterbalancing, and answer the question: , Does a uniform wave of deflection travel along the track with the train or are there recurrent points of greater deflection and therefore greater strain when the counterbalance is up or down?

A number of instruments could be mounted, on any section of track, in connection with photographic apparatus in such manner as to record the extension of the rail base and the position of the counterbalance at the instant the driver was over the instrument. By doing this with several engines at different speeds data could be obtained and comparisons made by means of curves which would show what really occurs when an engine runs over a track under working conditions of weight and speed.

* * *

PHOTOMETRY OF THE ENCLOSED ALTERNATING ARC LAMP.*

Arc light photometry, in so far as it involves the mere determination of luminous intensity yields unsatisfactory results for three reasons: The first is the marked difference in quality between the light of the arc and that of any of the ordinary standards. The photometrist realizes the general unsatisfactory character of the existing standards for the study of sources of a quality similar to that of gas light. Nevertheless, he is vastly better off, in this respect, than he is in the matter of a standard of suitable quality and intensity for arc light measurement. The eye estimates accurately an equality of brightness in two surfaces only when those surfaces are of the same tint. Moreover, with a color difference, the judgment of an equality differs with different observers. It should be said, however, that the difficulty arising from difference of color is less troublesome in the case of the enclosed arc than in the case of its progenitor, the open arc. The inner, opalescent globe absorbs the rays of short wave-length in greatest proportion, a fact which brings the color of the arc nearer that of the standard. When an outer globe of milky glass is used—the standard being a glow lamp maintained at, or above, its normal voltage—there is no annoyance from color difference.

The second obstacle to careful measurement is to be found in the variability of the quantity to be measured. These variations are largely due to the wandering condition of the arc—a peculiarity that is especially noticeable in the open alternating arc, and in both types of the enclosed arc. Indeed, it is to this feature of the enclosed arc that the flat-ended carbons are due. The change in luminous intensity corresponding to a shifting in the position of the arc from one side of the carbons to the other side is enormous.

To arrive at a fairly close value it was necessary to take the average of a number of readings. This required the construction of a special recording device which permitted rapid readings to be automatically recorded. This consisted of a long cylinder arranged just under the scale of the photometer and a marking point attached to the carriage which, when depressed, recorded the carriage position upon the cylinder. The details of this device were illustrated and described. Further apparatus, consisting of a Krüss-Bunsen photometer, a swinging crane with a 45° mirror, an incandescent glow lamp, a Hefner standard lamp, and various voltmeters, ammeters and wattmeters were employed.

A number of enclosed alternating current arc lamps placed at the disposal of the authors by their manufacturers were investigated very fully, and the paper described in detail the various tests and the results obtained.

The experiments show with considerable certainty that the economy of the alternating arc is less than that of the direct current lamp; that the use of opalescent globes materially reduces the candle power and that the great and rapid variation or fluctuations of intensity are due to the hunting of the arc rather than to any shifting of the carbons.

In opening the discussion Mr. L. B. Marks said that to his mind the first part of the paper was of the most value. There was a difference in the color of light to contend with, which made the setting of the photometer carriage difficult. An example of this was the Hefner lamp which has a reddish flame and the arc lamp which was decidedly violet. The sensation of color had a great deal to do with lights and there was no photometer which would take full account of this. The use of opalescent globes, he thought, had a tendency to change the quality of a light and to interfere with a correct comparison of the candle powers of a standard, such as the Hefner lamp, and an enclosed arc. He asked if the authors had not reversed "hunting" and its cause, and explained that he considered the flat ends of the carbon due to the burning with limited amount of oxygen and the hunting a result of the flat ends. The recording device was a good idea and likely to be of service to allusing photometers.

Mr. W. H. Freedman said that the flat ends were bound to result where the carbons were enclosed, and as the arc would always seek the path requiring the least expenditure of energy, hunting would naturally follow. His experience had been that in considering the alternating arc there was a power factor other than that due to the inductance of the mechanism. Its existence would be shown by determining the actual watts with a wattmeter and the apparent watts from voltmeter and ammeter readings.

He regretted that the results given in the paper were not in candle powers, as engineers were familiar with such units and could more readily make comparisons. The character of globe used made a very decided difference in the distribution of light and was quite capable of causing the difference in the form of curves which were shown in the paper.

Capt. John Millis, of the U. S. Lighthouse Board, asked Mr. Marks to explain more fully what he meant when he said that there was a difference between candle power and luminosity.

Replying, Mr. Marks stated that the term candle power implied a comparison. In the case of two candles the quality of light was the same; between a candle or a standard of some sort and an incandescent lamp a difference of quality might exist and there would be a still greater difference between the standard and an arc light. The latter might be 400 times as intense under a photometric test, but would it, if put in a room or out in the open, allow the observer to read or observe 400 times as clearly or as well. In other words, does not the illuminating power depend upon the use to which the light is to be put. There is something missing in the term candle power, for it should take into account the quality.

Capt. Millis considered it quite possible to obtain fairly close approximations notwithstanding slightly varying standards and different colors. In light-house work the vital question was how far could a certain light be seen, while in ordinary commercial work it was how much light. Two candles would give twice the light but they could not be seen further than one. The automatic recording device was good and would greatly facilitate photometric observations. Referring to the custom of painting the interior of photometer rooms all black, he had found that an arrangement of curtains was possible whereby the room could be white, or at least not black, thus making it pleasant to work in.

Open alternating arcs, as far as his experience went, had proved very satisfactory, especially with cored carbons. Prof. A. E. Kennelly said that engineers in making lamp tests should not forget that the ordinary buyer judges by appearance and prefers a pleasant and steady light without so much regard to its quantity. In considering the candle power of a lamp he favored the mean spherical candle power which could be described by calling it that light which could be caught up by a bag surrounding the lamp. The variation in candle power so frequently referred to he believed to be more largely a variation in direction than in the total candle power.

* * *

PAPYRISTITE is a new artificial stone, made from purified paper pulp and other ingredients by Fr. Gehre, a civil engineer of Zurich. It is an improvement on papyrolitte, invented by the same man. It is especially intended for jointless roofs or floors, and is a non-conductor of heat, cold or sound. It is hard as a stone, but has a soft, linoleum-like feeling under foot, and is noiseless. It weighs less than stone or cement, and 220 lbs. of the preparation in powdered form, spread 0.4-in. thick, will cover 90 sq. ft. The cost is said to be exceedingly low, and it can be laid without special machinery; it is dry in 24 hours and can then be highly polished. The Papyristite Co., Post Fach 10,469, Zurich, Switzerland, will supply samples at $4.50 per 220 lbs., free on boad cars at Zurich, to those wishing to make experiments.

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*Abstract of a paper presented by Messrs. C. P. Matthews, W. H. Thompson and J. B. Hilbish at the last meeting of the American Institute of Electrical Engineers held Sept. 28.

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We are glad to record that each of the great political parties in the state of New York has formally promised the voters that if it is placed in power it will visit with exemplary punishment those who have been responsible for the wholesale frauds on the New York State Canal improvements. The planks on this subject in the two party platforms are as follows:

Republican.

> We pledge the candidate this day nominated to a resolute and thorough continuance of the investigation, so fearlessly begun by Gov. Black, into all alleged mismanagement of the canals. If there are errors in the system and the law, we will correct them. If there has been fraud, we will detect and punish the wrongdoers.

Democratic.

> We pledge the people an honest and economical administration of the canals of the state; no squandering of the public moneys; no more millions to be stolen, wasted, or needlessly expended, as reported by a Republican investigating commission to have occurred with the nine-million canal improvement fund; all public contracts to be fairly and honestly awarded to the lowest bona fide bidder; no special privilege to pet surety companies favored by political influence. We favor a reduction of canal expenditures, and are opposed to the intrusting of the work of carrying on further canal improvements to Republican officials responsible for the prodigality, favoritism, and corruption which has characterized the present administration of the canals. Reform in canal management is the supreme issue of the hour. We promise the taxpayers that, if intrusted with power by the votes of the people, there shall follow a vigorous procedure on all canal officials implicated in the theft, waste, or misuse of the public moneys, and the recovery of so much of the diverted funds as it may be possible, by diligent effort, to procure through legal proceedings.

We need make no comment on the above pledges. Either of them could easily be criticised from the point of view of the other side; but either of them certainly commits the party responsible for it to a vigorous prosecution of those who are responsible for the loss to the state treasury of over a million dollars. The high character of the candidate named by each party for the office of Governor gives good ground for the belief that the party pledges above quoted will be faithfully kept; and this outlook must give satisfaction to every friend of good government.

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In our opinion this matter of uncovering the canal frauds and visiting the penalty of the law upon those responsible for them is the most important issue by far before the voters of New York. The men who were false to their trust and who secured the state's money by unlawful means did so with their eyes open and with the full knowledge that they were committing a misdemeanor, for which the penalty is imprisonment. They deliberately took the chances, believing that the political influence behind them was strong enough to keep them out of trouble. If they are right, and if they escape scot-free, a precedent will be established in the conduct of New York's public works that will not be forgotten. The state may as well say good-by to honest work and honest administration hereafter, unless it can prove its ability to inflict exemplary punishment on those who have proved so false to their trust.

We sincerely hope and believe, therefore, that whichever party's candidates may take the state government next January, those responsible for the canal frauds will receive the punishment their deeds deserve. It should not be overlooked that the injury they have done is not measured alone by the direct loss to the state treasury in dollars and cents. Every such case of dishonesty in public office and disregard of the obligations of trust, strikes at the very root of popular government. If public officers may make merchandise of their positions with impunity, the state certainly cannot safely undertake the construction of great public works. Nay, more: it cannot even fulfil the ordinary governmental obligations to punish crime, protect persons and property and maintain public order. If those who are engaged on public works may use their official position for their own or even for their party's gain, why may not those who detect and punish crime and those who administer justice do the same? This means, it is true, the blackmail of the innocent, the shielding of the guilty for a bribe and the sale of justice to the highest bidder; but it is only the logical result of such frauds as those on the New York State canal works, if allowed to go unpunished.

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In the conduct of the late war, no one feature was more faulty than the transport of troops and supplies on ships commanded by civilian sailors nominally under the control of the Quartermaster's Department of the Army. From the hasty shipment of troops at Tampa to the carriage of sick soldiers home from Cuba and Porto Rico, the accounts of the work done by these transports furnish evidence of the lack of experience of the army officers in responsible charge and of the insubordination of the civilian captains of the vessels. At Santiago, for example, these captains, instead of anchoring where they could be found, put to sea whenever they pleased, with their holds full of food, ammunition, and supplies imperatively wanted on the fighting lines. The officers of the quartermaster's department, who were nominally over the captains of these transports, were, in nine cases out of ten, too ignorant of the handling of ships and their cargoes to exercise anything more than a nominal authority, and the result was a disorganization and lack of system that called forth expressions of astonishment from the foreign military attaches.

It seems to us that in considering how to remedy this evil we will do well to look to the practice of England, whose experience in conducting military operations in foreign lands exceeds that of any other nation. When British soldiers are transported by the sea they are simply passengers on Her Majesty's ships; and every army officer on board below the grade of captain is under the immediate command of the captain of the ship, and the senior naval officer present. In other words, this transport service is entirely in the hands of the naval establishment. The men who are thus placed in responsible charge are not only experts in the handling of ships and the transport of goods and passengers by sea, but are subject to rigid naval discipline and are under the direct orders of the naval commander in chief. There is no division of authority under this system, and the troops and their supplies are moved and landed with certainty and despatch.

The need for a reform in the transport service has been brought to the attention of the War Department by Captain F. M. Dickins, U. S. N., of the Bureau of Navigation; and it was proposed to convene a joint board of army and navy officers to discuss this subject and submit a plan for the more perfect carriage of troops and supplies at sea. The army, however, has declined to accept this invitation, and unless Congress intervenes and orders some change in the system the transport of troops for the occupation of Cuba is very likely to result in the repetition of past scandal. The army proposes to improve the ships used for transport service, as we have already recorded; but it had no officers experienced in handling vessels, loading and discharging them, and caring for the men and materials on board ship and must continue to rely on civilians for this service. It is too much to expect, however, that the civilian sea captain in charge of a vessel will be really subordinate to a landsman, ignorant of nautical matters, and the division of responsibilities can work only mischief in the future, as it has in the past. The refusal of the army to even discuss this subject with the naval authorities is most regrettable. Apparently the army authorities feel that the movement of the troops is their business alone, with which the navy has no business to interfere. As we said before, however, the movement of men and materials in ships is not the business of the army, and it is to be hoped that Congress will place the responsiblity for this important evil where it belongs.

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THE PRESENT STATUS OF THE PANAMA CANAL ENTERPRISE.

Elsewhere in this issue we present a carefully prepared paper by Gen. Henry L. Abbot, U. S. A., on the present status of the Panama Canal enterprise. As the American member of an international commission of engineers appointed to report upon the plans for the completion of the Panama Canal, Gen. Abbot has personally examined the works at the Isthmus and has studied in every detail the plans now adopted for finishing this great work. As most of our readers are aware, Gen. Abbot is one of the most eminent members of the Corps of Engineers, and was in charge of important works from his assignment to duty with the Corps at the close of the war until his recent retirement for age. General Abbot's distinguished position and wide reputation as an engineer make whatever he has to say on the Panama canal matter worthy of serious consideration.

It must be confessed that up to the present time American engineers have been inclined to receive with a good deal of incredulity the reports concerning the resumption of work at Panama. It has seemed impossible from both the engineering and financial point of view that the terrible wreck in which the De Lesseps' scheme was involved could ever be repaired. It is apparent that those in charge of the new Panama Canal company realized that it could only be done by beginning wholly anew and by laying a foundation of careful engineering preparation, the lack of which was one chief cause of downfall of the De Lesseps company.

As some of our readers may recall, after the Panama bubble burst in 1890, and work on the canal came to a standstill, the company's affairs were placed by the courts in the hands of a "liquidator," or receiver, as we should say, who remained in charge until 1894, when the concession and all the assets of the old company were transferred to the new company.[*] According to information from official sources, this new company was organized by leading bankers and financiers of France who had no connection whatever with the old company, and by them a working capital of $13,000,000 was subscribed. In taking over the old company no cash was paid for its assets; but the holders of stock in the old company are entitled to receive a certain portion of the residuary profits of the new company from the working of the canal, should there be such

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[*] A partial list of the officers of "la Nouvelle Compagnie du Canal du Panama" is as follows: President, M. Bannardel (said to be also President of the Western Ry. Co. of France, though his name does not appear in the International Directory of Railway Officials for 1898); Directors, M. Brolemann, of the Credit Lyonnais; O. Melidon, a Director of the Comptoir Nacional D'escompte of Paris; MM. Chanove, De St. Quentin and others; Director-General, M. Maurice Hutin; Company's Agent in New York, X. Boyard, 29 Broadway; Attorneys in New York, Sullivan & Cromwell, 45 Wall St.

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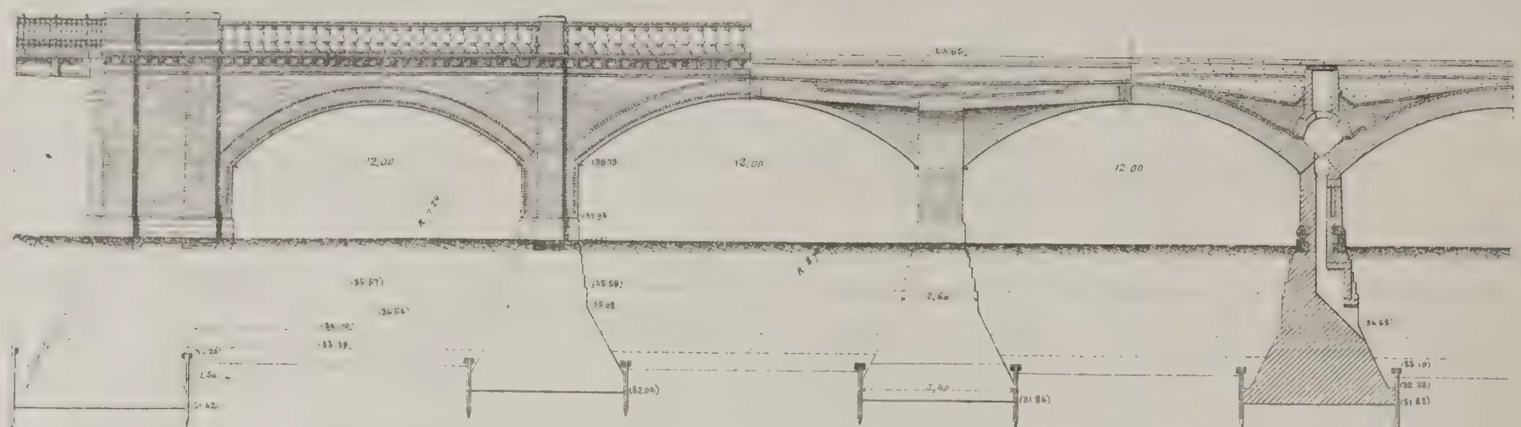
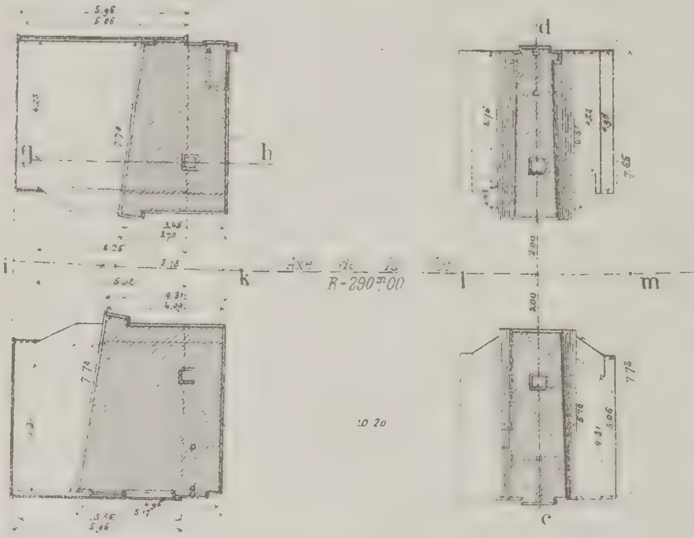


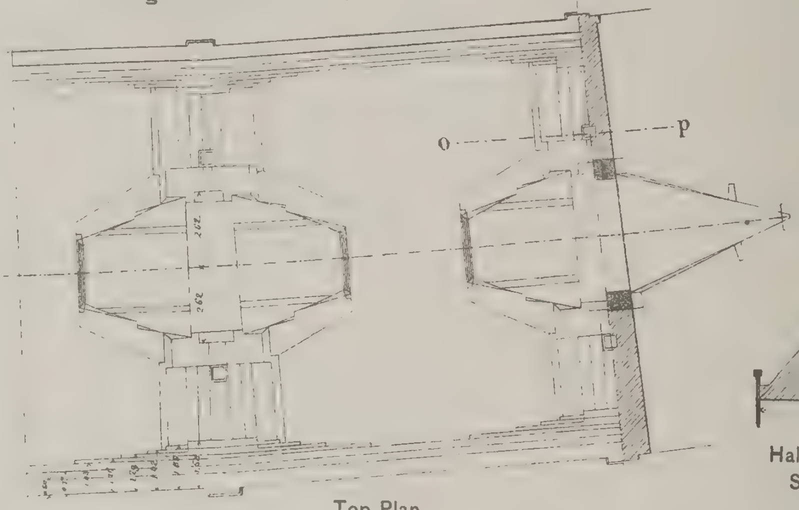
Side Elevation.

Longitudinal Section l-m.

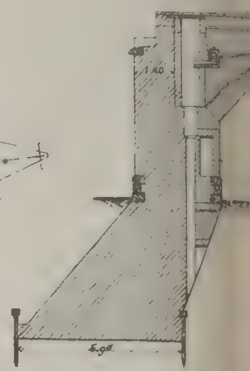
Longitudinal Section o-p.



Sectional Plan at Springing Line of Main Arches.

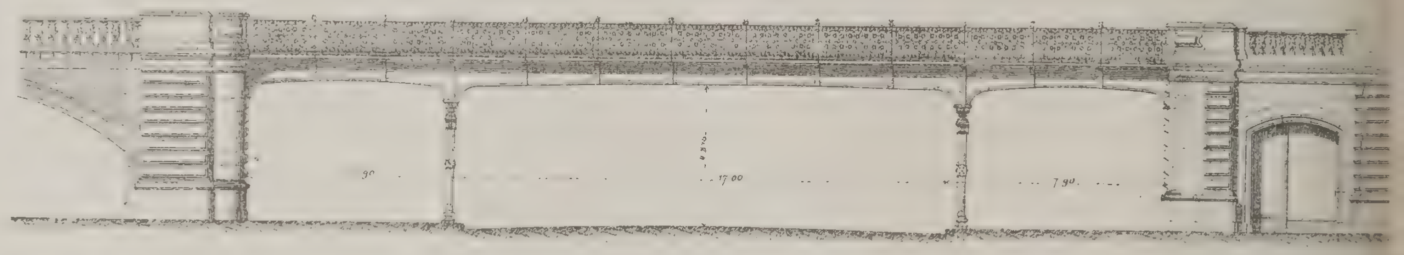


Top Plan.

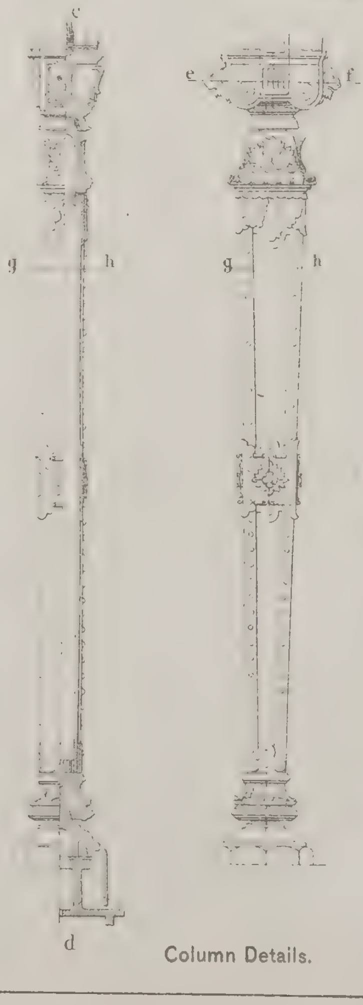


Half Transverse Section g-h.

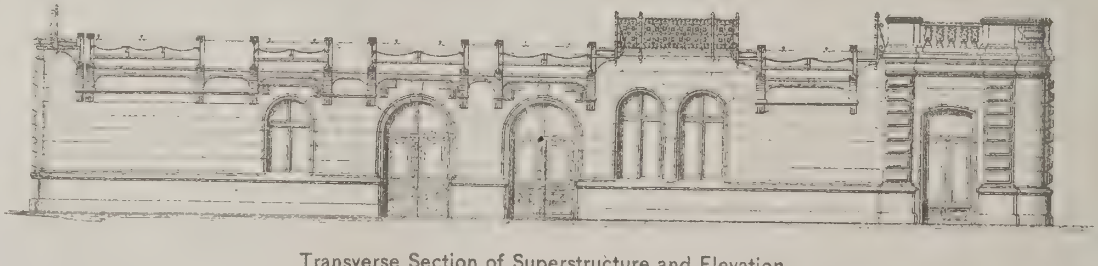
TYPICAL MASONRY VIADUCT.



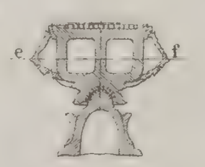
Side Elevation



Column Details.

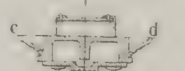


Transverse Section of Superstructure and Elevation of West Abutment.

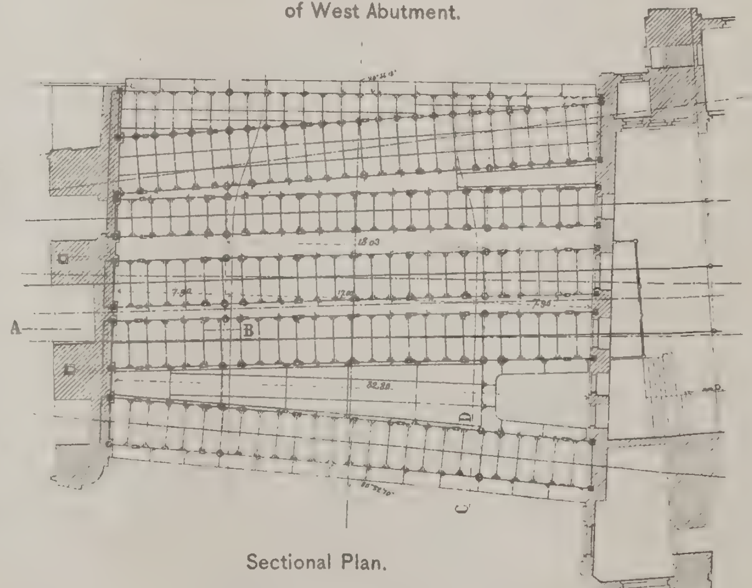


Vertical Section c-d.

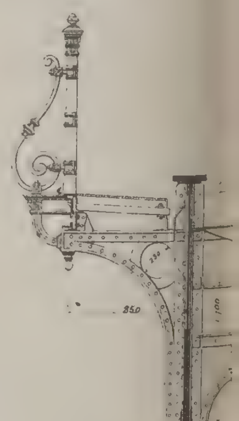
Horizontal Section g-h.



Horizontal Section e-f.



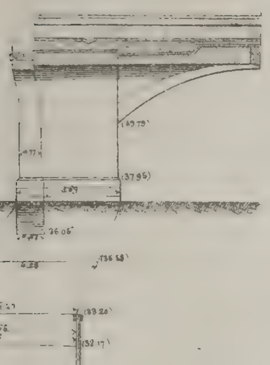
Sectional Plan.



Transverse Section C-D. on Plan.

BRIDGE OVER KOENIGSSTRASSE.

Section c-d.



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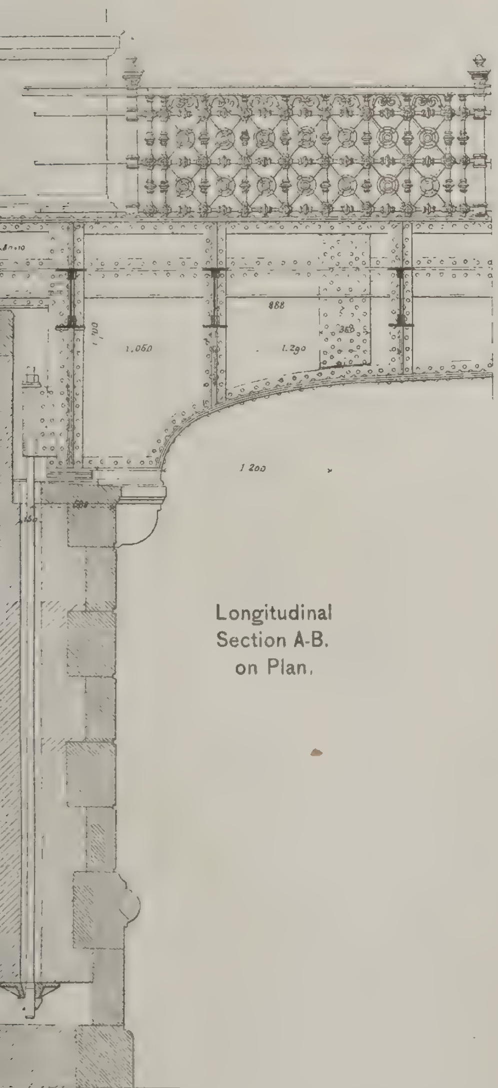
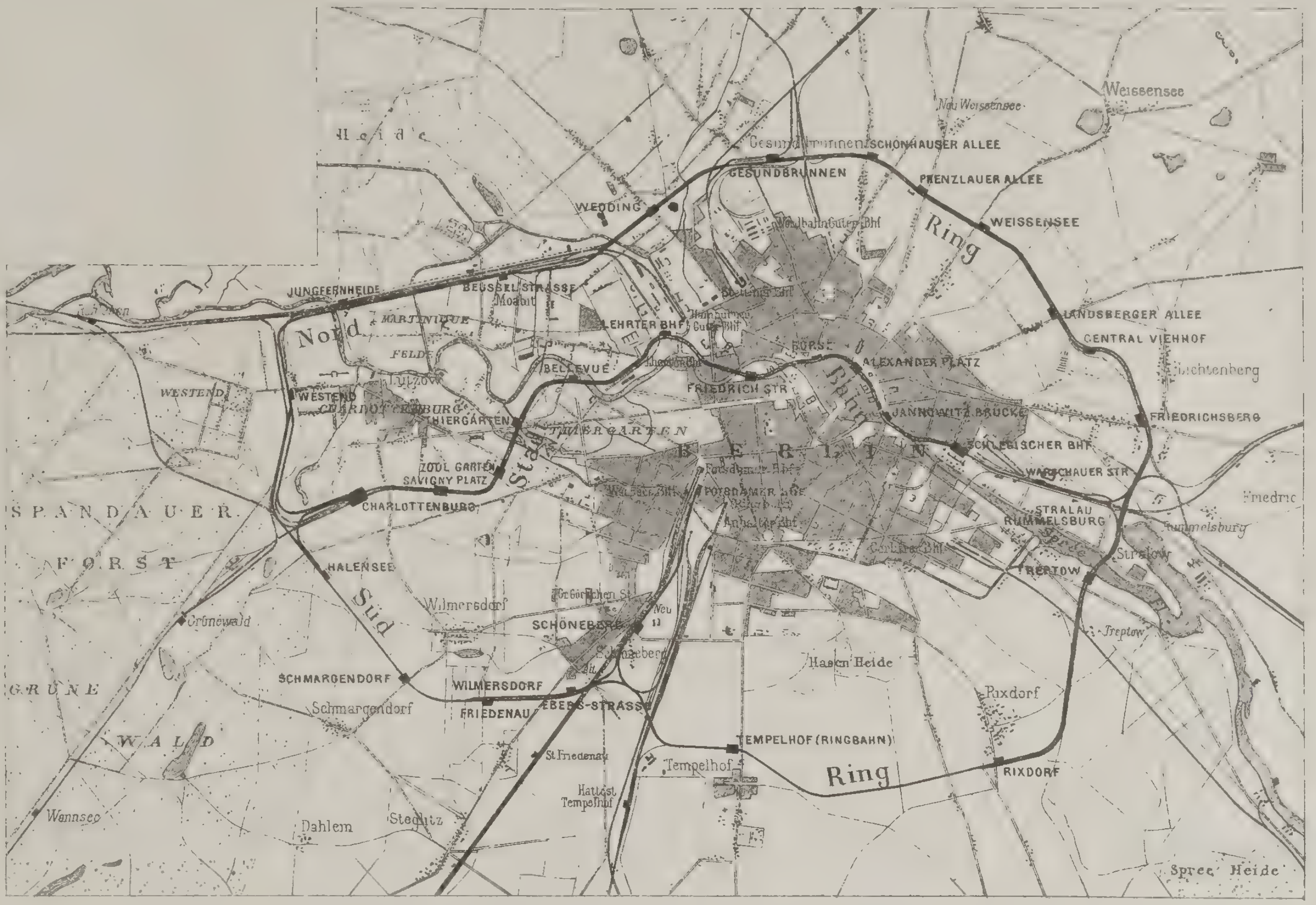


Longitudinal
Section A-B.
on Plan.



GENERAL PLAN OF THE BERLIN METROPOLITAN AND BELT RAILWAY.

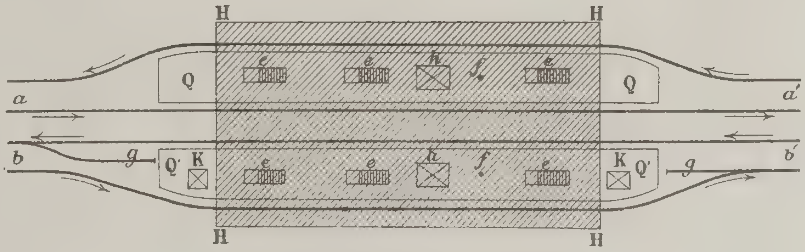


DIAGRAM PLAN OF MAIN STATION.

H. H. H. H.	Dimension of Shed.	h h	Offices.
a a'	Urban and Suburban Lines.	f. f	Posts Indicating Destination of Trains.
b b'	Trunk Line Service.	g g	Sidings for Several Cars.
Q Q Q' Q'	Passenger Platforms.	K. K.	Hydraulic Baggage Elevators.
e. e	Stairways to Platforms.		

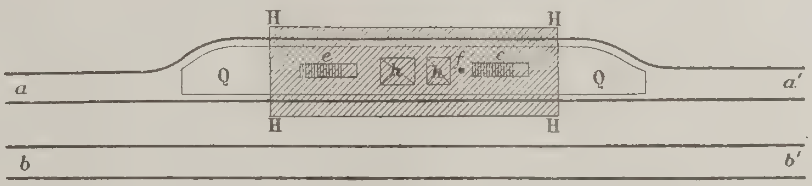


DIAGRAM PLAN OF SECONDARY STATION.

H. H. H. H.	Dimension of Shed.	e. e	Stairways to Platform.
a a'	Urban and Suburban Lines.	f.	Post Indicating Train Destination.
b b'	Trunk Line Service.	h h	Office and Shelter for Passengers.
Q Q.	Passenger Platform.		

THE METROPOLITAN
AND BELT RAILWAYS
OF BERLIN.

CHAS. HART, LITH., 36 VESEY ST., N. Y.

profits, after the charges on the securities to be issued by the new company have been provided for.

From all we can learn, this new company has devoted itself almost entirely to the task of investigating the engineering problems at Panama and determining in the most thorough manner the best solution of these problems. De Lesseps' proposition for a sea-level canal was abandoned, it will be remembered, even before the collapse of the old company; but the details of a new location, the height of its levels, the lift of its locks, and more important than all, the questions of the control of the Chagres River and of the sliding of the great earth mass at Culebra, had all to be investigated and settled by the engineers of the new company.

The detailed plans thus prepared were submitted first to a board of French consulting engineers, which included representatives of the Receiver of the old company. After this board had further elaborated the project and approved it in detail, an international engineering commission was appointed, which again went over the entire project, visiting and inspecting the works on the Isthmus, and examining the engineering problems involved.

General Abbot's paper in this issue of Engineering News is the first publication to be made anywhere respecting the work of this Commission and the conclusions which they reached. According to this paper, a satisfactory plan has been developed for the control of the Chagres, and the water supply of the summit level. Additional work at the Culebra cut has shown that the sliding of its sides can be successfully controlled. The work actually done by the old company is estimated to have been equivalent to an expenditure of about $125,000,000; and the cost of the work remaining to be done to complete the canal ready for traffic is set at $100,000,000. The time required to complete the canal is apparently fixed by the excavation remaining to be done on the great Culebra cut, and is set at ten years. The interest charges on the company's securities during this period are apparently not included in the above $100,000,000, and will increase the actual cost of the canal by one-fourth or more.

General Abbot's paper makes little or no allusion to the financial status, prospects or plans of the new company, which is the question of greatest practical interest just now; and the company's representatives in this country are not authorized to make any statement as to its future policy, except to say that no governmental aid will be asked from any source.

From all the information that we can glean, however, we believe that a few months hence, when the complete report of the International Engineering Commission is made public, an effort will be made to raise funds for the completion of the work; and it seems quite probable that the project will be placed in so favorable a light before European financiers that the required amount may be obtained.

This report of the Engineering Commission, we are informed, will probably be ready for publication before the close of the year, and will be accompanied by reports prepared by eminent French statisticians (among them M. Leroy-Beaulieu) upon the probable traffic and earning power of the canal. This is a matter which has been heretofore lightly passed over, both by De Lesseps and the Nicaragua Canal promoters, and the results of a careful statistical investigation will be awaited with interest.

The most important matter upon which General Abbot touches in his paper—at least to Americans—is the relative merits of the Panama and Nicaragua enterprises; and we are obliged to say that this seems to us the weakest part as well, for points in which the Nicaragua route has advantages over its more southern rival are left untouched. We shall not attempt, however, a discussion of the relative merits of these two enterprises at this time, for the very good reason that the public is not yet in possession of the data which would enable a fair and intelligent comparison to be made. When the full report of the International Commission of which General Abbot was a member, is made public, and when the detailed reports of the surveys made under the Walker Commission in Nicaragua are presented, an independent examination of the relative merits of the two enterprises from an engineering point of view will for the first time become possible.

General Abbot's paper does make clear, however, the very important fact that the Panama canal enterprise is not dead, but very much alive; and that it must be taken into consideration in making our decision as to what our national policy is to be with respect to the Nicaragua enterprise.

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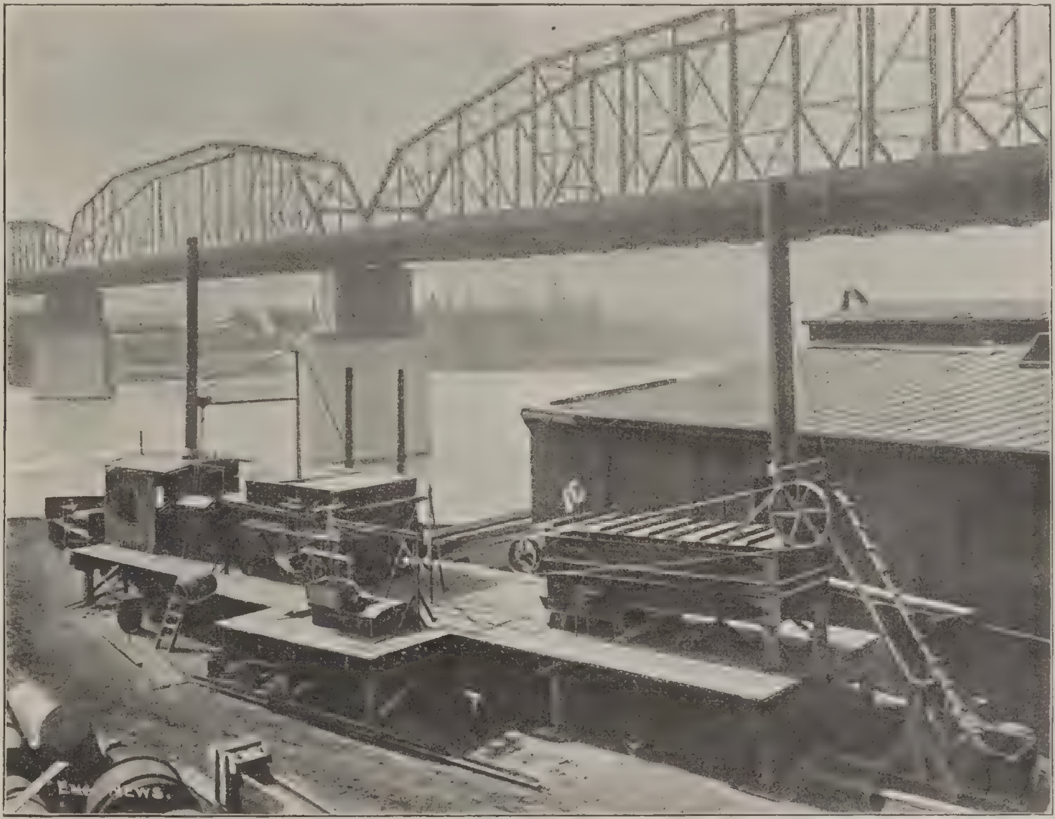
LETTERS TO THE EDITOR.

The Cause of Rails Creeping.

Sir: In the committee report of the annual meeting of the Roadmasters' Association of America (Eng. News, Sept. 15, 1898) I notice again the current explanation for the creeping of rails, viz., the wave-motion of the track under load. According to my experience the creeping of rails is partially due to this wave-motion, but not exclusively. Of even more importance are the shocks between the wheels and the rail-heads (at joints and when the flanges come in contact with the rails). The effects of these shocks on the track have always a horizontal component in the direction of the traffic; and are, of course, heavier on the outer rail than on the inner rail of a curve, on the down-grade than on the up-grade. Although generally the methods for restricting the creeping of rails will be the same for both causes, it may be desirable to reckon in special cases with the shocks as the principal factor. J. J. Israëls.

312 McPhee Building, Denver, Colo., Sept. 23, 1898.



THE FIRST PORTABLE ASPHALT PLANT IN OPERATION AT CINCINNATI, O.

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The Original Portable Asphalt Paving Plant.

Sir: In connection with the very interesting description of the portable asphalt paving plant manufactured by Messrs. Hetherington & Berner, of Indianapolis, in Engineering News of Sept. 15, your readers may be interested in a brief description and the accompanying photograph of the pioneer portable asphalt paving plant.

This plant was designed by the writer, and built by the Warren-Scharf Asphalt Paving Co., in the year 1889. It was intended for use in the towns and smaller cities where the amount of work likely to be required would not be sufficient to justify the erection of a permanent local plant. It was designed to turn out sufficient mixture to lay from 500 to 700 sq. yds. of pavement per day, but it has done much better in practice, and its actual capacity is about 1,000 sq. yds. per day.

Without going into a lengthy description of the machine, I may say that it is built on two flat cars, one of which carries the two revolving drums for drying and heating sand, the sand being fed to them from the ground, at the rear of the plant, by elevators. The front half of the car is used as a platform for storing the heated sand. The mixing apparatus is at the side of the car, near the stored sand, and is supported on a platform which, when the plant is to be moved, slides back onto that part of the car used for storing hot sand when the plant is in operation.

The second car carries the steam boiler and a 20-HP. engine protected by a cab. The engine drives a main shaft supported under one side of the cars and having a universal joint between the two cars to provide for any lack of accurate alinement of the cars. The same car carries the large kettles for melting the asphalt. The sides of the cars are hinged, and when let down form a platform around them. The plant was designed to use either oil or coal for fuel, but oil fuel has been found best and most economical.

The photograph, which was taken at Cincinnati, shows the plant set up, ready for operation, gives a good idea of its general plan and some of the details. (N. B.—This is a photograph of the paving plant, notwithstanding that the most prominent feature in it is the Chesapeake & Ohio Ry. bridge over the Ohio River.)

The design and construction of such a plant necessarily requires some ingenuity and mechanical skill in adapting well-known mechanism to the ends in view, but does not necessarily involve much invention. Such features of the plant as were novel were patented at the time. (Patent No. 451,989, issued to the writer May 12, 1891.) It will be seen that while the later plants, like the Hetherington & Berner, are larger, and involve some improvements and some new features, they follow pretty closely in general design this pioneer plant. The plant is still in use, and while limited in capacity, compares, in economy of operation, quite favorably with its more pretentious successors. S. Whinery.

New York, Sept. 22, 1898.

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Notes and Queries.

On the double-page engraving in our issue of Sept. 15 the numbers and titles of Figs. 5 and 6 were accidentally transposed. The cut marked Fig. 5 is properly Fig. 6, the Northern Pacific R. R. truck; and that marked Fig. 6 is properly Fig. 5, the Schoen pressed steel truck.

R. S. W., Milwaukee, Wis., asks which corrodes the most rapidly, wrought iron or steel?

According to the best information at hand, the difference in liability to corrosion between the two is not great, and the corrosion of a given specimen will vary with its chemical composition and probably also with its physical structure. This refers, of course, to soft structural steel. Harder grades of steel and tool steels, we believe, corrode more slowly. If any of our readers can answer the query more definitely we shall be pleased to hear from them.

C. W. S., New Rochelle, N. Y., writes:

Will you give through the columns of your paper your views as to the proper way in which the Department of Public Works should be administered in cities having a population up to 100,000? It is a subject in which engineers are interested, and the appointment of others than engineers as the head of such department is often a detriment to the profession as well as expensive for the taxpayer.

Our correspondent asks an easy question. The Department of Public Works in any city, large or small, should be administered on business principles, that is with the sole aim of carrying on all operations under its charge in the public interest. A competent engineer, if he has executive ability in addition to his technical knowledge should make an ideal head of a Public Works Department; but equally good results may be attained with a business man in that place, provided he also possesses executive ability, that he knows enough to seek expert advice on technical matters, and above all, that he is unswervingly honest and faithful to his trust. This is what ought to be. We are obliged to confess that those who select candidates for such offices are generally more particular to inquire concerning a candidate's "popularity with the boys," the extent of his probable contribution to the campaign fund, and the likelihood that he will use his official position to help his party.

ELECTROLYSIS OF WATER PIPES AT DAYTON, O.

One of the most thorough investigations of damage by electrolysis in a city's water mains that has been made in a long time was undertaken last summer at Dayton, O. Several cases of serious damage by electrolysis had come to light, and the trustees of the city water-works decided to have the extent of the damage determined as carefully as possible. They, therefore, called in as experts, Messrs. Harold P. Brown, of New York city; E. E. Brownell, of Dayton, and J. H. Shaffer, of Pittsburg. The reports of these engineers, together with a report by Mr. Chas. E. Rowe, Secretary of the Dayton Water-Works Board, have just been printed, and form a valuable contribution to the engineering literature on this subject.

It is now generally admitted that electrolytic action exists in all localities where a "ground return" is used for heavy electric currents. Any denial by railway companies that their currents are causing injury is always based upon the claim that the tracks are well bonded and that an ample metallic return circuit is provided for the current.

The burden of proof that damage is done is therefore thrown upon the complaining party, and an investigation, such as that undertaken at Dayton, must be made.

The fact that an electric current is flowing along a line of water or gas mains can be easily established by taking voltmeter readings at different points, attaching one terminal of the instrument to the hydrant, fire-plug or gas pipe being tested, and the other to the rails of the electric railway. Quoting from Mr. Brown's report:

> The current to operate the trolley cars leaves the dynamo and passes through the trolley wires in various parts of the city, then through the motor of each car and the wheels to the rails. To complete the circuit, it must return to the negative pole of the dynamos. To reach this pole, two paths are open to it; first, by the rails and feeder wires leading from the rails to the dynamos, and second, through the moist earth to the water or gas pipes below, along which it passes until within 1,000 to 3,000 ft. of the power house, when it leaves the pipes, again passing through the moist earth to the rails. A current of electricity passing through a conducting fluid, like water, decomposes it, and the oxygen and acids, if any, in the compound are delivered at the positive or outgoing pole, while the hydrogen and alkalies are delivered at the negative or receiving pole. This oxygen corrodes the metal of the positive plate, while the hydrogen produces no chemical effect on the negative plate.

It will be seen from the above that the tendency to corrosion by electrolysis on a line of underground pipes will exist wherever the current is leaving them. In remote parts of the city where the current passes onto the pipes or where it is passing along them without leakage there will be no electrolysis.* Wherever the current is leaving the pipe for the rails, however, the fact will be indicated by the pipe being at higher potential than the rail. In the Dayton investigations by Mr. Brown, voltmeter readings were made on all the streets of the city having electric railway tracks, and the difference between the trolley wire and the rail, between the trolley wire and the water main, and between the water main and the rail. At each hydrant along the line of the electric roads these readings were repeated for each of the four rails of the double tracks.

In making the readings, the time of the day was also noted, since the pressure depends upon the amount of the load carried at the power house. The results of the voltmeter readings were plotted upon a map of the city, showing the railways and water mains, and the extent of the mains where current was leaving the pipes and electrolysis was going on was thus plainly shown.

It was next necessary to determine the extent of the damage already done by exposing the pipes here and there at places where the instrument observations indicated the greatest action. Quoting again from Mr. Brown's report:

> A number of excavations were made in different parts of the city to determine how much damage had been done to the pipes and how much electrical pressure was required to seriously injure the cast iron. A pressure of three volts and less was found to cause a graphite-like coating not exceeding 1-32-in. in depth; the iron beneath seeming uninjured. At potentials of 3 to 4½ volts the thickness of the layer is increased in a ratio which depends upon the length of time the pipe has sustained this pressure. With a knife or file soft spots can be found in the pipe from 1-16-in. to ¼-in. in depth. With higher pressures the extent of the injury is even greater. * * * * * In ordinary soil the effect of electrolysis upon cast iron, if unprotected by sufficient amount of tar, is to produce an oxide of iron, which is a poor conductor of electricity, so that, with a given pressure, the deeper the layer of iron rust, the slower the rate of corrosion. To my surprise, the soil in which the pipes are buried, in Dayton, gives an entirely different reaction when the current passes from a pipe to the moist soil. The tar seems to be no protection whatever and the pipe is covered with a layer of black material, resembling graphite. This material proves to be an excellent conductor, so that instead of checking the action, it tends to increase the action by reducing the resistance of the path through which the current must flow. Furthermore, the stones or pebbles near the pipes, seem to be electro-plated with the metal of the pipe. This condition I have not seen in any other place, and as far as I know it has not been observed before.

It was next necessary to determine whether the soil itself had caused corrosion of the pipe in any degree, independent of the electric current. A pipe was uncovered which had been laid in 1874, at the same time as some of the pipes, which had been found seriously corroded. This pipe showed no evidence of electrical current and was so located that it could not carry current from one part of the city to another. It was in soil apparently the same as that surrounding the corroded pipes. It was still heavily coated with tar, and on scraping through this layer its surface was found as good as new. It was, therefore, evident that the soil contained nothing which would injure a cast-iron pipe, unless assisted by electrolytic action.

The question of the amount of injury which pipe has received is one difficult to determine in any quantitative way. The best method probably would be to take up several lengths of corroded pipe and compare the results of hydrostatic tests upon them with similar tests of pipe removed from unaffected districts, An easier method is to cut test pieces from the pipes and subject them to physical tests.

> In the investigation at Dayton, four test bars were cut from the very best portion of the pipes, and tensile and transverse tests were made which gave the following average results:

	Tensile strength, lbs. per sq. in.	Transverse strength, lbs. per sq. in.	Deflection, ins.
Affected pipe	11,425	1,085	0.20
Unaffected	16,000	1,800	0.25

> That is, the affected pipe had only 69.4% of the tensile strength and 54.3% of the transverse strength of the unaffected pipe.
>
> The pipe from which these bars were cut was also tested hydrostatically and leaked in several places at a pressure of 150 lbs. per sq. in.
>
> An analysis of pieces of these pipes, the incrustation upon the corroded one and soils from around both pipes was made by Mr. Jas. O. Handy, Chief Chemist of the Pittsburg Testing Laboratory, with the following result:

	Unaffected. pipe.	Affected. pipe.	Incrustation.
Phosphorus	0.789	0.800	1.821
Sulphur	.073	.057	none.
Silicon	2.270	2.500	not det.
Iron	not det.	not. det.	33.43
Combined carbon	.13	.24	7.12
Graphitic carbon	3.48	2.88	

	Alkalinity, %	Salt, %
Soil from unaffected locality	0.016	0.015
Soil from affected locality..............	.032	.810

Table I. has been prepared from data given in the report of Mr. J. H. Shaffer, which forms one section of the complete report from which we have been quoting. In it are shown the effects of electrolytic action as they were found at 15 places where the mains were uncovered. It will be noticed that the distance between pipe and rail varied from 3½ to 7 ft., and, further, that the pipe in all cases where actual corrosion was found, had a positive potential, which ranged from a fraction of a volt to as much as 9 volts, and in every instance the destination of the pipes varied with this difference of potential, being greatest for the higher and least for the lower values.

This is what could be expected, and the facts are well stated by Mr. Brown, who says "the amount of electrolytic action is directly proportional to the amount of current transmitted (which depends upon the potential) and the length of time the current flows; it is inversely proportional to the area in contact with the soil." This being the case, we would expect, what actually does happen, a greater or more rapid destruction of the smaller pipes.

The following remarks are also taken from Mr. Brown's report. While not absolutely new, they will bear repetition since they are applicable to nearly all cities and towns where electric railways are operated:

> The rate of electrolysis depends directly upon the electrical condition of electrical pressure between the positive and the negative plates (the pipes and rails). This rate is increased by the presence of any acid or alkali in the fluid (or soil in contact with pipes and rails). A slight leakage from the gas pipes, or a small amount of acid from the surface, or the presence of an alkali in the soil will increase the action, and the current itself, by carrying the metal oxide into the (ground) water, reduces the resistance of the solution, and tends constantly to cause a further increase of action. This increase of rate is augmented by the rusting of the bonds between the rails and by their mechanical loosening by hammer-blows from car wheels. The maximum laboratory electro-deposition of iron is obtained from a saturated solution of sal-ammoniac. In such a solution 100 amperes of current will remove over 3 lbs. in 24 hours, or with the proper solution, the same amount of current will remove over 20 lbs. of lead in the same time. The lead calking or service pipes will therefore sustain more damage than iron pipe. A difference of ½ volt between a lead pipe and a rail will injure the pipe. The fact that the bell of the iron pipe is nearer to the rail than the lead tends, however, to reduce the rate of injury of the lead below it. Since wrought-iron pipes are much more rapidly destroyed than cast iron, all natural gas service pipes in the vicinity of electric railway power houses should be ventilated at the curb, in order to prevent leakage into the houses and explosions. Inasmuch as gas can be ignited by sparks between separated portions of gas pipes, as at terminals where meters are to be inserted, the use of wire conductors between gas service pipes and gas pipes in houses is advisable. The difference of pressure between water and gas pipes in private houses has often been sufficient to cause fire, and it is therefore advisible to bind together electrically water and gas service pipes inside of the house line.
>
> It has been claimed by some that cast-weld joints would entirely obviate the effects of electrolysis. A comparison with the measurements made last February in the business portion of Dayton, O., however, does not bear out this claim, since the only variation is directly proportional to the variation of the loads then and now. To definitely determine this, measurements were made be-

TABLE I.—Effects of Electrolysis on Water Pipes at Dayton, Ohio.

No. of reading.	Time.	Size of mains, ins.	Date of laying.	Distance from rail ft.	Character of soil.	Potential with reference to rail (volts)	Remarks.
1	July 11, 1898 4:45 p. m.	6-in.	1874.	3½	Moist gravel.	+9	Tar coating destroyed; iron reduced from ½-in. thickness to ⅜-in.; iron decarbonized.
2	July 11, 1898 5:00 p. m.	6-in.	1874.	4	"	+5½	About the same as No. 1; lead pipe nearby completely destroyed.
3	July 11, 1898 5:30 p. m.	6-in.	1874.	4	"	+9	Pipe badly damaged.
4	July 12, 1898 2:20 p. m.	4-in.	1888.	4	"	0	Remote from influence of current; coating unaffected, showing no soil corrosion.
5	July 13, 1898 5:00 p. m.	6-in.	1893.	4½	"	+4½	Pitted and badly eaten; will soon give out.
6	July 15, 1898	6-in.	.....	6	"	+3½	Coating destroyed, good evidences of electrolytic action.
7	" "	4-in.	.....	7	"	+4½	Practically the same as No. 6.
8	" "	6-in.	.....	5	"	+4¼	Pipe eaten from ⅛ to 3-16-in.
9	" "	4-in.	.....	4	"	+2¼	Coating destroyed and pipe affected about 1-16-in.
10	" "	6-in.	.....	7	Dry gravel.	+1¾	Coating destroyed and slight evidence of electrolytic action.
11	" "	4-in.	.....	4	Good "	+2	Practically the same as No. 10.
12	" "	12-in.	.....	3½	Moist "	1†	Very slightly eaten.
13	" "	10-in.	.....	4	Good "	—5	Perfectly preserved; coating not the least affected.
14	July 16, 1898	12-in.*	.....	..	....	..	Perfect; made for electrical purposes.
15	" "	6-in.	.....	4	Good.	+2	Coating disturbed; pipe slightly affected.

*12-in. gas and 6-in. water. †Neutral at light loads.

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*It has been claimed by some engineers that electrolytic corrosion to a certain extent will take place at the lead joints of a pipe along which a current is flowing. The amount of such corrosion, however, is a disputed point. We may also note here that soon after the destructive effect of electrolysis was first observed it was suggested that the trouble could be remedied by reversing the polarity of the railway system—that is, by making the current on the overhead wires positive. This was tried in a number of instances, but it was soon found that the cure was worse than the disease, for, instead of preventing the electrolytic action, it simply removed the destructive region from the vicinity of the power house to distant and scattered sections of the city.

tween two hydrants on different corners along the line two blocks apart. Similar readings were then taken on each of the four rails opposite these hydrants, using in each case an insulated wire stretched along a dry, paved street. The measurements showed that the pipes between these points were carrying 19-20 of the current returning, while 1-20 was divided between two of the rails; and the other two were carrying no current.

The report concludes with a resume of the results obtained, and a calculation of the damage done based upon the data obtained during the tests. In making the calculations no account was taken of mains that were found neutral or negative to the car rails, but only of those that were positive. The total length of affected pipe, ranging in size from 4 to 16 ins. in diameter, amounted to 46,065 ft., the indicated voltage as taken showing this amount of pipe to be carrying from 0.3 to 9 volts positive to the rails. This was made up as follows:

	ft.
Total length of mains on streets running parallel to the railway	40,825
Length of 143 intersecting streets, estimated as affected 20 on each side	2,860
112 fire hydrant branches, affected 20 ft.	2,240
7 fire cistern branches, affected 20 ft.	140
Total	46,065

The idea of calculating 20 ft. either side from the car tracks for side streets and fire hydrant branches, is based on the fact that in making excavations little effect of electrolysis on the surface of the pipe is observed, beyond this distance. As already stated the measurements were taken to pipes contiguous to the track, yet it is not improbable that the current in seeking the most favorable path would follow other pipe lines away from the tracks, and the water pipes could become positive to either the artificial or natural gas pipes. It was known that service pipes have been destroyed, about 1,300 ft., beyond the limits of the danger district. The conditions at the time of the tests were ordinary, and as all were favorable to obtaining average values the figures here given are considered very fair.

Mr. Chas. E. Rowe, Secretary of the Water-Works, says, in concluding his report:

> In making the report the matter of damage is confined entirely to the city's property, which comprises the main lines and fire hydrant branches. No account is taken of the enormous risk, in case of fire, while removing the damaged pipes and replacing them with new ones, which will require closing off some of the main arteries for probably weeks. Neither is any pecuniary consideration given of the loss and inconvenience to the business interests of the city in closing off hydraulic elevators, fire protection and power lines. There are 110 of this class of consumers, whose services range from 2 to 6 ins. in diameter, whose pipes are undergoing the same process of destruction. There are also in the confines of this positive district 1,419 domestic and other consumers with lead service connections, ranging from ½-in. to 1½ ins. in diameter.
>
> The action of the current on lead and wrought-iron pipes appears to be much more destructive than on cast iron, and as it is known that the aptness of pipes to destruction by the electric current is for cast iron, 1, for wrought iron, 3, and lead, 7, which fully accounts for the large number of services, both water and gas, that have had to be repaired, and the difference in the thickness of the metal between large and small pipes, naturally destroys the small pipes in much less time than the mains. Wherever the main lines are damaged to the extent that they would have to be replaced, service pipes would be in a much worse condition and replaced several times.
>
> As the property owner is responsible for the repairs to the service from the main, the cost of replacing the services and repaving the streets would be very great (and almost ruinous to the streets), which entire cost would have to be borne by the property owners on the abutting streets, and no estimate is here made of the cost. Of the nearly 9 miles of pipe lines affected there is only 1,600 ft. of the pipe on unpaved streets. There is 10,845 ft., or more than two miles of the pipe line, that is laid directly between the two car tracks, or under what is called the dummy track. The ties of the railroads nearly join each other between the tracks, and it will be very difficult to get at this pipe, and the annoyance of the cars passing and repassing adds still more to the expense, and will be very dangerous to the workmen.
>
> In calculating the cost of replacing the pipes in the whole affected territory, it is estimated at $77,208.80. There is 17,513 ft. of pipe that shows a voltage of from 2 to 9 volts positive, and from pieces of pipe removed where electrically charged to this extent, it is found that they have deteriorated 50% in four years. Where they were required, when laid, to withstand a hydrostatic pressure of over 300 lbs. per sq. in., a pipe, when tested, after being subjected to 4.5 volts for four years, leaked at 150 lbs. pressure. It has been clearly demonstrated by the test made that the physical condition of the pipe corresponds to the voltage of current traveling thereon. At 4.5 volts it has been shown that a 6-in. pipe can certainly become useless in five years. At a lesser current the pipes are being corroded, but the life of the pipe is simply prolonged to correspond with the amount of current.
>
> The fact having been established that all pipes positive to the car tracks are damaged, and the agent causing the damage not having been removed, and the fact that the water pipes are used to convey the return current of electricity to the power stations of the electric railways, a purpose for which they were never intended, it remains for the Board of Water-Works Trustees, or others having authority, to see that the city is reimbursed for the damage sustained, and to enjoin the railway companies from using the water pipes as a return conductor. There is 28,412 ft. of pipe that shows .3 to 1.75 volts positive. This division is made to show that at least a portion of the pipe that is positive from 2 to 9 volts is now in a very dangerous condition, and from the tensile and hydrostatic tests made would indicate that at the ratio of depreciation the pipes are now undergoing that they would soon burst under the fire pressure (100 lbs.). It should be stated that the coating on the water pipes hermetically seals the iron from any ordinary conditions that would be apt to corrode them, but after the electric current has affected the pipe so that the coating begins to scale, the destruction will be much more rapid.

In conclusion, Mr. Rowe suggests the following pertinent questions:

> Should the pipes be at once replaced, or should the city wait until some calamity occurs? With the direct pumping system would not the unexpected bursting of some large main be apt to damage the pumping machinery? If new pipes and services are put in where others have been destroyed, and the current is not eliminated therefrom, or the pipes made neutral to the rails, are the conditions changed, and will not the pipes so replaced be again subject to destruction?

MODERN CUPOLA PRACTICE AND THE PHYSICS OF CAST IRON.*

By Bertrand S. Summers, Chicago, Ill.

The question is sometimes asked, What is the most important element governing the quality of cast-iron for any particular purpose? Some twenty years or more ago, silicon was regarded by foundrymen as one of their worst enemies; but since the work of Turner and of Keep, silicon has been greatly growing in favor, until it is regarded in some quarters as the panacea for all evils encountered in the iron-foundry. This has led to the founding of a school, the followers of which seem to regard silicon as the one element of decisive importance in pig-iron. It is the writer's opinion that graphite is the controlling element in pig-iron, and that a greater success is obtained where this metalloid is governed, than in cases where the silicon only is watched.

The most prominent function of silicon is that of promoting the formation of graphitic carbon, while it also lowers the saturation-point of iron for carbon. The former is the property that concerns the foundry-man almost exclusively; and it is necessary for him to know about how much silicon cast-iron should carry, in order to have the desired properties. It seems fair to say that nothing absolute can be stated regarding this question. Frequently, we notice in text-books and journals, that if iron carries this or that percentage of silicon it will have certain properties. This sweeping general proposition the writer cannot accept, being of the opinion that other conditions will affect the content of graphitic carbon as much as, if not more than, the content of silicon. In general, if it is desired to make good machinery-castings of close structure, and at the same time so soft that no difficulty will be experienced in tooling them, the silicon should be between 1.50 and 2%, or may even run to 2.25%. It is always wise in these cases to consider the iron used in the mixture. It is well enough to say in a general way that if we have the same chemical composition in cast-iron we will have the same properties, but experience has shown that this is true in a general way only. For example, mixtures in which the chief component is charcoal iron, show a perceptible difference from those made entirely from coke-iron. The reason for this seems to lie in the different conditions of the carbon, which will be mentioned later.

For light hardware, in which great strength is not a very important item, it is well to run the silicon up even as high as 3%. This practice tends to make the iron more fluid, so that it will take delicate molds well, and avoid difficulty or loss due to shrinkage. It is also said to enable the foundry-man to carry more scrap in his mixture. This assertion, however, is open to serious doubt, as the amount of scrap which a mixture will carry is dependent upon the carbon-content of the mixture and the scrap.

As silicon approaches or exceeds 3%, the casting becomes more and more brittle, and it is desirable to keep well within the limit of 3% in most classes of foundry-work. For most foundry purposes, on the other hand, a silicon-content below 1.5% is to be avoided.

Sulphur.—The good effects of silicon are frequently counteracted by the presence of sulphur, and mysterious troubles encountered in the foundry are not infrequently traceable to this element; the practical foundry-man being, in this respect usually at the mercy of the pig-iron manufacturer. Most brands of soft iron, both charcoal and coke, are usually considerably below the danger-limit in sulphur. Foundry-men, however, are frequently misled by the statement that sulphur need not be considered, as it never occurs in pig-irons in sufficient quantities to affect the results of their work. If analyses are made of drillings from castings that give trouble to foundry-men not possessing means for determining sulphur, the trouble will, in many cases, be traceable to this element. In most instances, sulphur is introduced into the mixture through the ferro-silicon irons used to supply the silicon to the charge. The writer has found well-known brands of ferro-silicon containing 0.17 and 0.18% of sulphur, and in one case 0.34%. If a careful watch is not made of these irons, or if strict specifications are not drawn upon them, it is not infrequent that 0.10% of sulphur is found. Most furnace-men endeavoring to do so can keep the sulphur below the limit of 0.05%.

A maximum limit of sulphur for good foundry-practice should be fixed at 0.10%; but foundry-men should strive to keep it below 0.08%.

Phosphorus.—The element is present to a greater degree than is commonly supposed in most cast-irons. It may be said that for the greater part of foundry-work it is an excellent ingredient up to a certain limit. This limit, for most cases, is about 1%. Where great strength and resiliency are desired, the phosphorus should be very much below this point. However, in cases of this kind, it will seldom be noticeable in high graphitic iron, where it is kept below 0.5%. In snap-flask work phosphorus is a very desirable element to the foundry-men, tending to make the metal fluid and to keep it so. Its effect on strength is not immediately discernible, if the test-bar of cast-iron is subjected to a transverse stress. A severe blow upon the bar, however, will soon make apparent the difference in irons. It is weakness under sudden shock that phosphorus most distinctly promotes; and for this reason it should be kept low, wherever this property would be a detriment. Like sulphur, phosphorus occurs in large quantities in the ferro-silicon irons commonly used in foundry-mixtures. It may be stated that most of the common brands of these compounds on the market carry 1% or more of phosphorus. The writer has known cases in which 7% silicon-iron carried more than 1.60% of phosphorus. Of course, this is unknown to most foundry-men not having facilities for analyzing their iron; and in this way phosphorus is frequently introduced into mixtures which never should carry a high percentage of it.

Manganese.—Manganese is an important element in many ways. It will scarcely be noticed in a mixture, up to 0.8%, as far as the ordinary foundry-man is concerned. Frequently an excellent casting is found to contain over 1% of manganese. It is not long since it was suggested that manganese is a very beneficial element in cast-iron, and it has been asserted by some metallurgists that a considerable content of this element is desirable. The writer's experience with manganese in general practice has not been extensive, but it seems to him that this modern view is to be looked upon with favor. Although it is well known that manganese promotes combined carbon, silicon predominating in the iron would tend to counteract this effect. Manganese, however, has considerable effect on the magnetic properties of the iron, which have been discussed in another paper by the author ("Journal of the Society of Chemical Industry," December, 1897).

Carbon.—The consensus of opinion seems to be that a great deal is yet to be discovered relative to carbon. There is no question that graphite carbon is the softening agent in cast-iron; and, so far as silicon can control this, it is the governing agent. The writer hopes to show, however, that, in many cases, silicon is powerless to effect this change in the state of the carbon.

Combined Carbon.—It is usually admitted that combined carbon embraces more than one kind of carbon. This is, to some extent, substantiated by work upon the magnetic permeability of metals relatively high in carbon. However, the present state of the art will not permit much to be said with certainty in this direction. Reference may be made in this connection to recent work of Messrs. Donath and Haissig on silicon-irons, in which they cite the fact that a high-silicon iron, when analyzed for carbon by ordinary methods, gives about 1.36% less of carbon than when the drillings are oxidized completely by combustion with lead chromate, or volatilization in chlorine. Lower results were also obtained when the metal was oxidized with chromic and sulphuric acid. This differece, Messrs. Donath and Haissig suggest, is due to some silico-carbide. The writer has endeavored to duplicate these results, working on a ferro-silicon containing about 7.5% of silicon. The total carbon, obtained by solution in a double chloride and the residue burned in a combustion-furnace, was 2.24%. In every case in which the carbon was determined either by direct combustion with lead chromate, or the residue from the chlorine treatment burned in a combustion-furnace, the results agreed quite closely with those obtained by solution in a double chloride. It is possible, however, that the results obtained by these scientists may be true for ferro-silicon higher in silicon; or it may be that the metal used for their experiments was in some respects anomalous.

Relation of Silicon to Graphite.—Let us now endeavor to see what grounds there are for the assumption that silicon is the governing factor in cast-iron. If we have several pieces of cast-iron, made at different dates from practically the same mixture, the analyses of which show practically the same total carbon and a variation in silicon, we have an excellent opportunity to trace the effect of silicon. For example, in the following table, are irons which would seem to show this quite clearly:

Table 1.—Analyses of Charcoal-Iron Castings.

	I.	II.	III.	IV.
Silicon	2.20	2.66	2.92	2.41
Graphitic carbon	2.92	2.93	2.77	2.98
Total carbon	3.44	3.48	3.41	3.42

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*Condensed from a paper to be presented at the Buffalo meeting of the American Institute of Mining Engineers, Oct. 18, 1898.

The other constituents of these irons are nearly the same, and all of them are controlled as far as possible in foundry-practice. They were made from almost identical mixtures, as is clearly indicated by the uniformity of total carbon. It is evident that this table does not support the unqualified assertion that an increase in silicon causes a proportional increase in graphite, and the practical rule, based on that theory, that silicon may be blindly added to the foundry-mixture, without considering other conditions, in order to increase graphite and soften the iron, is not substantiated. Comparing irons I. and III., we find that although the latter contains 0.72% more of silicon than the former, the graphite is 0.15% lower, while the total carbon is practically the same. Obviously this increase in silicon has not produced graphite, yet the total carbon indicates that there was no marked difference in burden.

Taking IV. as the second in the series, we see that silicon increases by about 0.20%, yet that the graphite is nearly constant, except as to III., which is both highest in silicon and lowest in graphite. The fair deduction seems to be, either that silicon has no marked effect upon graphite in ordinary foundry-practice, or that there are other conditions more potent. The latter view seems the more probable.

The above analyses are taken from a vast number made in the course of practice, which confirm this conclusion. Daily records for months show conclusively that the silicon varying between 2 and 3% has not nearly the effect on the graphite that it is usually supposed to produce. No relation apparently exists between the change of silicon and the content of graphite within these limits, and there is little if any doubt, if we can judge from this long series of tests, that there are other influences in cupola practice which are more potent than the variation in silicon.

Another proof of this proposition is seen in the analyses of pig-iron, before they are introduced into the cupola. Pig-iron shows the effects of the metalloids in the blast-furnace, instead of in the cupola; yet even in the blast-furnace, with its high temperature, the silicon is not always able to govern the graphite. For example, the following are strong indications in this direction:

Table II.—Analyses of Pig-Irons.

	I.	II.	III.	IV.
Silicon	7.94	7.48	3.36	3.30
Sulphur	0.041	0.029	0.051	..
Phosphorus	1.39	1.05	0.606	..
Graphitic carbon	2.02	1.95	3.31	3.26
Total carbon	2.24	2.19	3.33	3.37

Here it appears that the irons carrying more than 7% of silicon have less graphite in proportion to the total carbon than the one containing 3.36%. Number III., however, is a remarkable iron, and one that is seldom seen, although its high proportion of graphite to total carbon is quite characteristic of the brand, and has been found in most shipments received from this furnace. This anomaly must therefore be due to local conditions.

The castings in Table I. were all compounded from high-graphitic charcoal-iron. In coke-iron mixtures the failure of silicon to increase the percentage of graphite is even more marked. The following analyses are taken from casts made entirely from coke-irons:

Table III.—Analyses of Coke-Iron Castings.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Silicon	2.85	3.76	2.62	2.47	3.18	3.11	2.79	2.95
Sulphur	0.073	0.083	0.074	..	..	..	..	..
Phosphorus	0.557	0.612	0.469	..	..	..	..	..
Manganese	0.39	0.260	0.42	..	..	..	..	..
Graphitic carbon	3.13	3.05	3.17	2.55	2.69	2.78	2.67	2.61
Combined "	0.18	0.24	0.08	0.74	0.51	0.62	0.54	0.60
Total carbon	3.31	3.29	3.25	3.29	3.20	3.20	3.21	3.21

The first four members of this table have about the same total carbon, and were made from the same irons, with but minor changes in the burdening. From these irons little if any relationship can be traced between the silicon and the graphitic carbon. Looking at the last four members, the total carbon contents are seen to be practically identical, while the graphitic carbon is very nearly the same in the irons containing the highest and the lowest content of silicon; and, again, no relation can be traced between silicon and graphitic carbon. As in the case of the first four, these mixtures were compounded from the same irons with but minor changes in the burdening.

That temperature controls the effect of silicon is shown when a close examination is made of different shipments of the same brand of pig-iron, the blast-furnace running on the same ore-mixture. A case came under my personal observation recently, in which the graphitic carbon ran from 3.40 to 3.50%, the silicon remaining in the neighborhood of 1.5%; but when the silicon rose to 1.8 or 2%, the graphitic carbon rose above 3.50%. In nearly every case of this kind a decrease in the total carbon was likewise noticed. This has also been frequently noticed with other brands of iron, and it is more apparent with charcoal-irons than with coke. The heat in the blast-furnace seems to be great enough to make the silicon a more important factor.

It is hardly legitimate to attribute these differences to the effect of the other elements, as a glance at the tables will show that they do not vary enough to enter into the consideration. It would seem, on careful consideration, that the effect of silicon is largely governed by the temperature at which it is allowed to act. It is doubtful if the necessary temperature is obtained in the cupola to permit the silicon to have a very strong effect upon the carbon, where its contents does not vary beyond certain limits. It also seems probable that, where the burden is light, the effect is not as marked as in the case of large burdens, where more heat is developed.

Influence of Oxidized Material, Especially Rusty Scrap, Upon Mixtures.—Little attention has been paid to the peculiar effect of introducing rusty material into the cupola. Only one experience of this kind is necessary to convince a foundry-man of the deleterious effect of corroded scrap. The surface-rust on pig-iron is usually not noticeable, but where corrosion has taken place to any considerable depth, a very bad effect is quickly discovered. This is particularly true where light scrap is used, and a large surface has been exposed to the corrosive effect of the atmosphere, in proportion to the small volume. A prominent effect in bad cases of this kind is to make the iron exceedingly dirty and spongy, and when this dirt is noticeable, the cleaner the material introduced into the cupola, the cleaner will be the casting obtained.

Effect of the Blast.—There is scarcely any one factor in cupola-practice deserving of more close and constant attention than the blast. There are reasons to believe it exerts considerable influence in furthering the mutual reactions of the different elements in the metal, but this has not been clearly demonstrated in the tests thus far made. Aside from its effect in this way, increase of blast seems to have a decided tendency to increase the total carbon in the cast-iron, and correspondingly to increase the percentage of graphite. It is not unlikely that when the results of further investigation are known, the amount of air passed through the cupola will be found to condition, to a certain extent, the effect of the metalloids in the iron.

Iron-Mixtures and Iron-Specifications.—An attempt has been made in the foregoing pages to demonstrate that the desire for silicon has been carried to an extreme. This desire has become a mania in some quarters. If the foregoing tables prove anything, they certainly prove that high-silicon irons are, in many cases, a useless luxury. A certain amount of silicon is undoubtedly necessary, but the plan of gaging the value of irons by their content of silicon is but one step in advance of the old fracture-method. The carbon is undoubtedly the governing factor in irons, and the most radical advocate of silicon can do nothing with foundry-mixtures without a certain carbon content. It seems, then, that total carbon is one of the most important elements to specify in purchasing foundry-irons. The writer has yet to meet with an iron too high in carbon to be of excellent use in the foundry. It has been the custom in our practice to specify 3.75% of total carbon in our No. 1 iron, especially when charcoal-irons are purchased, while a very lenient specification is allowed in silicon, it being, for charcoal-iron, not below 1.50%. The furnace man is allowed to have silicon about anywhere he wants it as long as he can furnish iron with the necessary carbon. A minimum graphite specification is also inserted in nearly every case. In the cupola, comparatively little combined carbon is changed to graphite, and this is especially true when the heats are small, and, consequently, the heat developed is not sufficient to produce any marked change in this direction. This fact can easily be demonstrated in practical work, where frequent analyses are made of daily casts, and the compositions of the irons composing the mixture are known.

In these specifications the minimum is specified, and any variation must be above this limit. This is thoroughly practical, and has been in operation long enough commercially to demonstrate its value. It is difficult to get iron merchants to make carbon-determinations, but they will agree to furnish iron under specifications requiring certain minimum limits of total carbon and graphite. Whether the latter is specified or not, there can be no doubt about the necessity of specifying total carbon. Very little attention is paid to silicon in the work, as most of the high-carbon irons will carry sufficient silicon for most classes of work. However, it is often useful to require a certain silicon-content in the iron, so as to get sufficient graphite, as the heat of the blast-furnace is sufficient to enable the silicon to control the graphite to a great extent. In the best snap-flask work, where a large proportion of charcoal iron is used in the mixture, 2% of silicon is found to make elegant castings, and in such mixtures no ferro-silicons are used; but a high-silicon coke-iron, carrying over 3% of silicon and about the same of graphitic carbon, is used. This gives good results, especially where a high grade of machinery-castings and fine snap-flask work are poured from the same mixture. This is further substantiated by analyzing some of the best castings of tools and machines that can be found on the market. Some of the best-known firms making this class of work will be found to be using this variety of iron. With coke-iron it is well to run the silicon a little higher, although for machinery-work it is best not to have it too high.

When trouble is experienced with open or spongy iron, and the trouble cannot be traced to some such cause as rusty scrap, a good procedure is to run the total carbon in the casting as high as possible. This will give a higher content of combined carbon, and at the same time the high content of total carbon, with the graphite, usually increased slightly in this way, will keep the iron soft. When this is done it is well to consider the content of silicon, and if this is much over 2% a decrease will be found beneficial.

The Use of Carbon.—As mentioned in the first portion of this paper, silicon is commonly believed to enable a mixture to carry more scrap. This belief is open to serious doubt. It is obvious that if a mixture is running low in carbon, and ferro-silicon is added in greater amounts to enable the mixture to carry more scrap, this procedure will not only fail to enrich the carbon content, but will actually impoverish it. The reason for this lies in the fact that high-silicon iron carries less graphitic and total carbon than a good scrap, and much less than a good cast-iron. Inasmuch as the iron is dependent upon carbon for its softness, it is open to grave doubt whether, by increasing the silicon, and thereby decreasing the carbon, by adding ferro-silicon, any more scrap can be carried, and the same quality of iron poured from the cupola. The amount of scrap that can be loaded into the cupola without changing the quality of the iron is dependent upon the carbon, and especially upon the graphite. Even if we admit that an increase of silicon can cause an increase of graphite, yet, if there is not sufficient carbon present to be changed into graphite, the graphitic carbon cannot be obtained in the required proportion. Further, when it is doubtful that silicon will cause any appreciable increment in the graphite, it is open to question if the ferro-silicon does not tend to lower the scrap-carrying ability of the mixture.

A high-carbon mixture averaging, for example, 3.10% graphite, and about 2% silicon, will carry considerably more scrap than a mixture containing over 3% silicon, and lower in graphitic carbon, or than a mixture impoverished in total carbon, no matter what the silicon-content. This assertion can be proved in practical work, and it would seem that the popular idea to the contrary is based on a fallacy.

SPECIFICATIONS FOR FOUNDRY CASTINGS.

The specifications for castings adopted by the J. I. Case Threshing Machine Company, of Racine, Wis., are given in the "Iron Age" of Sept. 29. We reprint them in a slightly condensed form below. They will be found to differ in some essential particulars from those given by Mr. Summers in the article printed elsewhere in this issue:

No. 1.—Special Hard Iron. (Close Grained.)

Designed for air and ammonia compressors, high pressure engine cylinders, valves, etc.

Silicon must be between 1.20 and 1.60%. (Below 1.20 the metal will be too hard to machine; above 1.60 it is liable to be porous unless much scrap be used.)

Sulphur not over 0.095%. Any casting showing 0.115 or more of sulphur will be the cause for rejection of the entire mix. (Above 0.115% produces high shrinkage, shortness and "brittle hard" iron.)

Phosphorus below 0.70%, unless specified for special thin castings. (High phosphorus gives brittle castings under impact.)

Manganese not above 0.70%, except in special chilled work.

Transverse breaking strain, with load applied at the center and supports 12 ins. apart, on a square test bar 1 in. square and 13⅓ ins. long, must stand a stress of not less than 2,400 lbs. All bars to be micrometered and figured to an exact square inch.

Deflection not less than 0.08 in.

Shrinkage, measured on a 13⅓-in. bar cast in a yoke, giving chilled ends, must not exceed 0.161 in. after deducting one-tenth, so as to compute the shrinkage in 12 ins.

Chill, measured on the end of a test bar cast in a yoke, not more than 0.25-in., except in chilled work where certain depth is required.

Tensile strength of an extra test bar cast in sand, without the yoke, not less than 22,000 lbs.

The castings must be free from blow holes, slag, dirt, shot, cinder, kish and cold shuts.

A clean, close grained and strong iron is required for this class of work.

The mixture for this iron may be made from charcoal iron, low silicon foundry, home scrap and steel scrap not to exceed 25%, or wrought scrap not to exceed 10%.

Enough scrap should be used so as to keep the graphitic carbon down low enough to produce a close grained iron.

Extra strength and greater chill may be obtained by adding from 1 to 10 lbs. of 80% ferromanganese to every 1,000 lbs. of the charge, but should not be added unless specified.

No. 2.—Medium Iron.

For engine cylinders, gears, pinions, etc.

Silicon to be between 1.40 and 2%. (Silicon 1.50 gives the best wearing result for gears.)

Sulphur not over 0.085%. Any casting showing on analysis 0.095% or more will cause the rejection of the entire mix. (Sulphur preferred at 0.075 to 0.080%.)

Phosphorus below 0.70%, except in special work.

Manganese below 0.70 unless otherwise specified.

Transverse breaking strain, as described under No. 1, not less than 2,200 lbs.

Deflection not less than 0.09-in.

Shrinkage on test bar cast in yoke, not over 0.151-in.

Chill below 0.15-in.

Tensile strength of a test bar cast in sand, above 20,000 lbs.

The iron must be free from blow holes, shrink cavities, slag, kish, shot, cold shuts, blisters, etc.

This mixture may be made with No. 1, 2 or 3 foundry pig, home and foreign scrap. Total scrap should not be over 50%. For safety, in a 50% mix the foreign scrap should be figured at 0.100% of sulphur.

No. 3.—Soft Iron.

For pulleys, small castings and general agricultural implement work.

Silicon not less than 2.20 or more than 2.80%, with a preference for about 2.40. (Below 2.20% small castings will be very hard; above 2.80 large castings will be somewhat weak and have an open grain.

Sulphur in no case over 0.085%. (If above 0.095 the whole lot will be condemned.) High sulphur makes iron "brittle short" and causes excessive shrinkage.

For frictional wear in brake shoes, etc., the sulphur may run up to 0.150%.

Phosphorus below 0.70%, except in cases where great fluidity is required, as in thin stove plate, when it may run up to 1.25%. (Phosphorus makes iron brittle under impact.)

Manganese below 0.70%, except in chilled work. (Manganese toughens iron, produces chill and causes excessive shrinkage.) For a heavy chill the manganese may vary from 0.70 to 1.25%.

Transverse breaking strain not under 2,000 lbs.

Deflection not under 0.10-in.

Shrinkage in no case above 0.141-in., when figured to a 12-in. bar, this being equivalent to ⅛-in. to the foot on castings molded in sand.

Chill should be under 0.05-in.

Tensile strength on a sand cast bar not below 18,000 lbs.

The iron must be free from defects, such as blow holes, shot, blister, cold shuts, slag, shrink cavities, kish, contraction cracks, etc.

Misplaced cores, poor molding and insufficient cleaning will also be cause for rejection.

This mixture may be made from Nos. 1 and 2 foundry pig, home and foreign scrap.

Scrap should be used in sufficient quantity to prevent formation of kish and to obtain the desired strength. It should run from 30 to 50%, being governed by the sulphur. Equal parts or 15% home with 30% foreign scrap is a good proportion to use. Scrap or remelted iron gives strength to castings by reducing the graphitic carbon and closing the grain.

In mixing by analysis it is better to figure foreign scrap at 0.100% sulphur.

When the sulphur in the castings rises above 0.081% the per cent. of scrap should be reduced in the next mix in order to regulate the sulphur. With low sulphur (0.071% about) 50% of scrap may be used.

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THE VOLUME INCLOSED BY TWO INTERSECTING CYLINDERS.

Notwithstanding the excessively warm weather of the past summer, a number of our readers sent us solutions to the problem suggested by Mr. Alex. Miller in our issue of Aug. 4, in which the volume included between two cylinders of different diameter intersecting at right angles was desired. These solutions received are of two kinds, the geometrical and the mathematical, the former depending upon scale drawings, developments of the same and the use of the planimeter; the latter using the calculus and winding up in most cases with a long formula in the form of a series. In these each term decreases in value so that all except the first three or four terms may be neglected.

We cannot spare space to give the derivation of the various formulas and the necessary explanation, but we present in the accompanying table the formulas suggested, and the names of their authors. If values are given to (a) and (r) and the formulas tested, it will be found that 4, 5 and 6 agree quite closely. We also received a solution from Mr. Guy P. Burch, of Dubuque, Ia., and Mr. Chas. H. Clark, of Canastota, N. Y.; but as their final formulae contained other quantities than the radii of the two cylinders we do not give them here.

We desire to compliment our correspondents on the industry they have displayed at a season when industry is not popular. We are still inclined to advocate the "solution by water," which we originally suggested, as the coolest way, at least, of solving the problem for a given case.

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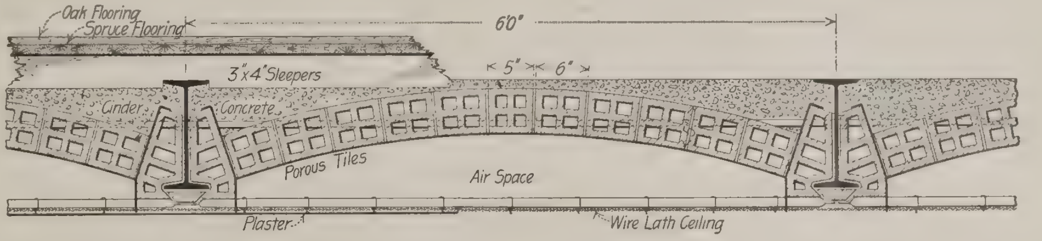
THE MERRICK FIREPROOF FLOOR.

We illustrate herewith a new form of fireproof floor construction designed by Mr. Ernest Merrick and controlled by the Merrick Fireproofing Co, of 1 Broadway, New York, N. Y. This floor consists of a true curved arch of porous terra-cotta blocks, filled above with cinder concrete, and having a wire-lath ceiling suspended beneath the arch. As will be seen from the illustration, a special skew-back block protects the floor beam, and has suspended from it a metallic hanger which hooks over its top and passes down the joint between the skew-back and the adjacent arch block, with a free end, to which is fastened the metal bars supporting the wire-lath ceiling. The arch is constructed on light portable centers of pressed steel construction, the skew-back blocks being set first and the wire hangers inserted before the arch blocks are set. This construction permits the ceiling bars and wire-lath ceiling to be erected by the plasterers after the centers have been removed and the floor proper has been completed in all other respects. Among the other claims made for the floor, in addition to the cheapness and convenience of the ceiling construction, are the greater strength of the circular arch construction and the especially complete protection of the floor-beam flanges. We are indebted to the Merrick Fireproofing Co. for the information from which this description has been prepared.



THE MERRICK CIRCULAR ARCH, TERRA COTTA FIREPROOF FLOOR WITH SUSPENDED WIRE-LATH CEILING.

The Merrick Fireproofing Co., New York, N. Y.

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FIRST ANNUAL CONVENTION OF THE CENTRAL STATES WATER-WORKS ASSOCIATION.

The first annual convention of this association was held at Springfield, O., Sept. 27 to 29. The membership now numbers about a hundred. The number of papers presented was small, partly due to the youth of the organization, which was only started in February of the present year. The membership is divided into two classes, active and associate, and the former are subdivided into resident and non-resident active, on the plan which has been so successfully followed by the New England Water-Works Association. The resident active members are limited geographically to Ohio, Indiana, Michigan, Illinois, Kentucky, West Virginia and Western Pennsylvania, and the place of meeting must be within this territory, a restriction similar to that which the New England Association removed at its last meeting. Thus far nearly the whole membership and all the officers have been from Ohio, due largely, it is presumed, to the fact that the original idea was to form an association of Ohio men alone.

The convention opened Wednesday afternoon with the usual addresses of welcome, the President, Mr. Jerry O'Shaughnessy, of Columbus, O., being in the chair. The report of the Secretary, Mr. John Fisher, of Hamilton, O., showed total receipts of $360, and a balance of $134 in the treasury.

Electrolysis and Quality of Water Supplies.

A paper dealing with these two subjects was presented by Mr. Joseph J. Pater, of Hamilton. He urged that the association should investigate the subject of electrolysis.

TABLE OF FORMULÆ FOR SOLVING THE PROBLEM OF VOLUME INCLOSED BY TWO INTERSECTING CYLINDERS.

Formulæ submitted by	Formulæ a = smaller radius. r = larger radius.
F. W. Salmon, Burlington, Ia.	Lay out to scale on paper; develop intersection of cylinders in a plane; determine area of this figure; multiply by average height obtained with planimeter, as with indicator card.
John Peterson, Montclair, N. J.	Divide upper cylinder into slices by planes intersecting axis of large cylinders, get area of each segment of large cylinder thus formed, and subtract from area of rectangle formed by chord tangent and side of upper cylinder; average the area between adjacent sections and multiply by distance apart. The sum of these products equals volume.
George N. Linday,* Chicago, Ill.	${}^2/_3\, d_0^3$; d_0 being a medium of the diameters if they are nearly alike.
Ward Baldwin,† Cincinnati, O.	$\frac{a^4}{r}\pi\left\{\frac{1}{8}+\frac{1}{64}\left[\frac{a}{r}\right]^2+\frac{5}{4\times256}\left[\frac{a}{r}\right]^4+\frac{35}{64\times256}\left[\frac{a}{r}\right]^6+\frac{147}{256\times256\times2}\left[\frac{a}{r}\right]^8+\text{etc.}\right\}$
L. K. Sherman, Lockport, Ill.	$\frac{4}{5}a^2\left(r-\sqrt{r^2-a^2}\right).$
J. H. Serviss, Closter, N. J.	$4a^2\left[\frac{r}{4}\pi-r+\frac{a^2+r^2}{6r}-\frac{2a^2r^2-a^4-r^4}{40r^3}-\frac{(a^2+r^2)(2a^2r^2-a^4-r^4)}{112r^5}-\frac{4(a^2+r^2)(2a^2r^2-a^4-r^4)-(2a^2r^2-a^4-r^4)^2}{1{,}152r^7}+\ldots\right]$
Charles W. Comstock, Golden, Colo.	$4\pi r a^2\left\{\frac{1}{32}\left[\frac{a}{r}\right]^2+\frac{1}{256}\left[\frac{a}{r}\right]^4+\frac{5}{4{,}096}\left[\frac{a}{r}\right]^6+\frac{35}{65{,}536}\left[\frac{a}{r}\right]^8\ldots\right\}.$
C. F. Peterson, Edge Moor, Del.	$r\,a^2\left\{\pi-\left[\frac{a}{r}\right]^2 0.3955-\left[\frac{a}{r}\right]^4 0.0500-\left[\frac{a}{r}\right]^6 0.0157-\left[\frac{a}{r}\right]^8 0.0069-\ldots\right\}$
S. W. Frescoln, Reading, Pa.	$a^2r\left\{\pi-\frac{1}{30}\left\{97-14\left[\frac{a}{r}\right]^2-3\left[\frac{a}{r}\right]^4\right\}\ldots\right\}.$
Fred'k M. Thomas, Skaneateles, N. Y.	$0.4a^3P\left[1+\frac{P^2}{8}+\frac{5P^4}{128}\right]$ In which $P=\frac{a}{r}$. This is an approximate formula for practical use.
A. N. Talbot,§ Champaign, Ill.	$\frac{\pi}{8}\times\frac{a^4}{r}\left\{1+\frac{1}{8}\left[\frac{a}{r}\right]^2+\frac{5}{128}\left[\frac{a}{r}\right]^4+\frac{35}{2{,}048}\left[\frac{a}{r}\right]^6+\ldots\right\}.$
George R. Dean, Rolla, Mo.	$\frac{\pi a^2 r}{8}\left\{\left[\frac{a}{r}\right]^2+\frac{1}{8}\left[\frac{a}{r}\right]^4+\frac{5}{128}\left[\frac{a}{r}\right]^6+\ldots\right\}.$

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*1323 Monadnock Block. †University of Cincinnati. §University of Illinois.

The discussion indicated that the subject was new to many of the members, although some pointed out that it had been exhaustively treated before similar societies in past years. A special report on the subject, being a study of the conditions at Dayton, O., by Mr. Harold P. Brown, of New York city, and other experts, was presented in printed form, by Mr. Chas. E. Rowe, of Dayton, and is abstracted at length elsewhere in this issue. Mr. J. R. Cook, of Toledo, said his city was one of the first to have electric railways, but they had never had an instance of injury to the water mains. Great care had been taken so to connect the tracks and the water mains as to maintain a positive current in the latter. Mr. Rowe cited an instance of a cast-iron welded joint where a test showed the rails were not carrying more than 5% of the return current. The subject of electrolysis was referred to the Executive Committee, to report to the next regular meeting, with power to pay the expenses to the next convention of some one who had made a study of the subject and would give them an address.

The other division of Mr. Pater's paper, the quality of water supplies, was designed to awaken the interest of the members in the subject. On request, Mr. B. H. Flynn, an inspector employed by the Ohio State Board of Health, outlined some work he has been doing on stream pollution. He had found that on the Sandusky River, for instance, Crestline, Bucyrus, Upper Sandusky, Tiffin, Fremont and Sandusky, located in the order named, are taking water from the river and discharging it back again as sewage for the towns below to drink.

The Additional Water Supply for Columbus, O.

Mr. O'Shaughnessy described briefly what is being done in his city in this line. About 8,000 ft. of 42-in. perforated cast-iron pipe is to be laid, of which 3,000 ft. is now down, for an infiltration gallery. Near by and connected with this pipe are 18 driven wells, 6 ins. diameter, 75 to 80 ft. deep, and 32 ft. apart. The water in the wells rises to the surface of the ground. The formation here, in a typical section, consists of 12 ft. of clay, 24 ft. of gravel, 6 ft. of boulders, 12 ft. of sand, 8 ft. of blue clay and 8 ft. of yellow clay, below which is rock. The perforated pipe is in the gravel, from 15 to 18 ft. below the surface of the ground. Bids for a concrete dam 52 ft. high, across the Scioto River, were to be received Oct. 3, the site being 5½ miles above the wells. It is thought that the effect of the water stored by the dam will be to keep the water level along the wells more constant than it would be otherwise. If water is taken directly from the river the State Board of Health expects the city to filter it.

Mr. Pater stated that where galvanized iron well points are used the perforations should be made before galvanizing, to prevent them from filling with rust.

The Purity of Public Water Supplies.

This paper was read by Mr. J. J. Hoppes, M. Am| Soc. M. E., of Springfield, O. He referred to the fact that the comparatively few recent deaths from typhoid fever in the army had stirred up the newspapers to much comment and criticism, while they scarcely mention the fact that 40,000 deaths from this disease occur annually in the United States, and many times that number of cases. The last analysis of the water from the filter gallery at Springfield, O., showed only 45 bacteria per cu. cm. He urged the members to work for legislation against the pollution of streams.

Idiosyncracies of Some Water Consumers.

In a very brief paper on this subject Mr. C. W. Wiles, of Delaware, O., cited instances of alleged bad odors in water from certain services, which odors, he said, were really due to bad plumbing in the sinks at which the water was drawn.

Sanitary Sewers and Automatic Flush Tanks.

Mr. H. C. Stilwell, of Marion, O., stated that his company was obliged, by its franchise, to furnish water free of charge for certain public purposes, including 2,500,000 gallons per year for sewer flushing. In 1894 sewers were put in operation, with automatic flush tanks. After a struggle, meters were secured on the services for the tanks. The first year afterwards the city paid nearly $200 for excess flushing water. The next year it kept under the limit. Last year the city began extra cleaning on the sewers, without notifying the company, and for the year used 5,000,000 gallons, or double the amount allowed free of charge. He was convinced that the regulating apparatus of flush tanks is not reliable, and that such devices are a menace to good fire protection.

A member stated that his works supplied 225 flush tanks, it was supposed, through orifices. The consumption running up to a high point, it was found that ½-in. faucets had been put in and were running full stream. On regulating the tanks the consumption fell 500,000 gallons a day.

Repairs to a Submerged River Crossing at Hamilton, O.

This work was briefly described by Mr. John Fisher, of Hamilton, O. On March 23, 1898, a freshet damaged a 20-in. submerged pipe, 600 ft. long. About 100 ft. of the main was undermined and a break occurred. A coffer-dam and centrifugal pumps were used in making the repairs. It was found that there were eight leaky joints, besides the broken ones. The injured portion of the pipe has been protected by piling, cut off at the top line of the pipe. It is proposed to continue this protection across the whole length of the submerged pipe. Calking with cold lead would not stop the leaks, so bands were used in addition.

Mr. J. R. Cook, of Toledo, O., said he had a 16-in. main, 1,300 ft. long, beneath the Maumee River. A leak occurred in 28 ft. of water at a ball and socket joint. Sand blast action made a large hole. A hand-hole plate was used as a temporary repair and a sleeve and lead joint as a permanent repair.

Closing Business.

The following are the principal officers elected for the ensuing year: President, Mr. T. R. Cook, Toledo, O.; Secretary, John Fisher, Hamilton, O.; Treasurer, Chas. E. Rowe, Dayton, O.; Editor, J. J. Pater, Hamilton, O. For the next place of meeting Cincinnati was chosen, it receiving 22 votes, against 15 for Put-in-Bay, O.

Excursions.

Besides several interesting trolley rides, there were excursions to the State Masonic Home, the shops of Warder, Bushnell & Glessner, manufacturers of reapers, binders and mowers, and to the pumping station of the local water-works. A lunch was served at the pumping station by the water department.

An account of the exhibits of water-works appliances will be found under Industrial Notes.

◆

OHIO HAS 1,228 COAL MINES, according to the annual report of Chief Mine inspector R. M. Haseltine. Most of these are small, however, only 413 employing more than ten men. The total production in 1897 was 12,448,822 tons, a decrease of nearly half a million tons over 1896 and 1½ million tons over 1895.

Of the year's coal production 4,106,124 tons were mined by machinery, a gain of 737,775 tons as compared with 1896. 732 hands were engaged in operating the machines, as against 579 in 1896, and there were 5,001 men engaged in blasting down and loading out the coal after being undermined by the machines. Coal is produced by machinery in 53 mines, as compared with 44 during last year. At the close of the year there were 166 electric machines and 67 which used compressed air.

There were 277 casualties reported, of which 40 were fatal, 142 were serious, and 95 were of minor consequence. There were 311,220 tons of coal mined to each life lost, as compared with 314,942 tons during 1896. There were 87,667 tons produced to each serious injury received and 44,841 tons were secured to each casualty that occurred as compared with 64,563 tons during 1896. 35.4% of the accidents were due to falls of roof, 17.3% to falls of coal, 25.3% to contact with mine cars, and 5.8% to premature explosions of powder.

Light carburetted hydrogen gas (fire damp) was present in 34 mines as compared with 38 during 1896, 4 serious and 1 minor accident are reported as emanating from this source.

◆

COTTON PRODUCTION, in the United States, has shown a remarkable increase and a coincidental fall in price. U. S. Treasury statistics show that since 1872 the United States has quadrupled its cotton production, and the price is now about one-fourth of what it was then. In 1872 the cotton crop was 1,384,084,494 lbs., with an average price of 22.19 cts. per pound—with paper money at some discount. In 1898 the crop was 5,667,372,051 lbs., and the average price was 6.23 cts. per pound. Twenty-five years ago the United States produced 70% of the cotton of the world, and now produces 85% of all that is used. The cotton crop of other cotton-producing countries was an average of 1,618,000 bales per year between 1872-78 inclusive, and 1,924,000 bales for the average of the years 1890-97. The price of cotton cloth is also reduced at about the same rate. In 1872 "cotton printed cloth" was quoted at 7.38 cts. per yd.; in 1898 the same grade of goods bring 2.17 cts. per yd.

◆

THE EXPORT TRADE OF THE UNITED STATES, as shown in an article on the world's export trade in the Antwerp "Journal of Maritime Interests," has increased nearly 150% since 1872, and has passed from fourth to the second place in the list of nations. In the interval, 1872-1898, the exports of England increased $207,475,000, while those of the United States gained $620,109,000. France, since 1872, has changed places with the United States, and is now fourth instead of second; she has lost $69,673,000 in this time. Germany holds third place and Russia fifth, with Austria-Hungary and Belgium holding sixth and seventh places. The total amount and relative rank of different nations at the two periods is shown in the following table:

	—Amount of exports.—			Relative rank.	
Countries.	1872.	1896.	Increase.	'72.	'96
England ...	$1,235,200,000	$1,422,000,000	$207,475,000	1	1
United Sta's	430,583,000	1,050,692,000	620,109,000	4	2
Germany ..	559,700,000	994,156,000	384,456,000	3	3
France	726,066,000	656,393,000	*69,673,000	2	4
Russia	270,586,000	513,908,000	261,322,000	5	5
Aust-Hngry	250,900,000	369,016,000	118,116,000	6	6
Belgium ...	193,000,000	283,324,000	90,324,000	7	7

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*Decrease.

A PROCESS FOR MAKING LEVEL GLASSES which is a decided improvement over old methods is described in "Iron Age" for Sept. 29. This process has been adopted by the Stanley Rule & Level Co., of New Britain, Conn. The level glass is centered properly and brought into contact with a 6-in. cast-iron wheel running at 2,500 revolutions per minute. The wheel has a sharp ridge on its circumference, and the friction between this and the glass melts the glass and small particles of iron are fused into the glass, leaving a sharply defined permanent mark without weakening the glass, as in the ordinary method of marking by scratching.

◆

TESTS OF THE STRENGTH OF FLAT HEADS for cylinders subject to internal pressure were recently made by Prof. C. Bach and reported in the "Zeitschrift des Vereines Deutscher Ingenieure." The heads tested were over 2 ft. diameter. For cast-iron heads the author deduces from his tests the following formula:

$$K_b \geqq 0.8 \left\{ \frac{r}{s} + \left(\frac{a - 0.5\,r\left(1 + \frac{r}{a}\right)}{s} \right)^2 \right\} p.$$

For riveted flanged heads with a good sized radius for the curve at the junction of flange and head he proposes the following:

$$K_b \geqq \left\{ \frac{1}{2}\,\frac{r}{s} + \varphi \left(\frac{a - 0.5\,r\left(1 + \frac{r}{a}\right)}{s} \right)^2 \right\} p.$$

In these formulas—

K_b = assumed working stress for bending.

a = diameter of head in inches.

φ = percentage of elongation of metal in ultimate tensile test.

r = radius of curve at junction of flange and head.

s = thickness of metal in inches.

p = internal pressure on head in pounds per sq. in.

Prof. Bach states that his tests indicate that the strength of flat heads varies not as the thickness, as D. K. Clark supposed, but as the square of the thickness.

◆

RAINFALL IN INDIA is variable. English engineers report as follows concerning the rainfall in the Midnapur and Howrah districts of Lower Bengal: The average annual rainfall in this section is about 70 ins.; but observations made at Ban Kura record a rainfall as follows for the four days ending at 8 a. m. on the dates set down:—

June 16	0.90 ins.	June 18	12.48 ins.
June 17	6.45 "	June 19	2.40 "
Total			22.73 "

◆

THE UTILIZATION OF OLD RAILS in railway track is a very important matter, in order to increase the service life of the rails and several methods have been tried to make old rails again available for use in the main track. Many rails are removed from the track on account of worn, battered or depressed ends, and the Holland Co., of Pittsburg, Pa., has a plant for cutting off the ends and re-drilling the rails. A sufficient length is cut off to remove any marking due to the old splice bars, so as to get a good bearing for the new bars. The rails are calipered and arranged in regard to height, being graded to 1-32-in. in height, so that they go together well in the track. This method was described in our issue of Aug. 18 (p. 102). Rails which have been in service for 15 years have been treated in this way and put back in the main track. The plant has a capacity of 200 tons per day, and the company has several contracts on hand. The Holland Co. also re-rolls old rails to smaller sizes. This practice was introduced a few years ago by the McKenna Rail Re-Rolling Co., of Joliet, Ill., which has treated large quantities of rails.

BOOK REVIEWS.

CAMBRIA STEEL.—A Handbook of Information Relating to Structural Steel, Containing Tables, Rules and Formulas for the Use of Engineers and Architects. Cambria Iron Co., Johnstown, Pa. Leather; 4½ × 7 ins.; pp. 350; illustrated; $2.

This is the fourth edition of the Cambria Iron Co.'s pocket-book, and it shows considerable improvement over preceding editions. In place of the tables of weights and dimensions of the earlier editions it includes plates of sections, complete tables of weights, dimensions and properties of the principal structural shapes manufactured by the company, together with numerous tables and formulas useful to the structural engineer. It is stated that the tables pertaining to structural shapes were especially prepared for this edition. Those giving the properties of I-beams, channels and angles, safe loads of channels and I-beams and spacing I-beams are given in detail for each section, so that the required information can be obtained without interpolation. The various mathematical tables, formulas and other information have been compiled from authentic sources and revised and corrected to bring the information up to date. Altogether the book is very creditable in contents and make-up, and every engineer having structural work in charge can profitably add it to his list of manufacturer's pocket-books. A good index is provided.

OUTLINES OF PRACTICAL HYGIENE.—By C. Gilman Currier, M. D., Assoc. Am. Soc. C. E., Fellow of the New York Academy of Medicine, etc. Third edition, revised and enlarged. New York: E. B. Treat & Co., 242 West 23d St. Cloth; 6 × 8 ins.; pp. 461; 86 illustrations; $2.

This book treats a great range of subjects, and on the whole in a very satisfactory manner, considering the necessary limitations of space. The principles laid down seem to be well in accord with the best ideas and practice. The greatest faults of the book seem to be the failure, in the latest revision, to bring some of the sections wholly up to date. Thus, under garbage disposal, no mention is made of utilization or reduction processes, which have been prominently before the public of late and deserve some words both of praise and caution. Under water, more might well have been said regarding mechanical filtration, while it would help many readers to know that slow sand filtration is now being used in this country with notable success at a number of places. Besides the subjects already indicated the book discusses soil, climate, clothing, bathing, diet, exercise, lighting, heating, ventilation, plumbing, infectious diseases, disinfection, and many other vital matters affecting the health of the individual and the community.

EXPERIMENTAL MECHANICS.—Tests and Experiments made by the Class of '99 of the Stevens Institute of Technology during the Supplementary Term, June and July, 1898. By D. S. Jacobus, M. E., Professor of Experimental Mechanics and Engineering Physics, Stevens Institute of Technology, Hoboken, N. J. Press of the Stevens Indicator. 8vo.; cloth; pp. 67, with blank pages for notes. $1.50.

This book was printed for the use of one class in the Stevens Institute, but we understand that a few copies are for sale. It consists of brief directions for making tests, formulae for calculating results, and tables to be filled out by the students when the tests are completed. The preface states that experience has shown it to be necessary to modify from year to year, tables and directions such as those given, and it has been decided, therefore, not to issue a number of books to be used by succeeding classes, but only enough for one class each year, so that any desired changes may be made. The tests, concerning which directions are given, all of which with many others are required to be made, comprise tests of two steam boilers, of a condensing engine with independent vacuum pump and with a jet condenser, of a compound engine, of a simple non-condensing engine, of a rotary engine, of a steam turbine, of a gas engine connected direct to a dynamo, of a hot-air engine, of a steam pump, of a centrifugal pump, of ejectors and injectors, of air-compressors, fans and blowers of different kinds, of dynamo meters, of a water wheel, flow of water, and of steam in pipes, of lubricating oils, of a steam radiator, of non-conducting coverings, etc.

A large number of blank pages are bound in the book for additional notes and sketches. We commend the idea of this little book to the professors of mechanical engineering in other technical schools. It is the result of many years of experience in testing work in Stevens Institute.

THE NEW ROADMASTER'S ASSISTANT.—A Manual of Reference for those having to do with American Railroads. By George Hebard Paine. New York: "The Railroad Gazette." Limp cloth; 4¾ × 7¼ ins.; pp. 253; illustrations, 259. Price, $1.50.

This book is the successor to the "Roadmaster's Assistant," written by William C. Huntington in 1871 and revised by the late Charles Latimer in 1877. The arrangement and treatment of the subjects follow mainly upon the lines of the former work, but while the new book is more comprehensive than the old one, it is much less thorough, the style being general and brief rather than detailed. This is necessary in view of the variety of subjects included in this small book, but it is in many cases unsatisfactory, as it allows of but very little information being given on any one subject. As an example, the man looking for information as to the once much discussed "miter joint" for rails, finds only a diagram plan which "shows what is called the mitered end, a plan that has been largely followed on the Lehigh Valley R. R." There is no reference to the merits or demerits of, or the results of experience with, this joint, and as a matter of fact the Lehigh Valley R. R. some years ago abandoned the use of this joint. In the same way frogs are disposed of in a little more than one page of type, and the brief description of the automatic switchstand states that if the switch is "set wrong it will be thrown by the train itself whether going over the main track or side track route." This might be understood to mean that a train approaching the toe of a misplaced switch will throw the switch right, which is, of course, incorrect. The book nevertheless contains a considerable amount of information and is a useful addition to modern literature on railway track. It is well printed in large type, but considerable space is wasted by wide margins with unnecessary marginal paragraph headings.

PRISMOIDAL FORMULÆ AND EARTHWORK.—By Thos. U. Taylor, C. E., University of Va.; M. C. E., Cornell University; Assoc. M. Am. Soc. C. E. John Wiley & Sons, New York. Cloth, 9 × 5½ ins.; pp. 102; diagrams. $1.50.

This is not a book of earthwork tables, but an historical and practical treatise on prismoidal formulæ and their application to earthwork under many varying conditions of surface. Mr. Taylor, in Chapter I., takes up the formulæ of Newton, Hirsch, Koppe and Kinklin, proves and extends them and shows their limitations. He proposes no new formula, but points out that the term "prismoidal formula" is misleading, inasmuch as in another chapter on two-term formulæ he shows that there are an infinite number of formulæ more characteristic of the prismoid than that formulated by Newton. But the rules of Newton and Kinklin apply to the prismatoid and cylindroid, and they will thus apply with exactness to all forms of earthwork that fall in the class of ruled surfaces. As the burden of the work of finding the volume of earthwork cuts or fills consists in obtaining the areas of cross-sections, Mr. Taylor devotes himself to developing methods by which these areas can be found correctly, and with the least labor. To this end he explains the construction of a diagram which applies to all three-level sections and renders the work easy. He illustrates this by a number of problems worked out, including five-level, or very irregular surface sections, borrow-pits, etc. The cost of earthwork is discussed, chiefly based upon data taken from Trautwine; and included in this section are drag and scraper work, steam-shovel work, overhaul, etc. In another chapter he treats of correction for curvature, giving also Rankine's and Henck's methods. He concludes with the chapter on two-term formulæ, before referred to. The treatment of this subject is necessarily mathematical; but it is simple in form and easily understood, and according to the bibliography appended, on both the prismoid and earthwork, Mr. Taylor gives us a very complete and satisfactory resume of all authorities.

AMERICAN CEMENTS. — By Uriah Cummings. Boston: Rogers & Manson. Cloth; 6 × 8½ ins.; pp. 299; illustrated; $3.

In his preface the author of this book, who by the way is a manufacturer of natural cement, states that the chief motive which has animated the work "has been a desire to an adequate consideration paid to the claims and merits of American rock cements." In this connection he says:

> It has always seemed to the writer that scant justice has been done to natural hydraulic cements and that the tendency to regard artificial products as, in some mysterious manner, much superior to all others has no sufficient justification in the facts of the case, and that when all the evidence is heard it will be found and conceded, that for enduring qualities, for excellence in places of trial, for permanence and for worth, no artificially made cement can be found to compare with that mixed in the molds of nature.

As the author, on p. 192, states that what he should consider an ideal cement would

> consist in a selection of the raw materials which were found to be best adopted for the purpose (especial care being taken at least as to the quality of the clay) and then to be thoroughly and finally commingled in correct proportions, then calcined to a mild clinker, sufficiently vitrified to produce a medium weight, and then ground exceedingly fine.

It is evident that he refers in his prefatory statement to artificial cements as they are generally made and not to such cements as they might or should be made. In a word, the gist of the author's argument throughout the book is that the modern methods of Portland cement manufacture which produce a high short-time testing product are entirely faulty. That he succeeds in proving this is perhaps doubtful, but he at least presents evidence strong enough to be worth pretty careful study, and any cement user trained in modern doctrines in this matter will do well to read Chapters III., IV., VI. and VII. of this book. Outside of these chapters the book is not to be extravagantly commended, to say the least, and in some parts reads much like a trade catalogue. With these parts improved or cut out entirely and the really important chapters written in a more temperate tone the author's argument would have carried much more conviction to his readers than it is likely to do with the book in its present shape.

AMERICAN STREET RAILWAY INVESTMENTS.—A Supplement to the Street Railway Journal. Published annually for the use of bankers, brokers, capitalists, investors and street railway companies. 1898. The Street Railway Pub. Co., Havermeyer Building, New York. Cloth; 12¾ × 9½ ins.; pp. 279; maps. $3.

This excellent publication adds several new features to its annual exhibit of the mileage, equipment and financial condition of the street railways throughout the United States and Canada. The preface makes a comparison of gross receipts in 1896 and 1897 that has a general interest. According to this statement, 26 properties earned over $1,000,000 each in 1897; 19 earned from $500,000 to $1,000,000; 46 properties earned from $100,000 to $500,000; 51 earned from $50,000 to $100,000, and 33 properties earned from $25,000 to $50,000. In the first group the average rate of increase over 1896 was 2.20%; in the second group there was a decrease of earnings amounting to 0.11%; in the third an increase of 1.87%; in the fourth an increase of 1.61%, and in the fifth group the average decrease was 0.67%. This table rates 175 properties in all, and the total receipts from these were $113,394,903, with 75.2% of this amount credited to the 26 companies in the first group. The proportionate receipts of the other groups respectively were 11.3, 9.4, 3.0 and 1.1%. The gross receipts of the 175 companies in 1897 were 1.9% higher than in 1896. The various street railway companies are then taken up in alphabetical order; and in every case, where accessible, the statement covers the population in 1880, 1890 and 1896; date of charter or consolidation; plant and equipment at latest possible date; capital stock, funded debt, liabilities and earnings and operating expenses; officers of the road, etc. A new and useful feature is the presentation in tabular form of operating expenses and receipts and a balance sheet for four or five years past. This table enables comparisons to be made without referring to previous issues of the annual. There is also an increased number of excellent maps showing the street railways of principal cities throughout the United States.

SOME COMMON ERRORS IN IRON BRIDGE DESIGN.—By W. C. Kernot, Professor of Engineering, Melbourne University. Ford & Son. Melbourne, Australia. Cloth; 6 × 9 ins.; pp. 49; illustrated.

The trite saying that an engineer learns more from his failures than from his successes receives considerable substantiation from this little volume, in which Prof. Kernot has collected and analyzed something over a score of the most common errors made in designing iron and steel bridges. These errors are considered by the author under the following headings: Disproportion of Foundation Area to Load Carried; Excessive and Disproportionate Size of Columns; Girders Supported in an Unfavorable Manner; Imperfect Expansion Apparatus; Insufficient Depth of Girders; Unfavorable Disposition of Material for Enduring Bending Moment; Insufficient Connection Between Chord and Web; Vertical Stiffeners Absent or Wrongly Placed; Incomplete Triangulation; Redundancy; Curvatures of Members; Eccentricity; Unscientific and Wasteful End Pillars; Unduly Numerous Systems of Triangulation; Inefficient Forms of Compression Members; Imperfect Joining of Tension Members; Local Weakness at Intersection of Web Members; Arrangements Involving Serious Secondary Stresses; Arrangements Involving Severe Temperature Stresses; Insufficient Lateral Bracing; Cross Girders Not Placed in Proper Relation to the Web System of Main Girders; Improperly Designed Cross Girders; Unscientific Forms of Footpath Brackets; Faulty Parapets.

In each of these cases the author defines the error in a general way, then follows by quoting and describing several actual examples in which it occurs, and, finally, points out the best method of remedying or avoiding it. Generally the examples selected are legitimate ones and the criticism is well taken, and if once in a while the author dwells upon errors of old practice now generally avoided or selects cases which are purely local it does not come at all amiss to remind engineers that they are examples to be avoided. It will repay bridge engineers to obtain and read this book to refresh their memories concerning some of the errors which have been made in the past, and which are to be avoided in the future.

A POCKET-BOOK FOR MECHANICAL ENGINEERS.—By David Allan Low, M. I. Mech. E., Professor of Engineering, East London Technical College (People's Palace), London. With over 1,000 illustrations. Longmans, Green & Co., London, New York and Bombay. Cloth; 4¼ × 6⅝ ins.; pp. 740. $2.50

This new addition to the long list of "pocket-books" for engineers is a very creditable production. It differs from all other recent books of its class in the great number of its illustrations, and in the unusual amount of space given to details of design of power transmission appliances, such as pillow blocks, hangers, keys, pulleys, etc. We notice, for example, two pages of illustrations of different styles of lock nuts, a page of spanners or wrenches, with proportions of sizes, a page of wire rope fastenings, 2½ pages of details of connection of iron or steel roof trusses, two pages of types of cross-heads, etc. Over a dozen forms of steam boilers are illustrated, more than 20 pages being devoted to them, including their descriptions and lists of sizes. The most notable differences between this pocket-book and the American books of Trautwein, Haswell and Kent, are the large proportion of space given to illustrations, the smaller size, the smaller number of pages and the larger type used. The book, therefore, contains probably less than one-third of the amount of text that is given in either of the other books named. The subjects treated and the amount of space given to each are approximately as follows: Mathematical tables, weights and measures, notes on geometry, algebraic and trigonometrical formulae, etc., 203 pages, of which about 25 are devoted to tables of comparison of Metric and British measures. Center of gravity and moments of inertia, 14 pages. Statics, kinetics, friction, efficiency of machines, etc., 28 pages. Sizes, weights and strength of materials, 98 pages. Stress diagrams for framed structures, 17 pages. Screws, bolts, nuts, keys, cotters, pipes and pipe joints, 25 pages. Shafting, coupling, bearings, 32 pages. Belt, rope, friction, and toothed gearings, and wire rope transmission, 36 pages. Cranks, eccentrics, connecting rods, cross-heads, pistons, stuffing boxes, valves, 31 pages. Heat, combustion, fuel, properties of steam, factors of evaporation, 37 pages. Steam boilers, riveted joints, boiler details, 62 pages. Steam engines, 43 pages. Locomotives, permanent way, 49 pages. Gas and oil engines, 19 pages. Compressed air, hydraulic transmission of power, hydraulics, 25 pages. Miscellaneous notes and data, 8 pages. Index, 18 pages.

The author states in his preface that the preparation of the work has occupied the whole of his spare time during the past five years, and he has had the services of several assistants in the calculation of tables and the preparation of the illustrations. The older tables have been checked by comparing them with those given by the best authorities, English, American and German. So far as we have been able to examine it, the work seems to have been exceedingly well done. Since the book contains so much less matter than the standard American works of its class, it can by no means be considered as a substitute for them, but since it contains much matter which they have omitted, chiefly in relation to details of design, such as are found in works on machine design, it may prove to be a useful companion to them.

RESERVOIR SITES IN WYOMING AND COLORADO.—Report from Capt. H. M. Chittenden of a Preliminary Examination Made by Him of Certain Reservoir Sites in the States of Wyoming and Colorado. House of Representatives, Document No. 141. Paper; 6 × 9 ins.; pp. 110; illustrated. Address Members of Congress or the author, care of Missouri River Commission, 1515 Locust St., St. Louis, Mo.

This investigation originated in an appropriation of $5,000 in the River and Harbor bill of June 3, 1896:

> For the examination of sites and report upon the practicability and desirability of constructing reservoirs and other hydraulic works necessary for the storage and utilization of water, to prevent floods and overflows, erosion of river banks and breaks of levees, and to re-enforce the flow of streams during drought and low-water seasons, at least one site each in the states of Wyoming and Colorado.

The report discusses briefly but quite comprehensively the various phases of water storage and stream flow regulation mentioned in the above quotation, reviewing some classic French studies of flood prevention made in the middle of this century and giving especial attention to the storage of water for irrigation. Among the appendices to the volume is a monograph by Mr. Jas. A. Seddon, Assistant Engineer, "On Reservoirs and Their Effects on the Floods of the Mississippi System." Sites for five reservoir systems, including seven reservoirs, were surveyed under Captain Chittenden's direction, and estimates of their cost were made and are included in the report. Three of these systems are in Wyoming, the Laramie, Sweetwater and Piney Creek systems, and two in Colorado, the South Platte and Loveland systems. The character of the dams recommended are straight and curved masonry, and combined rock-fill and earth structures. The primary function of these reservoirs would be the storage of water for irrigation and power. Possibly they would also alleviate flood conditions in the rivers. Captain Chittenden is convinced that the cost of a reservoir system for the Mississippi large enough to materially diminish the height of floods would be too great to warrant the expenditure, "unless it is called for by other and more direct causes." He is strongly of the opinion that reservoir construction is essential to the wisest development of the arid West, and that it should be carried out by the general government, which should control all the water rights involved and own and operate the reservoirs, holding "the stored waters absolutely free to public use under local regulations, subject only to the right to close the reservoir whenever flood protection or other emergency should require."

The report is illustrated by good half-tone reproductions of a number of handsome photographic views of reservoir sites, by several diagrams, and by seven large folding maps of the reservoir sites examined.

FORESTRY CONDITIONS AND INTERESTS OF WISCONSIN.—By Filibert Roth, Special Agent. With a discussion by B. E. Fernow, Chief of the Division of Forestry, U. S. Department of Agriculture, Washington, D. C. Paper; 9 × 6 ins.; pp. 76; map.

In an introduction, Mr. Fernow describes the object of and the methods followed in ascertaining forest conditions; while Mr. Roth enters into the detail of the investigation, by counties, and describes the principal timber growing in Wisconsin. A summary of Mr. Roth's report shows that Wisconsin, with a population of 2,000,000 and taxable property worth about $600,000,000, annually consumes over 600,000,000 ft. B. M. of lumber, besides enormous quantities of other wood materials. In the northern part of the state, with a land surface of more than 18,000,000 acres, only 7% is under cultivation, and the rest is a continuous body of forest and waste land. From this area in the last 60 years over 85,000,000,000 ft. B. M. of pine lumber alone has been cut, with an annual average of 3,000,000,000 ft. for the last ten years. The lumber industries of the state employ 55,000 men, receiving $15,000,000 in wages per year, and the value of the product is $35,000,000; to this $25,000,000 more must be added as coming from wood manufactories. The standing timber is estimated as follows: Of pine, 17,000 million feet; hemlock, 12,000 million feet; hardwoods, 16,000 million feet; the present annual growth amounts to about 900 million feet, of which only 250 million feet is marketable pine, and this growth is largely balanced by natural decay in over-ripe timber. At present nothing is being done to restock 8,000,000 acres of "cut-over" land, and Mr. Fernow recommends that the state of Wisconsin in its own interest, establish a permanent forestry commission, and control the manner of exploiting forests under state ownership.

NOUVEAU TRAITE DES BICYCLES ET BICYCLETTES.—Equilibre et Direction; Le Travail. Par C. Bourlet, Docteur Es-sciences Mathematiques, Etc. Encyclopedie Scientifique des Aide—Memoire. Second edition. Paris: Gauthier-Villars et Fils. Two volumes. Paper; 7½ × 4⅝ ins.; pp. 180, and pp. 186; illustrated.

The first edition of these two volumes on the design of and the work done by bicycles was published in 1895; but the rapid development and radical changes made in these machines render a new edition necessary. Mr. Bourlet calls those machines bicycles which have the motor wheel in front, and is thus at the same time a motor and a directing wheel; and terms those having the motor wheel behind, bicyclettes. In succeeding chapters of the volume on "Equilibrium and Direction," he treats of the trajectories of the two wheels, the analytical conditions of equilibrium upon the level and upon inclined ground, or the security of the machine; and finally discusses effects of a change in direction. In this volume he devotes a chapter to the construction of bicycle race-tracks. He handles this from a mathematical and a practical point of view, and discusses gradients and curves for semicircular, elliptical and parabolic tracks.

The second volume, that on "Le Travail," is devoted to a mathematical discussion of the resistances to be overcome by the cyclist, or the friction in transmitting gear, the rolling friction, resistance of the air, etc. A chapter is also given upon the measure of work performed on the level and on grades, by the pedal, etc., and the influence of weight. The final chapter is upon the product of work; a study of pedal and crank pressure and the choice of gear. In the latter connection he argues that the maximum work, under the best conditions, is obtained with 115 revolutions of the crank per minute. Mr. Boulet compares the work done by a pedestrian and by a cyclist and concludes with a number of tables giving air-resistances at various speeds; the resistance and work performed at varying speed on a level or an inclined road, on the race track and on a mountainous route. The two works combined are a careful mathematical and theoretical discussion of bicycle design and operation.

MECHANICAL HEATING AND VENTILATION.—An Exhaustive Analysis of All Systems. Second edition. By M. C. Huyett, Heating and Ventilating Engineer, 66 Piquette Ave., Detroit, Mich. 8vo.; morocco; pp. 155; $3.50.

The author of this work is a man with a grievance—several grievances, in fact—and therefore his book is forcible and interesting, although his style is not above criticism, and his statements sometimes lack in technical precision. His two chief grievances are that "text-books, so called," do not give the kind of information concerning heating and ventilation that he thinks they should give, and that manufacturers of fan blowers tell falsehoods in their catalogues concerning the capacity of their fans and the horse-power required to drive them. The book is addressed "To Architects," and he tells them

> The following pages present the essentials of heating and ventilation; the tables are original and are given to aid in the development of your part of plans on a scientific basis. It is information which has been withheld by manufacturers and engineers.

A sample of the author's method of treating technical questions is the following. On p. 13 he says:

> The subject has been treated from a theoretical standpoint by most writers; in no "text-book," so called, can anything be found helpful or even suggestive which will aid architects in proportioning flue areas required for heating and ventilation.

This certainly encourages us to hope that in this book at least something helpful and suggestive on the subject will be found, and here it is on p. 25, under the heading, "Proportioning Areas of Heat Risers and Ventilating Flues."

> Conditions are seldom alike, consequently no iron-clad rule can be stated for initial velocities. The judgment of a heating and ventilating engineer, based on practical experience, is the ony safe guide. Velocities must base on size and exposure of rooms, kind of occupancy, and location and distribution of displacement openings.

Then follows a "rule for computing pipe and riser areas for heating and ventilation based on changing air times per hour," given in a most complicated form, but which may be translated into a simple form as follows: Multiply the capacity of the room in cubic feet by the number of times the air is to be changed in an hour; divide the product by the velocity the air is to have in the flue in feet per second, and the result will be the area of the flue in square feet. Following this are several pages of tables of figures giving flue areas for different capacities of rooms and different velocities of air.

With all this how much has the architect learned that is helpful or suggestive in proportioning flue areas? Why, simply that he must first call in a heating and ventilating engineer of practical experience who will use his "judgment" in determining the number of times the air should be changed and the velocity to be given the air in the flue, and then with these data given he may by reference to Mr. Huyett's tables and rules compute the area required. There is not a word in the book so far as we can find by means of which a student of the subject of heating and ventilation may arrive at a "judgment" as to the velocity, or by which he may check the "judgment" of the "practical man."

Mr. Huyett's criticism of the fan manufacturers for publishing false information in their catalogues is no doubt deserved. He gives examples from the lists of four makers whom he calls A, B, C and D, showing that the actual capacity of their fans is only about half, and in some cases less than half of that claimed, and that the horse-power required to drive them at the stated number of revolutions is often understated by about half. A disk fan rated at 25,000 cu. ft. per minute was found by anemometer test to deliver less than 7,000 cu. ft. He has done a public service in thus protesting against this evil, and it is to be hoped that fan manufacturers will pay attention to it and mend their ways.

The book contains some good suggestions in regard to specifications for heating and ventilating apparatus, from which we quote the following:

> Any seller who fails to specify the actual quantity of 1-in. steam pipe, diameter of fan wheel, and its width at the periphery, r. p. m. and speed of engine, does so with the intent to get a contract that shall be definitely indefinite—except they hedge behind "we are responsible" and "we guarantee." Responsibility and guarantee never yet warmed and ventilated a building. That requires a definite quantity of steam pipe and volume of air contact therewith.

NORTHWARD OVER THE "GREAT ICE." A Narrative of Life and Work Along the Shores and Upon the Interior Ice-Cap of Northern Greenland in the Years 1886 and 1891-1897. With a Description of the Little Tribe of Smith Sound Eskimos, the Most Northerly Human Beings in the World, and an Account of the Discovery and Bringing Home of the "Saviksue," or Great Cape York Meteorite.—By Robert E. Peary, Civil Engineer, U.S.N., M. Am. Soc. C. E., M. Am. Geographical Society. With maps, diagrams and about 800 illustrations. In two volumes. Frederick A. Stokes Co., New York. Cloth, 9 × 6¾ ins.; pp. 520 and 625.

This story of adventure and discovery in North Greenland is remarkable among narratives of its kind, as illustrating what one man can do,almost unaided by others, in extending our common knowledge of geography, and of a remote and peculiar people. Though Mr. Peary has devoted twelve years of his life to Arctic explorations, has made six expeditions to the North, and for nearly four years of that time remained within the Arctic Circle, the government has never appropriated, nor been asked to appropriate one dollar towards this purpose, nor has any scientific or geographical society, as a body, provided funds for furthering his efforts. Fully two-thirds of all the money expended has been earned by Mr. Peary and by his wife, by lectures and publications issued. Some few individuals have been generous in their personal contributions, though none of these latter exceeded $1,000, except the aid extended by Mr. Morris K. Jesup, in assisting to send a ship after Mr. Peary in 1895. Mr. Peary, evidently, did not propose to be open to the charge of "wasting other people's money on useless Arctic exploration," and he reduced the risk of human life to a minimum, the chief risk being to himself.

In the introduction to this work, Mr. Peary gives full credit by name to those who assisted him in his efforts, describes his outfit, and gives a sketch of those who accompanied him to the North. He then takes up in detail his several expeditions, from the reconnoissance of 1886 to his latest voyage. In the first volume the chief interest centers upon his 1,200-mile march across the Greenland ice-cap to Independence Bay and back, with but one companion—the faithful Eivind Astrup. Aside from the details of camp-life and the experiences on the ice-cap and the rocky moraines, very considerable information is given relating to the geological structure of the region visited, and to the peculiar Smith Sound tribe of Eskimos and their manners and customs. The many illustrations are chiefly reproduced direct from photographs, and in their way tell a graphic story of the difficulties encountered and surmounted and the curious and interesting people met with.

The second volume is devoted to the North-Greenland expedition of 1893-94, and 1894-95, and to the summer voyage of 1896-97 after the Cape York meteorites. Here again we have detail, but very interesting detail, of the almost daily doings of the party in building and fitting out their winter home, in passing the weary winter in preparing for the long marches across the ice-cap and in actually making the several journeys towards the North. This part must be read to be appreciated as no abstract will do justice to the strange conditions encountered.

Mr. Peary gives a detailed history of the Cape York meteorites, of exceptional size, purity and homogeneous composition. He traces this history to 1818, when Captain Ross found the natives in possession of rude implements edged with iron which they said came from an "iron mountain" near Cape York. Various expeditions sought this iron mountain, but it remained for Mr. Peary to discover the true source of these nickel-alloyed fragments of iron. Having gained the confidence of the Eskimos, in 1894, he was led to the long-sought-for "mine" and found it to be three great masses of true meteoric iron, the "Woman," the "Dog," and the "Tent," as the natives termed them. The first named weighed 5,500 lbs., and this was secured in 1895 after much trouble in getting it aboard the "Kite," and it and the "Dog," a smaller mass of 1,000 lbs., were transported to New York. The great meteoric stone, the "Ahnighito," or the "Tent," was partly removed from its bed in 1896 and finally secured in 1897. This mass, the largest of the meteorites, was irregular in shape and had a maximum length of 11.2 ft., a maximum width of 7.6 ft., and a maximum thickness of 6 ft.; its estimated weight is between 90 and 100 tons. Etchings show the characteristic Widenannstätten figures, and analyses show the typical meteoric nickel-steel alloy of about 92% iron and 8% nickel. Final analyses of the three masses indicate that they were three fragments of one original mass. In answer to objections made that the specimens obtained were not of meteoric origin, Mr. Peary produces certificates from three of the highest authorities upon this branch of mineralogy—Prof. L. Hetcher, of the British Museum; Dr. E. A. Weinschenk, of the Institute of Minerals of Munich, and Professor Bezina, Director of the Natural History Museum of Vienna. The book itself is handsome in appearance and it includes a map of the Arctic regions, showing the most recent explorations of Robert E. Peary, Fridtjof Nansen and F. Jackson; the map being made by Prof. Angelo Heilprin, who accompanied Mr. Peary.

ENGINEERING NEWS
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THE MATTER OF WATER FILTRATION AT PHILAdelphia was referred to Mr. John C. Trautwine, Assoc. Am. Soc. C. E., Chief of the Bureau of Water, on Aug. 3, requesting that by Sept. 1, or in just four weeks, he submit plans and estimates for the "filtration of all the water used by the city." Mr. Trautwine submitted his report to Mr. Thos. M. Thompson, Director of Public Works, on Sept. 9, and the report has just been made public. The report first mentions the inadequacy of the time available for its preparation, and states that on that account no general plan can be recommended for adoption. In deference to the wishes of Mr. Thompson and Mayor Warwick the estimates are based mostly upon slow sand filtration, with suggestions for mechanical filtration at one station. Owing to the vast amount of water wasted in Philadelphia, two sets of estimates are submitted, one for water used, and the other for water used and wasted, both in the year 1900, the quantities per capita being 100 and 300 gallons, respectively. The figures for construction and operation are as follows:

Cost of Installation.

	For water used in 1900.	For water used and wasted in 1900.
Filtration plant	$2,398,500	$7,195,500
Real estate	100,000	300,000
Meters, $500,000 to..............	1,000,000	0
Total incidental to filtration......	$3,498,500	$7,495,500
Immediate requirements for other extensions and improvements...	1,107,000	5,014,000
Total	$4,605,500*	$12,509,500†

Annual Expense of Operation.‡

Filtration plants	$200,000	$600,000
Meters	90,000	0
Total annual additional expense.	$290,000	$600,000

*This would give an ample supply of filtered water for the entire city in 1900, and a surplus of pumping capacity of about 100%.

†This would furnish sufficient water (filtered) to meet the demands of the year 1900, but without surplus capacity.

‡This, in the case of water used, would undoubtedly be more than covered by the reduction due to restriction of waste.

The report also includes an estimate for the cost of mechanical filters for the whole supply, submitted by the New York Filter Manufacturing Co. These figures were $2,052,387 and $6,149,849, respectively, for water used and for water used and wasted in 1900, the total daily quantities in each case being 130,000,000 and 390,000,000 gallons, as in the estimate for slow sand filtration. In conclusion, Mr. Trautwine strongly urges that no measures be adopted for the filtration of the whole supply until a filter plant large enough to supply a whole district has been built and operated. He recommended the appropriation of $300,000 for the restriction of waste and a filter plant for the Roxborough district, and that experts be appointed to co-operate in the design of the plant. The information given has been taken from an authorized abstract of Mr. Trautwine's report. Unofficial abstracts of the report of Mr. Thompson indicate that he favors the immediate construction of filtration plants to the extent that the money available will allow, recommending slow sand filtration at Lardner's Point, on the Delaware River, and at Belmont, on the Schuylkill River. Regarding the restriction of waste, Mr. Thompson is reported as saying in one place that he is in favor "of increasing our facilities to supply a greater abundance of water," and in another, "the adoption of such legislation as may result in the curtailment of the excessive waste of water."

THE COVERING OF THE FILTER BED connected with the water-works of Lawrence, Mass., has been recommended by the Massachusetts State Board of Health. This is deemed necessary to prevent the formation of ice on the bed and insure the proper working of the filter and the ability to clean it in winter.

◆

PROGRESS ON THE CLEVELAND WATER-WORKS tunnel, described in our issue of Aug. 11, 1898, has been as follows, up to Oct. 1: The steel intake crib has been brought to within 0.11-ft. of a level position, the steel work is nearly finished, ready to begin on the parapet, and the work of filling the crib with stone is in progress. As an additional protection against floating ice a belt of concrete 4 ft. wide and 8 ft. high, 4 ft. above and 4 ft. below the water line, is being placed on the inside of the crib. Shaft No. 3, in which there has been trouble with water, has been sunk to its full depth, and 14 ft. of tunnel driven. After having been shut down several weeks for repairs to the contractor's plant, it was proposed to pump out the shaft early this month and calk leaks preparatory to going on with the headings. From Shaft No. 2 there has been completed 2,024 ft. of tunnel in the East drift and 2,056 in the West. From the shore shaft, or No. 1, no work has been done since the second explosion, last July. The contractors talk of finishing the remaining tunnel between shafts Nos. 1 and 2 entirely from Shaft No. 2, but the matter has not been decided. These facts were obtained by a representative of this journal, while in Cleveland, from Mr. M. W. Kingsley, M. Am. Soc. C. E., Chief Engineer of the work, and Mr. C. F. Schulz, First Assistant Engineer.

◆

THE ABOLITION OF GRADE CROSSINGS in Newton, Mass., has been reported on by Mr. H. D. Woods, City Engineer. The estimated cost of abolishing all such crossings now remaining is $987,000, of which it is stated the city would pay about $100,000.

◆

THE TOTAL DEATHS in the United States Army from May 1 to Sept. 30, inclusive, are reported as follows by the Adjutant-General's office:

	Officers.	Enlisted men.
Killed	23	257
Died of wounds	4	61
Died of disease	80	2,485

This makes an aggregate of 2,910 deaths out of a total force of 274,717 officers and men, or a death-rate of 10.59 per thousand for the five months. We understand that deaths of officers and men on furlough are not included in these totals.

◆

THE LOSS IN THE U. S. NAVY, in the war with Spain, was only 17 men killed and 67 wounded, and of the latter 54 returned to duty. Surgeon-General W. K. Van Reypen, U. S. N., Chief of the Bureau of Medicine and Surgery, has handed in his official report. He shows that the U. S. Navy, before the war commenced, secured competent surgeons from civil life to meet the possible demand for them on auxiliary vessels and commissioned 37 as Assistant Surgeons out of the 2,000 applications received. The Bureau fitted out as a hospital ship the "Solace," a steel vessel of 3,801 tons, a speed of 16 knots, and comfortable accommodations for 200 patients and the medical staff. She was ready to take the wounded at the bombardment of San Juan. The "Solace" made numerous trips to northern ports and went back loaded with all manner of supplies for the sick. The medical officers of the "Solace" first introduced antiseptic surgery at sea. Throughout the report there is evidence of careful and intelligent preparation for all emergencies, by the naval medical staff; and the small percentage of loss of life from wounds and the general good health of the navy is proof of the efficiency with which the medical officers discharged their duties.

◆

CORN-PITH CELLULOSE, for the protection of warships against leakage from shot-holes, was officially tested in Russia, on July 19. The cellulose was furnished by the Marsden Co., of Philadelphia, and was handled by experts of that company. It was packed in a coffer-dam 6 ft. long by 6 ft. deep and 3 ft. thick, and subject to a head of water of 5 ft., and compressed until it weighed 8 lbs. per cu. ft. This dam was then perforated by a 6-in. solid shot striking 20 ins. from the bottom and less than half a pound of cellulose was carried out by the shot. In one-half hour after the water was turned on back of the dam a moist spot appeared on the front, but this was proven to come along the bottom of the packing and not through the shot-hole; in four hours no water came through the shot-hole and only 6 gallons passed under the packing. The test was pronounced a complete success by the Russian naval authorities present, according to the statement of U. S. Consul-General W. R. Halloway, of St. Petersburg. He says it opens up an immense market for Indian-corn pith.

◆

A NEW SYSTEM OF SIGNALING at night has been tested on the steamer "Kaiser Wilhelm der Grosse," at her pier in Hoboken, the signals being read from the pier of the American Line in New York, over two miles distant. The system consists in throwing the letters of the international code, one at a time, on a screen by means of a reflecting lamp. The inventor proposes to use instead of a fixed screen, on which to display his signals, a rotating canvas-covered wind wheel, or screw, which will not flap in the wind as a sheet would do. The letters used in the test were 15 ft. high.

◆

THE MANCHESTER SHIP CANAL was designed for ships of not over 3,000 tons and drawing 22 ft. of water. The steady increase in the capacity and draft of ocean steamers is now giving trouble for the canal owners, as the present channel will not accommodate even the later class of ocean tramps. As a direct trade in cotton with American ports was one of the chief objects of the original promotors of the canal, the deficient depth of channel presents a grave problem for solution. More docks and warehouses are also needed for handling and storing the cotton; and the want of these taken with the comparatively shallow channel, are hindering the growth of the canal business. In the first half of 1898 the increase in canal revenue was about $45,000, as compared with an increase of $80,000 in the corresponding half of 1897, and $90,000 in 1896.

◆

THE DRAINAGE OF THE CALUMET DISTRICT lying to the south of the main business section of Chicago, Ill., and comprising South Chicago and the neighboring territory, is discussed in a special report recently made to Mr. L. E. McGann, Commissioner of Public Works, by a commission of engineers appointed to investigate the subject. At present the Calumet River receives a large amount of Chicago sewage, which in time of high water is swept out into Lake Michigan to pollute the water supply. To remedy this the report recommends constructing a canal from the river to a connection with the Drainage Canal at the Sag, which will divert the flow from the lake westward. The canal recommended is to have a capacity of 50,000 cu. ft. per minute, and is estimated to cost $1,621,000.

◆

THE CHANGE OF GAGE from 3 ft. to 4 ft. 8½ ins. on the Port Austin division of the Flint & Pere Marquette R. R. was effected on July 17. This division extends from Port Huron to Grindstone City, Mich., a distance of 92 miles, and the work was done by 274 men during a long, hot day. A considerable amount of preparatory work was done in advance to enable the change to be made in one day. This consisted in planing the ties by machinery attached to a car, the ties being planed for a space wide enough to receive the rail and spike. This was done before any spikes were driven. Then, by means of suitable gages, all the outer spikes were set for the new position of the rail, and were driven nearly home. On July 16 a large number of the old spikes were drawn. The old rails were used almost entirely, joints being unbolted at suitable intervals to facilitate the sliding of a length of rails to the new line of spikes. The rails were then spiked on the inside at the joints, centers and quarters, to make the track safe for the passage of trains. The railway company had been putting standard ties in the track for two or three years, about one-fourth of the ties being new and put in during May and June. The rails weigh from 35 to 45 lbs. per yd., and the traffic is light. Trains passed over the line on July 18, the only delay being for three hours on one section, where a green man blundered and failed to notify the division roadmaster in time to receive aid. Mr. Wm. B. Sears, M. Am. Soc. C. E., is Consulting Engineer; Mr. Geo. M. Brown, Chief Engineer, and Mr. E. Treadwell, General Roadmaster.

◆

ELECTRIC LIGHTING FROM THE CAR AXLE has been adopted on the limited train of the Atchison, Topeka & Santa Fe R. R., running between Chicago, Ill., and Los Angeles, Cal., a distance of 2,209 miles. The aggregate candle power generated will be about 4,928 candle power, including, besides the regular train lights, lamps in all berths and the locomotive headlight.

◆

A FAST RUN was made by a special train on the Lehigh Valley Ry. on Oct. 9. From Buffalo, N. Y., to Rochester Junction, 69 miles, the time was 67 mins., and the first 105 miles were covered in 102 mins. The run to Ithaca, 148 miles, was made in 2 hrs. 46 mins., including 12 mins. lost in stops.

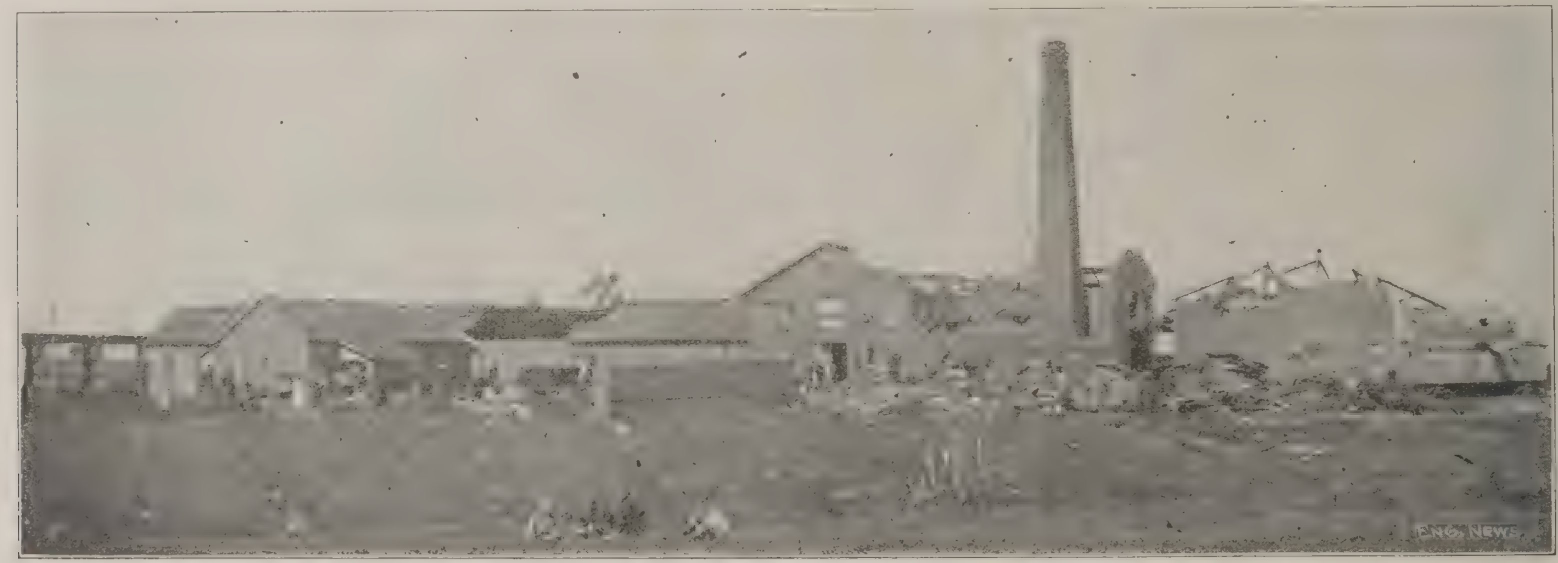
◆

THE CHINESE NORTHERN RAILWAY, as built by the state and open for traffic, includes the Tiensin-Tonghu-Chunghouso line, 214 miles long, and the Tiensin-Pekin line, 80 miles long. These roads are said to be the cheapest yet built in China, and cost $25,500 per mile, not including large bridges, but including the heavy fees demanded by Chinese officials. On the Pekin section the only heavy work is the lattice bridge over the Peiho River, 984 ft. long. There are heavy embankments and many small bridges. The roadway and station buildings on these lines are American in type; ballast is very scarce and not used at all on some sections, and the American pine ties cost 81 cts. each. The rails are of Belgian make and the locomotives were made in England and America; the rest of the rolling stock was built in the shops at Tongshaw. The line is single track, but roadbed and bridges are built for double track. The Viceroy Chi Li is the head of the railway department, and excepting a few Europeans at the head of each secondary department the staff is Chinese. These notes are taken from an article in the Proceedings of the Austrian Society of Engineers and Architects for 1898.

THE MERRITTON TORNADO.

By Orrin E. Dunlap.

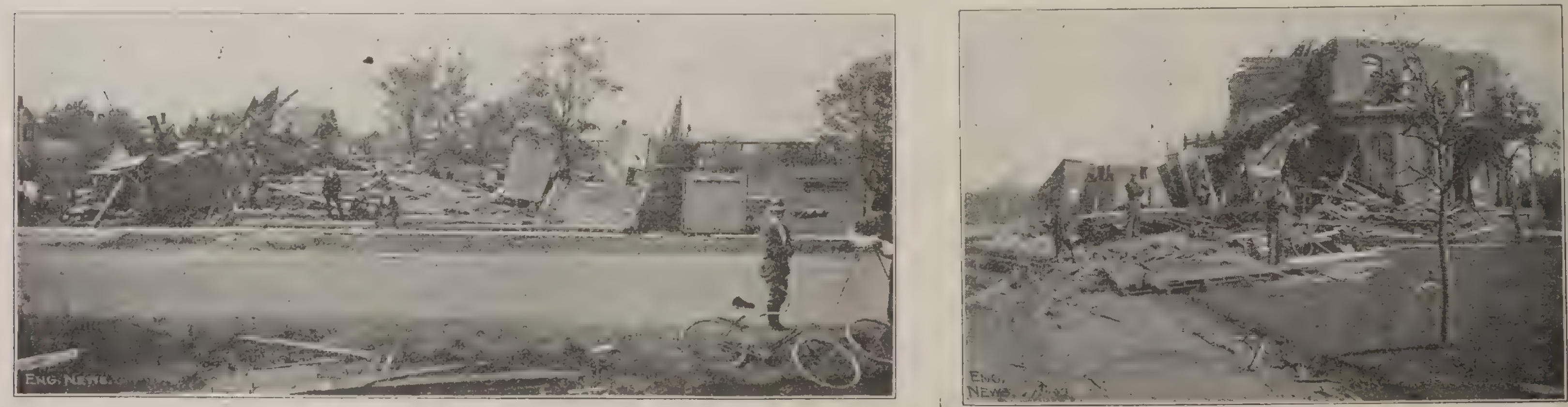
One of the most severe tornadoes that has ever been recorded east of the Mississippi Valley swept through St. Catharines and Merritton, Ont., and Niagara Falls and the Tonawandas, N. Y., on the afternoon of Monday, Sept 26. The destruction of life and property during the brief period while the storm lasted was something awful, and while pictures and words may in part describe the result in this storm-swept territory, they cannot give to the reader a full realization of the terrible nature of the disaster. The people living in the vicinity of the storm of September 26 had read of the destruction done by tornadoes on the Western prairies, but it was only when they themselves found the storm upon them that they realized the power and terror of such a visitation. With loved ones dead or injured, and with their homes swept out of existence, the full truth came home to them.



WRECK OF THE LINCOLN PAPER MILLS, MERRITTON, ONT.

The early part of the afternoon of Sept. 26 was beautifully bright until after 3 o'clock, when a dark, peculiar-looking cloud made its appearance in the northwest sky. Many noticed it, and watched it, and remarked its unusual appearance. This strange-looking cloud grew in size, and distant thunder announced an approaching storm. The cloud changed its shape; gathered itself like a balloon, and then was seen to send out two funnel-shaped tails earthward. One of these tails touched below Welland Ave., between Lake and George Sts., in the city of St. Catharines, Ont., and traveled in a direct line from this point to the southerly limit of the city. Its course was marked by ruin. The drill shed was practically demolished, the western arch being blown in on the gun sheds, breaking them in, and the roof of the hall being carried away. The cloud appeared to rise and fall; in some places destroying houses and barns, unroofing others and carrying away chimneys. Trees were uprooted and tossed about like paper, and the roads were rendered impassable.

It was the village of Merritton, Ont., that suffered most from the cyclone, however, for there it struck with greatest fury. About the first building it struck was the Lincoln paper mill, and it is evident from the wreck it made here that its force was fresh. The buildings were most substantial, of heavy stone and brick construction, but after the storm had passed over them they presented the appearance of a shell-riddled fortress. Roofs and parts of the wall were carried away, as shown in the photograph, but the tall brick chimney withstood the storm. The rain that followed the wind damaged the stock and the interior of the buildings, as well as some of the machines. There were 80 employees at work when the storm struck the mill. One girl was killed outright, and many were injured. Cars on the mill siding were picked up and dropped into the canal. Two men at work loading pulp into a car from a wagon were swept into the water, but were rescued. The wagon was wrecked and the horses were killed. Parts of the mill were carried long distances.



The Presbyterian Church. Residence of Samuel Smith.

SCENES IN MERRITTON, ONT., AFTER THE TORNADO OF SEPT. 26, 1898.

The destruction in and about the public school house was remarkable. When the teacher saw the storm approaching she gathered her little pupils to the number of 40 in the southwest corner of the room. The wind struck the building, and in an instant it was a mass of debris. The children were almost buried, but, after all were taken out, it was found that only one was killed. The school was located on a street running east and west, and next to it on the west was Orange Hall, a frame structure. West of Orange Hall stood the residence of James Bradley, and across the street, directly opposite it, stood the new residence of R. Thompson. The storm first caught the Thompson house, carried it across the street against the Bradley house, which it struck with great force. The two dwellings were then carried onward under the storm's power against Orange Hall, which was in turn swept against the school house. At this point the force of the cyclone seemed to be at its highest. One woman was killed in the wreck of the Bradley house. The Willson carbide plant was damaged, as were also the power houses.

The Presbyterian Church was razed to the ground. A person unacquainted with the conditions before the storm would not have known a building once occupied the site. John Hogan's house, a frame structure, was picked up and tossed against the brick dwelling of Samuel Smith, both being badly wrecked, as shown in one of the photographs reproduced herewith.

In one instance a man was blown out of his buggy. In another case a child was blown from its mother's arms and killed. In several instances boards were driven into the ground, and in one place the ground had the appearance of having been plowed.

After leaving Merritton the cloud seemed to divide, one end rushing over Niagara Falls and the other southward to Tonawanda. At Niagara Falls a severe hailstorm occurred, some of the hailstones weighing 2 oz. and measuring from 7 to 9 ins. in circumstance.

In Tonawanda the scenes at Merritton were repeated, though the force of the storm was not so great. Houses were leveled to the ground, and in one instance a barn was carried 300 ft. Piles of timbers represented what before the storm were three dwellings. In Tonawanda it was also noticeable that the storm jumped about, striking here and there. One strange fact in connection with the storm is that near Merritton there is a highway called Hurricane Road. It is said on good authority that many years ago the locality was visited by a storm which swept a path through the woods, which was continued as a road and given the name Hurricane Road.

THE WORK OF THE ENGINEERS IN THE SANTIAGO CAMPAIGN.

By Eduardo J. Chibas, Assoc. M. Am. Soc. C. E., late Assistant Engineer to the Chief Engineer of the Fifth Army Corps.

(With maps showing position of troops at Santiago.)

The echo of the heavy cannonading from our war ships—which from early dawn had taken their position in front of Daiquiri—had hardly died away, and clouds of smoke from the bombardment were still hanging here and there over the landscape, when the advance guard of the Fifth Army Corps landed on Cuban soil on June 22 without any opposition from the enemy. Among the transports near shore waiting for orders to unload her troops was the steamship "Alamo," with the Fifth Army Corps' Battalion of Engineers, which was composed of two companies of the U. S. Engineer Corps of the regular army —Company C and Company E, of 100 men each. The latter company started from West Point for Tampa on April 30, and the former went from Willett's Point on May 14. Both companies were organized into a battalion in Tampa, under the command of Capt. Jas. L. Lusk, who was relieved before the sailing of the expedition by Capt. Edward Burr, afterwards Lieut.-Colonel of the Second Volunteer Regiment of Engineers. The officers of Company E were Capt. Edward Burr, First-Lieut. E. E. Winslow, now Captain, and Second-Lieutenants H. B. Ferguson and L. Brown. The officers of Company C were Capt. G. D. Fitch, afterwards Major of Volunteer Engineers, Lieut. T. H. Rees, now Captain, and Second-Lieutenants G. M. Hoffman and S. A. Cheney.

On board the "Alamo" were stowed a large amount of square timber of various sizes, 12 pontoons and 15 completed trestles, susceptible of adjustment to any height from 3 to 12 ft. for military bridges; and all the tools and material that any possible emergency might have called into requisition. All the contingencies that might arise had been considered in Tampa, before sailing, and under the personal supervision of Brigadier-General William Ludlow, Chief Engineer of the Army in the field, all the necessary material had been provided. Through his efforts also, many photographs of the Spanish blockhouses and forts had been secured.

The work performed by the engineers in the Santiago campaign may be subdivided into "Reconnoissance," "Piers," and "Road and Bridge Work."

Reconnoissance.

On the morning of June 22, shortly after the first troops had landed, Lieutenants G. M. Hoffman and S. A. Cheney, with four men each, were detached from the Engineer Corps for reconnoissance work under Lieut.-Colonel Geo. McC. Derby, Chief Engineer Fifth Army Corps. They followed close to the advance, taking topography and mapping roads and foot-paths, noting their condition with reference to the transportation of artillery and supplies. They reached the Siboney landing, six miles away, on the next day. The two parties had kept separate, doing work along different roads They reported every evening to the Chief Engineer's office at headquarters—which for the first week was kept on board the steamer "Seguranca," that lay first in Daiquiri and then in Siboney Bay. After the troops passed beyond Las Guasimas, three miles from Siboney on the road to Santiago, where the first skirmish of the war was fought by the Cavalry Division, on June 24, four line officers were added to the reconnoissance party under orders of Major William D. Beach, Division Engineer of the Cavalry Division, through whom they reported to Lieut.-Colonel Derby, Chief Engineer of the Fifth Army Corps. These line officers were Lieut. Guy H. B. Smith and Lieut. D. P. Cordray, of the Infantry, and Lieutenants G. P. White and M. A. Batson, of the Cavalry. After July 3 they reported direct to the Chief Engineer. During the six days of rest and preparation that followed the first battle, and while the troops were camped on either side of the road to Santiago, the reconnoissance party kept constantly at work, very often venturing considerably beyond our outposts and going into the very heart of the enemy's country. The quiet and unostentatious manner in which the work was performed failed to bring it into general notice, and very little has been known by outsiders of the many risks incurred by individual members of the party, and of the commendable and valuable services rendered by them. After looking back over the excellent work accomplished by that small number of men, the only regret is that a much larger party was not placed in the field so that it could have covered the whole country around Santiago before July 1. The information we started with was very meager, as the Spanish government has never made a topographical map of Cuba, and the maps we had for reference showed merely a general outline without topographical features.

On June 27, when the American outposts were located at La Redonda, near where General Shafter established his headquarters three days later, and the Cuban outposts were a mile farther on the road to Santiago at El Poso, Lieut.-Colonel Derby and Lieut. Hoffman pushed the reconnoissance work half a mile beyond on the same road.

On June 28, Lieut. Hoffman went three-quarters of a mile beyond the outposts on the road to Caney, and Lieutenants Batson and Smith, from another direction, approached within less than a mile of the forts around that village.

The writer, on that morning, was ordered to measure a base line and make triangulations at the front to find distances to the City of Santiago, and to locate the prominent points of the surrounding topography. The positions we were able to secure on the hills near our outposts were not advantageous enough for the purposes intended; and on the next day, after having secured an additional force through Major Beach, Engineer of the Cavalry Division, we ventured with Lieut. Batson to within less than a mile of Caney and close to the road connecting it with Santiago, Without the use of field glasses we could see the Spanish sentinels pacing back and forth in front of some of their block-houses. The other members of our party, on that day, were Mr. E. M. Bane, official photographer, one sergeant and two Cuban privates, and one sergeant and five privates of the Ninth Dismounted Cavalry. A peculiar incident of the day was that, without firing a shot we returned to our lines after our work had been performed, with ten prisoners and a horse, captured by our small force. It is fair to explain, however, that they were not soldiers, but civilians, who claimed they had come out of the city to get mangoes and other fruits, and were on their way back to Santiago when we detained them. From them we obtained information as to the number of Spanish troops in Santiago, their condition and the nature of the barbed-wire entanglement around the city. On that same day, Lieut.-Colonel Derby and Lieut. Hoffman had gone scouting with a detachment of six Cubans beyond El Poso and almost to the San Juan River crossing. Later on, they proceeded to Marianage, which the Spaniards had evacuated the day before, and climbing a tree they observed the Spanish position on San Juan hill. On June 30, Lieut. Cheney had completed his reconnoissance along the coast line, and venturing within sight of the Spanish sentinels of Aguadores, reconnoitered their strong position. On that same day Lieut.-Colonel Derby continued reconnoitering the country towards San Juan and went again far beyond our outposts.

On July 1, Lieut.-Colonel Derby, Chief Engineer, and Lieut. Maxfield, of the Signal Corps, made their balloon ascension, which has been so much criticised. The opponents of the balloon claim that its presence at the front betrayed the position of the troops, and that the deadly fire poured upon it by the Spaniards was the cause of unnecessary casualties. On the other hand, the observers in the balloon, who certainly deserve credit for their unflinching valor while exposed to a most severe fire, argue that their discovery of the trail running parallel and to the left of the main road, through which General Kent swung his division as soon as Colonel Derby notified him of its existence, saved many lives by relieving the congestion of the main road through which the troops had been advancing. The results proved, however, that the usefulness of the balloon in warfare must be confined to the rear, or far enough from the enemy to insure it a fair chance of escape from the fire that will be directed against it, while it must be kept far enough from the main body of the troops to prevent the spent bullets from causing losses that might be avoided.

While the fighting was going on, nearly all the officers attached to the reconnaissance party were out with the troops at either Caney or San Juan in the line of fire, noting the position of the different regiments and brigades.

The instruments used in the reconnaissance work were the prismatic compass, cavalry sketching case, and often a hand level. The distances were estimated by pacing. The average daily distance covered by each individual varied, according to the nature of the country and the width of the belt sketched, from one to ten miles. The different parties reported every evening to the office of the Chief Engineer where the works were compiled, fitted together and added to the map of the previous day. A tracing was made, and then blue-prints were issued to the commanders of divisions, brigades and batteries, and other officers as far as the available number would permit. The first blue-print issued in the field was on July 3, and they continued to be issued from that time on nearly every other day, showing all additional information and changes in the position of the troops.

The Chief Engineer's office was moved from the "Seguranca" to headquarters in the field, on June 30; but soon after the capture of San Juan, the office was moved to San Juan hill, just behind our intrenchments for convenience in receiving the daily reports. The mapping and all the field office work was performed by Lieut. Geo. M. Hoffman, of the Corps of Engineers, and the writer, or by either one of them when the other was in the field. Mr. R. S. Porro had charge of the compiling on board the "Seguranca," and continued attached to the office of the Engineer Corps till July 8, when he was transferred to another branch of the service.

The blue-printing was done by means of an improvised field outfit, as the glass of the blue-printing frame was broken while being unloaded at Siboney, and we were unable to secure another one of the same size to replace it. We were fortunate enough, however, to find two pieces of window-glass about 24 × 30 ins. each. Our improvised frame consisted of the cover of one of the packing boxes around headquarters, over which was stretched a blanket folded to make three or four thicknesses. The blue-print paper and the tracing were unrolled, placed on the blanket and kept in contact by the weight of the two pieces of glass resting on it. For a tray for washing the blue-prints, we used a rubber blanket.

The trenches in the Santiago campaign were not laid out by the engineers, but were dug on the nights of July 1 and 2 by the troops of the line, under the direction of their own officers. After the capture of San Juan hill, however, a line officer from each brigade was appointed as Brigade Engineer, under the direct orders from Lieut.-Colonel Geo. McC. Derby, Chief Engineer, and his duty was to look after the trenches and to report daily to the Chief Engineer's office, through one of the members of the reconnaissance party, the changes in his own line of intrenchments, or any changes or extensions he might have observed in the enemy's positions. Some of the trenches that were hastily thrown up during the nights of the first and second of July, were improved later on by orders of the Chief Engineer, and a few had to be changed so as to place them on the military crest, that is, the point from which the defender can sweep with his fire the whole line over which the enemy must advance.

Piers.

On the morning of the first landing at Daiquiri, the engineer battalion was ordered to put ashore a large quantity of intrenchment tools, which were afterwards distributed to the troops of the line; also pontoon material and sufficient lumber to repair the small pier that had been partially burned by the fire started by the Spanish forces as they evacuated the place in the early morning. The damage had been mostly confined to the approaches, and before midnight the repairing was ended. On the next day the main portion of the engineer battalion, under the direction of Brigadier General William Ludlow, was ordered to proceed on the "Alamo" to Aserradero, twenty miles west of Santiago, to build a temporary pier to facilitate the embarkation of the Cuban forces, under General Calixto Garcia, which were to be transferred to the eastward to co-operate with the American forces. The wharf built at Aserradero consisted of two rows of piles of 5 × 5-in. timber driven by a heavy wooden maul 8 ft. apart longitudinally, and 4 ft. between the rows. The caps were spiked to the side of the pile, to do away with the labor of leveling and cutting them off, and on them rested the flooring of three or four planks.

On June 25, the 3,000 Cuban troops were transferred from the landing at Aserradero, to the three transports, about a mile away, by means of twelve large ship-boats and two navy launches. On the next morning we arrived at Siboney, and the battalion was immediately ordered to proceed to the building of a boat landing at that place. Before dark the work had been completed. The landing consisted of a crib 7 × 7 ft., sunk in 6 ft. of water, and connected with the shore by an approach 45 ft. long. On that day Brig. Gen. Wm. Ludlow, now Major Gen. U. S. Vol., was detached from the Engineer Corps and given active command of troops in the field; the 1st Brigade of the 2d Division. A portion of the battalion was detailed to begin work on a much larger pier from June 27 to July 1, when the whole battalion was ordered to the front and did not return to Siboney to resume its work till July 5. This pier consisted of three cribs. The first one was 10 ft. square, built of 5 × 12-in. timber, and sunk 30 ft. from the shore in three or four ft. of water. This portion of the approaches was finished about July 1, and began to be used shortly afterwards. The next two cribs, one of which was partially built by the 33d Volunteer Michigan Regiment while the battalion was at the front, were built of 12 × 12-in. timber. They measured 30 ft. deep and 10 ft. wide, and were sunk in 6 and 10 ft. of water, respectively. The spans between the cribs were 15 ft., making the total length of the pier about 130 ft. It was completed on July 12 after many difficulties, due to the heavy surf constantly beating aginst the shore, had been encountered and overcome.

Road and Bridge Work.

The portion of the battalion which was not detailed for the pier construction worked on the road from June 27 to July 1, when both sections were combined, and, as before stated, were ordered to the front. On July 2 the whole battalion worked all day under fire, improving the road near the crossings of the San Juan and Aquadores Rivers, and rendering those fords passable by wagons. On the next day, July 3, the battalion was marched to Sevilla, and on that day and the succeeding one they worked on the road from there to Siboney, where they went to resume the pier work. At that time Lieut. Brown was detached from the battalion and placed in charge of road repairing. Under his orders he was authorized to draw details of two battalions, or about 600 men, from Division Commanders. These details were generally taken from the volunteer regiments, and many men from the 71st New York were assigned to this work. These men made wide clearings on both sides of the road to allow the sun's rays to penetrate and dry the road beds. They corduroyed the swampy portions, improved the drainage, and opened up new roads on either side of the old road, along portions which had been rendered impassable, and extended them so that all portions of the line along which the besieging army was located could be reached by pack mules or wagons. These men also built some bridges and culverts, using such material as was at hand, which was often bad and difficult to procure. Lumber from the landing could not be had on account of lack of transportation.

After the surrender the Battalion of Engineers continued at work until August 16. From July 19 to July 22 they repaired the Aquadores Railroad bridge, one of whose piers and the two spans resting on it had been blown up by the Spaniards. The completion of this work allowed the trains to run from Siboney to Santiago Harbor. Later they repaired portions of the railway from Santiago to San Louis that had been partly destroyed; rebuilt about 300 ft. of a high trestle over Purgatorio Creek, which had been partially burned, and a smaller bridge near Boniato that had also been damaged.

General Remarks.

The Engineer Corps has been widely criticised for not doing work that they were expected to do during the Santiago campaign; but the critics certainly ignore the difficulties under which the Battalion had to labor, not difficulties of nature, which they were fully able and prepared to meet, but difficulties arising from the peculiar manner in which the campaign was conducted. Had the Engineers been furnished with two or three wagons to transport to the front some of the material that was safely stowed in the hold of the S. S. "Alamo" while she rode on the waves in front or Siboney, they could have bridged every single ford in a short time. They could have improved many portions of the road, and its carrying capacity would have been greatly increased. But the Engineers were dependent on other Departments for transportation which they could not secure. They had three wagons for their own use while camping in Port Tampa, and although, I understand, they asked to be allowed to take them with them to Cuba, their request was refused.

The Battalion of Engineers is equipped and drilled as Infantry. The enlisted men in it are trained and drilled as infantrymen, and besides have special drills in building pontoons and military bridges; in laying out and building fortifications; in sapping and mining; in planting and operating submarine mines, etc., and although they accomplished a great deal at Santiago with the means at their command, they were certainly fit to have performed a much greater service than they were given a chance to perform.

In conclusion, it may not be out of place to refer to what was one of the most impressive lessons of the campaign, to every intelligent observer, that our troops were under a great disadvantage on account of their use of black powder. Whenever our cannons and small arms poured forth their shots such a dense cloud of smoke hung around them as to furnish an excellent target for the enemy. On the other hand, when the Spaniards fired it was almost impossible to detect their position, and it was only after considerable watching on our part that their artillery could be located at all.

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POPULAR ERRORS ABOUT WATER METERS.*

By John C. Trautwine, Jr.†

The water-works of Philadelphia are pumping more than twice as much water as would furnish to all its people a lavishly bountiful supply at good pressures; yet from all sides come well-founded complaints of beggarly supply and low pressure. The Bureau of Water appeals in vain, year after year, for millions of dollars for new pumps and new mains, and private companies improve the opportunity by suggesting the expenditure of many more millions for prodigious facilities which the city does not need.

The reason is not far to seek. It is perfectly well known that more than half of all the water pumped is wasted, flowing off into the sewers without benefiting even those who waste it—or the sewers. If the waste, or even the major part of it, were stopped, the capacity of our works would be practically doubled, and there would be plenty of water for all. The cost of installation of filter plants, or that of bringing water from a distance, would be cut in two. Even without the adoption of means for purifying the water, the quality of that furnished would at once improve, for pumping could then be stopped during seasons of muddy or coal-polluted water, and the water in the reservoirs would have longer time for sedimentation.

The experience of other places leaves no doubt whatever that the proper use of the water-meter is a radical cure for the evil of waste, and the only one. In other words, upon the meter depends the salvation of our city's water supply. It is therefore most unfortunate that, through ignorance of the facts of the case, the public seems to be standing in its own light by a reluctance to sanction the increased use of meters.

Many of our people appear to be under the impression: (1) That the proposed use of meters in dwellings is intended to restrict the use of water. (2) That the charge for water by meter is excessive. (3) That the waste is exaggerated. (4) That the wasted water helps to cleanse the sewers.

To correct the first error it ought to suffice to say that it is not desired to charge by meter for water used in families. In the first place, it is not proposed to apply the meter to all dwellings, but to those only where outrageous waste is found to be going on.

In the second place, every metered supply, however little the meter shows, pays a minimum charge, established for the express purpose of discouraging economy in the use of water, and in most cases the consumer will have drawn all the water he can possibly use and enjoy, and will have done a fair amount of wasting besides, long before the meter reading equals this minimum charge. The meter thus charges only for water wasted (and not for all of that), not for water used.

There is therefore, as a rule, no inducement to be even careful in the use of water from a metered dwelling-house supply, and this is as it should be. Otherwise undue economy might lead to filth and disease. Gas may properly be so charged for as to induce care in its use, but this is not the case with water. It is better to have a gallon of water wasted than to discourage the proper use of a pint.

The present meter rate (after the minimum charge has been exceeded) is 30 cts. per 1,000 cu. ft., or about 4 cts. per 1,000 gallons, or 1 ct. per 2,000 pints, or 1 ct. per ton. One cent's worth of water would supply from five to ten liberal baths, even if it were proposed to charge by meter for water used for baths in dwellings, or for other domestic purposes.

My bath-room faucet recently began leaking, and I placed the stopper in the tub, in order to measure the loss. The faucet was merely trickling, yet a measurement showed that it was passing about 70 gallons per day. Even so trifling a leak, if it existed in each dwelling-house in the city, would amount to 6% of our total consumption, and would require an engine pumping 20,000,000 gallons a day to supply it; and it is notorious that thousands of houses have numerous leaks, in comparison with which the one in question is insignificant.

An investigation of the consumption of the district bounded by Broad, Seventh, Chestnut and Spruce Sts. showed that 63% of the water furnished to that district was wasted, and by only 17% of the population, the other 83% paying for the wasted water.

A similar examination of a district consisting of two intermediate streets in the northwestern section of the city, where 142 seven-room houses built in 1893 were inspected, gave the following results:

Number of inhabitants	539
Number of appliances	782
Number of appliances leaking slightly	22
Number of appliances turned on continually	32
Average consumption per capita per day, gallons	222
Water consumed during 24 hours, gallons	119,800
Water used, gallons	16,120
Water wasted, gallons	103,680

In other words, of the 222 gallons per head per day consumed, 30 gallons were used and the other 192 gallons wasted.

The only hardship inflicted, even upon those wasteful consumers whose supplies should be metered, would be that of seeing that their plumbing was in good order, and that no considerable quantity of water ran to absolute waste. In short, in order to keep their bills within bounds, they must take care to use most of what they draw.

As regards hardship to manufacturers, it is to be hoped that no Philadelphia manufacturer is in such straits that he would find it a hardship to pay one cent per ton (or but little more than bare cost) for the water supplied to him by the city; but, if it is considered advisable to give water to any or to all manufacturers at less than cost, the city can do this as well with meters as without them. The meter does not fix the rate. It simply substitutes payment by the ton in place of payment by the year. It encourages and rewards care, where the present method puts a premium on the vice of prodigality.

It is a mistake to suppose that wasted water aids in keeping our sewers clean. This water flows through the sewers with too little velocity to accomplish any good in this respect; but the use of meters would render the supply (with our present means) so ample that water could easily be spared for proper flushing of the sewers by jets introduced at high velocities.

I quote as follows, from correspondence and from publications, respecting the experience of other towns:

> Atlanta, Ga.—There never was a better illustration of the duty so constantly pressing upon municipal authorities to save and protect the unthinking public against themselves and against the consequences of their own want of knowledge as in this instance. The reform was met by a storm of protests, and so great was the opposition that nearly 400 consumers ordered the water cut off. Soon, however, finding that the pressure and service was so greatly improved and the rates with meters really less than they were without, they all came trooping back, admitting their error and full of thanks and praises.
>
> It was a fight and a sharp one at first, when we put in the meters and filters. Such, however, has been the effect of experience and education, with demonstration of success, that now I make bold to say it would not be merely a fight, but a revolution, if we attempted to abolish meters and filters.
>
> In 1885, with about 2,000 consumers, we pumped about the same amount of water per day as we now do in 1895 with over 6,000 consumers. Our experience is that, with a minimum rate, consumers use nearly the full amount of water allowed them. The sanitary conditions of our city has not suffered by reason of scarcity of use of water.
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> We had been pumping 6,000,000 gallons per day, but

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*Abstract of a paper presented to the Engineers' Club of Philadelphia, Oct. 1, 1898.

†Chief of Bureau of Water, **Philadelphia**, Pa.

when meters were put in the daily pumpage immediately fell to 1,250,000 gallons, and the pressure rose to such an extent that we could throw ten or more streams from the street hydrants over the tallest buildings without using the fire engines at all.

It was the adoption of meters that made it possible to filter the total supply.

Atlantic City, N. J.—One leaky hopper closet (or one that is allowed to run continuously) in some small property that paid perhaps $6 or $8 per year on the assessed rate will waste water enough to supply half a dozen fine residences and sprinkle an acre or two of lawns besides. In cheap houses, or where there is cheap plumbing, by letting the water run to prevent freezing in cold weather, enough is wasted to furnish baths galore to the whole population.

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The per capita pumpage has been reduced from a maximum of 260 gallons per day to about 75 gallons per day.

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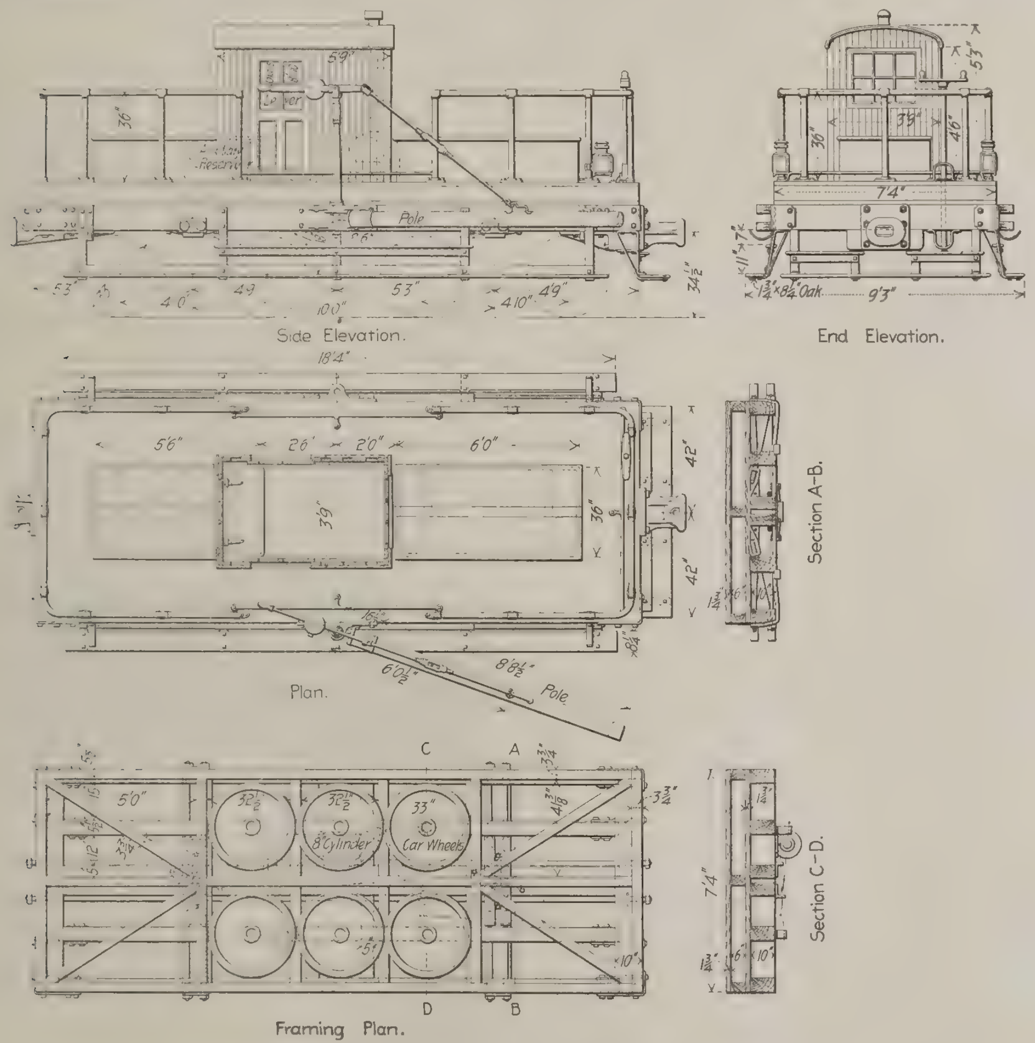
Richmond, Va.—At the commencement of this year we had about 1,400 meters in use. I have, so far, set about 500 meters this year, with the result, taken with those previously placed, that the pressure has increased five pounds at the high points, enabling many consumers who had no water on their second floors during the hours of the day to use water on those floors. Our pumpage has been decreased about 25% from what it was four years ago, and we have a larger number of consumers.

Harrisburg, Pa.—We overcame popular objection by teaching people that the only objectors to meters were those who wanted to get water without paying for it. You know, of course, that more than half of your pumping plant would be idle if you supplied water equitably by meters.

(Besides the opinions quoted, the paper contained others, all in favor of meters, from Utica and Poughkeepsie, N. Y.; Providence, R. I.; Milwaukee, Wis., and Lexington, Ky.—Ed.)

STANDARD POLING CAR; PENNSYLVANIA R. R.

For the handling of cars in railway freight yards, in making drilling movements, two different systems are in general use. In the first, each car or cut of cars is hauled or pushed direct by a switch engine on the same track as the cars. In the second, the cars are pushed by means of a horizontal pole seated in a socket on a switch engine or poling car running to and fro on a track parallel with that on which the cars move in passing to the classification tracks. Operating the pole from the locomotive is usually more or less inconvenient and unsatisfactory, especially in a busy yard, and for such yards poling cars are in many ways preferable. The car is, of course, attached to a switch engine, and runs to and fro on the poling track. One great advantage of the poling system is the rapidity with which the work can be done, there being no time lost in coupling or uncoupling the switch engine, while there is of course far less chance of injury to the yard men than when such frequent coupling and uncoupling movements have to be made.



STANDARD POLING CAR; PENNSYLVANIA R. R.
F. D. Casanave, General Superintendent of Motive Power.

The accompanying cut represents the latest type of poling car in use on the Pennsylvania R. R. We are indebted to Mr. F. D. Casanave, General Superintendent of Motive Power, for the blue prints from which our illustration is made.

The poling car is essentially a short flat car, 20 ft. long over the end sills and 7 ft. 4 ins. wide over the side sills. There are two end sills, 10 × 10 ins., and six longitudinal sills, the side and intermediate sills being 5½ × 10 ins., and the two center sills (only 2 ins. apart) 5 × 10 ins. At the middle of the car are two rows of transverse blocking let into the sills. The body bolsters are flat steel plates, let into the sills and having their ends turned up against the outside faces of the side sills, being supported by heavy truss rods which pass through the turned up ends and are attached to loops on a strap resting on top of the center sills. Two heavy tie-rods pass longitudinally through the frame, close to the center sills, and each longitudinal sill is attached to the end sill by a bolt having a flattened strap end, this flat end being bolted through the sill. The design was prepared with a view to the racking and twisting strains to which the car is subjected in service. The car is mounted on two four-wheel trucks with 33-in. wheels, the truck wheelbase being 4 ft. 10 ins., and the total wheelbase 14 ft. 10 ins.

Over the sills is a decking of 1¾-in. planks, upon which is a framing of timbers 3¾ × 6 ins., carrying the floor of 1¾-in. planks. In the middle of this 6-in. space between the two floors are placed six 33-in. car wheels to weight the car down upon the track, while the end panels have horizontal diagonal bracing, as shown. A railing runs around the ends of the car, and a cabin or house is built in the middle and fitted with a stove and locker. This cabin is 5 ft. 3 ins. high, 5 ft. 9 ins. long, and only 3 ft. 9 ins. wide, leaving a gangway on each side for the men handling the pole. Two oak footboards, 1¾ × 4½ ins. and 1¾ × 8¼ ins., are placed along each side and end of the car, 17 and 28 ins. below the tops of the sills, and to each end sill is bolted a heavy coupler head, while at the front end are two large marker lamps. The car is fitted with air and hand brakes.

At the middle of each end sill is a heavy casting with two lugs having holes for the vertical standard which supports the pole lever. The pole is 6 ins. diameter and 10 ft. 1 in. long, its heel being pivoted to the vertical standard, between the two lugs. The pole is handled by a horizontal lever pivoted at the top of the standard, the inner end of the lever being counterweighted to balance the weight of the pole, and the outer end being connected to a shackle near the end of the pole by a tie-rod and turnbuckle. The pole can thus be swung round horizontally to engage with or clear the poling sockets attached to the corners of the freight car frames, and its end can be raised or lowered to adjust it to the varying heights of the cars. The platform is about 4 ft. 6½ ins. above the rails, so that the men are well placed for handling the pole. A curved arm supports the end of the pole when it is not in use. There is only one pole, with its operating standard and lever, but a socket casting is placed on each side of the car, and the pole can be transferred from one side to the other when necessary.

A NEW SYSTEM OF SEWER ASSESSMENTS IN BOSTON.

After trying a great variety of plans for raising the money required for sewerage purposes in Boston, and finding it next to impossible to secure sufficient funds to carry on the work under any of the methods tried, an entirely new system is just being put in operation. The system seems rather complicated, at first, but a very slight study of it will show this appearance to be largely due to the bringing together of several methods of raising money which have heretofore been carried on separately. The only innovation seems to be the raising of three-fourths of the cost of maintenance in the form of sewer rentals, and the other fourth by general taxation, instead of securing the whole amount by taxation.

The law which made this method possible was enacted by the Massachusetts legislature in 1897, through the efforts of Mr. Josiah Quincy, Mayor of Boston. It was drawn by Mr. Andrew Bailey, Corporation Counsel. It provides that there shall be annually determined, before the first day of July, just and equitable sewerage charges to be paid by estates in said city for the construction, maintenance and operation of the sewerage works of said city, taking into consideration the necessity of the works as caused by each estate, the amount of the use thereof, if any, by the estate, or its occupants, the benefit received therefrom by each estate, the amount of any assessments for a sewer paid by any owner of the estate, the length of time which has elapsed since such payment, and the use, if any, that has heretofore been made of the sewerage works by the occupants of the estate, and such other matters as shall be just and proper.

In working out the details of the new system, Mr. F. Herbert Snow, Assoc. M. Am. Soc. C. E., of Snow & Barbour, Sanitary Engineers, Tremont Building, Boston, acted in the capacity of consulting engineer to Mr. Benj. W. Wells, Superintendent of Streets, and his deputy, the Superintendent of the Sewer Division, Mr. C. R. Cutter. These gentlemen were assisted by Mr. J. Frank Williams, Assistant Engineer in Charge of the Record office, and by the Chief Engineer of the Sewer Department, Mr. E. S. Dorr. Mr. Cutter was selected to supervise the investigation of various methods for Mr. Wells and to report his findings.

Under the plan adopted, the total sum appropriated by the city council each year for the maintenance and operation of sewers is to be divided into two parts, of one-fourth and three-fourths, respectively. The one-fourth is to be raised by general taxation of all the land in the city and the three-fourths on the basis of water charges on an amount of water used by each estate in the city.

The interest and sinking fund requirements for all sewerage bonds issued since June 21, 1897, are to be met in three ways, as follows: (1) By an assessment of $1.25 per ft. frontage on all land abutting on lateral sewers, using the word "lateral" to include all sewers with which house connections are made; (2) the cost of lateral sewers in excess of $1.25 per ft. frontage and of all district trunk sewers not used as laterals is met by general taxation of all the land in the district; (3) all the remaining charges for interest and sinking funds are to be raised by general taxation of all the land in the city. The bonds in question, it appears, run for 30 years.

The various sums chargeable, as described above, against any property are to be included in the regular tax bills and collected like other taxes.

We are indebted to Messrs. Wells and Snow for the information given. By referring to our issue of July 19, 1894, it will be seen that the new Boston plan is similar in principle to that recommended by Mr. Snow for Brockton, Mass., and adopted by that city. Besides Mr. Snow's exhaustive report for Brockton, which was abstracted in Engineering News of the date given above, those interested may consult with profit a symposium on the subject, giving the practice in six cities, published in the Journal of the Association of Engineering Societies for January, 1897.

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TEST OF AN ELECTRIC STREET RAILWAY POWER PLANT AT BROCKTON, MASS.*

This test was made to determine the performance of some new machinery installed in the power house of the Brockton Street Railway Co., and included tests to determine the following data:

Boilers.—Evaporative performance, commercial horse power, rate of combustion and rate of evaporation.

Engine.—Speed regulation, power and efficiency.

Generator.—Efficiency and capacity. The engine is a 700-HP. cross-compound condensing engine built by the E. P. Allis Co., of Milwaukee, Wis., with cylinders 20⅛ and 38 × 48 ins. The flywheel weighs 60,000 lbs., the rated speed being 110 revolutions per minute. A 24 × 12-in. Reynolds independent steam air pump and a jet condenser are also used.

Two specially designed vertical water-tube boilers rated at 200 HP. each are used. These have 222 tubes 2½ ins. in diameter and 15 ft. long and furnish steam at about 115 lbs. gage pressure.

Boiler feed water was taken from the city water mains and pumped through the main feed-water heater, which utilized the engine exhaust steam, thence through an auxiliary heater, which received the exhaust steam from the pumps and condenser, to the boiler.

Coupled directly to the engine is a 10-pole 500-K-W. railway generator built by the General Electric Co., of Schenectady, N. Y.

Generator Tests.—The armature resistance was obtained by the "Fall of Potential" method; that is, the armature was put in series with a water resistance and the bus-bars of the old part of the station, which were connected with the other generators. The resistance was adjusted to allow 100 amperes to flow through the armature. The drop in pressure between the terminals of the armature, as shown by a low-reading voltmeter, divided by the current flowing (100 amperes), according to Ohm's law ($R = \frac{E}{C}$), gave an average value of 0.0189 ohms. In the same way the series or compound winding gave 0.0026 ohms and the shunt field 47.1 ohms; the resistance being measured in each instance while the machine was hot.

To obtain the "External Characteristic" or curve which shows the variation of the voltage of the machine under different loads, the engine speed was maintained constant and the load varied from 0 to 800 amperes by means of a water resistance. At zero amperes the voltage at the machine terminals was 500, at 800 amperes 510 volts and at 910 amperes, 550 volts.

The "Electromotive Force Curve," or the curve showing the different values of electromotive force between the brushes, was obtained by the third brush method, one terminal of a voltmeter being attached to one of the brushes and the other to a movable brush which was slipped around the commutator towards the other machine brush, readings being taken at frequent intervals from the voltmeter. In this case the plotted values gave almost a true sine curve.

The efficiency of the generator was obtained by running it as a motor, to do which it was necessary to disconnect the connecting rod at the crankpin and the valve rods at the rocker arms, leaving the armature, flywheel, shaft, crank-disk, eccentric strap and rocker arms as the only moving parts. The shunt field was then excited from the station bus-bars. The armature was also connected to the bus-bars in series with the water resistance, already mentioned, which was gradually cut out until finally the armature was directly on the bus-bars and running at full speed. It was then found that the no load voltage at the machine terminals was 569; current through shunt field, 9.5 amperes; current through armature and series field, 47.5. This gave 569 × 47.5 = 27,027, say 27,100 watts, as the power required to turn the armature over at full speed without any external load. In other words, the amount of power necessary to overcome the internal losses of the machine, not, however, including C^2R losses, was 27,100 watts. The machine was rated at 500 K-W. and 550 volts at full load, or

$$\frac{500 \times 1{,}000}{550} = 910 \text{ amperes}$$

at full load.

$$\text{The efficiency} = \frac{W}{W + w + m}, \text{ in which}$$

W = useful output, or available output.
w = unavailable but used energy.
m = wasted energy, C^2R and other losses.

Using this to calculate the full load efficiency, we have

$$\frac{910 \times 550}{(910 \times 550) + [(550 \times 10) + 27{,}100] + [(910 + 10)^2 \times 0.0215]} = 90.8\%.$$

The stray losses (waste energy) and power required to magnetize the shunt field are practically the same for all loads, and the efficiencies for ½, ¼ and 1-10 load were calculated in the same way, using ½, ¼ and 1-10 the total current output.

The efficiencies found were lower than those guaranteed by the manufacturers, as shown in Table I.

TABLE I.

Load.	Per cent., efficiency. Found.	Guaranteed.	Corrected.
Full load	90.8	95.0	94.6
½	87.0	93.0	94.3
¼	78.7	91.5	91.8
1-10	60.4	...	...

This apparent discrepancy is explained by the fact that from 35 to 40% of the friction of a steam engine is due to the bearings and the air resistance to the flywheel's motion. The general value allowed for total engine friction is about 10% of the rated power, and this is practically constant for all loads. If the full load horse power be taken as 750, then 750 × 10% × 40% = 30 HP., or the amount of power absorbed by the bearings and air resistance to the flywheel.

Deducting 30 H.P., = 30 × 746 = 22,380 watts from the sum of the terms W + w + m in the efficiency calculations, the values given in the last column of Table I. will be obtained. These agree very closely with the guaranteed efficiencies.

The following table gives the results of the tests of boilers and engines.

The Boiler Test.

Date of trial	June, 1897
Duration of trial	10 hrs.
Number of boilers in use	2
Dimensions and Proportions:	
Grate surface of each boiler	33.18 sq. ft.
Grate surface, total	66.36 "
Water heating surface of each boiler	1,648 "
Water heating surface, total	3,296 "
Superheating surface of each boiler	502 "
Superheating surface, total	1,004 "
Ratio of water heating surface to grate surface	50
Ratio of total heating surface to grate surface	65
Average Pressures:	
Steam pressure in boiler, by gage, per sq. in.	112.3 lbs.
Atmospheric pressure per sq. in.	14.5 "
Absolute steam pressure in boiler per sq. in.	126.8 "
Force of draft in colm. of water beyond damper.	0.40 "
Average Temperatures:	
Of external air	85 degs.
Of fire-room	88 "
Of feed-water before entering 1st heater	68 "
Of feed-water before entering 2d heater	137.3 "
Of feed-water before entering boiler	197.1 "
Of escaping gases after leaving boiler	554 "
Of steam	384.4 "
Fuel:	
Moist coal consumed	10,149 lbs.
Moisture in coal	2.4%
Dry coal consumed	9,966 lbs.
Wood consumed	458 "
Coal equivalent of wood	183 "
Total dry coal consumed, incl. wood equivalent	10,149 "
Total dry refuse	817 "
Total dry refuse	8%
Total combustible	9,332 lbs.
Dry coal consumed per hour	1,015 "
Combustible consumed per hour	933 "
Quality of Steam:	
Number of degrees superheated	39
British Thermal Units:	
Heat units absorbed by boilers per lb. of steam generated	1021.4 B. T. U.
Factors of Evaporation:	
Factor of evaporation for boilers	1.06
Water:	
Total water pumped into boilers	98,119 lbs.
Water actually evaporated, corrected for quality of steam	100,007 "
Equivalent water from and at 212° F.	106,007 "
Equivalent water from and at 212° F. per hr.	10,601 "
Evaporation Performance:	
Water actually evaporated per lb. dry coal	9.85 lbs.
Equivalent per lb. of dry coal from and at 212° F.	10.44 "
Water actually evaporated per lb. of combustible	10.72 "
Equivalent per lb. of combustible from and at 212° F	11.36 "
Commercial Horse-power:	
On basis of 34½ lbs. of water from and at 212° F. per hour by boilers	307.3 H.P.
No. sq. ft. of total heating surface per horse-power	14
No. sq. ft. of water heating surface per horse-power	10.72
Rate of Combustion:	
Dry coal actually burned per sq. ft. of grate surface per hour	15.3 lbs.
Rate of Evaporation:	
Water evaporated per sq. ft. of total heating surface per hour from and at 212° F.	2.47 lbs.
Water evaporated per sq. ft. of water heating surface per hour from and at 212° F.	3.16 "

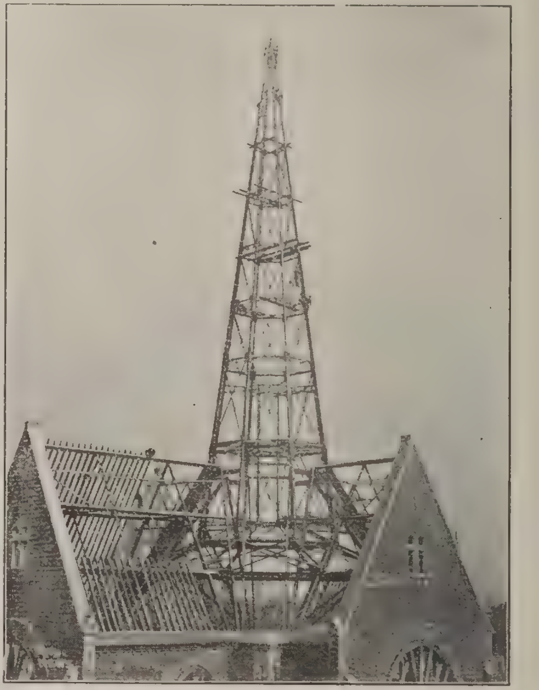

Fig. 1.—Steel Framework of Dome and Spire of St. Paul's Church, Chicago.

The Engine Test.

Duration of test	6 hrs.
Dimensions:	
Diameter of high pressure cylinder	20⅛ ins.
Diameter of low pressure cylinder	38 "
Stroke	48 "
Speed:	
Total revolutions of engine (6 hours)	38,526
Average revolutions per minute	107
Average pressures:	
Atmospheric pressure per sq. in.	14.5 lbs.
At throttle by gage per sq. in	112.0 "
At throttle absolute per sq. in	126.5 "
In receiver by gage per sq. in.	5.9 "
In receiver absolute per sq. in.	20.4 "
Vacuum in inches of mercury	24.0 "
Average Temperatures:	
In steam pipe at throttle	370.7° F.
In pond from which condensing water was drawn.	71.3° F.
In condenser discharge pipe	106.0° F.

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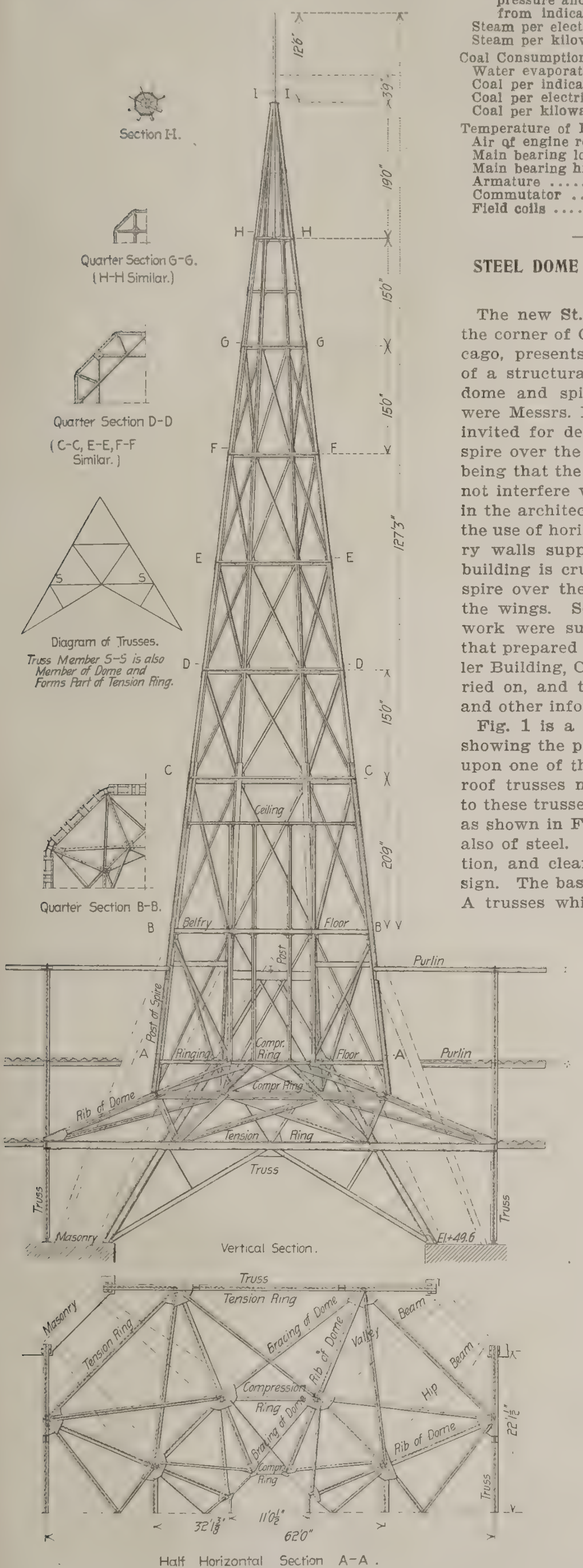
*Abstract of an article in the August "Street Railway Journal," with additional information from Messrs. Stone & Webster, Boston, Mass., the engineers making the test.

Condenser:	
Diameter of air pipe	24 ins.
Stroke	12 "
Total revolutions of condenser (6 hours)	22,525
Average revolutions per minute	62.6



Half Horizontal Section A-A.

FIG. 2.—PLAN AND ELEVATION OF STEEL DOME AND SPIRE.

Carl Binder, C. E., Designer and Contractor.

Power and Efficiency:	
Average indicated horse-power	708.5
Total indicated horse-power hours	4,251.0
Average electrical horse-power output	627.8
Total electrical horse-power hours output	3,767.0
Efficiency of unit, per cent	88.6

Steam Consumption:	
Total steam supplied to engine	64,927 lbs.
Steam per indicated horse-power hour	15.3 "
Steam per indicated horse-power hour when engine is running with 125 lbs. initial pressure and 25 ins. of vacuum (calculated from indicator cards)	14.4 "
Steam per electrical horse-power hour output	17.2 "
Steam per kilowatt hour output	23.1 "
Coal Consumption:	
Water evaporated per lb. of dry coal	9.85 lbs.
Coal per indicated horse-power hour	1.57 "
Coal per electrical horse-power hour output	1.78 "
Coal per kilowatt hour output	2.4 "
Temperature of Parts at End of Test:	
Air of engine room	83.5° F.
Main bearing low pressure side	129.0° F.
Main bearing high pressure side	129.0° F.
Armature	146.0° F.
Commutator	146.0° F.
Field coils	129.0° F.

* * *

STEEL DOME AND SPIRE OF ST. PAUL'S CHURCH, CHICAGO, ILL.

The new St. Paul's Church, recently erected at the corner of Orchard St. and Kemper Place, Chicago, presents an interesting feature in the use of a structural steel skeleton framework for the dome and spire. The architects of the church were Messrs. Hill & Woltersdorf, and plans were invited for designs for a steel-framed dome and spire over the center of the church, one condition being that the members must be concealed by and not interfere with the domed ceiling provided for in the architect's design. This condition prevented the use of horizontal members between the masonry walls supporting the roof construction. The building is cruciform in plan, with the dome and spire over the center, and four gable roofs over the wings. Several designs for the steel framework were submitted, and the one selected was that prepared by Mr. Carl Binder, C. E., 903 Schiller Building, Chicago, by whom the work was carried on, and to whom we are indebted for plans and other information.

Fig. 1 is a view of the completed framework, showing the posts or columns of the spire resting upon one of the rings of the flat dome. The four roof trusses next to the dome are of steel, and to these trusses are attached the ribs of the dome, as shown in Fig. 2. The hip and valley beams are also of steel. Fig. 2 is a general plan and elevation, and clearly shows the character of the design. The base of the structure is formed by four A trusses which rest on the walls and have inclined bottom chords above the line of the ceiling. It will be seen that the horizontal member of these trusses forms also a part of the dome, and extends beyond the dome truss to the roof trusses. These members form an octagonal tension ring, to the corners of which are attached the ribs and bracing of the dome. Above this ring are an intermediate and an upper compression ring, the latter being 11 ft. above the tension ring, while from the former spring the eight ribs or columns of the spire, each of which is formed of channels connected by lacing bars. The height of the walls at the truss seats is 49 ft. 6 ins., and the top of the dome is 74 ft. 5 ins. above the ground. The belfry floor is 18 ft. 4 ins. higher, and above this the spire rises 127 ft. 3 ins., the total height from the ground to the top of the spire being 201 ft. 8 ins.

The eight ribs of the spire are connected by eight horizontal frames or bents, and unite at the top in a cap ring, above which rises the steel flagstaff. All the side panels, except those near the top, have diagonal bracing. Angle iron rafters attached to the main frames support the slate covering.

The loads and wind pressure assumed for the design are as follows:

	Lbs. per sq. ft.
Roof, including covering and steel framing	28
Church ceiling	15
Ringing floor	100
Belfry floor	250
Wind pressure (horizontal) for main members	30
Wind pressure (horizontal) for anchorage and connections	45

The ironwork was manufactured by the Universal Construction Co., of Chicago, and had to be shipped in small pieces, the work of connecting and fitting being all done in place. For the trusses and the dome a square wooden trestle tower, about 60 ft. high, was used, but above this no falsework was employed. Very little adjustment was required in erection. The work occupied about 25 days, and cost about $8,400.

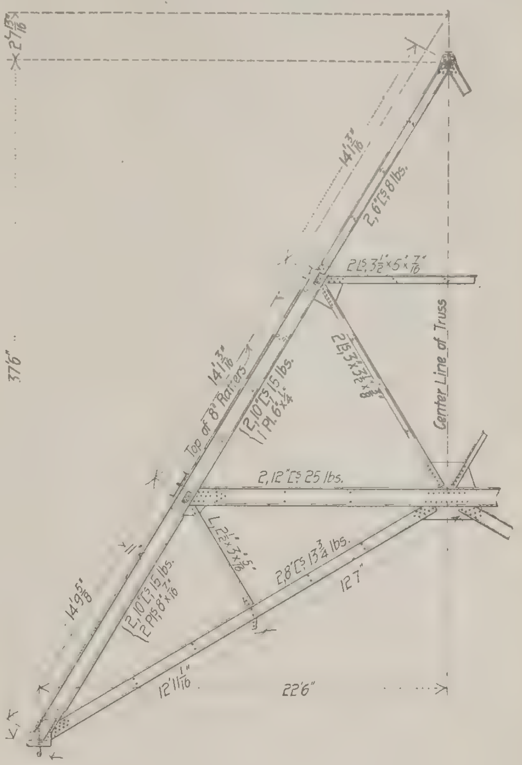


Fig. 3.—Details of Roof Truss.

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THE RAILWAY SYSTEM OF PORTO RICO needs reorganization. Some years ago a line was projected making a circuit of the island along the coast line, and the provincial authorities finally made terms with a French company for its construction. This company promised to complete the belt system in six years, and the government gave the company the exclusive franchise for all railway construction for 99 years and guaranteed 8% on the cost of construction. Neither promise has been kept. Only three parts of the system are completed. The longest line is the 62 miles between San Juan and Camuy, on the north coast, with one train per day each way, besides two covering a part of the distance. Proceeding westward the finished work begins again at Aguadilla, and proceeds southward, 36 miles, to Hormigueros. At Yauco the line again begins and leads to Ponce, about 22 miles distant and on the south coast of the island. The company has also built a line, 14¼ miles long, from San Juan to Carolina. The three coast-line sections mentioned were built, equipped and put into operation within the time and in accordance with the terms of the franchise, as distinct parts of the general system. The provincial government accepted them under these terms, and recognized the obligation to pay the 8% interest; but the Carolina line has not been accepted by the government as complying with time and other conditions. When the first section was accepted the government began appropriating money annually to pay deficits and bring the interest-earning power up to 8%. Finally the people protested that the railway company was under obligations to build more railway and was not meeting its obligations, and payment on interest was stopped. Both of the French companies—one a construction company and the other holding the stock—have failed, and the charter has lapsed by its own terms, but has not been declared forfeited. No reports of operation are available, but freight rates are so high that transportation by ox-carts is said to be cheaper. The roadbed and equipment are in fairly good shape, all the latter being French in design and build. The gage of the road is 1.2 m., or nearly 4 ft., and the maximum speed is about 13 miles per hour. In addition to the lines named the same company has built a branch, of one meter gage, from Anasco, on the west coast, to San Sebastian, a distance of 21.7 miles. There is also a local tram-line, from San Juan to Rio Piedras, 6.8 miles long; and another tram from Catano to Bayamon, 6.2 miles long. This list includes all railways actually in operation on the island; and in this connection it is noted that most maps of Porto Rico show lines as in existence which are only projected.

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Engineering News takes pleasure in presenting to its readers with this issue the first complete and official map to be published of the district surrounding Santiago, Cuba, and of the positions of the United States and Spanish forces during the investment and capture of the city. We are also able to give the first published statement of the work done by the engineer division during the advance upon Santiago. This statement is of no small interest at this time, since several well-known magazine writers and newspaper correspondents in their accounts of the Santiago campaign have taken occasion to criticise the engineers of the army for failing to do their part in the work of the campaign.

In his paper on another page of this issue, Mr. E. J. Chibas, of the engineering staff of the 5th Army Corps, shows that, despite published statements to the contrary, a thorough reconnoissance was made of the country lying between the Spanish and American forces prior to the advance of July 1. In the building of piers, everything seems to have been done that the exposure of the shore and the limited material and time available for the work would permit. In the work of building roads and bridges, the engineer battalion appears to have labored heroically and well; and the only reason why the rivers had to be crossed by fords instead of bridges was that there was no means of transporting the sectional bridges and other material which were taken to Cuba in the hold ot a transport, to the site where they were needed.

It will be borne in mind that the engineer troops which did service in the Santiago campaign were not the volunteer engineers, but the engineers ot the regular army, who have had long drill in the especial work that falls to their lot, and the officers engaged in the work were almost entirely commissioned officers of the engineer corps. These men knew their business as well as the regular infantry and cavalry regiments knew theirs; and from Mr. Chibas' account it seems evident that, so far as the engineers at Santiago failed to do the engineering work that was needed, it was due to circumstances beyond their control.

The Nominating Commitee of the American Society of Civil Engineers, appointed at the Detroit Convention, has presented a full list of officers to be voted for in January next, and it heads this list with the name of Mr. Desmond FitzGerald, of Boston, as the candidate for President. We believe the committee has made a wise choice, both in the selection of an engineer who deserves the honor, and in awarding the office to a locality which has hardly had its proper share in the selection of the Presidents of this Society.

Mr. FitzGerald, during his many years of service in connection with the Boston water supply and other important engineering works, has won for himself an enviable professional reputation; and his name ranks high among the engineers whose original research and whose contributions to professional literature have brought hydraulic engineering in this country to its present position.

Besides the question of personal fitness, however, it is certainly important that in a truly national society like the American Society of Civil Engineers, the highest honor which it can bestow should be given with some regard to the representation of all sections of the country. The Society now has members in every state and territory of the Union, except Nevada, North Dakota and Oklahoma. Of course in many of these the members are very few and widely scattered. Under these conditions the equitable selection of a President by location is a somewhat delicate task, especially as precedent requires that the selection of candidates should be made from the engineers who have become prominent by a long and distinguished professional career. As a natural result of the last condition, candidates must be generally selected from the older sections of the country, where engineering works of magnitude are most plentiful, and where alone employment in the highest grade of professional work is to be found. In looking over the list of Past-Presidents of the Society and classifying them by location at time of election, we find, that New York State has furnished 11 Presidents out of a total of 28. This is almost half of all the Presidents, but it is accounted for by the original organization of the Society in this city and by the fact that for a long time the bulk of its membership came from this section of the country. As the interest in the Society spread, Presidents were selected from other states, and the general list to date, and excepting New York, reads about as follows: Pennsylvania, four Presidents; Missouri and Illinois, two each; Louisiana, Kentucky, Wisconsin, Ohio, New Jersey, Maryland, Massachusetts, Canada and the Corps of Engineers, U. S. A., one each.

It will be seen from the above that New England has furnished but a single President for the Society; yet a very large membership is located there. Massachusetts alone has 128 members of the Society, in all grades, and at least 70 of these belong to the City of Boston. The only President ever selected from Massachusetts, or, in fact, from the New England States as a whole, is the late James B. Francis, who was elected in 1880. The nomination of Mr. FitzGerald, therefore, is not only the bestowal of the highest professional honor on a worthy candidate; but it is an appropriate recognition of a geographical section, which, both in the number and quality of its members, is a most important component part of the American Society of Civil Engineers.

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We desire to call attention to the new plan of sewerage assessments recently adopted at Boston, and described elsewhere in this issue. The plan is similar in principle to that in vogue at Brockton, Mass., reviewed at length in our issue of July 19, 1894. It is based on the fact that since a sewerage system confers both public and private benefits upon a community, its cost should be divided between the municipality as a whole and individuals; or, in other words, that a portion of the expenses should be raised by general taxation and the balance be met by individuals who are benefited. The private benefits are divided into two classes, the actual use of the sewers, and the increased value of property because of the mere fact that sewers are available. Under the Boston plan, of the total cost of maintaining the sewerage system, one-fourth will be raised by general taxation and three-fourths by rentals for the privilege of using the sewers. The cost of sewer extensions and improvements is to be met partly by assessments on frontage, and partly by taxation, thus recognizing both the private and the public benefit. To carry out this plan, all sewerage construction is divided into three classes, namely, lateral, district and main trunk sewers and works, and the cost is distributed among these classes, as explained elsewhere. The plan is one of the comparatively few attempts which have come to our attention. to distribute the cost of the construction and maintenance of sewerage systems in a way that shall be really equitable to all parties concerned. The use of water charges as a basis of determining rentals for the use of the sewers has the double advantage af apparent equity and of tending to prevent the waste of water. The new plan will probably add somewhat to the clerical work of the city, sewer and tax departments, but not so much as might be thought at first, since for years past the cost of most of the new sewers has been distributed between frontage assessments and general taxation, and the charge for maintenance has also been raised by general taxation. Once the various charges are computed, they are added to the regular tax bills and collected in bulk with the other taxes, thus doing away with the separate collection of special sewerage assessments. In cities where sewer extensions are made only on private initiative, and where sewer connections are not compulsory, the Boston plan might retard the development of sewerage systems, since the placing of a lateral sewer in front of one's property means an assessment, and a sewer connection means a yearly rental. But, as we pointed out in our review of the Brockton report, the system is so arranged as to place a part of the burden of sewers upon all real estate, and having this to bear already there is an inducement to take the next steps and secure the full benefit of the system.

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For over thirty years the Mississippi River has been the scene of extensive and costly experiments in removing the shifting sand-bars which impede navigation during the season of low water, but within recent years there have been adopted two general systems of improvement. The first of these is the establishment of permanent bank-protection works to rectify and improve the channel. The second is the use of hydraulic dredges of enormous capacity to cut channels through the bars which develop at every season of low water.

A peculiar feature of this dredging is that the entire benefit from it is reaped in the few weeks, or sometimes months, that the low-water season lasts. As soon as the depth of water in the river increases again, the shifting sands of its bottom are again set on their interminable travels, and long before the water comes again every vestige of the season's dredging work is wiped out. The same thing would be true even if dredges of ten times the size of the huge machines now at work were to undertake the task.

Beside the power to carve its way of the Mississippi in flood, man's largest machines are puny indeed. A very full and detailed account of the machines used, the work done, and the conditions under which the work is done, is given in a paper by Mr. J. A. Ockerson, M. Am. Soc. C. E., which was presented at the recent annual convention of the American Society of Civil Engineers, at Detroit. We give an abstract of Mr. Ockerson's paper in another column, but the paper is so comprehensive and so long that we are compelled to abbreviate it greatly. We would advise every engineer and contractor interested in dredging work and machinery to procure a copy of the complete paper, which is published in full in the June number of the "Proceedings" of the Society.

The paper forms a worthy addition to the list of remarkably good papers which have been recently presented to the Society on the bank-protection and levee building on the Lower Mississippi by Major Starling, Mr. Coppee and others.

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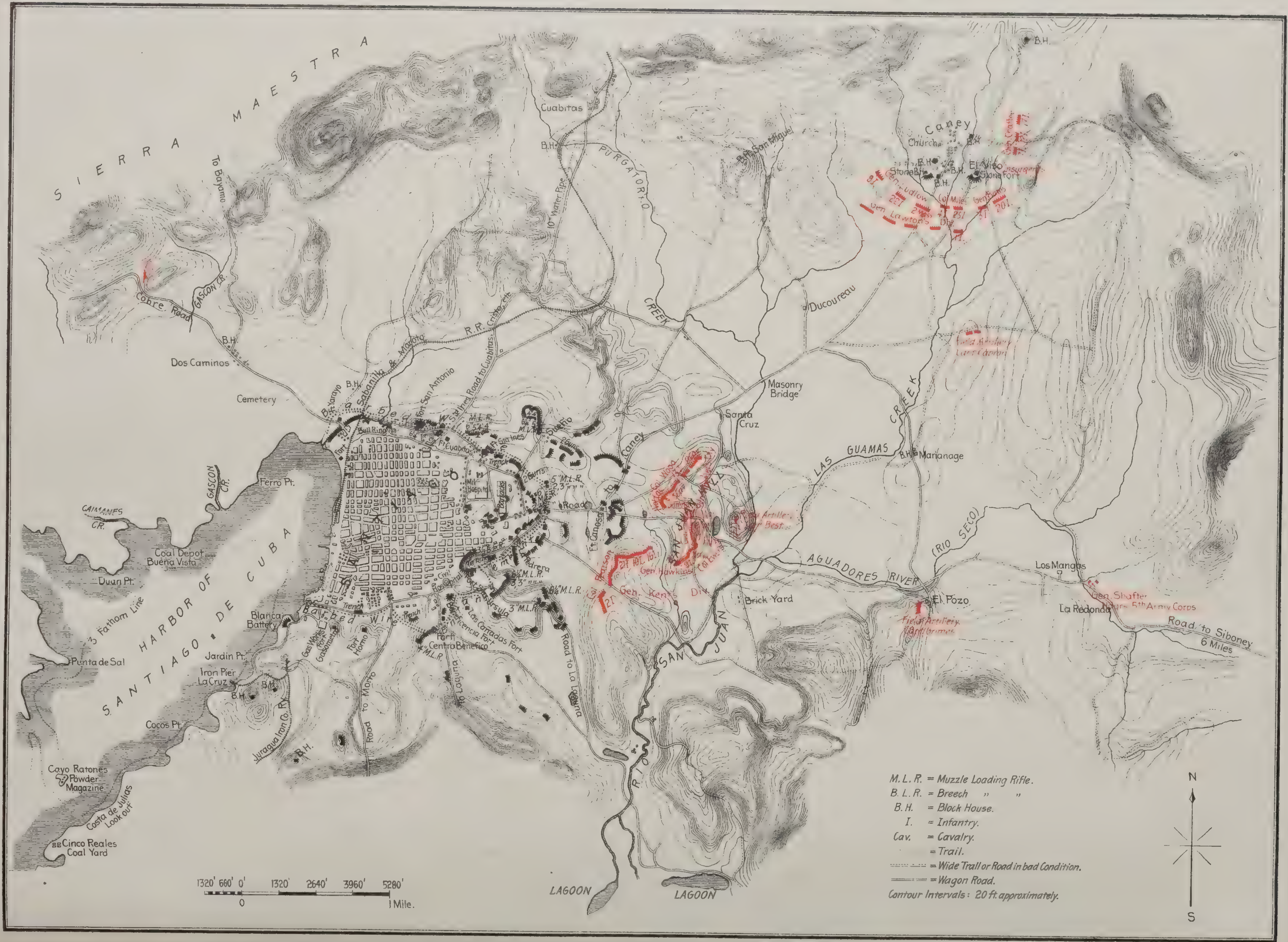
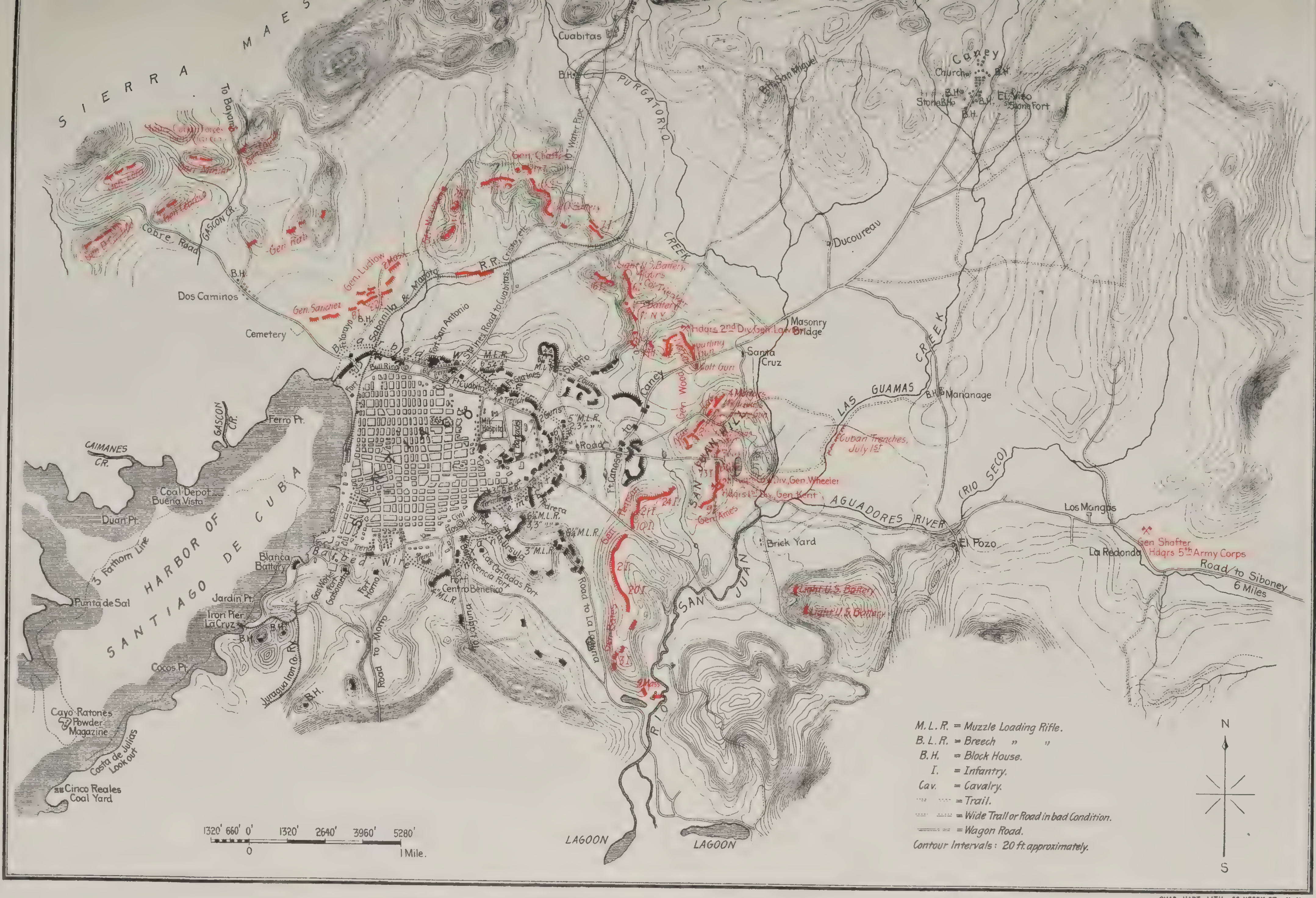
The article describing a new method of measuring the power of a steam engine, announced in the bulletin at the top of our front cover page this week, is postponed to our next issue, by reason of delay in the preparation of the illustrations to accompany it.



MAP OF SANTIAGO DE CUBA AND VICINITY, SHOWING INTRENCHMENTS AND POSITIONS OF THE UNITED STATES AND SPANISH FORCES AFTER THE CAPTURE OF CANEY AND SAN JUAN HILL, EVENING OF JULY 1, 1898.



CHAS. HART, LITH., 36 VESEY ST., N. Y.

MAP OF SANTIAGO DE CUBA AND VICINITY, SHOWING

INTRENCHMENTS AND POSITIONS OF THE UNITED STATES AND SPANISH FORCES ON JULY 14, 1898.

(Compiled from Surveys by Lieutenants Smith, Cordray, Batson, White, Hoffman and Cheney, and E. J. Chibas, C. E., under direction of Lt.-Col. Geo. McC. Derby, Chief Engineer, Fifth Army Corps, U. S. A.)

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UNIVERSITY OF ILLINOIS

THE COOLGARDIE PIPE LINE; A REMARKABLE ENGINEERING PROBLEM.

In our issues of Feb. 12 and 17 we described at some length the project for furnishing a water supply to the Coolgardie gold mining district in Western Australia, and criticised in some particulars the plans proposed for this work by an English Commission of Consulting Engineers. Since that time bids have been asked for the pipe to be used on this work, amounting to 246 miles of steel riveted pipe of 31 ins. diameter, and 3-16 to 5-16-in. thickness, and 82 miles of welded pipe of 26 to 29 ins. diameter and ¼-in. thickness. These bids were opened on Aug. 23, and no authentic statement of the award of the contract has yet been made; "The Iron Age," of Oct. 6, prints rumors that the contract has been awarded to two Australian firms, Mephan Ferguson, of Melbourne, and Hoskins Bros., of Sidney. Mr. Ferguson is the inventor of a novel longitudinal joint for steel pipes, which was illustrated and described in Engineering News of June 9 (p. 373), and which has been used on 8¾ miles of pipe for the Adelaide Water-Works. The above-mentioned rumor, however, still lacks confirmation, and our last direct advices were that to some extent, at least, the details of the conduit are still an open question.

We have also received, since we made our former comments on this scheme, the final report of the Board of Consulting Engineers (Messrs. Carruthers, Deacon and Unwin), upon the plans for this work, and very interesting reading it is.

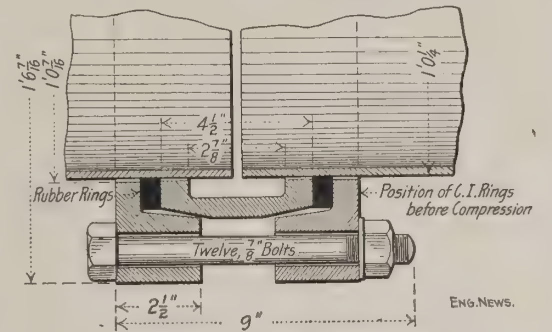
As our readers will recall, the project proposes the delivery of 5,000,000 gallons of water per day at a point in the interior of Australia, 328 miles from the reservoir in the mountains near the coast where it is impounded. To force the water through a pipe line for this long distance, not only must its friction be overcome, but it has to be actually raised a total vertical distance of 1,330 ft. Further, the district through which the pipe line passes is a desert whose soil is impregnated with salts, which are said to be so corrosive to iron that it is deemed safest not to bury the pipe in the ground at all. Another reason for leaving it exposed is that in a pipe line of such great length avoidance of leaks is essential. If an ordinary pipe line leaks a thousandth part of its flow in a mile, the loss may be a trifling matter; yet even so small a loss in a pipe line of this length would amount to nearly a third of its flow. In the arid desert through which this pipe line will pass, it is thought that the soil might absorb small leaks, so that they would not show at all on the surface of the ground if the pipe were buried. Facility of inspection, therefore, is another important reason for keeping the pipe above ground instead of burying it. Besides this, the ordinary reasons for burying water pipes—to get them out of the way, and to keep them from freezing in winter—do not obtain at all in the region over which this pipe line will pass; and as the cost of excavating and backfilling a trench 328 miles long will be saved by placing the pipe on the surface, the decision not to bury it seems, on the whole, a wise one.

The one great difficulty which is involved in keeping the pipe on the surface is the necessity of providing for expansion and contraction. In an ordinary line of pipe buried in the earth, the variation of temperature to which it is subjected is so small that the internal strains caused by the change of temperature do not reach serious proportions. To explain this more clearly! The modulus of elasticity of steel is about 30,000,000. That is to say, if a piece of steel of 1 sq. in. section be put under a tensile stress of 1 lb., it will be stretched $\frac{1}{30{,}000{,}000}$ of its length. The coefficient of heat expansion of steel per degree Fahrenheit is 0.0000065. That is, if a bar of steel be heated one degree Fahrenheit, it will be increased in length by $\frac{65}{10{,}000{,}000}$ of its original length. Dividing this coefficient by the one above given for the elasticity of steel, and we have a quotient of 195, as the stress per square inch that will be set up in a steel rod or plate by heating it or cooling it 1° F., and at the same time preventing it from changing its original length. Since the above coefficients are not exact, however, we may as well take the stress per square inch per Fahrenheit degree as 200 lbs., a quantity which is worth memorizing, as it is often convenient to use in calculations.

In an ordinary continuous steel conduit, buried in the earth in a temperate climate, the extremes of temperature of the water passing through it will probably not exceed 35°. If we suppose that the conduit is under no strain when at its mean temperature and is under compression during warm weather, and under tension during cold weather, the maximum internal stress will be:

$$\frac{35}{2} \times 200 = 3{,}500 \text{ lbs. per sq. in.}$$

Turning now to the Coolgardie conduit, to be laid unprotected on the surface of the ground, and with a distance between pumping stations as great as 75 to 80 miles, it is evident that the water confined from evaporation and exposed in a steel pipe to the fierce rays of the Australian sun, may reach a very high temperature in its passage from one pumping station to the next, which in the case of the longest conduits will require nearly three days. The English engineers estimate the range of temperature which will occur in the pipe line at 75°; and we should think this rather an under estimate. It will be seen at once that with such a range of temperature, internal strains would be set up in the pipe which might become so great as to cause movement and leakage at the circumferential joints. Expansion joints are, therefore, essential to the safety of the pipe; and the English engineers propose that such joints shall be placed at intervals of about 120 ft. for the whole length of the conduit, which would make a total of about 15,000 expansion joints in the length of the conduit.



Section of Expansion Joint for the Coolgardie Water Supply.

The engineering problem presented then (and one which we need hardly say is without precedent) is the design of an expansion joint for a pipe of 26 to 31 ins. diameter, which shall provide for a motion reaching ⅝-in., which shall sustain pressures reaching 200 lbs. per sq. in., which shall be and remain tight, with little or no attention, and which shall be as nearly as possible a permanent part of the pipe line. Our readers will be interested, we are sure, in learning what solution Messrs. Carruthers, Deacon and Unwin recommend for this problem. We, therefore, print this portion of their report in full:

> Expansion Joints.—If the Coolgardie main is placed above ground, it is of the highest importance to have durable and efficient expansion joints. The amount of expansion to be provided for is large, about ⅝-in. per 100 ft. length, for a change of temperature of 75° F. So far as we know, no case has previously occurred in which the general expansion of a water main has required to be met by an extensive use of expansion joints. We have, therefore, been driven to consider and to recommend what is essentially a new expedient in such a case. It appears that, with such a range of movement, some form of stuffing-box joint must be adopted. After considering various forms, we have come to the conclusion that a joint on the principle of that used on the more recent Paris compressed air mains is well adapted to this purpose. (This joint is described in Reuleaux "Der Constructeur," 1869, as the joint of Normandy.) No form of expansion joint which has come under our notice, or which we have been able to devise, is simpler, cheaper, or likely to be more efficient than the Paris joint, although, so far as we can ascertain, it has not, up to the present time, been used for water mains, except for the joints of a 59-in. steel pipe, subject to a head of about 262 ft., recently constructed in connection with the water supply of Paris. The materials on which it depends have, however, been so used for a long time past, and we have no doubt whatever that a joint of this kind can be so designed as to be and remain perfectly watertight for such a time as would amply justify its adoption. Such a joint was constructed at our suggestion by Mr. Cleminger, the representative of Mr. Mephan Ferguson, patentee of the seamless pipe. We saw this joint tested on one of the seamless pipes several times up to a pressure of 500 lbs. per sq. in. It appeared so far to be quite satisfactory.
>
> We next thought it necessary to carry out prolonged tests of the joint in such a manner that the movements due to expansion and contraction of the pipes would be imitated. We send with this report a drawing and description of the joint so experimented with. It is substantially the same as that used in Paris. The trials, which were carried out under the direction of Mr. Deacon, indicated that the details of the design could be improved, but notwithstanding some defects of the experimental apparatus, which on the whole were unfavorable to the endurance of the joint, the results of the trials are excellent, and, in our judgment, fully warrant the adoption of a joint on this principle.
>
> The apparatus consisted of a 12-in. welded steel pipe, about 5 ft. long, divided transversely into three pieces, the two end pieces being fixed, and the middle pieces—3 ft. long—being free to move axially to the extent of about ¾-in. The joints shown and described on the drawing were placed round the open spaces between the three pieces. The pipe was charged with water maintained at a head of from 300 to 400 ft., and the central pipe was so connected with a steam engine that an approximately harmonic reciprocating motion in an axial direction, with periods of three to the minute, could be given to it.
>
> We believe that if expansion joints are placed at every 120 ft. in the Coolgardie pipes, the maximum annual motion which ought to be allowed for will not exceed ⅝-in., and we think that this range is only likely to occur if the pipes are emptied during extremes of local temperature. We, therefore, made ⅝-in. the maximum range of motion at each joint, and we have imitated the smaller and more usual annual movements by ranges of about ⅜-in., and the diurnal movements in an exaggerated way, by ranges varying from ¼ to 1-10-in.
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> Four different qualities of vulcanized India-rubber were experimented with, and the general result was to show that the dearer qualities were not the best for this puruose. With medium qualities, used in two rings, the full range of ⅝-in. was repeated 990 and 1,420 times, respectively, before any leakage occurred, while 13,000 and 16,000 double strokes, respectively, of ⅛-in. were given with another quality of rubber of the same price before any leakage occurred.
>
> It is to be observed, moreover, that, on tightening up the bolts of the joints subjected to the ⅝-in. strokes, when the leakage amounted to about two drops per minute, they were further subjected to more than 13,000 double strokes of 5-16-in. each, during and after which no leakage occurred. We are satisfied that the diurnal contraction and expansion will not amount to anything like 5-16-in., and we therefore think that this may be regarded as a very severe test of diurnal work.
>
> The above observations apply exclusively to the two rubber rings encircling the two ends respectively of the central moving pipe. But, owing to the construction of the apparatus, the two joints themselves move through smaller ranges, but more or less in proportion to the difference of recorded motions between the central pipe and the joint. In one of these, made with a ring of the lowest quality of rubber used, this motion of the joints in relation to the two fixed end pipes, varied from about ⅛-in. to about 5-16-in., during the first 2,500 strokes, and subsequently from about 1-10-in. to ⅛-in. throughout the remaining tests, covering 37,605 double strokes. The motion of the other ring, with the medium quality of rubber, varied from about ⅛-in. to 5-16-in., during the first 2,500 strokes, and subsequently from about 1-10 to 1-16-in. throughout the remaining tests, covering 37,605 double strokes. During the whole 40,105 strokes, both these outer rings remained perfectly watertight, and were still watertight after the experiments had ended.
>
> It is believed that, unless leakage occurred, no sliding of the rubber took place, but that the whole of the displacement was satisfied by distortion of the rubber. It must not, of course, be expected that the rubber will endure for the number of years corresponding with the number of repetitions of double strokes of the longer ranges, each of which was completed in one-third of a minute. Other elements will probably conduce to the deterioration of the rubber, before the mechanical strains to which it will be subjected cause the joint to leak. But it is one advantage of this joint that the replacement of the packing is not a very serious matter. Other advantages are the lateral flexibility of the joints, which permits of considerable angular movement of any two adjoining pipes, and the facility with which any length of pipe may be rapidly removed and replaced.
>
> On the whole, we regard the result of these experiments as most satisfactory, but the larger joint required for the Coolgardie main must be carefully and specially designed. In the case of the riveted pipes, a seating must be pro-

vided at the ends of the pipes to receive the expansion joints. This must be a steel ring with countersunk rivets.

The joint which was subjected to the tests above described is shown in the accompanying cut. It is a simple form of double stuffing-box joint. The details of the experiments upon it we do not reproduce, as they seem to us absolutely inconclusive. An expansion joint might work very well on a 12-in. pipe, and very poorly on a pipe of nearly three times the diameter. More important than this, however, is the fact that the tests ignored the element of time. The movement of the joint was effected by the deformation of the rubber packing rings, and not by their slipping on the surface of the pipe. Now, soft and elastic rubber has a very short life, especially in such a hot and dry climate as that of West Australia. The engineers, indeed, hint at this in one of the paragraphs above quoted; but they seem to think that the replacement of the packing rings will be no serious matter. Perhaps this may be true, if the packing can be renewed while the conduit is in service, and if the rings have a reasonably long life, say two or three years. It is by no means clear to us, however, that the packing rings could be renewed without emptying the conduit; and if the rings should require renewal every few months, it would very seriously interfere with the usefulness of the whole water supply plant.

At last accounts the question of the design to be finally adopted for these expansion joints was still open. The specifications on which bids were received Aug. 23, did not require the contractor to furnish the expansion joints, although a clause provided for the receipt of designs in which the longitudinal seams of pipes were made by other means than welding or riveting, accompanied by designs for expansion joints suitable for such pipes. Whether any such designs were received, we are not yet informed.

In searching for previous instances of the use of expansion joints on long lines of pipe of large size, the only example we have been able to find is the system of underground mains of the New York Steam Co. In this system, expansion joints made of thin corrugated copper plates are used; and have proved eminently successful. The joints were fully described by the late Chas. E. Emery, their inventor, in Trans. Am. Soc. C. E., Vol. XXIV., p. 188. The largest of these pipes, however, are about half the diameter of the Coolgardie conduit, and the application of joints of this type to pipes of such large size might involve some difficulties. The advantage of an all-metal expansion joint, with no parts depending on a sliding contact, or on the elasticity of perishable materials, is evident enough, and would be worth considerable added first cost to secure.

Turning now to some other features in connection with this project, we note that the specifications require all plates and pipes to be dipped in a bath of dilute sulphuric acid and scrubbed if necessary to remove the mill scale, followed by a bath of lime water. The plates must then, before exposure to the weather, be dipped in a bath of Trinidad asphalt and creosote of a composition satisfactory to the engineer. The pipes must be heated to about 300° F., before dipping in the bath.

The Commission of English engineers, in their report, remarked that the asphalt coating on the exterior of the pipes, if unprotected: "Will soon dry and become brittle by exposure to sunshine, and lose those properties which cause it to adhere to steel." To prevent this they recommended that, after laying, the pipe should be given a coat of lime whitewash with enough size to make it adhere firmly.

Steel for the pipes must be open-hearth acid steel, with ultimate strength between 25 and 29 tons, elongation in 10 ins. of 20% and reduction of area of 45%. A drifting test is also required as follows: A ⅝-in. hole punched within 1¼-in. of the edge of the plate must drift cold to 1⅛-in. without signs of fracture. Hot and cold bending tests may also be made to the satisfaction of the engineer.

The welded pipes are to be made in lengths of 9 ft. 2 ins., and these are to be riveted up at Midland Junction, West Australia, into 27½-ft. lengths. The joining up of these lengths into the 110-ft. lengths, which will be joined by stuffing-boxes, is to be done by the Colonial government. The unit lengths for the riveted pipe is 7 ft., and these will be joined up into 28-ft. and 112-ft. lengths. Longitudinal seams in riveted pipe will have two rows of rivets. The joinings of the rings will be on the telescopic plan, every alternate ring being of smaller diameter than the rings on either side by twice the thickness of the plate. All rivet holes may be punched except those in the circumferential seam by which the 28-ft. lengths are joined together.

To prevent creeping of the pipe, an anchorage will be provided at the middle of every 112-ft. length. Here two of the 7-ft. rings are joined by a butt joint and cover ring, and three pieces of angle iron are riveted on for attachment to the anchorage.

In our review of the project in our issue of Feb. 17, we suggested that the use of wood stave pipe for the Coolgardie pipe line would solve the many difficulties from contraction and expansion and corrosion by the soil. We are informed, however, that the pressures on most of the line will be so great as to make this class of pipe inadmissible. Its use is under consideration, however, for a large mileage of smaller pipes which will be necessary in distributing the water from the main reservoir at Coolgardie to the various towns and mining camps in the district. A question in connection with its use on which more information is desired is to what extent water is lost from existing wood stave pipes by small leaks and by evaporation from the surface of the pipe. The latter, it is thought, might be a source of considerable loss in a climate so dry as that of West Australia, if the pipe line were exposed to the sun for long distances. If any of our readers can furnish us information upon this point we shall be pleased to receive it.

LETTERS TO THE EDITOR.

Duty Record of the Indianapolis Pumping Engine.

Sir: I notice in your issue of September 29th an abstract of a report made by me to the Indianapolis Water Company upon a test of the 20,000,000-gallon Snow pumping engine recently installed at Indianapolis, in connection with which you refer to the performance of the Leavitt pumping engine at the Chestnut Hill Station, Boston, as published in the edition of Peabody's Thermodynamics, just issued. You note that while the duty, on a heat unit basis, of the Indianapolis engine is higher than that of the Leavitt engine, the steam consumption per horse-power per hour of the Leavitt engine is lower. I would add, as a fact which is of interest in this connection, that it appears from the data to which you refer that the Leavitt engine worked under a steam pressure of 175.7 lbs., which is 20.1 lbs. higher than the pressure available for the Snow engine.

Respectfully, W. F. M. Goss.

Purdue University, Lafayette, Ind., Oct. 8, 1898.

NOTES AWHEEL IN BOSTON AND VICINITY.

(Editorial Correspondence.)

For some years past Boston and vicinity has been the scene of a large amount of interesting engineering work, much of which is still in progress. A large part of this work is being carried out to meet the municipal wants of what may be called the metropolitan district. Most of it has been described in Engineering News at some stage of its progress. The following notes relate chiefly to work in the metropolitan district. They were secured on a bicycle trip made the latter part of September. The writer found a wheel a most excellent means of getting about the metropolitan district, the distance between points of interest being short, the grades generally easy and the roads for the major part of the 250 miles traversed most admirable. The days were long ones, but they need not have been so long, nor the total distance so great had not the writer wished to make his headquarters at picturesque and historic old Concord.

In recording what he saw and heard, no attempt will be made to follow the order of the trip. Instead, facts bearing on the different pieces or systems of work will be brought together.

The Metropolitan Water System.

Enough work on this system had been accomplished early this year to permit the introduction of water from the Nashua River, supplementing the supply from the Sudbury River and Lake Cochituate and cutting off the Mystic supply, which was objectionable in quality. The water from the Nashua River is diverted by a temporary dam, just above the site for the permanent one, into the Wachuset aqueduct, which changes to an open channel and empties into what was formerly known as Basin No. 5 of the Boston water-works, but is now the Sudbury Reservoir of the Metropolitan System. From here on, the waters of the Nashua are mingled with those of Boston's earlier sources of supply, passing through the old aqueduct. From the Chestnut Hill reservoir the mingled waters are pumped for the high service of the district. Some of it goes to Spot Pond, the former supply of Malden, Melrose and Medfield, and part of this will again be repumped to a high service reservoir described later on, both Spot Pond and the new reservoir being in the beautiful Middlesex Fells Reservation of the Metropolitan Park System.

At the Chestnut Hill pumping station a 30,000,000-gallon Allis high duty pumping engine is now being erected, and three 35,000,000-gallon low duty Allis pumps, working under a head of some 60 ft., are to be placed in a new pumping station. The high duty pump is a fine piece of workmanship. Its pump cylinders will support the rest of the machine.

It is hoped that the contract for the new dam at Clinton will be let next spring. About 1,000 wash drill and 30 diamond drill borings were made at the site of the dam in 1895 and 1896. Connected with this reservoir there will be two immense dikes, the North one being about 9,500 ft. long and the South one, about 4,000 ft. long. The latter will have a core wall, but the former will not. The contract for the eastern part of the North Dike was let on Aug. 22 to Joseph Genarro, of Boston, and work was already well under way when the writer visited Clinton. The maximum fill on this section will be about 85 ft. Preliminary wash drill borings were taken on every square of 100 × 100 ft., and on the center line of the dike the same kind of borings were taken at intervals of 50 ft. Some of these were 265 ft. deep and their average depth was about 110 ft. The location of the North dike will be about 100 ft. nearer Clinton than that recommended in the special report of the Massachusetts State Board of Health. A cemetery is included in the site, from which the remains must be removed. The contract for the western portion of this dike and for the whole of the South dike have not yet been let. The dikes will have outer slopes of 4 to 1, and will be composed principally of the soil which is to be stripped, as a sanitary precaution, from the site of the reservoir. The central part of the North dike will be constructed of selected material, and there will be a secondary wall of selected material some distance down the slope, outside of the first one. These precautions are being taken to prevent the possibility of sliding which might occur if water should get into the soil composing the dike and change it to a somewhat pasty mass.

The new reservoir at Clinton will have a storage capacity of over 60,000,000 gallons, or about double that to be formed by the New Croton Dam. It will have a length of 8½ miles and a shore line of 35½ miles. New highways will probably be constructed around the reservoir, about one-third of this having already been done.

One of the most interesting features of the new reservoir is the blotting out of a large part of two towns and the destruction of the water power of the Lancaster Gingham Mills, employing 2,500 hands, when working full force. The mills have been paid about $500,000 for their water power, and are spending some $600,000 for improvements, most of which will be for the installation of a steam and electric plant. The mills will hereafter be operated by electricity, in 100 to 150-HP. units, thus doing away with long lines of shafting. Mr. Chas. H. Richardson is agent for the Lancaster Gingham Mills.

Altogether millions of dollars will be spent for the sanitary protection of the waters of the new reservoir at Clinton. The bulk of this will be for stripping the site of organic matter. In addition, a sewage disposal system for the city of Clinton will be built. Contracts have been let for this work and construction started. It includes about a mile of intercepting sewers, having a maximum diameter of 30 ins., a 600,000-gallon receiving reservoir, a pumping plant and 23½ acres of filtering area divided into 25 beds. The reservoir will have a bottom and roof of groined arches, built of Portland cement concrete, 4 parts screened gravel, 2½ parts sand and 1 of cement. The centering of all arches is to be placed before any are built, the desirability of which practice seems to have been impressed upon Boston engineers by the recent failure of the reservoir roof at Wellesley, Mass. The bottom of the reservoir is designed to sustain the upward pressure due to a 12-ft. head of water, the reservoir being close by the river. For about a half month each year the ground water level may be 5 ft. higher. To provide against this, that is, to keep the head at 12 ft., instead of 17 ft., underdrains are to be laid beneath the bottom and a relief pipe carried up through it, with its top at such a level as to draw off 5 ft. of ground water. The reservoir is to be 100 ft. in diameter, with elliptical groins at the top, and circular at the bottom, the bottom to be filled in as desired to facilitate draining and cleaning.

The high service reservoir in the Middlesex Fells, mentioned above, will have a storage capacity of 38,000,000 to 40,000,000 gallons. It will be formed partly by excavation, much of which is in rock, and partly by five dams. The dams have concrete core walls, plastered with cement. The bottom of the reservoir will be covered with 4 ins. of Rosendale cement concrete, and the inner slopes of the dams, to 4 ft. below low water, with 4 ins. of Portland cement concrete. The inner slopes of the dams will be 2 to 1, as far as the lining extends, and 4 to 1 above that, gravelled. In rock excavation the slopes will be given no treatment, unless on trial it proves necessary to prevent leakage, or unexpected fissures develop as the work progresses. There will be a division wall formed partly by natural rock, the balance being of concrete. The water surface, when the reservoir is full, will be at elevation 271, Boston datum, and its bottom will be 17 ft. lower. Two pockets of muck are being removed, one going down 12 ft. below the bottom. The reservoir, as stated above, will be filled from Spot Pond, not far distant, by pumps yet to be placed in a station not yet built. Spot Pond has a high water surface of 154 ft., or 20 ft. above the Chestnut Hill Reservoir, from which water is now pumped to supplement the yield of the drainage area of the pond. A 36-in. force main will lead from the Spot Pond pumping station to and through the new reservoir, so the service may be direct, if desired.

Mr. F. P. Stearns, M. Am. Soc. C. E., is Chief Engineer of the Metropolitan Water System, with Messrs. Jos. P. Davis and Alphonse Fteley as Consulting Engineers. The heads of the several departments are as follows: Distribution, Dexter Brackett; Sudbury, Desmond FitzGerald; Dam and Aqueduct, Thos. F. Richardson; Reservoir, Hiram A. Miller. Mr. Reuben Shirreffs is Principal Office Assistant. All of these gentlemen, it is hardly necessary to say, are members of the American Society of Civil Engineers.*

The New State Road in Concord, Lincoln and Lexington.

The state road work of the comparatively few states that have taken it up with vigor and intelligence has now been in progress long enough to show most admirable results, both in state roads completed and in the stimulus given to improved road building by local authorities. Naturally, with limited appropriations available and large mileages demanding attention, the work must be done piecemeal. But after a few years stretches of fair length are developed in some sections. One of the longest of these in Massachusetts, and a fine example of road work, too, extends for some seven miles in the towns of Concord, Lincoln and Lexington, on the route from Concord to Boston. The work was begun in 1895 and has been continued each year since. A missing length has just been completed, and a start is just being made on a section continuing on well into the center of Concord.

Under the statutes authorizing this work, the towns in which it is done have the privilege of taking the contract for it. At first each of the three towns took the contract, Concord subletting it, but this year none of the work is being done directly by the towns. The towns were thus compelled to buy stone crushers, rollers and other road building plant, one of them after having voted down such a proposition yearly for many springs in the town meeting. This town has since been building some improved road on its own account, thus fulfilling one of the great objects of the state work and of letting the towns take the contracts for it.

On the stretch of road being finished there were in use a Buffalo Pitts Co. steam roller, of about ten tons net weight, and a Studebaker sprinkler, with very wide tires and wheels gaged to overlap, thus acting as rollers. The improvement consists of 15 ft. of macadam, with 5-ft. shoulders, making a total width of 25 ft. The macadam is 6 ins. deep at the center and 5 at the sides, in three layers. The first layer is of 2½-in. stone 4 ins. deep; the second of 1¼-in. stone 2 ins. deep; and the last is of dust from the crushers. The gravel shoulder is 6 ins. deep. The gravel is paid for by the yard, spread, blue gravel hauled some distance costing 60 cts. per cu. yd., on this year's contract. Most of the stone is of trap rock, from ledges along the road, but some is field stone, hauled by farmers. The crushed stone cost $1.45 per ton, in place. There is but little competition. For culverts, the inside masonry is of rubble, and the outside is laid in Portland cement. Where there is only 2 ft. of dirt fill above the culverts iron pipe is used for the channel; where more than this, sewer pipe, the diameter generally being 12 ins. Sometimes a stone channel is used. The roads are drained with tile pipe, where necessary, and always when they abut upon banks or hillsides.

The crown of the roads is ¾-in. per ft. of width for macadam and 1 in. for the gravel. This brings to mind one of the greatest faults of the ordinary road; it is allowed to sag so that that water runs in it on grades and stands in it on level stretches, to the destruction of the road in either case.

Fences are placed where necessary for safety. They consist of 6-in. chestnut posts, 8 ft. c. to c., with the upper edge of the top rail 3½ ft. above the ground. This rail is 4 ins. sq., set with corner up, being notched half its width into the post and having joints formed by halving the ends onto each other. Half way between the rail and the ground is a 2 × 6-in. plank, generally let into the post from 1 to 2 ins. The rail and plank are of spruce, planed, and given one coat of white paint. The rails and plank are in 16-ft. lengths, and break joints. This fence costs about 15 cts. per lin. ft.

At intervals along the state roads notices, printed on cloth, are posted, warning the public that

> any person who injures or defaces trees, guard rails or other structures, or disturbs or removes road material or other property of the Commonwelth on any State road will be prosecuted.

The placing of placards, signs or advertising devices within the limits of state roads is also prohibited. Quotations are also made from the Acts of 1893, Chap. 476, Sec. 14; Acts of 1894, Chap. 497, as amended by Acts of 1897, Chap. 355, Sec. 1, all bearing upon the making of openings in and repairs to the state roads. These roads are placed under the police jurisdiction of the local governing bodies.

Most of the information given above was obtained from Mr. F. P. Cutter, of Lexington, Mass., Resident Engineer on the road work described. Mr. Mills is Chief Engineer of the Massachusetts Highway Commission.

The Metropolitan Park System.

Only a part of one day could be devoted to the park system. The start was made from Concord, Mass., over the seven miles of state road already described, then through Arlington to the Mystic Parkway, extending along the Mystic Lakes. At Winchester a turn was made into the Middlesex Fells, crossing here over a causeway dividing the Winchester reservoir and passing along Spot Pond, up and down hills and out on the Malden Boulevard. The Mystic Parkway is an example of engineering and landscape work carried to a high state of perfection, but without over-elaborateness or too much ornamentation. In the Fells, science and art have attempted little or nothing except to make the beauties of nature accessible to man. Men were at work raking stones from the roads and clearing up tangled underbrush. The roads were mostly in good condition, but with rather heavy grades, which last could not be avoided, perhaps, without making too deep gashes in the hills.

One rather startling thing that met the eye in these woods was a piece of bagging tied around nearly every tree, a few feet from the ground. The vast amount of work involved in this is a good example of what the carelessness of one man may cost a whole state or nation. Years ago a naturalist brought home some Gypsy moths to this country as specimens, and allowed them to escape. They have so multiplied and proved so destructive that the state of Massachusetts is now spending some hundreds of thousands of dollars annually in the endeavor to exterminate them.

From Malden the course taken led on through several towns to the Revere Beach Reservation, a strip of ocean front which has been provided with an immense bath-house and a grand boulevard a mile or more in length, connecting with a fine piece of state road. During the past season 140,400 bathers patronized this bath-house, the greatest number in a single day being 5,508 on a Sunday. The total number would have been greater had it not been for a fire on Sept. 6, caused by overheating in the drying room. This was confined to the upper floor of the bath-house, but damaged the drying room and offices to the extent of some $30,000. The establishment was in operation again in two days, the work, where necessary, being done by hand. The beach is accessible from Boston in a very few minutes' time, and the fare each way is only 5 cts., by either the electric cars or the Boston, Lynn & Revere Beach Ry. Thus Boston has provided what is, perhaps, an unparalleled seaside resort, available for the humblest.

The curbstones and gutters along the boulevard are of concrete, made in sections, in place. The curb is about 7 ins. wide at the top, 9 at the bottom, and 18 ins. deep. The gutter is some 2 to 2½ ft. wide. Tar paper is placed between each joint. The curbs are of ordinary concrete, faced with ¼-in. of neat Portland cement. All the stonework around the shelters is of the same material, which was all built by the Murdoch Parlor Grate Co.

Mr. Chas. H. Howes is the Resident Engineer at the Beach, and Mr. Wm. T. Pierce is the Chief Engineer of the Metropolitan Park Commission.

The Massachusetts-New York Boundary Line.

A remarkable piece of instrument work in the way of long sights was described in our issue of Dec. 23, 1897, in connection with a re-establishment of the boundary line between the states of Massachusetts and New York. Subsequent surveys have verified the accuracy of this line, which was 38 miles between points, and it has been officially adopted by the State of New York, through its state engineer, Mr. Campbell W. Adams. The engineers of 1787 stated in their report that they had run the line as closely as possible with the instruments available, and the recent work shows that they did remarkably well, considering their facilities.

Boundary posts are now being set along the line at all highway and railway intersections, mile posts and important summits. Of these posts 44 are of 12 × 12-in. × 9-ft. New Hampshire granite, at highways; 38 are of 12 × 12-in. × 5-ft. Connecticut granite, at mile points or summits; and 29 are iron posts of 97 lbs. weight, 5 ft. long, about 4 ins. in diameter, with small oval heads. On one side of each head are the letters MASS, and on the other N. Y. The posts are set in concrete and their exposed portion is painted white, with the letters in black. Mr. Henry B. Wood, M. Am. Soc. C. E., is Engineer of the Massachusetts Topographical Commission, and we are indebted to him for the information given.

Improvements to the Water-Works of Winchester, Mass.

A high service system is now being added to these works, with Mr. F. L' Fuller, M. Am. Soc. C. E., 12 Pearl St., Boston, as engineer. A 20-HP. oil engine will drive a 500,000-gallon triplex Gould pump, lifting water to a stand-pipe 40 × 40 ft. With a full stand-pipe the lift will be about 125 ft.

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*Previous articles on the Metropolitan Water System may be found in Engineering News for March 7 and April 4, 1895, and Feb. 25 and March 4, 1897.

The engine is of English design, known as the Hornsby-Akroyd, made by the De La Vergne Refrigerating Co., of New York.

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DREDGES AND DREDGING ON THE MISSISSIPPI RIVER.*

By J. A. Ockerson, M. Am. Soc. C. E.

About 1870 the use of temporary expedients for improving the channel of the Mississippi River gave place to a system of permanent improvements, consisting of the closing of chutes, the contraction of wide places by means of jetties or dikes, and the revetment of banks. The inauguration of this policy, to the exclusion of temporary expedients, was evidently a mistake, due probably to the fact that the length of time required before tangible results could be realized by the so-called permanent method was very much underestimated.

In the meantime, competition of railway lines along the banks of the river, and difficulties of navigation, threatened to annihilate the river traffic. Immediate temporary relief must be found, or the river as a great commercial highway must be abandoned. In response to the appeal of the steamboat men, temporary channel improvements were again taken up, and were made obligatory by Congress, for the lower river, in the River and Harbor Bill of June 3, 1896.

In 1883 a plant was provided for dredging in the Mississippi River above the mouth of the Illinois River. This plant consisted of an Osgood dipper-dredge and six dump-scows, the whole plant costing $29,348. It was used with good results.

In 1887, a contract was entered into for a hydraulic dredge and decked flat-boats to support 500 ft. of discharge pipe, to be used in the district above named. Experience had shown that a dipper dredge could do good work under favorable conditions, but for opening temporary channels through bars it was found to be too slow in its operations and hence too expensive. A dredge provided with a centrifugal pump for pumping sand and water from the channel and delivering the same through pipes far enough away to clear the channel was manifestly an improvement. This hydraulic dredge was equipped with a Van Wie pump with a 14-in. intake and a 12-in. discharge. The pump was run at 330 revolutions per minute and the material was lifted about 9 ft. above the surface of the water and discharged from 300 to 800 ft. from the pump. The intake nozzle was provided with a jet supplied by a Worthington pump, to aid in stirring up the material so that the suction could take hold of it.

While this dredge was evidently a move in the right direction and was very useful in the upper river, its capacity was entirely inadequate to meet the requirements of the lower river. Here the dredging required at a single bar often exceeds 100,000 cu. yds., and the time permissible to remove this large amount of material is very short. To successfully accomplish this result machines were required of far greater capacity than any heretofore used or known.

In November, 1891, the representatives of steamboat transportation lines below St. Louis appeared before the Mississippi River Commission and urged immediate relief for low-water navigation. They stated that if such relief depended on the completion of the permanent improvement work, by the time it came, there would be no traffic. In response to this appeal, the Commission appointed a committee of two to study the subject of the construction and operation of such appliances for dredging as can be applied to the deepening of the Mississippi River over the bars in extreme low water; . . . and to prepare and report a project for the construction of a dredging boat of as large capacity as can be handled in the channel of the Mississippi River at low water with safety and convenience.

Col. Chas. R. Suter and the late Henry Flad, both members of this Society, were designated to serve on this committee. After a thorough investigation of the matter, the committee concluded that among the various devices for temporary relief, dredging was the only means which held out a reasonable promise of success. The problem involved so many new features in the way of the enlargement and combination of devices heretofore used, that the construction of an experimental dredge was recommended. Drawings and specifications for an experimental dredge were prepared under the direction of this dredging committee, and contracts for the construction of the various parts were let at the close of 1892.

Dredge "Alpha."—This experimental dredge was equipped with an Edwards centrifugal pump having a curved drag-suction at one end, and an Allis-Reynolds screw pump having a straight suction with jet agitators at the other end, the object being to make practical tests of the efficiency of the different devices. The pumps, engines and boilers were designed by their respective manufacturers. The Edwards pump runner was 6 ft. 4 ins. in diameter, and was operated by a compound non-condensing, vertical engine with cylinders 15 and 27 ins. in diameter, and 20 ins. stroke. The suction and discharge were each 30 ins. diameter. The Allis-Reynolds pump was operated by a similar engine, with cylinders 8 and 16 ins. diameter and 12 ins. stroke. The suction and discharge pipes were each 30 ins. in diameter. The jet pump was of the Allis-Reynolds pattern, with 15-in. suction and discharge. This pump operated six jets 2½ ins. in diameter under a head of about 20 ft. By this means the material was loosened and divided up so as to enter the suction of the sand pump thoroughly mixed with water.

The machinery was mounted on a wooden hull 130 ft. long, 36 ft. wide and 8 ft. deep. The dredge in working order drew about 4 ft. of water.

The material pumped was discharged through a floating pipe-line made up of sections of pipe 33 ft. long, connected by means of strong rubber joints and iron coupling bars. An air chamber on each side of the discharge pipe served to float it when loaded with 10% or less of sand. In order to operate the dredge, two hydraulic piles are set about 25 ft. apart, near the upper end of the bar to be excavated. A wire rope about 1,000 ft. long is attached to each of these and to the hauling drums on the dredge. If the wind does not deflect the dredge from its proper place, it is allowed to swing freely in the current with the discharge pipes trailing below it. If necessary, side piles are set, and by means of lines attached to them, the dredge can be hauled into such position as may be desired. In dredging, the boat is pulled ahead up-stream at rates varying with the depth of the material taken out, the average movement being about 60 to 75 ft. per hour. After one cut is finished, the dredge is dropped down again to the lower end of the bar, the head piles are moved over about the width of the cut and another cut is made near by and parallel to the first. This process is repeated until a channel of the required width and depth has been secured.

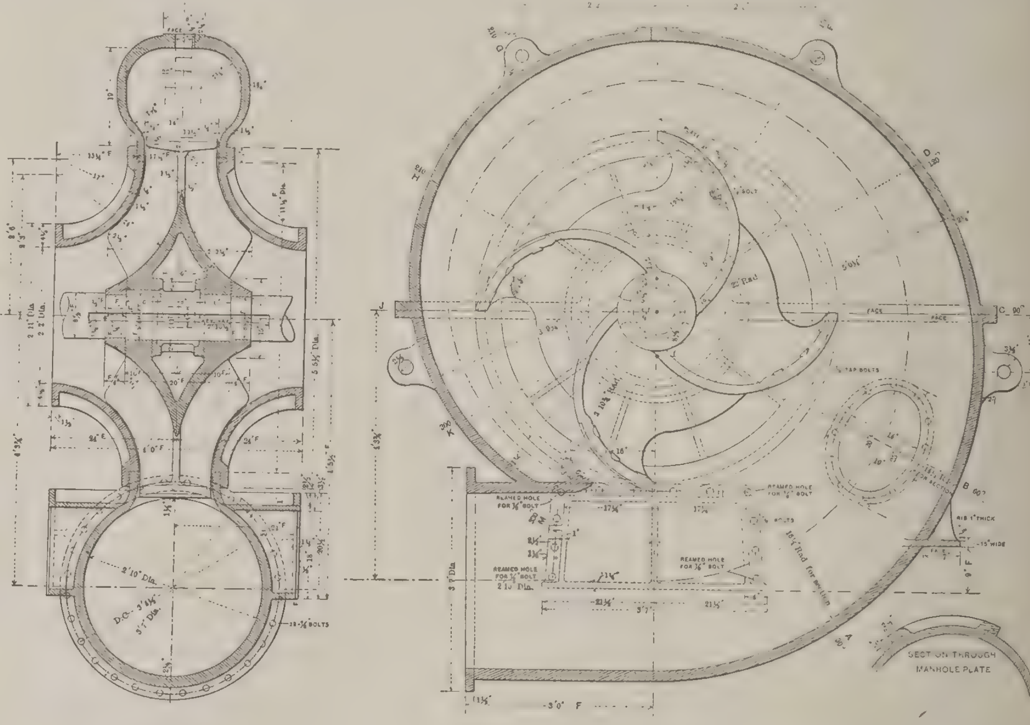

FIG. 1.—CENTRIFUGAL PUMP OF THE HYDRAULIC DREDGE "GAMMA"; MISSISSIPPI RIVER.

There is perhaps no single feature which facilitates this method of dredging as much as the hydraulic mooring piles.* The ease with which they can be set and withdrawn, and their great holding power, make them really indispensable where dredging is done in strong currents. They are sunk 15 or 20 ft. deep in the sand, and the head lines are attached to a shackle down at the surface of the sand, and consequently there is little danger of bending.

In the fall of 1894 the first attempt to aid navigation was made near Cape Girardeau, Mo., where there was a bar about 1,600 ft. long with from 3 to 4 ft. of water. Work began on Oct. 19, and by Oct. 26 a channel 6 ft. deep had been made and this channel remained good throughout the season.

With a view to get the benefit of the best dredging experience available, a circular was sent out in August, 1894, to engineers, contractors and builders of dredges, inviting "informal plans and suggestions as to the methods and machinery best adapted to the work." The capacity of the required dredge was to be 1,600 cu. yds. of sand per hour. Several replies were received, and three firms were requested to prepare detailed drawings and specifications of the plant they proposed to furnish. These were submitted in December, 1894, and a contract was let to the American Hydraulic Dredging Co., of Chicago, for the construction of the dredge "Beta," at a cost of $172,775. The dredge was completed and ready for testing in January, 1896.

Dredge "Beta."*—This dredge has two independent dredging machines complete from suction to end of discharge pipes. The sand pumps are of the centrifugal pattern with runners 7 ft. diameter and with 8 arms in each runner. The suction for each pump is 33¾ ins. diameter, and is split near the pump so that the water enters the casing from both sides. The discharge for each pump is from a single 33-in. pipe leaving the pump chamber from the top. The suction for each pump divides near the forward end of the hull into three sections, each 19½ ins. in diameter. A cast-iron elbow is riveted to the hull at the bow for each of the three branches, which are provided with elbows of hammered copper ⅜-in. thick, and these work in the iron elbows and form a radial telescopic joint. The axis of rotation is the center of a 7-in. shaft supported on brackets at the bow of the boat. These three suctions are framed together and can be raised or lowered, as one piece, through a depth of 20 ft.

Each of these suctions is provided with a vertical revolving cutter, 5 ft. in diameter, and 5 ft. long, with 12 nickel-steel blades on each cutter. These serve to loosen up the material so that it will readily enter the suction. There are six of these revolving cutters for the two pumps. They are spaced 6 ft. apart, c. to c., and are driven, through a system of spur gearing, by a cross-compound, non-condensing engine with cylinders 14½ and 29 ins. diameter and 18-in. stroke. The engines make about eight revolutions to one revolution of the cutters.

To support a portion of the weight of the cutter machinery, a pontoon is provided for each set of suctions. This pontoon is made of steel plates, and is built around the various pipes and frames. Each pontoon has a displacement of 1,000 cu. ft.

Each pump is operated by a direct-connected, triple-expansion, vertical, inverted, four-cylinder, tandem engine provided with jet condensers. The cylinders are 20½, 33, 38 and 38 ins. in diameter, and 24-in. stroke, with the cranks set at right angles. These engines are run at a speed of about 130 revolutions per minute, each being of about 1,250 I. HP., with boiler pressure of 175 lbs. Each engine is provided with a Worthington duplex air pump and jet condenser, with cylinders 14 and 19 ins. and 15-in. stroke. They are also arranged to exhaust without condensing. The steam is supplied by four Heine boilers, and mechanical filters are provided to free the boiler feed from water sediment.

The winding engines are placed near the bow of the boat. There are six drums, operated by a double cylinder, link-motion, reversing engine with cylinders 12¼ ins. diameter and 15-in. stroke. Four of the drums are 24 ins. in diameter and 40 ins. long. Two of these drums are used for side warping, and are geared 25 to 1. The other two are used for pulling the dredge ahead, and are geared 30 to 1; 1,200 ft. of ⅞-in. wire rope is used for this purpose. The two end drums, 30 ins. diameter and 28 ins. long, are used for raising and lowering the suctions.

At the stern of the boat is a steam capstan and a spud hoist. There are also two vertical anchor-spuds and one push-spud at the stern of the boat. The anchor-spuds are of oak, 24 ins. square and 40 ft. long. These were intended mainly as pivots on which to swing the boat, so that a wide cut could be made by moving the suction on the arc of a circle, but this method is not well adapted to streams with a strong current.

The machinery is mounted on a steel hull 172 ft. long and 40 ft. wide. It is 7 ft. 2 ins. deep in the waist, and for 36 ft. from the forward end and 16 ft. from the after end it is

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*We are obliged to condense largely this long and interesting paper, which was presented at the annual convention of the American Society of Engineers at Detroit, in July. The paper is published in full in the June number of the Society's "Proceedings."

*A similar mooring pile, used on a later dredge, was illustrated in our issue of July 22, 1897.

*Illustrated and described in Engineering News of April 23, 1896.

10 ft. 10 ins. deep. These deep portions are decked over, as are also the guards, for the entire length.

The requirements of the contract fixed the limit of draft at 4½ ft., and the width at 40 ft. When the dredge was completed, the draft was found to be about 6½ ft. The total displacement when running, with suction and discharge pipes, boilers, filters, heaters, etc., full of water, and a supply of coal on board, is about 1,175 tons.

The discharge consists of two independent pipe lines, each 1,000 ft. long. A deflecting baffle plate is provided for the end of each line. Eight of the sections of each line are 100 ft. long, and four sections are 50 ft. long. When the pipes are empty, the pontoons draw about 14 ins. of water.

A number of defects were developed in the use of this dredge, many of which were remedied. At first the cutters all worked in the same direction, and the result was that the dredge was pulled sidewise out of the cut. This was remedied by changing one set of cutters to work in the opposite direction. The breaks in the gearing of the cutter machinery were frequent, although the spur gears were made of nickel-steel, and the pinions of phosphor bronze. The 6-drum hoist also gave considerable trouble. The cutters were found to be very much longer than necessary, and their operation drew heavily on the boiler capacity. The unexpected draft developed difficulties in coaling, and in manœuvring the dredge over the shoal bars.

The preliminary tests of the dredging machinery began in January, 1896, and continued until March. Of the 400 working hours embraced in this period, 255 hours were used in repairs and changes, and 74 hours in actual pumping. The capacity tests were begun on March 10 and continued for about a month. The tests show an average capacity of 4,920 cu. yds. per hour, and, therefore, according to the terms of the contract, a bonus of $86,387 was earned by the contractor.

During the low-water seasons of 1896 and 1897, the enormous capacity of the "Beta" was fully demonstrated. Before the dredge is again put into service for the low-water season of 1898, numerous changes will be made. The hull will be widened to 56 ft. and lengthened, so as to reduce the draft to 4½ ft. About $41,000 has been retained from the contract price to do this work, as the specifications required that the draft should not exceed 4½ ft. The cutter engines, cutters and other parts belonging to the present suction will be replaced by a jet suction and pumps. This is done because it has been found in actual practice that mechanical agitators are unnecessary in the sands of the Mississippi River. The wear and tear of the cutter machinery is a very large item of expense, to say nothing of the power required. The jet agitators are quite efficient, are much more economical in point of repairs and power required, and are more simple in manipulation. The push-spud and one anchor-spud will be discarded. The other anchor-spud will be moved to the bow of the boat, and the spud-hoist will be discarded. The forward battery of boilers will be turned end for end in order to properly distribute the weights under the new arrangements, and to improve the facilities for coaling. Much of this work would probably be deferred were it not that the boat must be put into dry dock to make the hull repairs, and this opportunity is seized for making the changes outlined.

Dredge "Gamma."—The Act of Congress of June 3, 1896, was the first to formally recognize and require the use of dredge boats and other devices as an adjunct to the permanent improvement of the lower Mississippi River. The act requires that as much of the money appropriated as may be necessary

> shall be expended in the construction of suitable dredge boats and other devices and appliances, and in the maintenance and operation of the same, with a view to ultimately obtaining and maintaining a navigable channel from Cairo down, not less than 250 ft. in width and 9 ft. in depth, at all periods of the year, except when navigation is closed by ice.

This formal recognition of the necessity of temporary relief for low-water navigation resulted in the construction of four more dredges.

The contract for the "Gamma" was let in July, 1896, to the Bucyrus Steam Shovel & Dredge Co., of South Milwaukee, Wis. The capacity required was 800 cu. yds. of ordinary river sand per hour, delivered through 1,000 ft. of pipe with a single centrifugal pump.. The price paid was $85,530, and the time fixed for completion was nine months. This dredge was used in actual work throughout the low-water season of 1897, and was found to be very satisfactory, both in capacity and economy. The hull is of steel, and is 128 ft. long over all, 38 ft. wide and 8 ft. deep. There is a well at the bow, 32½ ft. long, in which the suction is placed.

The main dredging pump is a centrifugal pump, with a 24-in. suction inlet on each side and a 34-in. discharge at the bottom. The runner is 5 ft. 9 ins. in diameter, and has four blades. It revolves at a speed of about 150 revolutions per minute. The pump is driven by a cross-compound, condensing engine with an independent condenser. The high and low pressure engines are horizontal, and are connected to two disk cranks set at right angles and keyed to opposite ends of the pump shaft. The cylinders are 18 and 32½ ins. in diameter, and 22-in. stroke. The high-pressure cylinder has an adjustable cut-off, with a hand adjustment to regulate the point of cut-off. Expansion relief-valves are provided for the low-pressure cylinder. These engines develop about 500 HP., with a boiler pressure of 140 lbs. The jet pump is of the centrifugal type, with 18-in. suction and discharge. This pump supplies the water to stir up the sand at the suction head. The runner has four arms, with steel tips, running as close as practicable to the casing, to obtain the greatest available pressure. This pump is shown in Fig. 1.

The main hauling winches are located on opposite sides of the boat near the bow. They are driven independently and are provided with fast and slow feed controlled by clutches. The drums are 42 × 42 ins., giving space for 1,200 ft. of ¾-in. wire rope. Each drum is driven by a pair of 7 × 7-in. double cylinder engines, with cam reverse, and the power is transmitted through a combination of worm and spur gearing. The movement is controlled by means of a brakewheel and strap. The speed ratio is 81 to 1 for fast, and 493 to 1 for slow speeds. The hoisting engine for raising the suction pipe has a drum 24 × 24 ins.

The anchor-spud is hoisted by means of an upright, single-acting, steam cylinder, 18 ins. in diameter and 6-ft. stroke. The piston is attached to a cam clamp at its upper end, which grips and holds the spud against the slides. Steam enters at the bottom of the cylinder through a three-way valve, raising the piston and spud to the height of its movement. When the valve is turned to the exhaust port the piston and clamp descend, the spud being supported by a rack and pinion. The pawl locking the pinion is hinged between its center of movement and point, and the tripping is effected by making the pawl buckle on itself so that the point turns under. This releases its hold and allows the spud to drop.

Steam for this plant is furnished by six boilers 48 ins. in diameter and 28 ft. long, with five 11-in. flues in each. They are designed to carry a pressure of 140 lbs. In front of the fire doors are coal bunkers having a capacity of 40 tons.

The two intake pipes at the pump casing run forward to the suction head. They are hinged to the boat at the bow by two flanges connected by a pivot pin on the lower side and provided with a circular stuffing-box, making a radial joint that will allow the suction to be lowered to a depth of 15 ft. Outside of the joint the pipe and suction head are framed together and rigidly connected so as to form essentially one piece. At the suction head the pipes are 11 ft. apart, c. to c. The suction head for each pipe is 8 ft. long and they are 3 ft. apart, forming one suction head 19 ft. long over all. The suction head proper has two inlets, one for the upper and one for the lower intake, and between the two is a triangular pressure chamber running the whole length of the head. This connects directly with the jet pump. This chamber has nine 2¼-in. nozzles through which the water from the jet pump is forced with sufficient pressure to loosen the sand in front of the suction. The discharge pipe is 34 ins. in diameter. The floating discharge pipe is 1,000 ft. long, divided into 20 sections, each 50 ft. long. They are made of ¼-in. tank steel, and the pipes are floated by means of 40 cylindrical pontoons, each 23 ft. 9 ins. long and 30 ins. diameter.

This dredge was tested near St. Louis, Mo., in August, 1897, and, after the completion of the tests, was used in actual dredging between Cairo and Memphis until early in December of the same year. The general efficiency test, called for by the contract, required that the dredge should be operated 60 working days of 12 hours each in water from 5 to 15 ft. deep, and with sand of such different degrees of coarseness as will be found on the low-water bars. After this had been done and the machinery found satisfactory, then 20 capacity tests were required to be made with the suction at different depths. This last requirement was considered filled when the total amount pumped per hour divided by 20 was equal to or exceeded the required capacity of 800 cu. yds. per hour.

The total weight is 1,019,623 lbs., and the working draft of the dredge is about 46 ins.

Construction was begun in June, 1896, and the dredge was practically completed in March, 1897.

Dredge "Delta."—This dredge was constructed under contract with the New York Dredging Co., which sublet the construction of different parts to various manufacturers and builders of machinery. The contract price for this dredge was $124,940. It differs from the "Gamma" chiefly in having a mechanical agitator instead of jets, in its hoisting and hauling winches, and in the form of pump. Its capacity is also somewhat greater. Its construction was begun in June, 1896, and it was practically completed by the end of June, 1897. After the tests were finished, this dredge was used in removing sand bars below Cairo throughout the low-water season of 1897.

The hull is of steel, 175 ft. long, 38 ft. wide, and 8¼ ft. deep.

The dredging pump is different from those on the dredges heretofore described, in the shape of the casing and the runner, Fig. 2. The runner has five blades 22 ins. wide, and is 7 ft. in diameter. The edges run close to the casing, but the runner is not concentric with the casing, hence the outer ends of the arms are nearer one side of the casing than the other, the widest space being at the bottom, and the space being nearly cut off by a projection in the casing at the upper side of the discharge opening. The axis of the pump is parallel to the axis of the boat and lies over the center line of the same. The shaft has one long bearing through the aft side of the casing, and is provided with water bushing under pressure to keep the sand out of the bearing. The sand pump is driven by a vertical, inverted, two-crank, compound-condensing engine, with cylinders 22 and 48 ins. diameter and 24-in. stroke. It is fitted with a piston and slide valve and has an adjustable cut-off for the piston valve. This engine was designed to develop 800-HP. at 140 revolutions per minute, with a boiler pressure of 160 lbs. and a vacuum of 25 ins.

The engine which drives the cutters is horizontal, two-cylinder and non-reversible, attached to a sliding steel frame, which moves back and forth in guides as the cutter is raised or lowered. This is necessary because the shaft which drives the sprocket chain is not in the axis of motion, on which the suction and cutter revolve. The whole engine, with its frame, follows the motion of the shaft, so that the gear and pinion are always engaged. To admit of this motion, the steam pipes are provided with slip joints. The cylinders of this engine are 12¼ ins. in diameter and 15-in. stroke, with the locomotive type of slide valve.

There are two winding drums located forward of the sand pump, one on the starboard and the other on the port side of the hull. These drums are provided with clutches and brakes, and are driven by two independent double-cylinder, horizontal engines with cylinders 10 × 12 ins.

The ladder hoist for raising and lowering the suction, and the spud hoist for raising the spud, each have drums 24 × 24 ins. The cables from these drums lead to the roof and thence out through sheaves to the ladder and spud. These drums are operated by the same engines that operat the winding drums.

Steam is supplied by four Heine safety water tube boilers rated at 250 HP. each.

The intake of the sand pump is from one pipe 34 ins. in diameter, entering in the axis of the pump at the forward side of the casing. This single pipe runs 25 ft. to the forward bulkhead and there branches into two pipes, each 24½ ins. in diameter, which separate and pass through the bow of the boat below the water-line, 9 ft. apart. These two pipes turn to the right and left square along the outside of the bow and then turn forward again and each branch separates into two pipes 17½ ins. in diameter, which connect with the suction head. The whole is framed together so that the four pipes, suction head and cutters are raised and lowered together as one piece. Instead of a radial slip joint for the suction pipes, as used on the dredges already described, there is a vertical flanged joint in the horizontal part of each pipe next to the bow, and the revolving pins that sustain the weight of the aft end of the suction are placed in the prolonged axes of these pipes.

The cutter for loosening up the material is placed at the outer end of the suction head. It has 22 cast-steel wheel cutters, each having four blades mounted on a steel shaft 6⅞ ins. square. This shaft is driven by the cutter engine by means of two steel sprocket chains, at a rate of about eight revolutions per minute.

The floating discharge pipe is 1,000 ft. long, with the usual rubber couplings at intervals of 50 ft. There are pontoon floats on each side of this pipe, U-shaped in section, with the flat side closed, and they sustain the pipes in yokes which are firmly attached to the floats. There is a baffle plate at the end of the pipe line. The dredge is provided with sixteen hydraulic piles, six of which are 10 ins. in diameter and 38 feet long, and ten are 6 ins. in diameter and 25 ft. long.

The total approximate weight is 1,375,608 lbs., and the weight of the floating pipe line is 221,477 lbs. This dredge was launched on Feb. 20, 1897, and the tests were completed Aug. 11, 1897.

Dredges "Epsilon" and "Zeta."—The construction of these dredges was begun early in January, 1897. They were built under contract with the Springfield Boiler & Mfg. Co., of Springfield, Ill. The work done by this company at its own shops was confined chiefly to the hulls, floating pipe lines, boilers and other plate work. The pumps, engines, etc., were sublet to other manufacturers.

The stipulated capacity of these dredges is 1,000 cu. yds. of ordinary river sand per hour, dredged from a maximum depth of 15 ft., and delivered through 1,000 ft. of floating pipe.

The dredges are alike throughout, except that the "Epsilon" has water jet agitators, and the "Zeta" has mechanical agitators. The contract price of the "Epsilon" is $102,000, and of the "Zeta," $106,000.

The hulls are of steel, 157 ft. long, 40 ft. wide and 7½ ft. deep. There is a well at the bow 35 ft. long, 18 ft. wide at the hull, and 22½ ft. wide at the forward end. There are two open spaces in the hull, one for the engine and pumps, and one for the boilers and coal bunkers. All other parts are decked over. It is divided into 11 water-tight compartments by two longitudinal bulkheads and five cross bulkheads.

The main sand pump, Fig. 3, is located on the axis of the hull, in the forward part of the engine pit. It is similar in form to that on the "Gamma," having a divided suction, consisting of two 24-in. pipes, admitting the water on both sides of the casing, and the shaft of the runner extends through the casing with a bearing at each side. The main bearings of the pump runner are protected from sand by means of a ring of water under pressure supplied by the fire pump. The discharge is from the bottom of the casing and is 32 ins. in diameter. The pump runner is 5 ft. 9 ins. in diameter and has seven blades 11⅝ ins. wide at the outer ends. It is run at a speed of about 160 revolutions per minute. Pressure gages are provided to show the suction and delivery heads.

The main engines which operate the pump are connected to the ends of the shaft passing through the pump runner by means of flange couplings. There is a tandem-compound engine at each end of the shaft, each having cylinders 16 and 26 ins. in diameter and 18-in. stroke. The cranks are set at right angles with one another. These engines are balanced in a horizontal direction, and automatic governors are provided to regulate the speed. They are designed to develop 650 HP. at about 180 revolutions per minute, with a boiler pressure of 150 lbs.

The "Epsilon" has a 15-in. centrifugal jet pump operated by a vertical cross-compound engine with cylinders 12 and 22 ins. in diameter and 12-in. stroke. The engine is on the same base as the pump, and is directly connected by a flanged coupling.

The winding engines and the hoisting and hauling drums are located near the bow of the boat. The drums are 42 × 42 ins., and hold about 1,200 ft. of ¾-in. wire rope in two laps. Each drum is operated by an 8 × 8-in. double cylinder engine provided with a link reverse and suitable clutches and brakes giving fast or slow motion, as may be required. The suction hoist drum is 14 ins. long, and 42 ins. in diameter, operated by a double engine with 8 × 8 ins. cylinders. The spud hoist is located just behind the anchor spud, and is also operated by an 8 × 8-in. double engine. It is used for raising or lowering the anchor spud. The drum is 21 ins. long and 42 ins. in diameter. The operator stands on an elevated platform behind the winches and controls their movements by means of vertical levers.

On the "Zeta" the jet pump is omitted and a mechanical agitator for stirring up the material is used. This agitator consists of a vertical scraper or harrow attached to the front end of the suction head, which is given an up and down motion by means of a bell crank. It is divided into two parts, which are suspended in front of the suctions. A connecting rod or pitman extends from each agitator back to the rear end of the well, where it connects with a second oscillating crank operated by an engine with cylinders 10 × 14 ins. These engines are connected through gearing to a common shaft extending entirely across the boat. In order to lessen the danger of breakage from snags or other solid obstructions, a shearing pin is provided at the angle of the forward crank, which is so arranged as to shear off before sufficient strain can come on the agitator to break it. Mechanically considered, its movements are quite satisfactory. In the tests, however, it was demonstrated that the capacity of the pump with this agitator was not much over half the capacity of the pump with jet agitators. It will, therefore, be taken out, and jets will be put in. This device is the invention of Edward Flad, M. Am. Soc. C. E.

Steam for the various machines is derived from six boilers, 48 ins. in diameter and 28 ft. long, with three 11-in. and two 13-in. flues. They are designed for a working pressure of 140 lbs.

The two suction pipes run forward from the pump casing, separating gradually until 12 ft. apart at the bow. At this point a tight radial joint is provided, which connects the pipes in the hull with the pipes from the suction head, and admits of the vertical motion necessary for dredging at different depths. The suction can be lowered to a maximum depth of 15 ft. Outside the hull the two suctions are framed together rigidly and are handled as a single piece. The raising and lowering is accomplished by means of sheaves and tackle attached to a derrick

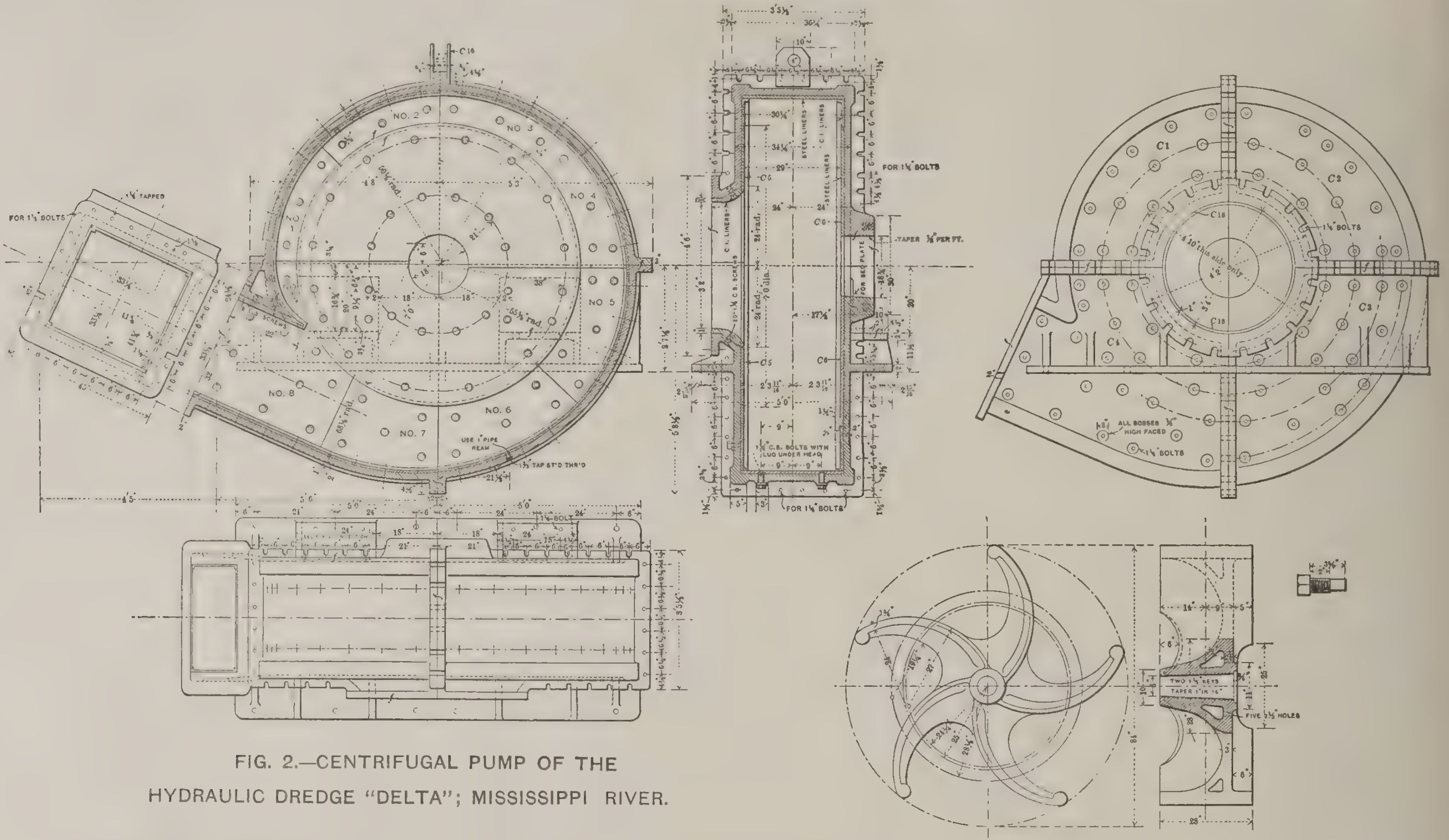

FIG. 2.—CENTRIFUGAL PUMP OF THE HYDRAULIC DREDGE "DELTA"; MISSISSIPPI RIVER.

TABLE NO. 1.—DIMENSIONS AND EQUIPMENT OF DREDGES WORKING ON THE MISSISSIPPI RIVER, BELOW CAIRO.

	Name of dredge.	"Alpha."	"Beta."	"Gamma."	"Delta."	"Epsilon."	"Zeta."
	When built	1893.	1895.	1897.	1897.	1897-98.	1897-98.
	Cost	$87,000	$217,000	$86,000	$125,000	$102,000	$106,000
	Capacity in cu. yds. of sand per hour	600	2,000	800	1,000	1,000	1,000
Hull	Kind	Wood.	Steel.	Steel.	Steel.	Steel.	Steel.
	Size	140' × 36' × 8'	172' × 40' × 7' 2"	138' × 38' × 8'	175' × 38' × 8' 4"	157' × 40' × 7' 9"	157' × 40' × 7' 9"
	Working draft	4' 10"	6' 6"	4' 3"	4' 3"	4'	4'
Main engines	Number	1	2	1	1	2 coupled.	2 coupled.
	Kind	C'mpound non-condensing.	4-cyl. triple, exp., 2-crank condnsg.	Hor. cross-compnd. condensing.	Vertical compound condensing.	Hor. tandem coup. non-condensing.	Hor. tandem coup. non-condensing.
	Size	15"—27" × 20"	20½"—33"—38"—38" × 24"	18"—22½" × 22"	24"—48" × 24"	16"—26" × 18"	16"—26" × 18"
	Horse-power	300	2,000	500	800	650	650
	Revolutions per minute	140	135	150	150	180	180
	Kind of condenser	None.	Jet.	Jet.	Jet.	None.	None.
Main dredging pumps	Centrifugal.	1	2	1	1	1	1
	Diameter of runner	6'	7'	5' 9"	7' × 28" wide.	5' 9"	5' 9"
	Kind of suction	Side.	Divided.	Divided.	Side.	Divided.	Divided.
	Diameter of suction	30"	Six 19½"	Two 24"	Four 17½"	Two 24"	Two 24"
	Discharge pipes—Number	1	2	1	1	1	1
	Discharge pipes—Size	30"	33"	34"	34"	32"	32"
	Suction head in ft. of water	7	18	9	18	12	12
	Delivery head in ft. of water	20	29	37	45	28	28
	Velocity—ft. per second.	10	14	10	15	13	13
Sand agitators		Six jets, 2½" diam.	Six vert. cutters.	9 jets, 2½" diam.	Horizontal cutters.	10 jets, 3" diam.	Oscillating rake.
	Engines, kind	Compound non-condensing.	Cross-compnd non-condensing.	Compnd condensing.	Two simple.	Vertical compd non-c'nd'sng.	Two simple.
	" size	...	14½"—29" × 18"	12"—22" × 14"	12¼" × 15"	12"—22" × 12"	Each 12" × 16"
	" revolutions per minute	190	120	160	...	200	180
	Cutters, revolutions per minute	...	12	...	5	...	60 double strokes.
	Engines, horse-power	125	...	200	...	150	80
	Jet pumps	Centrifugal.	...	Centrifugal.	...	Centrifugal.	...
	Suction and discharge, diameter	10"	...	18"	...	18" and 15"	...
	Suction head	6	...	7	...	5	...
	Delivery head	20'	...	28'	...	30'	...
Boilers	Number	4	4	6	4	6	6
	Kind	Mississippi River.	Heine 375 HP.	Mississippi River.	Heine 250 HP.	Mississippi River.	Mississippi River.
	Size	42" × 28"	...	48" × 28" Five 11" flues.	...	48" × 28" Three 11" & Two 13" flues.	48" × 28" Three 11" & Two 13" flues.
	Pressure used	135 lbs.	165 lbs.	140 lbs.	155 lbs.	150 lbs.	150 lbs.
	Coal used per 24 hours	500 bush.	2,088 bush.	400 bush.	1,200 bush.	....	....
	Total cost of running dredge per day	$98.70	$221.63	$100.51	$111.76	....	....

Cost of steam tender per day, $37.00. Cost of pile sinker per day, $13.00.

frame located over the forward end of the suction well. A straining frame is provided so that when the suction is lowered to a suitable depth it can be locked; it thus relieves the tackle of the weight, and maintains the suction at a constant depth. Each part of the suction head is 10 ft. long, making the suction 20 ft. wide over all.

The "Epsilon" suction head has a pressure chamber on the under side at the front end connecting with the jet pump. Ten 3-in. jet nozzles are screwed into the front side of this pressure chamber and serve to loosen and stir up the sand and induce the flow of material to the suction.

The discharge pipe passes straight aft from the pump between two central keelsons, and rests on the floor beams for a distance of about 52 ft. From this point it rises gradually for a distance of 22 ft. until the center of the pipe is 4 ft. above the bottom of the boat. Then it runs horizontally straight out through the stern, projecting far enough to couple on the floating pipe line. The pipe is flattened out near the pump casing so as to depress it below the water-line and thus facilitate priming, which is done by using a steam syphon at the top of the casing. The floating discharge pipe is similar to those previously described, except that greated buoyancy is provided, and the shape of the float is somewhat flatter.

A velocimeter is provided for showing the velocity of flow in the discharge pipe. This consists of two vertical tubes whch pierce the discharge pipe. They are set in the vertical plane passing through a longitudinal axis of the discharge pipe. About 5 ins. below the upper inner surface of the pipe, ¼-in. tubes, 6 ins. long, are inserted horizontally; the one nearest the pump being open toward the pump to receive the pressure of flow and the other turned in the opposite direction. The upper ends of the vertical tubes connect with glass tubes attached to suitable scales. The difference in the height of the columns of water in the two tubes, when water is flowing through the discharge pipe, gives results from which the velocity of flow can be deduced.

Weighing apparatus, designed to show the percentage of solid matter passing through the discharge pipe, is also provided. To accomplish this, a suitable length of the pipe is connected at each end by rubber thimbles, which leaves the joints flexible. One end of this pipe is then supported by a weighing apparatus properly counterbalanced. An indicator is located where it can be readily seen by the engineer. The pointer is set so that it reads zero on the dial when water only is pumped. When sand is pumped the pointer will show on the dial the weight of the same at any moment, and consequently the percentage of solid matter.

The total approximate weight of each dredge is 1,057,118 lbs.; weight of floating pipe line, 325,000 lbs.

The efficiency tests of these dredges were begun about the middle of January. Owing to delays occasioned by high water and some minor modifications that were required, the capacity tests were delayed until the latter part of March, 1898.

The specifications and plans of all the dredges of the Mississippi River Commission have been prepared under the direction and subject to the approval of the Committee on Dredges, consisting of Major Thomas H. Handbury, Corps of Engineers, U. S. A.; Henry Flad, M. Am. Soc. C. E., and B. M. Harrod, Past-President, Am. Soc. C. E. The dredges "Gamma," "Delta," "Epsilon" and "Zeta" were constructed under the direction of Capt. H. E. Waterman, Corps of Engineers, U. S. A.

Table No. 1 gives the leading features of these five dredges, working below Cairo, Ill. Table No. 2 gives some particulars of the tests, showing the minimum and maximum capacities of these dredges:

Another dredge has been designed for work on the river below Cairo, and the contract for its construction will be let during the present year. This will be a single-pump dredge, similar in form to the "Epsilon," but will be provided with side wheels and propelling machinery.

Two dredges for use on the Mississippi River between the Missouri and Ohio Rivers are now under construction, and are practically completed. They were designed and constructed under the direction of Major Thomas H. Handbury.* They will be ready for use during the next low-water season. It is expected that a navigable channel 6 ft. deep can be maintained with these dredges, aided by the temporary jetties and the jet dredge.

The hulls of these dredges are of steel, 160 ft. long and 40 ft. wide, with 6½ ft. depth of hold. Their working draft will be about 3½ ft.

Each dredge is provided with two centrifugal pumps with a single 20-in. suction in the axis of the pump, discharging from the lower side of the casing. The discharge at the pump is 20 ins. diameter, but is expanded to 24 ins. at the discharge pipe. The casing of the pump is 48 ins. in diameter and 28 ins. across the inside.

Each pump is operated by a direct-connected, horizontal, compound, non-condensing engine, designed to run 200 revolutions per minute and develop 300-HP. at a boiler pressure of 140 lbs. This speed is to be regarded as the average work of the engine, and is expected to maintain through the suction and discharge pipes the velocity necessary to carry at least 20% of sand and 80% of water under a maximum head of 30 ft.

A jet pump is provided with each main pump, which serves to loosen up the material at the end of the suction and thus facilitate its passage into the suction pipe. The jet pump has two high-pressure cylinders 8 ins. in diameter, two low-pressure cylinders 12 ins. in diameter, and two water plungers 12 ins. in diameter; all having 10-in. stroke. The capacity of the pump is 1,200 gallons per minute against a water pressure of 65 lbs. when running compound under a steam pressure of 150 lbs. These pumps discharge through 8-in. pipes terminating in three bronze nozzles 1½ ins. in diameter, their extremities radiating to a distance of about 30 ins. apart and just beneath the suction of the main pump.

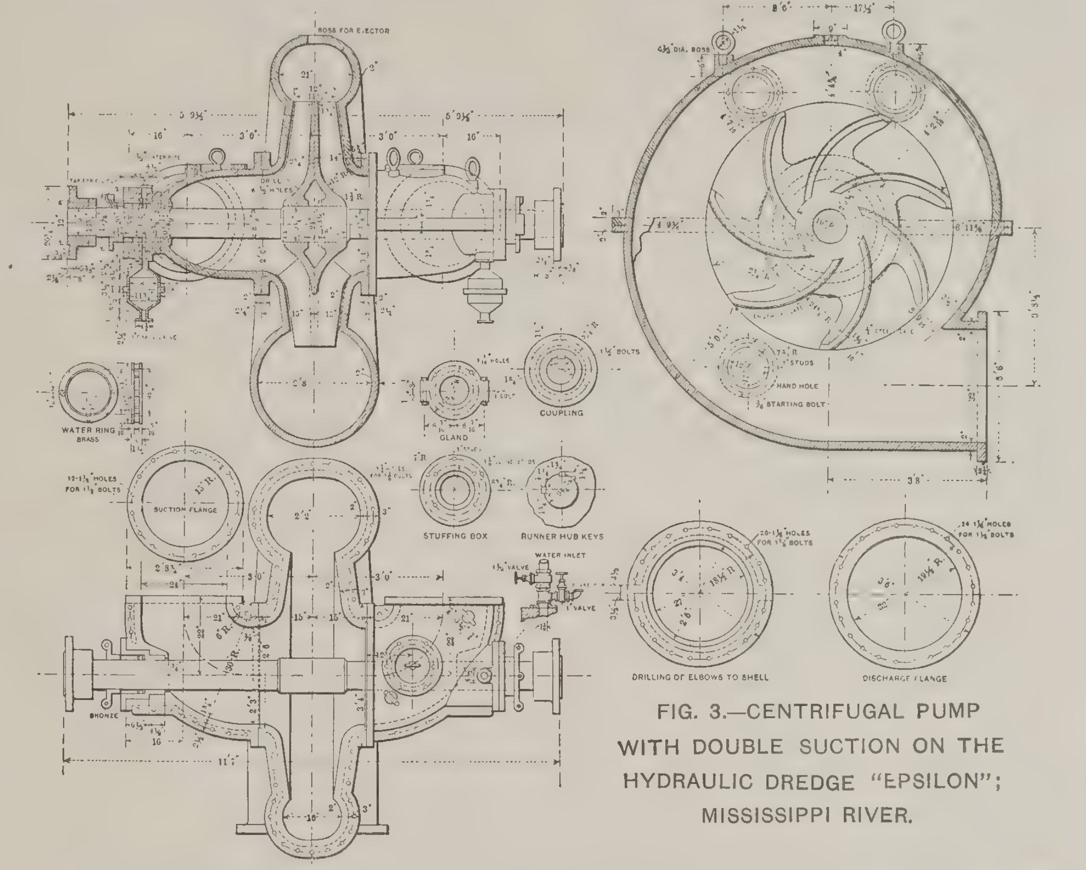

FIG. 3.—CENTRIFUGAL PUMP WITH DOUBLE SUCTION ON THE HYDRAULIC DREDGE "EPSILON"; MISSISSIPPI RIVER.

Steam is supplied by six boilers of the Mississippi River steamboat type.

Dredge "Ram."—In the fall of 1893 the dredge "Ram" was completed by the Bucyrus Steam Shovel & Dredge Co., for use in keeping open the channel from the Mississippi River into the Red and Atchafalaya Rivers. It was built under the direction of Capt. John Millis, Corps of Engineers, U. S. A., and cost $69,500. The capacity is about 300 cu. yds. of mud per hour, delivered through 300 ft. of pipe. It is provided with propelling machinery such as commonly used on stern-wheel steamboats. The hull is 95 ft. long, 27 ft. beam and 7½ ft. deep. The dredging pump is an Edwards centrifugal, with 15-in. suction and discharge. The pump is run through a belt connection by a horizontal, compound-condensing engine, with cylinders 14½ and 26 ins. diameter, and 20-in. stroke.

This dredge can work in any depth up to 30 ft. It is so arranged that material can be discharged on either side at will. A vertical anchor spud is provided in the stern of the boat, on which it swings by means of kedge anchors laid out from either side of the bow and maneuvred by winding drums. In this way a wide cut can be made by swinging the cutters from side to side.

The cutter and suction is supported by an A-frame, the inner legs of which are pivoted to the sides of the bow. The frame is raised or lowered with wire rope tackle attached at the upper end to suitable shears and operated by winding drums. The cutter is a conical steel casting with eight steel blades forming a cutter 24 ins. in diameter at the end and 54 ins. in diameter at the base. This cutter is at the outer extremity of a 5-in. steel shaft, which is revolved by gear wheels at the bow of the boat, and operated by a sprocket wheel and chain. The suction proper starts at the base of the cutter.

This boat has been quite successful from the start. During the low-water season of 1894 she dredged 265,000 cu. yds. of material at a cost of a trifle over 4½ cts. per yard. The material was largely mud and clay. The material is generally delivered through about 50 ft. of pipe suspended from a derrick and attached to the boat. This boat has also been used with considerable success in building levees. It is estimated that under favorable conditions a levee 10 ft. high can be built at a cost of about 6 cts. per cu. yd.

Menge Dredges.—In 1888 two dredges of the elevator type were procured, one for use in Vicksburg harbor and one for the mouth of the Red River. These were called the 'Menge" and the "Pah-Ute."

In actual work the "Menge" has dredged 4,000 cu. yds. in 10 working hours. This dredge cost about $18,000. The "Pah-Ute" has about half the above capacity, and cost $10,000. These dredges, as generally equipped, deliver the dredged material in dump scows, which are towed to the desired point and dumped. In some favorable situations the material is delivered through sluice boxes supported on barges. These dredges, if properly constructed, are very successful when operated in soft material.

Dredge "Bayley."—This was built by Carroll & Co., of Pittsburg, for use in South Pass. It arrived at Port Eads in the fall of 1877. It is constructed of iron throughout. The hull is about 200 ft. long over all, 32 ft. wide, and 10 ft. depth of hold. With fuel on board, it draws about 5 ft. of water. It is self-propelling by means of side-wheels 25 ft. in diameter, with buckets 11 ft. long. These wheels are operated by two engines with cylinders 21 × 84 ins.

This dredge has a centrifugal pump of the Andrews' cataract pattern, with a runner 6 ft. in diameter and 3 ft. wide, mounted on an 8-in. steel shaft. It is operated by two independent condensing engines, placed forward of the pump, having cylinders 24 × 20 ins. The wrought-iron suction pipe is 27 ins. in diameter. The suction is supported on a flat plate resting on the sand to prevent the scraper from cutting too deep. This scraper takes in a slice of sand about 8 ins. deep and 4 ft. wide. A stream of water of about half the above depth and the same width enters the suction at the same time.

The movable part of the suction, when in operation, in 26 ft. of water, stands at an angle of about 35°. When not in use it is lifted above water, under the extension of the main deck, the end projecting about 15 ft. aft of the stern post. The discharge pipe is 30 ins. in

TABLE No. 2.—Summary of Tests of Mississippi River Dredges.* (Showing minimum and maximum capacity.)

	"Alpha."		"Beta."		"Gamma."		"Delta."		"Epsilon"		"Zeta."	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Sand pumped, cu. yds. per hr....	405	905	868	7798	1130	2595	928	3212	1713	3102	1071	1872
Percentage of sand‡............	6.93	12.45	2.6	36.4	15.8	29.0	7.4	25.5	13.6	25.8	8.1	14.8
Velocity, discharge, ft. per sec..	8.94	11.10	20.8	13.5	8.48	10.64	14.96	15.01	16.9	16.4	17.8	17
Material pumped, cu. ft. per sec.	43.85	54.49	247	160	53.46	67.07	94.35	94.65	94.48	90.16	99.31	94.92
Efficiency, per cent.	62.62	54.85	65.8	65.2	59.5	74.2	74.4	..	83.6	78.8	87.6	78.4
Revs. of main pump, per min...	125	153	150	154	174	169	150	149	181	182	181	182
Steam pressure, lbs.	130	118	177	176	152	125	156	156	155	165	146	145
I. HP. of main eng. and pump..	274	319	2561	2392	486	508	997	..	712	801	661	718
Forward movement, ft. per min.	1.26	4.26	7.5	5	2.2	6.6	2.7	7	4.4	9.4	3.2	4.8
Depth of suction	7.3	10.56	14.6	17.5	12.0	11.0	14.2	15	15	14	14	14
Depth of water	6 to 7	7 to 8	8.3	9.2	4.7	5.2	8.3	7	8.5	7	8	7.5

*This table is compiled from the various tables in Mr. Ockerson's paper.
‡The sand weighs about 100 lbs. per cu. ft. when dry; and has about 35% of voids when wet.

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*These dredges were described and illustrated in our issue of July 22, 1897.

diameter, and is arranged so that the spoil can be deposited in the spoil bins on board, or delivered on either side of the boat through pipes swung from derricks.

The four spoil bins stand forward of the engines. They are 60 ft. long, 19 ft. wide and about 20 ft. deep, and have a capacity of about 512 cu. yds. of dredged material. These tanks are filled in about 7 minutes, when the suction is raised and the boat proceeds to the dumping ground. Two-thirds of the available time is occupied in unloading. Overflow gates are provided so as to allow the water to escape while the sand settles to the bottom, thus insuring a greater load of solid matter. In a working day of 13 hours the average amount of solid matter removed is 1,309 cu. yds. The tanks are divided into compartments, each of which terminates in a hopper having a 4-ft. opening through the bottom of the hull. These openings are closed by valves operated by hydraulic jacks with a capacity of about 12½ tons. The sand is washed out of the tanks by means of two jets in each hopper.

The capacity of the dredge when delivering the material as described is about 350 cu. yds. per hour. If the material is simply delivered overboard, the capacity is about 1,000 cu. yds. per hour. When dredging, the boat moves down stream, with the suction lowered, at the rate of about 2½ miles per hour.

This dredge cost about $150,000. It was designed by Jas. B. Eads, M. Am. Soc. C. E., for the special purpose of working in deep rough water with strong currents.[*] This boat is now over twenty years old, but is still serviceable.

The foregoing descriptions cover a fleet of eight hydraulic dredges of large capacity and five other dredges, all of which are now available for use in improving the low-water navigation of the Mississippi River. The "Alpha" has been operated for three seasons, the "Beta" for two seasons, and the "Gamma" and "Delta" for one season. They have all demonstrated the practicability of moving economically immense quantities of material in a short space of time. They have also shown that good navigable channels can be opened through the reefs that obstruct navigation.

As far as the machines themselves are concerned, they seem to meet the requirements fully. The value of these dredges as aids to navigation depends far more on the proper location and direction of the cuts to be made than on the efficiency of the machinery. Experience may show that in some cases the dredges can be made more efficient by filling side chutes and thus throwing the water into one channel, rather than attempting to enlarge one of the channels by dredging out the material. It may also be found desirable in some cases to discharge the material at the sides of the proposed channel rather than to deliver it at a distance through long discharge pipes.

The volume of material rolled along the bottom is so great as to far outweigh the greatest possible capacity of any dredge. To those who are not familiar with this phenomenon it will seem incredible that a dredge with a capacity of over 1,000 cu. yds. per hour may be operated for days and leave scarcely a trace of the cut. Or, on the other hand, if the cut has been so located as to meet the requirements of the current, a channel will be scoured out and an amount of material removed which would probably exceed the capacity of the dredge many times. It is by no means certain that the channel will always follow the line of the cuts. It sometimes happens that after some days of diligent dredging, a channel develops without assistance on a line quite remote from the dredged cuts.

Whatever is done during one low-water season is generally obliterated by the succeeding high-water. The successful location of a cut during one low-water season does not necessarily imply that a similar location during the following season will give like results. In fact, a new problem is presented by each bar every season.

In a stream of this character it is, of course, extremely difficult to determine in a particular case justs what share of the channel should be credited to the dredging and what proportion to natural causes. Enough bars have been dredged, however, to fully demonstrate that the dredging at least induces the scour which eventually results in a wide and deep channel.

During the low-water season of 1897, four dredges were at work on the bars below Cairo, and the cost of operating them was as follows:

Labor	$26,704.53
Fuel	13,474.23
Subsistence	7,586.99
Lubricants	970.79
Lighting supplies	215.05
Miscellaneous supplies	1,527.79
Office supplies	145.10
Hire of tow boats for moving plant	10,115.50
Preparation and moving into field	3,269.44
Moving to winter quarters at end of season	4,637.03
Cost of inspection and supply boat	10,554.75
Cost of operating two survey boats	8,674.10
Total	$87,875.30

There was a conspicuous sand bar at Lazelles, some 82 miles below Cairo. When the survey of this bar was made, just before dredging, the distance from the 9-ft. depth in the upper pool to the same depth in the lower pool was 1,400 ft. At that time the amount of excavation required to make a 9-ft. channel 250 ft. wide at the datum stage was 61,000 cu. yds. The dredge "Gamma" was at work on this bar ten days, and the actual dredging time was 178 hours. Taking the capacity of the dredge at 800 cu. yds. per hour gives the total amount dredged as 142,400 cu. yds. Thirty-one days after the dredging was completed there was a 10-ft. channel clear through the reef, except for a distane of about 225 ft., where the depth was only 8 ft.; 76 days after the dredging was completed the channel was found to be 350 ft. wide at the narrowest point, over 1,000 ft. wide for more than nine-tenths of the length, and with a least depth of 9 ft., and an average depth of 11 ft.

At President's Island, just below Memphis, the dredge 'Delta" was employed in opening a channel through a reef which was causing much trouble to navigation. In the bed of the river in this locality there is a considerable quantity of conglomerate rock and lignite to be found. The mechanical agitators of the "Delta" were, therefore, put to a very severe test. One solid piece 3½ × 4½ ft. was caught in the cutters. It had to be broken into small pieces to dispose of it. When work began there was barely a 5-ft. navigable channel across this bar. After 15 days' work, during which period much time was lost in clearing the cutters of débris, leaving only 80 hours actual dredging time, a 9-ft. channel 100 ft. wide and 1,300 ft. long was completed. This channel remained intact throughout the season, although a wider channel broke through the bar lower down.

These bars do not all develop at the same time, and they do not necessarily develop at the same places during successive seasons. There are, however, certain general localities that have long been recognized by steamboatmen as liable to develop bad navigation during any low-water season. Now and then, even these places pass through a season without developing any serious obstructions, and at such times dredging below Cairo will be unnecessary. Seasons having good navigation throughout are, however, not frequent.

Dredging operations will, in the main, be confined to the same general localities from year to year, although wrecks, snags and bank erosions may occasionally develop new bars that will require dredging.

The season of 1895 was one of extraordinary low water. At one time during that season there were 57 crossings between St. Louis and Cairo, where the water was 6 ft. or less in depth. During ordinary seasons about as much dredging would be required between St. Louis and Cairo to secure a 9-ft. channel 250 ft. wide as is required below Cairo for a similiar channel. The supply of water above Cairo at extreme low stages is too limited to readily admit of 9-ft. channel depths. The requirements of river traffic on this reach would be satisfied fairly well by 7 or 8 ft., and it is doubtful whether these depths can be materially exceeded by means of dredges or other temporary devices at an expense justified by the value of the results obtained.

It is evident from the foregoing that the problem of keeping navigation open in the Mississippi River during the low-water season is very far from being a simple one. The magnitude of the plant described is sufficient evidence that strenuous efforts are being made to "improve and give safety and ease to the navigation" of the river, and the experience gained thus far justifies the belief that these efforts will be successful.

The writer is indebted to Gen. John M. Wilson, Chief of Engineers, U. S. A., M. Am. Soc. C. E., to Maj. Thomas H. Handbury, Capt. H. E. Waterman and other officers of the Engineering Corps for free access to records and drawings. He is also indebted to his associates, engaged in the improvement of the river, for valuable assistance in the preparation of drawings and tabulated data.

◆

THE RAILWAYS OF NEW SOUTH WALES, which are owned and operated by the government, aggregated 2,691 miles in length on June 30, 1898, or 52 miles more than in 1897. Several light or pioneer railways have been built and have given satisfactory results. The traffic aggregated 8,340,338 train-miles, with gross and net earnings of $1.81 and 84 cts per train-mile. The total earnings were $15,133,740, and the balance after paying operating expenses was $7,060,715, the operating expenses being 53.34% of the gross revenue. The freight traffic aggregated 4,561,943 tons, with an average haul of 56.63 miles per ton, and earnings of 2.76 cts. per ton per mile. Improvements of grades and curves are being made, the work being done by the Railway Commissioners and not by contract. The Commissioners also control and operate 65 miles of street railway, operated by steam, cable and electricity.

◆

AN ELECTRIC RAILWAY TRAIN SERVICE has been put into operation between Berlin and Zehlendorf, 7.5 miles distant. The train is made up on nine carriages of the type used on the Berlin elevated railway, weighing 210 metric tons. The carriages at the head and rear of the train are equipped with electric motors, and one or the other hauls the train, according to the direction of motion. All shifting of cars at terminal stations is thus avoided. The run occupies 27 minutes including four stops, and there are 15 trains a day each way. Each motor car is equipped with two electric motors of 100 HP., mounted over the two end axles. The two motor cars are so connected, electrically, that both may be used in case of need, and the four motors may be employed in braking. Besides the electric brakes on the motors, all the carriages in the train are equipped with electro-magnetic and Westinghouse brakes. The current is distributed by the third-rail system at a tension of 550 to 600 volts.

◆

THE ELECTRIC TRAMWAYS OF SWITZERLAND, on July 1, 1898, had a total length of 69 miles in actual operation, and 64 miles under construction; concessions for 200 miles more had been granted to different companies. Water power is usually available for generating the current. The usual gage is one meter. The overhead system is generally used with copper wires 6 to 9 mm. diameter, elevated from 16 to 20 ft. above the road surface. In the establishment of new lines alternating currents are generally employed, with a maximum tension of 750 volts, as fixed by law; when continuous currents are used the maximum tension is 1,000 volts. The motor cars weigh from 9,900 to 16,500 lbs. and carry from 22 to 45 passengers. Handbrakes, working on 4 or 8 shoes, are usually applied to the wheels. For the tramways of Fribourg and Lausanne, where grades of 9.2 to 11.3% are met with, the heaviest grades on simple friction railways in Europe, very strong safety brakes are employed, in the form of spurs that may be forced into timbers running parallel to the rails. Speed on the Swiss tramways is fixed by law, at a limit of 7.5 miles per hour in cities and towns, and 15.5 miles in the open country.

◆

A NEW TIMBER DAM AND POWER PLANT will be constructed by the Twin City Rapid Transit Co., of Minneapolis, Minn., at a point about 3½ miles north of the city limits of Minneapolis, Minn. The dam will be 1,198 ft. long and will cross the Mississippi River, furnishing a head of water of 20 ft. Its total cost ready for the power house and machinery, is estimated at $308,079. The power house contemplated provides for nine flumes, each holding four 42-in. turbines on one shaft, or 36 turbines capable of developing under a 20-ft. head a nominal power of 10,145 HP. This power house and the machinery, including about $75,000 for flowage rights, will bring the total cost of the improvement up to $525,000. The bulk of the power—all but 3,000 HP. or 4,000 HP., which will be sold—will be used by the rapid transit company, which will thus be able to abandon all its steam plants. The preliminary estimates and plans for the timber dam have been made by Mr. E. T. Abbott, Civil Engineer, of Minneapolis, Minn., and a beginning on the construction will probably be made this winter.

◆

THE MOTOR USED ON THE ELECTRIC CABS in use in New York city are 4-pole, 2-HP. machines operating on 80 volts, and 23 amperes at a speed of 800 r. p. m. They are of the enclosed circular type with cast steel fields and laminated poles. The armatures have 41 slots, and both armature and field coils are machine wound. The fields are connected two in series, and these pairs in parallel, making four field wires and two armature wires which pass through the field frame and connect with the controller. At full load (23 amperes) the efficiency is 83%; at ¾-load 84%; at 1½-load 79%. At full-load the motor will operate for two hours with a maximum temperature rise of only 40° C.

◆

THE SWISS TELEGRAPH BUSINESS is a branch of the Post, Telegraph and Railway Department, and any post-office will receive or deliver prepaid telegrams. At the end of 1896 the telegraph lines represented a length of 4,865 miles, and there were 252 telephone stations, with 6,150 miles of wire and 25,090 subscribers. Snowfall is very troublesome, and 35% of the wires are now underground. In 1896 the official balance-sheet showed, for telegraphs, $562,780 received and $519,520 expended; for telephones, the statement was $866,700 received and $869,680 expended. On Jan. 1, 1896, the telephone rates were reduced, with an increase of 4,555 subscribers; but the annual income was decreased $56,870. The unfavorable weather of 1896 also affected the summer business in telegrams; in the extent of 3.83% in internal, 0.04% in international and 5% in through messages.

◆

MAGNETIC DEFLECTION OF IRON PLUMB-BOBS, in shaft work, is noted by Mr. O. Brathuhn in an article on underground surveying in the "Berg und Hüttenmannische Zeitung" for 1898. He notes that in plumbing a shaft 390 ft. deep with an iron plumb-bob, he found a considerable error. The explanation lay in a cross-cut from the shaft in which a large number of spare rails had been stored with one end of the pile very close to the plumbline. He says that by the induced magnetism of the rails the plumbline was drawn from its perpendicular position to such an extent that the bottom of two lines were 7.5 mm. further apart than the tops of the same lines, and the line connecting the plumblines at the points of suspension formed an angle of 6′ with that at the bottom of the shaft. The trouble was corrected by using brass plumb-bobs.

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[*] See "The Mississippi Jetties," by E. L. Corthell, M. Am. Soc. C. E.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

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THE EIGHT-TRACK DRAWBRIDGE which is to cross the Chicago drainage canal near Campbell Ave. is meeting with continued delay and opposition. A review of the history of this proposed great structure up to the final rejection of plans for a swing bridge was given in our issue of April 7. Since then new bids have been received and a contract awarded to the Scherzer Rolling Lift Bridge Co., but an injunction has now been granted to prevent this contract from being carried out. The chief engineer of the sanitary district estimated that the ultimate cost to the district, including a capitalization for payment to the railways of the cost of operation, maintenance, repairs and depreciation, would be about $915,000, as compared with $690,000 for a bridge of the type proposed by Mr. C. L. Strobel. This latter design, however, is entirely new and provides for a center pier 8 ft. wide, with two waterways 80 ft. wide, and the engineers of the railways interested estimate its ultimate cost at $1,069,393 instead of $690,000. The Scherzer bridge would give a clear waterway of 120 ft. (originally planned for 150 ft.), and would be in general similar to bridges now in successful operation in Chicago. In view of these facts and of a resolution adopted by the Trustees in favor of avoiding the use of center piers, the contract was awarded to the Scherzer design although two minority reports were presented in favor of the Strobel and Schinke designs. Suit was brought, however, to prevent the carrying out of this contract on the ground that the contract should have been awarded to Mr. Strobel as the lowest responsible bidder. The court has granted the injunction, but based its action mainly upon the methods adopted by the district in inviting bids. It was held (1) that the Trustees should have selected one of the designs in the first place, (2) that there must be a common basis for all the bids, and (3) that unless the design was selected in advance the terms and conditions were necessarily incomplete. On these grounds the court held that the award of the contract was invalid. The Trustees will appeal the case to the Supreme Court.

◆

THE TRACK ELEVATION of the Chicago, Burlington & Quincy R. R. from Rockwell St. to W. 48th St., will be done next spring. In the mean time the foundations and abutments are being put in for the girder bridges of the 21 subways which will be required. The distance is 2.8 miles, with four tracks throughout. Mr. G. H. Bremner is the engineer in charge of the work. The Chicago, Milwaukee & St. Paul Ry. has some very extensive and complicated track elevation now in progress at junctions involving a large number of tracks and connecting Y's. On this road all the bridge abutments for subways are of monolithic concrete, and the plate girders are set in position by means of two cars with jib cranes, the cars being placed on each side of the subway and the girders being run out on cars on the trestling which carries the temporary tracks. Mr. W. L. Webb is the engineer in charge of track elevation.

◆

THE HAVANA FLOATING DRY-DOCK, including its elaborate machinery, is said to have cost Spain about $4,000,000. It is capable of lifting a 10,000-ton vessel, and was towed from Newcastle-on-Tyne to Havana. At the latter point and during the tests of the dock unskilful manipulation of the machinery by the Spanish engineers resulted in the sinking of the dock; some valves failed to work, some rivets gave way and plates opened and the dock filled and sank on its side. The dock was raised, however, by an English engineer after considerable trouble owing to the mud in the harbor. The Spanish Government would doubtless dispose of this dock at a sacrifice under present conditions, and it is said that the harbor authorities of Kingston, Jamaica, are after it. Kingston now has a floating dock of 3,000 tons capacity; this Havana dock has actually lifted an 8,900-ton ship, and can raise a 10,000-ton ship. The Spanish dock charges are excessive, as they amount to 45 cts. per ton for the first 24 hours and 25 cts. per ton for each subsequent 24 hours or parts thereof.

◆

THE GROWTH OF THE U. S. NAVY is rapid at the present time, as 55 warships are now under contract and 20 are nearly completed. Of the 55 ships, 8 are first-class battleships, 38 are torpedo boats and destroyers, 4 are monitors and one is a heavy armored cruiser. Of the 20 nearly finished 17 have been launched and the other three will be afloat before the end of the year. Naval Constructor Hichborn, in a late report, says that the five battleships launched are respectively 68, 66, 55, 63 and 50% completed. The cruiser "Albany," bought from Brazil with the "New Orleans," is still under construction at the Armstrong yard in England; work on her was stopped during the war, but the builders promise to deliver her within six months. A number of the torpedo boats and destroyers contracted for are well on the way towards completion.

◆

A RIVAL NICARAGUA CANAL COMPANY is trying to obtain a concession from the Government of Nicaragua, according to recent press reports from Managua, the capital of Nicaragua. These state that Edwin F. Crogin, of Chicago, and Edwin Eyer and Frank J. Washburn, of New York, are negotiating with President Zeloya and his Ministers with reference to obtaining a new concession for an interoceanic canal. According to the same authority the Nicaraguan Government holds that the concession granted to the Maritime Canal Co., of Nicaragua, expires during the present month, the company having failed to begin active work on the canal within the limit of time prescribed in its charter. The company claims however, that the charter does not expire until October, 1899, and, further, that as Nicaragua has not furnished the police force which it agreed to provide to guard the company's stores, property, etc., the company is entitled to a further extension of time.

◆

THE LOSS OF THE STEAMER "MOHEGAN" off the Lizard, England, on the evening of October 14, is one of the most serious marine disasters in recent years. The latest accounts state that 116 of the passengers and crew were lost, and only forty-five were saved. The vessel was bound from London to New York, and, as far as can at present be learned, when off the Lizard, between The Manacles and the Lowlands, ran onto the rocks. Lifeboats put off from the shore, and every possible effort was made to save those on board, but, owing to the extremely rough weather, only partial assistance could be rendered. The early reports stated that the engines broke down and that the vessel was blown ashore, but it now appears that she was out of her course. The "Mohegan" was a single screw steamer, 480 ft. long, 52 ft. beam and 36 ft. deep, with a carrying capacity of 8,500 tons and a displacement of 15,500 tons. She had stalls for 700 cattle, and was equipped to carry 125 first cabin passengers. She was built at Hull, and made her first trip in the summer of 1897, being at that time one of the freight steamers of the Wilson & Furness-Leyland Line. Later the Atlantic Transport Line bought the Wilson fleet, including the "Mohegan."

◆

A RAILWAY COLLISION in England, in which an express train ran into a freight train, which was switched across the main track, occurred on October 17, at Barnet, about eleven miles north of London. Nine persons were killed and thirteen were seriously injured, while a number of others received minor injuries.

◆

A WROUGHT IRON STAND-PIPE BURST at Waco, Tex., on Oct. 6. It is said that the pipe was full of water at the time, and that the break occurred midway in its height. According to "The Manual of American Water-Works" for 1897, the Bell Water Co., to which the structure belonged, had two pipes, one 20 × 80 and the other 20 × 88 ft.

◆

THE EFFECT OF THE CHICAGO DRAINAGE CANAL upon the water supply ot St. Louis is again agitating the people of the latter city. It is said that the St. Louis Board of Health and a committee representing the Merchants' Exchange are discussing the possibilities of federal interference to prevent the use of the canal as designed; also that an attempt will be made to secure the co-operation of Illinois towns to prevent the use of the canal without proper dilution of the sewage with lake water.

PLANS FOR STORM SEWERS AT DENVER, estimated to cost $400,000, have been adopted, and contracts for the work will probably be let on Dec. 15. The largest sewer will be 81 ins. in diameter. The plan contemplates the drainage of 2,100 acres of land at an ultimate cost of $1,000,000. Mr. S. N. Wood is President of the Board of Public Works. Mr. Harvey C. Lowrie, M. Am. Soc. C. E., is the designing engineer.

◆

A JOINT OUTLET SEWER for South Orange, Milburn, Irvington, a portion of Newark, and a number of other New Jersey municipalities is being investigated by the places named. Mr. Alex. Potter, Assoc. M. Am. Soc. C. E., is making engineering studies for the scheme.

◆

THE MUNICIPAL ELECTRIC LIGHTING PLANT at Grand Rapids, Mich., will have the old-fashioned system of belted machinery instead of the more modern and more economical system of direct-connected machinery. This is contrary to the advice of the consulting engineers and due to the interference of some of the local authorities who have no technical knowledge whatever, and whose interference will result in increased expenditure on the part of the city. The plant as first designed by the engineers called for the direct-connected system, with engines running at 460 revolutions per minute. The claim was made by some of the bidders, however, that only the Willans engine could make that speed, and only the Western electric dynamos were built for the same speed. They therefore complained that there could be no competition. In spite of the fact that the engineers showed a great economy for the direct-connected system the local authorities rejected their advice and decided to advertise for new bids under different specifications, permitting of a very wide range of competition. While the former plan would have required a power house only 28 ft. wide the belted plant now decided upon will require a building 56 ft. wide. The cost of operation of the new municipal plant is estimated at $35 per lamp (or even less when the number of lamps is increased), while that of the old company plant was $97 per lamp. The old tower system of lighting will be retained, but the lamps will be of the Adams & Bagnall enclosed arc type. The contract has been awarded to the Chase Construction Co., of Detroit, Mich., for $90,000. This includes the pole line, 500 lamps, Russell engines, dynamos and Babcock & Wilcox boilers with the Hawley down-draft furnace. Nagle & Ball, of Chicago, are the consulting engineers.

◆

ASPHALT PAVING IN NEW YORK, about which there is just now considerable political controversy, is said to have cost nearly $1.00 per yard more, under Mayor Strong's administration, than similar pavement cost in other cities. The price paid in New York was generally about $3.10, and as low as $2.55 per yard. But the officials of the late Board of Public Works explain that with this price went a guarantee to keep the pavement in repair for 15 years without cost to the city. The city retained 30% of the contractors' pay for five years, and then paid this balance in ten yearly installments. If the company failed to make the repairs the city had them made, and charged the expense against the money retained. As a result the paving company could only figure on 70% of the contract price as ever coming to it, or $2.17 per yard. Practically all of the balance will be required to keep the pavement in repair for 15 years. To compare the $3.10, therefore, with work done in other cities with a shorter time-repair guarantee or no guarantee at all, and with light street traffic compared with New York, is evidently unfair. In New York other conditions also call for a relative higher price per yard. The grading of the street requires the removal of from 12 to 18 ins. in depth of soil, and to get rid of this dirt costs from 50 to 60 cts. for every square yard of asphalt laid. In other cities this cost may range from 8 to 15 cts. Long hauls, high rental of real estate and high prices for labor also tend to increase the cost of paving in New York city as compared with other cities.

◆

STREET CAR FENDERS are at last being introduced in Chicago after prolonged litigation between the railway companies and the city. The companies have fought several ordnances on legal technicalities, and have made the long-disproved claim that the stop planks set across in front of the wheels were more efficient than any fenders on the front of the car. The North Side cars are now being equipped with a fender composed of steel strips curving out in front of the dashboard and projecting over the track, but it is noted that in many cases the lower edge is set too high above the level of the paving.

◆

THE OPERATIONS OF THE ENGINEER CORPS, U. S. A., during the war with Spain, were reported upon to the War Investigation Commission by Gen. John M. Wilson, Chief of Engineers, U. S. A., in answer to specific questions. Gen. Wilson said that the expenditure for work on coast fortifications aggregated $4,821,500. Submarine mines to the number of 1,535 were planted in 28 different harbors, together with all their cables, anchors and electrical connections. Including additional mines and accessories, force of skilled electricians, fleet of tugs, detachments of engineers, etc., the expenditures on account of torpedo harbor defences amounted to about $1.661,000.

THE FAILURE OF THE SNAKE RAVINE DAM, TURLOCK IRRIGATION DISTRICT, CALIFORNIA.

By J. B. Lippincott.*

The Turlock Irrigation District, located in the San Joaquin Valley, in Stanislaus Co., Cal., is organized under the California law for the purpose of irrigating the semi-arid lands of the state. This law (known as the Wright Act) was passed in 1887, and has been the subject of such endless litigation that it is sometimes referred to as "the Wright Litigation Act," instead of the Wright Irrigation Act. It provides, in short, that a majority of freeholders living in any given neighborhood may define a "district" for purposes of irrigation, submitting their proposition to the County Board of Supervisors, who may then at their discretion call an election at which officers and bonds are to be voted for by all electors residing within the defined limits of the district. The bonds require a two-thirds vote to carry. These bonds, when passed, become a first lien on all lands. The officers, who are usually local farmers, or store-keepers, administer all finances and physical features of the district without any supervision save by injunction of the courts. They decide on the legality, quality and quantity of the water supply and the character of all works. Engineers and attorneys are employed by the district, but the directors pass the final judgment on all points. Landholders on the outer edges of the district may be excluded upon request, but no holder residing entirely within the lines can withdraw. The bonds frequently aggregate $20 to $30 per acre, and a failure of the enterprise means the ruin of all interests. In a few cases where the districts have exchanged bonds for existing plants the result has been satisfactory, but in over 90% of the districts, lack of judgment and endless litigation with large landholders has blighted all hopes. It would be as reasonable a proposition to give the ordinary granger a surgeon's knife and tell him to operate in a dissecting room as to be a combined banker and engineer over works that cost hundreds of thousands of dollars. If this work must be done in a communistic way, it should surely be under a very strong state financial and engineering supervision, which should ensure: (1) The rejection of enterprises without physical merit; and (2) upon endorsement by the state the full face value of the bonds. The central idea of common ownership of irrigation water by the consumers is a good one, but lack of proper detail has condemned the Wright Act as one of the blackest errors on our legal code. Defective engineering works and litigation directly reduces the market value of the district bonds, and, therefore, proportionately increases the actual cost of the work.

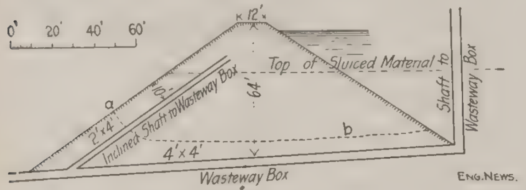

FIG. 1.—Improper Use of the Hydraulic Method of Dam Building—Turlock Irrigation District, California.

Mr. L. M. Holt, Secretary of the convention of irrigation districts, held in Sacramento, Jan. 6, 1893, stated publicly that out of 38 irrigation districts then in existence, 19 reported having voted bonds to the extent of $11,834,000. Out of this, bonds amounting to $2,622,000 had been sold for cash and $2,995,200 had been traded for water rights, making in all $5,617,200 of bonds disposed of, a little less than one-half the amount voted by the 19 districts. Thirteen other districts had voted bonds amounting to $4,942,000, none of these being sold. These 32 districts which had voted bonds contained 1,830,769 acres, and the bonds averaged $9.16 per acre. The 38 districts then in existence contained 2,149,069 acres. Out of this number 28 districts, containing 1,515,594 acres, had an assessed valuation of $39,982,849, the assessed valuation being thus $26.38 per acre.

Such a district is the Turlock, and from this prelude the two failures of the Snake ravine dam, described below, may be largely explained. The "District" contains 176,210 acres, and has voted $1,200,000 in bonds for the construction of its works. A contract was given for the delivery of the water by the contractor to the "District," and at his own cost, to make good all failure in the works.

The purpose of the dam across Snake ravine was to save the construction of 1,500 ft. of side hill canal and flume. The canal, with a capacity of 1,500 cu. ft. per sec., is designed to discharge into the basin above the dam, which basin would act as an enlarged section of conduit. At the western upper end of this reservoir the canal passes through a divide with a maximum cutting of 50 ft., and length of 800 ft. The material was an auriferous gravel in sizes from 1 in. to 2 ft. in diameter, imbedded in red clay with some sand. In original position it is extremely firm and impervious, standing when mined for years in walls nearly vertical, as high as 50 ft. A hydraulic mining canal of 24 sec. ft. capacity, 100 ft. above the grade of the irrigation canal and one-fourth mile distant, furnished existing conditions which were ideal for the construction of an earth dam by the hydraulic process.

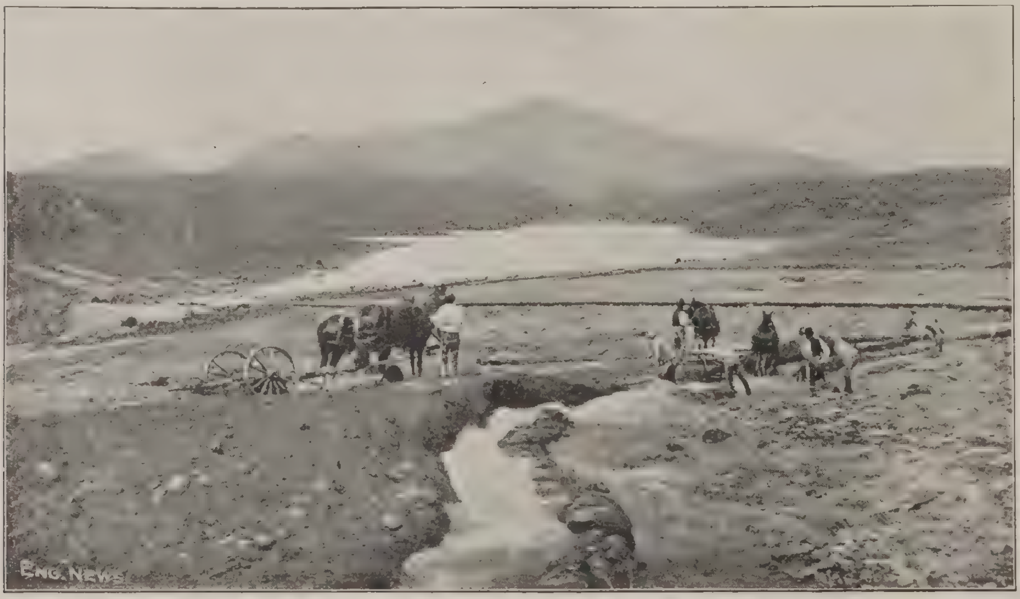

FIG. 2.—PROPER USE OF THE HYDRAULIC METHOD OF DAM BUILDING—LA MESA DAM, NEAR SAN DIEGO, CAL.

The plan was to make the dam from material from the big cut. The opening to be closed is 294 ft. long and 64 ft. maximum central depth. The top of the dam was 4 ft. above the maximum water line. The top width was 12 ft., and the slopes between 1½ to 1 and 2 to 1, which is lighter than is called for in good practice. The first dam was built in 1893, and went out when it had reached the 30-ft. level. The second dam went out when first tested, on June 14, 1898. The second dam was built upon the wreck of the first, and in the same manner.

Hydraulic mining in the ravine had deposited "tailings" at the dam site. These were never removed, or the bed-rock explored. A section of the dam is shown by Fig. 1.

The plan of the work was to build up the lower toe of the dam with scrapers and keep it all the time at an elevation of 2 ft. or more above the remaining portion of the dam, as shown by the lower dotted line, a b. Material was then washed down with a hydraulic jet at the big cut or from the adjoining side hills of the basin and sluiced to the dam site in the natural water courses.

The inclined shaft was built as the work progressed, its top opening being kept below the lower dike, as shown at a, and above the line a b. It was 2 × 4 ft. in the clear; the water carrying the earth in suspension would be stilled in the pond above a, deposit its load, and waste from its clarified surface through the inclined shaft. The purpose of the sand box, or vertical shaft, was an additional waste to draw down the water level in the reservoir when desired. The result of this procedure is obvious. The material from the bank instead of being carried in a homogenous mass, as would have been the case if conveyed in a flume or large pipe from the working face to the dam, segregated itself, boulders, gravel, sand and clay being progressively deposited from the cut to the dam. The basin was filled with many hundred yards of material that never reached the dam. The material that actually got in place in the dam was a very fine clay or silt which could not drain itself, and which remained slimy and slippery until the dam went out. The dam was stratified throughout, layers of this silt in some way being followed by layers of pure sand.

The first dam was constantly shaky and wet, vibrating when jarred. It slid out when 30 ft. high. The effort was made to "use more care" in the second structure, but, in a general way, the same method of work was followed. The waste box in the bottom of the dam was built 4 × 4 ft. in the clear, of 2-in. Oregon pine on two longitudinal 6 × 8-in. stringers as sills. There were no corner or central bracings. When the dam reached a height of 40 ft. it crushed in this box and prevented its further use as a wasteway. The dam was then finished by hauling the material deposited above the dam into position with carts. The dam leaked badly. With a few feet of water in the basin a stream of 1 cu. ft. per sec. passed under the dam, issuing from the broken waste box. This at first ran muddy and carried considerable sediment. Later this water became less in quantity and clearer. This was caused by sluicing in material from the side hill, above the dam, which closed the pores in the debris above and under the dam. There was more leakage through the material that was deposited by carts than through the stratified material that was sluiced into position.

It was optional with the contractor whether he should put in a flume across the ravine or build the dam. When the dam was decided upon it is said that the contractor rejected the request of the officers of the district, both as to its location and method of its construction, and, therefore, the loss falls entirely upon him.

The intake canal passes near the east end of the dam and a wooden box 4 × 4 ft. for a new wasteway was put in the west end of the dam 10 ft. below the top. The intake canal is located on a steep hillside. It soon leaked and sloughed off a piece of the side hill immediately next to the dam, which then began to leak around that end. The waste box, which was also leaking, was then opened on the west end and washed out a large hole from the side hill and dam on its lower side. The dam was leaking at its foundation also. Attacked on both flanks and center, the entire structure gave way. It was pushed en masse down the ravine at a velocity of from 6 to 10 ft. per sec., and thrown into the Tuolumne River. The total distance traveled was over 1,000 ft. It temporarily dammed the river to a depth of 20 ft. The Superintendent and two dogs were on the dam when it gave way. They all were carried entirely across the river and none of them hurt, though the man's shirt and pockets were filled with sand and mud on his trip. The ravine is now to be crossed by a flume.

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*U. S. Geological Survey, Los Angeles, Cal.

Dams have been most successfully built by the hydraulic process elsewhere. The method is well described under "Reservoirs for Irrigation," XVIII., Geological Survey Report, by Jas. D. Schuyler, M. Am. Soc. C. E. Fig. 2 shows the construction of La Mesa dam, near San Diego, by the hydraulic process. This work has proved both economical and efficient and shows the proper method of handling the material. In this case a clay and gravel soil is being stripped from a hard pan and conveyed through an iron pipe to the dam site. The sluicing stream is so located as to erode rapidly, the clay and gravel and this material is also thrown into it by plowing and picking. The feature of this class of work is its economy, and when well done it should produce the very best class of earthwork. The method is being used extensively in the far Northwest in putting in large railroad fills at a cost of from 3 to 10 cts. per cu. yd., depending largely on the location and quantity of the water supply.

As an interesting demonstration of how not to do it, the history of the Snake ravine dam is unique.

PROGRESS ON THE NEW CROTON DAM.

(With full-page plate.)

After nearly six years of work on the part of the contractor for the new Croton dam, some portions of the masonry of the main structure are now up to a point slightly above elevation 50, about the original bed of the river. All of this part of the work has reached the zero level, or average mean tide at Sing Sing, 30 miles from New York. Although the masonry already built is 140 ft. in maximum height, the working levels are still spoken of as "the hole." In its greatest cross-section this immense dam will be 290.8 ft. high and 216 ft. wide at the base. These figures exceed the preliminary designs, owing to the fact that it was necessary to go deeper at one or two points than had been expected, the maximum depth reaching elevation — 80.7, or 130.7 ft. below the old river bed. A total of about 270,000 cu. yds. of masonry had been laid up to Aug. 1, 1898. All but about 100 ft. of the foundation for the heart-wall was in place when a representative of the editorial staff of this journal visited the dam on Aug. 23, and only some 250 ft. of the foundation for the spillway were still lacking at that time.

A typical section of the dam, showing the depths of the rock excavation at various points, is shown by Fig. 1. Views of the work at different stages of its progress since the beginning of 1896 are shown by Figs. 2 to 5, inclusive.

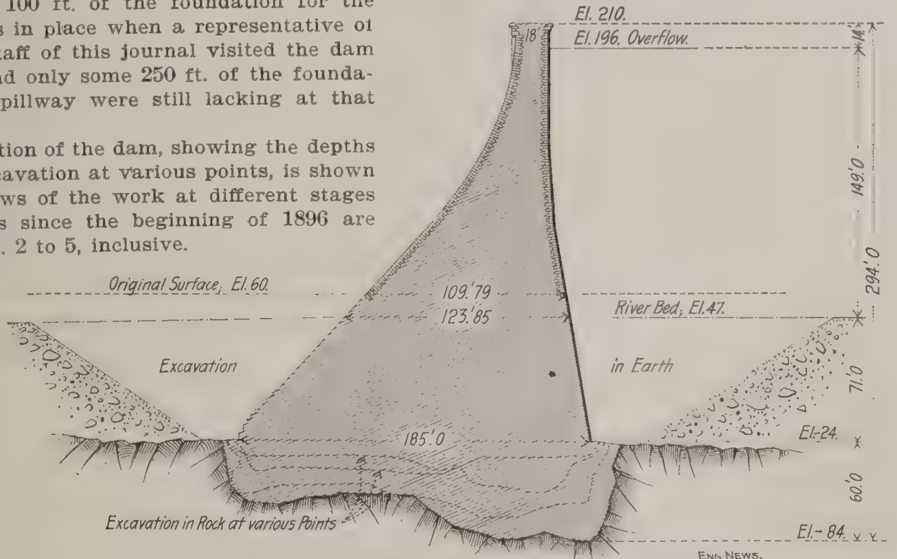

FIG. 1.—SECTION OF THE NEW CROTON DAM.

A full illustrated description of the new Croton dam was published in Engineering News for June 2, 1892, and the detailed bids for the structure were given in our issue of Sept. 5, 1892, under "Contract Prices." For the convenience of the readers of this article some of the information in these earlier issues will be repeated here. The new dam is located about 3.1 miles below the original Croton dam, and 3¼ miles above the point where the Croton River discharges into the Hudson. The dam site, in relation to the Croton drainage area, was shown in our issue of Nov. 22, 1890. The dam is divided into three parts: (1) A masonry structure about 700 ft. long and 18 ft. wide on top; (2) an earth embankment with masonry heart-wall joining the masonry at the south, some 500 ft. long; and (3), a masonry spillway about 1,050 ft. long, nearly at right angles with the main dam. The heart-wall and spillway wall, together with the main dam, form a continuous masonry wall across the valley.

The contractors for the dam complete are Coleman, Breuchaud & Coleman, of New York city. The preliminary estimates of quantities, together with the engineers' estimates of unit prices and the contractors' bid for the work, are reprinted from our issue of Sept. 8, 1892, as follows:

Quantities.			Eng'rs estimate.	Contract price.	
				Rate.	Amount.
Excavation:					
Soil and placing....	2,000	cu. yds.	$0.35	$0.50	$1,000
Earth	550,000	" "	.50	.61	335,500
Earth, vert. trenches	35,000	" "	1.25	.95	33,250
Rock	300,000	" "	1.50	1.95	585,000
Sodding	10,000	" "	.30	.30	3,000
Refill and embnkmnt.	900,000	" "	.30	.25	225,000
Earth hauled, 3%....	150,000	" "	.009	.0075	1,125
Permanent timbr wrk	200	M. ft..	40.00	40.00	8,000
Tongued & grooved.	120	" "	45.00	45.00	5,400
Cribwork	8,000	cu. yds.	2.50	3.00	24,000
Portland cement.	1,000	bbls....	3.00	3.00	3,000
Concrete (Am. cemt.).	10,000	cu. yds.	4.50	4.55	45,500
(Portland cement) .	3,000	" "	5.94	6.006	18,018
Masonry: Brick	2,000	" "	12.00	10.00	20,000
Block stone	2,500	" "	15.00	15.00	37,500
Granite dim. stone.	2,500	" "	30.00	35.00	87,500
Facing stone	24,000	" "	15.00	13.50	324,000
Rubble: Dry	12,000	" "	2.50	2.50	30,000
(Am. cem., 2 to 1)..	470,000	" "	5.00	4.05	1,903,500
(Port. cem., 2 to 1).	30,000	" "	6.60	5.346	160,380
(Port. cem., 3 to 1).	50,000	" "	6.00	4.944	247,050
Riprap	5,000	" "	1.50	1.75	8,750
Broken stone	10,000	" "	1.50	1.50	15,000
Face work for rubble.	15,000	sq. ft...	.30	.40	6,000
Face dressing:					
Fine ham'r'd (6-cut)	22,000	" "	.75	.65	14,300
Rough pointed	12,000	" "	.40	.40	4,800
Highway fence	8,000	lin. ft..	.50	.50	4,000

The final estimates thus far, as compared with the preliminary estimates, indicate an increase in earth excavation and masonry, and decrease in embankment and earth excavation in vertical trenches.

The new dam will have a storage capacity of about 32,000,000,000 gallons, giving, with the other reservoirs completed, or under construction, a combined available storage capacity of about 72,000,000,000 gallons. The drainage area tributary to the new reservoir is about 360 sq. miles, and the run-off for the driest year from 1870 to 1895, inclusive, was about 15 ins. in depth, or 700,000 gallons per sq. mile. If none of this were lost it would afford an average minimum daily supply of about 250,000,000 gallons. With the new storage completed the average daily supply in a dry year will be 280,000,000 gallons.

The reservoir formed by the new dam will be about 18 miles long, overtopping the crest of the overfall of the old Croton dam to a depth of about 30 ft., and that portion of the old aqueduct between the old and the new dams to a depth of about 35 ft. above the crown of the arch. It is desired to send water back to the new gate-house at the old dam, through this submerged portion of the old aqueduct, in order to prevent the lower portion of the lake from becoming a dead end. This raises the question of the effect upon the old aqueduct embankment of lowering the lake so as to expose the embankment after it has been flooded. The subject is now being studied. There has been talk of reinforcing the old embankment and of laying pipes in this stretch of the aqueduct.

The principal change in the original plans for the new dam has been the making of the masonry portion some 115 ft. longer, and the consequent shortening of the earth embankment. This was due to a variety of reasons, one being the desirability of decreasing the height of the embankment, and another to limit the heart-wall to the stretch of hard pan reaching to bed rock. Where the hard pan has been found it has been a most excellent material in which to place the heart-wall. The masonry throughout the whole structure, it hardly seems necessary to say, is carried down to the solid rock.

In backfilling about the heart-wall every stick of timber is removed and the hard pan material replaced in 4-in. layers, wet and rammed. At first 6-in. layers were used, but great care is necessary to prevent the material from becoming jelly-like, and the 4-in. layers have been found to give the best results.

The immense trench to rock bottom for the foundations of the dam was excavated by means of steam shovels, the spoil being removed in cars on light railways. The stone for the masonry is a very heavy dark granite weighing 185 lbs. per cu. ft., quarried about 1½ miles above the dam. The sand for the cement mortar is obtained from the old river bed about a mile above the dam. Natural cement is being used for the rubble work composing the bulk of the masonry, and Portland cement may be used for the facing stone, the parts being 2 to 1 and 3 to 1, respectively. No faced stone has yet been laid on the main dam. The masonry is being carried up in benches about 15 ft. high, the approximate elevations on Aug. 23 being 0 in the center, 45 ft. at the north end, and 60 ft. at the south end. The faces are now being stepped by courses, but so as to bring the steps entirely outside the neat line of the cross-section.

In laying the masonry every block is lifted at least once. This gives an impression of the stone on the bed, and allows the latter to be dressed up as needed. Most of the masons have worked on the other dams, built in the drainage area by the Croton Aqueduct Commission. Many of them are Italians. In exceptional months the masons have averaged nine cu. yds. of masonry per day per man for entire months. Nearly all the rock is brought to the works on light railways located on each side of the dam, being shifted from the cars to the benches by derricks and also put in place by derricks. There are three cableways extending the length of the dam, one a Lidgerwood and the other two, Trenton. These are used principally for handling sand, cement and spawls, and for shifting the derricks, being especially handy for the latter work.

Work is carried on by night as well as by day, the night shifts working on back-filling. The back-filling against the main dam is kept well wetted. Thus far it has not been rolled or tamped, but it will be later on.

Most of the water encountered has been on the upper side of the dam. This is lifted over the masonry by means of centrifugal pumps, where it and the water from below is repumped to the new river channel. For the second pumping three 4,000,000-gallon Worthington pumps have been provided, but except after rains one of these is able to handle all the water upon emergency. A number of springs have been struck, one being a very large one. These have all been piped and eventually the pipes will be filled with grout.

The river has been diverted from its old channel by means of dams of earth and crib-work and a masonry wall. The new channel is 125 ft. wide, and during one freshet was filled to a depth of about 11 ft., the rate of flow being about 9 or 10 miles an hour.

A feature of the gate-houses at the new dam is iron guides for the stop planks, formed of channels, with exterior plates or webs to bind them into the masonry. It has been found that the heavy stop planks sometimes catch on the joints of the ordinary granite grooves.

Mr. Alphonse Fteley, Pres. Am. Soc. C. E., is Chief Engineer of the Croton Aqueduct Commission. Mr. Charles S. Gowen, M. Am. Soc. C. E., is the Division Engineer in charge of construction at the new dam, and Mr. B. R. Value is Assistant Engineer on the work. We are indebted to each of these gentlemen for courtesies and aid extended in the prepartion of this article.

A NEW RAIL SPLICE AND AN ANTI-CREEPER FOR STEAM RAILWAY TRACKS.

We illustrate herewith a new rail-joint which has recently been put into use on the Pennsylvania Railroad, and which seems to possess in an unusual degree the strength, stiffness and simplicity of construction which are now generally recognized to be the essential features of a successful rail-joint.

As every engineer who has given attention to the rail-joint problem knows, the perfect rail-joint must give to the two ends of the rail which it holds the same stiffness to resist transverse stress that is possessed by the rail itself. The common angle-bar joint cannot secure this, by reason of the limit of height by the distance between the head and flange of the rail; and most inventors of improved rail-joints have sought to give additional support to the rail in some manner. The joint shown herewith embodies one of the simplest and most effectual plans of strengthening the angle-bar that has ever been devised. It is also so designed to be simple and economical in manufacture, and to give the greatest strength with the least material employed. The two parts forming the splice have a combined section from 20 to 30% greater than that of the rail to be spliced, and the parts are rolled in practically the same form and in the same manner as the ordinary angle-bar, except that the flange of the bar is made about 3 ins. wider than usual. After it is rolled and cut into proper lengths, the plate is reheated and is then pressed by dies into the form shown in the illustration. The result is a largely increased bearing on the tie, and a deep and strong truss under the rail-joint, with gusset-plates connecting the depending flange and the horizontal, or bearing flanges. The value of this gusset-connection is especially marked, as it obviates all danger of the movement of the depending flange, either inward or outward, under applied loads; as has occurred in somewhat similar splice-plates where the lower flange was simply cut twice and turned down. This splice is simple, strong, economical and rigid, with single parts only for each splice-plate. There are no bolts or parts under the joint to be manipulated; a feature that will be appreciated by all trackmen.

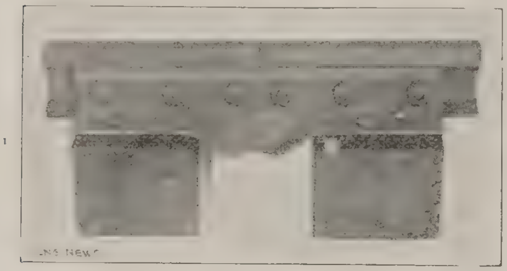

Fig. 1.—A New Rail Joint.
A. Bonzano, M. Am. Soc. C. E., Inventor.

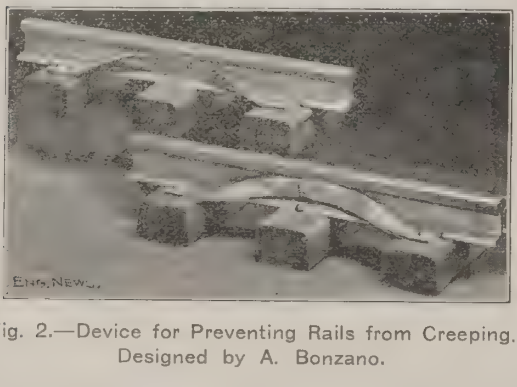

Fig. 2.—Device for Preventing Rails from Creeping.
Designed by A. Bonzano.

This rail-splice has now been in regular service for some months on three miles of the main line of the Pennsylvania R. R., west of Harrisburg, Pa.; and Mr. Joseph T. Richards, Engineer of Maintenance of Way, authorizes the statement that trains run so smoothly over this section that the rail-joints cannot be noted. Computations show that this joint has 1.08% of the stiffness of the rail itself; or, in other words, is somewhat stronger than the rail, and the rail is thus practically continuous. It is also shown that a track equipped with 70-lb. rail and this splice is equal in service to an 80-lb. rail fitted with the ordinary angle-bar splices. According to Mr. Richards the ordinary angle-bar joint is only from 28 to 32% as strong as the rail.

The creeping of rails under traffic presents another serious railway problem that has not yet been satisfactorily solved. But that some efficient method of preventing this creeping is imperatively demanded is made evident in battered rail-heads, wear and annoyance of jolting over open joints, and in the derailments caused by the vertical or horizontal deviation from track line resulting from the crowding together of rails under this creeping movement.

In the anti-creeper here described, the inventor proposes to firmly anchor each rail to the roadbed; where it is free to contract or expand within its own length, but cannot "creep," or concentrate at any one point the movement of a large number of rails. It is this latter feature that causes all the trouble. The device is so simple that it is remarkable that it has not been sooner applied. It is a metal bar, about 2¼ × ⅝-in., of sufficient length to be spiked, or secured by screw-bolts, to two cross-ties, preferably, with one tie intervening. The middle of this bar is bent at right angles to the ends, so as to fit the web of the rail, and it practically forms a bracket with either half acting as a strut or a tie according to the direction of the stress. The crossties embedded in the ballasted roadbed form a firm anchor, and the advantages claimed are that the distances between the rail-heads will be uniformly maintained; no bending or shearing of the splice-bolts is possible—and this alone would compensate for the cost of the bars; the rails cannot crowd together, and they will remain in position at frogs, switches and cross-overs, on draw-spans, trestles, etc., exactly as they were originally placed by the trackmen with much labor. The purpose of the anti-creeper is to save wear in track material, to decrease track labor, and to obviate as much as possible the danger from derailment from creeping rails.

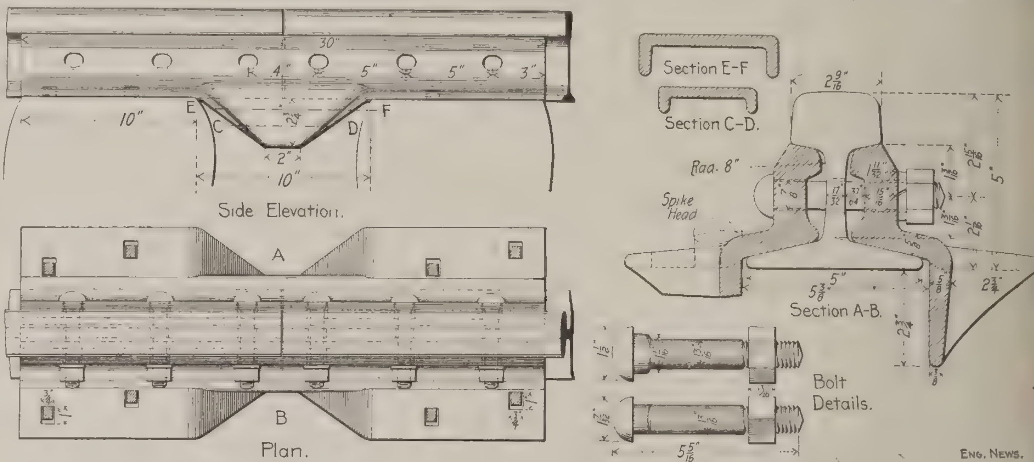

FIG. 3.—DETAILS OF BONZANO RAIL JOINT FOR 85-LB. RAIL, PENNA. R. R.

According to estimates submitted for applying this anti-creeper to five miles of track on the Pennsylvania Railroad, the cost for one rail is 50 cts. As there is practically no wear, the life estimate is placed at 20 years, and the annual cost is thus 2½ cts.; and as the scrap is worth 20 cts., the actual cost of the anti-creeper may be put at 1½ cts. each for one year. In other words, the claim is made that for 1¼ cts. per mile per day rails may be kept in their original and exact position, and the many troubles and expenses incident to creeping may be practically eliminated.

Both the rail-splice and the anti-creeper above described are the invention of a well-known civil engineer, Mr. Adolphus Bonzano, M. Am. Soc. C. E., 331 South 18th St., Philadelphia, Pa.

* * *

THE WORLD'S COAL TRADE.

From a statement recently issued by the British Board of Trade, the following figures are taken relating to the world's production and consumption of coal, from 1883 to 1896. In the latter year the most important coal producing countries gave the following outputs:

United Kingdom	195,361,000 tons.
United States	171,416,000 "
German Empire	85,690,000 "
France	28,750,000 "
Belgium	21,252,000 "
Russian Empire	9,229,000 "
Japan	5,000,000 "
British India	3,848,000 "
Canada	3,743,000 "
Australasia	5,345,000 "
Total	529,626,000 tons.

As to comparative cost per ton at the mine, the United States delivers the coal at the cheapest rate, the figure being about $1.14 per ton. The same cost for the United Kingdom is $1.40; Germany, $1.66; France, $2.08; Belgium, $1.82; Japan, $1.20; and the average cost in Australasia is $1.62 per ton. From these figures the "British Trade Review" expects that the United States, notwithstanding the distance to the seaboard and local demand, will be able to send huge quantities to foreign countries. In 1896 the excess amount of coal exported to other countries was as follows: From United Kingdom, 44,587,000 tons; from Germany, 6,122,000 tons; from Belgium, 4,018,000 tons; from United States, 2,337,000 tons; from Japan (1895), 1,805,000 tons; from New South Wales, 2,474,000 tons, and from Natal, 90,000 tons.

The consumption of coal per head of population is, of course, largest in the countries where steam traction and machinery are most used. But in France the average consumption seems very small for a country so far advanced in civilization; it is only .98 ton per head, as compared with 2.65 tons in Belgium, and 3.82 tons in the United Kingdom. The consumption is not noted for the United States; but, deducting the export and taking the population at as much as 75,000,000, the average would be 2.25 tons per head.

An important development of the coal trade is having a place in the far East. Including the output of Chili and the British export of coal to the east of Cape Horn and west of the Cape of Good Hope, the East is now consuming nearly 25,000,000 tons of coal annually. Indian coal production is rapidly increasing, and some of the Assam coal is said to be quite as good as the best English steam coal, and the cost of raising is about one-half of the English cost. The Japanese coal deposits are not very extensive, and their competition in the Eastern market need not be greatly feared by England; and the manufactures of that country are increasing so fast that coal is even now high in cost in that country. But there are great, undeveloped possibilities in China and Siberia. On the Trans-Siberian railway fifty groups of workable coal deposits are reported upon, and the output in Eastern Siberia, particularly from the Amour valley, is now about 2,000,000 tons annually. In China, a British syndicate claims a concession, in the Shansi district, for a coal field 250 miles long and 40 miles wide; and by its side are immense deposits of brown hematite and spathic iron ores and an abundance of limestone. The development of these deposits would enormously effect the evolution of industry in the far East, and have a marked effect upon economic and industrial conditions in Great Britain, says the "Review."

A DIRECT READING POWER GAGE FOR STEAM ENGINES.

The measurement of the power developed by a steam engine has always been a difficult operation, and is rarely a completely satisfactory one, involving, as it at present does, a series of operations, each one contributing a small error to a total which amounts sometimes to a considerable figure. Several ingenious integrating indicators have been devised to measure the total work done over any period of time. One of the most successful was described in Engineering News of July 28, 1898. Practically all of these instruments depend upon the elasticity of springs and the use of pistons, and there are several mechanical limitations which restrict the use of these devices. For instance, it is not mechanically practicable to operate continuously an indicator spring through its entire range of elasticity without permanent set or crystallization; neither is it practical to operate a piston within a cylinder with a constant coefficient of friction. In the device referred to in the title of this article, a radical departure has been made and an entirely new principle is employed for the meaurement of the pressure in the cylinder. For purposes of explanation it may be spoken of as a steam turbine driven by a steam jet whose pressure is the same as, or directly proportional to, the working pressure in the engine cylinder. This will be clearer if Fig. 1, a diagrammatic illustration, is examined. The cylinder represented may belong to any kind or make of engine, the details of construction or valve mechanism playing no part so long as there are the usual indicator taps, represented in the figure by A and B. From these, short curved pipes lead into the back of the instrument, which is placed beside the cylinder at a convenient height for observation.

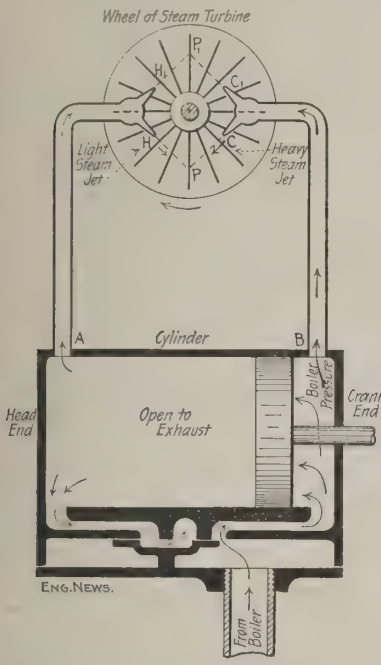

Fig. 1.—Diagram Illustrating Principle of Operation of the Atwood Power Gage.

Inside the instrument case the pipes just mentioned terminate in four nozzles, H H_1 and C C_1 shown in Figs. 1 and 2, and just back of the nozzles is a metal disk mounted upon a shaft and nicely balanced on ball bearings. This disk is provided with a series of thin radial blades set perpendicular to its surface. The nozzles H H_1 C C_1 are set at an angle, as will be seen in Fig. 1, and are inclined towards the turbine wheel, as shown in Fig. 2, so that the steam jets impinge at the two points P and P_1. In addition a simple valve or shutter arrangement cuts off the steam jets H C or H_1 C_1, as the case may be, just as the engine piston changes direction or better at the instant the steam pressures of the head and crank ends of the cylinder reverse. This jet-controlling mechanism is very simple, and is operated by a simple reducing motion.

Considering now the operation of this turbine wheel and referring to Fig. 1, it will be seen that the steam at boiler pressure is free to pass through the steam port into the crank end of the cylinder, and thence through B to the nozzle marked C (C_1 being at that instant closed by the shutter device). The steam jet issuing from C strikes the turbine wheel at P with a force which is directly proportional to the pressure in the working end of the cylinder. At the same time a jet is issuing from H, H_1 being closed, but here the pressure is that on the exhaust side. The result of these two opposing forces is a force tending to turn the turbine disk at a velocity which is at all times directly proportional to the effective pressure in the cylinder.

The disk is made of a weight sufficiently light to readily respond to the series of impulses and yet heavy enough to have sufficient inertia to integrate the impulses and maintain an approximately constant velocity, when the impulses are of equal value. In fact the turbine wheel plays exactly the same part as the flywheel of an engine, the speed of which, were there no governor upon the engine, would be a measure of the mean effective pressure. To prevent racing, and at the same time to put a constant load upon the turbine a fan consisting of several radial blades is mounted upon the turbine shaft (Fig. 2), but in a separate compartment. Directly in front of the load fan, but in no way connected to it, is another similar fan. Upon the shaft of this second fan, but in a third compartment, is mounted a dead beat or dampening device and a spiral retractile spring. The indicating needle or pointer is outside of this compartment, and swings around a dial, Fig. 3. The only connecting link between the turbine and the indicating portion is, therefore, the air in the enclosed compartment.

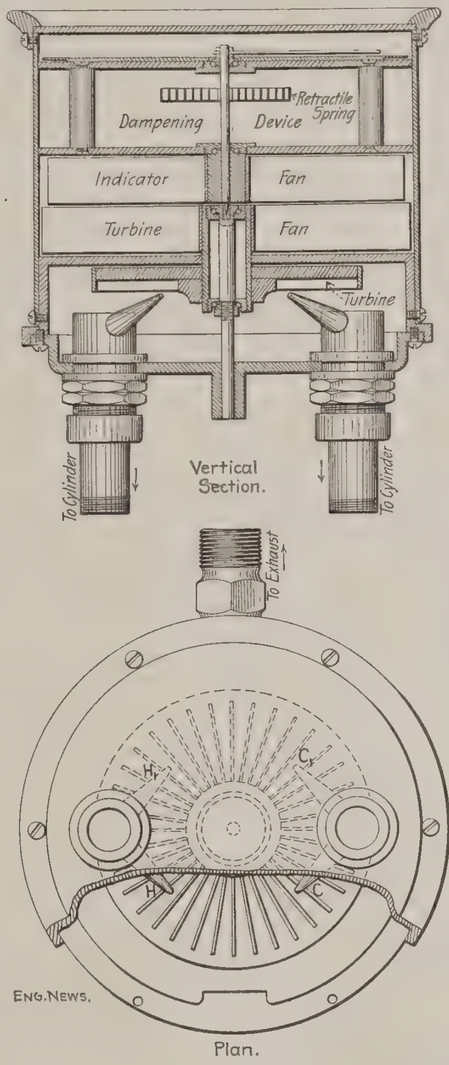

Fig. 2.—Section and Elevation of the Atwood Power Gage, Showing Arrangement of Parts.

In the operation of the instrument, the turbine revolves continuously in one direction, clockwise, with a speed ranging from a few revolutions up to 1,200 or 1,500 revolutions per minute, depending directly upon the effective pressure in the cylinder. In so doing it gives a rapid whirling motion to the air in the intermediate compartment, and this whirling air tends to turn the second fan against the resistance of the spring. Thus this fan is actually turned from its normal position a distance proportionate to the turbine speed. The dampening device prevents any sudden movement of the fan and needle.

In calibrating the instruments at the factory, two compressed air tanks are employed, one supplying each pair of nozzles. The air is compressed in these tanks by electric motor-driven compressors and a calibration can be made for any desired range of pressures. The scale on the dial can be graduated for indicated horse-power, or in the case of constant speed engines the scale may be marked for mean effective pressure on an inner scale, and the horse-power for various pressures marked on an outer scale. Other methods are possible and will suggest themselves.

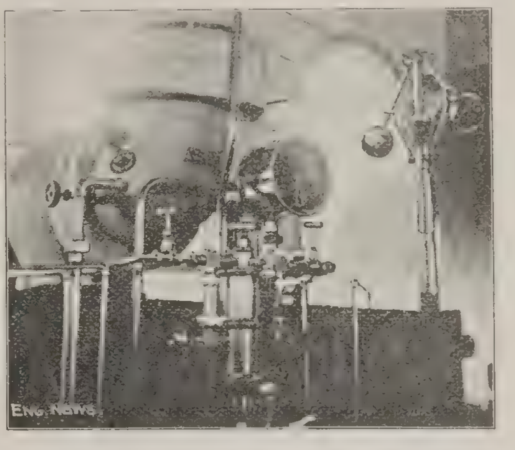

Fig. 3.—View of Engine with Atwood Power Gage Attached, Showing the Size of the Instrument.

In installing the instrument it is advisable to employ a 3-way cock at each end of the cylinder, and also in the pipe leading to the exhaust pipe. This will permit the testing of load distribution and the use of an ordinary indicator for valve adjustment should it be desired.

The possibilities and utility of the instrument are briefly as follows: It will enable an accurate and complete log of station operation to be kept; it forms a check upon the condition of the engine and will enable the efficiency of the plant to be easily determined and maintained; it forms a constant indication of valve setting, and will at any time show the distribution of work between the several cylinders or between the ends of the same cylinder. In the case of a condensing engine the operation of the condenser can be tested. Friction loads and the power required to run any one or several machines can also be readily determined, absolutely no skill being required, as the operator has only to open the valves and note the dial indication.

Several of these power gages have been in continuous operation on the engines of the Peoples' Elec. Light & Power Co., at Orange, N. J., for the past 18 months, during which time comparisons with indicator cards show a variation of less than 1%. Another instrument is at present in use on a high speed engine in the New York Telephone Building, 15 Dey St., New York city. The principal duty of this engine is to drive a generator furnishing current for several Sprague electric elevators, and a rough and ready check upon the power gage is afforded by comparing it with the switch-board ammeter. As the load is increased or decreased both needles swing out slowly in perfect unison.

This ingenious instrument is the invention of Mr. G. F. Atwood, of the Atwood Power & Speed Gage Co., 95 and 97 Liberty St., New York. We are indebted to him for the information and drawings from which our description and illustration have been prepared.

TELEGRAPH LINES IN SANTIAGO PROVINCE, Cuba, to the extent of 447 miles, have been ordered by the military authorities and are being put up under Capt. Jasper E. Brady, of the U. S. Signal Corps. These lines will connect Santiago with Manzanillo, Victoria de las Tunas, Holguin, Guantanamo and Baracoa. There is also a line from Guantanamo to Sagua Tanamo. As business increases the system will be extended. The line to Holguin and Victoria will connect with a line building eastward from Havana. American operators and American methods are employed, and any profits will be devoted to extending the lines, the same rates being charged for service as in the United States.

COUNCIL REPORT ON THE STREET RAILWAYS OF CHICAGO.

There has for a long time been strife between the street railway companies and the city authorities and the people of Chicago, over questions involving the terms of franchises, the relations of the companies to the city, and the character of service and accommodation furnished. In October, 1897, the City Council passed a resolution introduced by Mr. J. N. Harlan, directing the appointment of a special council committee to investigate the street railways, their franchises, financial operations, traffic conditions, and the wages paid to employees. The Mayor, Mr. Carter H. Harrison, was chairman of the committee. This report was presented in March, 1898, but its publication was delayed for some months, owing to a failure on the part of the city to provide an appropriation for printing. The report is lengthy and is not very well arranged, as might be expected, nor is it always quite logical, but it contains much matter of considerable interest, and it certainly shows the need of some change in the relations between the city and the street railway companies. The officers of the companies refused to furnish any information, and a certain bias against the companies is somewhat evident, but on the other hand it must be said that the city and the people of Chicago have many reasonable grounds of complaint against the street railways.

The first subject taken up for discussion is that of the franchises, and at the very outset a great difficulty was experienced, due to the fact that many of the lines are operated by lessee companies, instead of by the companies to which the franchises were granted, but that no copies of these leases were submitted to the Council for approval, or filed with the city, so that the Council might be informed as to their terms. Other difficulties arise from the fact that there is no ordinance requiring the companies to file statements as to their assets, or to furnish any other information, and that many of the franchises have been drawn up by the representatives of the companies instead of by those of the city. It is also noted that the public records contain no specific grants for some of the lines now in operation. In this respect the committee makes the following note, which contains a very important truth:

> The Metropolitan Railroad Co., of Washington, D. C., which has constructed and is operating an underground electric system probably unsurpassed anywhere in the world, makes an annual report to Congress, giving its assets, its receipts, an itemized statement of all its disbursements, and a list of all its stockholders, with the amounts of their holdings. This fact seems to indicate that openness and publicity of accounts and personnel are quite consistent with, if not distinctly conducive to, superior equipment and service.

As to the discussion of the franchises, the subject is so involved and so complicated by changes, legal quibbles, amendatory franchises, doubtful ordinances, ambiguous phraseology in the franchises, etc., that no direct line of argument can be followed out. The question of greatest importance, and the one which largely gave rise to the agitation which resulted in the appointment of this committee, was as to the time of expiration of the present franchises and the terms upon which extensions of these franchises should be granted. Most of the old franchises were for 25 years, but in 1865 the legislature passed the "ninety-nine-year act," extending the life of the three companies (operating on the North, West and South sides) and their several franchises from 25 to 99 years, or until Feb. 14, 1958. The "horse and dummy line act" of 1874, required the consent of the local authorities for the location or construction of any street railway, and provided that such consent should not be granted for a period of more than 20 years. In 1875, the city of Chicago adopted its new charter, which authorizes the city to permit, regulate and prohibit the locating, constructing or laying a track of any horse railway in any street, alley or public place, such permission not to be granted for a longer period than 20 years. These promises were undoubtedly made to prevent any future "ninety-nine year" grants, but could not affect grants already made.

In 1883, the period of the three main 25-year grants expired, and the question as to the legal effect of the ninety-nine year act came before the Council for decision. As the result of controversies over this question and that of car licenses, a compromise ordinance was passed July 30, 1883, granting the three companies an extension of time for their then existing lines until July 30, 1903, or postponing the settlement for 20 years. The committee arrives at the conclusion that these and all later grants are either terminable by the city at will on July 30, 1903, or will expire absolutely on that date, while the companies claim that the later grants do not expire until Feb. 4, 1958.

Grants for mechanical power are usually for a term of years, sometimes extending beyond the term of the original franchise, but it is not supposed that these could extend the franchises. In other cases, no duration is specified and the grants can be revoked, or would terminate with the original franchises.

The second part of the report deals with the history, operations, liabilities and profits of the three principal companies: The Chicago City Ry. Co., the North Chicago Street Ry. Co., and the West Chicago Street Ry. Co. The figures of the financial operations aim to show excessive profits by the payment of very large dividends and by the distribution to stockholders at par ($100) of stock which would sell on the market at $200 to $300. In other words, all the companies are charged with extensive watering of their stock, while they are further charged with misplacing money by means of contracts for installing mechanical traction, and building the Van Buren St. tunnel, etc., these contracts being let to construction companies composed of members of the street railway companies. The estimates of cost of all the work let under these contracts are claimed to have been very much too high. The cost of putting in the cable system on the main lines of the West Chicago Street Ry. Co. is given by that company as $8,000,000, although it gave the construction company $10,000,000 of its stock for the work. Independent estimates, however, have put the actual cost at only $5,000,000.

The committee considers that an income of 8% would be a liberal allowance, and presents tables showing the actual profits realized in excess of such an income. To ascertain these profits as realized up to any given date, the difference between the stockholders' investment and the present value of the entire stock was ascertained, and to this was added the sum of the annual excesses of dividends above 8%, these excesses being accumulated at 4% compound interest.

Another point taken up is the over-capitalization of the companies, which is derived by comparing the cost of duplication of the lines (as given by Prof. Bemis in the Report of the Illinois Bureau of Labor Statistics, 1896), with the capitalization, that is, the par value of stocks and bonds. From these figures deductions are drawn as to the payments which might have been made to the city, and the reductions in fares which might have been conceded by the companies if dividends in excess of 8% had been foregone, the reduction in fares being based on the assumption that it would not increase the number of passengers. The companies make certain annual payments to the city for car licenses, operating bridges, and public improvements, but in 1897 these payments amounted to only about $30,000 by each of the three main companies, as shown in the accompanying table, this being less than 1% of their gross receipts.

The general tenor of this part of the committee's report is that the companies are directly blamable for these conditions, but it should be borne in mind that if the city (through its representatives) has not looked out for its own interests, it is not reasonable to expect that the street railway companies will do so. The companies are not organised or operated on a philanthropic basis, but as money-making enterprises, and they cannot be expected to make payments to the city or concessions to the public which are not demanded by the terms of their franchises. It is true that it might be good policy on their part to make certain concessions, but that is a matter upon which the companies alone are the judges.

Another source of trouble which is discussed is the insufficiency of transfer privileges, by which many passengers have to pay two or more fares for comparatively short rides. This is due largely to the way in which the three sections of the city are apportioned among the three main companies, which give no transfers over each other's lines. In other cities, however, such interchange transfers are given, and have proved very satisfactory. The best system of transfers is said to be on the South Side, while on the North Side the transfers are limited. The latter case is said to be due to the fact that branches and feeder lines which should properly form a part of the main North Side system, are built and operated by separate companies which collect their own fares. These companies, however, are composed of representatives of the main company, which thus practically receives both fares.

Another curious fact in regard to transfers is that the first street railway grant was to the Chicago City Ry. Co., for a line running east and west on Madison St., from Western Ave. to State St., and north and south on State St., from Lake to 31st St. The ordinances for this and later lines extending from the South Side through the city to the West Side, required that the rate of fare for any distance should not exceed 5 cts. In 1863, however, the company sold its Madison St. line and all West Side lines to another company, and since then separate fares are required on the West Side and South Side lines, although the original requirement for a single fare has never been legally repealed, nor has the sale been approved by the city.

The three main street railway systems terminate in the business center of the city, and passengers going from one section of the city to another must change cars and pay at least two fares. The report states that a similar "radial" arrangement of routes formerly prevailed in Detroit, but that through or "diameter" routes have recently been adopted as a means of economy in operation and increased accommodation to the public. Under this arrangement the cars start from the city limits, on one side, pass through the business section and continue to the city limits on the opposite side. In Detroit, too, tickets and transfers are good on the cars of different companies. It seems very certain that in a city as large as Chicago, better facilities should be afforded in this respect, as well as in the number of cars on some of the principal routes. In some cases single cars only are run, even in the busiest hours when they are crowded to the great discomfort and even danger of the passengers. The danger is especially great with the open cars having foot boards. On other lines of the same system trail cars are put on during these hours.

Another point which may be considered in this connection, but which is not referred to in the report, is the frequent use of open cars in cold, wet and wintry weather. In view of the very changeable and uncertain climate of Chicago, an ordinance should be adopted and enforced, requiring the companies to run a certain proportion of closed cars throughout the year, as is done in some eastern cities. The companies usually have two sets of equipment, and keep one in use and the other on storage tracks until the weather makes it absolutely necessary to change the sets.

As already noted, the companies cannot be expected to take the initiative in these improvements, although it might be good policy and even economy for them to do so. The city, however, has the remedy in its own hands, but in Chicago the ordinances for such purposes are usually so drawn that the companies successfully fight them in the courts. Even when such ordinances are allowed to stand, only spasmodic efforts are made to enforce them, and consequently the companies pay no attention to them unless disposed to do so. The use of fenders is a case in point. For a long time the city has tried to get the companies to equip their cars with fenders, but ordinance after ordinance has been turned down by the courts. One of these required "all cars" to be equipped, but the companies argued that this would include trail cars, which could not and need not be so equipped. The companies claimed that the fenders would be an absolute danger, and that the stop planks across the wheels were sufficient safeguards, in spite of the fact that investigations have shown their claim to be unsupportable. Fenders are now, however, beginning to be applied to the cars on some lines.

An ordinance was passed last year requiring the motor cars and grip cars to be equipped with vestibules or shelters for the men, and there were threats of vigorous enforcement. No attention was paid to the ordinance, however, and no practical results ensued, but throughout the severe winter the men worked exposed to the weather as usual, except on some few lines which ordinarily use vestibule cars.

To return to the committee report. The next subject taken up is that relating to wages of employees and conditions of employment, on which points very little official information was obtained. The gripmen and conductors on the cable lines appear to be ranked above the motormen and conductors on electric lines, the former receiving from 25 to 28 and 30 cts. per hour for a 10-hour day, while the latter receive 21 cts. per hour and work from 10 to 11 hours. If the cable lines should adopt the trolley system, as has been suggested, the lower rates of wages would prevail. It is commonly understood to be the policy of the companies to discourage and prevent any trade organization on the part of their men, and they are said to require these men to sign contracts not to join any labor organizations, though no copies of such contracts are given to the men or made public.

One rather important matter mentioned is the existence of many sections of tracks and junction curves which are disused. These are especially numerous in the business center of the city, and there are also two or three lines which are operated in a desultory way, merely to hold the right of way, and are of no use to the public. These tracks constitute a serious obstacle in the streets, especially in the case of curves at street intersections. While none of the ordinances for street railway grants contain specific provisions requiring the companies to operate the lines or entailing the forfeiture of the lines if not operated, yet it is held that the acceptance of the grants implies an obligation to operate the lines. The committee is of opinion that the city has the right to remove these tracks and to regard the lines as forfeited.

No reference is made in the report to the condition of the tracks and pavements, nor to the requirements as to paving, repairing and cleaning the streets, or removing snow therefrom. In all these respects the companies are very negligent, and they are frequently the source of trouble between the companies and the city. This class of investigation, however, was not included in the instructions to the committee, but from an interesting digest of laws and city ordinances affecting the rights of the street railways, which is appended to the report, we take the following:

(1883). Companies to repair and maintain 8 ft. and 16 ft. of streets then occupied.

(1887). When companies remove snow from their tracks, they must within reasonable time clear this from the cross walks and level it down along the roadway.

(1893). It shall be unlawful for the companies to sweep the snow from the center of the streets and allow it to remain, preventing access to the stores and dwellings along the route.

In conclusion we give a table, compiled from the voluminous figures and tables in the report, giving some of the most important and interesting items bearing upon the discussion of the relations of the street railways to the city. The figures given are brought down to Dec. 31, 1897:

Statistics of Operation of Chicago Street Railways.

		Chicago City Ry.	No. Chi. St.Ry.	W. Chi. St. Ry.
Stockholders' investment*		$12,000,000	$5,000,000	$12,439,000
Market value of stock		27,525,000	17,676,750	21,379,945
Profits to stockholders by appreciation of stock		15,525,000	12,676,750	8,940,945
Dividends†		6,956,645	4,419,704	3,253,240
Total profits in excess 8%		22,481,645	17,096,455	12,694,186
Per cent. gross receipts which could have been paid to city if dividends had been limited to 8%; 1890 to 1897		16.82	19.59	9.67
Reduced fare which might have been conceded, if as above, cts.		4.15	4.02	4.51
Lisense fees and amts for pub.impts. paid city,'97		$31,525	$35,359	$30,637
Value of present franchise	Equipment	21,628,180	18,071,420	22,854,610
	All trolley.	22,833,500	19,102,150	25,225,795
Cost, duplication§	Equipment	56,000	60,297	61,698
	All trolley.	50,000	50,000	50,000
Total cost, duplication	Equipment	10,316,320	6,035,927	12,506,184
	All trolley.	9,211,000	5,005,000	10,135,000
Total capitalization		16,619,500	14,780,900	31,857,900
Over capitalization	Equipment	6,303,186	8,745,170	19,351,715
	All trolley.	7,408,500	9,775,900	21,722,900
Mileage	Total (single tr'k)	184	100	202.70
	Cable	35	17	30.42
	Horse	7.5	2	6.60
	Trolley	141.5	81	165.58
Passengers carried, 1897		95,621,000	56,354,000	....
Gross receipts, 1897		$4,816,000	$2,836,000	$3,899,918
Ratio, op.exp. to grs rec.'90		66.85%	55.09%	60%
" " " " '97		60.40%	46.83%	50%

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*Face value of stock.

†Dividends in excess of 8% on face value, 1890-'97, with accumulation at 4% compound interest. Similar figures are given for a dividend of 6%, but these we do not think it necessary to reproduce.

§Per mile.

MINERAL PRODUCTS OF THE UNITED STATES IN 1897.

Mr. David T. Day, Chief of the Division of Mineral Resources, U. S. Geological Survey, has issued a tabular statement of the mineral products of the United States for each year from 1888 to 1897, inclusive. An abstract of the chief items follows; though this abstract is generally confined to the year 1897, with some comparisons with previous years:

The pig-iron output for 1897 was 9,652,680 tons, valued at $95,122,299. This is the largest output in tons in the decade under consideration; but the 9,202,703 tons of 1890 were valued at $151,200,410, indicating a marked decline in price per ton since that date. The gold and silver output last year was 2,774,935 ozs. of gold, valued at $57,363,000, and 53,860,000 ozs. of silver, valued at $69,637,172; generally speaking, there has been a decline in the silver production and a gain of nearly 40% in that of gold in the past decade. The copper output for 1897 exceeds that of any previous year, and has risen from 231,270,622 lbs. in 1888, valued at $33,833,954, to 491,638,000 lbs. in 1897, valued at $54,080,180. The lead produced in 1897 amounted to 208,192 tons, worth $14,885,728; this is also larger than for any other year in the decade, and has steadily increased from 151,919 tons in 1888, valued at $13,399,256, again showing a fall in price per pound. Of other metallic products in 1897, zinc shows 99,980 short tons, worth $8,498,300; quick silver, 26,648 flasks, worth $993,445; aluminum, 4,000,000 lbs., worth $1,500,000; this latter is an increase from 1,300,000 lbs. in 1896, 920,000 lbs. in 1895, and 19,000 lbs. in 1888. There were reported for last year 23,707 lbs. of nickel; no tin, and 150 lbs. of crude platinum.

The non-metallic products also generally show marked gains in 1897 over other years in the decade 1888-1897. Bituminous coal amounted to 147,789,902 short tons, worth $119,740,052, and the increase is practically steady from 102,039,838 short tons in 1888, valued at $101,860.529. Pennsylvania anthracite, however, fell, in 1897, to 46,814,074 long tons, worth $79,129,126, from a maximum output in 1895, for the decade, of 51,785,122 long tons, worth $82,019,272. The petroleum output last year was 60,568,081 barrels, worth $40,929,611, as compared with 60,960,361 barrels in 1896, valued at $58,518,709. Of cement, 10,989,463 barrels, worth $8,178,283, were made in 1897; this is greater than for any year in the decade. Other important non-metallic products were as follows, for 1897: Mineral waters, 23,255,911 gallons, worth $4,599,106; phosphate rock, 1,039,345 long tons, worth $2,673,202; 15,973,202 barrels salt, worth $4,920,020; 4,247,688 long tons limestone, for iron flux, worth $2,124,000; and 16,000,000 lbs. borax, worth $1,080,000.

The total values of the mineral products of the United States for 1897 sum up as follows: Nonmetallic, $329,113,845; metallic, $302,198,502; unspecified, $1,000,000; grand total, $632,312,347. This is the maximum total for the decade 1888-1897; that for 1888 being $540,781,936, or $91,530,411 less in amount than for last year.

* * *

THE NEW PUBLIC ELECTRIC LIGHTING CONTRACT for Boston contains some novel features. It is for a period of ten years, from Feb. 20, 1899, and thereafter until a new agreement is made or either party notifies the other in writing of its decision to terminate the contract. The contract, however, is subject to the yearly appropriations of the city council. The prices are on a sliding scale, ranging from 35 cts. per lamp per night, or $127.75 per year, for 2,365 lamps, to 30 cts., or $109.50, each, for 5,000 lamps. The price must be readjusted by arbitration at the end of five years, and may be so readjusted at the end of 2½ and 7½ years, if the Mayor so elects, as to keep the net earnings down to 6% on the capitalization devoted to public business, or at a correspondingly lower rate in case any of the bonds bear less than 6% interest. The distribution of the expenses and earnings between public and private lighting is to be based on the relative electrical outputs, measured separately in kilowatt hours, for each class of business. A maximum depreciation of 7%, exclusive of land, is to be allowed in calculating the net earnings. The city may also refer to its arbitrators any invention or improvement which it claims will reduce the cost of electric lighting. If the arbitrators report that the claims of the city are valid, the price for public lighting is to be decreased accordingly, whether the company adopts the improvement or not. The company is to substitute, at its own expense, wooden poles, with ornamental iron goose-neck lamp supports, for the iron posts now owned by the city. It is also to provide closed arc lamps, like those described in U. S. Patent No. 603,630, dated May 10, 1898, for the open lamps now in use. The new lamps are to require an electrical energy of not less than 500 watts on the average and not less than 480 in any case. The present lamps have a nominal candle power of 2,000. This contract is a modification and continuation of the five-year contract made in 1894. Its new features are largely due, we judge, to Mr. Josiah Quincy, Mayor of Boston, who recently gave it his approval.

WEATHER TABLE FOR SEPTEMBER, 1898. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Degrees Fahrenheit.)				Wind.			Precipitation—Rain or melted snow. (Inches.)		
		Average.	Max.	Min.	Range.	Velocity in miles per hour. Average.	Velocity in miles per hour. Max.	Direction at time of max. velocity.	Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	59.0	90	30	60	7.7	42	SW	2.66	1.01	7
	Portland, Me.	61.2	87	41	46	6.1	30	NW	3.48	1.38	11
	New York City	68.9	94	49	45	10.2	72	SW	1 28	0.94	6
	Pittsburg, Pa.	70.2	94	48	46	5 3	24	N	1.06	0.42	8
	Chicago, Ill.	67.6	92	49	43	15.9	41	E	3 16	1.20	11
	Omaha, Neb.	68.3	96	43	53	7.4	30	S	2.94	1.42	6
	St. Paul, Minn.	63.4	95	38	57	6.8	32	SE	0.90	0 46	6
	Duluth, Minn.	59.2	86	40	46	10.0	34	SW	1.21	0.43	10
	Bismarck, N. Dak.	58.6	97	28	69	9.1	50	NW	0.76	0.32	5
	Average	64.1	92	41	52	8.7	39	—	1.94	0.84	8
Southern Cities.	Washington, D. C.	71.0	95	48	47	5.0	30	NW	0.89	0.69	5
	Louisville, Ky.	73.8	97	52	45	6.8	48	W	2.97	1.36	9
	St. Louis, Mo.	74.2	95	51	44	9.2	30	SW	3.23	0.85	12
	Savannah, Ga	78.0	91	64	27	7.8	25	S	5.06	1.94	10
	Kansas City, Mo.	71.4	94	48	46	8.1	31	SE	4.48	1.73	10
	Jacksonville, Fla	79.8	93	69	24	7.6	28	SE	3 46	1.28	13
	Chattanooga, Tenn.	73.6	90	57	33	5.2	27	SW	6.50	4.30	6
	New Orleans, La.	79.5	92	68	24	8.2	42	SE	13.90	2.99	18
	Memphis, Tenn.	76.2	93	57	36	9.4	34	E	5.57	2.57	9
	Palestine, Tex.	77.8	95	55	40	5.8	18	SW	1.92	0.70	7
	Average	75 4	94	57	37	7.3	31	—	4.80	1.84	10
Western Cities.	Helena, Mont.	56.7	87	32	55	7.5	32	SW	0.87	0.35	8
	Port Angeles, Wash.	55.0	76	38	38	4 9	30	NW	1.78	1.01	9
	San Francisco, Cal.	58.9	80	50	30	11.9	35	W	1.06	0.73	3
	Salt Lake City, Utah.	65.6	90	36	54	6.2	33	S	0.15	0.13	3
	Santa Fe, N. Mex.	61.1	82	32	50	5.4	30	S	0.18	0.12	2
	Denver, Colo.	61.9	90	32	58	7.7	41	S	0.28	0.13	6
	Yuma, Ariz.	—	—	—	—	—	—	—	—	—	—
	Average	59.9	84	37	48	7.3	34	—	0.72	0.41	5

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Street cleaning and garbage collection in Chicago are being now more than usually neglected, the money appropriated and the time of the men employed having been apparently largely diverted to political campaign purposes. Chicago is notorious for its ill-paved and dirty streets, and in fact it has hardly a street in good condition, with the exception of the boulevards (which are cared for by the Park Commissions and not by the city authorities), and some suburban roads. Many of the important business thoroughfares have great holes and pools of mud, which it would be impossible to clean in any ordinary way, even if the attempt were made. Such repair work as is done is largely of a very poor quality, and in some cases the property-owners have preferred to do the work by private contract, under permission from the city. All municipal work is under political rule, in spite of efforts to introduce the civil service system. Only recently, a man who had the work of street cleaning in one of the wards, but who had not a regular contract (being paid by the day), was replaced by another man without any notice, because he had interfered in some way with the aims of a local politician. The new man, having no proper machinery, made a failure of the work. To one who has seen the streets of Detroit, Milwaukee, Denver, San Francisco, or even Kansas City, the Chicago streets appear to be deplorably bad and filthy. After the litigation over the garbage collection contracts, which has been recorded in our columns, the city took up the work, and the authorities talked loudly about the great improvements that were to be made. At the present time, however, the garbage boxes are overflowing with the accumulation of weeks, and dirt, refuse and waste paper are thick in the alleys. In some of the residence districts the garbage wagons come along at irregular intervals of two to four weeks. Recently, the complaints have been so numerous that the authorities have taken steps to have this matter attended to, for fear of their political opponents making capital out of it during the coming campaign, and they have also promised to clean the streets on the route of the jubilee parade. The Council has made an appropriation of $50,000 for the work, but this has been declared illegal, as the city, under the terms of its charter, exhausted its power in this direction last spring, when it made an appropriation for the same purpose, and which has long since been expended. Even if the appropriation should hold, the local papers express the opinion that it would not result in $50,000 worth of street cleaning. After a few weeks, the present condition of affairs will doubtless prevail again. Many of the bridges, and viaducts also, are in very bad condition, owing to failure to provide money for painting or repair. The city of Chicago is loud in proclaiming preeminence among western cities, but it is more noted for a certain bad eminence as an example of defective municipal government under political administration on the "spoils" system.

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For a long time, builders and users of steam engines have felt the need of some better method of measuring and recording the power developed by a steam engine than the ordinary piston indicator. The desirability of this has been more than ever felt since electrical machinery came into general use, and its advantages in the way of accurate indicating and recording instruments became familiar to mechanical engineers. The electrical engineer, although the industry with which he is concerned is not a score of years old, has at his disposal instruments which show him at a glance the amount of power which his machines are giving out or absorbing. The steam engineer who desires to know the power his engine is developing must perform the tedious work of taking an indicator card, measuring and computing it, and when his task is done he knows only the power developed at a given instant, which in an engine with a variable load may vary widely from the average work that the engine is doing.

The task of doing for the steam engine what the wattmeter does for the electric motor, has been attacked within recent years by a number of inventors. The devices they have produced, however, have generally been based upon the ordinary steam cylinder indicator invented by James Watt, and first employed by him in experimenting with his engines. Taking this as a foundation, other inventors have devised various types of continuous recording instruments which it may be interesting to briefly review.

In the simplest of these the oscillating drum of the ordinary indicator is replaced by an arrangement which feeds a continuous ribbon of paper. An example of this class was described by its inventor, Prof. Thomas Gray, at the meeting of the American Society of Mechanical Engineers, in May, 1897 (Eng. News, June 3, 1897). The record of this instrument is a continuous zigzag line or wavy line, the amplitude of the waves giving the indicated pressure and their length, the length of stroke.

A step in advance of the instrument just described is to make an instrument in which a mechanical integration of the continuous diagram is effected. One of the best of this class of instruments is that devised by Mr. W. O. Amsler, of Pittsburg, and described in the "Sibley Journal of Engineering," for October, 1896, and later by Mr. A. A. Cary.* In this instrument the inventor still adheres to the piston and spring, although the spring is not in direct contact with the steam. With this instrument steam is admitted to both sides of the piston, which moves up and down under the combined influence of the steam from the engine cylinder and the indicator spring. In so doing it shifts the center of a spherical roller which is in contact with a small cylinder whose axis is parallel with the piston motion. This spherical roller is being continually oscillated about its axis by a reducing motion similar to that used with the ordinary indicator. With atmospheric pressure in the engine cylinder the axis of the spherical roller is perpendicular to the rolling cylinder, and no motion results. Increase the pressure and the axis of the spherical roller tips, throwing the point of contact out of line with its axis and immediately the cylinder begins to turn. In turning (which it will do to an amount proportional to the inclination of the axis of the spherical roller and the rate of rotation of the latter which depends upon the position of the engine piston), it drives a small dial at one end of the cylinder, which always turns in one direction. It will be seen that the instrument can be so calibrated as to continuously indicate the power developed.

Another example of this class of instrument was described in Engineering News, July 28, 1898. It is the invention of Messrs. W. G. and C. W. G. Little, Bexley, Kent, England, and as in the other cases depends upon the small steam cylinder, piston and spring. The paper drum is replaced by a plain metallic drum upon which rolls a small integrating wheel, the inclination of whose plane of rotation is varied by the indicator piston. In other words, this integrating wheel replaces the pencil motion of the ordinary indicator.

There is also a modification of this form designed by Prof. C. S. Brown, and described by Prof. Thomas Gray, in the Transactions Am. Soc. M. E. (Vol. XVIII., p. 1,035), in which the drum, instead of oscillating, is given a reciprocating motion back and forth along the line of its axis by a reducing motion. The wheel or roller presses against its surface, and as its plane is shifted by the movement of the piston, just as in the Little instrument, the cylinder is turned. The force with which the cylinder revolves is considerable, and is used to drive a light train of gears turning needles over properly-calibrated dials.

◆

This steam engine power gage is a wide departure from the other instruments above described. The ordinary steam engine indicator preserves the cylinder and piston which are the essential parts of the engine itself. The new power indicator discards these and adopts in their place the steam turbine. Briefly stated, the power measuring part of the device consists of a small steam turbine operated by two jets of steam, one from the working end of the cylinder and one from the exhaust, arranged to oppose each other so that the actual turning force at any instant is proportional to the effective cylinder pressure, and the greater the pressure the greater the speed of the turbine. This turbine, which has sufficient weight and inertia to maintain its speed between the impulses which occur, owing to the reversal of piston direction and the changing of pressures from one end of the cylinder to the other.

It may be asked whether the speed of the turbine is directly proportional to the pressure of the steam issuing from the cylinder. If the turbine were entirely free to revolve, this probably would not be the case, since the velocity of the steam issuing from a nozzle increases very slowly with increase of pressure after about 10 lbs. gage pressure is reached. However, as the turbine is given a load which causes it to revolve much more slowly than the steam, its speed will be proportioned not to the velocity of the steam, but to the energy of the issuing steam jet, and this is approximately proportional to the steam pressure.

We think our readers who follow the detailed description of the power gage in another column will be satisfied that the instrument is designed upon correct principles. It may seem to them, however, that it would be impossible for an instrument of this sort to be accurate in its indications. The only proof of this, of course, is actual test; and we are informed that the tests thus far made have shown gratifying results.

The practical value of an instrument which will indicate upon a dial at every moment the horsepower which an engine is developing is too obvious to require proof. It will doubtless be an easy step from such an instrument to an automatic recording instrument which will tell a graphic story at a glance to the eye of the Manager or Superintendent.

◆

Gen. Henry L. Abbot, Corps of Engineers, U. S. A., and member of the technical commission on the Panama Canal, asks us to correct several errors in the original manuscript of his article printed in this journal Oct. 6. The errors are important and for this reason we call attention to them in this place. Under the heading of the "Regulation of the Chagres River," in the second paragraph, the sentence, commencing "the largest within the memory of the inhabitants," should read, "is at Gamboa, 2,040 cu. m. per second," in

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*Transactions Am. Soc. M. E., Vol. XVIII., p. 1026.

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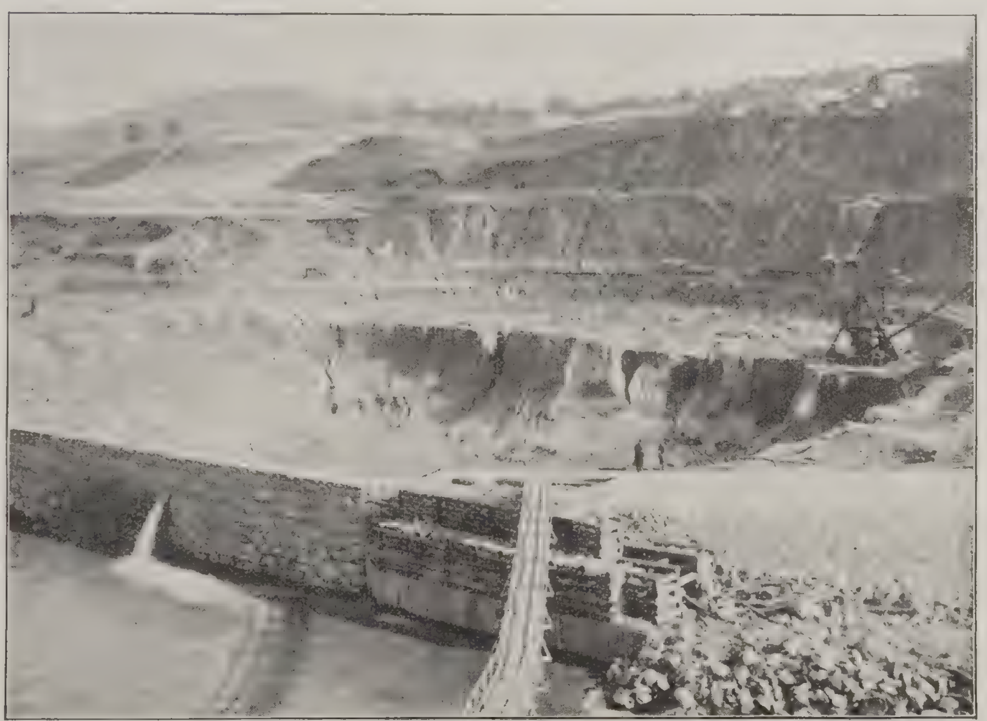

FIG. 2. LOOKING SOUTHEAST, FEB. 7, 1896. NEW RIVER CHANNEL IN FLOOD, WITH EXCAVATION IN PROGRESS BEYOND.

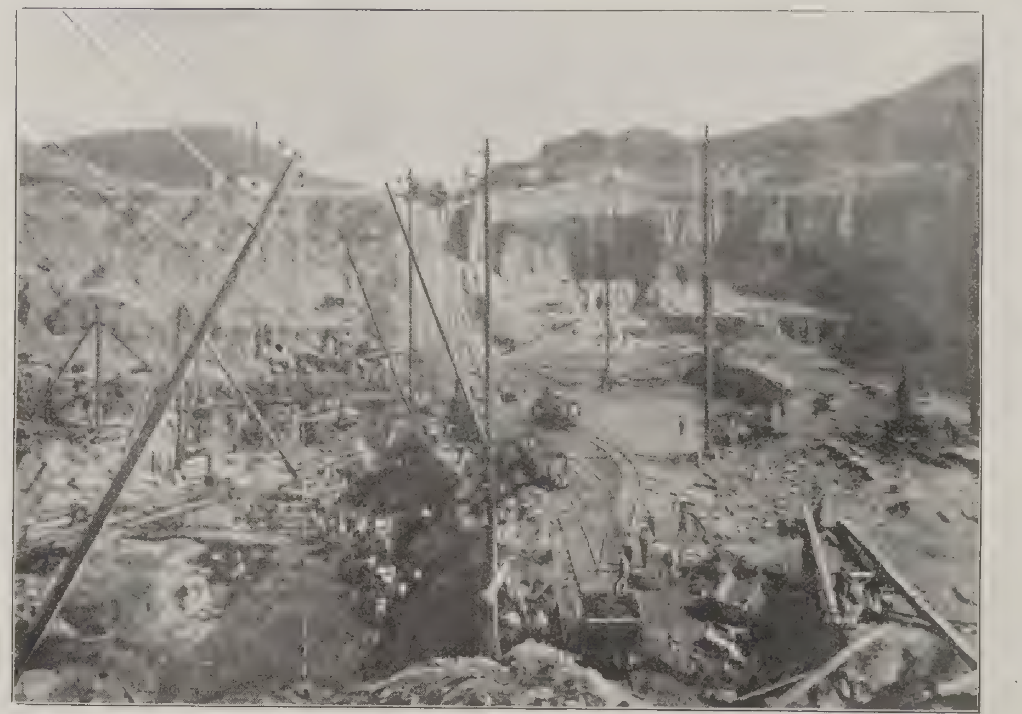

FIG. 3. LOOKING EAST, SEPT. 30, 1896. EXCAVATION AS SEEN FROM FOOT OF INCLINE RAILWAY, No. 3.

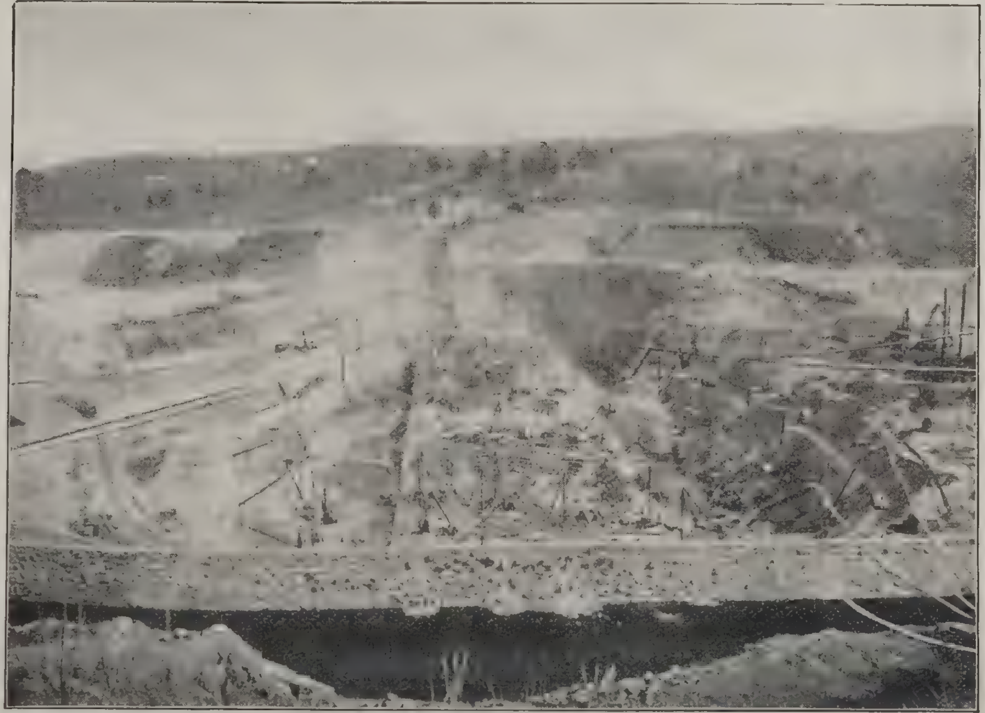

FIG. 4. LOOKING SOUTH ACROSS MAIN DAM, APRIL 13, 1898. NEW RIVER CHANNEL IN FOREGROUND.

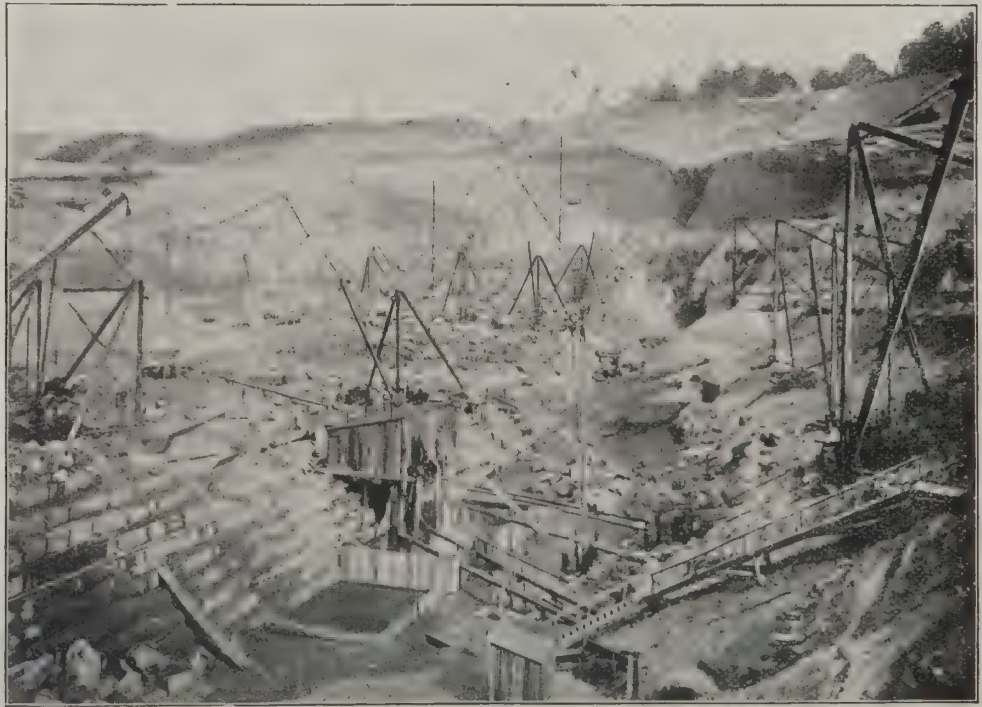

FIG. 5. DOWN-STREAM SIDE, JUNE 6, 1898. EXCAVATION FOR FARTHER END OF HEART-WALL OF SOUTH EMBANKMENT IN THE DISTANCE.

PROGRESS VIEWS OF THE NEW CROTON DAM.

Alphonse Fteley, Pres. Am. Soc. C. E., Chief Engineer.

Chas. S. Gowen, M. Am. Soc. C. E., Resident Engineer.

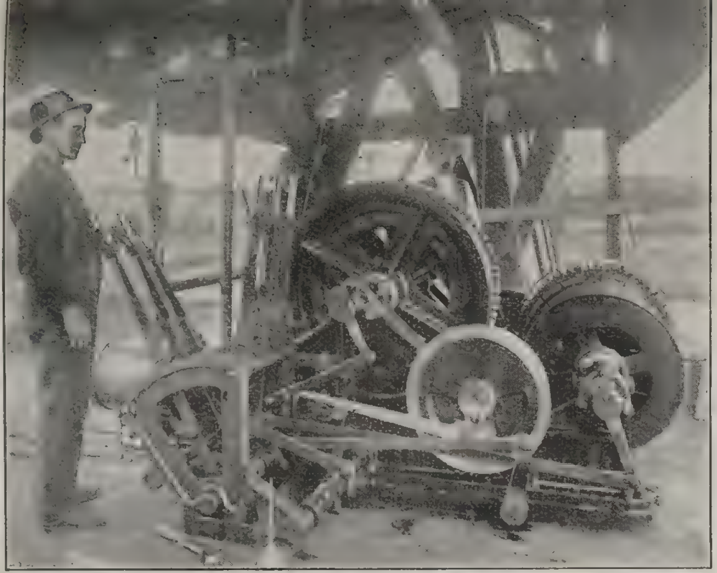

FIG. 2. ENGINE FOR OPERATING SHERMAN HOISTING AND DISTRIBUTING PLANT. W. D. SHERMAN, INVENTOR OF PLANT.

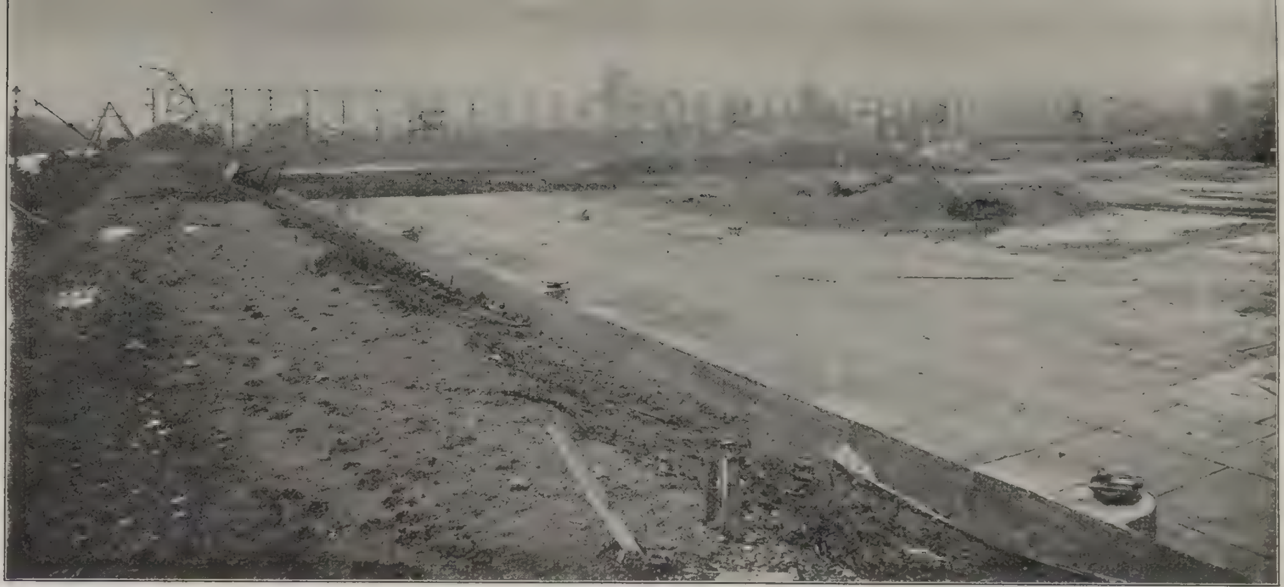

FIG. 1. CONCRETE FLOOR OF SEDIMENTATION BASIN, WITH ONE TRESTLE OF HOISTING AND DISTRIBUTING PLANT IN THE BACKGROUND.

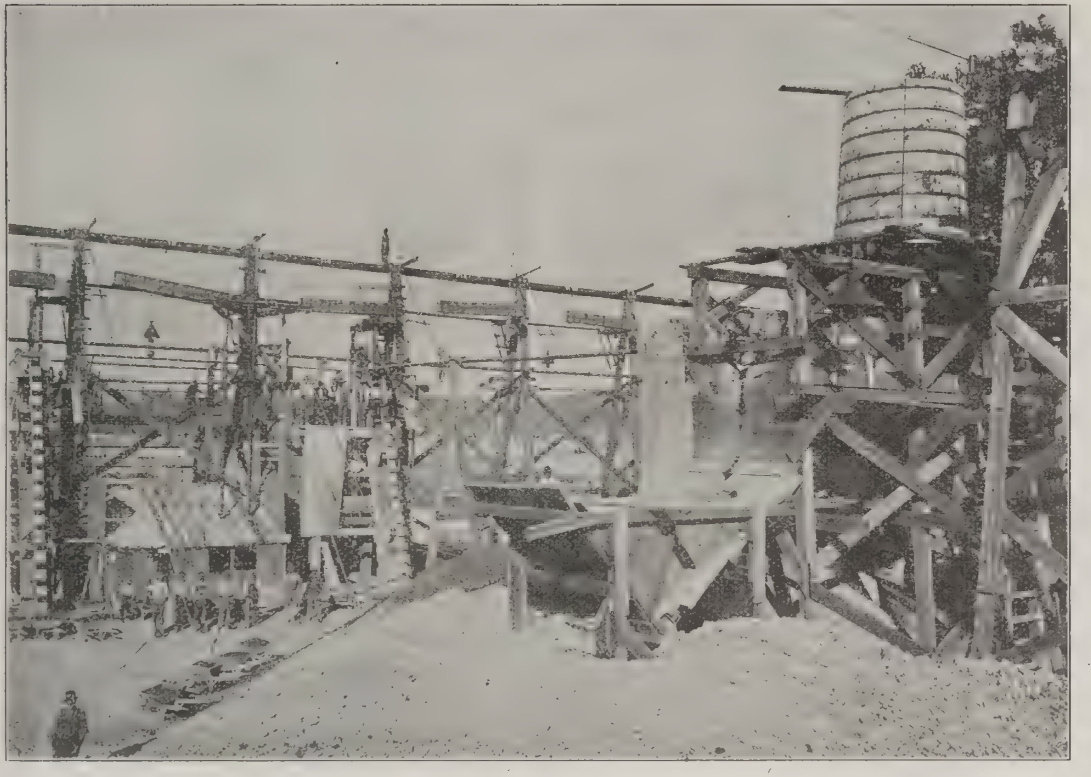

FIG. 3. SCREENING APPARATUS, CONCRETE MIXERS AND TRESTLE FOR DISTRIBUTING PLANT.

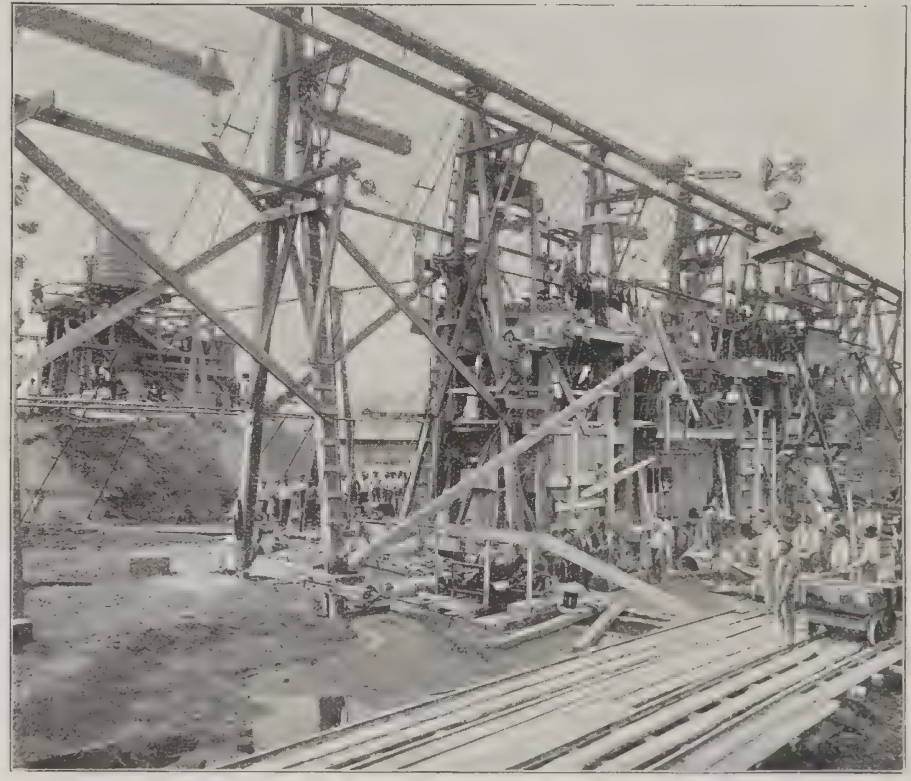

FIG. 4. CONCRETE MIXERS, TRESTLE FOR DISTRIBUTING PLANT, AND CROSS-CARRIER TRACKS.

VIEWS OF THE WATER PURIFICATION PLANT UNDER CONSTRUCTION AT ALBANY, N. Y.

Allen Hazen, Assoc. M. Am. Soc. C. E., Chief Engineer.

Wilson & Baillie Mfg. Co., Contractors.

stead of 1,630 cu. m. In the next paragraph, the sentence, "reservoirs to contains 1 million cu. m., above Alhajuela and 1.5 million cu. m. above Bohio," should be corrected to 100 million cu. m. above Alhajuela, and 150 millions cu. m. above Bohio." In the sixth paragraph, the sentence "calling for a layer of water 9 m. deep, to contain 1 million cu. m.," should read "100 million cu. m." In the eighth paragraph, the sentence "a capacity of 1.5 million cu. m.," should read "150 million cu. m."

LOSSES OF HEAT IN A STEAM PLANT.

The science of thermodynamics is taught, and we presume well taught as a rule, in all our schools of mechanical engineering, and its elements at least are more or less familiar to all engineers engaged in steam engineering work. And yet we venture to say that there are few among either students or practitioners who will not obtain, if they study the accompanying diagram, a clearer idea of the heat losses and heat interchanges that take place in a working steam plant than they have ever had before.

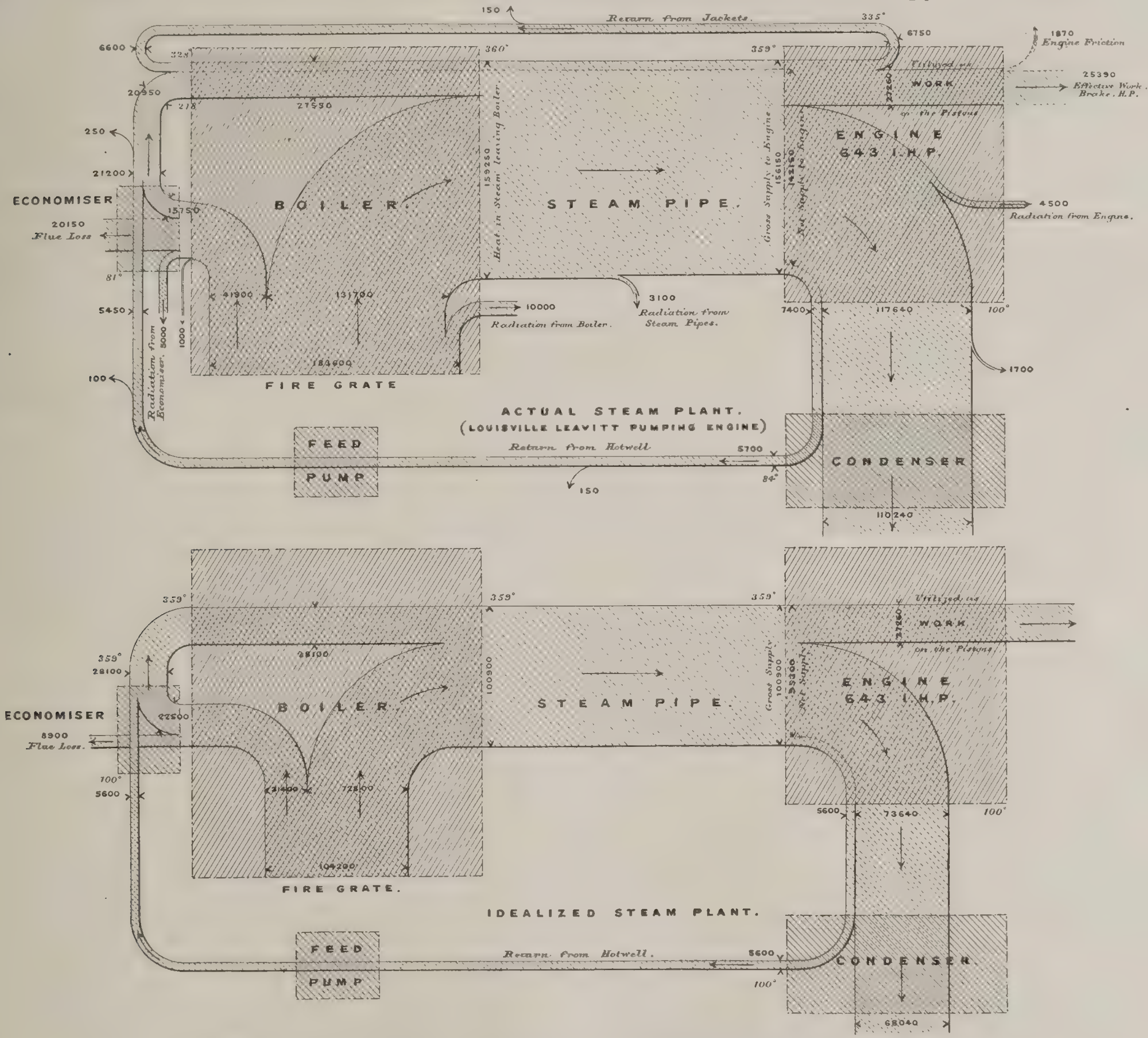

FIG. 1.—DIAGRAMS ILLUSTRATING THE LOSSES AND TRANSFERS OF HEAT IN STEAM POWER PLANTS.

It is a fact too often forgotten by teachers—and let us add, by those who write for and edit technical journals, as well—that it is the fact presented in the simplest and most forcible form that sticks in the mind. For example, the literature of steam engineering contains much with reference to the losses that take place during the expansion of steam in an engine cylinder. They have been explained and presented in diagrams and equations galore, yet an engineer of thorough education and wide acquaintance with the literature of steam engineering tells us that this never became a vivid, concrete reality to his mind until he ran across the statement that the difference in the temperature of steam in an ordinary engine when it entered the boiler, and when the exhaust port was opened was greater that the difference between the hottest day of summer and the coldest day of winter.

It is the trouble with much of our teaching and much of our learning, too, that we fail on the one hand to present facts, and on the other hand to grasp them in a way that shall make them vital realities to the mind. It is one of the objections to advanced mathematical work for engineering students, that it diverts the mind from realities to abstract things. The student absorbed in algebraic manipulations too often forgets what his symbols represent, and thereby falls into errors of reasoning which make his whole work of no value.

Turning again to the diagram shown herewith, it seems to us that it presents more vividly and clearly to the mind the heat interchanges of a steam power plant than anything which we have ever seen in technical literature. The broad river of heat generated by the coal burned on the grate is shown flowing to and through every part of the apparatus, losing by radiation at every step, and finally emerging at the chimney in a flow of heated air and gases, at the condenser in the circulating water discharged and at the engine shaft as useful work.

We have reproduced this diagram from the report recently issued by a committee of the Institution of Civil Engineers upon the "Thermal Efficiency of Steam Engines," made up by Professors Kennedy, Macfarlane, Gray, Ewing and Beare, Capt. H. R. Sankey and Messrs. Capper, Davey, Donkin, Longridge and Maw. The diagram shown herewith was made by Capt. Sankey, to accompany an introduction to the report, and to make clear exactly what is meant by the "thermal efficiency" of a steam engine.

The boiler, the engine, the condenser and the air pump; the feed-pump and economizer, are each shown on the diagram by rectangles (of arbitrary size). The flow of heat is shown as a stream, the width of which is proportional to the amount of heat entering and leaving each part of the plant per unit of time. The losses are shown by the many waste branches of the stream. Capt. Sankey continues the description of the diagram as follows:

> The upper diagram represents, in the main, the trial of the Louisville Leavitt pumping engine as described in the Transactions of the American Society of Mechanical Engineers, Vol. XVI.,* and the data are sufficiently full to enable the flow of heat to be stated at all points with fair accuracy. The numerals represent British thermal units flowing per minute; the streams are drawn to such a scale that each inch of width represents a flow of 100,000 B. T. U. per minute. Temperatures are also given.
>
> Starting at the fire-grate, it is shown that 183,600 B. T. U. are produced per minute by the combustion of the coal, and that 131,700 of these go direct into the water of the boiler, 10,000 are lost by boiler radiation and leakage, and the remainder, viz., 41,900, pass away with the flue gases. On the way to the economizer, 1,000 B. T. U. are lost by radiation, but in the economizer itself 15,750 B. T. U. are diverted into the feed water, 5,000 B. T. U. are dissipated by radiation, and finally 20,150 B. T. U. pass out of the economizer and into the chimney, and are lost to the steam plant. The heat entering the economizer with the feed-water is 5,450 B. T. U., which is added to the 15,750 B. T. U. diverted from the flue gases, thus giving a flow of 21,200 B. T. U. in the feed out of the economizer. Radiation, however, reduces this flow to 20,950 B. T. U. per minute at the entry to the boiler, where a further

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*Eng. News, Dec. 13, 1894.

addition is made of 6,600 B. T. U. returned by the jacket water.

The steam produced by the boiler is thus seen to derive its heat from three streams, as shown on the diagram; the steam finally leaves the boiler with 159,250 B. T. U. per minute. Before this heat gets to the engine, however, 3,100 B. T. U. are lost by radiation and leakage from the steam pipes, so that the flow of heat is reduced to 156,150 B. T. U. per minute, which is the gross supply of heat to the engine; the net supply is less, because there are certain returns of heat to the boiler to be deducted. In the first place credit has to be given to the engine for the heat which could be imparted by means of the exhaust steam to the feed-water, inasmuch as the exhaust is theoretically, and very nearly practically, capable of raising the temperature of the feed to the exhaust temperature. On this basis, 7,400 B. T. U. should be credited to the engine, although the actual return to the boiler, or rather to the economizer, is only 5,450 B. T. U. The difference is due to excess of circulating water, which lowers the hot-well temperature, and also to radiation in the feed arrangements, which are a necessary portion of the steam plant, independent of the engine proper, and which are not applied to correct any fault of the engine. The loss of 1,950 B. T. U. should therefore be debited to the feed and condensing arrangements, and not to the engine. It will be seen that the 7,400 B. T. U. credited to the engine is equal to the water-heat of the feed at the temperature of the exhaust. In the present case a special credit has to be given to the engine, because 6,750 B. T. U. leave the engine in the jacket water to return to the boiler; but 150 are lost by radiation on the way, so that the net return is 6,600 B. T. U. Only the net return to the boiler should be credited to the engine, because the jackets are applied to correct a fault of the engine, namely, cylinder condensation; hence any loss to the steam plant that may be entailed by the use of jackets (i. e., the radiation in question) should be reckoned as a loss due to the engine, although it takes place outside the engine. In the case under consideration the jacket water was returned direct to the boiler; but if, as is frequently the case, the jacket water is drained into the hot-well, the heat in it cannot be credited to the engine, for the reasons given above.

The net supply to the engine can therefore be obtained as follows:

	B. T. U.	B. T. U.
Gross supply	....	156,150
Less returnable by feed...............	7,400	....
" returned by jackets	6,600	....
		14,000
Net supply per minute.................		142,150

It will be seen that only 27,260 B. T. U. are utilized as work upon the pistons. The ratio of the heat so utilized to the net heat supplied is called in this report the "Thermal Efficiency of the Engine." In the numerical case under consideration the thermal efficiency is $\frac{27,260}{142,150} =$ 0.15.

The engine under discussion indicates 643 HP.; the heat supplied "per minute per I. HP." is therefore $\frac{142,150}{643}$ = 221 B. T. U., and it is this figure which, as recommended in the report, should be used to express the thermal economical value of a steam engine. This recommendation is made with a view of replacing the present usual method of stating the performance in lbs. of feed-water per I. HP. per hour, although the latter statement is useful for other purposes.

It will be seen that 1,870 B. T. U. are deducted from the 27,260 utilized as work on the pistons, as engine friction, so that the effective or brake power of the engine corresponds to 25,390 B. T. U. per minute; in other words, the brake HP. of the engine is 599, so that the "B. T. U. per minute per I. HP." are $\frac{142,150}{599} = 237$, another figure which the committee recommends should be quoted whenever it is possible to ascertain the brake efficiency.

Let it now be supposed that the actual steam engine is replaced by an ideal steam engine, forming part of an idealized steam plant working according to the "Rankine cycle," using for this cycle the name recommended by the committee. It must be assumed that the I. HP. of the "ideal" engine is the same as that of the "actual" engine, namely, 643 HP., and that the admission and exhaust temperature are the same, namely, 359° F. and 100° F. respectively. The flow of heat in the ideal steam plant is represented by the lower diagram, and it will be observed that all the losses have disappeared, except the flue loss and the heat carried away by the condensing water. There are no jackets, but there is an economizer, because, although the boiler is perfect, 31,400 B. T. U. are sent into the flue, since the gases cannot be cooled down below the temperature of the water in the boiler, and a portion of this heat can be saved by heating the feed to the steam temperature. The heat returnable by the feed is, of course, less than in the case of the actual engine, owing to the reduced weight of steam passing through the engine. The heat supplied to the ideal engine is therefore:

	B. T. U.
Gross supply .... , ...	100,900
Less returned by feed	5,600
Net heat supplied per minute................	93,300

The I. HP. of the ideal steam engine being the same as that of the actual engine, the same number of B. T. U. per minute are utilized as work upon the piston, namely, 27,260. The thermal efficiency of this ideal steam engine is therefore $\frac{27,260}{95,300} = 0.285$, and the B. T. U. per minute per I. HP. are $\frac{95,300}{643} = 148$, as against 221 for the actual engine. The actual engine, therefore, requires 73 B. T. U. per minute per I. HP. more than the ideal engine; these heat-units are lost on account of imperfections in the actual engine, and can be looked upon as a measure of these imperfections. The ideal steam engine thus becomes the "standard of comparison," as recommended and defined by the committee.

The number of B. T. U. per minute per I. HP. required by the ideal engine depends on the temperature of the steam at admission, and its temperature at exhaust, and also on whether the steam is saturated or superheated. Fig. 2 has been drawn to enable this number of B. T. U.'s to be read off directly in all cases likely to occur in practice.

If the number of B. T. U. per minute per I. HP. required by the ideal engine be divided by the number needed by the actual engine, there is obtained what has been called the "efficiency ratio" by the comimittee. In the numerical case under consideration this ratio is $\frac{148}{221} = 0.67$.

The report of the committee, to which the above forms an introduction, is too long for us to reprint. Their recommendations, however, are summarized as follows:

1. That "thermal efficiency" as applied to any heat engine should mean the ratio between the heat utilized as work on the piston by that engine and the heat supplied to it.

2. That the heat utilized as work be obtained by measuring the indicator diagrams in the usual way.

3. That in the case of a steam engine, the heat supplied be calculated as the total heat of the steam entering the engine less the water-heat of the same weight of water at the temperature of the engine exhaust, both quantities being reckoned from 32° F.

4. That the temperature and pressure limits, both for saturated and superheated steam, be as follows:

Upper limit: the temperature and pressure close to, but on the boiler side of, the engine stop-valve, except for the purpose of calculating the standard of comparison in cases when the stop-valve is purposely used for reducing the pressure. In such cases the temperature of the steam at the reduced pressure shall be substituted. In the case of saturated steam the temperature corresponding to the pressure can be taken.

Lower limit: the temperature in the exhaust-pipe close to, but outside, the engine. The temperature corresponding to the pressure of the exhaust steam can be taken.

5. That a standard steam engine of comparison be adopted, and that it be the ideal steam engine working on the Rankine cycle between the same temperature and pressure limits as the actual engine to be compared.

6. That the ratio between the thermal efficiency of an actual engine and the thermal efficiency of the corresponding standard steam engine of comparison be called the "efficiency ratio."

7. That it is desirable to state the thermal economy of a steam engine in terms of the thermal units required per minute per I HP., and that, when possible, the thermal units required per minute per brake HP. be also stated.

8. That, for scientific purposes, there be also stated the thermal units required per minute per HP. by the standard engine of comparison, which can readily be obtained from a diagram similar to that given in Fig. 2, and from which the efficiency ratio can be deduced.

Your committee would also suggest that in papers submitted to the institution bearing on steam-engine economy, authors be invited to conform to the above recommendations.

The only matters in the above recommendations which may need further explanation relate to what the committee defines as the "standard steam engine of comparison," and which is designated on the diagram as an ideal steam engine. The description given of this engine in the report is as follows:

After careful consideration, your committee recommend an ideal steam engine working as part of the Rankine cycle as the standard steam engine of comparison, both for saturated and for superheated steam engines.

The definition of the Rankine cycle is as follows: It is assumed that all the component parts of the steam plant are perfect, and that there are no losses due to initial condensation, leakage, radiation, or conduction, and that there is no clearance in the cylinder. The feed-water required is taken into the boiler at the exhaust temperature, and its temperature is gradually raised until that corresponding to saturated steam is reached. Steam is then formed at constant pressure until dry saturated steam is produced, after which, if the steam is to be superheated, heat is added at constant pressure and at increasing temperature, until the required temperature of superheat is reached. The steam is introduced into the cylinder at constant pressure, displacing the piston, and performing external work equal to the absolute pressure multiplied by the volume swept through by the piston up to the point of cut-off. Beyond that point expansion takes place adiabatically, doing work until the pressure in the cylinder is equal to the back pressure against which the engine is working. The steam is then completely exhausted from the cylinder at constant pressure corresponding with the lower limit of temperature, work being done on the steam by the engine during exhaust, equal to the absolute back pressure multiplied by the total volume swept through by the piston. The steam is thus removed from the cylinder and the cycle is complete.

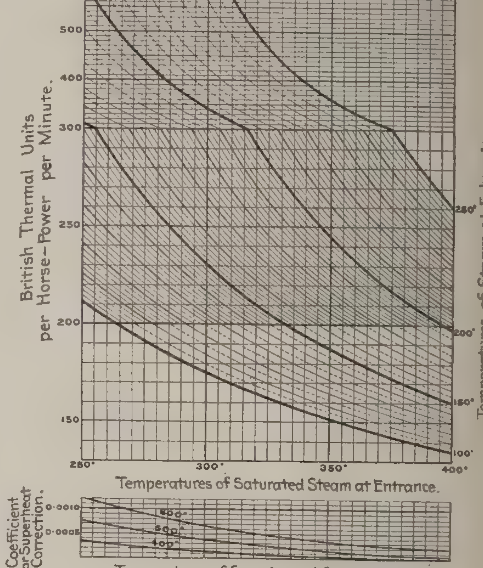

Fig. 2.—Curves Showing British Thermal Units Expended per Minute per. I. HP. by the Standard Engine of Comparison, viz., the ideal Steam-Engine Forming Part of the Rankine Cycle. (Temperatures in Degrees Fahr.)

(It will be noticed that the upper and lower portions of the diagram are to different scales; this is in order that the lower and more important part may be read more easily, and accounts for the cusps in the curves.)

The formulas for finding the heat units per minute per HP. for an ideal steam engine working on the Rankine cycle above described, are so long and complex that a diagram has been prepared from which this quantity may be found at a glance. It may be remarked that in the plotting of the diagrams for superheated steam the specific heat of superheated steam at constant pressure has been taken at 0.48. The practical use of these diagrams may be made clear by an example. Suppose it be desired to determine the B. T. U. per minute per HP. required for a "standard steam engine of comparison," taking saturated steam at 350° and discharging it at 212°. Follow up the vertical line from the figure 350 at the bottom of the diagram until it intersects the curve starting from 212° on the right-hand side. From the point of intersection follow a horizontal line to the left, and the required quantity is found to be 265 B. T. U.

Again suppose that it be required to obtain the B. T. U. per minute per HP., for the "standard steam engine of comparison," working with superheated steam at 135 lbs. pressure and 500° F. temperature, and with an exhaust temperature of 212°. Find the B. T. U. as before, using for the higher temperature the temperature corresponding to the pressure in saturated steam, then subtract from the B. T. U. per minute thus found a number to be found as follows: On the small lower diagram follow up from 350 to the curve marked 500°, and then from the point of intersection to the left on a horizontal line, by which process the correction coefficient is found to be 0.00015. Multiply this coefficient by 212, the exhaust temperature, and the product by 265, the number of B. T. U. found from the under diagram. Subtract the final product, 8.5, from the 265 B. T. U. already found. The remainder, 256.5 B. T. U. is the quantity required.

With the above explanation we believe our readers will have no difficulty in making practical use of the method of recording the efficiency obtained in steam engine trials recommended by the Institution committee. The advantages of the heat unit system as a basis of comparison have already been made familiar to American engineers to a considerable extent by the adoption of the system by the American Society of Mechanical Engineers in its standard code for duty trials of pumping engines. To state the economy of an engine merely in terms of the weight of coal or of steam which it uses per horse-power in a given time, is something like stating the width of a piece of land in paces.

In conclusion, we will again call attention to the diagram showing the various heat losses in a real and an ideal steam plant, which forms, we are inclined to believe, one of the most valuable parts of the committee's report.

While the facts it displays may be elementary to many of our readers, the general plan of the diagram may be studied with much profit by all engineers who have to do with the records and testing of steam or electric power plants. The idea of representing the energy in a power plant as a flowing stream and the various losses and dispositions of the energy as diverging branches therefrom is one which is worthy of general adoption. Facts displayed in such a graphical manner may be impressed on the minds of Boards of Directors, or other superior officers, when columns of figures and tables would be ignored. The most successful engineers are those who can deal with men as well as with materials; and the ability to present the facts of a situation forcefully and graphically is often worth as much to an engineer as all his knowledge of mathematics or materials.

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LETTERS TO THE EDITOR.

Typhoid Fever in the Army.

Sir: I am directed by the Surgeon-General to acknowledge receipt of an article on "Typhoid Fever in the Army" in Engineering News, Sept. 22, 1898. The article appears to be clear and comprehensive and based upon competent knowledge of the subject. Cases of typhoid fever, diagnosed as such, were, however, not transported through the country to distribute their diarrhoeal discharges without disinfection along the tracks. Such cases were only transported by the Medical Department of the Army in hospital trains, fully equipped with all modern hospital appliances, where disinfection was as thoroughly carried out as in any civil hospital in the country. It may be true that certain undiagnosed cases sent home on sick leave proved ultimately to be typhoid infection, but such cases represented only an extremely small proportion of the typhoid cases. They were allowed to proceed on their journey simply because the symptoms manifested did not warrant the diagnosis of any grave affection. Their return was perhaps due to mistaken diagnosis based on incomplete data, but certainly was not a sin of omission or commission to be attributed to the Medical Department of the Army.

The publication of such a fair-minded and dignified article as the one above mentioned cannot fail to have a decided influence in shaping public opinion at a time when newspaper sensationalism appears to have run riot.

Very respectfully, Edward L. Munson,
Captain and Assistant Surgeon, U. S. Army,
Washington, D. C., Oct. 12, 1898.

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The Comparative Corrosion of Iron and Steel.

Sir: Your answer to R. S. W., of Milwaukee, Wis., in Engineering News of Oct. 6, is, I believe, partially incorrect. My opinion is that hard steel, which you say corrodes more slowly than iron, corrodes more than twice as fast as iron. This opinion has been confirmed in nearly every talk I have had with some of the best posted men on the subject, and I believe this is the reason why the best informed builders are now using iron instead of steel for roofing and sheet metal work. If I remember correctly Mr. M. P. Wood, in his essay on "Rustless Coating for Iron and Steel," says steel corrodes about five times fast as iron. It is certainly much easier to make paint stay on iron than on steel. As this is an interesting and important matter I for one would like to hear from any others who can speak with authority on this subject.

Very truly, C. H. H.
Cleveland, O., Oct. 15, 1898.

(We join our correspondent in asking those who have experience to discuss this topic. The literature upon the comparative liability to corrosion of iron and steel is exceedingly meager and unsatisfactory. Mr. Francis T. Bowles, Naval Constructor, U. S. N., states that "good unpainted iron or steel plates" will lose on one surface in 100 years from .30 to .50-in. thickness, if immersed in sea-water; .02 to .03-in. if in pure, fresh water, and .25 to .30-in. if exposed to the atmosphere. But, unfortunately, he makes no distinction between the iron and the steel. The action of sulphurous gases upon iron and steel, the presence of sewage in the water in which iron and steel are immersed, and the general prevailing conditions will doubtless much modify the rate of corrosion in each, and these conditions should be carefully noted in observations of this kind.—Ed.)

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Laying Out Turnouts and Crossings.

Sir: I wish to heartily concur in the remarks of Mr. E. D. Wileman on the subject of frogs and crossings in your issue of July 28, which has just come to my notice. He is quite right in saying that it is impossible to make a satisfactory plan of a crossing by measuring an old one in the track, or a new one either. The only way is to measure the angle of intersection of tracks, calculate angles and dimensions, and check them from a large-scale drawing.

The whole subject of turnouts and crossings has been completely befogged by a multitude of useless and cumbersome formulas. Every young engineer approaches his first turnout with fear and trembling, having imbibed the idea from the books that the subject is exceedingly difficult, whereas it is very simple, involving only problems in the use of simple circular curves, and requiring only such formulas as should be at the finger-tips of every transitman of two months' experience.

A common mistake in laying out turnouts is to begin with the location of the head-block instead of the frog point. If the latter be chosen first, and the frog angle be turned from the main line or from a tangent to the main line at that point, the turnout can be run as easily as any other curve. A table of leads and turnout curves for straight track should be constructed by considering the frog from heel to toe as one tangent, and the main line rail for stub switches, or the switch rail for split switches as another, and calculating the circular curve required to join them. Then calculate the offset between the main line and turnout curve at a point half way between the frog point and the head-block for stub switches, or heel of switch rail for split switches. This offset will be the same for the same frog, whether the turnout be on either side of tangent, taper, simple or compound circular curve, and should be used in staking the lead, as it saves the trouble of determining the degree of the turnout curve in the three last named cases.

Frogs of the same number but different lengths will of course have slightly different turnout curves, as will also stub and split switches with the same frog.

Respectfully, J. P. Newell, O. R. & N. Co.
Portland, Ore., Oct. 10, 1898.

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Electro-Plating of Stones and Pebbles With Metal From Water Pipes.

Sir—In the article on "Electrolysis of Water Pipes at Dayton, Ohio," in your issue of Oct. 6, I note the following quoted from the report of Mr. Harold P. Brown:

> Furthermore, the stones or pebbles near the pipes seem to be electro-plated with the metal of the pipe. This condition I have not seen at any other place, and, as far as I know, it has not been observed before.

In this connection I would refer to a letter of mine, dated March 15, 1894, and published in your issue of March 22, 1894 (Vol. 31, p. 242). With this letter I sent you samples of earth in which the redeposited metal from the pipes was plainly visible. At that time, and frequently since then, we have observed here that stones or pebbles near the pipes were especially apt to be electroplated with the metal of the pipe, whether lead or iron; and where there were moist streaks or faults in a clay soil, I have found samples of the redeposited metal extending as far as the sides of the excavation, sometimes 6 ft. from the pipes. I have been very much interested in the portions of the Dayton report which you published, more especially since our experience here agrees in many particulars with the results of the careful observations made by the experts employed there.

Yours truly, Dabney H. Maury, Jr.,
Engineer and Supt. Peoria Water-Works Co.
Peoria, Ill., Oct. 13, 1898.

(As a matter of interest in this connection we take the following additional remarks respecting the electro-plating of pebbles, etc., at Dayton, from the report of Mr. E. E. Brownell, one of the electrical experts employed by the city.—Ed.)

> Wherever any electrolytic action has attacked the cast-iron mains, there remains upon or adjacent to the mains a black substance, that is due to the nascent oxygen being liberated from the decomposed water, oxidizing the iron in the pipes, and this iron is then carried or held in solution by a solvent, which is formed by the reaction of a current of electricity upon the constituents of the soil; from this solvent the iron, lead or whatever metal it has attacked, is taken or given up to be deposited or electro-plated upon the soil and stones to the distance of several inches.

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Sir—In your issue of Oct. 6 is an abstract of reports upon the damage to water pipes at Dayton, Ohio, by electrolytic corrosion. In this there are several statements which clearly appear to be founded on misadvertence or misinterpretation of facts.

For instance, it has been fully proved by experiments made here in 1893 and 1894 that such electrolytic corrosion is a direct electrolytic action and not one in which free oxygen comes into play. Similar conclusions may be derived from the results of Mr. Farnham's experiments of about the same date. It would be a very fortunate thing if the view of the cause of electrolytic damage set forth in your abstract were correct; since, in this case, an electric pressure of some considerable magnitude would be requisite to set up the action, and careful bonding for the purpose of reducing the difference of pressure between pipes and track return would bring this below the critical value required to liberate oxygen under the existing conditions, and the danger of damage would be entirely avoided. Unfortunately, the action does not take place in this way, but was shown in the experiments referred to above to be a direct electrolytic action, which may be set up by a mere directive force. Hence results the carrying away of iron from the pipes and its deposition elsewhere. This is plainly explained in the paper read on July 11, 1894, before the Western Society of Engineers, and published in the Journal of the Association of Engineering Societies (monthly number for September, 1894). I have frequently observed an accumulation of iron or lead salts in the earth near electrolytically damaged pipes, and the phenomenon is well known amongst those who have had experience in making examinations for the purpose of prescribing alleviative measures.

Respectfully yours, D. C. Jackson.
Department of Electrical Engineering University of Wisconsin, Oct. 13, 1898.

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STANDARD SPECIFICATIONS FOR STEAM BOILERS.

At the recent annual meeting of the American Boiler Manufacturers' Association, at St. Louis, the report of a committee appointed at the convention of a year ago to prepare a set of specifications for steam boilers was presented, and after extended discussion was adopted with slight changes. The report as finally adopted is as follows:

Materials.—The materials for first-class boiler work should be the standard materials as adopted at Philadelphia, by final vote recorded on page 77 of Proceedings of 1897, and as given in concise form on pages 207 and 208, Proceedings of 1897. Other materials not therein specified are given in the body of these specifications in connection with provisions for the design and workmanship of the parts to which they apply.

Riveting.—Holes should be perfectly true and fair, made so by use of clean cutting punches or drills; sharp edges and burrs to be removed by slight counter sinking and burr reaming before and after the sheets are joined together. Under side of original head of rivet must be flat, square and smooth to insure perfect contact with the plate. For rivets from ⅝ to 13-16-in. diameter allow 1½ diameters for length of stock to form the head; for large rivets allow less length. For button set on snap rivets 5% more stock may be allowed to form the driven head. Light regulation riveting hammers to be used until rivet is well upset in the hole; after that the snap and heavy mauls. For machine riveting more stock may be left for the driven head, to make it equal to the original head; this to be fixed by experiment. The amount of pressure on the die should be obout 80 tons for 1⅛ or 1¼ in. rivets; 65 tons for 1 in., 57 tons for 15-16-in., 35 tons for ¾-in. rivets.

Rivets should be tested both hot and cold by driving down on an anvil with the head in a die, by nicking and bending, and by bending back on themselves, all without developing cracks or flaws. The heads of rivets to be of equal strength with the shanks. This is fulfilled by giving the head at the periphery of the shank a height equal to one-third the diameter of the shank. A slight fillet at this point is advisable. The rivets should have a diameter about double the thickness of the thinner plate; the pitch should be about three times the rivet hole; the distance between staggered rows of rivets half the pitch; the lap for single riveting about equal to the pitch; the lap for double riveting about one and one-third times the pitch. and one-half pitch more for each addtional row of rivets.

All these are approximations; the exact dimensions to be determined by making the resistance to shear of the total rivet strength of the net or standing metal.

A factor of safety of 4½ shall be used where the tensile strength of the plate and the shearing strength of the rivets have been determined by actual tests. Where this has not been done a factor of safety of 5 shall be taken, and at most 55,000 lbs. tensible strength per square inch for steel plate and 40,000 lbs. shear strength per square inch for rivets be allowed. Rivet holes may be punched with good sharp punches and well fitting dies in American Boiler Manufacturers' Association steel up to ¾-in. in thickness. Above that thickness either punching and reaming with a fluted reamer, or drilling is advisable. The judicious use of the drift pin with light hammers in pulling the plates into place and rounding up the holes is not objectionable; but enlarging or gouging holes to a fit by driving in a drift pin with heavy hammers or mauls is condemned as a barbarous practice. When drawn into an approximate fit the holes must be trued up by means of reamers.

Calking—The old style, known as split calking, is unfit for boiler work. Excellent work can be done, both by hand calking or calking with pneumatic hammer and the Conery or round tool. Excessive calking throws undue strains on the rivet heads and must be avoided. The square nosed tool should be used only in corners where the round nosed cannot reach, and in taking up small local leaks, and extreme care is necessary to avoid nicking the lower plate. The fit should be made in the laying of the plates, the calking only to correct the natural and unavoidable roughness of the surfaces of contact. Calking edges should be prepared by bevel planing, bevel shearing or bevel chipping.

Flat Surfaces.—The rules for flat surfaces have been experimentally determined, and should be amended from time to time in the light of tests of full sized structures built up of the best modern materials and with the best modern tools and workmanship. The mathematical formulae for a plate supported on all sides have never been worked out to full satisfaction. The exact factor of safety under any empirical rules cannot, therefore, be determined. The rules of the United States Board of Supervising Inspectors approximate a factor of safety of five. And as they have given satisfactory results during past years, with materials of less excellence than American Boiler Manufacturers' Association stock, they are recommended as safe rules—viz.:

State of thickness of plate in sixteenths of an inch, thus for ½-inch plate, 8-16 or 8; then:

Assume a constant (C) for the following varying methods of construction:

C = 112 for plates 7-16 inch thick and under, with screw stays, riveted ends.

C = 120 for plates over 7-16 inch thick, with screw stays, riveted ends.

C = 140 for all plates when in addition to the screw threads in the plates a nut is used both inside and outside of each plate.

Whenever salt, acids or alkali are contained in the feed water all plates must have nuts inside and outside, in addition to the screw threads in the plate. The safe working pressure per square inch is

$$P = \frac{C \times t^2}{p^2} \text{ (where p = the pitch in inches)}$$

by formula. Or it can be expressed in the rule: Multiply the constant C by the square of the thickness of plate expressed in sixteenths of an inch, and divide by the square of the pitch expressed in inches. The quotient is the safe working pressure:

The supervisor's rules allow a still higher constant, C equals 200, based on large washers riveted as reinforce plates on the outside of the plates. But this introduces the element of doubt as to weakening by rivet holes (which has caused abandonment of this method of reinforcing manholes), and it is therefore wiser to discard it.

Bumped or Dished Heads.—Whenever a head is uniformly dished or bumped as a segment of a sphere, any radial section of same is under the same conditions of equilibrium as the circle seam of a cylinder, and as a circle seam has double the strength of a side seam (subject to percentage reduction due to riveting), it follows that the thickness of a convex or dished head should be the same as that of the cylindrical shell whose diameter is equal to the radius of curvature of the dished head. As this rule applies to a solid plate any reduction by rivet holes, man holes, etc., must be allowed for by proportionate increase in thickness.

Flanging, Bending and Forming.—The exact heat for flanging, bending and forming cannot be fixed, but must be left largely to the judgment of the flanger, since it depends on various qualities of the steel or iron, but under no circumstances should any blow be struck, or bending attempted, after that portion of the plate undergoing manipulation no longer shows red in the dark. As the danger point is what is known as blue heat, this rule must be understood to apply to parts of the plate at least 4 ins. distant from the point where the actual bending takes place or the blow is struck.

Rolling.—All rolling should be done cold, and gradually by regular increments from the straight plate to the exact circle required, and care must be taken that the whole length of the plate is rolled to a true circle. If the lap for the rivet seam is left straight instead of being brought to this true circle there is always a danger point on the line of demarcation.

Boiler Tubes.—Boiler tubes should be made of charcoal, iron or mild steel, specially made for that purpose, and should be lap-welded or drawn. They should be round, straight, free from scales, blisters and mechanical defects, and each tube subjected to an internal hydrostatic pressure of 500 lbs. per sq. in., and so stenciled. The manufacturer's name should also be plainly stenciled on each tube. The metal thickness should be as follows, but may be increased when demanded by specially high pressure or extreme lengths:

No. 13 B. W. G.	1 in., 1¼ ins., 1½ ins., 1¾ ins.
No. 12 B. W. G.	2 ins., 2¼ ins., 2½ ins.
No. 11 B. W. G.	2¾ ins., 3 ins., 3¼ ins., 3½ ins.,
B. W. G. No. 10.	3¾ ins., 4 ins.
B. W. G. No. 9	4½ ins., 5 ins.

Tests.—A section cut form one tube taken at random from a lot of 150 or less must stand hammering down vertically without cracking or splitting when down solid.

Size.	Length of test section.	Size.	Length of test section.
For 1-in. tubes.	¾-in.	For 2¾-in. tubes.	1¼ ins.
" 1¼-in. "		" 3-in. "	
" 1½-in. "	1 in.	" 3¼-in. "	
" 1¾-in. "		" 3½-in. "	1½ ins.
" 2-in. "		" 3¾-in. "	
" 2¼-in. "		" 4-in. "	
" 2½-in. "		" 4½-in. "	
		" 5-in. "	1¾ ins.

All tubes should stand expanding flange over on tube plate and bending without flaw, crack or opening of the weld.

Tube Holes.—If punched, should not be full size, but allow not less than ⅛-in. on the diameter for reaming. Tube sheet should be annealed after punching, and before reaming. All holes should be slightly countersunk on both sides to prevent cutting tube by expanding and beading.

If copper ferrules are used the hole should be a neat fit for the ferrule. If ferrules are not used the hole should be 1-64 to 1-16-in. larger, according to size of tube.

Tube Setting.—Ends of tubes should be annealed in the tube mill before setting. The tube should be allowed to extend through the sheet 1-16-in. for every inch of diameter, which is ample for beading, then expanded until it is tight in the hole and no more. Excessive expanding should be guarded against. On the end exposed to direct flame, flange tube partly over the sheet, allowing part of the right angle flange or bead to be completed by beading tool. The beading tool should not come in contact with the tube sheet, but work entirely on the tube. After beading, tube should be slightly expanded to counteract the loosening effect of the beading process.

Copper Ferrules.—Copper ferrules should be used in fire-tube boilers on the ends subject to direct heat. They protect the flue holes; protect the flues from crystallization on account of expanding, and make better and surer joints on account of softer metal being compressed between the two harder ones. The tubes are more readily removed on account of tube holes being larger, and when scaled, scale and sediment is removed with them, while when body of tube fits the hole it scrapes all scale and sediment off and leaves it on the inside of the boiler. Ferrules should be from 18 to 14 wire gage, according to size of tube.

Removing Old Tubes.—This depends largely on circumstances. There is always one end of the boiler where the tube is more readily removed than on the other. Some times it is convenient to drop them down and take them through a man or hand hole, then again raise them to a dry pipe hole, or take them through the hole they have been occupying. In any event, first remove the beading with a flat chisel. Be very careful not to injure the flue sheet. Then cape in past inside of flue sheet with a chisel or round back diamond point. Have sharp corners removed from tool to avoid cutting or scoring edge of flue hole. Then cave end of tube inward. The tube is then ready for removing from boiler, as circumstances may suggest. Where the tubes have not been beaded over they can be readily loosened for removing by using a crimping tool made with two fingers of unequal length, between which the metal of the tube fits easily. The longer finger inside the tube forms a fulcrum; the shorter one outside crimps the metal inward.

Riveted and Lap-Welded Flues.—There are so many variations in details of construction involved in the question of the strength of such flues that a mathematical determination of their strength, which must necessarily depend on certain assumptions, is not practical. On the other hand, experimental work in testing flues of this character is necessarily very expensive and would have to cover so large an amount of ground that no private firm or corporation could undertake it, and the determination should be left to the government testing works. Your committee, therefore, deems it best for the present, and until other experimental data are available, to adopt in full sections 8 to 13, inclusive, of Rule 11 of the Board of Supervising Inspectors of Steam Vessels.

Corrugated Furnace Flues and Steam Chimneys.—The same remarks as made regarding flues apply to corrugated furnace flues and steam chimneys, and your committee, therefore, recommends the adoption, for the present, subject to amendment on the basis of further experimental data, the provisions of sections 14 and 15 of Rule 11 of the Board of Supervising Inspectors of Steam Vessels.

Stay Bolts.—Should be made of iron or mild steel specially manufactured for the purpose. If made of iron, the material should have a tensile strength of not less than 46,000 lbs., and not less than 26,000 lbs. elastic limit. Elongation not less than 22% in 8 ins. for bolts of less than 1 sq. in. net area, nor less than 20% in 8 ins. for bolts of 1 sq. in. and more in net area. If made of steel the material should have a tensile strength of not less than 55,000 lbs., and not less than 33,000 lbs. elastic limit. Elongation not less than 25% in 8 ins. for bolts of less than 1 sq. in. net area, nor less than 22% in 8 ins. for bolts of 1 sq. in. and more in net area. Stay bolts should be subjected to the following tests:

1. A bar to be selected at random from a lot of 1,000 lbs. or a fraction thereof. After being threaded with a sharp die, V-thread with rounded edges, it should bend cold 180° around a bar of the same diameter without showing any crack or flaw.

2. Another piece similarly threaded to be screwed into well-fitting nuts formed of pieces of plates to be stayed and riveted over so as to form an exact duplicate of the bolt in the finished structure. It is then to be pulled in a testing machine, and the ultimate stress carefully noted. If it fails by pulling apart, the tensile stress per square inch figured on the original net section is to be used in figuring the safe load. If it fails by shearing, the shear stress per square inch of the mean section in shear is to be thus used. This mean section in shear is found by multiplying half the thickness of the plate or nut by the mean between circumference at base and at crown of thread. The safe load to be determined by applying a factor of safety of 5 to the ultimate stress per square inch thus found.

Stay bolts should be carefully threaded with sharp, clean dies. They should be cut on a threading machine equipped with a lead screw, so that there will be no variation in the pitch of the stay bolt threads. Holes should be tapped with tap extending through both sheets and to a neat, smooth fit, just large enough so that the bolt can be put in by hand lever or wrench with a steady pull. Great care should be taken to make full, clean V-threads, rounded edges, making a close,neat fit, so that very little riveting will be required; 1-5 of diameter is proper height for projecting and riveting. Riveting is detrimental to threads in sheet and on stay bolts. In the case of hollow stay bolts a long, slender drift pin should be driven into the bore before and kept there during riveting, and afterward driven home firmly to slightly expand the bolt and counteract the tendency to loosen the thread due to the riveting, and finally removed by loosening it by slight taps of the hammer all around, or by driving out by a bar from the other end. When nuts are used on screw stays the height of thickness of such nut shall not be less than 60% of the diameter of the bolt. The largest pitch permissible for screw stays is 10 ins.

Braces and Stays.—The material in braces and stays should be fully equal to stay bolt stock. A bar not less than 10 ins. long shall be taken from each lot of 1,000 lbs. or fraction thereof and tested to destruction; the tensile strength thus found, subject to a factor of safety of 5, shall limit the tensile stress per square inch permitted on the brace in direct pull. Where such tests are not made the material shall be subject to careful inspection, and if it appears satisfactory, 6,500 lbs. per sq. in. for wrought iron and 8,000 lbs. per sq. in. for steel shall be the highest loads permitted. Welding should be avoided where possible, and where welds have to be used they are to be considered as having only 80% of the strength of the solid bar. Rivets by which braces are attached to the boiler when the pull on them is other than at right angles, should be subjected to only half the stress permitted rivets in the seams.

Manholes.—The older methods of reinforcing manholes have been found by practical tests to be defective. A ring or plate riveted on inside or outside never becomes a part of the original plate, and there are many instances where the main plate was fractured under test, while the reinforce plate or ring was as good as new. This shows that it is not possible to make the reinforce plate relieve the main plate of the portion of the load intended. This becomes worse when the metal of the reinforce plate is different in quality from that of the main plate. Besides this the rivet holes necessary for joining plate and ring together introduce a new element of weakness and uncertainty. Cast-iron reinforce flanges are of no value whatever, and are unqualifiedly condemned. The best method of forming a manhole is to cut the hole considerably smaller than required, and then flange it in with a straight flange on a radius of not less than three times the thickness of the metal. In place of attempting to rivet on a piece of plate to make up for that cut away, it is better to make the original plate that much thicker. Or the flange may be reinforced by shrinking on a reinforce ring around it, and this should always be done where the plate is ½-in. or less in thickness.

Domes.—Domes should be avoided when possible. No method of reinforcing the shell where the hole is cut for the dome gives absolute security. But where domes cannot be avoided the cylindrical portion of the dome should be flanged down to the shell of the boiler and the shell either flanged up inside of the dome or reinforced by a collar flanged at the joint, and these flanges should be double riveted.

Drums.—Drums may be put on with collar flanges of A. B. M. A. steel, not less than ⅜-in. thick, double riveted to the shell and the drum and single riveted to the neck or leg, or the flanges may be found on the legs.

Saddles or Nozzles.—Should be of flanged steel plate or of soft cast steel. The latter, however, has the disadvantage that it is frequently porous, and has not the same ductility as the shell plate, and cannot be held to be as good as flanged A. B. M. A. plate. Cast iron must not be used for any opening in which it will be in tension.

Hanging.—The boiler should be supported wherever practicable at the points where there is the greatest excess of strength. Excessive local stresses from the weight of the boiler and contents should be avoided, and therefore short lugs are objectionable. Any straps or lugs from which the boiler is suspended should be made very long on the shell, so as to insure them against distortion of any kind, and the rivets for securing them to the structure should be so proportioned as to take only one-half of the stress which is permitted for rivets in the seams. The boiler should be set in such a manner that the furnace may be rebuilt without in any way disturbing the proper suspension of the boiler. All boilers should be so set that there will be a little less water at the gage cocks than at the opposite end of the boiler.

Hydrostatic Pressure.—The old methods of testing by excessive hydrostatic pressure are condemned as barbarous, and tending to weaken the structure and disturb the proper fit of the parts. The hydrostatic test should never be used to take the place of a proper and thorough examination of the quality of materials, proportions and workmanship of the boiler. The hydrostatic test should never exceed a pressure of one-third above the regular working pressure, and under no circumstances should this excess be more than 100 lbs. per sq. in. The water used for hydrostatic test should never be less than 125° F. in temperature.

We present these specifications in this form in order that a full discussion of them may be had. We think we have done our duty, as we understand it—i. e., simply to bring into a tangible form, and as short as possible, the vast amount of information which has been contributed by all members during the discussions at our nine previous conventions. Where conflicting opinions exist we have attempted rather to harmonize them or to arrive at a just and fair compromise between them, than to assume an attitude of partisanship. We are far from believing that this is the best specification that could possibly be written to-day, but we know that it represents the average opinion of those of our members who have been most earnest in the work of this association and most desirous of establishing uniformity in excellence.

After it has been fully discussed, amended and adopted, we propose to recast it in a more concise form, leaving out matters of explanation and reciting only the rules which should govern good boiler work. It will, in our opinion, then be best to incorporate under the head of "Materials" the standard specification heretofore adopted, so that when finally completed it can be issued to the members at the joint work of the two committees.

Even then we shall consider it only as representing for the present time the average standard of good American boiler practice, and to bespeak for our work the advantage of additional amendments so that it may keep pace with all improvements tested and finally adopted in the best American boiler shops. Committee: E. D. Meier, Henry J. Hartley, George N. Riley, James Tappan, D. Connelly.

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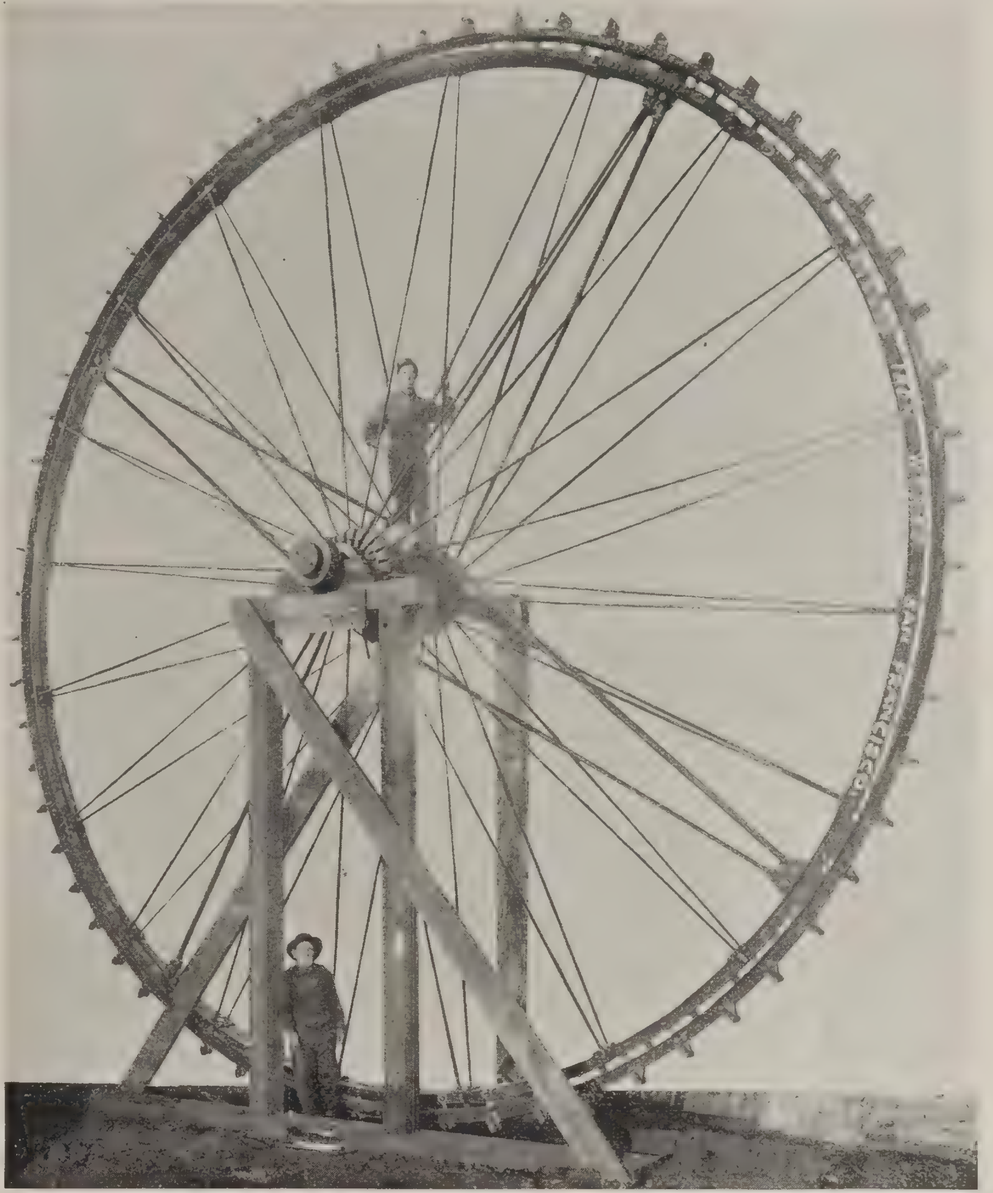
IMPULSE WATER-WHEELS OF LARGE DIAMETER.

In our issue of Dec. 10, 1895, we illustrated an impulse water-wheel for driving an air compressor at the North Star Mine, Grass Valley, Cal. The wheel was 18 ft. 6 ins. diameter, and was designed by Mr. E. S. Cobb, of San Francisco. Mr. Cobb has patented this design of wheel, and the accompanying cut shows one of still larger size (30 ft. diameter) made from his designs by the Risdon Iron & Locomotive Works, of San Francisco. It will be seen that the spokes of the wheel are all in tension, and that tangent as well as radial spokes are used. The wheel weighs about 15,000 lbs. It is entirely of steel, with the exception of the hub, and was built in four sections for convenience of shipment. It runs at the rate of 65 revolutions per minute, operating under a head of 775 ft. water pressure, and develops 330-HP. when driven by one nozzle, or 1,000-HP. with three nozzles, all of 1¾ ins. diameter. The power is used to drive a duplex, single-acting, compound air-compressor.

The buckets on the wheel are of a pattern covered by a patent issued to the Risdon Works, March 1, 1898. They are finished on the inside and polished to a smooth surface.



30-FT. DIAMETER IMPULSE WATER-WHEEL FOR A HEAD OF 775 FT.

Designed and Patented by E. S. Cobb, San Francisco, Cal.; Built by the Risdon Iron & Locomotive Works, San Francisco.

◆

THE MACHINERY OF STEAM VESSELS ON THE GREAT LAKES.

A summary of the machinery of 1,300 steam vessels engaged in traffic on the Great Lakes has been prepared under the direction of Mr. Walter Miller, of Cleveland, Ohio. The substance of the information obtained is contained in a paper read by Mr. John H. Coffin before the Engineers' Club, of Cleveland. Referring to the survey of the 1,300 vessels in which work he assisted, Mr. Coffin said:

> There are 1,150 screw propellers and a trifle over 50 paddle, or side wheel, propellers; the balance being schooners or tow barges, which are equipped with boilers and steam pumps, or hoisting or steering machinery. Of those fitted with screw propellers, 960 have solid cast wheels, 6 of them being of bronze, 8 of steel and 946 of cast iron; 185 have sectional wheels, one of them being bronze, 6 steel and 178 cast iron. Of the entire number, 1,060 of these propeller wheels are fitted on the tail shafts with straight bore and key, while only 74 are fitted on a taper end with feather and nut, the latter arrangement being more modern practice and considered by most engineers to-day to be the preferable way of fitting propellers on the shafts. Of the paddle wheels, 23 are fitted with feathered floats and 29 have solid floats.
>
> The lack of uniformity of proportion of parts of these machines is surprising. There seems to have been no hard and fast rules for the construction of engines on the lakes, and each builder has followed his own ideas. In the item of crank-shafts, about 400 are of the solid forged type, 17 of these being of steel and 383 of wrought iron; 780 are built-up shafts, of which 23 are of interchangeable sections, 13 of them being of steel and the balance of wrought iron. Of the total number, 354 are light in section, according to Lloyd's rules for determining the size of crank-shafts. 106 cases were also found where the intermediate shafts are light of section, and 387 cases where the propeller shafts are light by these same rules; and 48 cases where the shaft couplings are reinforced, either or account of breakages or because of developed weakness. There are 296 cases where the thrust bearings are insufficient to properly relieve the crank-shaft from fore and aft strains. A perhaps more serious defect, from the insurer's standpoint, exists in the light cross-head connections, there being 446 cases where cross-head keys are too light and 54 cases where the nuts fastening piston rods in cross-heads are small. A point which seems to have been very sparingly covered by authorities on engine design, and yet which seems one of vital importance, is the bolting of cylinders to columns, of columns to bed-plates, and of bed-plates to seatings in marine engines. The strain to which each of these parts is subjected being a direct strain, the necessary strength of these parts is easily found by computation based on the steam pressure and the size of the cylinders. In these parts 340 cases were found where the cylinders are too lightly fastened to the columns, 68 cases where the columns are insufficiently secured to bed plates, and 64 cases where the bed plates are not sufficiently bolted to their seatings.
>
> The marine fire-box boiler is the most common type, though it has lost its prestige, the Scotch boiler having rapidly displaced it; 731 boilers of this type are in use to-day. The marine water-tube boiler is of more recent date, only one having been built earlier than 1880. There are none of this type now on the lakes built between 1880 and 1890, but there are 35 vessels, built since 1890, equipped with this type of boiler, and there are several vessels now under construction which are to be equipped with this type of boiler. It is also interesting to note the gradual increase in pressures in boilers built during these several periods, as shown in the accompanying table.
>
> 295 boilers were found having patches inside and 264 having patches on the outside; 82 boilers are poorly fastened to the hulls of the vessels; 139 boilers are without stop-valves between them and the throttle-valves; there are 191 cases where the slip joints in the main steam pipes are not protected with safety guard bolts; there are 134 cases, where there are no cocks between the feed check valves and the boilers; and there are 165 cases where the feed check valves are only common pipe checks.

Table Showing Types of Engines and Boilers Built for Lake Vessels During Ten-Year Periods Since 1860; Also the Steam Pressures Employed.

	1860 to '69.	1870 to '79.	1880 to '89.	1890 to '98.
Engines:				
High-pressure non-condensing.	40	93	185	93
" condensing ...	6	10	5	4
Steeple compound.	22	62	89	39
F. & A. compound..........	5	12	154	99
Triple expansion	..	..	67	147
Quadruple expansion	..	..	1	6
Walking beams	8	10	8	7
Inclined and horizontal	1	2	7	9
Boilers: Firebox	18	97	392	224
Scotch	1	8	193	348
Water-tube	..	1	..	35
Pressures: Below 50 lbs.	5	3	2	3
Between 50 and 75 lbs......	4	19	23	10
" 75 " 100 "......	5	59	122	29
" 100 " 125 "......	1	25	318	173
" 125 " 150 "......	..	3	52	184
" 150 " 175 "......	..	1	70	161
" 175 " 200 "......	..	..	..	19
" 200 " 225 "......	..	1	1	12
225 lbs.	..	..	..	2
250 "	..	..	..	12
265 "	..	..	..	2
300 "	..	..	..	1

PROGRESS ON THE WATER PURIFICATION PLANT AT ALBANY, N. Y.

(With full-page plate.)

One of the most interesting pieces of engineering construction now in progress is the water purification plant at Albany, N. Y. The plans for this work were shown in our issue of Feb. 10, 1898, just before bids were received for its construction. The contract was let to T. Henry Dumary, and the Wilson & Baillie Manufacturing Co., of Brooklyn, N. Y., and the work is now at a very interesting stage. The purification plant includes a low-lift pumping-station, drawing water from the Hudson River, a 16,000,000-gallon sedimentation basin, eight covered filter beds, each 0.7 acre in area, with a combined daily capacity of 15,000,000 gallons, and a 600,000-gallon covered pure water basin. The bottom of the sedimentation basin is composed of 16 ins. of puddle, covered with 6 ins. of concrete; the slopes have first a covering of 16 ins. of puddle, then 2 ft. of broken stone, on which is 10 ins. of stone paving. The floors and roofs of the filter beds and clear water basin are of concrete; the walls of the filter compartments are lined with brick and the piers of the compartment are of the same material.

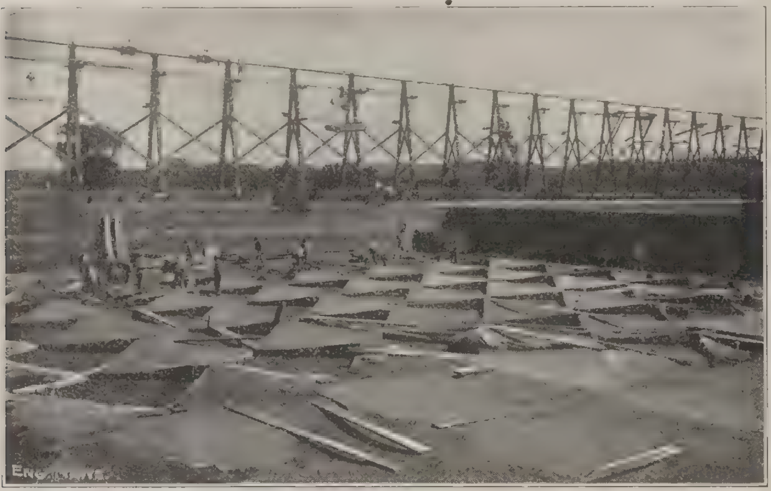


FIG. 5.—CONSTRUCTING THE INVERTED ARCHES FOR THE FLOOR OF THE FILTER BEDS.

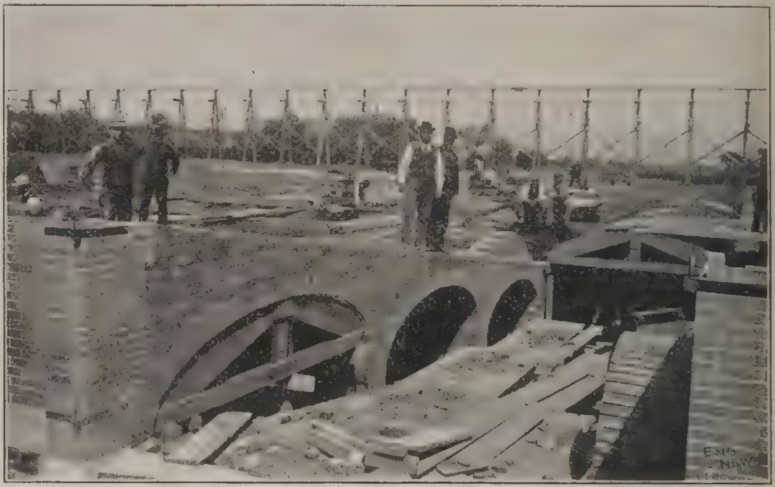


FIG. 6.—INCLINED ENTRANCE TO FILTER BEDS.

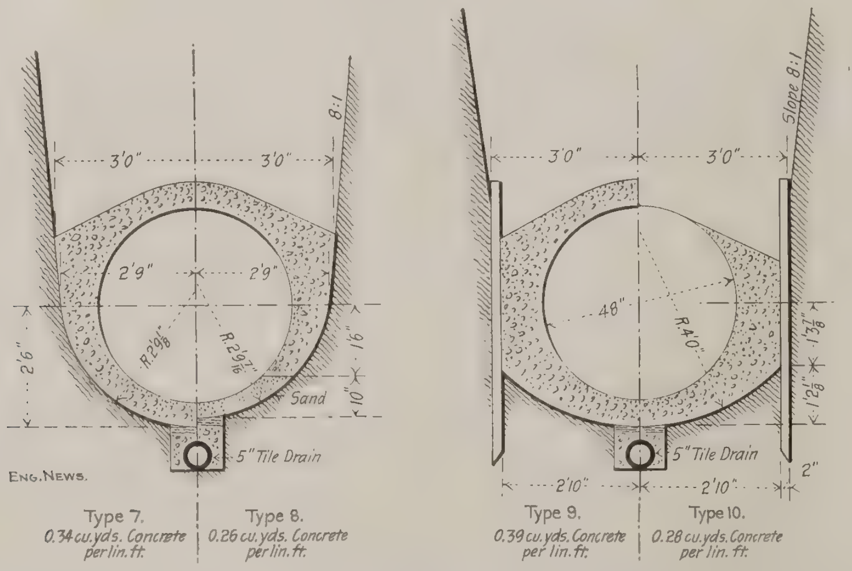


FIG. 7.—TYPICAL SECTIONS OF CONCRETE BACKING FOR 48-IN. STEEL PIPE.

In moving the large quantities of concrete, brick, stone, pipe and other material required for the plant, the contractors are using a "Sherman Aerial Hoisting, Carrying and Distributing Apparatus." This apparatus, as used on a much smaller scale, was illustrated and described in Engineering News of May 18, 1893. It was invented by Mr. W. D. Sherman. The present plant consists of four cableways, each of 730 ft. span, attached to cars running on trestles about 1,000 ft. in length, extending the length of each of the longer sides of the site of the plant. This apparatus hoists the material, moves it in a horizontal plane, both longitudinally and transversely, and lowers it at any desired point in an area 900 × 700 ft. A general view of one end of the plant is shown by Fig. 1, on the inset sheet. There is an engine for each cableway, as shown in the view, Fig. 2. The attendant of each engine controls the operations of the corresponding cableways from his station, in accordance with signals given him. Figs. 3 and 4 show the hoisting and transferring apparatus in more detail, as well as other parts of the contractor's plant. The trestles and cableways are also shown in the backgrounds of Figs. 5 and 6, in the text, and by the section, Fig. 10.

The purification works are very well located for receiving material, having the river on one side, canals on two other sides, and the railway not far distant.

The sand and gravel used for concrete is dredged from the river about two miles above the work, brought down in barges and dumped in the river, alongside a dock. From the river bottom it is again dredged up and is deposited in a pile on the dock, as shown in Fig. 1. From this pile the sand and gravel are automatically loaded on conveyors, by which they are hoisted and dumped into the screen, shown in Fig. 3. Here it is washed and separated into sand, gravel and tailings, the latter being gravel above the regulation size. The tailings are passed through a crusher and added to the gravel.

The concrete is composed of approximately 1 part of cement, 3 parts sand, and 5 parts gravel, but the proportions are changed slightly as occasion demands. The cement is paid for separately, so the city may vary the richness of the concrete at pleasure. All the cement is tested in a Fairbanks machine, a sample being taken for each ten barrels, from which twelve briquettes are made. Atlas cement is used, and it is expected that about 30,000 bbls. will be required.

The sand and gravel are elevated to an upper hopper, where cement is added, and all goes to a cubical mixer, where it is turned five times dry and five times wet. There are two mixers, each with a capacity of about 1½ yds. per charge, or 200 yds. per day. From the mixers the concrete goes onto skips of ⅔-yd. capacity. The concrete mixing plants are shown in the views, Figs. 3 and 4, the cubical mixers being enclosed so they are not visible.

The cross-tracks shown in Fig. 4 are used to convey the concrete and other material along the line of the trestle to the cableways, thus saving some of the time required for moving the cableways to position for picking up material.

The steam for power is furnished by a battery of four boilers. There are ten or eleven engines in use.

The filtered water is to be delivered to the present main pumping plant, further down the river, through a 48-in. riveted steel conduit, 8,000 ft. long, encased in concrete. The pipe is made from 5-16-in. plates and has in and out joints. For a distance of 5,000 ft. the conduit is located in the bed of the Erie Canal, and for a distance of 2,200 ft. its bottom is at an average depth of 22 ft. and a maximum depth of 25 ft. below the surface of the ground. To overcome the tendency of the canal section to float, and to withstand the external pressure on the other section, the whole length of the conduit is encased in concrete. The cross-sections of concrete used for the greater part of this casing are shown by Fig. 7, types 7 and 9. A portion of the conduit 168 ft. long, beneath railway tracks, was built in a tunnel about 6 ft. wide and 7 ft. high. The concrete filling about the pipe in the tunnel was conveyed by means of a small car, running on the top of the pipe. A sketch of the car is shown by Fig. 8. Fig. 9 is a section of the tunnel, the dotted lines indicating the position of the car. The car was designed by Mr. Hilt, of Hilt, Johnson, Fitzgerald & Mulderry, contractors for the steel conduit. Nearly all the work on the conduit was done in winter. The excavation contained considerable running sand. The pipe, in excavation, was suspended in slings until the concrete was placed beneath it. It was found that concrete made with broken stone did not pack well beneath the pipe, but with gravel instead of stone, and a curved rammer, no trouble was experienced.

When a representative of the editorial staff of this journal visited the work on Oct. 5 the puddling and concreting of the floor of the sedimentation basin were about half done and stone for the slope paving was being received; four of the eight filter beds were well on towards completion, and the foundation walls for the clear water basin were in. It is expected that the four filter beds now so far advanced and the clear water basin will be put in use before Jan. 1, but that work on the other beds and the sedimentation chamber will be suspended as soon as cold weather sets in.

Mr. Allen Hazen, Assoc. M. Am. Soc. C. E., is

Chief Engineer for the plant, and Mr. Wm. B. Fuller, M. Am. Soc. C. E., is Resident Engineer. We are indebted to these gentlemen, and to the contractors, for the information here given.

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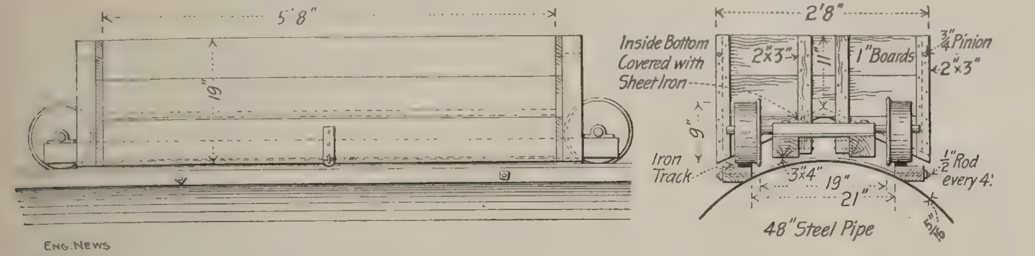
THE COAST SIGNAL SERVICE DURING THE WAR.

In a remarkably short time after the outbreak of the war with Spain there was established a thorough system of communication along the whole coast line of the United States, between the inner line of naval defence and the outer army line of coast defence. The establishment of this system in so short a time called forth the unstinted praise of the European military authorities, and the report of Captain John R. Bartlett, U. S. N., Chief of the Navy Intelligence Bureau, indicates how these results were secured.



Side Elevation.

End Elevation.

FIG. 8.—CAR USED IN DEPOSITING CONCRETE AROUND THE 48-IN. STEEL PIPE IN TUNNEL.

Captain Caspar F. Goodrich, U. S. N., then President of the Naval War College, began work upon the plans on March 15, 1898, and in less than one month he announced that he was ready to put them into operation. He was not permitted to incur the expense, however, until the Spanish fleet was well on its way to Cuba and attacks by Spanish vessels upon the Atlantic seaboard seemed probable. On April 22, permission having been granted, he sent the following telegram to the commanders of the naval militia, from Massachusetts to Louisiana:—

> Establish and man coast signal stations already determined by me. Lowest bids, greatest economy, most speed necessary. Let crews sign temporary agreement pending receipt of enlistment forms. No heliographs needed. Send further communication to Superintendent, New York.

On April 23 Captain Goodrich was ordered to sea on the "St. Louis," and Captain Kane took his place, until May 9, when Captain John R. Bartlett, then Chief Intelligence Officer, was placed in charge, and to him belongs the credit of building up the system. Within twenty-four hours after the receipt of the above telegram the men had reported at their stations, and in a week they were fully established and equipped with apparatus ordered in accordance with the instructions of Captain Goodrich.

The preliminary organization covered eight districts and 36 signal stations, officered and manned from the State Naval Militia, with 18 officers and 210 men in all. The station equipment consisted of the international code flags and books, "wigwag" flags, "shapes" (cones and drums), powerful telescopes and binoculars, torches and an improvised Ardois system of red and white lights. At each station quarters were built for the crew, and a 90-foot mast, with a 40-foot yard, was erected; in some cases signal towers were built. There was also a telegraph or telephone outfit, or both, which connected with the Life Saving Service lines along the beach. The station crew included one chief quartermaster, three second-class quartermasters and one landsman. These men were divided into watches and armed with Springfield rifles; there was a daily and weekly routine of exercise and drill, and notes of this were entered into the log. Once in every two weeks each station was inspected by an officer, who reported to headquarters.

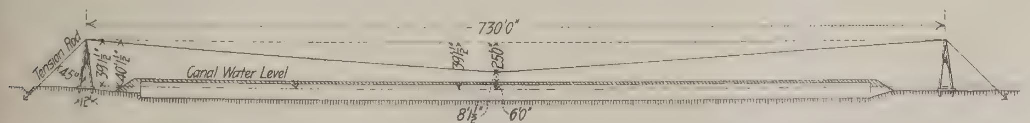


FIG. 10.—SECTION OF HOISTING AND DISTRIBUTING APPARATUS.

The services of these 210 men were efficiently supplemented by the watchful crews of the life-saving stations, including 1,443 men, and the 850 light-keepers along the coast. Including 33 observers of the Weather Bureau there was thus an aggregate of 2,536 men on the lookout for the approach of suspicious vessels. Tests of wires were made at the beginning of each watch, and a daily telegram was sent from each station to the district headquarters. By arrangement with the telegraph companies the Coast Signal Service had the right of way over the wires by simply notifying the company in advance. Arrangements were also made at each district headquarters to send notice of the presence of an enemy to the auxiliary naval force and the principal forts and batteries in the district.

Captain Bartlett says that from the practical operation of the Coast Signal Service for three months he is confident that it would have well served the use for which it was established—to observe and report the approach of an enemy's vessel or fleet. It was frequently of use in keeping the Navy Department advised of the movements of its own vessels, and was particularly serviceable in the case of the battleship "Oregon." It also kept the several navy yards advised in advance of the approach of vessels, and enabled them to make preparations for their reception. The most valuable result, however, was the determination of points where signal stations are necessary, in time of war, to supplement the systems of Life-Saving, Lighthouse and Weather establishments. Captain Bartlett recommends a permanent service of this nature, as being in fact an integral part of a naval coast-defence system. Each life-saving station should be made a coast signal station, and the crews should be drilled in the "wigwag" code and naval night signals. The same should be done for lighthouses and certain of the stations of the Weather Bureau. Permanent Coast Signal Stations should be established at designated important points, and equipped with three-armed semaphores and an acetylene gas "Ardois" system for night work.

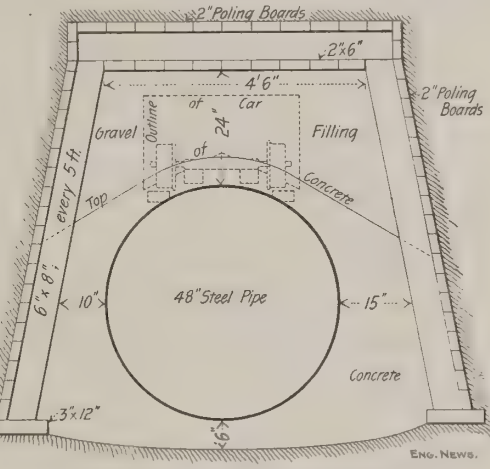


Fig. 9.—Section of Tunnel Showing Position of Car.

THE WESTERN UNION TELEGRAPH CO. reports for the year ending June 30, 1898, total gross earnings of $23,915,732, an increase over 1897 of $1,276,873, and net earnings of $6,090,151, an increase of $357,848. During the year the company sent 62,173,749 messages, against 58,151,684 in 1897. This total has only been twice exceeded—in 1893 with 66,591,858 messages, and in 1892 with 62,387,278 messages. The present mileage of wire is given at 874,420, against 841,002 miles in 1897; there are 22,210 telegraph offices, an increase of 441. The average toll per message is 30.1 cts., against 30.5 cts. in 1897 and 30.9 cts. in 1896. The cost per message is rising, however; this was 24 cts. in 1896, 24.3 cts. in 1897, and was 24.7 cts. last year. In this case the decrease in average tolls and increase in sending cost is ascribed to the large number of Government and press messages sent during the war with Spain.

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GERMAN ADVANCED TECHNICAL EDUCATION in Saxony is commented upon by U. S. Consul Monaghan, of Chemnitz. He says that with a population of 3,783,014 Saxony has 1,953 of these schools attended by 75,358 boys and 1,699 girls. There are besides these 39 higher industrial schools, with 10,660 scholars; 112 industrial technical schools, with 10,119 scholars; 44 commercial schools, with 4,781 scholars; 11 agricultural schools, with 691 scholars, and 18 technical schools for girls, with 2,445 scholars. Compulsory education is established for graduates of common schools, and the hours of attendance are early in the morning or a certain number of afternoons in each week. Boys make a special study of the trades in which they are occupied.

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THE PEOPLE'S TELEPHONE CO., of New York, has been incorporated and the following officers have been elected: Darwin R. James, President; E. S. A. de Luna, Vice-President; Silas B. Dutcher, Treasurer; Frank S. Gardner, Secretary. This new corporation originated with some influential members of the New York Board of Trade who have been working to reduce telephone rates for some years past. The company promises to give its subscribers unlimited service in Manhattan for $100 per year, as compared with $240, the present charge, with free use of public pay stations for 100 calls per year for each subscriber. The message service will be cut from $90 for 600 messages to $40 for 400 messages; for a larger number of messages the rate will go as low as 4 cts. per message. The residence rate for service on private wires will be $30, and $1 per month on group lines. In Brooklyn the unlimited service for business places will be $75 per year instead of $150 as now charged. The new corporation says that its appliances and system are tested in over 2,000 independent exchanges now in operation in the United States, and all its instruments will contain the newest devices in receiver, transmitter and switchboard, with metallic circuits throughout the system.

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THE MANHATTAN STEAMSHIP CO., which now maintains a weekly service to Rockland, Camden, Belfast, Bucksport and Bangor, Me., and to Eastport and St. John, has secured four large lake steamers for this Atlantic service. Counting the fleet lately acquired by the Atlantic Transportation Co. for a similar service, 55 lake vessels, of from 1,400 to 2,500 tons capacity, have been purchased from the lake fleets to trade between Atlantic ports. The causes of this movement is the scarcity of available steamers on the Atlantic and the trade rivalry in barge traffic. The Atlantic Transportation Co. says that it was forced to secure lake vessels by the antagonism of other coal lightering companies, which advanced rates when this company needed more vessels than it owned in the conduct of its own business. The effect of the new method of coal transportation will eventually be to break up the single trip chartering business for coal and enable coal shippers to know exactly what rate they will be called upon to pay for transportation. They can thus quote prices "alongside" instead of "f. o. b.," as at present.

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A NEW YORK COMMERCE COMMISSION, appointed by Governor Black, is now investigating the existing dock system in this city. This commission is made up as follows: Ex-Mayor C. A. Schieren, of Brooklyn; Andrew H. Green, Alex. Smith, Hugh Kelly and C. C. Shayne. At the first meeting on Oct. 18, Mr. George S. Greene, Jr., for many years Chief Engineer of the old Dock Board, said that it was the policy of the Dock Department to gradually acquire the entire water front and to improve or lease it. This department had an income of $2,000,000 per year, and in a couple of years this will be increased by from $300,000 to $500,000. Of this sum only about one-fourth is paid by steamship companies for use of the city water front. As a general thing rentals of private dock property are higher than the rentals charged by the city. The lessees of private docks are nearly all domestic companies not engaged in foreign trade. Mr. Greene did not believe in free docks, as offered in other cities; these free docks were usually owned by railway companies who thus sought to attract trade for their railway lines and in this way really obtain a rental. The advantages of Staten Island for commercial purposes were urged by Erastus Wiman; and Mr. Charles Stoughton advocated a deep waterway in the Harlem River, to cost $1,750,000.

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THE SUBSIDIES TO THE FRENCH LINE of steamers, the Compagnie Generale Transatlantique, were originally granted in 1857. The government was to pay annually to the company the sum of $1,794,900, of which sum $579,000 was applied solely to the steamers running between Havre and New York. This was an average subsidy of $10.77 per nautical league on the New York line; with a minimum speed exacted of 11½ knots and 26 trips per annum. In 1873 the amount of the New York subsidy was increased to $703,292; but the trips were increased to 40 per year, or $8.50 per nautical league. In 1886 this franchise was renewed for 15 years; but sailings were made weekly and a minimum speed of 15 knots was exacted. To encourage the building of larger and faster steamers a bounty of $2.32 per gross ton was allowed for every tenth of a knot of speed in excess of 15. This speed bounty, however, was not to exceed $231,600, and this amount has been paid since 1892. The subsidy was also raised to $1,057.640 per annum, and with speed bounty added this is equivalent to $11.66 for every nautical league steamed. The Steamship Company is now building three new mail steamers which are to have a minimum speed of 22 knots under forced draft. The fleet of the Compagnie Generale Transatlantique numbers 63 ships of a gross tonnage of 166,797, developing 169,850 I. HP. The assets of the company amount to $28,273,314, in steamers, real estate, supplies, outstanding accounts and cash. The capital stock is 80,000 shares of 500 francs each, on which they paid in 1897 15 francs dividend, or about 3%; there are also $18,231,448 in 3% bonds, with some minor securities. The legal reserve and insurance fund is $1,944,197; the net earnings for 1897 amounted to $238,769.36. The total receipts of all kinds in 1897, including bounties and subsidies, was $8.879,538, and the total expenses were $7,647,784, leaving an excess of receipts of $1,231.754. The gross receipts decreased $487,442 in 1897, but the expenses were also decreased by $359,769. During 1897 the ships of the company made 681,342 marine leagues; and the Havre-New York line made an average speed of 16.72 knots, as compared with an average of 13.13 knots for the line to the Antilles. The foregoing statement is condensed from a more detailed one made by U. S. Consul A. M. Thackara, of Havre, and contained in the "Consular Reports" for October, 1898.

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A WIRE-MEASURING WHEEL, for finding the length of wire used in obtaining the depth of a shaft, has been devised by Mr. O. Brathuhn, and is described in the "Berg und Hüttenmannische Zeitung," 1898, p. 155. The brass wheel used had a diameter of 35 ins. and was 0.3-in. thick, with a rounded groove in the rim for the wire. The circumference of the wheel was divided into 100 divisions; and by the aid of a pointer and vernier a 1-10,000th part could be read. To the axle of the wheel was attached a counter registering complete revolutions; and a small spirit-level on the cast bed-plate of the wheel enabled the plane of the wheel to be kept vertical. In this plane was a ratchet winch for lowering or raising the wire passing over the wheel. Before measuring, the wire was weighted and hung over the wheel into the shaft for several hours, until it was fully stretched. By means of a level at the shaft-bottom a fixed point on the bottom of the wire was then marked by tying on a piece of thread; and another level at the top was adjusted to sight the wire. With the counter at zero the position of the pointer is read and the wire is carefully hauled up. When the top level strikes the thread-mark the wheel is clamped and the number of revolutions noted. The difference between the first and final reading, multiplied by the value of one revolution, is the required depth. The apparatus is sufficiently accurate and costs about $75.

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BOOK REVIEWS.

INSPECTION OF THE MATERIALS AND WORKMANSHIP EMPLOYED IN CONSTRUCTION. A reference book for the use of inspectors, superintendents and others engaged in constructing public and private works. Containing a collection of memoranda pertaining to the duty of inspectors, quality and defects of materials; requisites for good construction; methods of slighting work, etc. By Austin T. Byrne, C. E., author of "Highway Construction." New York: John Wiley & Sons. Cloth, 7 × 4¼ ins.; pp. 540. $3.00.

This is a new and useful handbook compiled from recent but very widely scattered materials, and Mr. Byrne has performed an excellent work in here bringing together in compact and accessible form a large amount of information necessary for the successful performance of the varied duties connected with the inspection of materials and workmanship. Structural materials are first very clearly described and classified; with the requisites of good materials, tests for fitness and methods of detecting qualities that make them unfit for use in public works. This list includes stone, brick, cement, timber, metals and miscellaneous materials. Fastenings of all kinds come next, covering nails, screws, pins, bolts and nuts, rivets and rivet inspection. Under the general head of construction we have earthwork in all its forms, foundations, masonry and stone-cutting, mortars, carpentry, iron and steel work, plumbing, roofing, plastering, glazing and painting. Water supply, sewerage and paving are discussed under separate chapter heads. Without entering into detail, it is sufficient to say that under each of these many heads the author briefly, but clearly, indicates to the inspector the quality of material and workmanship required in general good practice, and he also points out the methods by which certain kinds of work are scamped. An excellent feature of the work is the introduction of nearly every chapter by a definition of the use and a description of the tools employed in that special class of work; and this feature is supplemented by an appendix covering the definitions of terms used in general construction. As this book is essentially a handbook for inspectors, the chapters on water-supply, sewerage and paving, deal only with the qualities of the materials employed and the methods of placing them in the work; but throughout the whole book hints and suggestions abound that are quite as useful to the practicing engineer. In fact, it is difficult to find a book of similar bulk that contains more generally useful engineering information upon detail matters occurring in practice. It is supplemented by a number of tables of common use, such as weights and measures, specific gravity and weight of materials, mensuration tables, trigonometrical functions, etc. From the long list of authorities consulted, given in the end of the handbook, it is evident that Mr. Byrne has put patient and intelligent work into its compilation; and this and the contents of the book itself warrant him in the assertion that it is up to date and embodies the latest available practice in construction and inspection.

THE INDICATOR HANDBOOK.—A Practical Manual for Engineers. By Charles N. Pickworth. Part I. The Indicator, Its Construction and Application. Manchester: Emmott & Co, Ltd.; New York: D. Van Nostrand Co. Cloth, 12mo.; pp. 130. $1.50.

This is an English book, but much of its contents are from American sources, such as the descriptions of instruments made in this country and abstracts of discussions of errors due to long pipe connections, inaccurate reducing motion, etc., which have appeared in our technical press. The book is one of the best that we have seen on the subject. It contains good descriptions of all the standard forms of indicators, including the most recent improvements, and of a great variety of indicator rigs. There is a good chapter on errors of indicators, and another on errors of reducing motions. The book might be improved by expanding the brief account of the method of testing springs, showing the use of a steam gage tester for checking the readings of a gage when it is used for testing indicators. The illustrations have the muddy appearance which is common in English text books.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE. Vol. 53, No. 1, 1898. Edited by Bennett H. Brough, Secretary. London: E. & F. N. Spon, New York: Spon & Chamberlain. 8vo.; cloth; pp. 606.

This volume contains the proceedings of the London meeting of the Institute, in May, 1898, an extended obituary notice of Sir Henry Bessemer, which includes a reprint of his famous paper read at the Cheltenham meeting of the British Association for the Advancement of Science, Aug. 13, 1856, "On the Manufacture of Iron and Steel Without Fuel," and the usual Notes on the Progress of the Home and Foreign Iron and Steel Industries.

The titles of the papers read at the London meeting are: "On the Use of Blast-furnace Gas for Motive Power," by A. Greiner; "On Coking in By-product Ovens," by J. H. Darby; "On the Relative Merits of Limestone and Lime in Blast-furnace Practice," by C. Cochrane; "On Steel Permanent Way," by R. Price-Williams; "On the Iron Ore Deposits of the Ural," by H. Bauerman; "On the Crystalline Structure of Iron and Steel," by J. E. Stead; "On Allotropic Iron and Carbon," by E. H. Saniter; "On Brittleness in Soft Steel," by C. H. Risdale; "On the Solution Theory of Iron and Steel," by Bacon H. Juptner.

THERMODYNAMICS OF THE STEAM ENGINE AND OTHER HEAT ENGINES. By Cecil H. Peabody, Professor of Marine Engineering and Naval Architecture, Massachusetts Institute of Technology. Fourth edition. Rewritten and reset. New York. John Wiley & Sons. London: Chapman & Hall, Ltd. 8vo.; cloth, pp. 522; $5.

The first edition of this work was published in 1889. It is one of the best American treatises on thermodynamics and is largely used as a text book in engineering schools and as a reference book by engineers. The present edition contains much matter not in the earlier editions, and much of the text of the earlier editions has been changed in revision. More space than before is given to the subject of gas engines. The first seven chapters, covering about one-third of the work, are devoted to mathematical treatment of the principles of thermodynamics, including gases and vapors. The remainder of the book treats of flow of fluids, injectors, hot-air and gas engines, the steam engine, compressed air and refrigerating machines. Over 200 pages are devoted to the subject of the steam engine, and much of the matter given under this head is of a practical nature, outside of what is usually included in works on thermodynamics, such as economy of actual engines, cylinder condensation, testing of engines and friction of engines. The value of a book on thermodynamics, to the practicing engineer, is enhanced by the amount of matter contained in it which is not thermodynamics, and this work is well supplied with such matter. The information concerning economy of engines is brought down to the latest dates. We notice particularly a discussion of the Diesel oil motor, the latest of the petroleum engines. We would suggest that the theoretical part of the book might be improved for use as a reference book by adding a page or two giving in brief form the meaning of all the symbols used in the formulae.

THE COFFER-DAM PROCESS FOR PIERS.—Practical Examples from Actual Work. By Charles Evan Fowler, M. Am. Soc. E., Bridge Engineer. John Wiley & Sons, New York. Cloth, 6 × 9 ins.; pp. 159; illustrated; $2.50.

This is the first time we have seen this subject separately treated, and Mr. Fowler imparts much useful information in the actual examples of work done here described and well illustrated. Commencing with the history of early bridge foundations, he describes many varieties of coffer-dams and caissons as found in comparatively late engineering practice. In each case the methods followed and results obtained are briefly but clearly given. The several chapters cover timber and sheet pile construction, metal construction, the pumping and dredging plant, and separate chapters upon the character of the foundation soil, the use of concrete and the general location and design of piers. An interesting table notes 44 coffer-dams, used on generally important works, and gives the conditions of current, head of water, character of bottom and general dimensions and thickness of puddle. As Mr. Fowler says in his introduction, he takes the great part of his examples from current engineering literature but he does a good work in thus bringing them together in one book.

TUNNELING SHIELDS. (Emploi du Bouclier dans la Construction des Souterrains.)—By Raynald Legouez, Ingenieur des Ponts et Chausses. Paris: Beaudry & Co. Cloth; 8vo.; pp. 440; illustrations, 337. Price, 20 francs ($4).

This book is the first to bring together details of the various forms of shields used in tunnel excavation and of the works executed by means of these shields, although most of the shields and works have been described in the technical papers. The first design and use of the shield is attributed to Isambard Brunel ("a French engineer who emigrated to England"). To English engineers is given the credit for simplifying the design (even beyond reasonable limits), while to French engineers is given the credit for the use of oval shields and of substituting masonry for metallic lining behind the shields. American engineers are said to have followed on the English lines.

The first 14 chapters deal with individual shields and the works executed by them, commencing with Brunel's Thames Tunnel of 1825, and including the Mersey tunnel, the London and Glasgow underground railways; the Hudson, St. Clair and East River (gas) tunnels in the United States, and the Clinchy sewer tunnels near Paris. Many of these are dealt with in considerable detail, both as to the plant used and the progress of the work, while other tunnels are also mentioned. The next chapter discusses the design and construction of the shields, the dimensions, air pressure employed, safety appliances, etc. The tunnel lining is then taken up, and it is stated that Brunel in England and Beach in America (Broadway underground railway) employed a brick lining. In the Clichy tunnel, the shield was followed by a steel centering, upon which was built the brick lining, but for the extension of that tunnel under the city of Paris the shield itself formed the centering. The iron lining has the advantages of requiring a minimum of excavation outside the inner line of the finished tunnel, but it is very costly and involves an enormous weight of material. A lighter iron lining with an inner lining of masonry is not approved. The various operations connected with the progress of the work are described, and tables of cost are given.

The book is well printed and fully illustrated with line and half-tone engravings, but in many of the latter the figures are too small to be read conveniently, which is a defect very common to French engravings of this kind. For English and American works, dimensions and weights are given in metrical and duodecimal measures. The table of contents occupies about eight pages, but there is no index, which is a great defect in a book of this character, as we have several times pointed out.

REPORT OF THE CHIEF OF THE WEATHER BUREAU. U. S. Department of Agriculture. 1896-97.—Washington, D. C., 1897. Cloth; 11½ × 9 ins.; pp. 431; maps and other illustrations.

This report of Mr. Willis L. Moore, Chief of Bureau, under the head of administration, states that the cost of running the bureau, in 1896-97, was $883,772, as compared with $993,520 expended on the weather service in 1883. But the work now performed is largely in excess of that done in 1883. In the fiscal year reported upon, 4,315,000 weather maps were issued; 51,694 daily forecasts and warnings were forwarded by mail, telegraph and telephone; about 8,000 places reported climate and crop conditions; about 3,000 voluntary observers now make daily readings of U. S. Standard thermometers and rain-gages, and 253 stations on the Great Lakes displayed storm signals. The bulk of the report is devoted to the records of results for the year in tabular form, with explanatory text and maps graphically showing the year's record. The rainfall of the United States is very fully treated in a separate article by Mr. A. G. Henry, Chief of Division; and Mr. Park Morrill, Forecast Official, contributes a lengthy illustrated paper upon the floods of the Mississippi River and its main tributaries.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

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A HEAVY FREIGHT TRAIN was hauled from De Witt, near Syracuse, to West Albany, on the New York Central & Hudson River R. R., last week. The train consisted of 81 loaded grain cars, and its total weight was 3,478 tons. The total amount of grain was about 80,000 bushels. The distance hauled was 140 miles, which was made in 12 hours and 55 minutes. The train was hauled by locomotive No. 786, a Mogul, with 123,000 lbs. on the drivers, 20 × 28 cylinders and 57-in. driving wheels.

◆

A VERY HEAVY PASSENGER TRAFFIC was carried by the Chicago surface and elevated railways on the day of the Peace Jubilee parade, Oct. 19. The railways had made special rates for the week, and the city was crowded with visitors who came to see the President and the parade. As no surface cars were allowed within the limits of the parade from 9 a. m. to 3 p. m., all the traffic centered on the elevated loop. The trains ran at intervals of five to ten seconds, and took nearly 40 minutes to make the circuit, instead of the usual time of 14 minutes. The cars were packed to the gates, and policemen had to be stationed at the entrance to the stations, to keep the people from overcrowding the stairways and platforms. The street and elevated railways carried about 1½ million passengers, from which it is estimated that 700,000 people were carried to the scene of the parade and back again. The traffic was apportioned as follows:

West Chicago Street Ry.	450,000
Chicago City Ry.	440,000
North Chicago Street Ry	250,000
Other surface lines	30,000
Metropolitan Elevated Ry.	162,165
South Side Elevated Ry.	129,415
Lake St. Elevated Ry.	77,184
Total number of passengers	1,538,764

◆

CHEAP RAILWAY TRAVELING is to be made a specialty in Switzerland by means of tickets good for two weeks to twelve months, during which periods the holders can travel as much as they like on the entire railway system. The tickets are not transferable, and no baggage is carried free. They are available on the lake steamers, a second-class ticket being good for first-class accommodations on these steamers. The rates are as follows:

	Class		
	First.	Second.	Third.
15 days	$11.58	$8.11	$5.79
30 days	19.30	13.51	9.65
3 months	46.32	32.81	23.16
6 months	73.34	52.11	36.67
12 months	115.80	81.06	57.90

◆

GROOVED RAILS are proposed for Chicago's street railways, according to an ordinance recently introduced in the Council. In view of the condition of the streets. however, and the city's neglect to clean or repair them, the grooved rails would effect little or no improvement and would be of little benefit to the public. When the city undertakes to maintain its streets in good condition then it will be reasonable to consider the improvement of the railway tracks.

◆

CONTRACTS for the equipment of the Third Avenue (New York) conduit lines have been awarded. Electrical apparatus to the extent of $4,500,000, it is understood, will go to the Westinghouse Electric & Mfg. Co., Pittsburg, Pa. The underground construction, estimated at $1,500,000, will be done by the National Conduit & Cable Co.; 15,000 tons of 110-lb. rails fall to the lot of the Johnson Co., and the castings, such as yokes, handholes, etc., to the Pennsylvania Steel Co.

◆

THE EXTENSION OF CUBAN RAILWAYS, so as to provide a trunk line running the length of the island, is to be recommended by the Secretary of War, according to Washington items. He will also recommend that this work be undertaken by the government as a military necessity, and that Congress appropriate the funds necessary.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred on the Rock Island R. R., near Fort Worth, Tex., on Oct. 22. From newspaper reports it apppears that a freight train broke in two at the top of a steep grade and before the rear portion could be stopped it collided with the front section, wrecking several cars in one of which were 10 men stealing a ride. It is said that five were instantly killed and three mortally injured.

◆

A LOCOMOTIVE BOILER BLEW UP near Budsboro, Pa., on Oct. 17, killing four men. The engine which was drawing a freight train on the Wilmington & Northern R. R. had just taken water at Joanna and the explosion was a severe one, totally destroying the locomotive.

◆

AN EXPRESS TRAIN RAN 20 MILES with a dead engineer at the throttle on the Erie R. R. on Oct. 24. The train was drawn by a double-cab engine, and soon after leaving Binghamton it was noticed that the usual crossing signals were not given and that the train was running at an unusual speed. When the whistle was not blown for Susquehanna, 23 miles from Binghamton, the fireman went forward to the engineer's cab and found the engineer dead with his skull crushed. It is thought that he must have been struck by a swinging water crane just east of Binghamton.

◆

THE BURSTING OF SEVERAL BOILER TUBES on the torpedo-boat "Davis," which was undergoing an official trial at Astoria, Ore., on Oct. 20, scalded three men to death and injured four others so severely that they died later. It is understood that some derangement of the automatic water gage permitted the water to get low in the boiler. Although there were 40 men on board only those in the boiler room were killed. The "Davis" was one of two torpedo-boats recently built by Wolff & Zwicker, of Portland, Ore., for the United States Government.

◆

RECENT FLOODS IN JAPAN are reported to have caused great loss of life and to have done an immense amount of damage. A report received on Oct. 20, via Vancouver, B. C., states that in the valley of the Feng River 250 towns are under water and 2,000 persons were drowned; also that 1,000 persons suffered a like fate along the Ishikari River.

◆

THE NEW YORK CIVIL SERVICE COMMISSION gives notice that open competitive examinations will be held at its office on the dates given for the following positions: Nov. 14, Examiner to the Municipal Civil Service Commission; Nov. 15, Supervising Engineer. In the latter case candidates must have knowledge as to the construction, management and repairs of marine and stationary engines, and hold licenses for both; they must also have knowledge of the installation of steam heating, ventilation, boilers, plumbing and drainage. The candidate for Examiner will be examined in arithmetic, grammar and composition, general intelligence, special qualifications and experience.

◆

THE AWARDS OF PLANS FOR THE UNIVERSITY of California have been announced as the result of the preliminary competition. Out of about 100 sets of plans the following have been chosen to enter the final competition: Barboud Bauhain, Paris; E. Benard, Paris; F. Blunschli, Zurich; D. Dexpradelles and Stephen Codman, Boston; Rudolph Dick, Vienna; J. H. Freedlander, New York; Howard & Eichmuller, Paris; Howard & Cauldwell, New York; Howells, Stokes & Hornbostel, New York; Lord, Hewlett & Hull, New York; Whitney Warren, New York. Successful competitors in the preliminary competition will have six months in which to perfect their plans for the final competition, and a sum of at least $20,000 will be devoted to premiums for the best plans. These premiums will be awarded to at least five of the competitors.

◆

A NATIONAL PHYSICAL LABORATORY is proposed in England, and the committee appointed by the Treasury, in August of last year, has submitted its report. The committee, consisting of Lord Rayleigh (chairman), Sir Courtenay Boyle, Sir Andrew Noble, Sir John Wolfe Barry, W. C. Roberts-Austen, Robert Chalmers, Prof. A. W. Rucker, Alexander Siemens and Prof. T. E. Thorpe, was directed to consider and report upon the desirability of establishing a national physical laboratory for the testing and verification of instruments for physical investigation; for the construction and preservation of standards of measurements, and for the systematic determination of physical constants and numerical data useful for scientific and industrial purposes, and to report whether the work of such an institution, if established, could be associated with any testing or standardizing work already performed wholly or partly at the public cost.

This committee investigated the subject very thoroughly, visiting the various government physical laboratories of the Continent. As a result, the committee proposes that the Kew Observatory be enlarged by the addition of new buildings where the desired work can be conducted. It is further suggested that the institution be controlled by a governing board appointed by the Royal Society and by the principal commercial organizations.

◆

THE PARIS EXPOSITION MANAGEMENT has granted 26,000 sq. ft. additional space for American exhibitors, making the present total 203,000 sq. ft.

◆

THE EXTENSION OF THE PARCEL-POST SYSTEM in the United States is favored by the managers of the Philadelphia Commercial Museum. They contend that such an extension of privilege is necessary in the export trade to enable manufacturers to send samples to possible foreign buyers. Their competitors in England, Germany, France and Belgium can do this, and doubtless secure in this way considerable business. Objection is made that manufacturers would get into the habit of sending samples abroad and thus divert the trade from customary channels and build up a system of direct business which will not be satisfactory to either manufacturer or buyer, owing to a disarrangement of credits. The second objection is that the extension of the parcel-post might encourage the direct importation of European goods of small bulk, to the detriment of accredited importing agents, or of American manufacturers in similar lines. The Museum Managers think that as to the first objection, if the line of goods is of sufficient importance to warrant pushing in foreign markets, the manufacturer would arrange his own agencies. As to the second objection, they believe the danger is overestimated. It is always objectionable to deal out of established channels; and it is possible to make this parcel traffic subject to such tariff regulations as would prevent any great derangement of trade. Representative manufacturing firms believe that the extension of privilege in sending samples abroad would more than outweigh any damage from possible European competition.

◆

EXPORTS OF AMERICAN IRON TO GERMANY are exercising German trade papers. In 1895 Germany took raw iron and steel and manufactured goods and machinery to the value of about 4,500,000 marks; in 1897 these imports into Germany exceeded three times this amount. In 1895 the import of American machinery amounted to 2,761 tons, valued at 1,600,000 marks; in 1896, 5,213 tons, worth 3,000,000 marks; in 1897, 9,593 tons, worth 5,500,000 marks, and Germany has taken in the first seven months of 1898 12,570 tons of machinery from the United States.

◆

AMERICAN WATER PIPE IN GLASGOW is troubling Scotch makers of cast-iron pipe. The order for 1,000 tons of pipe has been given to R. D. Wood & Co., of Philadelphia, in the face of determined opposition. In the first letting the American firm offered to do the work for about $24,825, against $28,205 as the next lowest Scotch bid. The fact that the American pipe was 12 ft. long, instead of the 9 ft. usual in England, was made the grounds for a new letting. R. D. Wood & Co. reduced its bid about $366 and the Scotch firm reduced its offer $3,410; but the American bid was still the lowest, and it was then proposed to give the order to the home firm because it had a testing machine which could be used. Some members of the City Council objected to this unfairness, and an amendment was adopted giving the Scotch firm the small pipe. This offer was refused by the firm at the price named, and the American corporation received the whole contract. "Engineering" says that the Scotch makers have probably not heard the last of American pipe.

◆

THE KLONDIKE GOLD REGION has produced over $8,000,000 of gold this season, of which the Seattle assay office has taken about $4,400,000 and the San Francisco mint about $3,800,000. It is estimated that dust amounting to $500,000 was sent to Denver, Helena and Philadelphia.

◆

A NEW AND SHORTER CHANNEL FOR YUKON-bound vessels has been found by Mr. John F. Pratt, in charge of the U. S. Coast and Geodetic Expedition, working in these waters. The new channel saves 400 or 500 miles of distance, and will carry 8 ft. of water over the bar at low water, instead of 2 ft., as at the old Aphoon entrance. Vessels of moderate draft can now pass directly into the mouth of the Yukon and proceed over 400 miles up the river before transferring passengers and loads to smaller vessels.

THE LARGEST LOCOMOTIVE EVER BUILT.

The Union R. R. Co., of Pittsburg, Pa., has recently received from the Pittsburg Locomotive & Car Works some consolidation locomotives which, so far as we can find, are the heaviest and most powerful locomotives ever constructed. The weight on the drivers (208,000 lbs.) is greater than any locomotive of which we can find a record. The Mexican Central double-boiler locomotives designed by Mr. F. W. Johnstone, have 200,000 lbs. on two separate driving-wheel bases, and have the same total weight (230,000 lbs.) as the Union R. R. locomotive. The tank locomotives which run through the St. Clair tunnel, have 195,000 lbs. on ten driving wheels, and no truck wheels. The 12-wheel locomotives of the Great Northern Ry. (illustrated and described in our issue of April 17, 1898), have a total weight of 212,750 lbs., of which only 172,000 lbs. is on the driving wheels. The cylinders of this new locomotive are 23 × 32 ins., as compared with 21 × 34 ins. for the Great Northern locomotive, and its total boiler heating surface is 3,322 sq. ft., as compared with 3,280 sq. ft. for the Great Northern.

It will be seen, therefore, that this new locomotive not only has greater weight on its drivers than any other locomotive thus far built; but it exceeds also in cylinder power and in the steam producing capacity of its boiler, the huge machines of the Great Northern, which when they were built were generally agreed to be, on the whole, the most powerful locomotives ever constructed.

It is therefore entitled, until some new leviathan claims the precedence, to the distinction of being the largest locomotive in the world.

Our readers will of course be interested to know the class of work which these huge machines are to do. The Union R. R. Co., on which they are run, forms a part of the system operated in connection with the various works of the Carnegie Steel Co., and very heavy trains of iron ore, coke and mill and furnace products have to be moved over it. About four miles of this line has a grade of 70 ft. per mile, and one stretch of about 2,000 ft. from the yard at the Edgar Thomson works up across the main line of the Pennsylvania R. R., and reaching to the foot of the 70-ft. hill, has a grade of 2.4%. The road is laid with 80-lb. steel rails, and now extends from Munhall to North Bessemer, Pa., about 12 miles.

The accompanying half-tone view is reproduced from a photograph of one of these locomotives, and its great size is well shown by comparison with the small tank locomotive beside it. The principal characteristics of its design are, perhaps, best expressed in the remarks of Mr. D. A. Wightman, General Manager of the Pittsburg Locomotive Works, to whose courtesy we are indebted for the photograph from which our illustration is prepared, that the engine is "big all over." In other words, its great weight has been obtained by making all details of generous size and putting on metal liberally where it will do its part in taking strains, and there has been no loading with cast iron merely for the sake of adding weight.

Great pains has been taken to take care of the enormous strains which are thrown on the cylinder castings at the front end. The cylinder castings are of the half-saddle type, with unusual thickness and great longitudinal depth. The frames are 4½ ins. wide cut from rolled steel slabs made by the Carnegie Steel Co., and weigh when finished, 17,160 lbs. per pair. At the front end a steel plate 1⅜ ins. thick, and of the same width as the bottom of the saddle extends across from frame to frame, and is securely bolted to the lower frames. The cylinders are fastened to this plate, as well as to the frame. Heavy bolts pass through the top frame bars in front of and behind the saddle and form additional transverse ties. The longitudinal strains usually transmitted to the cylinders through the frames are largely absorbed by the use of a casting extended from the bumper beam well up to the saddle, and securely bolted to the top and bottom front frames. This casting also acts as a guide for the bolster pin of the truck. This method of relieving cylinders of longitudinal stress was introduced by the Pittsburg Locomotive Works nearly two years ago, and has proven, in practical use on a large number of locomotives, to be of great value in reducing the breakage of saddle castings.

The locomotives are now in daily use, steaming well, are not extravagant in the use of fuel and water, and appear to have ample grate surface for the work required of them.

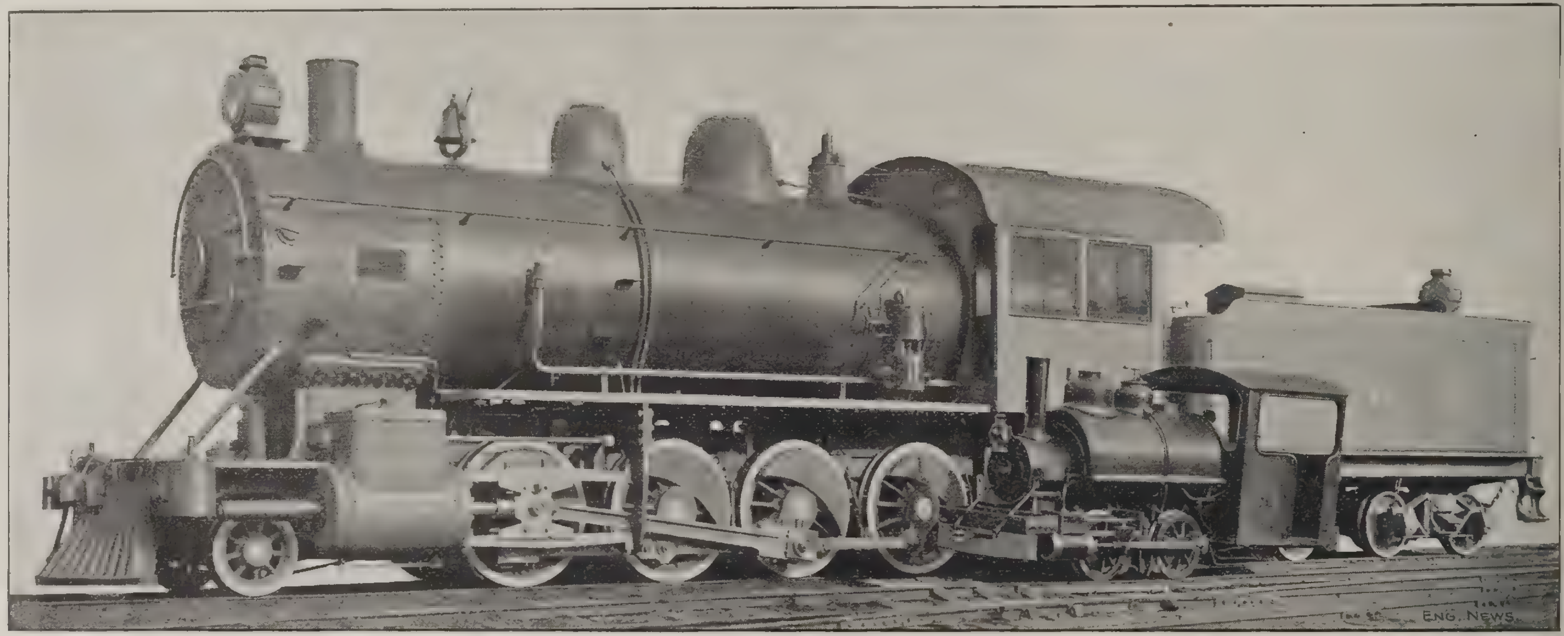
We give below in our standard form the principal dimensions of this locomotive. We would call especial attention to the fact that the load on each driving wheel reaches 26,000 lbs., which is a larger wheel load than has ever been adopted in any locomotive, so far as we are aware. The single driver passenger locomotive of the Philadelphia & Reading R. R. has 24,000 lbs. on each driver. It will also be noticed that the total driving wheel load of 104 tons is concentrated on a wheel base of 15 ft. 7 ins., giving an average load per foot of nearly 7 tons. The mere fact that such a locomotive as this is built and running is one which designers of railway bridge floors will do well to bear in mind in considering provision for future traffic requirements.

On another page of this issue we have noted the recent feat on the New York Central R. R. of hauling a train carrying 80,000 bushels of grain a distance of 140 miles with a single mogul locomotive, having a weight of 123,000 lbs. on its drivers. Let us see what train load this huge machine of the Union R. R. Co. could haul if working under the same conditions as the New York Central locomotive. If we take the hauling power as proportionate to the weight on the drivers, we have:

123,000 : 208,000 : : 80,000 : 135,000.

That is to say, this machine on such a track as the New York Central, from Syracuse to Albany, could haul a paying load of 135,000 bushels of grain, or a net weight of 3,375 tons, an amount equal to the cargo of a fair-sized Lake steamer.

We do not mean to say, of course, that the hauling of such huge trains would be practicable or economical with present rolling stock and railways. We do believe, however, that such powerful machines as this point the way toward future possibilities, if not probabilities, in the economical movement of bulk freights by rail; and the advocates of ship canals and barge canals for internal transportation will do well to bear the fact in mind.



THE LARGEST LOCOMOTIVE IN THE WORLD.
Built for the Union R. R. Co,, Pittsburg, Pa., by the Pittsburg Locomotive & Car Works.
Geo. E. McCague, General Manager Union R. R. Co,; D. A. Wightman, General Manager Pittsburg Locomotive Works.

Dimensions of Consolidation Locomotive for the Union Ry., Pittsburg, Pa.; Built by the Pittsburg Locomotive & Car Works.

Running Gear:
  Driving wheels (8), diameter ....54 ins.
  Truck wheels (2), diameter ....30 "
  Tender wheels (8), diameter ....33 "
  Driving wheel centers ....Steeled cast iron, and cast steel for main drivers.
  Journals, driving axles ....9 × 12 ins.
Wheelbase: Driving ....15 ft. 7 ins.
  Total engine ....24 ft.
  Engine and tender ....54 ft. 9½ ins.
Length over all: Engine ....39 ft. 8¾ ins.
  Engine and tender ....65 " 3½ "
Weight in Working Order:
  On driving wheels, 208,000 lbs.; truck wheels 22,000 lbs.
  Engine, total ....230,000 "
  Tender, loaded ....104,000 "
  Water in tank (full) ....37,500 "
  Coal on tender (full) ....10 tons.
  Total engine and tender, ...334,000 lbs.
Cylinders:
  Diameter and stroke ....23 × 32 ins.
  Diameter of piston rod, ...4½"
  Connecting rod, length between centers ....9 ft. 10½"
Valve Gear:
  Ports, steam ...20 × 1⅝ ins.; ports, exhaust...20 × 3¼ ins.
  Bridges, width, ...1½ "
  Slide valves, style,..Balanced; maximum travel....6 "
  " " inside lap..0 ins.; Outside lap..........1 in.
  " " lead (full forward gear)..............1-16-in.
Boiler—Type ....Straight barrel, sloping back end.
  Diam. barrel, inside smallest ring ....80 ins.
  Dome, diameter ....32 "
  Thickness, bar'l plates, ⅞-in.; smokebox tube sheets, ⅝-in.
  Horz. seams..Butt joint, double welded, sextuple riveted.
  Circumferential seams ....Double riveted.
  Height from rail to center line ....9 ft. 3⅜ ins.
  Length of smokebox ....68⅝ "
  Form of spark arresting device....Netting, 2 × 2-in. mesh.
  Injectors ....Two No. 11.
  Working steam pressure. ....200 lbs.
Firebox ....Above frames.
  Length, inside........10 ft.; width, inside....3 ft. 4¼ ins.
  Depth at front.....76¾ ins.; depth at back....69 7-16 "
  Thickness, sides and back ....⅜-in.
  Thickness, crown plate, 7-16-in.; tube plate..........½-in.
  Crown stays, diameter ....1⅛ ins.
  Grate bars ....Cast iron; rocking.
  Is firebrick arch used?..........Yes; supported on studs
  Water spaces, width all around ....4 ins.
Tubes.—Knobbled charcoal iron; No. 355
  Diameter, outside..2¼ ins.; length over tube plates, 15 ft.

Heating Surface and Grate Area.	
Heating surface, tubes (exterior area)	3,116.5 sq. ft.
“ “ firebox	205.5 “
“ “ total	3,322.0 “
Grate area	33.5 “
Ratio of total heating surface to grate area	99 to 1
Miscellaneous.—Exhaust nozzle. .Single; diameter	5¾ ins.
Exhaust nozzle below center line of boiler	5⅝ “
Smokestack, diameter at top, 18 ins.; diam. at base,	17 “
“ height above smokebox	2 ft. 9 “
“ height of top above rail	15 “ 6 “
Total tractive force. . . . .(builder's figures)	53,892 lbs.
Total adhesive tractive power at ¼ weight on driving wheels	52,000 “

Note.—The locomotive is equipped with pneumatic track sander; Westinghouse American brakes; sight-feed lubricator; metallic packing on piston-rod and valve stems; two 3-in. open-pop safety valves and one 3-in. muffler. The tender frame is of steel channels, and the tender has rigid bolster trucks with elliptic springs.

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THE NEW 50-FT. FURNITURE CARS OF THE CHICAGO ROCK ISLAND & PACIFIC RY.

(With two-page plate.)

A furniture car is nothing but a box car of exceptional size, intended particularly for light bulky freight, such as furniture or carriages, but it has come to be a very troublesome part of the equipment of a railway as far as the transportation department is concerned, owing to the fact that it is very frequently used in regular freight service. When a shipper has once sent a "carload" in a furniture car, he is apt to object when future shipments have to be made in the ordinary cars of less capacity. For this reason the furniture car is one of the important features in the large-car question, which was discussed at some length in our issue of March 12, 1896. We do not intend now to take up this question again, but the above remarks will serve as an introduction to a description of some enormous cars, which are exceptionally large even for furniture cars, and which are certainly among the largest freight cars ever built. In fact, there are probably many roads, especially in the eastern states, which could not handle the cars on account of the limitations of their tunnels.

These cars are 54 ft. 6½ ins. long over the couplers, 52 ft. 3 ins. long over the deadwoods, 9 ft. 10 ins. wide over the roof, and 14 ft. 1¾ ins. high from the rails to the running board. They are somewhat peculiar in appearance, as may be seen from Fig. 1, the huge box being set as low as possible, so that the bottoms of the sills project 2 ins. below the tops of the wheel treads. To allow of this, the outer intermediate sills are not extended over the trucks.

From the general plans given in Fig. 2, it will be seen that the underframe consists of two end sills and eight longitudinal sills, the frame being trussed by four 1½-in. truss rods. The rods have 1¾-in. upset threaded ends, and are set up by hollow turnbuckles. All the rods pass through the end sills, and the two inner rods also extend through the deadwoods. The transoms, to which the truss rod struts are attached, are 5 × 9 ins., 7 ft. 11¼ ins. c. to c. The outer intermediate sills do not extend from end to end of the car, but are fitted to cross pieces 4 ft. 5⅛ ins. back from the body bolsters, thus leaving a space for the wheels and allowing the frame to be dropped below the tops of the wheels, as above noted. The end sills are 13¼ ins. deep and taper in width from 9 ins. at the middle to 4¾ ins. at the ends. Upon the sills is laid the flooring of transverse planks 1¾ × 6 ins., tongued and grooved.

The side frames have posts 6½ × 2 ins. and braces 8 × 2 ins., fitted to malleable iron castings, and ¾-in. vertical rods extend through the plates and sills, these rods being let into the posts. The side plates are 6½ × 3½ ins. The end frames have posts and braces 6 × 3 ins. and 8 × 3 ins., with 3½-in. end plates, 6 ins. deep at the ends and 13 ins. at the middle. The corner posts are 7½ × 3 × 2 ins., and are tied to the side posts by ½-in. rods. Between the two posts are two rows of girths or belt rails, 4 × 3⅞ ins. in the ends and 4 × 2⅞ ins. in the sides. The outside sheathing is of vertical planks ⅞ × 4 ins., while the inside sheathing is of ⅞-in. planks placed horizontally. This inside sheathing is carried up to the upper girth on the sides and to the plates at the ends. On it are marked the heights for full capacity loads of wheat, corn, rye, barley and oats. The roof is supported by wooden carlines 3 ft. 2⅛ ins. apart, these carlines being 1⅞ ins. thick, 3½ ins. deep at the ends and 10 ins. at the middle. It has two layers of planking, between which is the asphalt roofing of the Drake & Weirs Co., Cleveland, O.

Fig. 3 shows the draft rigging, which is fitted between the center sills, these sills being strengthened by angle irons 4 × 4 ins., bolted under them and under the end sill. On the front of the end sill is a deadwood 4 × 11¾ ins., 3 ft. 1½ ins. long, faced by a ¾-in. iron plate and to the bottom of the deadwood is bolted the foot iron for the brake shaft. The Janney car couplers are used.

In accordance with the best modern practice in car construction, the body bolster is entirely of metal, as shown in Fig. 4. The top member is a plate ¾ × 10 ins., the ends of which are bent to form stirrups for the side sills. The lower member is a plate 1 × 10 ins. The top plate has a camber of about 1¾ ins., and the truss depth between the plates at the center is 12⅝ ins. Between the plates are three malleable iron fillers, supporting the sills and two of the truss rods, while underneath the bolster are secured the steel center plate and malleable iron side bearings. All the parts are put together with ⅞-in. bolts.

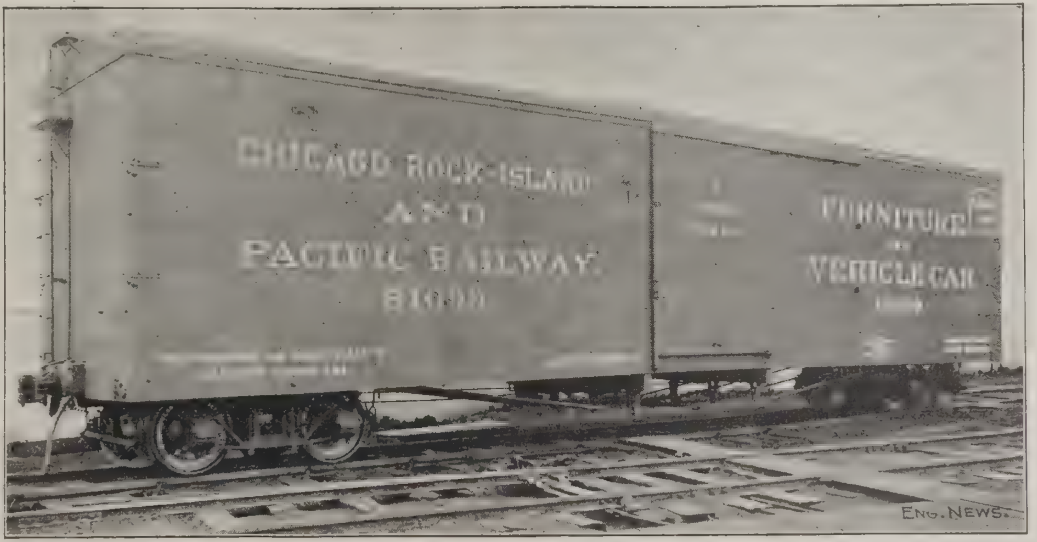

FIG. 1.—VIEW OF 50-FT. FURNITURE CAR; CHICAGO, ROCK ISLAND & PACIFIC RY.
Michigan-Peninsular Car Co., Builders.

The truck, Fig. 5, is of interest in that it is of the swing motion type, and it is built of metal throughout, having diamond frames, steel bolster, channel iron transoms and a channel iron spring plank. The side frames have top-arch bars 1¼ × 4 ins.; bottom arch bars 1⅛ × 4 ins., and tie bars ¾ × 4 ins. The columns are of malleable iron, there being but one casting for each side frame. In the column castings are formed seats for the transoms, which are 10½-in. channels 6 ft. 3 ins. long, weighing 20 lbs. per ft. They have unequal flanges, the top flange being 3⅜ ins. and the bottom flange 2½ ins. wide. These channels are set back to back, 15⅝ ins. apart. Upon the transoms are riveted the side bearings and center plate. The bolster is only 5 ft. 4 ins. long, being entirely within the frames, and is of box section, 12 × 7¼ ins. at the ends and 12 × 10½ ins. at the middle.

The swing motion arrangement is somewhat novel. Across the top of the transoms are two square bars, having turned ends which rest in bearings riveted to the top flanges of the transom channels. From the square part of each bar hangs a stirrup or truck hanger, whose sides are ⅞ × 4 ins., the width over the sides being 15⅜ ins. In the loop of the stirrup is a malleable iron seat for the spring plank, which is only 5 ft. long, being entirely clear of the truck frames. The hangers are given a slight inclination outward from the top, and two safety hangers are provided which are riveted to the transom channels and would support the spring plank in the event of the breakage of either or both of the truck hangers. The spring plank is a 13-in. channel, with 4-in. flanges, and weighs 31½ lbs. per ft. It is 5 ft. long, and at each end is a nest of four coiled springs upon which rests the bolster.

Malleable iron is used extensively throughout these cars, for such parts as post and brace seats, truss-rod struts, bolster filling pieces, truck columns, spring plank seats and saddles, side bearings, etc. As an example of these castings we show in Fig. 6 the malleable iron poling pockets which are fitted to the corners of the cars, on the sills. All these fittings were supplied by the National Malleable Castings Co., of Toledo, O.

The cars are fitted with the Westinghouse brake, the reservoir and cylinder being placed below and between the two intermediate sills, near the middle of the car. The brakeshoes are hung outside the wheels, and the arrangement of the brake rigging is very similar to that of the Illinois Central R. R. 80,000-lb. coal car, illustrated in our issue of June 16, 1898. The Bettendorf metal brake beam is used, supplied by the Cloud Steel Truck Co., of Chicago.

These huge cars are quite new, 100 of them having been built during the present year by the Michigan-Peninsular Car Co., of Detroit, Mich. They were designed under the direction of Mr. Geo. F. Wilson, Superintendent of Motive Power and Equipment of the C., R. I. & P. Ry., to whom, as well as to the builders we are indebted for information. The following is a list of the leading dimension and particulars of these cars:

Dimensions of Furniture Cars; C., R. I. & P. Ry.

Length over draw bars	54 ft. 6½ ins.
“ over deadwood face plates.	52 “ 3 “
“ over end sills.	51 “ 5½ “
“ inside	50 “ 0 “
Width over eaves	9 “ 10 “
“ over sills	9 “ 2½ “
“ inside	8 “ 8¾ “
Height, rail to under side of sill	2 “ 7 “
“ rail to under side of plate	12 “ 5¾ “
“ rail to top of running board	14 “ 0¼ “
“ rail to floor	3 “ 6¾ “
“ rail to center line of coupler	2 “ 10½ “
“ inside, clear	9 “ 3 “
Doorways	7 ft. × 8 ft. 10¼ “
Side sills.	5 × 9 “
Intermediate sills (2)	5 × 9 “
Intermediate sills (2)	4 × 9 “
Center sills (2)	5 × 9 “
End sills, (2) (section at middle)	9 × 13¼ “
Side posts	6 × 2 “
End posts	6 × 3 “
Side braces	8 × 2 “
End braces	6 × 3 “
Side plates	6½ × 3½ “
Transoms	9 × 5 “
Truss rods (4)	1½ “
Truss depth	18 “
Wheels	33 “
Journals	4¼ × 8 “
Wheelbase, truck	5 ft. 0 “
Wheelbase, total	45 “ 4 “
Distance c. to c. of trucks	40 “ 4 “
Capacity, rated	60,000 lbs.
Weight	40,400 “
Floor area	436.45 sq. ft.

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WOOD STAVE PIPE; ITS ECONOMIC DESIGN AND USE.

At the meeting of the American Society of Civil Engineers on Oct. 19, Mr. Arthur L. Adams, M. Am. Soc. C. E., of Los Angeles, Cal., presented a paper upon the above subject, which is, without doubt, the most complete and valuable presentation of it that has ever been made in engineering literature. Mr. Adams' complete paper occupies 32 pages in the September number of the Society's "Proceedings," and is too long, therefore, for reprinting in full in these columns. We have prepared an abstract of the most important parts of the paper and present it as follows:

The first use of a stave pipe as a continuous tube was apparently the 6-ft. pen-stock built at Manchester, N. H., in 1874, by Mr. J. T. Fanning, M. Am. Soc. C. E.; this pipe is still doing service. Round bands on stave pipe under pressure were suggested in certain letters patent in 1880, and were first extensively used at Denver, Colo., in 1883. The particular type of pipe referred to in the paper is one built continuously in the trench; of staves of variable length, having radial edges and concentric faces; and which are held together by metal bands, usually circular in section and spaced on the pipe according to the internal pressure.

The essential considerations in the design of a wood-stave pipe are as follows: The staves must be thin enough to secure complete saturation and to deflect readily to the degree of curvature employed; and they must be thick enough to prevent undesirable percolation through them. The bands must be of such size that, when spaced to give the desired factor against rupture, there will be no sensible flexure in the staves and no destructive crushing of the fiber beneath the bands. The proportions between the thickness of the staves and the strength of the bands must be such that the swelling of the wood will not produce injurious strains upon an otherwise properly proportioned band.

In discussing the source of strains in these pipes the author first takes up the initial strain caused by cinching during construction; this strain is necessary to secure practical tightness when the pipe is first filled. The requisites are a degree of compression per square inch between the staves in excess of water pressure, and uniform contact between the band and all the staves. Owing to the friction between the bands and the staves, and the compressive resistance of the wood, it is not practicable to secure the necessary area of contact, under a band of curved section, by screwing up the nut at the end of the band, without inducing an objectionably high strain. In practice the band is usually vigorously pounded at all points, as the wrench is used; this practice tends to secure the proper degree of indentation without the least residual tensile strain. The strains induced in the bands by water pressure are susceptible of positive determination by familiar methods.

The additional strain induced by the swelling of the staves is less easily determined, and exists only within certain limitations of the cinching source of strain. It may be assumed that the expanding power of swelling timber, at a given stage of compression, is well within what may be called its elastic limit, and is measured by the load necessary to produce that compression under like conditions. If, then, the staves be compressed laterally by the bands beyond the elastic limit of the saturated wood, there can be no swelling of the wood; and no increased strain on the bands from that source. But if the compression is less than the corresponding swelling power of the wood, at the degree of seasoning and compression used, the timber will swell and produce an increased strain in the bands. The amount of additional band strain thus induced is, doubtless, nearly proportional to the area of contact between the staves in the straight seams; and here the special advantage of the band of curved section becames apparent. The curved band permits a permanent compressive strain on the wood sufficient to produce a decided indentation; and the swelling of the staves, if any, and the increased compression under the band, are followed by a farther yielding of the wood; and as the band strain increases the area of contact with the band is increased by the farther indentation of the stave. With flat bands the unit compressive strain under them would almost invariably be so low that no indentation would result, and swelling strains to the full expanding power of the wood would be added to the band strains arising from other sources.

Mr. Adams then takes up the equation deduced for obtaining the permanent and temporary strains in the band. The symbols used are as follows:

R = internal radius of pipe.
r = radius of band section.
t = thickness of stave, in inches.
f = spacing of the bands between centers, inches.
S = tensile strain in the band, in pounds.
s = safe tensile strength in band, in pounds.
E = permanent sustaining power of the staves, in pounds per lineal inch of band.
E′ = temporary sustaining power of the staves, as above.
E″ = permanent swelling force of the wood, lbs. per sq.in.
E‴ = temporary swelling power of the wood, lbs. per sq.in.
P = water pressure, pounds per sq. in.
e = safe bearing power of the wood, lbs. per lin.in. band.
X = additional strain induced by band cinching, lbs.

The least band strain induced by water pressure = P R f. The permanent band strain induced by swelling of staves = f t E″. The least permanent strain in the bands of a tight pipe =

$$(X + P\ R\ f + f\ t\ E''), < R\ E.$$

Assuming $X = \frac{3}{2}\ t\ f\ P$ and substituting, we have as the least permanent value of S for a tight pipe when $P < E''$,

$$S = [P\ f\ (R + \frac{3}{2}\ t) + E''\ t\ f\ ], < (R + t)\ E. \qquad (1)$$

If $P > E''$, this becomes

$$S = [\ (R + \frac{3}{2}\ t)\ P\ f\ ], < (R + t)\ E, \qquad (2)$$

which is the equation generally used for computing band strains for all pressures.

The least temporary band strain induced on first filling a tight pipe =

$$(X + P\ R\ f + E'''\ t\ f), < (R + t)\ E'.$$

Assuming as before, $X = \frac{3}{2}\ t\ f\ P$, and substituting, we have as the temporary value of S when $P < E'''$:

$$S = [P\ f\ (R + \frac{3}{2}\ t) + E'''\ t\ f\ ], < (R + t)\ E'. \qquad (3)$$

If $P > E'''$, the equation becomes the same as (2).

From the foregoing the following equations, convenient for application, are deduced:

When $P < E''$,

$$f = \frac{s}{(R + \frac{3}{2}\ t)\ P + E''\ t}, \text{ when } s < (\ R + t)\ e. \qquad (A)$$

$$f = \frac{(R + t)\ e}{(R + \frac{3}{2}\ t)\ P + E''\ t}, \text{ when } s > (R + t)\ e. \qquad (B)$$

When $P > E''$,

$$f = \frac{s}{(R + \frac{3}{2}\ t)\ P}, \text{ when } s < (R + t)\ e. \qquad (C)$$

$$f = \frac{(R + t)\ e}{(R + \frac{3}{2}\ t)\ P}, \text{ when } s > (R + t)\ e. \qquad (D)$$

Inasmuch as stave pipe has never been used under heads where the value of P is greater than E″, and it has not as great economic value under such heavy pressures as under lighter pressures, formulas (C) and (D) have no great practical value.

The only experiments upon the sustaining and swelling power of staves known to the author are those made on Oregon "yellow fir" by Mr. D. C. Henny, M. Am. Soc. C. E.* The results are repeated in this paper in tabular form and commented upon, but the conclusions are as follows: So far as they go, these experiments demonstrate (1) That with a proper degree of compression, an ultimate permanent pressure of between 900 and 1,000 lbs. per square inch of contact with the band may be resisted by the staves. This result may be conservatively assumed to obtain in the use of all prevailing sizes of bands and of staves without regard to the character of the grain. (2) That the ultimate swelling power of the wood may be taken at from 90 to 100 lbs. per square inch of stave contact in straight seams; a result which may be affected by the spacing of the bands, since a light flexure in the stave would tend to release the strain instead of transmitting it to the bands. (3) That for water pressures exceeding, say, 94 lbs., per sq. in., and probably considerably less, hard cinching, rather than the swelling of the wood, must be relied upon to maintain a tight pipe. (4) That the yielding qualities of the wood renders hard cinching not seriously objectionable in its effect upon final band strains, with the usual factors of safety in the band, and when working reasonably close to the limit of ultimate compressive resistance of the stave.

One of the most important points to be determined from this discussion is the maximum value of e, which can be used with entire safety in designing a pressure pipe. While pressures as high as 1,100 lbs. per sq. in. have been successfully used under favorable conditions, this is not conservative enough for entirely safe construction. With thorough compression of the bands into the staves, well-seasoned lumber, skilled construction and no water-hammer, 800 lbs. per sq. in. is considered by the author as a maximum; and if there is any considerable fluctuations of pressure, or doubtful constructive skill, a much lower figure should be used.

In view of what has been said, the following values are assigned for use in the formulas here given:

E = 240 lbs. for ½-in. bands, when the fiber is fully compressed (960 lbs. per sq. in.).
E′ = say, 500 lbs., in the absence of any experiment.
E″ = 95 lbs. for 12-in. band spacing; assumed at 100 lbs. for all spacing.
E‴ = 120 lbs. for 12-in. spacing; assumed at 125 lbs. for all spacings.
e = equivalent of 800 lbs. per sq. in. of band contact, or less.

Before using any formula for band-spacing it is necessary to fix upon the size and form of section of the most economical and best band. Bands less than ⅜-in. diameter have torsional weakness and are difficult to upset. An oval form permits an increase in the value of e and costs but little more than round bands; the heavier band costs less per pound than light sections; the use of upset rods or rolled threads is always economical, and the heavier the band the fewer to be handled and the better for resisting corrosion. These are all general considerations influencing the selection.

Economy in the use of steel requires the selection of a band of such sectional area that if possible $s < (R + t)\ e$; otherwise it is necessary to use closer spacing, or more steel, than the pressure requires to secure a low value for e. By substituting for s and e, in the above equation, their proper values corresponding to bands of various standard sizes the limitations of the economic use of each may be ascertained, thus:

$$R + t = \frac{s}{e}.$$

The following table gives the minimum sizes of pipe to which specified bands are applicable without exceeding values of 650 lbs. and 750 lbs. for e:

Diameter of band.	s = ¼ ultimate st'gth, lbs.	Band pressure per sq.in., lbs.	e band pressure per lin.in., lbs.	Least external radius of pipe, ins.	Band pressure per sq.in., lbs.	e band pressure per lin.in., lbs.	Least external radius of pipe, ins.
⅜-in.	1,650	650	122	13.5	750	140	11.8
7/16-in.	2,250	650	142	15.8	750	164	13.7
½-in.	2,950	650	163	18.1	750	187	15.7
9/16-in.	3,725	650	183	20.4	750	211	17.6
⅝-in.	4,600	650	203	22.6	750	234	19.6
¾-in.	6,600	650	244	27.0	750	281	23.5

A factor greater than 4 must, therefore, be used in the steel in designing pipes of smaller diameter, if round bands are used, and the specified values of e are not exceeded. Bands of oval section give a greater bearing surface with the same degree of indentation, and permit the use of less steel for given values of e in small diameters of pipe. For this reason oval bands have been introduced and used by the Excelsior Wooden Pipe Co., of San Francisco, on a number of pipe lines.

The greatest band strains consistent with specified values of e for pipes of small diameter, are given as follows:

Int'rnl diameter.	External radius.	S = assumed working strain on band.	Factor of safety in band.	S = assumed working strain in band, lbs.	Factor of safety in band.
e = 122 lbs. = 650 lbs. per sq.in.				e = 140 = 750 lbs. pr sq.in.	
12 ins.	7.1 ins.	866 lbs.	7.6	994	6.1
16 "	9.2 "	1,122 "	5.9	1,288	5.1
20 "	11.2 "	1,366 "	4.8	1.568	4.2
24 "	13.5 "	1,650 "	4.0	.....	...

The staves used must be thick enough to prevent percolation, to resist undue flexure under the band spacing adapted, to prevent cracking or crushing of quarter-sawed staves under the cinching operation, and to afford the rigidity necessary to support the weight of the pipe and back-filling without distortion. If the size of band and band-spacing are determined in accordance with foregoing principles a maximum spacing of 12 ins. will make safe against flexure staves of the thickness generally used. The practice of running staves from 2 × 6 ins., 2 × 8 ins. and 3 × 8 ins. stock nearly meets the economic requirements of pipes designed as here set forth. These requirements would be better met, however, if 1½ × 4 ins. were used for the smallest diameters; and if the odd size, 2½ × 8 ins. were used for certain pipes of intermediate sizes between those for which 2 × 6 ins. and 3 × 8 ins. are used. The following relation between pipe diameters and size of stock is the result of careful study, the staves in each case being run as thick as the stock will permit:

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*The Astoria Water-Works; Transactions, Vol. xxxvi., p. 18.

Pipe diameter.	Stock sizes.	Pipe diameter	Stock sizes.
10 to 14 ins.	1½ × 4 ins.	50 to 58 ins.	2½ × 8 ins.
16 " 48 "	2 × 6 "	60 " 72 "	3 × 8 "

By assigning to e the conservative value of $\frac{650}{r}$, the author submits the following table of pipe diameters, with corresponding stave thicknesses and bands. Should it be desired to use some other value for e, the needed modification can be easily made:

Economic Proportions for Pipe Design.

Nominal diameter, ins.	Staves, Stock sizes, ins.	Staves, Thickness of finished, ins.	Economic sizes of bands, ins.	s = permanent band strain, lbs.	Factor of safety in band.	e = max'm value $= \frac{650}{r}$ lbs.
10	1½ × 4	1 1/16	5/16 × 7/16	1,255	5.26	207
12	1½ × 4	1⅛	5/16 × 7/16	1,475	4.47	207
14	1½ × 4	1 3/16	5/16 × 7/16	1,650	4.0	...
16	2 × 6	1 7/32	5/16 × 7/16	1,650	4.0	...
18	2 × 6	1⅜	5/16 × 7/16	1,650	4.0	...
20	2 × 6	1⅜	5/16 × 7/16	1,650	4.0	...
22	2 × 6	1⅜	⅜	1,508	4.4	122
24	2 × 6	1⅜	⅜	1,650	4.0	...
27	2 × 6	1 7/16	⅜	1,650	4.0	...
30	2 × 6	1½	½	2,673	4.4	162
36	2 × 6	1 9/16	½	2,950	4.0	...
42	2 × 6	1⅝	½	2,950	4.0	...
48	2 × 6	1 11/16	½	2,950	4.0	...
54	2½ × 8	2⅛	⅝	4,600	4.0	...
60	3 × 8	2½	⅝	4,600	4.0	...
66	3 × 8	2 9/16	¾	6,600	4.0	...
72	3 × 8	2⅝	¾	6,600	4.0	...

The author then tabulates the features and strains in about 15 existing pipe lines; and this, while interesting, is omitted here to take up some of the construction details in accepted practice.

In making connection between the butts of connecting staves it is the prevailing practice to snugly insert a No. 12 or No. 14 steel plate, about 1½ ins. wide and slightly larger than the width of the stave used; this plate extends slightly less than half its width into each stave. The use of a bead on the stave edge is not vital to the success of the pipe, but it has some strong points in its favor. By the use of a slight bead the compression due to cinching is at first concentrated on the bead, and a uniformly tight seam is secured without the necessity for hard compression through the entire contact area—as is the case without the bead. The bead adds nothing to the cost of the pipe.

Coupling shoes of various types have been devised, and these are of two classes; those which engage the two ends in the same transverse plane, as Figs. 1, 2 and 3; and those in which the ends are not engaged in the same transverse plane, as in Fig. 4. Figs. 2 and 3 are forged shoes; Fig. 4 is cast, and Fig. 1 is malleable cast iron, and is the shoe largely used by the Excelsior Wooden Pipe Co. The author says that, when properly proportioned, Fig. 1 admirably meets all the requirements for a successful connection. Fig. 2 is considerably used on the Pacific Coast, and is forged from a rolled section. But the length of the shoe in the rear of the nuts is wholly insufficient to afford the proper degree of bearing surface on the stave to safely resist the pressure; and the bending strain at X, due to the depressing of the end of the shoe into the stave, can only be resisted by the use of a much heavier section than the tensile strains alone require. The fault lies in the use of low connecting ribs.

The forged shoe, Fig. 3, is employed on the work of the Pioneer Power Co., of Ogden, Utah. While generally well calculated to economically resist imposed strains, it necessitates the use of a welded loop, and the shoe is expensive as compared to others. The author suggests that its form could be improved, and it could be more cheaply made of cast or malleable iron, without sacrifice in other respects. The type, Fig. 4, introduces a cross-strain, or tendency to rotate about an axis vertical to the center of the shoe. Attempts to resist this tendency to rotate are generally found insufficient, and hard cinching usually results in breaking the tail-pieces or rotating the shoe and bending the bolts. The author recommends Fig. 1 as most nearly meeting requirements.

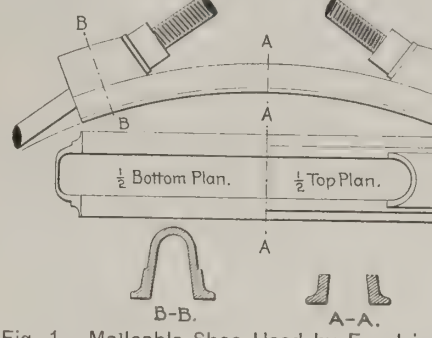

Fig. 1.—Malleable Shoe Used by Excelsior Wooden Pipe Co.

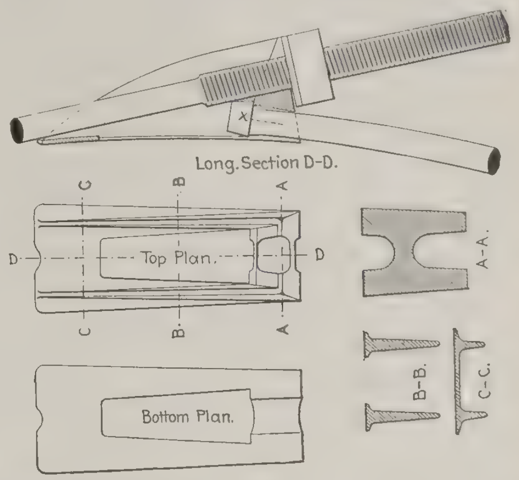

Fig. 2.—Forged Shoe Used on the Pacific Coast.

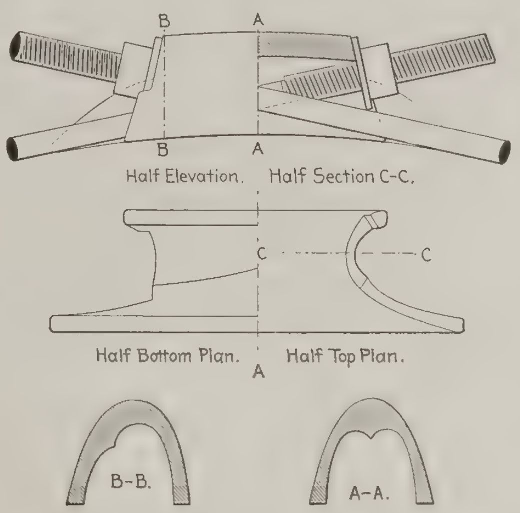

Fig. 4.—Cast Shoe Used on Los Angeles Outfall Sewer.

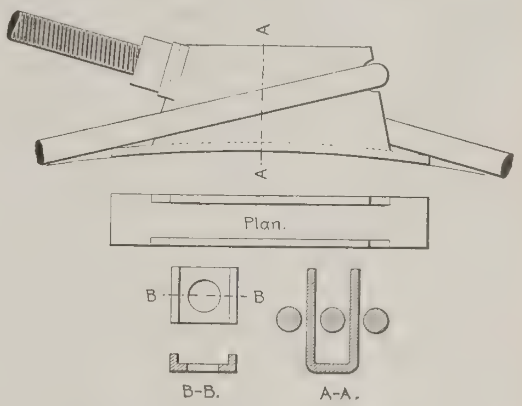

Fig. 3.—Forged Shoe Used on Pioneer Power Co.'s Pipe Line.

COUPLING SHOES FOR WOOD STAVE PIPE.

In discussing the economy of wood stave pipe he contrasts it with steel riveted and cast-iron pipe, confined to a pressure range not exceeding 100 lbs. per sq. in., which may be assumed as the practical limit of stave pipe construction. In order of merit, with reference to the three most important qualifications, he classifies them as follows:

	Cost.	Life.	Capacity.
1.	Stave.	Cast iron.	Stave.
2.	Steel riveted.	Stave.	Cast iron.
3.	Cast iron.	Steel riveted.	Steel riveted.

In placing steel pipe last in duration the author is influenced by the following considerations: The sheet metal is of less thickness than the diameter of the stave pipe bands; the same degree of care in protecting the metal can be exercised in both cases; the properly proportioned steel pipe does not eventually fail by bursting, but by the formation of rust-holes and the attendant leakage; or, the life of the steel pipe is measured by the life of its weakest point. The life of the stave pipe is determined by the life of the bands; and this is fixed by the reduction of the entire band until its ultimate strength is exceeded by the strain; say, to less than one-fourth of its original section. Stave pipe has done service in America for from 20 to 50 years in many cases, without failure from the decay of staves when proper requirements are absorbed. But steel pipe, under favorable conditions, has also done excellent service for many years.

As to carrying capacity, there are as yet but few experimental determinations in the case of stave pipe. But the experiments discussed in the Transactions of the American Society of Civil Engineers, Vol. XXXI., p. 144, Vol. XXXVI., p. 26, and for May, 1898, and reviewed at considerable length in Mr. Adams' paper, give startling results. Clean cast iron would seem to have about 90% of the carrying capacity of stave pipe; and if seriously tuberculated, the proportion is only two-thirds that of stave pipe. The steel pipe, when clean, discharges from 93%, in a 12-in. pipe, to 68% in a 6-in. pipe of the amount expected from stave pipes of the same size. If the steel pipe is tuberculated, by from 10 to 15 years' use, these discharges may fall to 74% and 54%, respectively.

The cost of any pipe is affected by market quotations on materials, freight rates, wages, geographical location, etc. But the author submits a table of comparative cost based on the following conditions: It is assumed that the wood pipe is designed in accordance with the formulas given; the steel pipe is supposed to be double-riveted on the straight seams, and single-riveted on the round, as ordinarily built, and to be coated with asphalt. The mill price for sheet steel is taken at from 1.60 cts. for No. 14 plate to 1.25 cts. for thicknesses over No. 8. The cast-iron pipe is proportioned for thickness by the Warren Foundry formula, and the price assumed per ton is $19 at Chicago, and $26 at San Francisco, as the lowest quoted. Comparative tables are given for both Chicago and San Francisco, but the latter only is here given:

Comparative Cost per ft. of Wooden, Steel and Cast-Iron Pipe at San Francisco. (Including laying, but not hauling.)

Nominal diameter.	Stave.				Steel riveted.								Cast iron.			
	Head, ft.				B. W. G., No. inches.								Head, ft.			
	25.	50.	100.	200.	No. 14.	No. 12.	No. 10.	No. 8.	No. 6.	¼-in.	5/16-in.	⅜-in.	25.	50.	100.	200.
12 ins.	$0.37	$0.45	$0.61	$0.94	$0.45	$0.52	$0.60	.....	.....	.....	.....	.....	$0.94	$0.99	$1.09	$1.31
18 "	.58	.71	.96	1.47	...	.77	.88	$1.04	$1.30	.....	.....	.....	1.65	1.73	1.89	2.21
24 "	.76	.96	1.35	2.12	...	...	1.01	1.35	1.67	$1.97	$2.51	.....	2.50	2.62	2.86	3.37
30 "	.83	1.03	1.43	2.23	...	...	...	1.64	2.04	2.45	3.10	$3.79	3.52	3.70	4.07	4.81
36 "	1.02	1.20	1.83	2.90	...	...	...	1.80	2.44	2.92	3.67	4.49	4.60	4.87	5.40	6.50
42 "	1.23	1.58	2.28	3.69	...	...	...	2.27	2.80	3.37	4.24	5.12	5.87	6.25	6.97	8.43
48 "	1.34	1.73	2.51	4.07	...	...	...	...	3.14	3.80	4.78	5.78	7.33	7.80	8.73	10.64
54 "	1.94	2.45	3.49	5.52	...	...	...	...	3.55	4.32	5.37	6.47	8.86	9.47	10.69	13.15
60 "	2.44	3.09	4.39	7.00	...	...	...	...	...	4.87	5.95	7.24	10.73	11.54	13.14	16.33
66 "	2.79	3.57	5.14	8.26	...	...	...	...	...	5.43	6.54	7.81	12.70	13.69	15.45	18.92
72 "	3.22	4.15	6.04	9.78	...	...	...	...	...	5.90	7.09	8.50	15.12	16.05	17.78	21.53

These figures are supposed to include only the common principal items of expense, with no profit to the contractor. They, are, therefore, perhaps in every case somewhat below probable cost, and are intended for use by way of comparison only. But a contract of actual quotations for particular cases would in almost every instance show a greater advantage from the use of the stave pipe than the table indicates, which assumes the most favorable conditions for the steel-riveted and cast pipe.

At the meeting of the American Society of Civil Engineers on Oct. 19, the presentation of the above paper was followed by a discussion which was opened by the Secretary, reading a letter from Mr. H. B. Patten, M. Am. Soc. C. E., City Engineer of Cheyenne, Wyo. This gave the experience of the City of Cheyenne, where in 1889, several thousand feet of 24 and 30-in. stave pipes for water mains were buried. These were only partially filled at times, and when removed 7 or 8 years later were found in bad condition. Grass roots had to a considerable extent forced their way between seams, and the staves were rotted principally on top, where the pipe was subjected to alternate wetting and drying. The pipes were also distorted, and in one place the section had changed from circular to elliptical with a vertical axis of 26 ins. and a horizontal axis of 34 ins. This reduced the section area and restricted the flow. The grass roots and other growths inside also interfered with the flow.

Mr. J. F. O'Rourke called attention to the fact that in a 6-ft. stave pipe under a pressure of 100 lbs. per sq. in., the maximum pressure set by the author, the pressure would be about the same as the pressure allowed on a steel pipe of ¼-in. thickness. It would, therefore, be necessary to have as much metal in the bands as would be necessary to make a steel pipe. This being so, he was quite certain that cast iron could be bought cheaper than stave pipe.

The chairman, Mr. James Owen, asked if the statements of the author regarding greater durability and capacity of a given size of stave pipe compared with the same size of other kinds did not seem contrary to general experience and opinion. Mr. Rudolph Hering, in considering these points, remarked that the question was one needing longer experience before it could be finally answered. The paper presented by Mr. Adams was based on more experience than appeared on the surface, and he for one considered the statements of durability quite true. He had seen stave pipes which had been in the ground 30 years, and were still as good as when put down. On the other hand, he had also seen wrought iron pipes that had been buried some time, and then exposed and subjected to weather supposed to be sufficient to cause considerable oxidization that, were barely rusted. Stave pipes should not be painted inside since the water cannot permeate the wood and keep it thoroughly wet, a feature which is necessary if rotting is to be prevented. To insure this saturation of the staves it is necessary to have the water in the pipes always under pressure. Regarding the form of band used for holding the stave pipe, experience had shown that the round or elliptical sections served best since the same section in this way exposed less surface to the weather, and there was, therefore, less likelihood of corrosion. Great care in the manufacture and placing of bands was necessary owing to the strains that they must stand.

Some wrought iron pipes which he had seen while in San Francisco, in which there was little or no uncombined carbon, seemed to stand the weather better than ordinary wrought iron pipes. These pipes were made according to specifications prepared by the Superintendent of the Spring Valley Water Co., of San Francisco.

Regarding capacity, he saw no reason why a wooden pipe properly made should not be better than a riveted steel or iron pipe. Of course, it was possible for a growth of some sort to accumulate which would materially restrict the flow. In response to a question from the chair, Mr. Hering stated that he had never heard of any chemical action between the bands and the staves.

Mr. G. W. Tillson pointed out that the rapid action of the weather upon pipes when alternately wet and dried was fully understood by the author, who expressly states that the staves must in every case be thin enough to become soaked. To show how rapidly wood rotted, unless continually saturated, he mentioned a case in Omaha where a substantial wooden sidewalk was badly rotted inside of four months, the walk being covered with ordinary earth taken from a foundation excavation. Cedar block pavement in the same city, notwithstanding the interstices were filled with gravel and tar, decayed inside of two years.

The chairman asked what were the possibilities of wooden pipes for water pipes in small towns.

Mr. J. R. O'Rourke mentioned an experience in taking up some old wooden water pipe, on Broadway, N. Y., which had been buried by the Manhattan Water Co. This pipe had been in the ground over 100 years. It was damp and water-soaked, but was not rotted, and was still serviceable. Another instance that had come under his observation occurred at the corner of Gold St. and Maiden Lane, in New York city. At this point while tearing down a building over 100 years old, they encountered oak mud sills 56 ft. long and 6 ins. thick. These timbers were just above the water line, and were in very good condition. Just above them were timbers 24 × 10 ins. which were 18 ins. above the ground water level. These timbers were perfectly sound, and not in the least decayed.

From his observation the principal difficulty with stave pipes would be the corrosion of the bands. The thickness of staves could, in his estimation, be much greater than the limits given by the author, and experience with some 3-in. yellow pine caissons, which he had recently used in connection with some foundation work, convinced him that water, even under moderate pressure, would permeate staves of considerable thickness.

Mr. J. C. Meem described a 4-ft. stave sewer which the Department of Sewers of Brooklyn had designed, but which had never been built. This was composed of 1¼-in. staves with strap bands placed every 2 ft. Outside of this the plans called for a casing of 6 ins. of concrete on top and 8 ins. on the sides and bottom. In section the whole resembled an inverted letter U. The object of this design was to preserve the roundness of the pipe and assist the clamp bands to hold the whole together.

Mr. F. W. Skinner spoke briefly of the cheapness of small wooden pipes, and described the process of boring logs, employed at a factory he had visited. The core cut out in forming large pipes was in turn bored to form a smaller pipe, thus making the cost very small, as there was little waste.

NEW FREIGHT LOCOMOTIVES FOR THE BALTIMORE & OHIO SOUTHWESTERN RY.

The introduction of heavier and more powerful locomotives for freight service, in order to ensure the greater economy in cost of transportation, which is now one of the principal aims of railway operation, as recently pointed out in our columns, is now being practiced by the Baltimore & Ohio Southwestern Ry., following the example of a number of other railways. This road has recently added to its equipment ten consolidation freight engines for service on the Ohio Division, between Cincinnati, O., and Parkersburg, W. Va. There are some rather heavy grades on this division, and it is expected that with the new engines the train load will be increased nearly 40%.

The locomotives are all alike, except that eight are simple engines and the other two are Vauclain four-cylinder compound engines. The simple engines have cylinders 21 × 28 ins., and carry a boiler pressure of 190 lbs. The compound engines have cylinders 15½ × 28 ins. and 26 × 28 ins., and carry a boiler pressure of 200 lbs. The piston heads are of cast iron, fitted with the Dunbar packing. The firebox is intended for bituminous coal, and has a brick arch, supported on studs, while the crown sheet is supported by radial stays. The grates are of cast iron, of the railway company's standard pattern. The equipment includes the Leach pneumatic double sanding jet, Sellers 10½-in. injectors, and a pneumatic bell ringer.

The engines were built by the Baldwin Locomotive Works, of Philadelphia, Pa., from designs prepared by Mr. J. G. Neuffer, General Master Mechanic of the B. & O. S.-W. Ry. The principal dimensions, etc., are as follows:

Consolidation Freight Locomotives; Baltimore & Ohio Southwestern Ry.

Running Gear:	
Driving wheels, 8, diameter	4 ft. 8 ins.
Truck wheels, 2, diameter	2 " 9 "
Journals, driving axles	8 × 12 "
Journals, truck axles	5 × 9½"
Wheelbase: Driving	15 ft. 3 "
Total engine	23 " 6 "
Engine and tender	53 " 5 "
Truck-pin to c. of leading driving wheel	8 " 3 "
Weight in Working Order:	
On driving wheels	137,000 lbs.
Engine, total	152,000 "
Tender, loaded	98,000 "
Cylinders:	
Compound engines, (4)	15½ × 28 ins. and 26 × 28 ins.
Simple engines (2)	21 × 28 "
Valve Gear.—Type	Stephenson link.
Slide valves, style	Richardson balanced.
Boiler:	
Diameter barrel, inside smallest ring	5 ft. 6 ins.
Height from rail to center line	8 " 4 "
Injectors	Sellers.
Working steam pressure, simple engines	190 lbs.
Working steam pressure, compound engines	200 "
Firebox.—Type	Radial stayed.
Length, inside	9 ft. 5 ins.
Width, inside	3 " 5 "
Crown stays, radial diameter	1⅛ "
Grate bars	Cast iron.
Fire-brick arch	Supported on studs.
Stay bolts, diameter....1-in.; pitch	4 ins.
Tubes.—Number	236
Diameter, outside	2¼ ins.
Length over tube plates	14 ft.
Heating Surface and Grate Area:	
Heating surface, tubes (interior area)	2,054.34 sq. ft.
" firebox	185.00 "
" total	2,239.34 "
Grate area	32.46 "
Miscellaneous:	
Smokestack, height of top above rail	14 ft. 7 ins.
Capacity of tender tank	5,000 gallons
Capacity of coal space	10 tons.
Brake fittings	Westinghouse-American.

TIME TESTS OF TIMBER IN COMPRESSION ENDWISE.*

By J. B. Johnson, M. Am. Soc. C. E.†

Some 6 tests were made on dry long-leaf pine blocks, 1½ ins. square and 3 ins. long, all cut from the same 2-in. plank. Sticks were first cut out 2 ins. square and 48 ins. long, and these were dressed down to 1½ ins. square, and then cut into 16 pieces each 3 ins. long, by a power cross-cut saw.

Alternate specimens were then tested in compression endwise in the ordinary manner in a Riehle testing machine, and the crushing strength determined. The intervening specimens were then loaded with certain percentages of the average two adjacent specimens, and this load left on till failure occurred, and the time noted. The load was made constant by using a geared Riehle 30,000-lb. testing machine, and mounting the specimen upon a nest of helical car springs which would deform about an inch under the maximum load upon the specimen. The time tests began by putting 95% of the breaking load on the specimen, then 90%, 85%, and so on.

The lowest time load was 65% of the breaking load. There were a number of time tests for each period, and the averages were taken, they plotted into a very smooth time curve, from which the following table is taken:

Crush'g load impos'd	90%	80%	75%	70%	65%
Time required to produce failure	10 min.	16 hrs.	36 hrs.	72 hrs.	200 hrs.

These tests were made in April and May, 1898, the material having been stored in my testing laboratory for four years and kept in the laboratory during these tests. To make such a series entirely free from moisture effects, due to changes in the hygrometric condtions of the atmosphere, all the specimens should be shellaced as soon as cut out, to hold them to a constant moisture condition. This was not done in this series of tests, and hence the above results must be accepted as approximate only.

A YACHT WITH CARBONIC ACID GAS as the motive power is being built at the ship yard of Capt. Louis N. Towne, at College Point, Long Island, N. Y. Its dimensions are: Length, 70 ft.; beam, 7 ft.; draft, 4½ ft. Compressed carbonic acid of 2,000 lbs. pressure per sq. in. will be used in a three-cylinder engine 10 × 10 ins. It is expected that the yacht will develop extraordinary speed.

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*Abstract of a paper read before Section D, Mechanical Science and Engineering, of the American Association for the Advancement of Science, Boston meeting, August, 1898.

†Professor of Civil Engineering, Washington University, St. Louis, Mo.

A TRAIN-ORDER ANNUNCIATOR FOR LOCOMOTIVE CABS.

One of the frequent sources for railway accidents is forgetfulness or carelessness on the part of enginemen in regard to making stops at the meeting points called for by their orders. Several devices have been invented to jog the memory of the enginemen, including a train-order board with pegs to be inserted opposite the names of the meeting points, which was described in our columns some time ago.

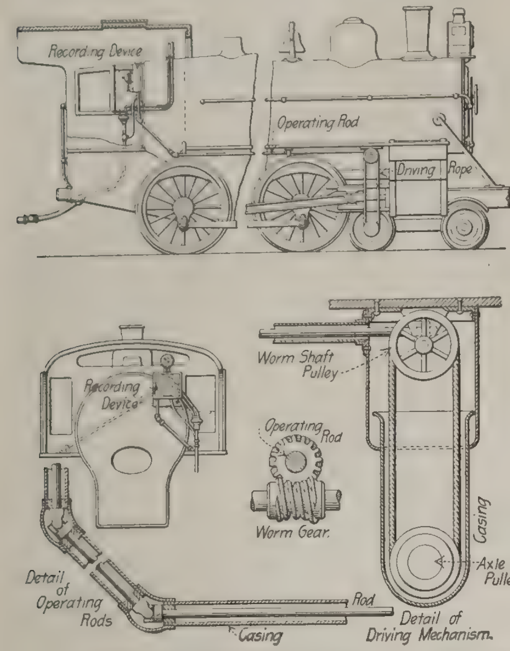


Fig. 1.—General Arrangement and Driving Mechanism of Train-Order Signal and Brake Setting Device.
Harry De Wallace, Inventor.

The device which we illustrate and describe in the present article is a step beyond other devices intended for the same general purpose, in that it automatically warns the engineman by sight and sound that he is approaching a meeting point, crossing, "slow" point, etc., while it would stop the train if he should carelessly or wilfully neglect to stop at the required places. It will at the same time show his position on the road, which is an additional safeguard in dark and stormy weather.

The recording apparatus is contained in a metal box about 10 × 10 ins., and 6 ins. deep, fitted with train-order dials, an air valve and a signal whistle. This is mounted on the boiler head or in any convenient part of the cab, as shown in Fig. 1. The mechanism is driven by rods with universal couplings, which rods are in turn driven by a bevel gear operated by a rope running around pulleys on the worm shaft and the end of one of the truck axles. The rods and driving gear are enclosed in suitable casings, as shown by Fig. 1.

A general view of the recording device in the cab is shown in Fig. 2. On the face of the box are two concentric dials, 8 and 6 ins. diameter, each graduated for 100 miles. These dials are set far enough apart to allow the hand or pointer to travel between them. The pointer is set at zero at the beginning of each run, and as the engine moves forward or backward this will show the distance traveled. On the face of the smaller dial are a number of triggers fitted with lugs which may be made to engage with the notches made in the edge of the dial at all the mile marks. In Fig. 2, the only trigger set is that at mile mark 76. When set in this position they will be released by an inclined lug on the pointer as it reaches them, the lug lifting up the trigger so as to free it from the notch, when the spring returns the trigger to its normal position. There are 15 of these triggers, allowing for that number of train orders, and they are pivoted at the center so that they may be set for any required distance or any required meeting point named in the orders.

A specially-prepared schedule card for the division on which the engine is running is attached to a holder on the box, the card being printed for westbound trains on one side and for eastbound trains on the other side. This is shown at the right in Fig. 2, the card being for the Fergus Falls Division of the Great Northern Ry., on which this device has been in use. On this card are marked the stations, sidings, crossings and other desired points on the run, together with the distance from the starting point, and the telegraph calls. The distance given is approximately one mile short of the near switch at the station or siding. Thus, if the train order requires the engineman to meet a train at Elk River, which is 40½ miles from St. Paul, the card shows 39 miles, so that the apparatus, being set for the latter distance, will give its warning at a suitable distance ahead of the meeting point.

The engineman will pull back one of the triggers convenient to that mileage and hook it in the 39-mile notch of the upper dial, where it will remain until the hand rotates and points to 39 miles, and in passing under the trigger releases it. Instantly the signal mechanism is set in motion and the signal whistle is blown by the air pressure, reminding the engineman that at a point about one mile distant, there is a siding, and that he has an appointment to meet, pass or clear for another train, or to do something else, as the case may be. If there are other triggers set for other orders at the same time, they will remain in their respective positions until the hand travels around to the mileage for which they are set. After the signal begins to sound, if the engineman hears it and is attending to his duty, he will release the signal by pulling out the button shown in the center of the dial, and also pushing in the one shown at the lower right-hand corner of the case, and prepare to make his stop (if a stop is necessary). But if he does not so release the device, showing thereby that he is attending to his duty, the signal will continue to sound while the train runs a quarter of a mile, and then the air will be automatically released from the train pipe and the train stopped before it reaches the station or point for which the trigger was set. The opposing train being similarly equipped, and the engineman being in the same condition, and affected in the same manner, his train in that emergency would also be stopped before it reached the station from the other side. If they are reminded by the signal and release it, then they will not forget their orders in the short distance they have to travel from the point of signal to the designated point. A train using this device cannot pass a point for which the apparatus is set unless it is released in the manner described.

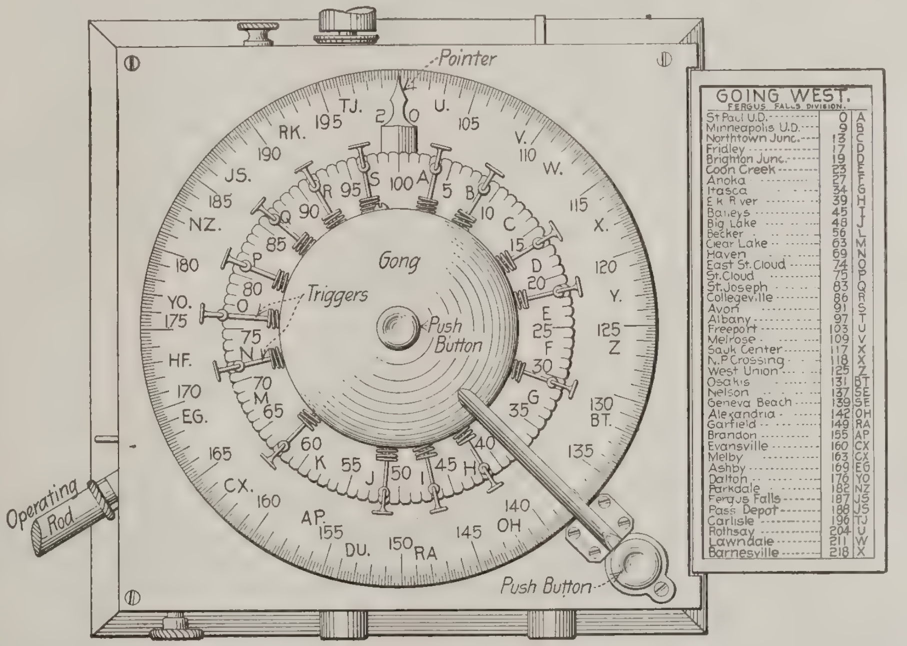


FIG. 2.—RECORDING AND SIGNALING APPARATUS IN THE LOCOMOTIVE CAB.

The setting of the trigger is done by a slight instantaneous movement, and the releasing of the signal and brake mechanism requires but one or two slight quick motions. The setting of the hand at zero at start of the run, is a very simple affair. If after setting has been made the order is countermanded, the engineman can release the trigger by lifting it up with his finger, and if necessary he can use the same (or the next one) to set for a new order given in its place for another point.

The signal consists of a small whistle, and is blown by the air pressure supplied from a valve located within the case, which is connected directly with the train pipe. It begins to blow upon the release of a trigger, and blows till the brakes are set, when it stops, unless the engineman releases it sooner. A bell or gong may be used instead.

The device requires no change or attention when the engine is reversed and run backward. Switching may be carried on for an indefinite length of time and space without alteration. The distance will be measured, the signal operated and the brakes set with the same facility and accuracy, whether the locomotive is going ahead, or backing up. Of course, when the engine backs up as in switching, the mileage is deducted. The backward distance may be added to the forward measurement, however, if desired. At night, or in stormy or foggy weather, the engineer can ascertain his whereabouts by looking at the face of the machine. If he has difficulty in finding any place on the road, he can set the device for the distance, and it will locate it exactly and inform him of his approach to it. In snow-plow work, the engineman can always tell his position when every other landmark is obscured.

As already noted, the mileage on the card is from one to two miles less than the exact distance to each station, according to whether it is level or down grade approaching the point named. This is done so that the automatic stopping of a train will occur at a safe distance from the desired point. The letters on the card are intended to be used by the dispatcher, and inserted after the names of the stations in his orders, as a check, to prevent his giving the wrong station for a meeting point. The same letters appear on the dials; a different letter is given to each five mile space.

The inventor has recently added to the signal combination, what he calls a "disorder signal." The purpose of this is to notify the engineman in case the train-order signal, or its connections, get out of order, or for any reason fail to do their work. It will also give a warning when any of its own parts become out of order. This makes the invention very reliable. If the engineman should learn to rely implicitly upon the contrivance, and it should fail without his notice, this latter attachment would let him know it at once. If it signals "out of order," he will not rely upon it or use it again until repaired or replaced.

Some time ago the inventor made a 7,000-mile test, with a full-sized working model, on the Great Northern Ry., running west from St. Paul, as far as Portland, Ore. In this long test, the device was attached to one of the large Brooks passenger locomotives in regular service, hauling the heavy and fast Pacific Coast train, and the machine is said to have clearly demonstrated the correctness of its principles, its practicability and usefulness. In July he placed an improved machine on one of the fine new Schenectady engines owned by the Minneapolis, St. Paul & Sault Ste. Marie Ry., and used in hauling the Atlantic & Pacific limited express between Minneapolis, Minn., and Gladstone, Mich. The length of run each way for this locomotive was 356 miles. Several trips were made over this distance with the train-order signal attached, and it is said to have worked very accurately. In all, the device was tested on 9,000 miles, all on long and fast runs.

The device has been patented by its inventor, Mr. Harry De Wallace, of St. Paul, Minn., to whom we are indebted for drawings and other information.

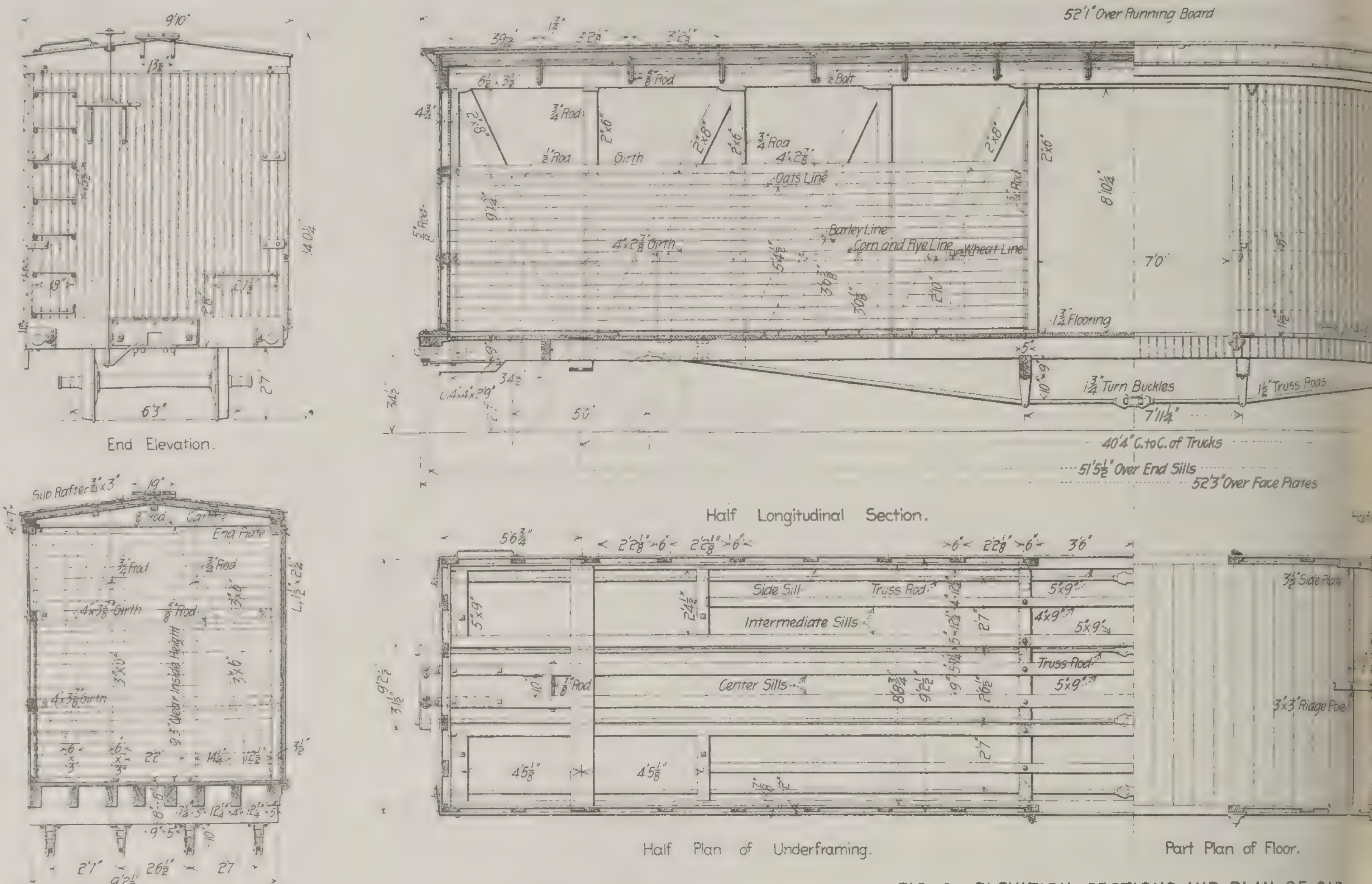
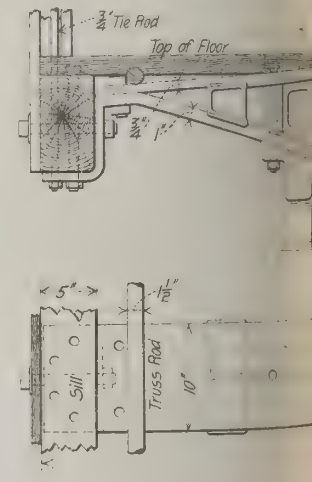
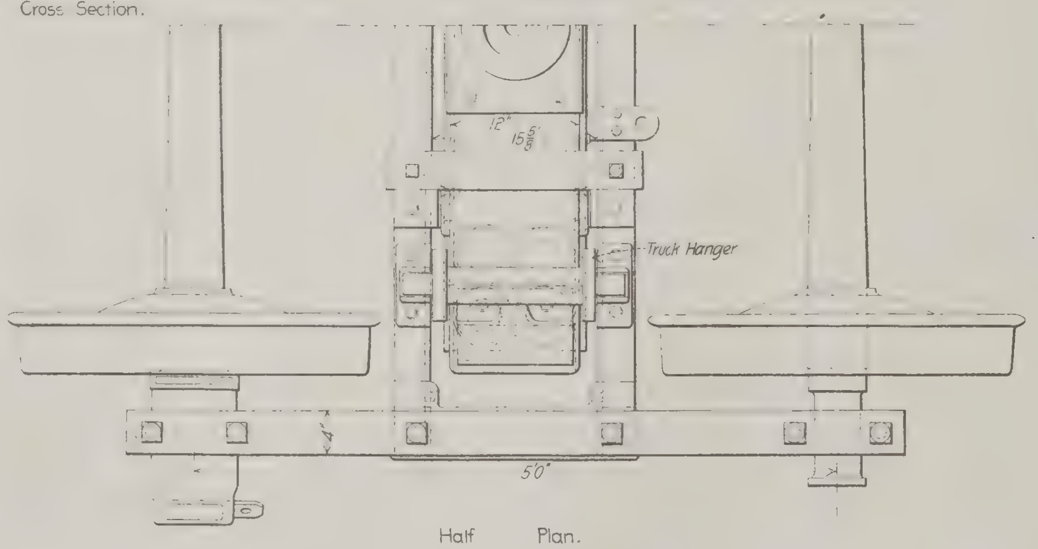


FIG. 2. ELEVATION, SECTIONS AND PLAN OF CAR.





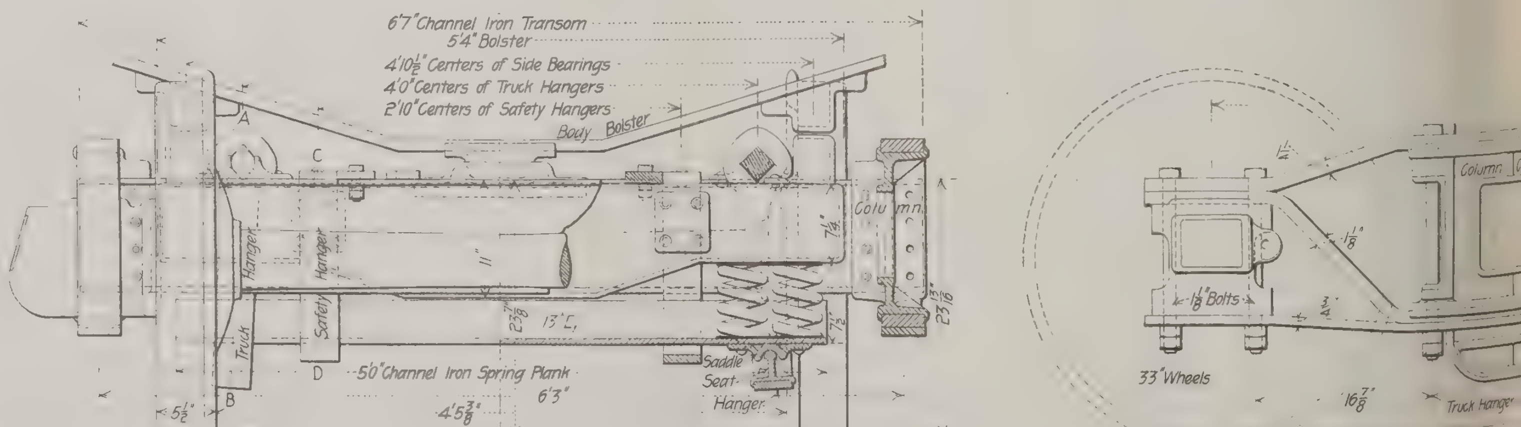
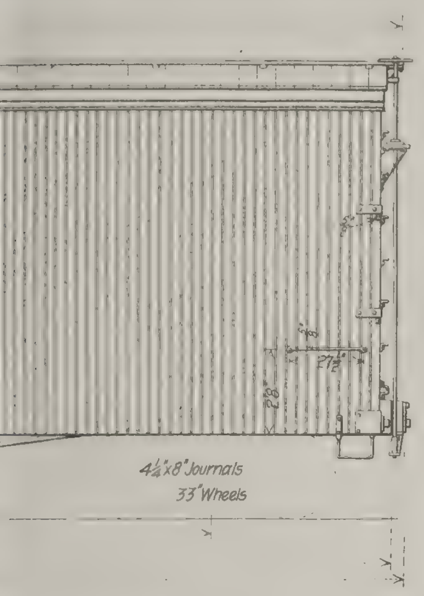


FIG. 5. TRUC

50-FT. FURNITURE CAR OF 60,000 LBS. CAP

Geo. F. Wilson, Superintendent of Motive Power and Equipment.



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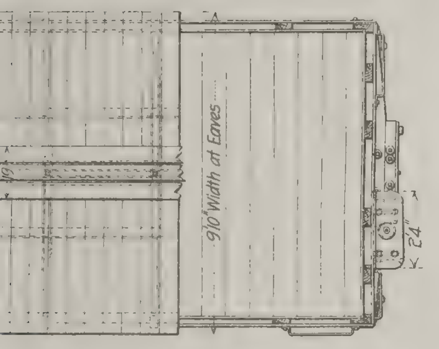
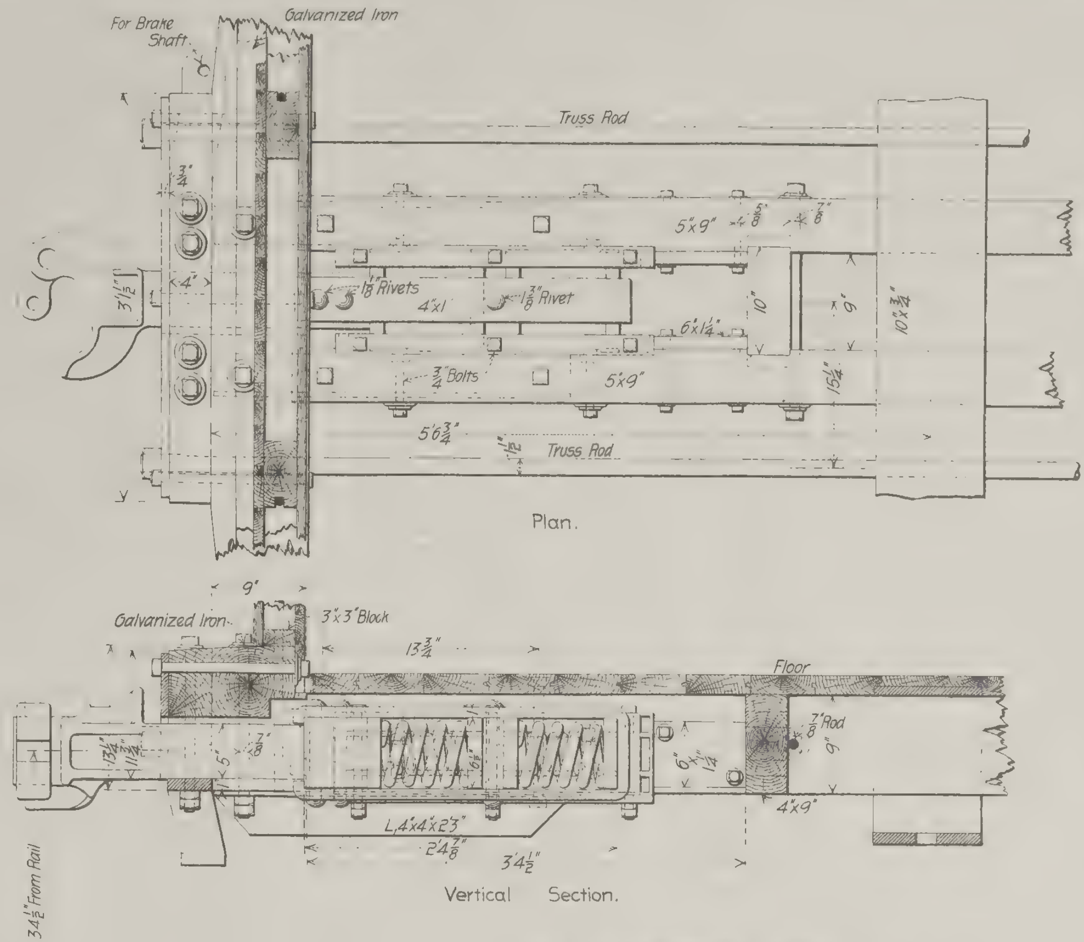


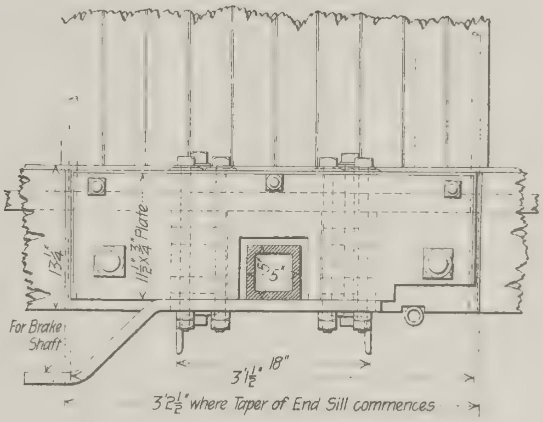
n of Roof.



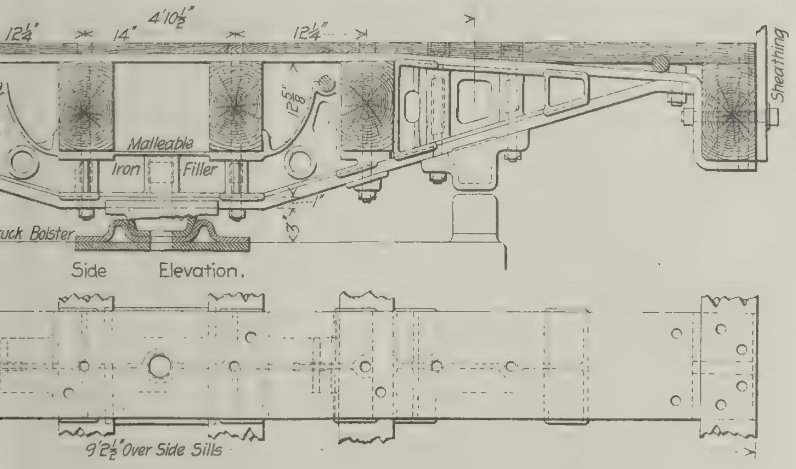
Plan.

Vertical Section.

FIG. 3.
DRAFT RIGGING.



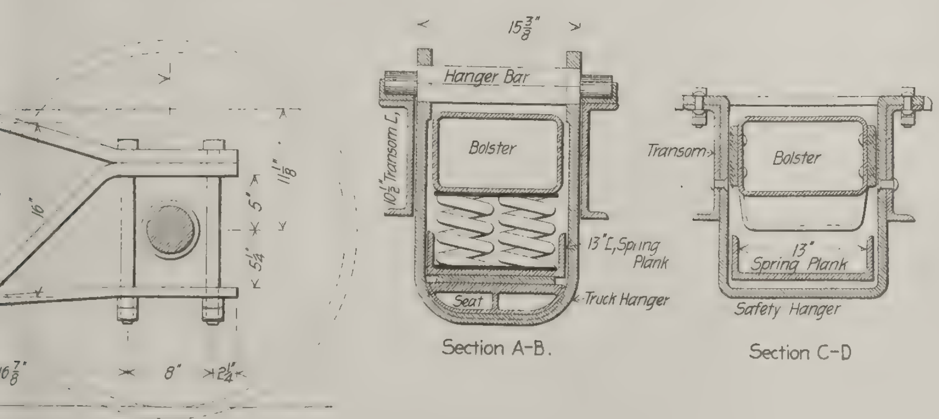
Part End Elevation.



Side Elevation.

Plan.

IG. 4. METAL BODY BOLSTER.



Section A-B.

Section C-D.

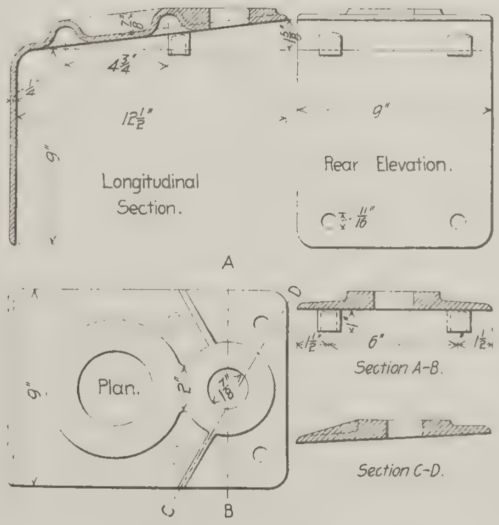


FIG. 6. MALLEABLE IRON CORNER POCKET.

CHICAGO, ROCK ISLAND & PACIFIC RY.

Michigan-Peninsular Car Co., Builders.

CHAS. HART, LITH., 36 VESEY ST., N. Y.

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has no such engineering education at the hands of the Government as is given in this country. Instead he goes from civil life directly to the engine-room, and receives his only training there. He is promoted from time to time as he succeeds in picking up the practical part of his business. There is no preliminary technical course, of any high order, at least; and while the system may produce very good mechanics, it is not calculated to provide that thorough and scientific, as well as practical, knowledge that is now an absolute necessity to efficient service in responsible positions in the engineers' division. As a direct result of this method, the English engineer officer in the navy is regarded as not quite up to the standard of the "English gentleman"; he receives considerably less pay than line officers of the same relative grade, and the same length of service; the position is unpopular among the brighter class of young men, and the opportunities for reaching a high rank in the staff grade are so few that out of 845 engineer officers now serving in the English navy only 14 have reached the relative grade of Captain. As a contrast, there are 65 Admirals and 185 Captains among 1,676 line officers. The "Record" charges this condition to the stupidity and old-fashioned prejudices of the English Admiralty, and practically claims that the ruling line of conduct of this board is based upon a navy now obsolete. The English engineer officers are very modest in their demands for reform, and only ask that they be given executive command over their subordinates and be relieved from the present necessity of reporting the most trivial offences to some line officer.

Our English contemporary seems to think that some concession of this kind would be sufficient, and it regards as a "foolish experiment" the amalgamation of the two classes of officers, which is now proposed in the United States Navy. But the "Record" suggests no way of otherwise avoiding the inevitable conflict of authority between the line and staff officers which occurs under prevailing conditions in the navy. It is well enough to suggest that the executive power of engineer officers should be confined to the engine and boiler rooms; but in a modern warship the engineering department covers a great number of auxiliary engines and mechanical appliances which also require engineers to manage and supervise them. To carry out the suggestion of the "Record," these auxiliary engines, etc., would have to be taken away from the engineer department and placed under the charge of line officers, who, to properly perform the duty thus imposed upon them, should also be trained engineers. Under this view of the case it would be very "foolish" indeed to make any distinction in grade and authority between the two classes of officers; and the interests of the service would be best advanced by making all officers line engineers. This is exactly the amalgamation proposed in the United States Navy and condemned by the "Record."

The fact is that the proposed change in personnel in the U. S. Navy is not the result of an attempt to adjust absurd differences, as to relative rank and dignity, between the line and the staff, but is the direct outcome of a radical change in the methods of conducting naval warfare. Under modern conditions the engineer officer of thirty years ago is almost as obsolete as the sailing-master in the proper performance of duty on a warship.

The objection which has been brought against the proposed amalgamation of the steam engineer officers and the line, is that the duties of the former are technical, and those of the latter are executive, and that men cannot be expected to become proficient in both fields. This argument, however, overlooks the fact that line officers in all the junior grades at the present day are really doing technical and engineering work, quite as much as the commissioned officers in the steam engineering department. The training of the two classes of officers is identical for a large part of the course, and the special work of the young line officers in ordnance manufacture, in torpedo work, in the handling of explosives, is as truly engineering work as the work of the young engineer officers on steam engine and boilers. It is a well-known fact that many line officers who have resigned from the navy have won distinction in the engineering field. Many of the latest and best appliances employed on our warships are the invention of naval officers. They have improved the apparatus for loading 12-in. guns and for handling water-tight bulkhead doors; they have devised range-finders and have applied compressed air to the handling of turrets.

Line officers are now in charge of the electric plant, and in the daily performance of their duty are constantly handling machinery. It only requires a slight extension of their present technical training to fit them for command in the engine-room.

On the other hand, the reason which formerly existed for making the engineer officers a class apart no longer exists. The lieutenant may be as well fitted for future positions of greater responsibility by command in the engine-room as in the turret, by the study of thermodynamics as of ballistics. He must be a competent engineer, if he is to obtain success in either case.

Diplomacy, the knowledge of men and the world, the ability to command and to successfully deal with emergencies of every kind, are all essentials in the make-up of the naval officer of high rank. But these qualities come with time and experience, and are not the direct results of academic training. As the officer gravitates toward a position of command, he will be relieved by younger men of active service in connection with the mechanism of the ship, no matter where located; but he would always possess that invaluable condition in all positions of command—a personal and intimate acquaintance with the duties of his most important subordinates and the possibilities of his ship as a fighting machine.

The successful conduct of our late war by the naval arm of the service is largely due to the thorough training of our naval officers, and their methods and their success have wrung praise from unwilling naval authorities. But the handling of the engines of the "Oregon," in her unprecedented sea-voyage, and the serving of the guns at Manila and Santiago, were alike the work of engineers, and the results reached were alike due to mechanical means; under these conditions there seems to be no good reason why any distinction should be made in pay or position between the officers who did the one piece of engineering work and those who did the other. The evolution in naval warfare has made engineering knowledge the essential, all-important requisite in the naval officer. Every warship must now have its practical mechanics, electricians and trained assistants of all kinds, and men of this class now form the bulk of the crew. But just as the old naval commander was a sailor in command of sailors, it now requires an engineer of a high degree of training to properly direct his mechanical assistants and to handle a ship in which practically every movement is controlled by intricate mechanism.

LETTERS TO THE EDITOR.

Relative Corrosion of Iron and Steel.

Sir: In your issue of Oct. 20 I note a query regarding the relative rate of corrosion of iron and steel and a request for discussion from anyone having experience with the two metals. I would call your attention to a discussion of the subject by me to a paper by Prof. A. H. Sabin in Trans. Am. Soc. C. E., Vol. XXXVI., December, 1896.

Since that was written I have had another examination made of the plates after two years' exposure, with the same general result.

My observation of these plates would not support the statement of your correspondent that steel is much more subject to corrosion than iron. but rather the contrary, that iron was the more susceptible of the two metals.

Yours truly,
L. M. Hastings,
City Engineer.
Cambridge, Mass, Oct. 21, 1898.

[In the discussion referred to, Mr. Hastings tells how he practically tested the effect of water and soil upon uncoated and protected plates of steel, wrought iron and cast iron, and gives the results. Taking the uncoated plates alone, we find those of steel and wrought iron were 6 to 10 ins. square and 5-16-in. thick; the cast iron was about 1 in. thick. These plates were carefully weighed and placed in the water in the pump conduit. This water was a mixture of brook and pond water, fairly soft and containing comparatively little acid. After one year's immersion the plates were examined on Oct. 8, 1896. The two uncoated wrought-iron plates were badly tuberculated and rusted and one of them was "the worst in the lot." The two uncoated steel plates were rusty and tuberculated but "not so badly as iron." The uncoated cast-iron plates were badly rusted and tuberculated. The percentages in increase of weight due to corrosion were as follows: For the two wrought-iron plates, 1.5 and 3.1%; the two steel plates, 1.1 and 2.1%; the two cast-iron plates, 1.0 and 0.96%. The wrought-iron plates buried in sand and in clay also showed greater increase in weight than steel plates similarly placed. Mr. Hastings concludes that, subjected to the action of water, unprotected plate iron was effected the most; steel plate to a less degree, and the cast iron least of all.—Ed.]

Conditions in Havana.

Sir: In fulfilment of the half promise which I made you before leaving for Cuba I now send a few lines from this city. In the first place, all friends of humanity will be glad to know that, largely due to the enormous quantities of food supplies shipped to this port from the United States and Mexico since the raising of the blockade, the evidences of intense misery and starvation have almost disappeared from Havana and its environs. I think any one revisiting Havana, a stranger to the events of the last four years, would be simply struck with the less degree of animation and movement in the streets and the greater number of beggars as compared with his previous recollection.

The streets of the city and the adjoining suburbs of Cerro and Jesus del Monte are about in their normal condition of cleanliness—or filth. The copious rains which are still falling (2.40 ins. were reported in five hours the other evening) are performing the work of the street cleaning department with considerable success, so that Havana at present is as clean as ever, be that saying much or little.

Outside of the city, to the west and south, through the region bounded by the springs of Vento, Mariel, Guanajay, Marianao and the Playa, which is included in the "zone of cultivation," no signs of want and starvation exist. A large part of this territory is under cultivation, and herds of horned cattle and pigs are to be seen. The people look in as good condition as to health and clothing as ever, and demonstrate to a remarkable degree their powers of rapid recuperation. The unfortunate victims of a previous cruel regime are at rest, and the survivors are regaining health and hope. No doubt by looking for them cases of still living victims might be found in a condition worse than death, but it would be necessary to go off the beaten track to find them. I believe that the worst and most permanent effects of past privation will be found in the broken nerves and lowered vitality of the formerly well-to-do inhabitants of Havana and other large Cuban cities. As you know, a large and strong commission, appointed by the President. among whom is Col. Waring, of New York, are now sitting in Havana, and much and radical improvement may be expected if their recommendations shall be carried out. The duties of the commission, as you will recollect, embrace not only the arranging for the landing and encampment of the incoming American troops, but the sanitation of Havana as well.

Speaking broadly and ignoring numerous exceptions, it may be said that the great body of the Spanish population of Havana are desirous of annexation to the United States as giving security to their commercial operations and enhanced value to their real estate. An exception may exist on the part of merchants, especially retail merchants, who are carrying large stocks and dread the competition of American rivals with large capital and low prices. Among the Cubans I should say that the most enlightened and truly patriotic also desire annexation, realizing the difficulty of erecting an independent nation upon a territory somewhat less in extent than the State of New York, and with a total population of at the outside one and a half millions, of which one-third are negroes, and perhaps one-third of the remainder Spaniards or Spanish sympathizers. Among those Cubans who are still dreaming of independence—a noble though unrealizable dream—I think very few are to be found outside of the insurgents still in the field, who do not ardently desire an American protectorate until perfect order and tranquility are established. Does not this really involve a permanent protectorate?

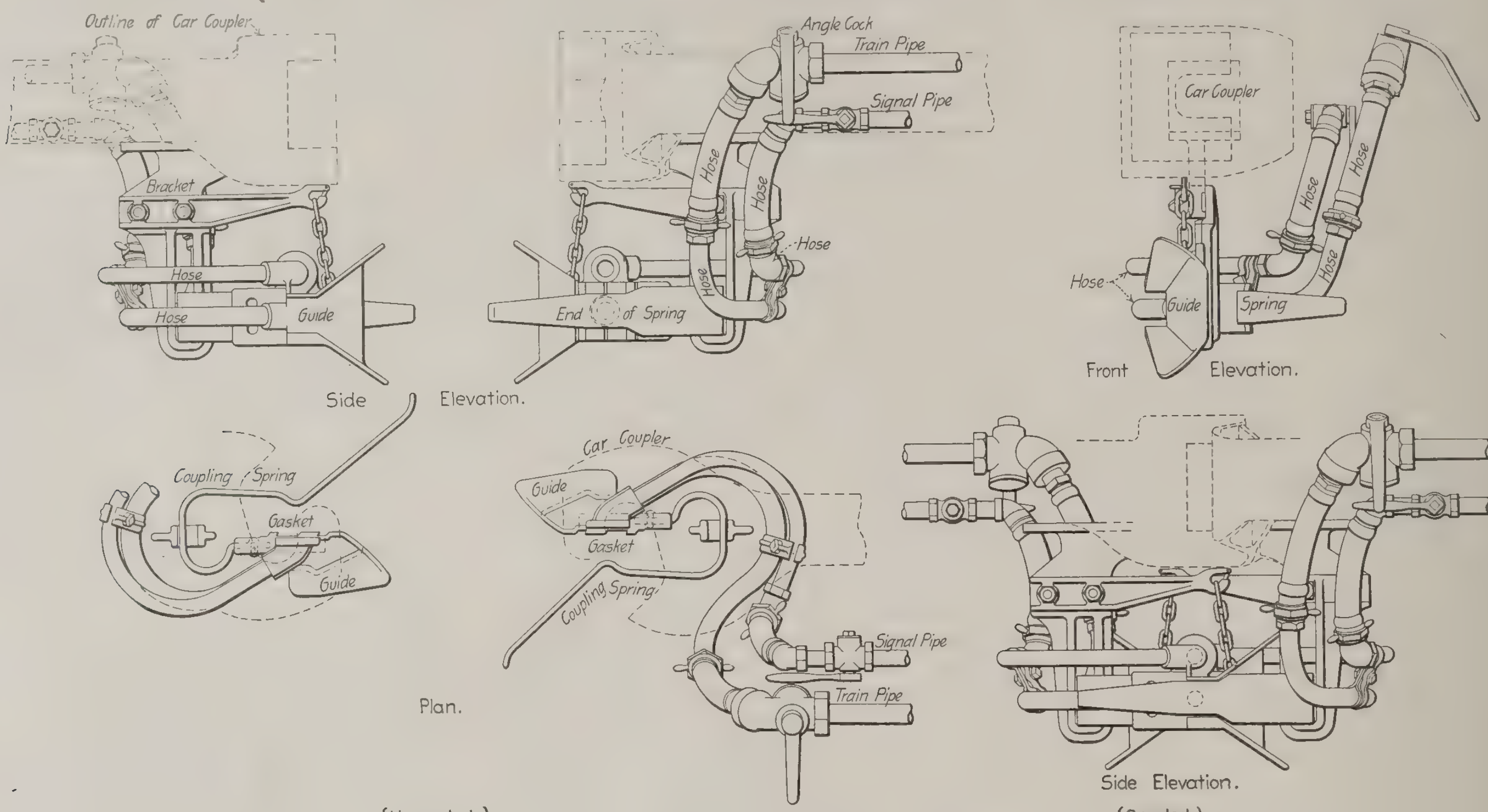
As to business opportunities and private enterprises of all kinds, the whole subject may be disposed of at once by stating that nothing can be safely undertaken until the Spanish troops have been withdrawn, the Cuban troops disbanded, American garrisons established and a able order of things set up, so that titles can be secured, franchises awarded and business carried on upon business principles. It is the object of the various commissions now in Havana to forward these desirable conditions, and it is to be hoped that their efforts will be promptly sustained by our Government. E. S. G.

Hotel Pasaje, Havana, Cuba, Oct. 21, 1898.

◆

AUTOMATIC COUPLERS FOR AIR BRAKE HOSE.

The general introduction of air-brakes and automatic couplers on railway equipment has naturally been followed by attempts to couple automatically the air-brake hose at the same time that the cars themselves are coupled. While various forms of apparatus have been devised for this purpose, but little practical success has been obtained, partly on account of the cost and complication of the apparatus, but mainly, it seems to us, for the reason that the conditions of operation are not such as to demand automatic action. Automatic car couplers were introduced largely to eliminate the danger to life and limb incident to coupling moving cars by hand, but the brake hose cannot be coupled until the cars are already coupled, and are very rarely connected up while the cars are in motion in the yard. There would be somewhat greater safety and a certain saving in time (particularly in uncoupling), but not enough probably to warrant the expense of applying and maintaining an apparatus which would require to be inspected almost as frequently as the ordinary hose coupling, in order to ensure that it is in proper condition and properly coupled. The claims made, however, include a minimum cost of maintenance and a large saving in hose.



(Uncoupled.) (Coupled.)

FIG. 1.—AUTOMATIC COUPLER FOR AIR BRAKE AND SIGNAL PIPES.
Automatic Air & Steam Coupler Co.; St. Louis, Mo.

It will probably surprise many of our readers to know that automatic hose couplers are in regular every-day service, though to a limited extent, and we are indebted to Mr. N. F. Niederlander, President of the American Brake Co., St. Louis, Mo., for particulars of the coupler which is manufactured by that company for the Automatic Air & Steam Coupler Co., of St. Louis.

This device, shown in Fig. 1, is attached to the underside of the car coupler by a bracket, to which is bolted a slotted hanger which supports the coupling spring, and also an arm carrying a chain which supports the coupling head. A short length of hose attached to the existing train-pipe fitting connects by means of a union nut with a pipe which enters the coupling head directly back of the registering rubber gasket. The coupling spring being free in the slotted hanger, and the short hose and chain being flexible, full and free movement is allowed to meet the variations in height of cars and the positions of couplers on curves. The flaring guides or wings on the back of the coupling head, and the projecting end of the coupling spring guide the heads into proper position for coupling under any conditions. The gaskets are so placed on the face of the coupling heads that neither is touched by the opposite member until the coupling is made. This protection of the gaskets is effected by means of an incline groove and strip on the face of the coupling heads, which parts interlock when the gaskets are in position to register. Provision is made to couple with the ordinary hand hose coupling by means of the union nut at the lower end of the short hose. In uncoupling, when the car couplers are released the brake coupler heads will readily separate as the cars are pulled apart.

Fig. 1 shows only the air-brake, and air-signal pipes fitted to the coupling head. The steam pipe fittings are separate and can be readily attached and detached. For freight service the brake hose attachment only need be used. This apparatus has been used on the Wabash R. R. and the Atlanta & West Point R. R. It has been in use for over three years on a passenger train equipped with the brake and signal coupling, and for about a year on two passenger trains equipped with the brake and steam coupling. Several freight cars have also been equipped with the air coupling above. Mr. George C. Smith, President and General Manager of the Atlanta & West Point R. R. and the Western Ry. of Alabama, informs us that the automatic coupling for air and steam hose on passenger cars, and for air hose on freight cars, which has been in use for more than a year, has shown very satisfactory results. This road has two passenger trains equipped with the apparatus, and last spring it was applied to 50 freight cars.

Another apparatus for the same purpose, which has as yet been tried only to a very limited extent, is the Walter automatic air-coupler, invented by Mr. Wm. J. Pugh, of Muscatine, Ia. In this apparatus, shown in Fig. 2, the coupling head is suspended from, but not rigidly attached to the drawbar, the thrust in coupling being taken up by a telescopic strut behind the coupler. A short vertical piece of hose connects the train pipe with the opening on the outer side of the coupling head. In this device, as in the one already described, the gaskets of the joint between the two heads are not forced into contact until the openings register, or coincide with one another. The patents on this latter device are owned by the Walter Automatic Air Coupler Co., 605 First National Bank Building, Chicago, Ill.

◆

A NEW METHOD OF PUMPING BY COMPRESSED AIR.

The accompanying illustration shows in an elementary way the principle of pumping water or other liquids, or semi-liquids, which has been adopted in several different forms of pumping apparatus that are now being put on the market by the Pneumatic Engineering Co., 100 Broadway, New York city. They are made under patents issued to Elmo G. Harris, Professor of Civil Engineering in the School of Mines of the University of Missouri, Rolla, Mo., who is well known as a writer on compressed air, especially in its relation to pumping.

Hitherto in the application of compressed air to the elevation of liquids confined in tanks a large part of the applied power was lost on account of the necessity of allowing the tank full of compressed air to escape into the atmosphere before the tank could be again filled with water.

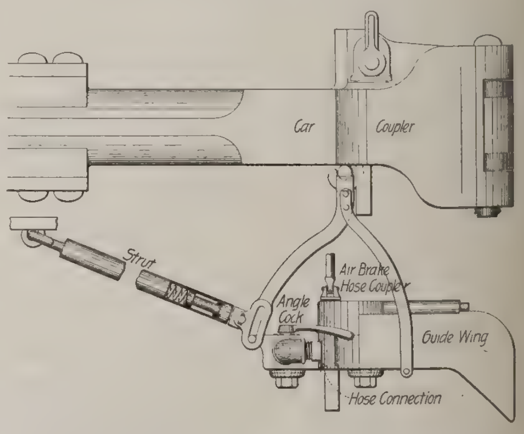


Fig. 2.—Automatic Coupler for Air Brake Pipes.
Walter Automatic Air Coupler Co., Chicago, Ill.

This loss is avoided in Prof. Harris's system by utilizing the stored energy of the compressed air, which would in the older systems be thrown away, to assist in doing the work of the air compressor. The figure shows how this is accomplished. There are two tanks which are alternately filled and emptied. When one tank is full air is admitted directly from the compressor until the water has all been discharged, then an automatic switch valve is turned so as to allow the compressed air remaining in the tank to pass to the suction side of the compressor. When the switch is set as in the figure the air is drawn out of the right hand tank and forced into the left hand tank. The charge of air in the system is so adjusted that when one is emptied the other is just filled. At that moment the switch will reverse the pipe conditions so that action in the tanks will be reversed. Several proposed practical applications of the system are described in a small pamphlet issued by the company, and to which we would refer any of our readers desiring further information.

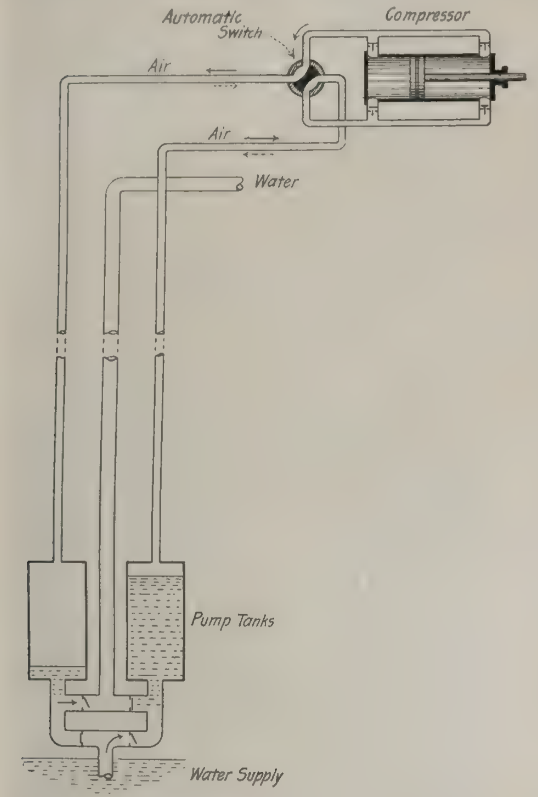


Diagram Illustrating Method of Pumping Water by Compressed Air,
Prof. Elmo G. Harris, Inventor.
Pneumatic Engineering Co., 100 Broadway, New York, Manufacturers.

THE MANUFACTURE OF SILK in the United States, says the Treasury Bureau of Statistics, amounted in 1860 to $6,607,771 in value; in 1870 it was $12,210,662; in 1880, $41,033,045, and in 1890, $87,293,454. It is now estimated that the silk production of the United States amounts to about $150,000,000 per annum in value. Meanwhile the importation of manufactured silks has rapidly fallen: from $38,686,374 in value in 1890, to $25,523,110 in 1898. The raw silk is imported; the amount in the fiscal year ending June 30, 1898, being 10,315,161 lbs., valued at $31,446,800, as compared with $18,918,283 in the previous year. This large increase is partly due to the fact that a number of cotton factories in New England and the Middle States have recently substituted silk manufacturing machinery in place of cotton. Our manufacturers are now exporting silk goods. In 1878 these exports amounted in value to only $19,032; in 1898 the silk exports were valued at $297,074. That there is room for growth in this export business, however, is made evident by the English export of silk manufactures, which amounted to about $5,690,805 in 1897; though this value was $13,321,220 in 1888. German exports have also decreased from $45,000,000 in 1889 to $26,000,000 in 1897. France still heads the list of silk manufacturing countries, and holds its own with a value of $52,283,700 for the silk manufactures exported in 1897. While our manufactures, in 1860, supplied only 15% of the silk goods used in the United States, to-day they furnish 85% of the consumption.

FAST TIME TO AUSTRALIA from New York has been made by the "Fort Salisbury," of the American and Australian Line. This ship, of 4,404 tons register, sailed from New York on Aug. 26 and arrived at Adelaide on Oct. 15; this is 50 days, or the shortest trip yet made between these ports. This line now sends a steamer every third week.

12 NEW STEAMSHIPS are under construction for the Hamburg-American Line, costing about $20,000,000. They are intended for transatlantic service and will ply between Hamburg and New York, Philadelphia and Baltimore. The largest of these vessels is being constructed by the Vulcan Company at Stettin for passenger service between New York and Hamburg. She will be 687 ft. long, 67 ft. beam and 45 ft. depth of hold, with 16,000 tons. Her engines will have 34,000-HP., giving an estimated speed of 24 knots. It is expected to complete the "Deutschland," for such is the name of this enormous vessel, in time for the Paris exposition in 1900.

THE NICARAGUA CANAL CONCESSION expires on Oct. 20, 1899, according to the late decision of a commission of Nicaraguan lawyers convened by President Zelaya. The concession was originally ratified by the Nicaraguan Congress on April 20, 1887, and granted to the Maritime Canal Co. of Nicaragua. But an official act of the Government of Nicaragua declared that the ten years within which the company obligated itself to complete the interoceanic canal commenced on Oct. 20, 1889. This act was signed and officially agreed to by the Minister of Public Works of Nicaragua, and by John Hall, official agent in Nicaragua of the Maritime Canal Co., in the presence of Mr. Mizner, then U. S. Minister to Nicaragua.

THE DEEPENING OF CERTAIN NAVIGABLE creeks on Long Island seems likely to be required of New York city by an act of the last legislature of the State of New York. This act provides that where any city or village diverts fresh water streams from any tide water creek or estuary which were previously navigable for boats of 20 tons burden and by the diversion are rendered unnavigable for that class of boats the city or village in question must dredge the creek or estuary. The constitutionality of the act, known as the Wallace bill (Chap. 469, Laws of 1898) has just been affirmed by Justice Johnson of the Supreme Court, in session at Jamaica, N. Y. The case in which the decision was rendered appears to involve some creeks in the town of Hempstead. It is yet to be established by the court, we presume, whether navigation has been actually affected by diversion for the Brooklyn water supply, which supply is now a part of that of Greater New York.

THE HENNEPIN CANAL is progressing, and the Illinois River division is said to be practically completed, all the locks and dams having been built. On the eastern division the line of the canal has been definitely located from the Illinois River to the feeder junction, 28 miles. The land for the first 24 miles has been condemned and paid for and enclosed by a barbed wire fence. All masonry on the eastern eight miles and the earthwork on the canal trunk and highway bridges is complete. Contracts have been let for the construction of miles 9 to 24 inclusive. Lock foundations 8 to 21 inclusive, and all work on the culverts of this section are complete. All earthwork on miles 9 to 16 is finished with the exception of approaches to locks and highway bridges and filling behind lock walls and the concrete masonry of locks 8 to 18. Highway bridges 1, 2, 3, 4 and 10, including approaches, have been completed. On the western section the route from the feeder junction to the Mississippi River is approved. Nearly four miles of canal trunk are completed, together with locks 36 and 37 and Girard lock, north and south dams, and railway and highway bridges. The right of way has been located from feeder junction to Rock River. The land for the main line of the western section, in Bureau county, will soon be condemned. The location of the feeder line along the Sterling route has been approved. All the right of way for the feeder except one piece of land (which has been condemned), has been secured. Proposals have been opened for constructing earthworks along the first eight miles of the feeder.

THE PATENT LITIGATION concerning the use of aluminum in the manufacture of steel, which has been in the courts nearly four years, has been decided in favor of the United States Mitis Co., complainants, against the Carnegie Steel Co., Limited. The Carnegie Co. appealed from the decision of the lower court, which enjoined it from using the patent, and now that the Court of Appeals has upheld that finding it is said that the Carnegie Co. has taken a license under the patent and made settlement for past infringement.

A NEW ABRADING MATERIAL equal to emery in hardness, according to the claims of Mr. Floryanowicz, the Russian inventor, is made from fire-clay. The clay is thoroughly washed, mixed in a pasty mass, dried and then burned at a temperature of about 2300° F. The described result is a uniformly hard product with a hardness of 8 to 9 on the Mohr scale; this is equal to that of emery. The burned clay is crushed and used for making wheels, etc.

A CIRCULAR SAW FOR CUTTING STONE is being employed in the construction of the buildings for the Paris Exposition. It consists of a steel disk over 6 ft. in diameter, which has about 200 diamonds set in its rim. The saw is mounted upon a suitable shaft, and driven by steam power at about 300 revolutions per minute, for hard stone, at which rate about one foot per minute can be cut. For soft stone steel teeth are used, with diamonds every fifth tooth, and the rate of advance is about 3 ft. per minute. It is estimated that the stone is cut in this way at from ⅛ to 1-10th the cost of hand labor.

NOTES FROM THE ENGINEERING SCHOOLS.

Colorado State Agricultural College, Fort Collins, Colo.—A new mechanical engineering laboratory, 40 × 60 ft., costing $3,000, is now being erected. Funds for its completion have been subscribed by citizens of Fort Collins.

Lehigh University.—Two changes have been made in the instructors of the mechanical engineering department. Instructors Barry H. Jones and L. O. Danse resigned at the close of last term, and their places have been filled by Lucien N. Sullivan, of the Sheffield Scientific School, and John C. Peck, of the Rose Polytechnic Institute.

Dr. C. B. Dudley, of Altoona, Pa., recently delivered a lecture on "What a Chemist Does on a Railroad." Lectures announced in the course in the near future are by John C. Trautwine, Jr., Chief of Water Department of Philadelphia, on "The Water Works of Philadelphia," by Mr. R. W. Hunt, of Chicago, on "The Iron Manufacture in Sweden," and by Mr. Geo. S. Morison, of New York, on "Masonry."

During the past summer the testing laboratory in connection with the civil engineering department has been entirely remodeled. The equipment has been increased by the addition of new machines for torsion and compression tests, while the appliances for testing cement have been made very complete. A comprehensive series of tests on roofing slates has been recently completed, and the result published in pamphlet form under the title "The Slate Regions of Pennsylvania." During the present year researches on methods of testing cement by flexure and impact will be undertaken.

Cornell University.—A new chemical laboratory building 65 × 130 ft., three stories and a sub-basement, is now being erected. It will stand to the north of Morse Hall, the present chemical building, and will be connected with it by bridges from the first and second stories. It will be devoted chiefly to assaying and to research work in inorganic chemistry.

Trinity College, Hartford, Conn.—It is announced that a course in gas engineering will be established next year.

Washington and Lee University, Lexington, Va.—A course of electrical engineering has been established, with Mr. Robert E. Hutton as instructor. Mr. Hutton is the manager of the Lexington Light & Power Co., and is a graduate of Johns Hopkins University.

THE MELTING POINT OF CAST IRON.*

By R. Moldenke,† E. M., Ph. D.

In the rapid development of the art of founding one point seems to have escaped general research, not because it was not recognized, but because the proper appliances were lacking. This is the question of melting and casting temperature, a question all foundrymen deal with daily, and which for some branches of the art means either a successful cast or an utter failure.

The question of whether silicon affects the condition of the carbon contents of a casting or not is coming up again, as it does periodically, analyses by the dozen being quoted to substantiate statements made on either side, and yet we see only an occasional statement that the temperature conditions were as nearly the same as possible. What proof is there of this? The writer has taken the temperature of a ladle of iron which to the eye seemed as hot as melted steel, and yet another ladle full of iron of a different composition, which was dull red, contained the hotter metal of the two. Again from the same tap differences in temperature were found running nearly 200°F. The castings made with the two extremes in this case, though of the same silicon contents, differed widely in the proportion of graphite to combined carbon for the same thickness of section.

No wonder we are told that the silicons do not play so important a part. In one of the determinations described later on, a piece of cast iron was placed side by side with some ferro-chrome, both being under the same cupola conditions. The comparatively thick piece of cast iron heated quickly and melted before the thin piece of ferro-chrome was thoroughly red hot. Thus it will be seen that the eye is a most inaccurate instrument for measuring high temperatures.

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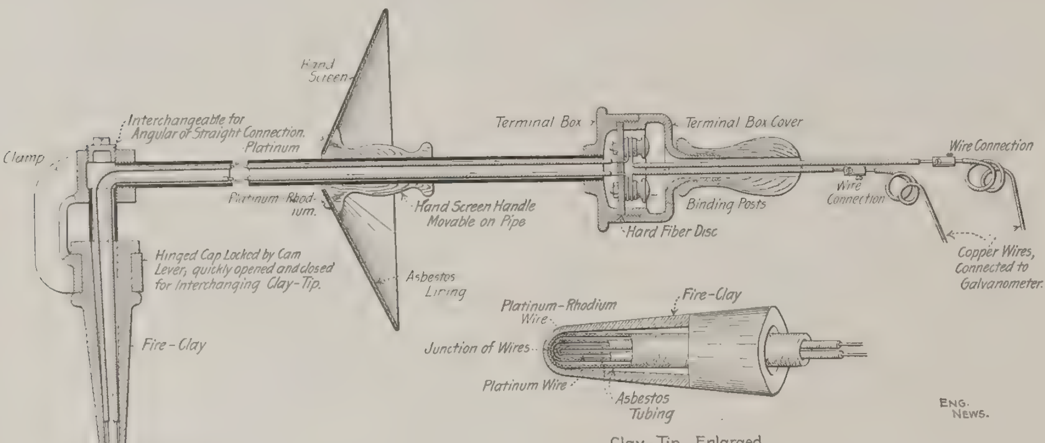
*A paper read before the Pittsburg Foundrymen's Association, Oct. 24.

†48th St. and A. V. Ry., Pittsburg, Pa.

Those who cast heavy work know the danger of pouring either too hot or too cold, many are the devices made use of to test the heat of a ladle full of melted iron. Since these methods are empirical at best, how will we know at least approximately the temperature of our melt? Only by a device capable of withstanding such a severe usage. In looking about for such an instrument the attention of the writer was naturally directed to the latest and admittedly the best form of pyrometer for very high temperatures, the Le Chatelier. This consists essentially of two pieces of wire of a slightly varying composition, a heating of the junction of which produces a current of electricity proportioned to the degrees of heat applied. The amount of this current is measured by a suitably calibrated galvanometer, and thus we can read off the heat at any convenient distance rapidly and with a surprising degree of accuracy.



Clay-Tip, Enlarged.

FIG. 1.—SECTION OF LE CHATELIER PYROMETER AS MODIFIED FOR MEASURING TEMPERATURE OF MOLTEN IRON.

A New Pyrometer.

Unfortunately, this wonderful instrument, one wire of which is of platinum, the other of an alloy of platinum and 10% of the rare metal rhodium, cannot be immersed directly in the melted iron—there would soon be an end to this expensive thermo-couple. The long porcelain tube which protects it when used in kilns is worse than useless in a ladle full of metal, and so at the suggestion of the writer the Pittsburg representative, the Vulcan Mfg. Co., set about remedying the matter and devising some protective cover which would allow experiments of this kind to be carried out readily. The outcome, while not having the advantage as yet of an extended period of trial, was, nevertheless so happy a solution that it is presented to-night for the first time and to the Pittsburg Foundrymen's Association with the hope that much of value may be learned with it, not only in our daily work, but also in connection with the many intricate problems still before us which await solution at the hands of those willing to give their time and energy to such an exacting study.

Fig. 1 shows a section through the instrument. The platinum wire will be noticed running from the terminal box through an iron pipe ending at the inner side of the point of the clay tip. Here is the button made by the fusion to the other wire of platinum and rhodium alloy which runs back, parallel to the platinum wire, to the terminal box. Both wires are covered with asbestos to insulate them from each other and from the iron frame as well as to serve as a protection in case the tip breaks while in the molten iron. The interchangeable connection holding the clay tip allows it to point out straight for use in small ladles or in experimenting, or it may come down at right angles for taking temperatures in large ladles full of metal. A third form, not completed in time for illustration purposes, has a ball and socket joint which allows the tip to stand out at any angle. A movable shield lined with asbestos protects the hand.

Fig. 2 shows two of the styles of the pyrometer, and Fig. 3 the method of using the angular form. In the terminal box are placed the connections which allow wires of any convenient length to run through the handle and connect with the galvanometer. The galvanometer itself is a "D'Arsonval," specially gotten up and calibrated for industrial purposes. The original form with the reflecting mirror, and capable of reading to one-half degree at these high temperatures, was found too cumbersome and delicate for factory use.

The sensitiveness of the couple, even though protected by a refractory material, is such that plunging it cold into the melted iron the correct reading is obtained in 1¾ minutes. When heated up to redness beforehand, however, this time is reduced to not many seconds.

It would be beyond the scope of this paper to show the many uses to which such an instrument can be put in the steel and iron trade. On the question of annealing alone it will pay for itself in a short time, and when its capabilities in foundry practice come to be investigated and generally understood, one more safeguard will be added to those already helping us to increase the efficiency of our plants.

Test of the Melting Point of Various Irons.

The material experimented with was gathered for several years, some of it being furnished by Mr. Jos. Seaman, Mr. Thomas D. West and Mr. J. E. McDonald, members of this Association, and the especially interesting alloys by Mr. R. McDonald, of the Crescent Steel Co.

There were 48 pig irons, embracing both foundry and Bessemer brands as well as softeners, made with coke and with charcoal, both cold and warm blast. Seven of the 15 cast irons were of the shape seen in Fig. 4, being melted right from the tip. The balance were of the sand and chill rolls made by Mr. West in his recent experiments. Two steels and nine alloys of chromium, tungsten and manganese with iron, complete the list of 73 specimens.

The melting was done in an assay furnace converted for the time into a cupola. A jet of steam entering the stack in the side near the top induced the blast, the air being drawn in all around the bottom. In this form it is really the "Herberz" cupola of European fame and excellent for small diameters. A hole was broken into the wall just below the charging door, which must be kept closed when not used. This hole allows the introduction of the pieces of pig iron, etc. After heaping up enough coke to last for some time, the piece of pig iron (of full section and about 5 ins. long), was driven into the bed, surrounded by incandescent coke and the opening closed with a tile. After it was red hot the tile was removed, the pyrometer inserted and pushed against the center of the pig where the borings were taken for the analysis. The temperature as registered by the pyrometer rose rapidly, then more slowly, remaining stationary while the iron melted slowly. Then, as the point finally became uncovered, the temperature jumped up, going above 2,000° F. In this way the results noted in the accompanying table were obtained.

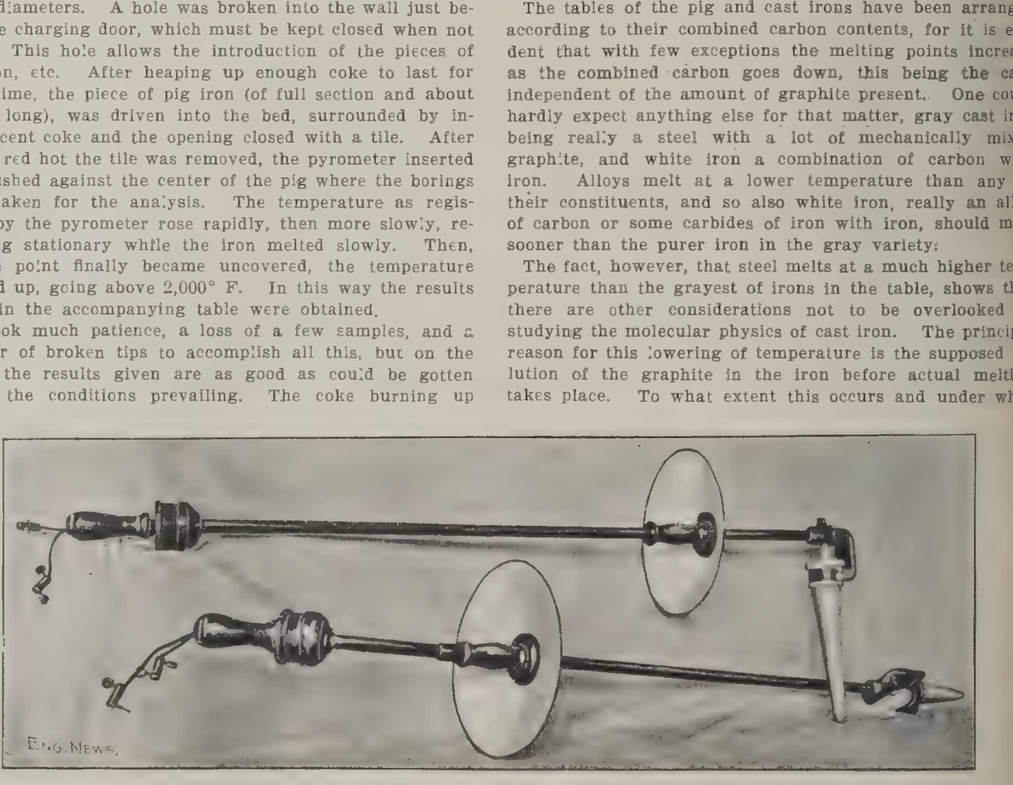


FIG. 2.—PERSPECTIVE VIEWS OF "ANGLE" AND "STRAIGHT" PYROMETERS.

It took much patience, a loss of a few samples, and a number of broken tips to accomplish all this, but on the whole the results given are as good as could be gotten under the conditions prevailing. The coke burning up would let the iron drop a little, and a failure to adjust the pyrometer to suit (the opening being closed by a piece of sheet iron, to prevent undue cooling by air drawn in), meant a break in the tip, which, while not affecting the results, caused subsequent delay and trouble.

The following general observations were made: The white irons held their shape, the iron running from the sides and bottom freely, leaving smooth surfaces. The gray irons became soft, dropped in lumps, leaving a ragged surface. Ferro-manganese samples became soft and mushy, exhibiting a consistency of putty before finally running down. Ferro-tungsten behaved most marked. As it melted it acted like white iron, but instead of chilling quickly it ran through the coke, coming down the spout in thin streams like white hot quicksilver, only setting after collecting in a pool in the pan of sand.

The cupola was fluxed heavily with fluor spar to take care of the ash, for it was a case of a furnace full of incandescent coke and only one piece of iron in it. The accompanying tables give the results:

TABLE I.—Melting Points of Various Pig Irons.

No.	Melting point. deg.F.	Combined carbon.	Graphite.	Silicon.	Manganese.	Phosphorus.	Sulphur.
1.	2,030	3.98	....	0.14	0.10	0.220	0.037
2.	2,040	3.90	....	.28	.11	.216	.044
3.	2.040	3.74	0.14	.38	.16	.172	.032
4.	2,070	3.70	...	.26	.09	.198	.033
5.	2,100	3.52	.54	.47	.20	.200	.036
6.	2,040	3.48	...	.36	.09	.240	.040
7.	2.055	3.22	.68	.71	.09	.142	.038
8.	2,010	3.21	.20	.45	.18	.198	.037
9.	2,110	2.28	1.14	.42	.13	.185	.026
10.	2,140	2.27	1.80	.45	1.10	1.465	.032
11.	2,150	2.23	1.58	.42	.16	.415	.045
12.	2,170	1.96	1.90	.75	.63	.097	.028
13.	2,170	1.93	1.69	.52	.16	.760	.036
14.	2,170	1.87	1.85	.56	.46	.713	.027
15.	2,150	1.84	1.95	.56	.34	.175	.022
16.	2,190	1.72	2.17	1.88	.54	.446	.028
17.	2,200	1.69	2.40	1.81	.49	1.602	.060
18.	2,230	1.54	2.08	2.02	.39	.632	.062
19.	2,190	1.49	2.26	2.54	.50	.349	.038
20.	2,210	1.48	2.30	1.41	1.39	.168	.033
21.	2,190	1.47	2.63	.89	.48	.164	.037
22.	2,190	1.36	2.41	1.65	.32	.160	.038
23.	2,210	1.31	2.70	1.25	.76	.170	.022
24.	2,210	1.31	2.40	1.69	.46	.085	.039
25.	2,230	1.24	2.68	.65	.26	.201	.020
26.	2,230	1.23	2.70	1.20	.37	.299	.022
27.	2,230	1.12	2.66	1.13	.24	.089	.027
28.	2,200	.90	3.07	1.09	.33	.176	.014
29.	2,230	.87	3.10	1.34	.42	.158	.030
30.	2,210	.84	3.07	2.58	.47	2.124	.051
31.	2.260	.83	3.26	1.97	.59	.210	.018
32.	2,230	.80	3.22	1.30	.59	.172	.042
33.	2,250	.80	3.16	1.29	.50	.218	.020
34.	2,250	.80	2.89	2.21	.25	.411	.041
35.	2,250	.67	3.60	1.32	.20	.205	.020
36.	2,240	.59	3.15	1.50	.61	.094	.032
37.	2,230	.47	2.84	2.19	.65	1.518	.042
38.	2,250	.38	3.43	2.44	.57	.422	.048
39.	2,250	.35	3.44	2.07	.28	.448	.039
40.	2,260	.35	3.70	3.29	.82	.501	.038
41.	2,260	.24	3.48	2.54	.30	.060	.020
42.	2,280	.13	3.43	2.40	.90	.082	.032
	Softeners, Ferro-silicons, and Silico Spiegel.						
43.	2,190	3.38	.37	12.30	16.98	....	....
44.	2,040	1.82	.47	12.01	1.38	....	....
45.	2,090	2.17	.72	10.96	1.34	....	....
46.	2,155	1.35	1.60	9.40	.32	....	....
47.	2,145	1.57	1.36	8.93	.39	....	....
48.	2,170	1.77	1.80	4.96	.39	....	....

The tables of the pig and cast irons have been arranged according to their combined carbon contents, for it is evident that with few exceptions the melting points increase as the combined carbon goes down, this being the case independent of the amount of graphite present. One could hardly expect anything else for that matter, gray cast iron being really a steel with a lot of mechanically mixed graphite, and white iron a combination of carbon with iron. Alloys melt at a lower temperature than any of their constituents, and so also white iron, really an alloy of carbon or some carbides of iron with iron, should melt sooner than the purer iron in the gray variety.

The fact, however, that steel melts at a much higher temperature than the grayest of irons in the table, shows that there are other considerations not to be overlooked in studying the molecular physics of cast iron. The principal reason for this lowering of temperature is the supposed solution of the graphite in the iron before actual melting takes place. To what extent this occurs and under what circumstances is not known, but may account for the difference in the melting points of steel and gray iron.

Again, in melting steel in the cupola commercially, an absorption of carbon from the fuel takes place, the melting point is doubtless lowered a little, and the results obtained are tangible, even though care must be taken to get the whole of the charge down before pouring. In the air furnace the steel absorbs carbon by contact with the pig iron charged and melts off, the wasting of wrought iron or steel poking bars used for rabbling giving evidence of this occurrence.

The writer is especially pleased to see the full corrobora-

TABLE II.—Melting Points of Various Cast Irons

No.	Melting Point.	Com. Carbon.	Graphite.	Silicon.	Manganese.	Phosphorus.	Sulphur.	Remarks.
49	2000°F.	4.67	.03	.57	.22	.266	.044	Cast into chill roll (Mr. West).
50	1990	4.20	.20	.63	.33	.254	.040	" " "
51	2010	4.08	......	.89	.06	.287	.040	" dry sand.
52	2000	3.90	.16	.75	.66	.240	.030	" chill roll (Mr. West).
53	2030	3.62	......	.72	.14	.193	.026	" dry sand.
54	2030	3.48	......	.47	.09	.190	.032	" "
55	2040	3.40	......	.42	.07	.196	.029	" "
56	2170	1.63	2.27	1.46	.50	.092	.032	" "
57	2210	1.60	3.16	.59	.25	.271	.048	No. 48 in sand rolls (Mr. West).
58	2250	1.57	2.90	.66	.31	.237	.040	No. 49 " " "
59	2240	1.22	2.66	1.69	.47	.274	.037	Cast into dry sand.
60	2250	1.20	2.90	.75	.66	.248	.030	No. 51 in sand rolls (Mr. West).
61	2260	.17	3.57	2.09	.43	.272	.042	Cast into green sand.
62	2080	1.95	1.28	11.64	.98	......	......	Remelted ferro-silicon No. 5, cast into chill roll (Mr. West).
63	2080	1.81	1.36	11.70	1.00	......	......	Remelted ferro-silicon No. 5, cast into sand roll (Mr. West).

tion of Mr. West's elaborate experiments with the melting of white and gray irons. The contrast is remarkably sharp, and on the whole it shows us that science and practice go hand in hand admirably, no matter what the field may be. Whatever theories may develop regarding the melting of iron, whatever the effect of high or low phosphorus, silicon, manganese and sulphur may be shown to be on the melting point of an iron eventually (the present series of irons not being well enough adapted for this phase of the question), the results here given are, it is hoped, of sufficient value to stimulate further research of practical value to the founders of cast iron.

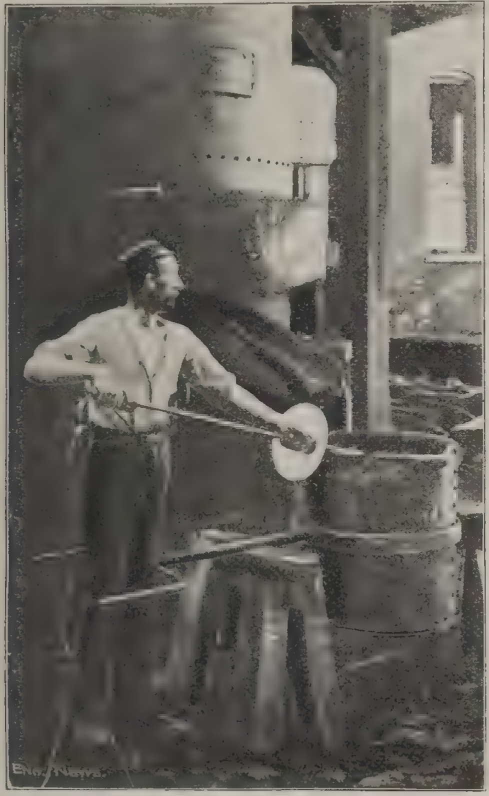


Fig. 3.—Testing Temperature of a Ladle of Molten Iron With Angle Pyrometer.

BOOK REVIEWS.

PURIFICATION OF THE OHIO RIVER WATER AT LOUISVILLE, KY. Report to the President and Directors of the Louisville Water Co., by George W. Fuller, Chief Chemist and Bacteriologist to the Louisville Water Co.; formerly Biologist in Charge of the Lawrence Experiment Station, State Board of Health of Massachusetts; Member of the American Chemical Society, etc. Published under agreement with the directors. New York: D. Van Nostrand Co. Cloth; 4to.; pp. 461; many tables and eight full-page plates. Price, $10.

For the past three years the attention of a large number of those interested in water purification has been directed to certain investigations of the subject at Louisville, commonly referred to as the Louisville experiments. At the start it was generally understood that these investigations would be limited to mechanical filtration and that the results would be available to the public within a year or less. But both the scope and length of the investigation was extended. Certain so-called electrical methods of water purification and of producing coagulation were included, together with more detailed studies of sedimentation, and the final report was not presented to the company by Mr. Fuller until two years after he assumed charge of the tests. Another year elapsed before the report, advance sheets of which have just been received by us, was off the press. More than one city has postponed the adoption of a much-needed system of water purification, largely to await the result of the Louisville experiments. The report now before us is a monumental piece of work, which does great credit to the Louisville Water Co. and its officials, to Mr. Fuller and his assistants, and to the several companies and gentlemen who met the expense of installing and operating the test plants. At the beginning of this review we wish to caution our readers that while this report marks an era in the development of water purification in some respects more notable than the special report on "The Purification of Sewage and Water," published by the Massachusetts State Board of Health in 1890, the Louisville studies, like those at Lawrence, were confined to the waters of one river and mostly to one general method of purification. It is true that the Ohio River at Louisville is in many respects typical of a large class of water supplies in the West and South, as is the Merrimac at Lawrence of many water supplies in the North and East. But it should be constantly kept in mind that there are variations in each class, due to local conditions, especially in the Southern and Western waters, which demand special investigations for each source of supply if the highest efficiency and economy of purification are to be obtained.

TABLE III.—Tests of the Melting Point of the Same Irons Cast in Sand and Cast in Chills.

No.	Combined Carbon.	Graphite.	Fracture.	Melting Point.	
57	1.60	3.16	Gray	2210°F	same ladle.
49	4.67	.03	White	2000	
58	1.57	2.90	Gray	2250	same ladle.
50	4.20	.20	White	1990	
60	1.20	2.90	Gray	2250	same ladle.
52	3.90	.16	White	2000	

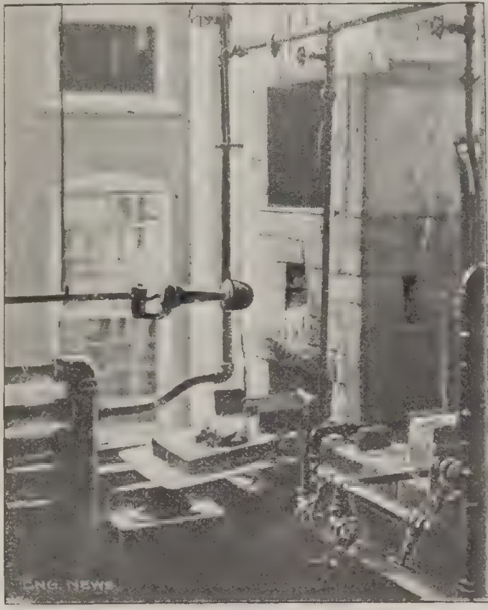


Fig. 4.—Experimental Cupola Showing Piece of Cast-Iron to be Melted, on the Tip of the Pyrometer, Before Thrusting it Into the Furnace.

Perhaps it should be stated, although most of our readers must know it, that the problems presented in the purification of the Ohio River water are the removal of suspended matter, in the most widely varying quantities, and also the removal of bacteria, some of which are of sewage origin. The water is not well suited for boiler purposes, and while the removal of mud improves it in this respect, some of the methods proposed add to the corroding and incrusting qualities of the water, necessitating a careful study of this phase of the subject.

Mr. Fuller took charge of the investigations on Oct. 1, 1895. The plan then being carried out was to test certain commercial systems of water purification on a working basis, each system to be designed for a daily capacity of 250,000 gallons, which was then the unit employed by the mechanical filter companies. The proprietors of each system were to install and operate their respective plants without further expense to the Louisville Water Co. than that involved in pumping the water and in testing the results by means of a proper engineering, chemical and biological staff. Three companies entered the tests: The O. H. Jewell Filter Co., of Chicago; the Cumberland Manufacturing Co., of Boston, proprietors of the Warren Filter, and the Western Filter Co., of St. Louis. Each company installed a 250,000-gallon gravity filter and the Western Company installed in addition a pressure filter of the same capacity. Later on tests were made of electrical methods of testing water submitted by the John T. Harris Co.,of New York,and Palmer & Browrell of Louisville. There was also tested a polarite filter and accessories, submitted by Mr. John MacDougall, of Montreal, this system being known abroad as the Howatson, and as the International process. While the Western pressure filter, the electrical methods of treatment and the polarite system are described and the results given in detail, none of them were considered as at all suitable for Ohio River water and they are not included in the final summaries. The systems so included are the Warren, Jewell and Western gravity filters and independent studies made by the Louisville Water Co. on sedimentation alone, sedimentation aided by coagulation, filtration and coagulation, the best coagulant, and the electrolytical production of coagulants. An appendix contains a technical description of the methods used for the collection of samples of water, the principal features in the methods of analysis and tables for the conversion of the various unit quantities employed. The eight full-page plates show a plan of the experiment station, plans and sections of mechanical filters and typical areas of the strainer floors of the filters.

TABLE IV.—Melting Point of Iron Alloys and Steel.

No.	Melting Point.	Carbon.	Silicon.	Manganese.	Chromium.	Tungsten.	Remarks.
64	2450°F.	1.18	.21	.49	....	....	Steel
65	2350	1.32	.29	1.27	3.40	6.21	Steel
66	2280	......	......	....	....	39.02	Ferrotungsten
67	2240	......	......	....	....	11.84	Ferrotungsten
68	2255	5.02	1.65	81.40	....	....	Ferromanganese.
69	2210	6.48	.14	44.59	....	....	Ferromanganese.
70	2400	6.80	......	....	62.70	....	Ferrochrom
71	2230	6.40	......	....	19.20	....	Ferrochrom
72	2260	1.20	......	....	19.10	....	Ferrochrom
73	2180	1.40	......	....	5.40	....	Ferrochrom

The outline given above conveys an idea of the general scope of the investigations and report, but the exhaustive character of the tests, the detail in which the apparatus, methods employed and results obtained are presented and the judicial spirit shown in drawing the conclusions can be gathered only by a careful reading of the report. Each system of purification is described with a minuteness almost sufficient to serve as specifications for duplicating it. The difficulties experienced in operation and the changes made to overcome them are given. The log of the tests is presented almost in full. And, finally, all the accumulated evidence is carefully weighed and the results obtained are clearly set forth, both as relates to the efficiency and the cost of operation of each plant.

The final conclusion of the report, which relates especially to mechanical filtration, as the term is commonly understood, is as follows:

> The general method of subsidence, coagulation, and filtration is applicable to the satisfactory purification of the Ohio River at Louisville; but, as practiced by the Warren, Jewell, and Western systems during these tests, its practicability is very questionable if not inadmissible. By removing the bulk of the suspended matters from the water, large reductions could be made in the size of filter plant, amount of coagulant and cost of operation. On the basis of 25,000,000 gallons daily, these reductions when capitalized at 5% would represent about $700,000. There is no room for doubt but that for a less sum than this satisfactory provisions for subsidence as outlined herein could be provided, which would not only aid in furnishing a filtered water of better quality, but would also give the water consumers a better service in other regards.

This conclusion, when separated from the discussion leading to it, needs to be supplemented by the statement that for the Ohio River water, with its varying character and occasional vast amounts of suspended matter, the systems in question need a number of modifications, the chief of which is greatly increased facilities for sedimentation. The only other conclusions which space permits mention of here are that sulphate of alumina is the best coagulant for use at Louisville, and that it can be bought much more cheaply in its ordinary commercial form than it can be prepared electrolytically.

THS BUFFALO MEETING OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.

The 75th meeting of the Institute was held in Buffalo, N. Y., beginning on Tuesday evening, Oct. 18. At the first session, held in the Public Library Building, addresses of welcome were made by the Mayor of the city and other prominent citizens, which were responded to by President Kirchhoff. Mr. F. P. Ricketts read a paper on "Slips and Explosions in the Blast Furnace," which was illustrated by lantern slides. An exhibition of stereopticon views was then given by Mr. Theodore Dwight, including several pictures taken at night and some photographs colored in the toning solution. This was followed by an informal reception.

The Wednesday morning session was devoted to the reading and discussion of a paper on "Multiple Tuyeres for Blast Furnaces" by B. F. Fackenshal. The discussion was a long one and was of much interest to blast furnace managers, many of whom were present. In the afternoon a steamboat excursion was taken on the lake. Visits were made to the Great Northern Elevator, the Union Iron Works and the Buffalo Furnace Co.

Sessions were held on Thursday morning and afternoon for the reading and discussion of papers. The morning session opened with the reading of a long list of names of members recently elected. A paper by Mr. Frank Firmstone on "Notes on the Forms Assumed by the Charge in the Blast Furnace" was presented. It had been previously printed and distributed to the members, but none of those present cared to discuss it. Mr. Bertrand S. Summers' paper on "Modern Cupola Practice, with Special Reference to the Physics of Cast Iron," which had also been printed in advance, was then taken up, and quite a long discussion followed, including written communications from absent members. The discussion showed that experts in foundry practice are still at variance in regard to what is called in the paper the "silicon fad." The ideas of the paper were strongly commended by some and as strongly condemned by others. Mr. W. R. Webster's paper on "The Relations Between the Chemical Constitution and the Physical Character of Steel" was then discussed at some length. This was followed by a brief discussion of Mr. W. H. Blauvelt's paper, "A Description of the Semet-Solvay By-Product Coke Oven Plant at Ensley, Ala." Mr. C. C. Upham then read from manuscript a paper on "The Effect of Sizing Upon the Removal of Sulphur from Coal by Washing." The Secretary, Dr. Raymond, made brief statements concerning some of the papers that had been prepared for the meeting but which there was not time to discuss, and other papers were "read by title." The morning session was rather poorly attended, but the afternoon session was only an apology for a meeting. Mr. Blue was to read his paper on "Corundum in Ontario," and as few of those present cared whether there was corundum in Ontario or not and the afternoon was a delightful one in which to make trips around the city, it was only by considerable urging of the men scattered around the hotel vestibule and parlors that an audience of about a dozen was collected to listen to the paper, which was a long one and was read from manuscript. It is a paper that will be a credit to the "Transactions" when it it published, but is not the kind to be read in full before an audience even of mining engineers.

The Institute is to be complimented upon the progress it has made during the past ten years in the direction of a proper system of treating its professional papers at the meetings, but it is still a long way behind the practice of other societies. The papers were divided into four classes, viz., 13 papers which had been printed in advance of the meeting and mailed to members, five papers in type but not finally corrected, proof copies being furnished on application; eight papers not in print, to be presented by the authors, or in their absence by the secretary; three papers read by title only for subsequent publication and discussion. The programme of the meeting contained this interesting announcement concerning the papers: "It is impossible to say precisely at which session any given paper will be presented, much depending upon the presence of authors and other circumstances." Nothing could be better calculated to discourage attendance at the professional sessions of the meeting and to decrease the number of those attending the meeting.

Notwithstanding the lack of interest in the sessions the meetings of the Institute as a whole are fairly well attended considering the great extent of territory, the whole world in fact, over which its members were distributed. Over 160 were registered as in attendance at the Buffalo meeting, including ladies and guests. Socially the meeting was a great success, as all meetings of the Institute are. The excursions to various places in Buffalo by different small parties were numerous and full of interest. All of Friday was given up to these excursions. On Friday evening the whole party went to Niagara Falls, where a session was held in the International Hotel to listen to Mr. F. H. Davis' paper on a "New Method of Drilling Holes of Large Diameter in Rock." On Saturday excursions were made to places of interest around the Falls, including the electric power plants and various manufacturing establishments in the vicinity.

We give below brief notes concerning the papers presented at the meeting:

1. The Kytchtym Medal. By Dr. Persifor Frazer. Philadelphia.—This was a brief paper describing a souvenir medal cast at the Kytchtym Iron Works in the Eastern Urals, on the occasion of the visit of the International Geological Congress, which met in Russia last year. The medal is a fine example of medal work in cast iron, showing great perfection of detail. Analyses of the iron and of the ores from which it is made were given.

2. Modern Cupola Practice, with Special Reference to the Discussion of the Physics of Cast Iron. By Bertrand S. Summers, Chicago, Ill.—This paper was printed in condensed form in our issue of Oct. 6.

3. The Relations Between the Chemical Constitution and the Physical Character of Steel. By Wm. R. Webster, Philadelphia, Pa.—This paper is chiefly a resume of previously published papers on the subject. Mr. Webster gives tables of both of his own investigations and of those of Mr. H. H. Campbell, Prof. H. M. Howe, Mr. A. C. Cunningham and others. His concluding remarks, given below, are of timely interest:

> In this practical age it will be asked, "What is the actual value of all this, and is it worth while to bother any more about it?" The answer is that already the steel-maker depends more and more every year on the very points that we have been discussing, and the engineer should know what he is doing when he uses both chemical and physical limits in his specifications. Is it to be wondered at that to-day we have specifications in which the chemical requirements do not all agree with the ultimate strengths specified? This in the ordinary home-orders may make very little difference, as it is an easy matter to investigate and make proper modifications required, but in specifications from foreign railroads or engineers at a distance, for material on export orders, it is a very different matter. There is no time to refer questions of this kind, and the inspector is sometimes forced to condemn material that he knows from experience is all right. It may give better physical tests than were called for, but not conform to the chemical requirements in the particular specifications in question, though it would meet both the physical and chemical requirements of our leading engineers and railway companies in this country. Some of these foreign specifications are so worded, and the requirements are such, that it is not safe for an American manufacturer to bid on the orders. This may be due in part to their not understanding all of the conditions under which the tests are to be made. In other cases it seems as though modifications must have been made on previous orders, either in the chemical requirements or physical tests called for, as no steel was ever made that would meet all the requirements of chemical and physical tests in some such specifications.
>
> Many export-orders for rails call for phosphorus not over 0.6%, while the sulphur is allowed a much higher limit, or not specified at all. This low phosphorus cuts out several of our largest steel works, whose material will meet all of the physical tests called for, being low in sulphur and under 0.10% phosphorus, and giving entire satisfaction to our leading engineers and railroad companies. The foreign manufacturers of basic Bessemer steel and low-phosphorus acid Bessemer steel are working the low-phosphorus clause for all it is worth, just as our manufacturers would do under similar circumstances; but we, as engineers, want to know if there is any good reason for this distinction, which is made on account of local conditions, and if the high sulphur is not as undesirable as the phosphorus would be up to the limit of 0.10% usually allowed in this country?
>
> This is a matter that should be thoroughly discussed and on which opinions should be secured from our leading engineers; for it of no use for the manufacturers to give their opinion unsupported by the experience of users of their rails. It is just here that the effect of the different elements plays an important part. Our manufacturers know from experience that as their phosphorus is a little higher than the limit of 0.06% referred to, they must keep the other elements inside of given limits to produce the best results in the finished rails. This is done successfully, and a rail is produced that will meet the requirements of the drop-test and give satisfaction in use. I do not wish to be understood as advocating high-phosphorus, but my position is that rails which will meet all the varying conditions in this country will meet all that is required of them when put in use in other countries. If one examines the methods of manufacture of rails in this country and those in other countries, then visits the countries where our rails are being introduced, and gets accurate information as to the service they are giving, he will be convinced that there is a great future for America in the export business in rails.
>
> The conditions with regard to the material for bridges are about the same. Foreign specifications, in many cases, provide that only acid open-hearth steel can be used. This has already prevented our bridge builders from bidding upon thousands of tons of bridge work, although in some cases they have accepted the requirement of acid open-hearth steel, and have taken the orders. In other cases they have explained that our Government is using the basic open-hearth steel; that in the manufacture of it the works here start with an iron very much lower in phosphorus than is ordinarily used, and that the resulting steel is much more uniform. This has had a great deal of weight, and the use of basic steel has been allowed in some cases. In other cases new specifications have been adopted after investigation in accordance with the best American practice, which allows the use of either basic or acid open-hearth steel. I refer to this matter at length as it is of the greatest importance to our engineers and manufacturers, as well as to all others who wish to see our export trade developed.
>
> The continued discussion on the physics of steel is broad enough to take up any specifications on home or export orders that may be brought forward; the uniform methods of testing and methods of manufacture and rolling that will improve the finished products. It is of the greatest importance to establish the quality of American material abroad, and to have on record all facts regarding the same, both from the engineers' side and the manufacturers', and I know of no better channel for doing this than the American Institute of Mining Engineers.

4. Slips and Explosives in the Blast Furnace. By F. B. Richards, Cleveland, O.—This paper was presented by the author at the first session on Tuesday evening, and was illustrated by lantern slides. It is of especial interest to blast furnace managers, some of whom discussed it at the session on Wednesday.

5. Multiple Tuyeres. By Dr. R. W. Raymond.—This paper also relates to blast furnace practice. It describes the Gaines tuyere, which has a horizontally elongated discharge opening, and which is claimed to have some advantages over a tuyere with a round nozzle.

6. Note on the Forms Assumed by the Charge in the Blast Furnace, as Affected by Various Methods of Filling. By Frank Firmstone, Easton, Pa.—This is a very fully illustrated paper giving the results of a long series of experiments carried on at the Glendon Iron Works to determine the method in which the stock distributes itself in the upper part of the furnace when different sizes of top and of bell and hopper and different methods of filling are used.

7. A Description of the Semet-Solvay By-product Coke Oven Plant at Ensley, Ala. By W. H. Blauvelt, Syracuse, N. Y.—This paper was presented by the author at the session on Thursday morning. It was illustrated by drawings and photographs showing the plant recently erected by the Tennessee Coal, Iron & R. R. Co. It consists of 120 ovens, and when in full operation is expected to produce from 420 to 460 tons per day, or as much as is produced by 300 beehive coke ovens. The plant will require 732 hours' labor per day, as compared with 1,020 hours for the beehive ovens. Besides the saving of labor there is the saving due to the value of the by-products, fuel gas, tar and sulphate of ammonia.

8. The Effect of Sizing Upon the Removal of Sulphur from Coal by Washing. By Chas. C. Upham, New York City.—This paper discussed the advantages of fine crushing and sizing by screens before washing to remove pyrites from coal. It was noted that the finest pyrites will float on the surface of water, and by screening before washing a large portion of this pyrites may be removed which would otherwise go with the washed coal.

9. Note on the Use of the Tri-Axial Diagram and Triangular Pyramid for Graphical Illustrations. By Prof. Henry M. Howe, New York City.—The author describes the use of the equilateral triangle diagram in plotting the total heat of fusion of silicates of lime and alumina, and its great advantage over the di-axial diagram for plotting the relation of any quality to the percentage composition of a substance composed of three constituents. He also shows that a pyramid with an equilateral triangle for a base and of a height equal to the altitude of the triangle may be used for graphically indicating the relation of any quantity which depends on four variables whose sum is constant, such as the heat of fusion of a slag composed of four constituents as silica, lime, alumina and magnesia.

10. Graphic Records of the Screening of Crushed Materials. By Prof. Courtenay De Kalb, School of Mines, Kingston, Ont.—The author has made a series of experiments on crushing ore of different kinds and screening it through sieves of different meshes, plotting the results so as to show the percentages of different sizes of the crushed material. He finds that the curves so plotted show practically identical characteristics for all the different ores, and only by varying the conditions of crushing were variations in the curves obtainable. This result was not expected.

11. Mill Practice of the Utica Mills, Calaveras Co., California. By W. J. Loring, Angels Camp, Cal.—This paper describes what is believed to be the best practice, in regard to cost, yet reached in California quartz milling.

12. A New Essay for Mercury. By Richard E. Chism, City of Mexico.—This is a new process for assaying ores containing mercury, which is accurate to 0.01%. The ore mixed with fine iron filings is heated in a small crucible over an alcohol lamp, and the vapor of mercury distilled is collected on a piece of thin, clean silver foil which covers the crucible. A silver dish containing water is placed over the foil to keep it cool.

13. The Influence of Bismuth on Brass and Its Relation to Fire Cracks. By E. S. Sperry, Bridgeport, Conn.—A brief abstract of this paper was given in our issue of Sept. 29, p. 208.

14. Experiments on the Sampling of Silver-Lead Bullion. By G. M. Roberts, Murchison Gold Fields, Western Australia.—Numerous experiments recorded in the paper lead to the conclusion that samples taken by chipping out of the top and bottom of each ingot almost always give a result lower than the actual value of the bullion. The only really accurate samples are the dip-sample from the kettles and the saw sample made by sawing through the ingot.

15. The Elimination of Impurities from Copper Mattes in the Reverberatory and the Converter. By Edward Keller, Baltimore, Md.—This is a reply by Mr. Keller to the discussion of his paper presented at the Atlantic City meeting.

16. A Modification of Bischof's Method of Determining the Fusibility of Clays, as Applied to Non-Refractory Clays, and the Resistance of Fire Clays to Fluxes. By H. O. Hofman, Boston, Mass.

17. Does the Size of Particles Have Any Influence in Determining the Resistance of Fire Clays to Heat and to Fluxes? By H. O. Hofman and B. Stoughton, Boston, Mass.—These two papers describe experiments made at the Massachusetts Institute of Technology. The query of the title of the second paper is answered in the negative. There is only a slight difference in the results obtained from mixtures made as those used in making bricks, blocks, pots, etc., and from the same mixtures ground fine, as is the usual custom in laboratory tests.

18. Notes on the Tunnel of the Melones Mining Co., California. By W. E. C. Eustis, Boston, Mass.—This paper is not yet in print. Dr. Raymond made a brief statement concerning it, and says that it shows some extraordinary records of rapid tunnel driving.

19. A New Method of Drilling Deep Holes of Large Diameter in Rock. By F. Harley Davis, New York city.—The author describes a new form of rotating rock drill, which he had invented while in Australia and had largely introduced in that country. It cuts out a core about 4 ins. in diameter, and does very rapid work in sandstone and limestone. An exhibition of the working of the drill was given in Buffalo, and its performance was highly praised. We hope to give an illustrated description of this drill in an early issue.

20. Hubnerite in Western Arizona. By William P. Blake, Tucson, Ariz.—Hubnerite is a manganiferous variety of wolframite. It compares most favorably with any wolframite as a source of tungsten, being very pure and free from sulphides and arsenides. It may prove to be of value in the manufacture of tungsten steel.

21. The Superficial Alteration of Western Australian Ore Deposits. By H. G. Hoover, Coolgardie, Western Australia.—This is a very brief paper. Its practical bearing is on the exploitation of new gold regions. Ores frequently show a transition from free milling to refractory ores, with increased depth, and disregard of this fact has brought many gold mining companies to ruin.

22. Notes on the Mines of the Frontino and Bolivia Company, Colombia, S. A. By Spencer Craigie, Mariana, Brazil.—These notes give a brief account of some gold

mines in Colombia. one of which, with a poor plant, giving only 50% extraction, nets a profit of $25,000 per month. The author says that there is probably no mining field of richer promise than that of Colombia.

23. Corundum in Ontario. By A. Blue, Toronto, One.—This paper was read from manuscript by its author. He gives an interesting history of the discovery of corundum of excellent quality in Ontario, and of the exploration of the whole area, which is of considerable extent, in which it is found. The deposits may prove to be of great value.

24. Mineral Lode Locations in British Colombia. By William Branden, Helena, Mont.—This paper is a brief statement of the laws of lode locations in British Columbia, which are far simpler and more satisfactory than those of the United States. From 1884 to 1892 the Mineral act was modeled after that of the United States, but was revised and greatly improved in 1891, and further amended in 1896 and 1897.

The following papers are not yet in print and were read by title:

25. The Evolution of Mine Surveying Instruments. By Dunbar D. Scott, Ironwood, Mich.

26. Note on the Operation of a Light Mineral Railroad. By James Douglas, New York city.

27. The Alluvial Deposits of a Dry Country. By T. A. Rickard, Denver, Colo.

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ANNUAL CONVENTION, ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

First Day's Sessions.

The eighth annual convention of the Association was held at Richmond, Va., Oct. 18, 19 and 20, 1898, the place of meeting being Murphy's Hotel. About 35 members were present at the opening session. Including the ladies and other guests, the total attendance was probably not far from twice this number. Besides a considerable amount of routine business, the convention had scheduled for consideration eleven special committee reports, and considerable other work of a technical nature, including as the principal item the discussion of the various committee reports presented at the previous year's meeting. In a number of instances this review of the previous year's work brought out valuable additional information. The list of the present year's reports was, however, shortened by the failure of two of the eleven committees to report; otherwise the programme already printed in these columns (Eng. News, Aug. 25, 1898) was carried out in full.

The first business following the opening exercises was the election of new members, 21 of whom were added to the rolls. In his address, the President called attention to the excellent work which had been done by the Association in the past, and mentioned with some pride that, taking into account the small membership and slender resources available, its technical work compared favorably with that of other societies. The reports of the Secretary and the Treasurer showed the Association to be in good financial condition, it having a surplus of $219 cash on hand with all debts paid. The total receipts during the past year were $1,[illegible]57. After some further routine business, the convention proceeded to the consideration of the special committee reports. It being the custom of the Association simply to read these reports at the first day's sessions and reserve their discussion for the second day's proceedings, they will be considered in connection with the discussions presented further on in this record of the convention's work.

The entire remainder of the first day's sessions after reading these reports was occupied with the discussion of the committee reports presented at the Denver, Colo., convention of 1897. Only two of these reports called out much discussion, viz., "The Most Suitable Material for Roofs of Buildings of all Kinds," and "Floor System on Bridges, Including Skew Bridges." In regard to roofing materials, the general concensus of opinion was that for station buildings of the first class nothing was superior to slate shingles. Regarding the best roofing material for shops, round houses, freight sheds, etc., the opinions and practice of different members differed widely, and pine or cedar shingle, gravel and tar, felt with gas tar and sand, asphalt, tile, granite felt, were all well spoken of. For roundhouse roofs, however, iron or steel was considered a poor material, and any material in fact which depended upon iron nails or other iron fastenings, was regarded as objectionable. Some of the members had used both slate and wood shingles, with copper nails, and had experienced no trouble from the destruction of the nails.

The discussion on bridge floors was confined largely to the method of placing guard rails and fastening them to the ties. Not much that was new was brought out in addition to the original report, and after transacting some routine business the first day's proceedings were concluded.

Second Day's Sessions.

The principal technical work of the convention was contained in the proceedings of the second day, when the discussion of the special committee reports came up. The first report considered was that on

Pile Rings and Methods of Protecting Pile Heads in Driving.

The committee considered the best protection for pile heads during driving to be a 1 × 3-in. iron ring. It was recommended that these rings should be made of iron hammered from old car axles. Such rings,1 × 3 × 14 ins. diameter would cost about $1.75, as compared with $2 when made of the best bar iron. One hammered ring would also last to drive 75 oak piles and 300 cedar piles, as compared with 50 oak piles and 200 cedar piles for a bar iron ring. A pile driver tool car should carry ten 15-in., thirty 14-in., ten 13½-in., and ten 13-in. rings, or 60 rings altogether. In fitting the pile ring, it was recommended that the pile should be chamfered down at least 5 ins. from the end, making the diameter of the head at the top such that the ring would just catch on and be driven home by the first blow of the hammer.

The face of a pile hammer should be concaved to a depth of 1½ ins. at the center and run out to nothing at a distance of 2 ins. from the edge. This form of hammer face acted to drive the fiber of the wood down slightly over the edge of the ring, and to make a neat fit of the hammer. The best weight of hammer was 3,300 lbs. The fall of this hammer should not exceed 12 ft. in driving cedar piles, nor 20 ft. in driving oak piles; short, quick blows will drive a pile as fast as long slow blows, and there will be much less danger of fracturing the pile. Piles should be neatly trimmed of knots and sharpened to a 4-in. square point for hard driving. Care should be taken not to overdrive piles. When, with a 3,300-lb. hammer, the penetration is not over 1 in. for a 10 ft. fall, the fall should be reduced to 6 ft., and the pile carefully driven until the penetration is only ¼-in., when the driving should be stopped.

The use of an iron cap or bonnet is not practicable for driving piles in trestles, as it interfered with getting the pile close to the stringers, but where it can be used freely the device is an excellent one. In driving piles through shale rock or soapstone, where shoes are required, the best shoe is four pieces of old car truck arch-bar iron welded together, with the end drawn to a point and the four arms flared out to fit the four sides of the pile, to which they are attached by spikes through punched holes.

The discussion divided itself into a consideration, first, of the recommended method of protecting the head; second, of the concaved faced hammer, and, third, of the best form and material for the shoe. Most of the members who spoke concurred in the committee's recommendation to use a single ring for protecting the pile head, and to chamfer the head down to the diameter of the ring. The practice of some simply to place the ring on the top of the pile head and drive it into place without removing the outside material was regarded as objectionable, in causing slivering or the splitting off of the outside in slabs often several feet long. Mr. Wm. O. Eggleston (Chic. & Erie), spoke in favor of using a cap or bonnet to protect the pile during driving, and thought that there were very few cases in which it could not be employed to advantage. Referring to the same device, Mr. A. Shane (C., C., C. & St. L.) stated that in a test made by him a gain in speed of fully 20% had been obtained in actual work by its use. The choice of the members seemed to be about equally divided between hammers having concave faces and those having flat faces. The use of the wrought-iron point, recommended by the committee was pretty unanimously objected to, a cast-iron point with a good socket for the end of the pile being generally preferred. Mr. C. M. Large (Erie & Pitts.) and Mr. A. E. Killan (Intercolonial) both stated that their experience had been that the strap point mentioned would frequently split the pile in hard driving, and accordingly they preferred a cast-iron socket point or shoe. The next report was that of the committee on

Cost and Manner of Putting in Pipe Culverts.

The report showed quite a diversity of practice in employing and constructing pipe culverts, on the 30 railways from which information was obtained regarding the subject. The kinds of pipe culverts used and the maximum and minimum sizes employed were as follows:

	Cast-iron.	Wr't-iron.	Steel.	Cement.	Vit. pipe.	Wood.
No. of road using....	24	2	3	2	14	1
Maximum size, ins...	24	60	48	..	48	72
Minimum size, ins. ..	8	30	36	..	12	24

The majority of roads built end walls for all pipe culverts, but others employed them only for certain kinds of pipes, or under certain conditions only, while a few did not use them at all. In putting in pipe culverts to replace timber culverts, the general practice was to make an open cut, supporting the track on stringers resting on piles or mud sills, but some roads tunneled deep embankments, and in a few cases the pipe was pulled through the old wooden culvert, the space between the two being finally tamped full of earth. When the pipe culverts were placed where no previous opening existed, the general practice was to make an open cut, or, in the case of deep embankments, to tunnel. Little trouble was had with the breaking or flattening of cast-iron pipe culverts, except for diameters of from 36 ins. to 6 ft. On the other hand, considerable trouble of this sort seemed to be experienced with vitrified pipe and cement pipe. The means generally adopted to overcome this difficulty were to use more care in packing the earth around the pipe. In the case of large size cast-iron pipe, it was the practice of some roads to place wooden or iron shoes inside and let them remain until the ground was settled firmly. In one case the remedy adopted was to line broken cast-iron pipe with a ring of paving brick. The costs of different kinds of pipe culvert per lineal foot were given by the report as follows:

Creosoted Stave Pipe Culverts; Southern Pacific Co.

Diam, ins.	Cost per lin. ft.
24	$1.06*
36	2.11
48	2.42
66	4.70
72	4.90

*This does not include cost of laying or of portals.

Cast-Iron Pipe Culverts.†

Diam. of pipe, ins.	Material.	Labor.	Total.
18..........	$1.11	$0.16	$1.27
20..........	1.00 to 1.62	.09 to 1.08	1.76 to 2.08
24..........	1.20 to 3.32	.17 to 1.82	2.09 to 5.19
30..........	1.22 to 2.90	.23 to 1.42	3.09 to 4.67
36..........	2.51 to 3.69	.30 to 1.64	2.81 to 6.50
42..........	3.25 to 5.00	.70 to 1.98	5.08 to 5.70
48..........	4.30 to 7.70	.36 to 3.12	5.29 to 10.32
60..........	2.94 to 10.61	1.26 to 2.66	10.60 to 11.82

†The cost of cast-iron pipe per ton, as given, ranges from $14.50 to $16.80. The cost of stone-masonry end walls ranges from $4 to $8 per cubic yard. The costs are exclusive of the cost of masonry end walls.

Steel Pipe Culverts.

24..........	$1.12	$0.12	$1.24
30..........	1.55	.17	1.72
36..........	2.28	.25	2.53
42..........	3.00	.30	3.30
48..........	4.13	.46	4.59
60..........	8.25	.45	8.70

Vitrified Pipe Culverts.

18..........	$0.30	$0.45	$0.75
20..........	.45	.51	.96
24..........	...	...	1.50 to 2.57

In the discussion Mr. J. B. Snow (B. & M.) stated that the usual cause of pipe culverts flattening was the failure to put in good, solid foundations and to pack the earth firmly around the pipe. Mr. A. S. Markley (C. & E. I.) stated that a frequent cause of failure in pipe culverts was leaky joints, the water from which washed holes under and around the pipe thus leaving it without support. A number of other members confirmed the statements of Mr. Snow and Mr. Markley. The next report was that of the committee on

Best Floors for Shops and Roundhouses.

The committee considered its subject under two heads, viz., roundhouse floors and shop floors, and its report was in abstract as follows:

Taking up first roundhouse floors, we find in general use: brick, concrete, granolithic concrete, cinder, disintegrated granite, cedar block, timber and plank. Of these, the four most commonly used are probably brick, concrete, plank, and cinder. In order to determine the most satisfactory floor for use in a roundhouse and the kind of material best suited for the purpose, it is necessary to consider the varying causes which combine to wear out the floor. Heavy repairs require the use of hydraulic jacks which bring great pressure to bear upon the floor adjacent to the cinder pits. To withstand the pressure requires a wide pit wall or else very firm foundation and rigid surface in the floor. In washing out boilers large quantities of water are used, much of which is spattered upon the floor. Besides this, there are numerous occasions for spilling all kinds of oil and grease. And with all, the demands for cleanliness are unceasing. Not the least of the destructive elements is the rolling of heavy trucks or driving wheels, or the dragging back and forth of jacks and large pieces of machinery. To find a material which will successfully withstand all of these destructive forces is the problem.

Your committee believes that good vitrified brick, properly laid, will give the best satisfaction in all roundhouses which are used for anything more than storage purposes. In this we have a floor that is smooth, firm, hard, and practically indestructible. It is absolutely unaffected by water, heat, oils, acids, or grease, and is easily cleaned, while one important advantage is in the ease with which it can be repaired, since any part may be taken up and replaced by common labor without the slightest injury to the floor as a whole.

The following method of laying brick floors conforms to the generally accepted practice: Assuming the soil to be firm and well drained, excavate the ground to an even surface 8 ins. below grade of desired floor. Tamp well with heavy rammers to secure a firm foundation, then fill in with good clean sand or gravel to within 3½ ins. of grade, making a crown of about 2 ins. between pits for drainage; wet this down well, tamp with rammers, and trim off with straight edge, taking care to get an even surface. Lay brick on edge close to each other and breaking joints so that tops come ½-in. above grade. After laying, roll bricks with 2,000-lb. or 3,000-lb. roller, cover the surface with 1-in. fine sand and broom it well into cracks, or fill cracks with cement grout. A concrete foundation is recommended by some, but, except in cases where the natural ground is not firm, or where the floor is to be subject to extremely heavy loads, it is not considered necessary.

The cost of brick floors in a number of isolated cases were given in the report and they ran from 6 cts. to 12.7 cts. per sq. ft., but averaged generally from 10 cts. to 13 cts. per sq. ft.

For blacksmith shops or foundries the natural earth frequently forms a very suitable as well as substantial floor. In localities where the soil is too soft in its natural state, the addition of cinders or clay will solve the problem cheaply and satisfactorily.

In machine shops the conditions are different, and here we find the recommendations almost as varied as are those for roundhouse floors. A brick floor in a machine shop answers many of the requirements, but there is good evidence in support of the objection that men cannot stand all day on such a floor or upon a surface of concrete or asphalt without feeling the bad effects of cold upon the feet. This difficulty is overcome to a large extent by the use of slatted floor racks or platforms at the machines where operatives stand. When machines are set upon a brick floor there should be special provision made for foundation. But this can hardly be urged as an objection as it is necessarily the case with heavy machines under almost any circumstances.

A bedded plank floor has recently been laid in an extensive shop plant of the Boston & Albany R. R. As this is somewhat novel, a description of the methods of building may prove interesting. The earth is well compacted and brought to the proper surface and a bed of coal-tar concrete put down in three courses. This bed is 4 ins. thick when finished. The specifications are that the stones of the lower course shall be not less than 1 in. in diameter and those of the second course not more than 1 in. in diameter. Stones of each course to be well covered with tar before laying and thoroughly rolled afterward. The finishing course to be composed of good clean sharp sand well dried, then heated hot and mixed with pitch and tar in the proper proportions. This is to be carefully rolled and brought to a true level to fit a straight edge. Roller to weigh not less than 700 lbs. on a length not exceeding 22 ins. On this finished surface of the foundation there is spread a coating ¼-in. thick of best roofing pitch put on hot, into which the lower course of plank is laid before it cools. Care must be taken to have the plank thoroughly bedded in the pitch and after laying the joints must be filled with pitch. If vacant places occur under plank they should be bored and filled. The finishing flooring is laid across the lower and thoroughly nailed. For the lower course 2½-in. spruce plank are used, and for the upper 1⅛-in. spruce plank. The cost of such a floor is given at 18 cts. per sq. ft. using spruce lumber.

For paint shops and car shops a brick floor has been found very satisfactory. Your committee believes that a brick floor generally speaking is the most economical, durable and satisfactory floor for shops as well as for round houses.

The discussion was opened by Mr. Jas. Stannard (Wabash), who stated that on his road vitrified brick floors were used for both shops and round houses. He considered them to be durabls and easy to repair, and especially convenient to take up and replace when pipe lines, etc., had to be installed or taken up from underneath the floor. The brick used was a vitrified paving brick. Mr. J. P. Snow (B. & M) had found common brick to be equal to all the requirements of round house floors. His practice was to lay the bricks flat and to grout the joints. For shop floors he considered brick objectionable on account of the difficulty of fastening heavy machinery to them and also because they were easily injured by falling tools and other heavy articles. Mr. A. E. Killan (Intercolonial) stated that his company had formerly used wood floors for shops and round houses, but they soon gave out. Vitrified brick floors were adopted later and were now used largely. The latest floor used, however, was one composed of a foundation of broken stone covered with firmly packed cinders, upon which was placed a layer of concrete with a 1½-in. top covering of cement. This floor was not much more costly than wood and had proved satisfactory so far. For shops he preferred wood floors, as workmen could not stand and work on concrete on account of the cold. A number of other members spoke, and nearly all expressed their preference for brick floors for both shops and round houses.

Round-House Smoke Jacks and Ventilators.

The committee contented itself with presenting drawings of different forms of smoke jacks and ventilators in use on various railways and with calling attention to the experience of those who had used them. From these it appeared that there was a great diversity of opinion as to the best style of smoke jack, the opinions in many cases being directly opposed to each other. The jacks illustrated comprised the standard round wooden smoke jack of the Chicago & Eastern Illinois R. R.; the Pickering wooden smoke jack (Eng. News, Feb. 18, 1897); the Chicago & Erie R. R. standard dormer ventilator; Fitchburg R. R. wooden monitor ventilator; metal telescope jack of Baltimore & Ohio R. R.; Scott ventilator; Roe ventilator; Pancoast metal ventilator; and the Portland Stoneware Co.'s terra cotta smoke jack (Eng. News, March 11, 1897).

The discussion was opened by Mr. Jas. Stannard (Wabash), who stated that, after having tried nearly all kinds of smoke jacks. he had settled down to the use of wooden jacks as being the best. He did not favor the use of a drop hood on smoke jacks. Mr. A. S. Murkley (C. & E. I.) stated that he used circular wooden smoke jacks and dispensed with painting and sanding, as he had found that the soot soon covered the interior of the jack and protected it from fire. These jacks had been in use two years and showed no depreciation. Mr. J. H. Cummin (Long Island) used wooden jacks altogether, and considered painting and sanding a waste of time and material. His jacks were square, 6 × 6 ft. at the bottom and 2 × 2 ft. at the top. He did not favor cast iron or other metal jacks. Had tried galvanized iron, lead-lined jacks, but they soon gave out. Copper jacks used to replace them had lasted two years and were yet in place. Mr. Jas. McIntyre (Erie) had in use smoke jacks made of cast iron, wrought iron and wood, and preferred the wooden jacks. A wrought-iron jack would last about five years. He had had several accidents from the drop hoods of cast-iron jacks falling, and was not in favor of using them. Mr. J. P. Snow (B. & M.) had used stoneware jacks with cast-iron hoods and had found them very durable but quite expensive. His present practice was to use the Pickering wooden jack. Mr. Wm. A. Eggleston (Chic. & Erie) had adopted the Pickering jack as a standard. Mr. A. E. Killan ((Intercolonial) had recently erected Pickering jacks. He did not think that much benefit resulted from painting the inside, as the covering of soot prevented fire, but he did paint the outside to preserve the wood from the weather. One objection to vitrified pipe jacks was the great weight they brought on the roof. Mr. Fred. Eilers (C., B. & Q.) used the Roe cast-iron smoke jack and had found that it did good work. One great advantage was the movable hood, which could swing aside without damage when an engine happened to be run out in a hurry. There was in his opinion danger from wooden jacks catching fire. The general concensus of opinion of the members named and of the others who spoke on the subject was that metal jacks and ventilators of iron or steel soon failed through corrosion. Wooden and stoneware jacks did not suffer from this cause and were therefore preferable. The wooden jack especially seemed to meet with general favor.

Cattle Guards and Wing Fences.

The report described briefly the various types of cattle guards in general use and stated that experience showed that each of them gave different results under different conditions. A guard which stopped highly domesticated tame cattle with fair success often failed entirely to hold the half-wild cattle which were allowed to run almost at free will on the western and southwestern cattle ranges. For the last kind of cattle a wide and deep pit guard—one deep enough to allow the beast to fall clear below the rails —was as satisfactory as any. No guard would turn cattle at all times.

The discussion brought out only a few points of especial interest, the principal one of which was that by whitewashing or painting white the ordinary surface guard and the wing fences adjoining it its effectiveness in stopping cattle was greatly insured. The patch of color differing from that of the surroundings served to frighten the cattle against attempting to cross. An objection which was raised to metal surface guards with pointed, sharp surfaces was their danger to brakemen called upon to run back in the dark to flag an approaching train. Mr. A. E. Killan (Intercolonial) mentioned an accident of this kind which resulted in the death of the brakeman.

Storage of Fuel, Oil and Other Station Supplies at Way Stations.

The report stated that this problem seemed to have been pretty generally neglected by railways, and recommended the following solution:

Keep office records and stationery on shelves and pigeonholes in a cupboard built for that purpose. Keep cupboard locked when not in use. These cupboards can be made at the shops. Files for tariff sheets should also be provided.

Coal stored at way stations, unless the station be very small, should be kept in a small house holding from a half car load to a car load of coal. Locate the house about 100 ft. from the station, on account of danger from fire, and, if possible, near a track, so the coal can be unloaded directly from the car through a trap-door in the roof of the coal-house. Partition off one end of the coal-house for an oil-house, of a size sufficient to suit the needs. Build a counter across one end, and cover it with zinc. Build a shallow box under the counter, and fill it with sand, so the oil will not soak into the floor. Place a ventilator in the roof to carry away all gases, and line the inside of the house with tin or zinc, to guard against fire. A shallow cast-iron pan with a grating over the top, to catch the oil while the lamps are being filled, should be placed on top the counter. This catches the waste oil. Where the size of the station warrants it, the coal and oil-house should be built of brick and provided with iron doors and shutters. No oil or coal should be stored in the freight house, as it is a constant source of danger from fire and often damages freight. Oily rags, waste, etc., should be kept in a galvanized-iron pail with a cover, to guard against fire from spontaneous combustion.

The discussion was opened by Mr. J. H. Cummin (Long Island), who stated that he provided at local stations small houses just large enough to hold a barrel of oil and resembling an ordinary dog house as much as anything. The upper half of this house was hinged and opened off the lower half like the lid to a trunk, to enable the barrel to be removed and renewed. This house was placed 100 ft. from the station. For filling lamps, a special table was placed inside the station building. This table had a top 2½ × 4 ft. with boards at the four edges projecting up 4 ins., and was lined with zinc. Mr. A. E. Killan ((Intercolonial) had recently made oil-houses for a number of small stations by cutting old box car bodies in two, boarding the open ends and placing them on suitable foundations. One car body made two houses. Mr. G. W. Smith (C., M. & St. P.) stated that his company had a series of standard oil and coal-houses for small stations which were made up in the shops and shipped to the stations as needed.

Railway Highway Crossing Gates.

The report stated that the gates in common use were either mechanical or pneumatic. In mechanical gates the arms were operated by wire connections to cranks or levers, and the great difficulty had been the freezing of the wire fast by water in the pipes. One way in which this could be prevented was to use larger size pipes and be more careful to make the connections water tight and to lay the pipe carefully. Another method of preventing freezing was to close the ends of the pipe by glands having holes making a tight fit for the passage of the wire, and to fill the pipe with oil. This device had been employed successfully in signal work. The great advantage of the mechanically operated gate was its positive action. It was considered that, notwithstanding the claims often made by their manufacturers, pneumatic gates had not proved their immunity from freezing. In order to carry the air at all the pipes had to be of fair size and laid with tight joints. The same construction would prevent pipes containing wires from freezing. In conclusion, the report described briefly the Bogne-Mills & Pneumatic Gate Co.'s pneumatic gates, the "single connection" gate of the Standard Railway Gate Co. (Eng. News, May 29, 1897), and the special lift gate employed at some of the Brooklyn, N. Y., street crossings of the Long Island R. R.

In the discussion which followed several members spoke in favor of each of the types of gates mentioned in the report, but little additional information was brought out. The next report was that of the committee on

Care of Iron Bridges After Erection, Including Best Method of Protecting Them from Salt Water Drippings.

The successful maintenance of a bridge depended upon the character and condition of the bridge to be maintained. Given a bridge in perfect condition the proper care of this bridge meant merely to keep it in as good condition as it was the day it was put up. The means adopted to do this must depend upon conditions, but above all other things the inspections should be frequent and thorough. One of the most important matters was to keep the metal well painted, and in painting much of the success depended upon seeing that the metal was carefully cleaned to receive the paint. With refrigerator cars venting their brine at various points the only successful method of protecting bridges from the drippings was to provide a water-proof decking over the metalwork. Should the car vents be placed so as to discharge midway between the rails, as had been suggested, the construction of a simple gutter to catch the brine and carry it away would perhaps be sufficient. It was considered, however, that the proper solution of the problem was to provide the cars with reservoirs large enough to hold the brine until discharged at regular stations.

In discussing this report Mr. J. P. Snow (B. & M.) gave the interesting information that his company was building a portable sand blast plant to be used in cleaning iron bridges for repainting. This plant had not yet been put in operation.

Turntable Construction.

This was one of the most complete and carefully prepared reports presented at the convention, but, on account of its length, it is not included in this report of the proceedings. Such parts of the report as are of principal general value will be abstracted in a future issue of Engineering News. There was no discussion of the report.

Subjects for Convention of 1899.

The following list of nine subjects were selected for special committee reports at the convention to be held in Detroit, Mich., in October, 1899:

(1) Most Economical Method of Painting Railway Bridges and Buildings and Best Materials to Use.
(2) Life of Different Kinds of Timbers in Bridges of Various Kinds and Advisability of Protecting it from the Weather.
(3) Best Method of Constructing and Maintaining Highway and Farm Crossings.
(4) Best Practical Sanitary Arrangements for Local Stations Where There Are No Water and Sewer Systems.
(5) Best and Most Economical Plant for Pumping Water.
(6) The Necessary and Kinds of Tools for the Equipment of a Gang of Bridge Men.
(7) Best Snow Fence, Stationary or Portable.
(8) Protection of Fire in Railway Buildings.
(9) What Repairs Can Be Made to Metal and Wooden Spans Without the Use of Falseworks and How Can They Be Made Safely?

Election of Officers.

The following officers were elected by the Association to serve during the ensuing year: President, J. H. Cummin, Long Island R. R., Long Island City. N. Y.; First Vice-President, Aaron S. Markley, Chicago & Eastern Illinois R. R., Danville, Ill.; Second Vice-President, C. C. Mallard, Southern Pacific Ry., Algiers, La.; Third Vice-President, Walter A. Rogers, Chicago, Milwaukee & St. Paul Ry., Chicago, Ill.; Fourth Vice-President, J. M. Staten, Chesapeake & Ohio Ry., Richmond, Va.; Secretary, S. M Patterson, Boston & Maine R. R., Concord, N. H.; Treasurer, N. W. Thompson, Pittsburg, Ft. Wayne & Chicago Ry., Fort Wayne, Ind.; Executive Committee, W. S. Danes, W. A. Eggleston, R. L. Heflin, F. W. Tanner, A. Zimmerman and J. H. Markley.

Third Day.

The third day of the convention was devoted entirely to sightseeing, and a number of excursions were taken to the historic places about the former Confederate Capital.

Exhibits.

Comparatively few manufacturers of railway supplies made exhibits at the convention. Among the exhibitors present, however, Fairbanks, Morse & Co., of Chicago, showed a gasoline engine air compressor and pumping plant, the compressor being operated in connection with pneumatic drills, chippers. hammers and other tools of the Chicago Pneumatic Tool Co. Another exhibit of special interest was an improved form of gasoline motor railway velocipede, made by the Sheffield Velocipede Car Co. The Norton Jack Co. showed several forms of its well-known ball-bearing jacks for heavy bridge work, and a number of other firms had catalogues and other trade literature and personal representatives present.

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BIDS FOR RAISING THE "CRISTOBAL COLON" sunk off Santiago Harbor in the naval battle of July 3 will probably soon be asked by the Navy Department. This policy has been prompted, it is said, by the failure of the Merritt & Chapman Wrecking Co., to accomplish much toward raising the vessel and by the offers received from other wrecking companies to undertake the work without expense to the Government unless altogether successful. The contract with the Merritt & Chapman Wrecking Co., for raising the "Cristobal Colon" was executed on July 29 and involved the payment of $829 per day during operations. The same company has also been receiving $800 per day since July 6 under a general contract for the prosecution of wrecking operations on the Spanish ships, and has succeeded in raising the "Maria Teresa" and starting her on her way to Norfolk, where a commission will decide what additional compensation not exceeding $500,000, shall be paid to the wrecking company on her account. According to press dispatches from Washington, D. C., what the Government proposes to do is to annul the "Cristobal Colon" contract on Nov. 10, and to order all work to be concentrated on the "Reina Mercedes," which lies in still water and is capable of ready raising. Meanwhile, as already stated, the Navy Department will ask bids for raising the "Cristobal Colon" on the basis that the Government shall be involved in no additional expense unless the work is successful. This decision has been influenced to some extent by the arrival in Washington of representatives of a Swedish wrecking corporation, which succeeded in rescuing the British battle-ship "Howe" from a condition similar to that of the "Cristobal Colon." This company, it is stated, is not only confident of its ability to bring the "Cristobal Colon" and the other Spanish vessels to the United States, but is ready to guarantee the delivery of the "Maine" in the big drydock at the New York Navy Yard. The Swedish wreckers propose to take all the risks of failure without expense to the Government, and to rely, if they succeed, for compensation wholly on arbitration. The raising of the "Maine" is also proposed by the Acme Wrecking Co., of San Francisco, Cal. According to the reports, this company simply asks authority from the U. S. Government to raise the vessel, assuming itself all the risk and expense. Should the raising be successful the Government may have the vessel upon paying for the salvage; but in case it is not so disposed of, the wrecking company expects to get its money back by exhibiting the ship at the large seacoast cities.

◆

THE COAST DEFENCES OF THE U. S. are reported upon by Gen. John M. Wilson, Chief of Engineers, U. S. A. The report especially deals with temporary seacoast batteries erected in consequence of the war with Spain. In addition to thirteen of these ordered, much work was done in arming the regular fortifications. Gen. Wilson says that the operations in Cuba and Porto Rico amply demonstrate the value of coast defences, shore batteries and marine mines in resisting naval attacks, and he urges the completion of the fortifications planned, as practically insuring the safety of our principal harbors. He also points out the great value and efficiency of rapid-fire guns in such coast defences. Existing projects for sea-coast defence call for the emplacement of about 500 heavy guns of 8, 10, 12 and 13-in. caliber; of about 700 rapid-fire guns of various calibers, and about 1,000 rifled mortars. The estimated approximate cost of the engineering work connected with the installation of this armament is about $55,000,000. Since the inauguration of the modern coast defence system, appropriations have been made amounting to $19,110,333, and $5,653,000 was allotted from the $50,000,000 "defence fund." Provisions have been made for mounting 288 heavy guns, 254 rapid-fire guns and 312 mortars; or, about 57% of the projected heavy guns, 36% of the rapid-fire and 31% of the mortars. This armament is placed at 71 localities in 29 harbors of the United States. The estimates for the next fiscal year aggregate $4,917,500, for gun and mortar batteries, land, protection and repair, torpedos, submarine mines, etc. Gen. Wilson again notes the material economy resulting from Congress providing funds for the completed contracts in river and harbor work; and he says that if this system is restricted to works fully justified by the interests of commerce, it is the best yet devised. The total amount expended on the improvement of rivers and harbors, in the year ending June 30, 1898, was $17,161,799. The estimate for the year 1899 is $12,883,437 for continuous work, and $15,500,341 for projects not covered by continuing contracts. Gen. Wilson asks Congress to authorize him to present special estimates for such works as are necessary to navigation.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred, Oct. 26, on the Union Pacific R. R., near Omaha, Neb. This was a rear-end collision which resulted in the death of three employees and the serious injury of one other.

◆

SIXTEEN SAILORS WERE DROWNED in Lake Michigan on Oct. 25 as a result of the foundering of the steamer "L. R. Doty" during a severe storm. The "Doty" was a wooden vessel, built in 1893. She was 291 ft. long and 41 ft. beam with a net capacity of 1,700 tons.

◆

A BURSTING FLY-WHEEL at the Pennsylvania Bolt & Nut Works, Lebanon, Pa., on Oct. 25, injured four men, two of them seriously.

◆

THE TRAIN-ORDER ANNUNCIATOR invented by Mr. Harry De Wallace, and described in our issue of Oct. 27, needs a little further explanatiton as to the lettering on the dial and card. In addition to the graduation of mileage, the dial is divided into five-mile sections, each denoted by a letter. The same letters are also marked on the card, opposite the names of stations running in the sections. These letters are a check upon the accuracy of the train order. In sending out an order, the dispatcher uses the letter representinng the five-mile section in which the station referred to is situated. If the letter and station do not correspond, the mistake will be detected, and the dispatcher asked for an explanation. Incidentally, also, the letters on the card and dial are of assistance to the engineman in finding the point at which the trigger is to be set in accordance with the train order. The letters are the same for any division or run. Within the last few weeks the device has been fitted to an engine used in passenger and freight service on the Canadian Pacific Ry., between Winnipeg and Rat Portage. It was set for over 150 stops and signals, and proved to be as reliable on freight runs where switching was done, as on the long through passenger runs.

◆

THE PENNSYLVANIA RAILROAD CO., during the Philadelphia Peace Jubilee, carried 872 975 passengers; and, as the returns are not all in yet, it is expected that the full number will be about 1,000,000. On Oct. 27 the company brought 192,142 visitors to the city. On Sept. 15, 1887, at the celebration of the centennial of the Constitutional Convention, this company brought 195,000 people to the city; but this was before the development of the present trolley system, now bringing people from a distance. Of this crowd, 380,364 people entered the city at the Broad St. Station alone.

◆

THE VENTILATION OF THE HOOSAC TUNNEL is proposed by means of a centrifugal fan mounted at the top of the center shaft and operated by electric power from the North Adams (Mass.) Electric Co. It is stated that contracts for the work have already been let.

◆

COMPRESSED AIR LOCOMOTIVES are contemplated by the New York Central & Hudson River R. R., for hauling trains through the Fourth Ave. tunnel in New York city in order to do away with the present annoyance from smoke. The company has, it is stated, experimented with both electric and compressed air motors during the past year and one of the air motors has given such good results that it is now proposed to equip a regular train on the Putnam Division with compressed air as a motive power. Should the method prove successful in this final test it will, it is said, be utilized in hauling trains through the Fourth Ave. tunnel.

◆

THE PENNSYLVANIA R. R. TRAINSHED in Jersey City, N. J., will be lengthened by detaching the east end arch and moving it toward the river about 125 ft., afterwards filling the opening with the necessary new arches and roof framing. By thus moving the end arch it can be used as a traveler for erecting the new steelwork. The work is a part of the extensive station improvements now in progress at the Jersey City terminal of the Pennsylvania R. R. A complete description of the present train shed was published in Engineering News of Sept. 26, 1891, shortley after its completion.

◆

THE TOWER FOUNDATIONS for the New East River Bridge on the Brooklyn side of the river have reached a depth of 108 ft. below high-water and bed rock has finally been struck at this depth. With the exception of the St. Louis Bridge, where some of the caissons reached a depth of 109 ft. 8½ ins., this is, we think, the greatest depth to which a caisson has ever been sunk by the pneumatic process in America. The caisson which reached this great depth of 108 ft. was the northerly of the two caissons for the Brooklyn tower and was fully illustrated and described in Engineering News, May 27, 1897. The sinking of its sister caisson has been completed for some time. It is stated that considerable difficulty has been had by the contractors in securing sufficient help to keep the work continuous since the caisson has reached over 100 ft. in depth and for some time it was possible to keep the work up only 21 hours out of the 24. Fifteen men only could be worked at once, and the maximum length of each shift was 45 minutes. The same men could work only two shifts per day. The 24 hours work thus took fourteen gangs, aggregating 210 men, besides a foreman for each gang.

◆

A NEW NICARAGUA CANAL CONCESSION has been granted by the Nicaraguan government and was ratified by the Nicaraguan Congress, after a four days' debate, on Oct. 31. The concession grants to Edward Eyre, of the firm of Wm. R. Grace & Co., of New York, and Edward F. Cragin, of Chicago, the right to build an interoceanic ship canal, the concession to take effect when the charter of the present Maritime Canal Co. expires, on Oct. 10, 1899. The concessionaires are to form a stock company for building the canal before April 10, 1900, and 8% of all securities issued go to the Nicaraguan government. Within three years from the date of the concession its holders must open combined water and rail communication between the Atlantic and Pacific oceans. The concession is perpetual, but after 199 years one-half of the profits go to the Nicaraguan government. The concessionaires have the right to police and control the canal district and import free of duty all supplies and materials.

◆

THE CHICAGO DRAINAGE CANAL channel through Joliet, Ill., which has been the subject of litigation since last winter, seems to be still undecided as the result of the recent court decision. The nature of the trouble may be briefly stated as follows: The Trustees of the Sanitary District of Chicago having the construction of the Drainage Canal in charge and the Commissioners of the Illinois & Michigan Canal entered into negotiations on March 11, 1898, for the prosecution of the work of the drainage channel on Section 18 at its terminous in Joliet, Ill. On this section the drainage channel is identical with a portion of the existing stream composed of the canal and the Desplaines River. This stream is dammed at convenient points, the dams being numbered from north to south and producing what are called the upper and lower basins. The drainage channel was through the upper basin. At the east end of dam No. 1, between the upper and lower basins, is located the Economic Light & Power Co., which derives a water power from the upper basin, for which it pays the Illinois & Michigan Canal Commissioners several thousand dollars a year. The drainage channel plans contemplated lowering this dam 3.6 ft., but on account of the additional volume of water which this channel would furnish there would be no reduction in the water power. This, the Trustees of the Sanitary District maintain, complies fully with the law, which requires that in constructing the channel they shall not injure any water power.

The Canal Commissioners, on the other hand, claim that the law requires the height of the dam to be left unchanged, and thus give the light and power company all the benefit of the increased head of water, which will amount to about 4.800 HP. The suit has been practically to decide this question, and the decision of the court sustains the Canal Commissioners as follows:

> In crossing the canal under the power conferring authority to do so, the plans of the sanitary district contemplate passing the water through the upper basin. We therefore have a situation which must have been anticipated by the legislature, and the last sentence of section 23 becomes of controlling importance when we remember that the plans in evidence contemplate the lowering of the crest of the dam 3.6 ft. A water power right is the right to avail of the potential energy of the water falling from the highest practicable altitude as well as to the lowest practicable depth. Any diminution of either altitude or depth must result in injury to the right. A valuable water right exists at this dam, and has been available of ever since the dam was built to utilize the water flowing at that point falling from an altitude of minus 42.4 ft. below Chicago datum. Is there any physical objection to maintaining the dam at minus 42.4 ft.? In other words, is it physically impossible to make the authorized crossing of the canal and at the same time maintain the dam at minus 42.4? Without going into an examination of the evidence it is sufficient to say that I find that such impossibility does not exist, but on the contrary it is practicable to do so.

It seems almost certain that the Trustees of the Sanitary District will appeal to the higher courts for the reversal of this decision.

THE ELECTRIC ELEVATOR EQUIPMENT FOR THE CENTRAL LONDON UNDERGROUND RY.

(With two-page plate.)

In our issue of July 1, 1897, we outlined the plans for this new underground railway in London, to which more than usual interest attaches by reason of the fact that all the operating machinery will be of American manufacture. At that time we mentioned that the contract for the elevators had been awarded to the Sprague Electric Co., of New York city. It is now our privilege, through the courtesy of that company, to present a description of this remarkable electric elevator equipment, much the largest ever contracted for, which is now being installed.

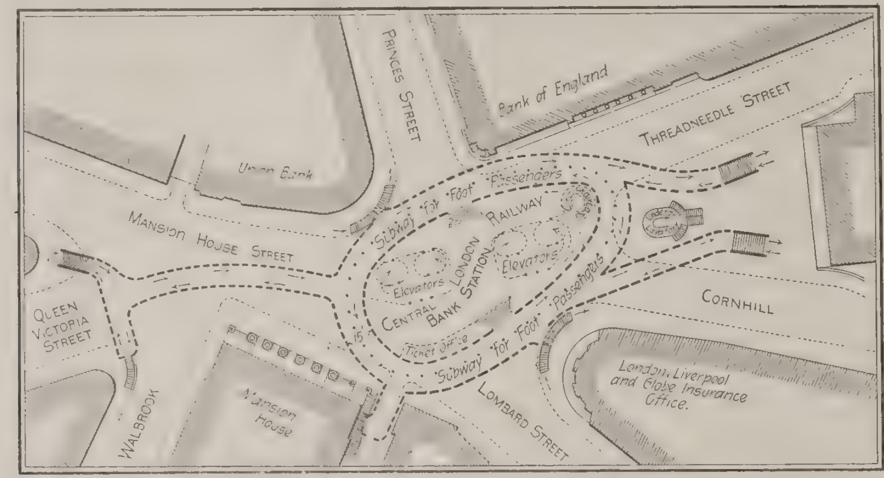

FIG. 1. PLAN OF THE UNDERGROUND STATION AT THE BANK OF ENGLAND, SHOWING STAIRWAYS AND ELEVATOR SHAFTS.

The London Central Ry. was authorized by Parliament in 1892; but owing to financial difficulties work was not begun until 1896. Since that time the excavation and construction work has been pushed until at present the tunnel work is practically completed. For the time being the section from the Bank station to the Liverpool Street station of the Great Eastern Ry., a distance of nearly ½-mile, will not be built, although the act authorizing the construction of the London Central Ry. included the right to construct this section.

The western ends of the tunnels are at Shepherd's Bush Avenue, where the entrance incline strikes the main tunnels, and from this point run almost due east under the busiest portion of London, a distance of 6½ miles. Like the other electric underground railways in London, the road consists of two parallel cast-iron lined tunnels, each carrying a single track. These tunnels are 11½ ft. diameter inside and at a depth of 30 ft. to 102 ft. below the street surface. Along the route are distributed 14 stations, and at each of these the tunnels are enlarged to 21 ft. for a distance sufficient to give platform room, usually about 320 ft. long by 11 ft. wide. At each station there are two or more entrance shafts, with stairways and 3 to 5 elevators depending upon the anticipated traffic at the station.

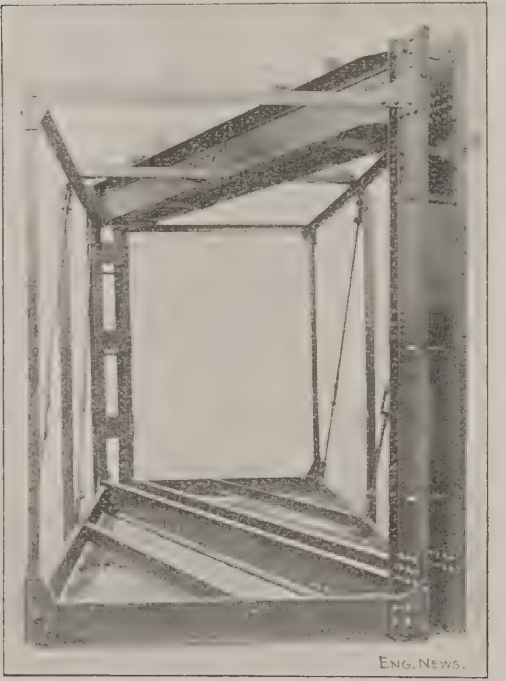

Fig. 2. View Showing the Framing of the Rectangular Type or Center Car for Three-Car Shafts.

Owing to the necessity of running under the streets, the railway not being permitted to tunnel under the city building line, the tunnels wind in and out, twisting about to a considerable extent. Some idea of the extent of this underground station construction is afforded by Fig. 1, which is the station at the Bank of England, the eastern terminus of the road. This station is naturally the largest and most important of all, located as it is in the very heart of the city. It will occupy pretty much all of the ground under the open space in front of the Mansion House, formed by the intersection of Poultry, Cornhill, Princes, Lombard and Threadneedle streets. In its construction a subway 15 ft. wide will be built around the space tangent to the building line, as is shown in the figure. This subway will be thrown open to the public as a thoroughfare, thus permitting persons to cross from street to street without the danger of being run down by cabs and carriages. The interior of this subway will be lined with white glazed tiles, and lighted by electricity. In the center of the oval thus formed will be constructed the Bank station, which will be nothing more than a large, open room, with a steel and concrete roof carried by steel columns and supporting the street pavement above forming the street of Mansion House square. Conveniently spaced about this room will be 5 elevators, which will take passengers to and from the train tunnels about 65 ft. below. Entrance to or exit from the subway will be afforded by a number of stairways, starting from the sidewalk in front of the Royal Exchange, the Liverpool & Globe Co., the Mansion House, Union Bank, etc., and leading down into the subway.

Coming now to a consideration of the elevator work, in Table I. will be found the number and diameter of shafts at each station, and the number of elevator cars, with the height of lift, together with other particulars.

The specifications received in this country by the Sprague Co., at the time bids were asked for the elevator equipment, were very meager. The main requirements, however, were as follows:

> The work included in the specifications is the find of all materials, tools and labor for the complete manufacture and installation, and, except as regards fair wear and tear, the maintenance for a period of 12 months after the opening of the railway of all the plant and appliances necessary for working the passenger lift service of the Central London Ry.
>
> The contract is to include the supply and fixing of all plant and machinery (except steam boilers) necessary for generating the hydraulic power required (if used) to actuate the lifts, for transmitting such power to each lift, and for return water mains along the whole line of railway, together with all machinery for actuating the lifts, as well as all cages, guides, safety appliances, fittings, etc., for a complete installation. If electric power is used to actuate the lifts, such power is to be taken from the company's mains, which pass through every station.
>
> There are four sizes of elevator shafts: 6 shafts of 30 ft. diameter, 12 shafts of 23 ft. diameter, 5 shafts of 20 ft. diameter, 1 shaft of 18 ft. diameter. The 30-ft. shafts are to contain 3 lifts each, 23-ft. shafts 2 lifts, the 20-ft. and 18-ft. are each to contain 1 lift only; the 18-ft. shaft lift is to resemble the 20-ft. shaft lift, but the headway, above the upper delivery floor, is the same as that of the 30-ft. and 23-ft. lift shafts.
>
> All work shall be of the highest class, to the entire satisfaction of the engineers of the Central London Ry. and the Electric Traction Co.
>
> The whole of the work shall be completed within 16 months of the acceptance of the tender.
>
> The time allowed for raising any lift from the low level to the high level platform is not to exceed 30 seconds in any case. As a general rule half the lifts at every station will work alternately with the other half at that station, but at many stations there will be times when the lifts may to some extent work at the same time. The train service is to be a 2 or 2½ minute one each way.
>
> The generating plant shall be of ample capacity for the working of the whole service, with only half of the said plant in operation and the remaining half in reserve.
>
> The steam engines, hydraulic pumps, main and return pipes, the machinery for actuating the lifts, the fittings of the lift cages, and all other necessary appliances, shall be such as will insure the highest attainable economy and facility in working and maintenance, and be least liable to breakdowns, so as to secure the safe and uninterrupted working of the lift service at all times with comfort to passengers.
>
> The contract will include the connection of the above steam engines with the boilers of the company at their depot, in the case of hydraulic lifts; and it will include the connection of all machinery to the company's electric mains in the case of electric lifts. The buildings, engine foundations, and other masonry works form no part of this contract.

In addition, a blue-print sheet giving a proposed lay-out plan for each of the four sizes of shaft was furnished. With this meager information Mr. Sprague determined to make an effort to secure the contract, and, assisted by Mr. J. R. Furman, consulting engineer, who erected the Glasgow tunnel hydraulic elevators, and was also one of the constructing engineers for the Eiffel Tower, and Mr. Charles C. Stutz, of the Sprague Co., prepared provisional plans. Accompanied by these assistants, he took these plans to Europe in May, 1897, and shortly after arrival made tender for the entire elevator equipment. Since it was necessary first to show the superiority of electric over the hydraulic elevators for the requirements of the road, against many strong prejudices, and then demonstrate that the particular plans submitted were the best, the issue was in doubt for some time, but the decision was hastened by a number of radical propositions made by Mr. Sprague. Among these propositions were:

To buy the current from the road at one penny (2 cts.) per Board of Trade unit (K-W. hour), and, conditioned on there being not less than an average total of 20,000 single trips per day of 67 ft. mean rise, to operate the elevators under contract for three years at a cost not exceeding £1 (4.86) per 1,000 single trips, or

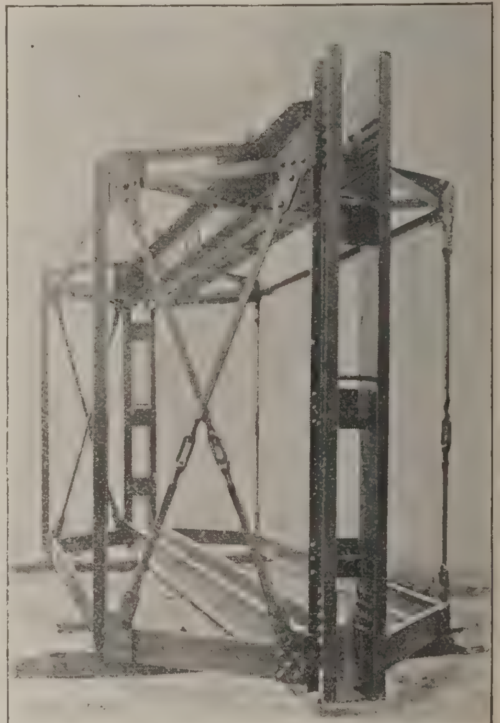

Fig. 3. View Showing the Framing of the Lozenge-Shaped Side Cars for the Three-Car Shafts.

To install a complete electrical equipment in one shaft, as against a direct or differential hydraulic with electric pumps in an adjacent one, both having the same maximum capacity, and both operating under the same loads and trips, with current from the same source, and to operate at less than one-half the cost of the hydraulic, and finally,

To make a contract conditioned upon the earliest possible installation of a complete shaft equipment, to be operated to the entire satisfaction of the representatives of both the Railway and the Traction Companies, the main equipment meanwhile to be proceeded with.

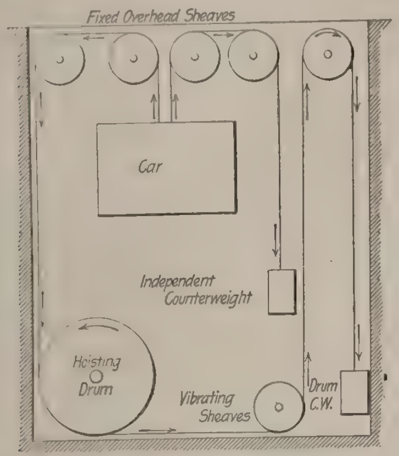

Fig. 6. Diagram Section of Shaft, Showing Arrangement of Car Cables and Counterweights.

The last condition was effective, for on June 16, only four weeks after the opening of the bids, the general details of the contract were agreed to, conditioned upon the satisfactory performance of two test elevators.

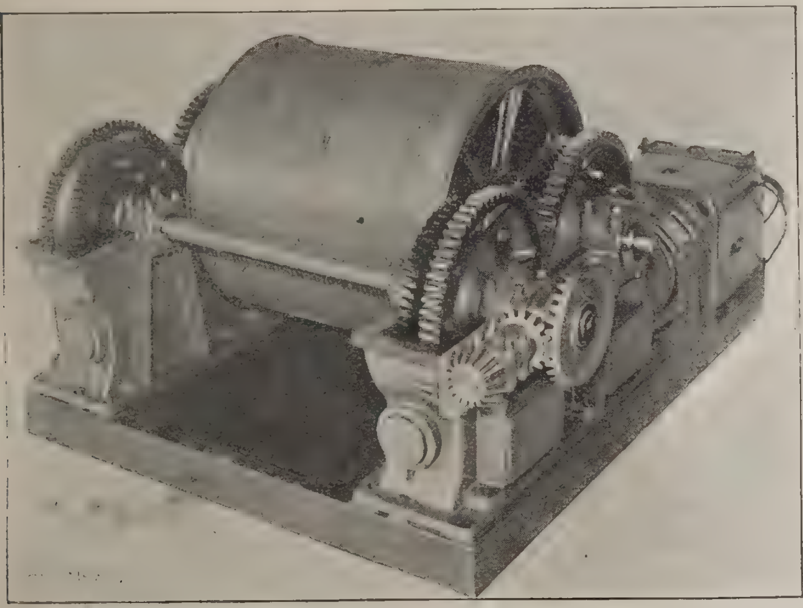

FIG. 13. HOISTING MACHINE WITH UPPER PART OF GEAR CASING REMOVED TO SHOW WORM WHEELS AND LOCKING GEARS.

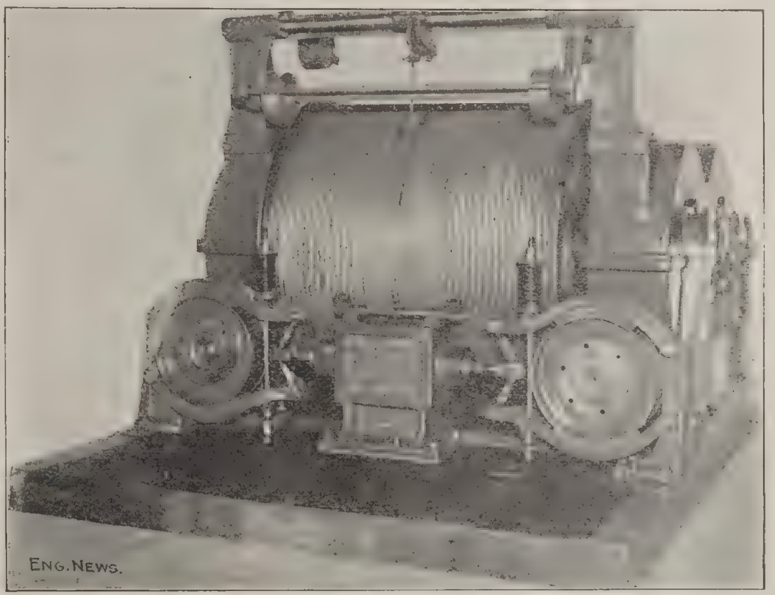

FIG. 14. HOISTING MACHINE, TYPE "S," COMPLETE, EXCEPT FOR MOTORS, SHOWING ELECTRIC BRAKE AND SLACK CABLE DEVICE.

Immediately upon getting the verbal award of the contract, supplemented simply by a letter of understanding, Mr. Sprague returned to New York, leaving Mr. Stutz abroad to collect data from which to prepare the full plans. Later a complete equipment for an 18-ft. shaft was sent from Watsessing, N. J., where the Sprague Company's works are located, to London, and installed under the direction of Mr. G. Rosenbusch, also of the Sprague Co. In the meantime, so confident was the company of the outcome of the test that plans were completed and work begun on the remaining 47 equipments. Before describing the extremely rigid tests given the specimen elevator it will be of interest to consider the plans and some of the constructional details.

Owing to the character of the soil it was necessary to make the entrance shafts circular, which made it a difficult matter to arrange elevators and stairways in them with economy of space. These shafts are all lined with segmental cast-iron plates bolted together through ribs cast around their edges, and backed with grout forced in by compressed air. They are of four sizes, as follows. (See also Table I.):

1 shaft 18 ft. diameter with 1 car having ......172 sq. ft.
5 shafts 20 " " " 1 " " ......250 "
12 " 23 " " " 2 cars each having..140 "
6 " 30 " " " 3 " two having...145 "
and 1 car having........117 "

The number of cars specified, the circular shaft and the large loads contemplated (17,000 lbs.) required cars of very unusual shapes, some of which are shown by Figs. 2, 3 and 4. Fig. 2 is a photograph of the framing for the center car for the 30-ft. or three-car shafts. The single car used in the 20-ft. shafts is of the same shape but of larger size. The extremely heavy construction noticed is necessary owing to the size of the cars and the test requirements which specified that the safety clutch on one side could be sprung without warping the car framing.

Fig. 3 is the framing for a car used at the sides of a three-car or 30-ft. shaft, and in this the heavy central frame is also noticeable. The cantilever supporting the corners and the diagonal braces in the end contribute to the massive appearance.

The cars for use in the two-car shafts have a very peculiar unequal sided form, shown to advantage in Fig. 4. These also require that the ends be supported by a cantilever. The method employed to attach the cables to the car frame, shown in Fig. 5, is simple and at the same time very satisfactory, since it permits a nicety of adjustment which equally distributes the load upon the lifting cables. At the same time the car can run closer to the sheaves at the top of the shaft, than with the ordinary form of attachment. The steel T guides for cars and counterweights are bolted firmly to the cast-iron shaft lining. The guides for the car weigh, when milled to 1-in. thick, on the guide part, 37 lbs. per yard. Special spring guide shoes are used on the cars owing to the extreme length of car framing in comparison with the height. These shoes are yielding and do not bind even when the car is unevenly loaded.

The specifications for 45 of the car frames made up of:

12 side cars for 30-ft. shafts, 6 center cars for 30-ft. shafts, 22 cars for 23-ft. shafts, and 5 cars for 20-ft. shafts, required that:

The material to be employed should be what is known as Medium Grade Steel; to have an ultimate strength of 60,000 to 68,000 lbs. per sq. in.; elastic limit ½ the ultimate strength; minimum elongation 20% in 8 ins. The use of this grade of material is to be guaranteed by the builder.

All holes are to be drilled or punched and reamed; all edges are to be planed; no welded parts will be accepted; they must be forged. Joints must come together well and not show gaps.

Rivets to permanently assemble each car are to be supplied, and 15% in excess of actual need.

After inspection all parts are to receive one coat of graphite paint.

Calculated weights, as taken from the drawings, to be on the basis: that a steel plate, 1-in. thick and 1-ft. area weighs 40.8 lbs. 2½% will be allowed on the calculated weight of plates and angles in the riveted portion of the structure.

The whole of the order is to be delivered three months from the date of award.

The car finish is plain but substantial, the sides being of oak and ceiling ornamental. Doors are provided both for regular and emergency exits.

The cable layout, or method of roping up as it is sometimes called, is diagrammatically shown in Fig. 6, in which it will be noticed that the lifting cables pass up from the car over the overhead sheaves and down to the under side of the winding drum. Wound on this drum, but in an opposite direction, are the drum counterweight cables which run under the vibrating sheaves or "vibrators," to be described later, and up overhead and down to the drum counterweight. In some cases where space is not limited this is a simple weight hanging at the end of the cables and in others it is a multiplying counterweight, Fig. 7. With this type the cables pass down under the counterweight sheaves and back up to the overhead framing; thus reducing the travel by one-half. These multiplying weights consist of a framing supporting a grooved sheave and two pendant side rods, between which are slipped cast-iron weights, each weighing 280 lbs., until the desired total weight, varying from 16,000 to 19,000 lbs., is obtained.

The rope details are interesting. They are of the best quality of mild steel, subject to approval by, and the satisfaction of, the engineers and officials of the Central London Ry., the Electric Traction Co., and the Sprague Co.

The ultimate breaking strain of ⅞-in. diameter rope is to be not less than 22 tons, and of ¾-in. diameter rope 16 tons. Such tests as the engineers require to be made at the maker's cost.

No. of strands forming each rope...................... 6
No. of wires forming each strand......................19
laid in two concentric circles, 12 outer wires, 6 inner wires, 1 center wire.
Main core round which strands are laid..hemp, well oiled.
Tensile test of each wire per sq. in.........85 to 90 tons.
Torsional test in length of 8 ins. wire..32 twists minimum.
The angles of lay for the wires and strands to be proportioned so that the rope shall be dead and free from any tendency to kink, spiral or spin.
All wires (excepting the center or core wire) to be of best cast steel, carefully hardened and tempered, and the wires and strands truly laid on their centers.

The approximate amount of rope is 110,000 ft. of ⅞-in. diameter, and 17,000 ft. of ¾-in. diameter, and the ropes are guaranteed for 12 months after the opening of the road.

The arrangement of sheaves overhead, the location of guides for cars and counterweights and the framing for the 30-ft. shafts is well shown by Fig. 8. The bottom layout or location of controllers and hoisting machinery and the relative size and position of cars is shown in Fig. 9.

We now come to the hoisting machinery upon which the success of the entire equipment is founded, and upon the working of which the continuation of the contract depended. There is not so much that is new in this very efficient machine, for it is rather an adaption of old methods with a refinement in construction of parts and details, resulting in a very perfect whole, which meets the difficult requirements of heavy electric elevator service to a marked degree.

In the first place, as will be seen from Figs. 10, 11, 12, which form the plan elevation and end view of the type "S" Duplex Tandem Worm Gear

Electric Elevator, as the machine is termed, the apparatus in its entirety is extremely simple. It is also completely self-contained, it only being necessary to attach the cables and controller wires to operate it.

Mounted upon a heavy cast-iron base are two side box-frames, seen best in Fig. 13, which, besides forming the bearings for the drum and idler shafts, form oil tanks in which the worm and worm wheels and lock gears, seen in Figs. 10, 11 and 13, are enclosed. In line with these casings, bolted to the bed plate and directly connected to the worm shafts, Figs, 10, 11, are the motors. These motors are of the 4-pole enclosed railway type. They are shunt wound, ironclad, and take current in series with each other from the feeders and the third rail. By putting the motors in series, the duty on each side of the machine is equalized for all speeds, the combination with the compensating gear arrangement later described forming an electro-mechanical couple. When running at 470 revolutions per minute they give an elevator speed of 200 ft. per minute. Fig. 15 shows the current required by the test elevator (18 ft. shaft) for running up under different loads, the current for running the car and cables alone, and the current returned to the line when the loaded car runs down. In other words, when a descending car is loaded, the motors generate and return current to the line. This factor is counted upon to materially reduce the total current consumed by the entire system.

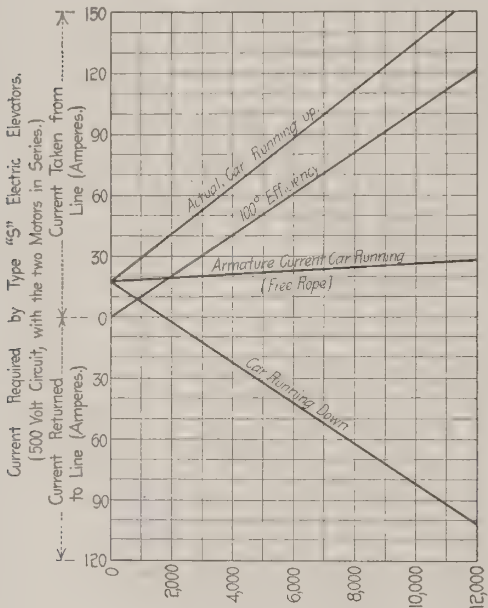

Fig. 15. Diagram Showing Curve of Relation Between Load on Car and Total Current Required for Car, in the 18-ft. Shaft.

The rest of the machine, shown in Fig. 14, consist of covers for the gears, a slack rope device, consisting of a couple of small loose pulleys mounted upon a pendulum device which holds these pulleys against the hoisting cables close to where they wind upon or off of the drum. In case the cables become slack, for any reason, the pendulum frame swings out under the influence of the weights, seen in Fig. 14, and springs a switch, thus cutting off the motor current, and also throws on the solenoid brake. This brake is clearly shown in Figs. 12 and 14, in which it will be noticed that friction pulleys are secured to the worm-shafts and are surrounded in part by two rubbing blocks held in close contact with the friction wheels by powerful coil springs. When current is passing through the solenoid contained in the metal box, seen in Fig. 14 midway between the friction wheels, the two plunger armatures are drawn in, the toggles straightened out and the brakes lifted. Any interruption of the current at once releases the armatures and allows the springs to throw on the brakes. This arrangement avoids the possibility of accident due to the breaking of a wire or the interruption of the current supply.

Referring again to the worms and gears, it will be seen in Figs. 10 and 11 that each motor drives a shaft upon which is securely doweled a right-hand and a left-hand worm which mesh with two worm wheels, one mounted upon the drum shaft and the other upon the idler shaft. There are also bolted to the worm wheels two straight gears, which are larger than the worm wheels, and mesh together, as is quite clearly shown in Fig. 13. The motors are arranged to run in opposite directions, both running in for raising, or out for lowering. In this way there is no side thrust on the drum bearings, and the usual end thrust, present with the ordinary arrangement of worm and worm wheel, is taken care of by the two worms mounted upon each driving shaft; the thrust of each worm just balancing that of the other. In this way the thrusts and side strains are so nicely balanced that the item of friction, usually a heavy one in this type of gearing, is greatly reduced. Another item contributing largely to the satisfactory operation is the use of the rotary cut worm. To assist in a full understanding of this Fig. 16 is given in which this worm and wheel is contrasted with a worm and wheel representing what may be termed ordinary practice. The greatly increased bearing surface is so well shown that no further explanation is necessary. In cutting these worms, blanks of the proper outside dimensions are mounted upon a vertical shaft, and a multiple cutter composed of a number of steel tools clamped radially to a circular disk, so that from the front the cutter resembles a gear wheel, is revolved at just the speed it would turn if driven by the worm about to be cut. The cutter is then gradually and automatically advanced until the worm has attained the proper depth and shape. To cut the worm wheel the operation is reversed and a steel worm, which has been carefully cut in the way described, is milled across the thread parallel with its axis until a cutter resembling a very large tap is formed. The worm wheel blank is then tamped on the disk, where in the former instance were the steel tools, and slowly advanced, both cutter and wheel blank revolving at the proper ratio. The pairs thus formed fit so snugly that they cannot be dropped together like the ordinary worm and wheel, but must be dropped in at an angle and turned into place. The function of the wheel straight gears is to lock the worm wheels at all times in their proper relative position. Considerable care is necessary when erecting these machines to fit the two pairs of gears and four worm gears and have the opposing thrust just balance.

One other feature of which mention must be made is the automatic idlers, vibrating sheaves, or "vibrators," as they are called, shown best in Figs. 10, 11 and 12. These are two large sheaves, each loosely mounted upon sleeve nuts which travel upon the right and left-hand screw. This screw is positively driven from a bevel gear on the extra gear shaft outside of the gear casing, Figs. 10 and 13. The pitch of the screw thread is such as to cause the vibrating sheaves to feed the rope upon or take it off of the drum at just the proper angle. The vibrator is complete in itself, and may be placed at any reasonable distance from the machine, it only being necessary to make the shaft between the winding machine and the vibrator the proper length.

In this type of machine the maximum net pull which can safely be excited upon the lifting ropes is 12,000 lbs., although the pull will not generally exceed 9,500 lbs. The rest of the load will be balanced by the counterweights which have already been described.

The safeties employed are the usual Sprague jaw clamp with certain slight modifications demanded by the unusual size and weight of cars and loads. These clamps, shown in Fig. 17, are at the bottom and at each side of the heavy car framing. They consist of a pair of heavy levers arranged to clamp the guide rails between their short arms like a pair of pliers, when their long arms are forced apart by wedges. Ordinarily, the wedges are held back, but any unusual car speed trips a catch and allows the five-coil springs, seen in the figure, to force the wedges between the rollers on the long end of the clamps which squeeze upon the girders with a force proportional to the ratio of the lever arms, the angle of the wedges and the power of the springs. In calculating the dimensions of the safeties for the elevators in question the loaded car was assumed to weigh 40,000 lbs. This amount had then to be supported by friction between the clamp jaws and the guide rails. The coefficient of friction was assumed as 15%, and the total pressure on the guide rails had, therefore, to be about 260,000 lbs., or 130,000 lbs. on each side, which made 65,000 lbs. on each clamp shoe. The ratio of long to short arm being 3,555 to 1, and the wedge 18 to 1, the total multiplication was 63.33; and $\frac{65{,}000}{64}$ gives approximately, 1,000 lbs. as the necessary spring pull. It will be noticed that there are five springs, each of which requires 250 lbs. to compress it, ¼-in. or 1,000 lbs. for a 1-in. compression. In service the five springs will be compressed 5 ins., and the jaws then adjusted to clamp the guide rails firmly. A further compression of 5 ins. will then be made, making 10 ins. in all or 2 ins. per spring. It will be seen that when the safeties are sprung, each spring will expand 1 in. in setting up the jaws against the guides and still have 1 in. per spring or 1,000 lbs. to clamp with.

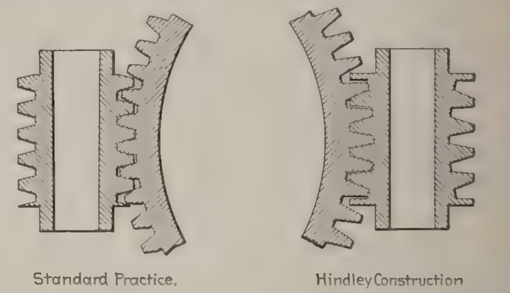

Fig. 16. Section of the "Hindley" Worm and Wheel used in the Type "S" Electric Elevator, and the Usual Form of Worm and Wheel.

To avoid any possibility of a mistake in design, a factory test was made of one of these safety clamps by springing it under working conditions (1¼-in, compression, 1,200 lbs. spring pull) upon a short section of standard guide rail. The whole was then put in a hydraulic jack and the guide rail forced one way and the clamp the other. 12 tons, or 24,000 lbs., were required to move the clamp. This would make 48,000 lbs. for both. Working backward, this gives a friction coefficient of 0.156, a close check upon the value used (0.15). The test was repeated both with the rails dry and when they were slushed with grease, and no difference was found in the results.

The clamp jaws are faced with steel with diagonal grooves cut one way across their faces. In determining the area of these faces 2,000 lbs. per sq. in. of metal in contact was assumed as the safe allowable compression.

As a further test, all parts were carefully measured, and the safety sprung 24 times as it would be in service. The measurements were then repeated while under the heaviest pressure, and no difference found.

As an additional guard against accident to passengers the oil buffers, seen in Fig. 17, are placed on all cars and counterweights. These are large and heavy dash pots, the plungers for which have tapering grooves cut in their outside surface. The grooves being large at the lower end permit the oil to flow rapidly past, thus allowing a rapid car settlement when the buffer first strikes. However, as the plunger settles the grooves narrow, less oil can pass, and the settlement gradually becomes slower, much the same as with an air cushion.

The controller by which the car is stopped or started is a small circular box about 6 ins. in diameter and 3 ins. deep with a square shank hub projecting from the center of the front of the cover upon which the operator slips a small handle when he desires to run the car. Inside are 6 contact points, two contact arcs, a lever and a spiral spring, which always returns the lever to the off position, when the operator lets go of the handle. This switch is represented diagrammatically in Fig. 18. The various points, 1, 2 and 3, connect by means of a flexible trailing cable with the controller, located at the bottom of the elevator shaft, which is nothing more nor less than a heavy resistance cut in or out of the motor armature circuits by a small "pilot" motor in turn operated by the car switch. If the operator turns the handle to the left, as shown in dotted lines in the figure, until it comes into contact with the arc, the main circuit is closed and the elevator motors started up and allowed to run slowly. No change occurs when the arm touches point 1. By continuing around until 2 is touched, the small pilot motor begins to turn the arm which cuts out the armature resistance, with a resulting increase of elevator speed. The amount cut out can be regulated by the length of time the switch arm in the car is held on 2. If allowed to remain any length of time all the extra armature resistance will be cut out; and the armatures be thrown directly across the line. Should the operator desire to reduce the speed he touches point 1, which reverses the pilot motor, cuts in resistance and hence reduces the car speed. This gives entire control of the car, permitting a faster or a slower speed without breaking the main circuit. Point 3 increases the speed still further by cutting out part of the field winding.

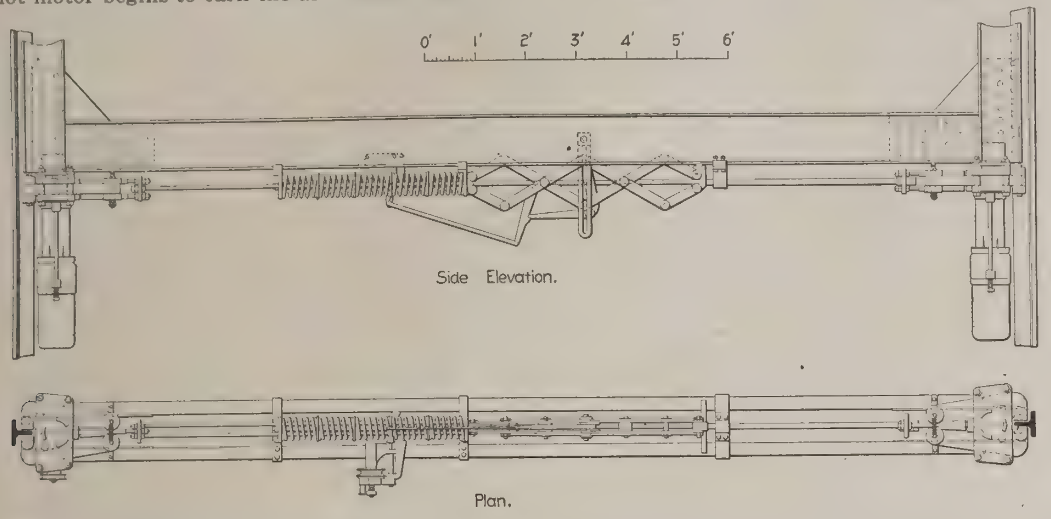

FIG. 17. CONSTRUCTION OF THE SAFETY CLUTCH USED ON ALL ELEVATOR CARS OF THE CENTRAL LONDON RY.

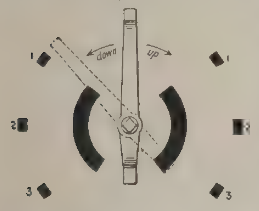

Fig. 18. Sketch of the Switch in the Elevator with which the Operator Controls the Car.

The current required to operate the controller is very small, varying from ⅓ to ½ ampere. As a safeguard, the controller is arranged to automatically return to the off position in case the current on the main circuit fails or the car runs into the automatic stops at the upper or lower limit of travel. In addition the limit stops open the main circuit, thus affording almost absolute protection against accidents due to ignorance or improper operation by the elevator tender, while the safeties and oil buffers guard against cable breaks, etc.

As a further precaution, a large factor of safety was used throughout all calculations. For steel, a safe working load of from 12,000 to 12,500 lbs. per sq. in. was allowed, while for cast iron the limit was placed between 1,700 lbs. and 2,000 lbs.

As already stated, one of the elevators was set up in England and subjected to a series of tests, some of which were exceptionally rigorous and unusual.

The most important were as follows:

1. A running test of 16 hours with an average unbalanced load of 3,000 lbs.; that is, 7,000 lbs. in the car and 4,000 lbs. on the counterweight. The average current consumption was 10 K-W. hours per car mile, or 15,840,000 ft. lbs. of work done with 26,542,800 ft. lbs. of electrical energy.

2. A load test with as high as 12,000 lbs. unbalanced load, counterweight was overloaded 5,000 lbs. and 17,000 lbs. of cast iron was placed in the car. During this test the total current averaged 150 amperes.

3. A running test of the safety devices, during which the car was loaded with 14,000 lbs., giving an unbalanced load of 10,000 lbs. It was run down the shaft at full speed, and the safeties were tripped which stopped the car so suddenly that the car or free counterweight jumped up, thus making a total load on the safeties of 25,000 lbs., 14,000 lbs. load and 11,000 lbs. the car weight. The test of the cable slack device consisted in stopping the car by the safeties and noticing how much cable ran off the drum before the automatic stop same into action. In this test 3 ft. was the maximum unwound from the time the safeties were sprung until the hoisting apparatus stopped. At another time the safety on one side was sprung with the car evenly loaded, and again with the load eccentrically placed, first on half of the car near one guide rail, and then on one side of the line drawn between the guide rails.

4. It was assumed that the pilot motor would fail to operate and the car was allowed to strike the limit stops at top and bottom.

5. The main circuit was broken with the car ascending and descending with no load and full load without the operator knowing anything about it. Going up with full load the stop was instantaneous, with light load there was a slight slide. Coming down, the motors generate on open circuit, and, therefore, have no effect on stopping the elevator unless the speed exceeds a certain predetermined limit, when the centrifugal governor operates, trips a switch and stops the machine.

6. Trip tests, running on schedule time, were made, and a series of 8 and 16 hour brake tests with the motors running at full rated load were also made.

One of the requirements was that an efficiency of 70% should be attained. In the contract test an efficiency varying from 70 to 75% was shown from the current at the brushes to the work on the ropes.

The tests were satisfactory in every respect, and the Sprague Company has since been shipping the other equipments to England. It is expected that the installation, which will be under the direction of engineers from the company, will be completed by the spring or summer of 1899.

In making estimates of costs of operation it was assumed that current would cost 1d., or 2 cents, per K-W. hour, and that it was estimated that 10 K-W. hours would be required per elevator mile. The average rise was assumed as 67 feet.

This gave $\frac{5,280}{67} = 79$, say 80 single trips to the mile, or 40 round trips to the elevator mile, 10 K-W. hours per elevator mile equals $\frac{40}{10} = 4$ round trips per K-W. hour; costing 1 penny (2 cents), or 1 round trip will cost ½ cent.

Again, asuming an average of ½-mile between stations, a two-minute headway and an average speed of 14 miles per hour, requiring 25 minutes for the trip one way, there will be 8,200 train stops. Each of these will require a down trip of each elevator to bring down entering passengers, and an up trip to remove passengers leaving; 8,200 × 2 = 16,400 may be assumed as the total number of one way elevator trips per day of 12 hours. There are 48 elevators and 13 stations, and 16,400 ÷ 13 = 1,260 single trips per station per day. Taking three elevators as a fair number running at each station, there will be 420 single, or 210 round trips, per elevator. For 12 hours (720 minutes) we have a trifle over three minutes per round trip as the maximum time limit. In other words, it would be necessary for each elevator to make a round trip every three minutes to meet the requirements established by the train schedule.

It is interesting to note that with the exception of the ropes, not only are the motors, the entire hoisting apparatus, the car frames, sheaves, etc., but even the heavy overhead work are furnished from America, the Carnegie Co., both in the matter of price and time, largely underbidding the English manufacturers for the beams.

For the photographs, drawings and data from which this article has been prepared we are indebted to Mr. Frank J. Sprague, former President of the American Institute of Electrical Engineers and Technical Director of the Sprague Electric Co.; Mr. Charles Pratt, Superintendent of the company's factory; Mr. G. Rosenbusch, A. I. E. E., who conducted the various tests described, and is to have charge of the entire electric installation, and Mr. Charles C. Stulz, V. D. I., in charge of the entire design and construction of the machinery called for by the contract.

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CAR TRUCK CONSTRUCTION AND REPAIRS.*

In my opinion the improved diamond frame or arch bar truck has come to stay for use in cars of 50,000 to 80,000 pounds capacity, and if I am correctly informed, these trucks of the above capacity are regularly used on 80% of the railways in the United States. There is, however, room for further improvement, and some of the more salient features I present for your consideration are as follows:

1. For convenience employ both bottom and top arch bars of uniform dimensions.

2. The size of arch bar should be such as to provide a proper factor of safety to carry the capacity of car.

3. In forming the angle for arch bars, have the bends made on a radius of not more than 1½ ins. instead of a radius ranging from 2 ins. to 5 ins., as done in common practice. The bending point to form the angle should start directly from the foundation of journal boxes and columns, instead of from 1 in. to 2½ ins. away. Unless this practice is followed, the arch bars when over-burdened will straighten to a line from one foundation to the other, causing a sag in the frames which increases the shearing strain on bolts and fastenings. Material that will not

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* Condensed from a paper by J. C. Barber, late M. C. B., Northern Pacific Ry., presented at the September meeting of the Northwest Railway Club.

TABLE I.—Distance Between Stations, Diameter and Depth of Shafts, Number of Elevators and Data Pertaining to Elevators and Counterweights.

No. of stat'n.	Distance fr'm last stat'n, ft.	Name of station.	Shafts, No.	Shafts, Diameter.	Shafts, Height of lift.	Cars, No.	Cars, Area of each in sq. ft.	Cables, Counterweight, cables per car.	Cables, Lifting per car.	Cables, Size.	Counterweights per car, No.	Counterweights per car, Kind.
1	0	Shepherd's Bush	1	30 ft.	41 ft.	3	2 at 145 1 " 117	4	4	⅞-in.	2	Simple.
2	3,036	Holland Park	1	30 "	51½"	3	2 at 145 1 " 117	4	4	⅞-in.	2	"
3	2,040	Nottinghill Gate	1	30 "	91½"	3	2 at 145 1 " 117	4	4	⅞-in.	2	"
4	2,304	Queen's Road	1	30 "	67 "	3	2 at 145 1 " 117	4	4	⅞-in.	2	"
5	2,358	Westbourne	1	30 "	41 "	3	2 at 145 1 " 117	4	4	⅞-in.	2	"
6	3,864	Marble Arch	2	23 "	74½"	4	140	4	4	⅞-in.	2	Multiple.
7	1,926	Davies Street	1	30 "	61 "	3	2 at 145 1 " 117	4	4	⅞-in.	2	Simple.
8	2,098	Oxford Circus	2	23 "	75 "	4	140	4	4	⅞-in.	2	Multiple.
9	1,998	Tottenham Court Road	2	23 "	71 "	4	140	4	4	⅞-in.	2	"
10	2,046	British Museum	2	23 "	69¾"	4	140	4	4	⅞-in.	2	"
11	2,238	Chancery Lane	2	23 "	76½"	4	140	4	4	⅞-in.	2	"
12 & 13	....	Postoffice	2	23 "	82 "	5	140	4	4	⅞-in.	2	"
			1	18 "	.. "	0	172	4	4	⅞-in.	2	"
14	2,569	Bank	5	20 "	50 "	5	250	6	6	¾-in.	2	"

WEATHER TABLE FOR AUGUST, 1898. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Degrees Fahrenheit.)				Wind.			Precipitation—Rain or melted snow. (Inches.)		
		Average.	Max.	Min.	Range.	Velocity in miles per hour. Average.	Velocity in miles per hour. Max.	Direction at time of max. velocity.	Total.	Heaviest in 24 hours.	No. of rainy days.
Northern Cities.	Northfield, Vt.	66.0	85	38	47	7.1	35	NW	5.22	2.22	15
	Portland, Me.	69.8	88	54	34	5.9	25	S	3.88	1.31	15
	New York City	74.3	90	60	30	10.1	48	NW	3.12	0.81	10
	Pittsburg, Pa.	74.9	92	56	36	4.8	22	W	4.01	1.02	12
	Chicago, Ill.	71.4	93	59	34	14.6	72	SW	3.03	0.89	9
	Omaha, Neb.	76.4	100	55	45	6.8	24	SE	1.98	1.21	5
	St. Paul, Minn.	69.6	95	50	45	5.9	27	N	3.93	2.62	8
	Duluth, Minn.	64.4	86	50	36	8.8	28	NE	3.39	1.17	12
	Bismarck, N. Dak.	68.8	99	43	56	9.0	38	NW	1.35	1.00	5
	Average	70.6	92	52	40	8.1	35	—	3.32	1.36	10
Southern Cities.	Washington, D. C.	76.9	93	57	36	4.8	30	S	8.76	4.96	8
	Louisville, Ky.	78.2	96	63	33	5.2	30	S	5.14	3.62	9
	St. Louis, Mo.	78.4	95	63	32	7.0	25	SW	0.87	0.64	7
	Savannah, Ga.	80.3	92	69	23	7.6	76	NW	22.79	7.31	20
	Kansas City, Mo.	77.2	96	59	37	7.5	24	S	5.01	2.81	6
	Jacksonville, Fla.	82.1	94	70	24	7.7	36	SE	5.44	1.84	17
	Chattanooga, Tenn.	78.2	95	66	29	4.9	26	SW	0.83	0.38	8
	New Orleans, La.	81.2	91	72	19	6.3	25	NW	6.24	2.07	14
	Memphis, Tenn.	79.8	95	66	29	5.9	40	NW	2.69	1.29	7
	Palestine, Tex.	81.6	96	66	30	4.6	20	N	3.22	1.04	7
	Average	79.4	94	65	29	6.2	33	—	6.10	2.60	10
Western Cities.	Helena, Mont.	69.0	93	46	47	6.5	27	NW	0.71	0.39	5
	Port Angeles, Wash.	58.3	82	46	36	6.2	22	NW	0.17	0.17	2
	San Francisco, Cal.	57.0	72	47	25	14.6	38	W	T	T	0
	Salt Lake City, Utah.	76.8	97	58	39	6.0	29	NW	1.35	1.04	4
	Santa Fe, N. Mex.	67.7	85	52	33	5.8	25	S	4.00	1.45	12
	Denver, Colo.	72.6	95	50	45	7.2	40	SW	0.96	0.59	6
	Yuma, Ariz.	—	—	—	—	—	—	—	—	—	—
	Average	66.9	87	50	38	7.7	30	—	1.20	0.61	5

stand bending to a radius of 1½ ins. without injury is unfit for use in arch bars.

4. Ream all bolts and rivet holes in arch bars and tie straps to fit bolts and rivets.

5. The wearing surfaces to support bolts through the top and bottom end of truck columns and journal box thimbles to have vertical bearings not less than the thickness of arch bars, with holes reamed to size, and abandon the common practice of applying the castings with holes roughly cored, which allows the columns to shift and the truck frames to get out of line.

6. Apply journal box bolts of sufficient dimensions to resist buffing and shearing forces, and abandon the expensive cost of forging, incident to turning up the ends of arch bars.

7. Attach brakes to truck frames where they will not be disturbed by forces radiating from the action of the bolster and springs, and eliminate the vertical or downward pull on the body bolster caused by the application of the brakes when attached to the car body.

8. Employ solid construction sufficient to hold side frames and journal boxes from being forced out of line when rounding curves and the usual switching derailments.

Bolsters.—The practice of employing a short bolster, or one not supported directly on the side frames at each end, but instead suspended from the channel transoms on swing hanger links or rigid hangers, is not the best construction for present service. Such a bolster has no support to resist longitudinal buffing shocks, execpt that of the transoms, which in turn are only supported by being riveted at their ends to the columns but not sufficient to resist service buffing forces. The short bolster and transom design of truck admits only of suspending the load from the transoms, which with age and wear deflect downward and give an inward tilting tendency to the arch bars or side frames, resulting in transferring a greater load to the back ends of the journal bearings. Investigation of this and similar construction on these lines will result in finding this to be the cause of a large percentage of hot boxes.

I would employ a bolster designed to rest directly on and in a certer line of the side truck frames, and supported between columns at each end, and in no case allow the bolster to bear against or be supported on the transoms or cross tie bars. The spring supporting the outer ends of the bolsters should also rest on a center line of the side frames, and the design should be such as would not produce an unequal ditribution of the load on the journal bearings or springs on account of the deflection of the bolster or transoms. This change in construction permits a reduction in weight and dimensions of transoms of about 30%.

Center Plates.—There has been a tendency for railways to adhere to their old standard form and size of center plates, which never had bearing surface sufficient to support even cars of 40,000 lbs. capacity. In proof of this fact you will often find cars on your repair tracks with base or flanges of the center plate cracked or settled into the wood various depths. Truck manufacturers have been compelled to employ these old center plates that were standard to the road, which have not only proved defective but have added another weakening factor to other parts on account of the base being not only too small to carry a load of the marked capacity but because it prevented solid construction. Those that are increasing the capacity of their truck should consider increasing the strength and bearing surface of their center plates proportionately.

Side Bearings.—As regards side bearings, if you are to employ a weak bolster in the truck or car body that readily deflects under loads of the marked capacity, then employ yielding or anti-friction side bearings, preferably the latter, but if your bolsters are of proper capacity to carry the load without material deflection, then the solid side bearings, which are now a serious element in producing friction, can be more safely employed.

Springs are rarely, if ever, broken through vertical action under loads, provided the bolster or load is designed to rest at all times squarely on the springs or group of springs, as lateral or torsional forces and thrusts are most destructive to both helical and eliptical forms of springs.

Brake Gear.—Power brakes, which become a necessity, furnish another destructive element to many designs of trucks unless the attachments are properly applied. To aid in reducing the load and strains on brake beams and attachments, it is necessary to connect them to truck frames instead of car body or truck bolster direct to eliminate forces resulting from the action of the bolster and springs, which, under certain conditions, have power sufficient to cause numerous defects. If properly attached to the truck frames we find that it eliminates about 72 pieces per car, reduces first cost and cost of maintenance about 45% per car as compared with the ordinary practice of attaching brakes to car body. The modern practice of attaching brakes to truck frames that admits of their being fixed to be operated concentric with the wheel, and embodying construction that prevents the side of shoe grinding away the wheel flange, and eliminating at least 60% of the causes of solid flat wheels, and, as above stated, about 72 parts per car, has proved highly satisfactory to those employing such construction. I recently counted in one train (36 cars) 84 brake shoes, with top ends of the shoes dragging against the wheels, which were worn off due to friction from 2 to 4 sq. ins.; this, together with the 72 brake beam guide pins nearly cut in two from friction, would present a proposition for us to figure the cost of extra fuel consumed annually to grind these parts away, not taking into consideration the expense incurred in loss of time, delays and accidents to trains; our train despatcher's sheets frequently note trains being delayed or making slow time with that same old excuse which is so familiar to us all, "delayed on account of heavy pulling train."

Box Lids and Dust-Guards.—A good dust-proof journal box lid and dust-guard form cheap and desirable additions to construction that prevent hot boxes and swell the economies in lubricating rolling stock. A good dust-proof lid, in my mind, is more essential than the dust-guard, as all dust lodging in the front end of box is forced under the journal by the packing spoon in hands of the oiler. As a matter of fact, worn-out dust-guards form a small factor towards hot-box troubles, but when we consider that railways have thousands of journal boxes running with imperfect dust-guards that never get hot, we are inclined to decide that the journal bearings, with loads unequally distributed thereon through faulty truck construction, are the paramount cause of 60% of the hot-box nuisance.

Metal Trucks.—Metal trucks are gradually superseding the various wood and grey iron forms of trucks. The prices of the metals that we could employ in trucks are as follows: Commercial rolled steel shapes, 1⅛ cts.; grey iron or common cast iron, 1½ cts.; malleable iron, 2¾ cts.; pressed steel from 3 cts. to 4 cts.; cast steel, 4 cts. to 6 cts. Commercial steel shapes are not only the strongest, lightest and most convenient to procure, but show for themselves a saving in first cost over other metals quoted; and from careful observation and personal investigation made from time to time during the past three years, I am convinced that these steel shapes combined with good malleable iron produce a truck, when designed on modern lines, with greater efficiency and units of strength than many other metals. In proof of this I have reports of a large number of trucks, made of the above material, that have been operated in almost continuous service for the past few months under loads of 70,000 lbs. at an expense of less than 1½ cts. per car per month. This statement does not include the cost of lubricating.*

Lateral Motion Trucks.—Lateral motion freight car trucks of the old swing hanger type, are being gradually discarded, owing to the large number of parts failing in service under heavy capacity cars. Many have replaced these trucks with the various other forms now on the market, while others, who still believe in certain economies the lateral motion trucks provide that rigid trucks do not, are now employing a more modern lateral motion truck constructed on lines which eliminate the former objectionable features, effecting a reduction of parts ranging from 150 to 300 pieces per car.

The question of introducing lateral motion in trucks, or employing one that is flexible enough to admit of its being easily adjusted to service, is seriously being considered, if not already adopted by many roads, for the reason they provide for greater economies than the common rigid form of truck. An officer on one of the large railway systems in the Northwest, whose standing as an engineer is high, is on record as saying: "We notice a great difference in favor of our improved lateral motiton truck in way of reducing flange friction against rail and the cushioning of the forces and blows on truck frames, wheels, axles, and reducing the wear on M. C. B. coupler, knuckles, etc., and especially so in our cars of 60,000 lbs. capacity and over, as compared with our rigid or swing hanger style of truck."

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*An article on "Metal Trucks for Freight Cars" was published in our issue of Sept. 22.

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THE U. S. SIGNAL CORPS is officially reported upon by Gen. A. W. Greely, Chief Signal Officer U. S. A. As to the work of this corps in Cuba, the report details the arrangement and installation of electrical and other appliances for quick communications between the army and Washington. Gen. Greely intimates that the work of the corps was handicapped because it was not allowed to take to Cuba the telegraph train fitted out at Tampa. The use of the war balloon is strongly commended, and its utility was demonstrated in the campaign, but Gen. Greely disclaims any responsibility for forcing this balloon on to the skirmish line, where it caused serious loss of life by disclosing the position of the troops. The report claims for the corps the credit of locating Cervera's fleet in Santiago harbor. This was done by Col. James Allen, and later verified by Lieut. Col. Joseph E. Maxfield, both of the Signal Corps. Col. Allen telegraphed to the chief signal officer on May 19, the day Cervera entered the harbor, that "five Spanish vessels arrived at Santiago de Cuba; have notified Admirial Sampson, etc." This information was sent to the President and prompt orders were at once given for the blockade of Santiago harbor. Col. Allen continued almost daily to send valuable information from Santiago. The report deals largely with these and similar services of the Signal Corps, and Gen. Greely says that the corps failed to receive, from Gen. Shafter, even a notice that it was to participate in the Santiago campaign.

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SPECIAL FIREPROOF CONSTRUCTION IN THE U. S. APPRAISERS' WAREHOUSE, NEW YORK CITY.

By Gunwald Aus, M. Am. Soc. C. E.*

This building occupies the entire block bounded by Greenwich, Christopher, Washington and Barrow Sts., in New York, and covers an area of about 53,000 sq. ft. It has ten stories and a basement, and the ridge of the central skylight is about 192 ft. above the street. The three lower floors with a temporary roof were completed in 1894 under a limited appropriation made by Congress in 1888. In 1895 Congress extended the limit of cost of the building and appropriated a sum sufficient to proceed with the construction. The walls of this building are of brick, with granite trimmings, and are self-supporting, and columns built into the walls support floors and roof.

After consultation with Mr. Theodore Cooper, C. E., it was decided to construct the steelwork of the building for an assumed "live load" of 325 lbs. per sq. ft.; that is to say, the floor beams were proportioned for the calculated dead load and a live load of 325 lbs. per sq. ft. The girders were designed for the dead load and two-thirds of the supported area covered by a load of 325 lbs. per sq. ft., it being assumed that in a building of this kind at least one-third of the floor area is kept open for passageways. The beams and girders in the roof are proportioned for the calculated dead load and a live load of 40 lbs. per sq. ft. The columns are proportioned for the dead load and two-thirds of the full live load on two floors, and a gradually decreasing percentage on all other floors. The foundations are of concrete and stone resting on a compact bed of coarse wet sand. They are proportioned so as to impart a pressure of four tons per sq. ft. to the sand under the load for which the basement columns are proportioned.

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*Engineer of Steel and Iron Construction, Office of Supervising Architect, Washington, D. C.

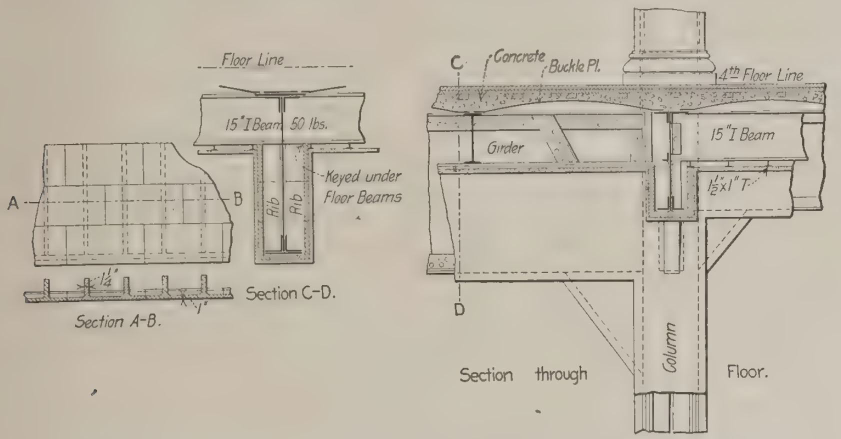


FIG. 1.—DETAILS OF FLOOR CONSTRUCTION AND COLUMN AND GIRDER FIREPROOFING, U. S. APPRAISERS' WAREHOUSE, NEW YORK.

The three lower floors are built of 24-in. I-beams supporting terra cotta arches of generally 11 ft. 6 ins. and 15 ft. 4 ins. span. A general section showing the floor construction, and a description of a test made on these arches, appeared in Engineering News of Nov. 7, 1895. While this construction is economical in cost, it is enormously heavy, the calculated dead load being from 120 to 130 lbs. per sq. ft.

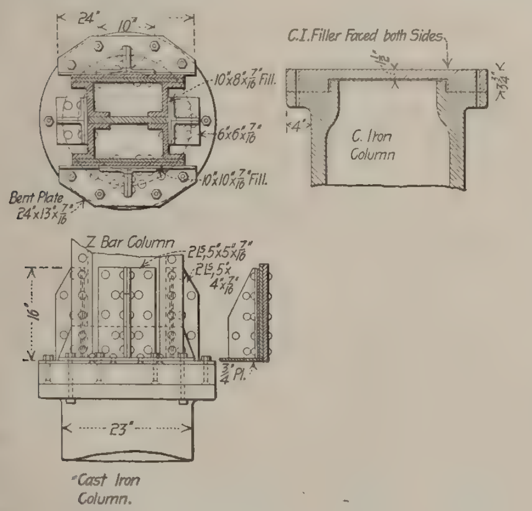


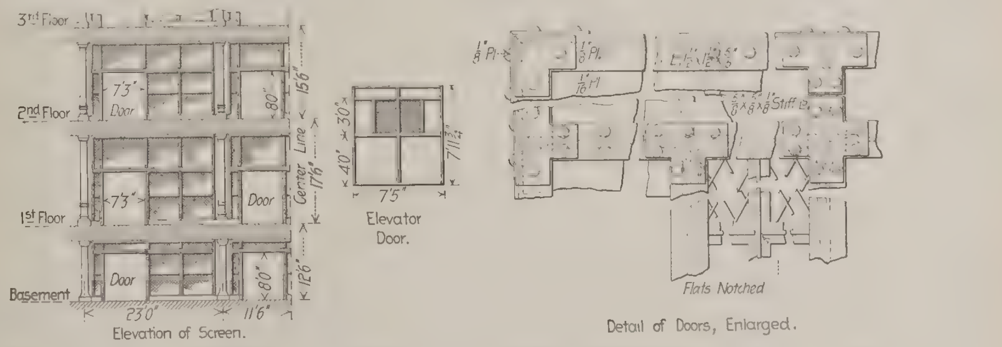
Fig. 2.—Detail of Connection of Z-bar and Cast-Iron Columns.

The upper seven floors are built of buckle plates riveted to the top flanges of I-beams spaced 4 ft. 7 ins. c. to c. (Fig. 1). The plates are ¼-in. thick and are covered with a coating of asphalt at least ¼-in. thick on buckles and ⅝-in. to ¾-in. thick in all valleys, so as to protect effectually both plates and beams against water leaking through the flooring. On this asphalt is a deadening of cinder concrete. From below, the beams and floor plates are protected by a ceiling of plaster on expanded metal fastened to light T-irons. The plaster selected is a comparatively new material, "Asbestic Plaster," which is manufactured from the waste material in the asbestos mines, and which appears to have splendid fire-resisting qualities.

If, however, the combined action of intense heat and cold water should destroy this ceiling, I am strongly of the opinion that no part of the solid steel floor would collapse, as its continuity would prevent any one beam from buckling, so that this floor is as nearly fireproof as it is practical to build one. The cost of such a steel floor is, of course, considerably higher than that of a concrete or terra cotta floor, but then this floor weighs only 65 lbs. per sq. ft. against 100 to 130 lbs. per sq. ft. for the other constructions, and it is certainly much more rigid.

The columns in the basement and first and second stories are of cast-iron and have terra cotta fireproofing. Above the third floor all columns are of Z-bars, Fig. 2, and have concrete fireproofing. The columns were first wrapped with expanded metal and then a 2½-in. thick layer of concrete was formed around it by enclosing the column in a wood form and tamping the concrete in place. The roof is built of cinder concrete on expanded metal. The metal was stretched on top of the roofbeams and the cinder concrete rolled in place on a wooden platform built in between the beams. On the concrete is placed a covering of asphalt 1 in. thick, put on in two layers, ½-in. thick.

A novel feature in this building which deserves to be mentioned is the fireproof, or rather fire-retarding screen, Fig. 3, which encloses the light well. This light well is 64 × 46 ft., and in it are located the ten freight elevators. In case of fire it would act like a chimney and rapidly communicate fire from floor to floor. To prevent this a screen was built. It is constructed of wire glass in iron sashes, protected on the side facing the warehouse with heavy wire netting. The elevator openings, whose doors close automatically as soon as the car leaves a floor, form the only openings in this screen. As the elevator doors are of sheet iron and are always closed, a fire will be confined to the floor where it started long enough to give the firemen a chance to put in some effective work. All openings in the outer walls are protected by corrugated steel shutters.



Elevation of Screen.

Detail of Doors, Enlarged.

FIG. 4.—HALF ELEVATION OF FIREPROOF SCREEN SHOWING DETAILS OF ELEVATOR DOORS.

The contract for the steel frame, including buckle plate floors above the third floor, was awarded to Post & McCord, of New York city. It amounted to 6,800 tons, of which 1,700 tons were buckle plates. The erection was commenced on Nov. 15, 1896, and completed on April 18, 1897. An idea of the amount of work done can best be formed from the statement that the shop rivets used weighed about 334,000 lbs., the field rivets about 210,000 lbs., and it required 6,690 gallons of red lead to paint the steel after erection. This paint was nearly all applied by a compressed air machine, which worked very satisfactorily. I am indebted to Messrs. Post & McCord for these data. Including steel and iron in the three lower floors, and other steel not included in the above contract, the grand total of steel and iron in the building amounts to over 11,000 tons.

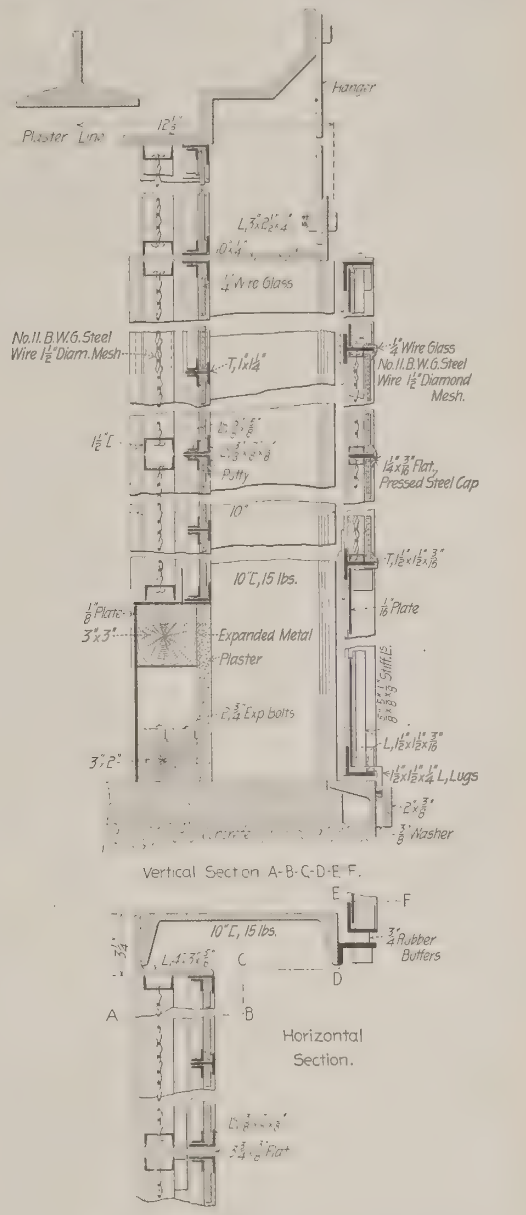


Fig. 3.—Section Showing Details of Fireproof Screen to Prevent Access of Fire to Light Shaft.

All steel above the third floor is "Open Hearth," of 60,000 lbs. to 68,000 lbs. ultimate strength. Holes in material over ⅝-in. thick were punched ⅛-in. small, and reamed to size. At the shop all steel was given a coat of linseed oil, except the buckle plates, which were given a coat of Edward Smith & Co.'s asphalt paint, as it was thought that the hot asphalt, to be put on after erection, would burn the oil. The Supervising Architect, James Knox Taylor, has kindly permitted me to publish these details.

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Our attention has been called to the fact that the heavy grain train hauled on the New York Central by a single locomotive recently and noted on p. 257 of our last issue, was not nearly as heavy as the coal train hauled from Altoona to Columbia, on the Pennsylvania R. R. on Aug. 9 last, and noted in our issue of Aug. 18. As both of these trains were of phenomenal size, however, we have tabulated the principal particulars concerning each below:

	Pennsylvania.	N. Y. Central.
Number of cars	130	81
Weight behind tender, tons	5,212	3,478
Freight carried, tons	3,692	2,000*
Distance hauled, miles	161	140
Time consumed	17 h. 13 mins.	12 h. 55 mins.
Average, miles per hour	9.4	10.8
Locomotive	Consolidation.	Mogul.
Weight on drivers, lbs.	186,000	123,000
Driver, diameter, ins.	56	57
Cylinders, ins.	23½ × 28	20 × 28

*Obtained by estimating the average weight of grain at 50 lbs. per bushel.

It may be noted that the Pennsylvania train made the run from Altoona to Harrisburg at an average speed of ten miles per hour. The maximum grade on this section was 12 ft. per mile.

◆

Another engineering association will soon be added to the already long list of such associations, and will have the descriptive but somewhat cumbrous title of the American Railway Engineering and Maintenance of Way Association. It will be open to all officers having charge of railway construction work, engineering work or maintenance of way. Mr. A. Torrey, Chief Engineer of the Michigan Central R. R., is chairman of the provisional association, which will complete its organization and adopt its constitution at a meeting next March. It is reported that a large number of officers have already signified their intention of becoming members. This association is the outcome of a somewhat unfortunate action taken by the Roadmasters' Association of America at its meeting held at Denver in September last. An amendment to the constitution was submitted, changing the name to that of "The Railway Maintenance of Way Association," on the ground that the title of roadmaster is not distinctive, and that the association has grown beyond the scope of the roadmaster's work alone. Under present conditions, the work of track maintenance is being put more and more under the direction of engineers, and is becoming a department requiring more skill and technical knowledge than is possessed by the ordinary typical "roadmaster," who is merely a foreman of high grade. Many roadmasters (or supervisors, as they are termed on some roads) are engineers, and the title of roadmaster as applied to the higher officers of this department is, therefore, falling into disuse, and the title of engineer of maintenance of way is becomong more general. For example, Mr. R. Caffrey, General Roadmaster of the Lehigh Valley R. R., who was recently president of the Roadmasters' Association, has had his title changed to that of Engineer of Maintenance of Way. It is true that all officers in charge of maintenance are eligible to membership in the Roadmasters' Association, and many engineers are members. In fact, we find 21 engineers (5 chief, 5 assistant, 4 engineers of maintenance of way, 3 resident and 3 division engineers) by a rough canvass of the list of members. It was felt by the progressive element in the association that the name should more fitly represent its present aim and membership. The conservative element, however, strongly opposed the change, being apparently fearful that the old-time "practical" roadmasters would eventually be crowded out by the "engineer." This, however, is a stage of evolution which will take place, and is already taking place, and no such action as holding on to a name can stop it. We are not sure, however, as to the wisdom of organizing an independent, and, in some respects, opposition, association, as this action will hardly conduce to harmony or good feeling between the various grades of men employed in the maintenance of way department. If all the engineers (by title or otherwise) who are now members of the Roadmasters' Association should resign and join the Maintenance of Way Association, the former would lose the most valuable element of its membership. It seems to us that a better plan would have been for the maintenance-of-way engineers to join the old association and thus gradually elevate its standing, and at the same time make the progressive element strong enough to carry out such changes in title and management as might from time to time be desirable. In a recent issue we deprecated the increase in the number of technical associations, and we are obliged to doubt the wisdom of creating this newest addition to the list.

◆

We give considerable space in this issue to description and illustration of the largest and most notable elevator plant ever constructed, that for the Central London Ry. Additional interest centers about this plant in view of the fact that the contract for the entire equipment was taken by an American company, the Sprague Electric Co., much to the chagrin of English machinery manufacturers, and that the selection of this elevator was made by English engineers after a long series of tests in which they exhausted their ingenuity in devising methods of determining the safety and efficiency of the apparatus. The selection of American elevators for so extensive and important a plant, however, was certainly to be expected, for the experience of engineers and manufacturers in the United States in the design of high speed and large capacity passenger elevators is far in advance of that of any other country.

◆

THE RESPONSIBILITY FOR THE INADEQUATE APPROPRIATION FOR THE NEW YORK CANALS.

The State Engineer and the Superintendent of Public Works of New York have recently made public their replies to the criticisms upon the work of their respective departments made in the report of the Canal Investigating Commission. These replies we have abstracted quite fully in this number, for the matters at issue are almost all of them questions of much interest to the engineering profession, and it is, moreover, the policy of this journal to give space for a fair presentation of both sides of any question in controversy.

The position of Messrs. Aldridge and Adams is substantially a denial, both general and specific, of the charges contained in the Canal Commission's report. They declare that the work has been honestly carried on by their departments, with as great efficiency as could possibly be expected; and that the Commission's charges in the main really amount to no more than an opinion on the part of the Commission and its engineers that the work could have been better done by other methods than those adopted. The difference between accusing a public officer of bad judgment, and of wilful corruption, is, of course, manifest.

Finally, Messrs. Aldridge and Adams make detailed replies to the instances in which specific irregularities were charged in the Commission's report. These matters, however, will doubtless be made the subject of further official inquiry; and it is certainly fair to suspend judgment upon them until the results of such inquiry are made known. The canal investigating commission was not a judicial body; its object was to investigate the work done rather than the personal responsibility for errors or irregularities. Its investigation, moreover, was conducted without the safeguards against error and injustice which exist in a court of law; and it is manifestly unfair to base conclusions as to the guilt or innocence of any man or body of men upon the investigation of such a tribunal.

Aside from these questions of personal responsibility, however, the controversy over the canal work has brought to light many questions of general interest to engineers. At the outset is the matter of discrepancy between the preliminary estimates and actual cost of engineering works. Messrs. Adams and Aldridge correctly say that what the voters of New York State are chiefly kicking about is that they were assured that $9,000,000 would accomplish a certain piece of work, and after they have paid over the money and it has been spent, they learn that two or three times as much will be required. It seems to be entirely clear that the responsibility for deceiving the people rests with that irresponsible body known as the Executive Canal Committee, made up of delegates from the principal commercial organizations of New York. They lobbied a bill through the legislature calling on the voters of the state to approve a state bond issue of $9,000,000 regardless of previous rough estimates in excess of this amount which the State Engineer had furnished; and they carried on a vigorous campaign to secure a favorable vote on this bill, in which they assured the people that this amount would be sufficient to complete the work.

It was hardly to be expected that Messrs. Adams or Aldridge would take the responsibility of opposing this appropriation, especially as there was then no absolute proof that the $9,000,000 appropriation might not be adequate. After the money was available the view they took was that it was their duty to perform the work ordered by the legislature, so far as the funds would permit, and they appear to have made considerable effort to bring the work within the limits of the appropriation. The first survey made in the spring of 1896 showed that the work would cost about $15,000,000; but the State Engineer ordered that the scope of the work should be restricted and everything that could possibly be delayed should be omitted, hoping in this way to keep the cost of the work down to the $9,000,000 mark.

It is a difficult question as to just when it became Mr. Adams' and Mr. Aldridge's duty to undeceive the people. That it was their duty to do this at some time is beyond question, and is proved by the fact that when the "cat was at last let out of the bag" it was on these two officials that popular condemnation chiefly descended. We believe, after careful consideration, that it was their duty as public servants to stop the expenditure of the state's money as soon as it became clearly evident that the work ordered by the legislature could not be accomplished by the funds which it had provided. If they did not go so far as to order work stopped on contracts already let, it was at least their duty to refrain from letting further contracts as soon as it became clear that the work would overrun the appropriation. Now, the first batch of contracts, amounting to $3,325,000, was let in

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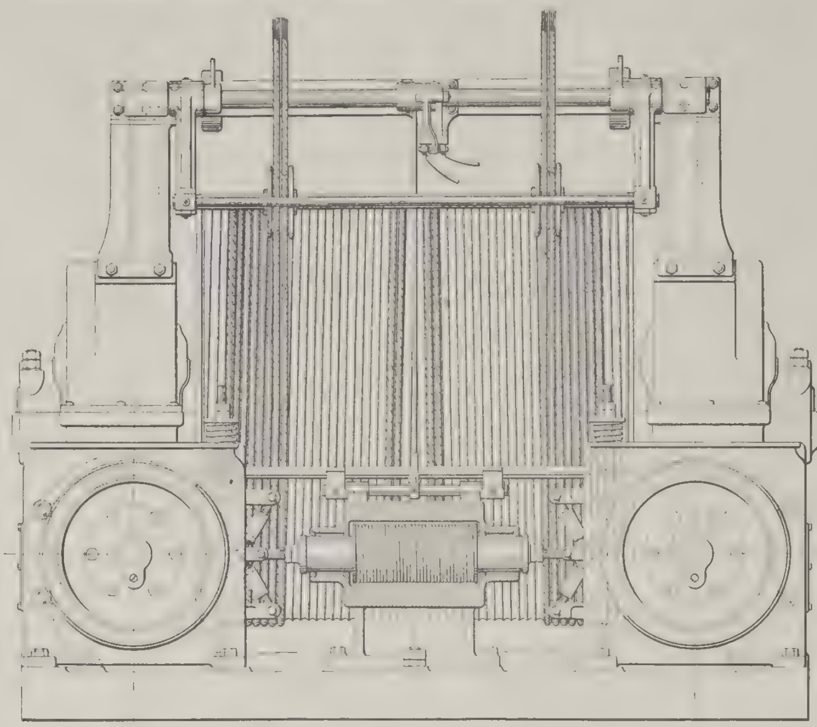
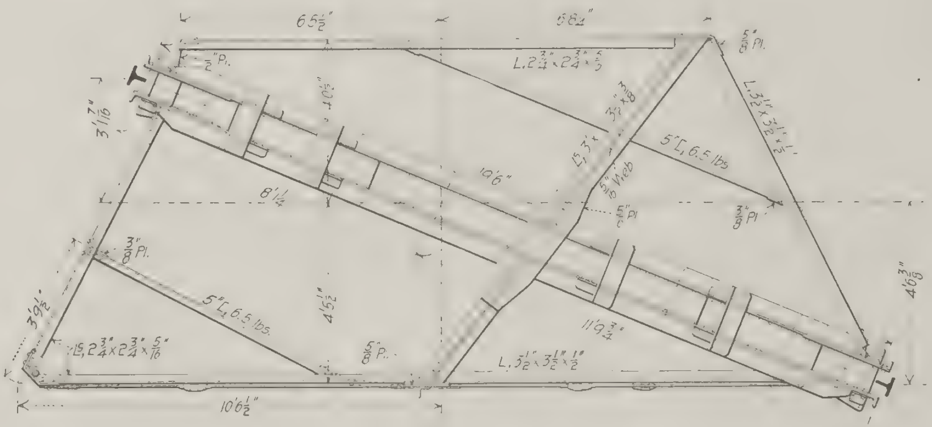
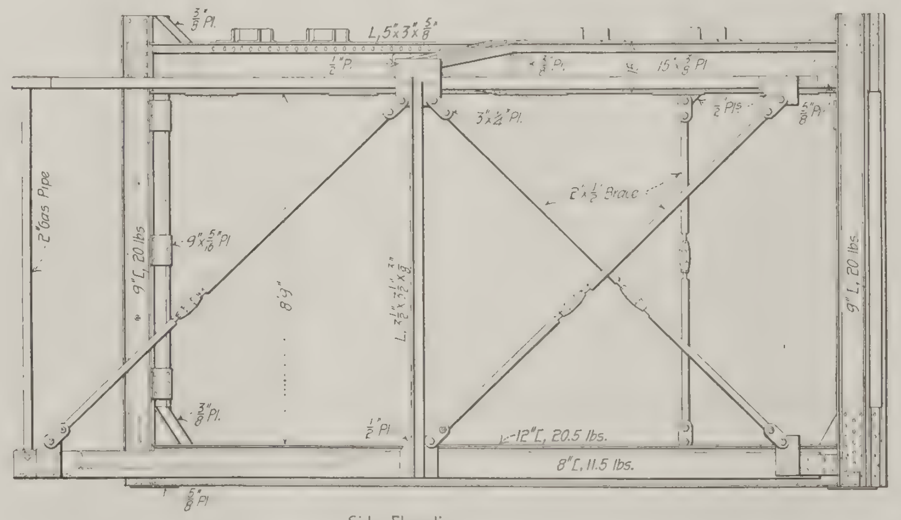


FIG. 12. END ELEVATION OF TYPE "S" DUPLEX TANDEM WORM GEAR ELECTRIC ELEVATOR.



Plan.



Side Elevation.

FIG. 4. FRAMING OF UNEQUAL SIDED CAR FOR TWO-CAR SHAFT.

ELECTRIC ELEVATORS FOR THE CENTRAL LONDON UNDERGROUND RAILWAY.

Sprague Electric Elevator Co., New York City,
Designers and Builders.

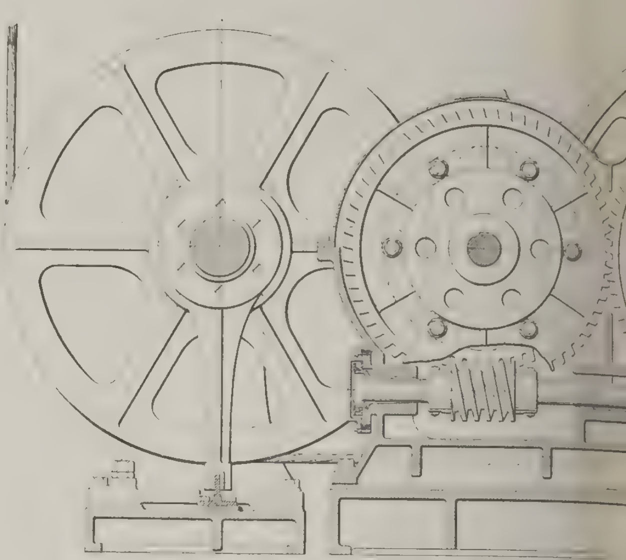


FIG. 11. SECTIONAL SIDE ELEVATION OF TYPE "S"

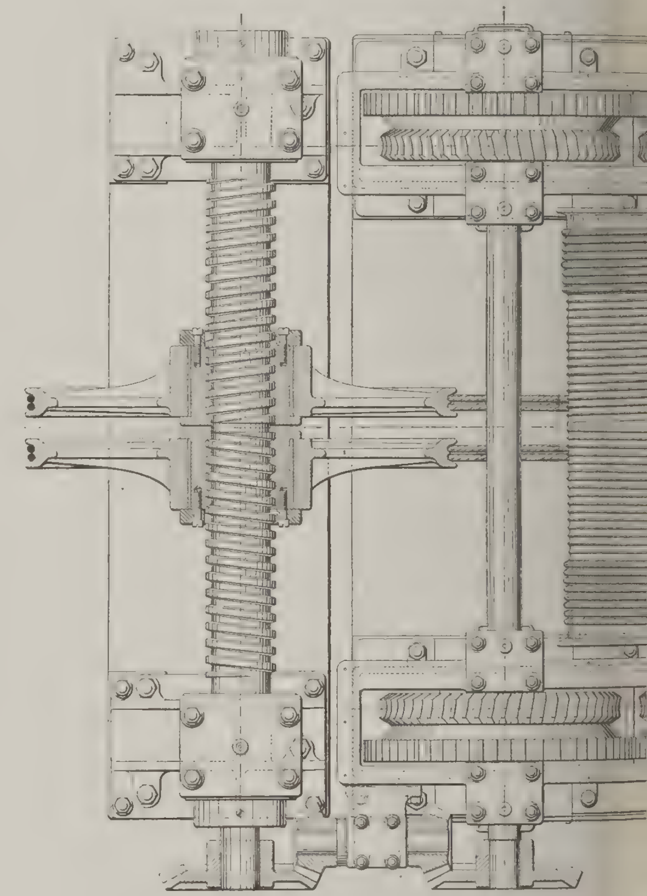


FIG. 10. PLAN OF TYPE "S" DUPLEX T

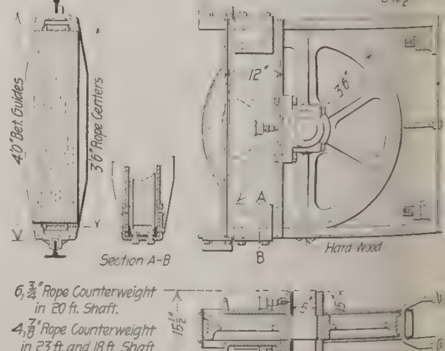
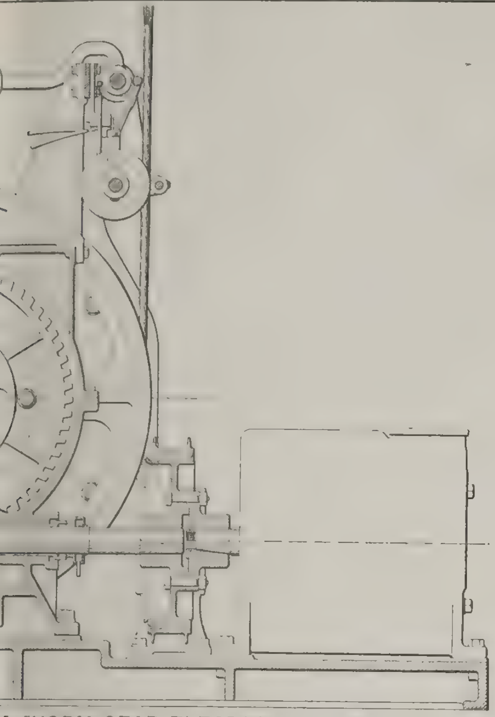

5'10½"
4'0" Bet. Guides
3'6" Rope Centers
12"
36"
A
B
Hard Wood
Section A-B
6, ¾" Rope Counterweight in 20 ft. Shaft.
4, ⅞" Rope Counterweight in 23 ft. and 18 ft. Shaft.
15½"
5"
15"

FIG. 7. DETAILS OF TH



M WORM GEAR ELECTRIC ELEVATOR.

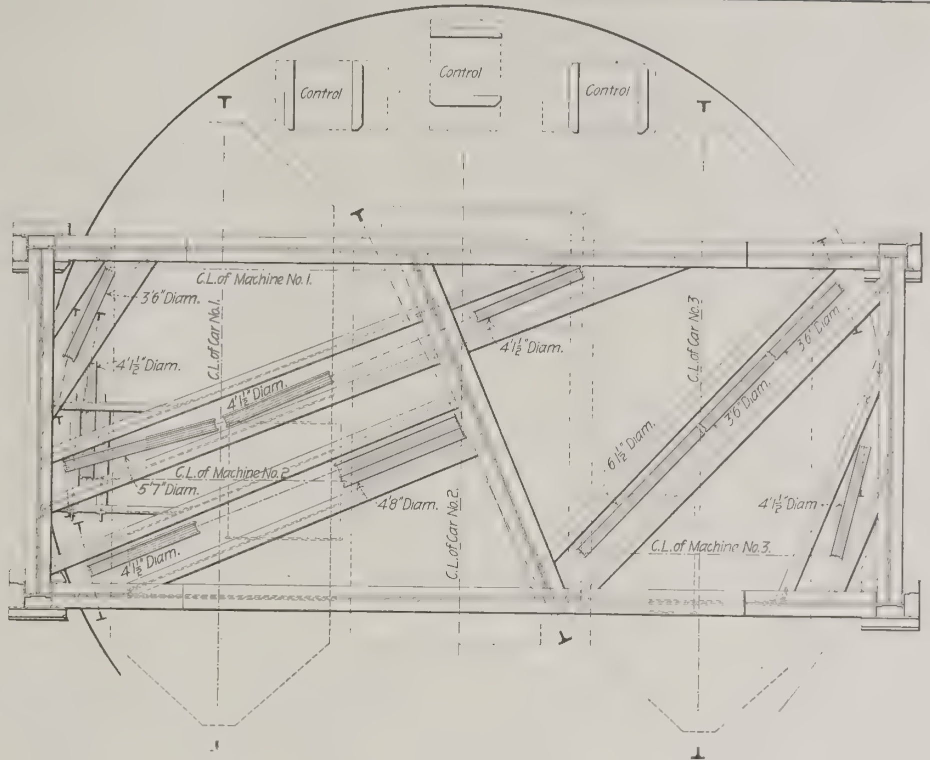
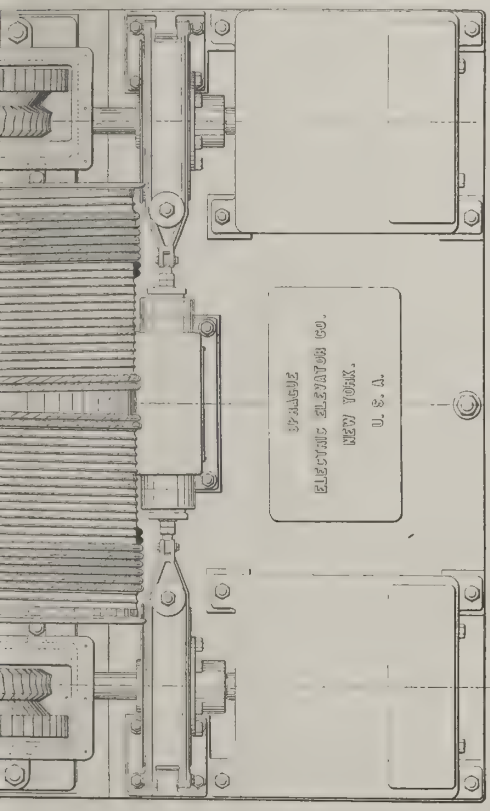


FIG. 8. PLAN OF OVERHEAD ARRANGEMENT OF THE 30-FT. SHAFTS.



EAR ELECTRIC ELEVATOR.

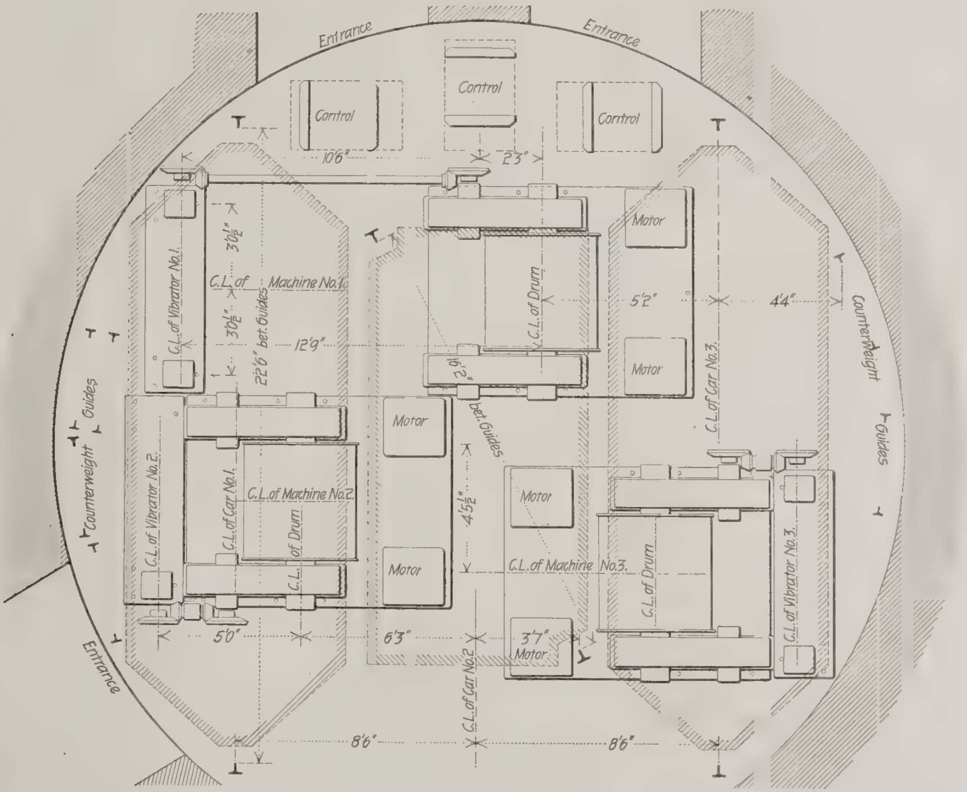
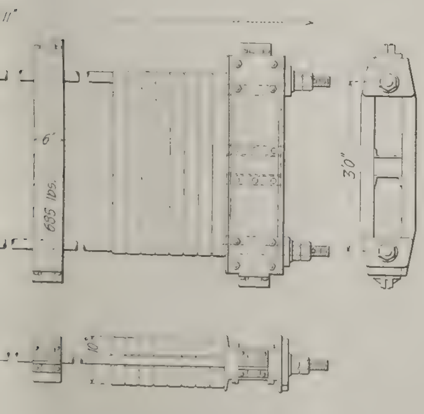
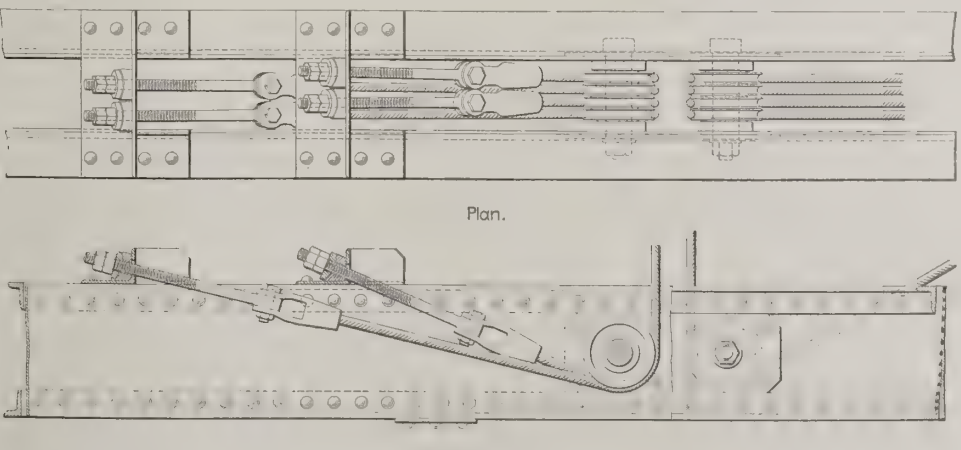


FIG. 9. PLAN OF BOTTOM OF 30-FT. SHAFT.



COUNTERWEIGHTS.



Plan.

Vertical Section.

FIG. 5. METHOD OF ATTACHING CABLES TO THE FRAMING OF ALL CARS.

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the fall of 1896. Bids on the second batch of contracts were received Aug. 24, 1897, and at that time, we believe, it was known to Messrs. Campbell and Adams that the work was certain to overrun the appropriation. In fact, this was publicly stated in September. Yet not only was the second batch of contracts let in the face of this knowledge, but months afterward additional contracts were let when the whole state was in an uproar over the news that the canal appropriation was inadequate. We understand that Superintendent Aldridge claims that the law was mandatory and he had no option in the matter. We know, however, of no punishment which could or would have been visited on him or the other members of the canal board had they, as soon as the real situation was apparent, stopped the letting of further contracts and saved the four or five millions still in the state treasury from going "into the ditch." We are of the opinion that had they done this they would have been supported in their action both by public opinion and by the courts.

In our abstract of Mr. Aldridge's reply to the Commission we have included a curious table which he gives in support of the statement that the preliminary estimate for the canal improvement work was no further out of the way than original estimates for other great public works have been. We have done so because we wish to combat emphatically the too common statement that engineers' estimates of the cost of works are wholly unreliable. The $9,000,000 appropriation, as we have seen, was not an estimate or even a guess of the cost of the work it was provided to accomplish. It was a guess at what the people could be induced to give—nothing more nor less. The "engineer's estimate" for the Hoosac tunnel was not an estimate in the present day sense of the word. It was made when engineering was in its infancy, and when absolutely no precedents for a work of such magnitude existed. It was a guess, pure and simple. We know of no "$12,000,000 estimate" for the Chicago Drainage Canal. If such an estimate was made, it was, we venture to say, a mere guess. As a matter of fact, the cost of actually constructing the Chicago Drainage Canal has come very close to the first official estimates of cost which were made by its Chief Engineer, Mr. Isham Randolph, at the outset of the work.

We might in a similar way review the other instances which Mr. Aldridge presents in his table; but it is not needful. What we wish to point out is that the "guess" of a promoter or a committee, or any other man or body of men, is not an "engineer's estimate." There is just one way to make a reliable engineer's estimate, and that is to make actual detail surveys, compute the quantities of materials of each kind involved, and on this basis ascertain the probable cost of the work. If the people who furnish the funds for public works prefer to take guesses in preference to engineer's estimates, they must not complain if they suffer disappointment. The Panama Canal dupes, for example, were satisfied with De Lesseps' guess as to the cost of the canal, and could not wait for engineer's estimates. They paid some $250,000,000 for their folly. The New York Capitol and the Hoosac tunnel, instanced by Mr. Aldridge, are two other pieces of work which would never have been undertaken had their enormous cost been foretold in advance.

On the other hand, such recent and notable works as the Boston subway and the Philadelphia subway are examples of large and costly pieces of engineering work, involving many features of novelty, which are carried out within the engineer's original estimate. Such instances as these show conclusively the value of careful estimates as a basis for any engineering work. The work may, indeed, proceed without them, but always at the risk of such disappointment and loss as befel the Panama investors, and has now come home to the taxpayers of New York.

LETTERS TO THE EDITOR.

Capacity Tests of Mississippi River Dredges.

Sir: In the article on "Dredges and Dredging on the Mississippi River," in your issue of Oct. 13, Table No. 2 (p. 239), seems to contain marked peculiarities in the columns indicated as "minimum" and "maximum," whereby a large number of figures in the former are in excess of those in the corresponding "maximum." Are these typographical errors, or is the table not understood by the writer?

Yours very truly,
L. Y. Schermerhorn, Pres. American Dredging Co.
Philadelphia, Pa., Oct. 22, 1898.

(The seeming discrepancy is easily explained. Each column represents one test, and the two tests for each dredge are those showing the minimum and maximum capacity, or sand pumped per hour. In the test showing the minimum capacity, however, it does not follow that all the conditions of working will be at a minimum: As an example, in comparing the two tests of the "Alpha," it will be seen that during the test showing the minimum capacity, the efficiency of the plant and the steam pressure of the boiler were higher than in the test showing the maximum capacity. Also in the tests of the "Zeta," the column for the minimum capacity shows that during this test the amount of material pumped was greater than during the maximum test, but as the amount of sand was only 8.1% instead of 14.8%, the actual capacity in sand pumped per hour was at its minimum.—Ed.)

The Advantages of Forced Blast Heating Systems for Drying Kilns.

Sir: One of our special inspectors has written to us, after a very thorough examination of premises in the South used for drying and ordering tobacco, recommending the introduction of drying kilns of the blower type as a substitute for the present method of drying by direct steam pipes. He states that manufacturers report that when once installed the process of drying by an air blast is preferable to and quicker than the steam pipe method, and he dwells particularly on the fact that in the elimination of the steam pipes from the rooms a great source of fire hazard is removed, as his inspection indicates that in no class of risks where dry rooms are used is there more universal carelessness than is found in the tobacco business. In addition to the improvement in methods, which is suggested, anything which tends materially to reduce the hazard from fire will unquestionably influence the rate which will be charged for insurance, and we write you suggesting that you call the attention of manufacturers of machinery and apparatus answering this description to the field for sales which seems to be clearly pointed out by our inspector.

You, of course, understand that we can only refer to the subject in a very general way, as the advantages of a change in system, or the reduction in the insurance rate which the change might warrant, would be determined by the conditions found in each separate property.

Yours truly,
E. L. Ballard, Asst. Secy. Continental Ins. Co.
46 Cedar St., New York city, Oct. 27, 1898.

(We believe that the general advantages of the blower system for drying kilns over the old method of drying by steam pipes directly in the kiln are now conceded by all who have given careful study to the matter. The reduction in fire hazard by this system, however, is a point which is, perhaps, not so generally understood, and the above letter is useful in calling attention to it. We may say in addition that the excess in first cost of the blower system over the old direct steam-pipe system is not so great as is sometimes claimed. With the blower system, the steam pipes are so much more efficient that a considerably smaller number of square feet of heating surface is required for a given work than is required with the direct steam system.—Ed.)

Public Improvements at New Orleans.

Sir: The City of New Orleans has just let contracts for the paving of 85,000 sq. yds. of streets, as follows: To the Compagnie Generales des Asphaltes de France (rock asphalt), at $2.49 per sq. yd.; The Ayres Land Asphalt Co., at $2.60 per sq. yd.; Belden & Seeley, or the Columbia Construction Co., of Syracuse, N. Y., the last work advertised for, at $2.10 per sq. yd. on 6-in. concrete foundation and $1.70 per sq. yd. on 4-in. concrete foundation.

We have been heretofore paying more for asphalt than any city in the county, for the reason that the Barber Asphalt Co., being the only concern in the field, enjoyed a monopoly.

The council of the City of New Orleans about a year ago passed an ordinance which prohibited the mention of any particular asphalt when bids were being advertised for. The result was that other bidders were able to enter the field and bid on every quality of asphalt. We have paid as high as $3.75 per sq. yd. for asphalt paving in the past, and up to a year ago $3.25. The low bids obtained for asphalt recently will give an impetus to street paving in this city, which is much needed, as most of our streets are paved with the square block granite or cobble stone. We would be glad to have it mentioned through the columns of your valuable paper that New Orleans contemplates letting an immense amount of street paving contracts, and would be glad to welcome all bidders.

Another work about to begin is the laying of all wires underground. The various wire companies have all their plans and specifications complete, and will begin to break ground within 30 days.

Another great work now under way is the construction of our drainage system, which will drain not only our city and lower the ground water level some 5 or 6 ft., but also drain every inch of swamp around New Orleans. The completion of this work, which will entail a cost of about seven or eight million dollars, will require some five years, and will remove the unsightly surface drainage which now prevails in our city.

A subject which is now being seriously considered by our people is the providing for the construction of a modern system of sewerage. This city granted, some years ago, a franchise to a corporation to construct a system of sewerage on plans drawn by Rudolph Hering. The company ran out of funds after building several miles of piping. The city brought suit to annul the contract or privileges. The corporation is now seeking to compromise the litigation, claiming it has plenty of funds at its back, and is willing to continue and complete construction of this sewer system. Some are in favor of a compromise and others are against; but all agree that sewerage we must have, if we desire to place this city in the rank of cities to which she belongs. The matter is now before the Sewerage Committee appointed to investigate the best measures proposed. We would therefore be glad to entertain bids, propositions or suggestions on that score.

A work of great importance about to begin is the construction by the National Government of a floating steel dry-dock for docking merchant ships and war vessels. The bids are to be opened by the Navy Department in Washington next month. Congress at its last session appropriated some $800,000 for this work.

The board of U. S. engineers appointed for that purpose have just completed their report of the survey of South West Pass at the mouth of the Mississippi. The object is to construct another jetty through South West Pass, such as was constructed through South Pass by Jas. B. Eads. This will give shipping a depth of channel at the bar of 35 ft., as compared with 26 ft. which now prevails.

Respectfully,
Sidney Story.
Equitable Building, New Orleans, Oct. 18, 1898.

Corrosion of Iron and Steel.

Sir: Your current discussion of the evidently unsettled question of the relative rate of corrosion of iron and steel reminds me that, years ago, I endeavored to secure reliable and sufficient data on the subject, to serve as a guide in practice. I found very little available material. There should be to-day much more, now that the use of steel has come to be general in all departments of engineering. The results of my researches in technical literature and reports are published in Sec. 192, Vol. II., of my "Materials of Engineering," page 328, et seq. In brief, they were.

(1) Corrosion can ordinarily only occur in the presence simultaneously, of oxygen, moisture and carbon-dioxide (Calvert).

(2) The gases of the locomotive accelerate corrosion by their peculiar acid quality, arising from their contents of sulphur-oxides; iron and steel absorbing acids somewhat greedily (Kent).

(3) Cast iron, in dilute solutions of acids, is rapidly acted upon, especially in warm water—in the flow of water of condensation from engine-condensers, for example—losing the metal, and often leaving the carbon and other matters; the piece retaining its form and general appearance unchanged, but with enormously reduced density. The metal is said by the uninformed to have been "changed to plumbago" (Calvert).

(4) Corrosion is rapidly effected with cast metal irregularly and quickly cooled in the mold, less rapidly where slowly and regularly cooled (Mallett).

(5) The rate of corrosion is ordinarily constant over long periods of time; but the removal of the rust retards oxidation as it destroys the voltaic couple composed of metal and of oxide.

(6) Hard iron, rich in combined carbon, rusts slowly. The presence of graphite or of a different quality of iron in metallic contact with it, increases the rate of oxidation —presumably by forming local voltaic couples. Hard steel rusts less rapidly than soft.

(7) Foul sea-water, as the bilge-water of a ship, corrodes iron and steel rapidly.

(8) The rate of corrosion is too variable to be stated in exact terms. The hulls of iron ships have been found to average a rate of not far from 1-16 in. in 25 years, when carefully painted. Iron roofs exposed to smoke and gases of locomotives, are sometimes ruined in three or four years.

(9) The observations of Thwaite are as follows:

The time of endurance in years may be expected to average about

$$T = W \times C L;$$

where W is the weight of metal in pounds per foot length of the member, L is its length of perimeter, inside and out, is hollow, and C is a constant, which has the following values, and the magitude of which measures the relative loss by corrosion.

Material	Water				Impure air.
	Sea		River		
	Foul.	Clear.	Foul.	Clear or in air.	
Cast iron	0.0656	0.0636	0.0381	0.0113	0.0476
Wrought	.1956	.1255	.1440	.0123	.1254
Steel	.1944	.0970	.1133	.0125	.1252
Cast iron, no skin	.23	.0880	.0728	.0109	.0854
Galvanized	.09	.0359	.0371	.0048	.0199

Average for sea water: Cast iron, in contact with brass, copper or gun bronzes, 0.19 to 0.35; wrought iron, in contact with the same, 0.3 to 0.45.

This is for unpainted metal, of course. For painted iron or steel it is safe to multiply the endurance, as above, by two or more.

The precision of the above figures would seem to indicate accurate measurements, and to settle the question as respects the various metals; but, unfortunately, the quality of the steel and the influence of varying proportions of carbon, remain unmeasured, although soft and hard steels were compared with variable results. It has been assumed by the writer that the very softest steels, which contain less of the hardening elements than common iron, would oxidize more rapidly and the harder steels less rapidly, than wrought iron; while the rate of corrosion of wrought iron is subject to great variation with the variation of the chemical composition, and the mechanical structure, of its always heterogeneous mass. Graphite in cast iron, and cinder in wrought iron make with the adjacent metal rather effective voltaic combinations, and may be assumed to thus influence greatly the rate of corrosion. Very respectfully,

R. H. Thurston.

Sibley College, Cornell University, Oct. 28, 1898.

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The Power of Windmills.

Sir: Mr. Hood, in his comment in your issue of Aug. 25 on my letter on the power of wind-engines, is quite right when he says that the power developed by them is a function of their load; and this phase of the problem I would have taken up there had I not, at that time, overlooked the column of Mr. Murphy's table in which he gives the loads of the wheels upon which he experimented. On correcting the proof-sheet, however, I noticed that this most important portion of the data was given, and I then rearranged my table and added two formulae, which I had devised for use when the load was known; but the letter was published before the corrected proof-sheet reached New York.

The formula

$$N.\ HP. = 0.0001\ D^3, \tag{1}$$

where N. HP. is the net horse-power developed by a wind-engine, with an air current of 16 miles per hour, and D is the diameter of the wheel in feet; was based on the performance of wooden wheels and was not intended for the more efficient back-geared metal wheels now so largely used; and although it gives results which agree fairly well with the average run of metal wheels, as shown in my letter, it does so by reason of so many of these wheels being most improperly loaded, and does not give the results that should be expested of them under anything like favorable conditions,

$$N.\ HP. = 0.002\ D + 0.0001\ D^3 \tag{2}$$

serves fairly well as a general formula for these latter under somewhat better conditions of load, as was also shown in my letter; although if the best judgment is displayed in proportioning the load to the size of the wheel, which seems, however, to be the rare exception, much better results may be expected from the best wheels of this class.

So extremely limited have been the data which I have found available, that I am not, at this time, able to give a general formula for all sizes of wheels and all conditions of load; from that at hand, however, I have developed the two provisional formulæ given below, which, within any reasonable limits of load, agree well with the results obtained from tests made on wheels in actual service. For back-geared metal wheels 8 ft. in diameter,

$$N.\ HP. = 0.001\ L - 0.023 \tag{3}$$

while for those 12 ft. in diameter,

$$N.\ HP. = 0.0004\ L + 0.039 \tag{4}$$

in which L is the load in foot-pounds per stroke, which should not, in the former, be less than 50 nor more than 100, nor in the latter less than 250 nor more than about 850.

To compare the results of these formulæ with the results of Mr. Murphy's tests, as given in his table already referred to, let us take from that table the following 8 and 12-ft. wheels, the only ones not shamefully underloaded:

No. of Wheel.	Name of Wheel.	Diameter in. ft.	Load in ft. lbs.	N. HP. from tests.	N. HP. from formula.	Formula.
4	"Ideal"	8	50	.029	.027	N. HP. = .001 L — .023.
6	"Gem"	8	78	.042	.055	
18	"Ideal"	8	89	.070	.066	
5	"Aermotor"	8	95	.072	.072	
13	"Aermotor"	12	330	.171	.171	N. HP. = .0004 L + .039.
17	"Gem"	12	385	.149	.193	
3	"Aermotor"	12	415	.207	.205	
19	"Gem"	12	450	.162	.219	
7	"Aermotor"	12	462	.221	.224	
2	"Mogul"	12	536	.260	.253	
11	"Ideal"	12	844	.325	.377	

From the above it is seen that the results of the formulæ agree closely with those of the tests, the only discrepancy of any importance occurring with the "Gem" wheels, the tests of which show results uniformly low.

It is because of this most important condition of load not ordinarily being taken into account that the results of tests nearly always present such an appearance of confusion as to give one, not familiar with the subject, an idea that to experiment is to waste time and to attempt to discover laws is folly. It will, however, be seen from the above table that, when properly arranged, these data present a most regular appearance, and show results so consistent as to surprise, perhaps, many to whom the subject is not new.

Due to an improper load, many superior wheels have, without doubt, been condemned, while a neighboring wheel of inferior make, but more properly loaded, receives undue praise. Due also to this is the fact that large wheels often perform less work than smaller ones of no better or inferior makes. This is shown in the case of Nos. 12 and 11 of Mr. Murphy's table. Here No. 12, a 14-ft. wheel of high grade, is given a load so small that it develops but 0.125 HP., while No.11, a 12-ft. wheel of the same make, but with a better proportioned load, develops 0.325 HP.

A series of experiments much more extended than any so far attempted, and on somewhat different lines, should be made, not only because it is a subject of considerable interest, but because it is one that is growing to be of greatest practical importance, as upon the successful installation of small pumping plants, cheap in first cost and economical in operation and maintenance, depends the success or failure of great numbers of agriculturists scattered over a vast area of our country.

M. Fargusson.

Southport, N. C., Aug. 29, 1898.

(After receiving the above letter we received from Mr. E. C. Murphy a letter criticising some features of Mr. Fargusson's first letter (Eng. News, Aug. 4), which were covered by the letter above. We, therefore, submitted a proof of the above letter to Mr. Murphy, who continues the discussion with the following letter.—Ed.):

Sir: I am glad to learn from Mr. Fargusson's second letter that he appreciates the fact that the load on a windmill should be taken into account in computing its power. In his first letter he neglects the effect of load, and has to throw out of account some of the results of mills that I have tested, because "they are not consistent with one another." In his second letter he takes into account the load factor and finds that "they show results so consistent as to surprise perhaps many to whom the subject is not new."

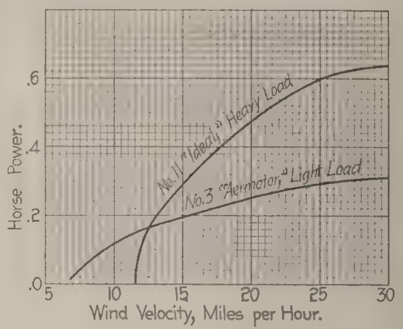
The effect of this load-factor on the power of a windmill was first published in the "Kansas University Quarterly," of October, 1895; it is illustrated by the case of a 12-ft. "power" mill in Engineering News of Aug. 19, 1897, and is quite fully discussed in "Water Supply and Irrigation Paper," No. 8.

Mr. Fargusson mentions the need of a more extended series of tests of windmills. The U. S. Geological Survey is in possession of the results of two seasons' tests in addition to those in Paper No. 8, by the writer and will publish them in due time; these cover all sizes of steel mills and several sizes of wooden ones.)They include power as well as pumping mills.

In regard to Mr. Fargusson's formula for the net power of a windmill, it does not give the total net power of a mill. The efficiency of the pump and well should be taken into account. The total power can be best found from power mills.

Prof. O. P. Hood in his remarks on Mr. Fargusson's formula (Eng. News, Aug. 25) makes a statement that may be misleading. He speaks of Mr. F. H. King getting results very different from those that I have gotten. Mr. King found the brake power of a 16-ft. mill to be 1.08 HP. in a 16-mile wind. I found the pumping power, expressed in useful work done by the mill and pump, of a 16-ft. mill No. 9, to be .433-HP. in a 16-mile mind. The loads on the mills are not given, or the make of mill, hence a just comparison of the actual power of the two mills cannot be made.

Professor Hood also gives some figures showing the useful work done by a "typical" 10-ft. mill and pump per month, in the vicinity of Manhattan, Kan. He does not state what kind of a mill this typical mill is, whether wood or steel, back geared or working direct stroke, or what the load on the mill. Permit me to give the useful work of two 12-ft. steel, back-geared pumping mills, in the vicinity of Dodge City, Kan., for the six irrigating months—April to September. The data for this purpose is taken from "Water Supply and Irrigation," Paper No. 8. The two mills selected are a 12-ft. aeromotor No. 3, and a 12-ft. Ideal No. 11. The former being a lightly loaded mill, 415 ft.-lbs. per stroke of pump, and the latter heavily loaded, 844 ft.-lbs. per stroke, the effect of difference in loading will be seen.



Horse-power Curves of Two 12-ft. Windmills, Showing Influence of Load.

The useful work in horse-power done by these mills in different wind velocities is shown in Fig. 1. No. 3 being lightly loaded will start in a 7-mile wind; No. 11 requires an 11½-mile wind to start it, but gives more power than No. 3 for all velocities above 12½ miles per hour.

The mean monthly wind movement at Dodge City for seven years, for the months, April to September, is given in Table I. The numbers in this table show the mean number of hours in each month that the wind velocity was 0 to 5 miles per hour, 6 to 10 miles per hour, etc. Thus for the month of April—if the number of hours that the wind velocity was 0 to 5 miles per hour for the seven years be added and the sum divided by 7, the quotient is the first number given in column 2.

From this table we see that at this place, for these six irrigating months, there are 140 hours per month when the wind velocity is 0 to 5 miles; 198 hours per month when it is 6 to 10 miles; 157 hours when it is 10 to 15; 109 when it is 16 to 20; 72 when it is 21 to 25; 34 when it is 26 to 30; and 22 hours when it is 31 and upwards miles per hour. The wind velocity here is 11 and upwards miles per hour for 54% of the time.

By a study of the diagrams and table we see that during the 140 hours when the wind velocity is 0 to 5 miles per hour neither of the mills will do any useful work. Mill No. 3 will start in a 7-mile wind, and will run about four-fifths, or 158 hours, out of the 198 hours when wind velocity is 6 to 10 miles per hour. This mill will run for all higher velocities. No. 11 requires an 11½ miles wind to start it, and will run for about 141 hours out of the 157 hours when wind velocity is 11 to 15 miles—it will run for all higher velocities. No. 3 will run—if in the wind—about 75% of the time, and No. 11 about 51% of the time.

The useful work done by each mill in a mean month is given in Table II. Columns 2 and 5 give the number of hours during the mean month that each mill was running when the wind velocity was as given in column 1. The power, given in columns 3 and 6, is the hourse-power taken from the diagrams Fig. 1 for the mean of the corresponding velocities in column 1. The useful work—columns 4 and 7—in ft.-lbs. is found by multiplying the power by 1,980,000 to reduce to ft.-lbs. per hour, and this by the number of hours in columns 2 or 5, as the case may be, to get the work for the particular time. The total useful work done during the mean month is 197,010,000 for No. 3, and 289,476,000 for No. 11. If we divide the first of these by 73, and the second by 75.3, these being the number of sq. ft. in the respective sail areas, we have 2,700,000 ft.-lbs. for No. 3, and 3,844,300 ft.-lbs. for No. 11; as the useful work per sq. ft. of sail area for the mean month. The former of these is only 70% of the latter, hence No. 3 lightly loaded and running about 75% of the time does only

TABLE I.—Mean Wind Movement at Dodge City, Kan., for the Seven Years 1889 to 1895.

Months.	Velocity, miles per hour.						
	0 to 5.	6 to 10.	11 to 15.	16 to 20.	21 to 25.	26 to 30.	31 and upwrds
April	116	175	157	113	76	43	40
May	116	195	168	120	74	39	32
June	120	187	139	111	86	49	28
July	144	218	176	117	57	23	9
August	178	230	152	99	62	18	5
September	166	182	152	93	75	34	18
Sums	840	1,187	944	653	430	206	132
Means	140	198	157	109	72	34	22

TABLE II.—Total Useful Work Done by Mills Shown in Fig. 1. in an Average Month.

Velocity wind, miles per hour.	Mills.					
	No. 3.			No. 11		
	Hrs.	Power.	Useful work.	Hrs.	Power.	Useful work.
6 to 10	158	0.067	20,988,000	0	0.0	....
11 " 15	157	.168	52,272,000	141	0.19	53,064,000
16 " 20	109	.230	49,698,000	109	.40	86,328,000
21 " 25	72	.277	39,402,000	72	.56	79,794,000
26 " 30	34	.308	20,790,000	34	.63	42,372,000
31 & upwads.	22	.320	13,860,000	22	.64	27,918,000
Total			197,010,000			289,476,000

7-10 as much work as No. 11, which runs only about 51% of the time.

It must be remembered that this is not a comparison of the power of these mills. These figures show the actual amount of useful work these mills are doing per month, each with its own conditions of well, pump,etc. There must of course, be a reservoir to store the water pumped, so that the mill can be at work whenever there is wind enough to run it.

It must be remembered,too,that the wind velocity at Dodge City, Kan., is somewhat greater during July and August than in Eastern Kansas, and many other parts of the United States. It is quite possible that if these two mills were placed, say in Eastern Kansas, the other conditions of loads, wells, pumps, etc., remaining the same, No. 3 might do more work in some months than No. 11. The load on the mill should be suited to the wind velocity of the locality where the mill is to be used.

Respectfully, E. C. Murphy.

Lawrence, Kan., Sept. 10, 1898.

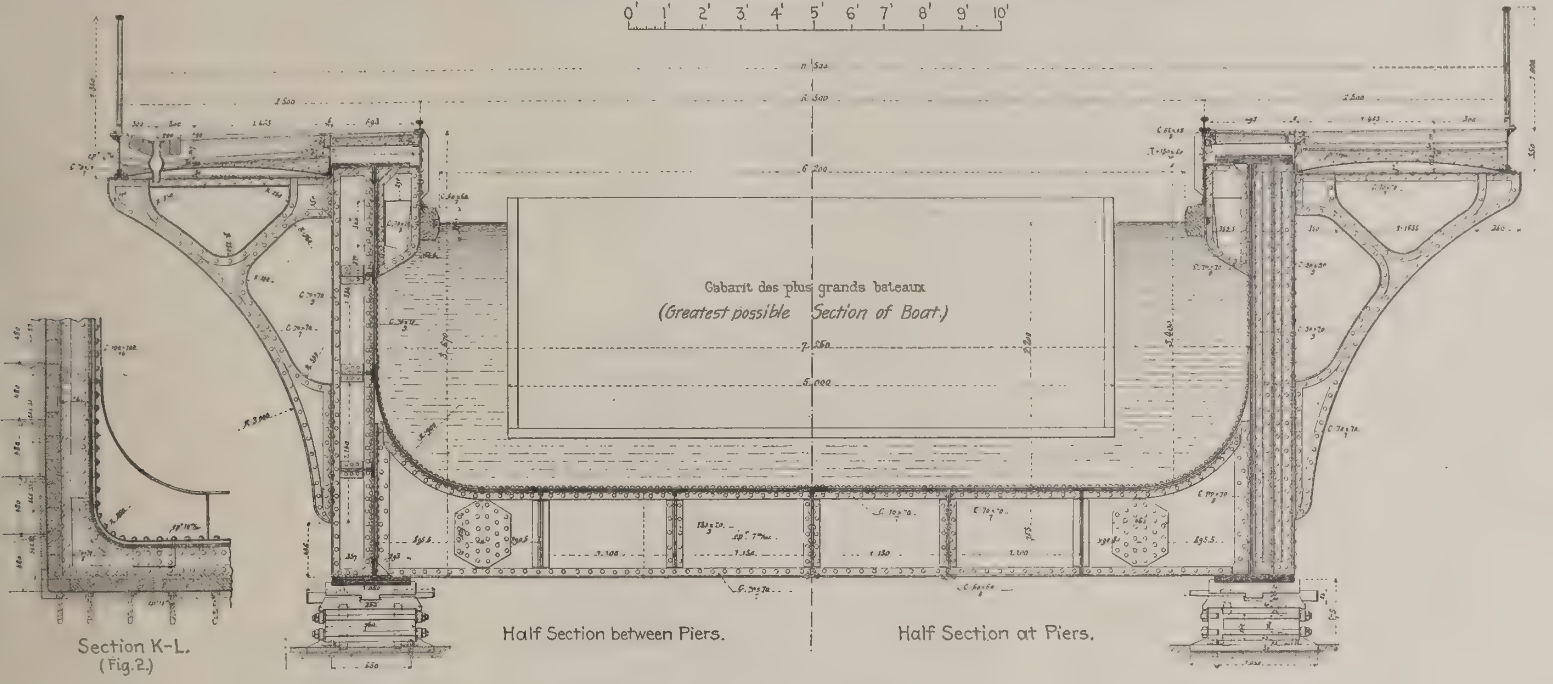

0' 1' 2' 3' 4' 5' 6' 7' 8' 9' 10'
Gabarit des plus grands bateaux
(Greatest possible Section of Boat.)
Section K-L.
(Fig.2.)
Half Section between Piers.
Half Section at Piers.

FIG 1. TRANSVERSE SECTION OF STEEL TROUGH OF BRIARE CANAL AQUEDUCT, BRIARE, FRANCE.

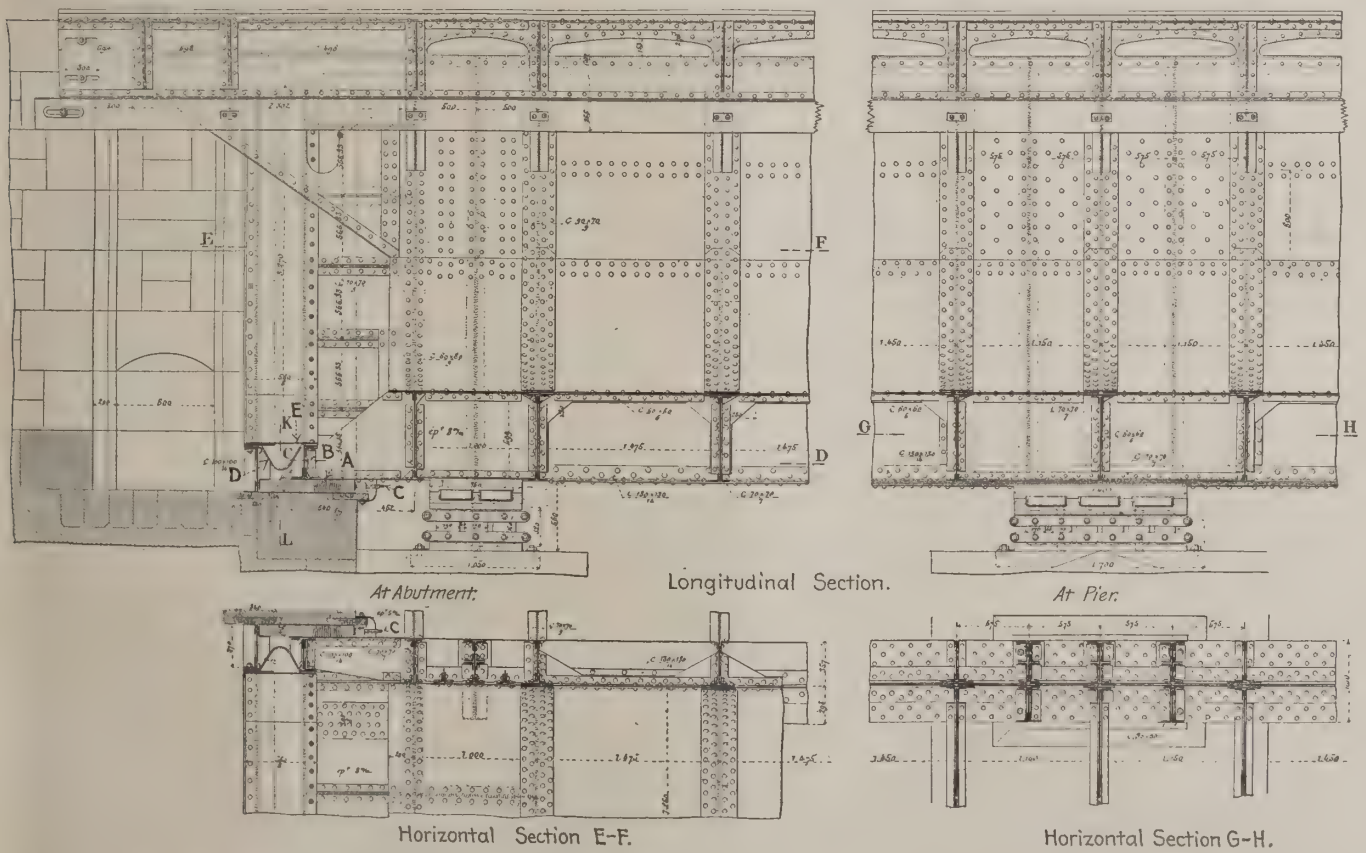


FIG. 2. VERTICAL AND HORIZONTAL LONGITUDINAL SECTIONS OF STEEL TROUGH OF BRIARE CANAL AQUEDUCT.

STEEL CANAL AQUEDUCT AT BRIARE, FRANCE.

The Briare aqueduct carries the new level recently built to connect the Loire and the Briare canals across the River Loire, near the town of Briare, France. It is 662,687 m. (2,173.6 ft.) long and 6.2 m. (20⅓ ft.) in clear width, with a depth of water of 2.2 m. (7.216 ft.), and consists of a continuous trough-shaped steel tank carried on masonry piers. Altogether there are 14 piers and 3 abutments carrying 15 spans of steel trunk 40 m. (131.2 ft.) long, and one span 12,150 m. (39.85 ft.) long. The 15 main spans cross the river Loire proper, and the single short span passes over the old line of the Loire canal, which runs parallel and close to the right bank of the river at this point. Fig. 1 is a transverse section, and Fig. 2 is a part longitudinal section of the steel trunk showing its construction and the method of supporting it on the masonry. So far as we know, this is the longest steel trough canal aqueduct ever built.

The material of the river bed at the point of crossing was a calcareous earth with interspersed modulus of chalk, below which at a depth of from 5 m. to 8 m. (16.4 ft. to 26.24 ft.) was a homogeneous calcareous tuff suitable for a foundation bed. Upon this solid layer the piers were founded, steel caissons sunk by compressed air being used to reach the proper depth. Except for the number of caissons sunk and the amount of masonry to be built this foundation work calls for no especial mention.

The more interesting features of the work are connected with the steel trough construction. This is shown quite clearly in Figs. 1 and 2. First of all the question arose whether the trough should be made continuous from one end of the aqueduct to the other, or whether each span should be independent. The continuous structure was cheaper, but in case of settlement of the foundations it would involve serious difficulties from racking strains. These difficulties would be largely avoided by constructing the spans independent, but, on the other hand, the cost would be far greater. Considering the excellent foundation bed and the very small likelihood of settlement, it was finally decided to make the trough a continuous structure. It was, therefore, fixed to pier No. 8, counting from the left bank of the river, and mounted on movable bearings on all the other piers, and at the abutments where properly-designed recesses in the masonry allow free expansion and contraction.

Referring to Figs. 1 and 2, it will be seen that the main supporting members of the trunk are the two parallel I-beams or plate girders which form its sides. These girders are 3.4 m. (11,152 ft.) deep and are spaced 7,259 m. (23.8 ft.) apart c. to c. Riveted to these girders is a bottom framing of transverse and longitudinal girders carrying the steel plate flooring or bottom of the trough. Brackets attached to the outside of the main plate girders carry the tow paths, and similar brackets on the inside support the footpath and fender timbers. Altogether the metal trunk weighs 6,935 kilos. per lineal meter without water, or 22,535 kilos. per lineal meter when filled to the normal depth of 2.2 m. of water for navigation. The total amount of steel in the structure is 3,076,647 kilos. (6,768,623 lbs.).

The manner in which the expansion and contraction of the steel trough is provided for is about the only detail not clearly explained by the drawings. Between the limits of temperature of — 20° and + 50° C, the movement at one side of the anchor pier is 216 mm., and upon the other side 246 mm. To provide for these movements the steel trough slides back and forth like a piston in recesses in the end abutments. This sliding joint is shown by Fig. 2, where A is a compressible packing held in place by the timber lagging B and the screws C; D is a sheet of rubber joining the ends of the fixed and movable troughs; and E E are sliding steel plates protruding over the rubber joint.

The total cost of the steel trunk, including the guard gates at each end and miscellaneous constructions, was 1,243,028 fr., or about $248,605. The cost of the substructure was 1,563,689 fr., or about $312,737, making the total cost about $561,342. For the information from which this description has been prepared we are indebted to a paper by Mr. Mazoyer, in "Annales des Ponts et Chausses," for July, 1898.

GEORGE E. WARING, JR.

Col. George E. Waring, Jr., one of the best known sanitarians of the country, died at his home in New York city on Oct. 29, from yellow fever, contracted while acting as special commissioner of the United States Government to investigate the sanitary condition of Havana, with the view of devising a system of sanitation which would render the Cuban capital safe for occupation by the American troops. Col. Waring had returned to New York from his duties at Havana only five days previous to his death. At the time he landed he was suffering from what was supposed to be malarial fever, and it was not until two days later that the disease was correctly diagnosed as yellow fever, when a thorough quarantine was established over the patient and his family. The body was cremated in accordance with the personal wishes of Col. Waring when alive and conforming to the regulations of the New York Board of Health in cases of death from malignant infectious diseases.

Geo. E. Waring was born at Poundridge, Westchester Co., New York, on July 4, 1833, and received his education at Poughkeepsie, N. Y. He also took a course in agriculture and agricultural chemistry under the late Prof. James J. Mapes. In 1855 his lectures on agricultural subjects attracted the attention of Horace Greeley, who made the young student the manager of his famous experimental farm at Chappaqua, N. Y. Mr. Waring remained the manager of the Greeley farm for three years, when, in 1857, he was appointed drainage engineer of Central Park, New York city. This position he held four years, during which time he designed the present drainage system of the park, and he left it only to go to the front as Major of the Garibaldi Hussars at the outbreak of the Civil War. Later Major Waring raised a squadron of cavalry in New York city which was known as the Fremont Hussars. Afterwards transferred to the Department of the Southwest, he was appointed Colonel of the 4th Missouri Cavalry.

In 1867 Col. Waring established himself in Newport, R. I., as manager of the Ogden farm, where he lived for ten years, conducting, in addition to his work on the farm, a general consulting and advisory practice in drainage and sanitation for dwellings and institutions. His name first became prominent in city sanitation and sewerage when, in 1878, he designed and constructed at Memphis, Tenn., the well-known "separate system" of sewerage which has since been inseparably associated with his name, and which he has introduced into various other American cities.

Without doubt, however, Col. Waring gained his greatest reputation, in the mind of the general public at least, by his work as Commissioner of Street Cleaning in New York city, to which position he was appointed Dec. 30, 1894. The revolution accomplished in the work of cleaning the streets of the metropolis by the systematic and business-like methods introduced by the new Commissioner are of too recent knowledge to engineers to require description here. The change in the politics of the city administration, however, threw Col. Waring out of his position on Jan. 1, 1898, although the system which he had established still remains in force in the department which he put on such an efficient basis.

When a few weeks ago it was determined to send a Government Commission to Cuba for the purpose of selecting camp sites for troops and making provision for sanitary improvements in the principal cities of the island, Col. Waring was appointed at its head. He was appointed by President McKinley on Oct. 2, and he sailed for Havana shortly afterward. In that city he spent the next few weeks making a special study of the sanitary conditions with the view of suggesting plans for perfecting them. Having completed his studies, he had returned home to submit his report to the Government authorities, when the illness which caused his death overtook him.

Col. Waring was a member of a number of scientific and technical societies, including the Institution of Civil Engineers, the Sanitary Institute of Great Britain, and the Royal Institute of Engineers of Holland, and he also belonged to the Century Club, Players' Club and the City Club, and was President of the last organization. Besides his well-known writings on sewerage, street cleaning and sanitation, Col. Waring wrote many admirable sketches of travel for the more prominent magazines. A widow and one son survive him.

THE TONNAGE AND DISPLACEMENT OF SHIPS.

At the present time, when naval matters are a source of great interest to the general public, one continually finds the terms "displacement" and "tonnage" improperly used, both in the daily press and in common speech. The confusion between the terms would not occur if their meaning were understood. "Displacement" refers to the quantity of liquid displaced by the immersed hull of the ship; and "tonnage" to the freight-carrying capacity of the ship determined by certain rules of measurement.

The displacement of a vessel is the entire weight of the hull with all its contents, according to the well-known law of hydrostatics; that a floating body displaces a weight of fluid just equal to its own weight. A ship sinks in the water to such a level that the pressure of the fluid displaced exactly counterbalances the weight of the ship.

Tonnage is figured by what is known as the Moorsom system; originally adopted by England, in 1836, and since 1865 officially recognized by all maritime nations, with some unimportant differences in the methods of measurement. The "register ton" is 100 cu. ft. of internal volume; and a ship having 100,000 cu. ft. of internal space, within the points of measurement prescribed in the English Merchants' Shipping Acts of 1854 and 1867, is said to be "1,000 tons register." This cubic ton of 100 cu. ft. now forms the unit of assessment for dock, harbor, towage and other dues. Previous to 1836 the tonnage of British ships was found by multiplying the square of the breadth by the inboard length and dividing by 94. This "old measurement," though far from exact, is still used to some extent in measuring pleasure yachts, etc. Under this old system the depth of the hold was taken as being the same as the beam; and the interest of ship-owners caused them to build ships of narrow beam and increased depth, with resultant unseaworthiness and poor sailing qualities. Abuses of this kind and the imperfections of the old system of measurement brought about the adoption of the new law of 1836, and this law was simply an elaboration of the theorem of Isaac Newton for measuring spaces bounded by irregular curves.

The Moorsom system of 1836, amended and elaborated by later enactments, provides for actual measurements of depth made at certain intervals, with the number of these intervals depending on the length of the tonnage-deck of the vessel. (This tonnage-deck is the upper deck on ships with less than three decks, and the second deck, from below, if there are three or more decks.) Transverse areas are then computed at these points in feet and decimals of feet; these transverse areas, after being multiplied by certain numbers, according to the class of ship, are added together, multiplied by one-third the common distance between the areas, and divided by 100. To obtain the "gross registered tonnage," there must be added to this the tonnage of all spaces above the tonnage-deck, the poop, deck-houses, etc. This is obtained by multiplying the horizontal area by the mean height and dividing by 100, as before.

In steamships, the space occupied by the engine-room, and the screw-shaft space considered as part of the engine-room, is to be deducted from the gross tonnage. The Merchants' Shipping Act of 1867 especially refers to the crew-space, and requires that owners provide proper accommodations for the crew before the space they occupy on a ship can be deducted from gross tonnage in estimating dues of various kinds. In freighting ships, 40 cu. ft. of merchandise is considered a ton, unless that bulk should weigh more than 2,000 lbs., in which case the freight is charged for by weight.

NOTES FROM THE ENGINEERING SCHOOLS.

Cornell University.—The annual report of President Schurman says that during the last year attendance has been greater than ever before, and, owing to the great advance recently made in the standards of admission to nearly all courses, a striking improvement in scholarship has been wrought. The "median age" of the freshmen has decreased from 19 years 11 months in 1895-6 to 19 years 7 months in 1897-8, notwithstanding the increased requirements for admission, which indicates that the high schools of the country are improving.

Under the direction of Profs. Fernow and Roth there have been arranged a full four-year course leading to a degree of Bachelor of the Science of Forestry, a one-year special course, and a one-term synoptical course. The four-year course is planned to give a thorough knowledge of all branches of the profession and to prepare men to manage and administer forest estates for private owners or for the state or national government, and also to teach the profession in the colleges, which are likely in the near future to establish chairs of forestry science and practice. This course comprises in its first two years the preparatory studies of mathematics, natural science, engineering, political economy, etc., its last two years being devoted to the purely professional subjects. The one-year special course is planned for farmers, lumbermen, and others not desiring a general scientific training, but wishing to acquire such technical and practical knowledge of forestry as will enable them to manage more intelligently and economically their own woodlands. Finally, the one-term synoptical course will meet the requirements of students of political economy and others wishing to make a brief survey of the subject of forestry as a matter of general education.

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THE GERMAN CANAL BILL which is to be introduced into the Reichstag during the coming session provides for the expenditure of 400,000,000 marks on canals and river improvements as follows: Midland Canal, 192,000,000 marks; Dortmund-Rhine Canal, 68,000,000 marks; 50,000,000 marks for water sheds, etc., in the Oder district; 40,000,000 marks for the Berlin-Stettin Ship Canal, and 20,000,000 marks for the improvement of the Weser River. When the scheme is executed it is announced that the main waterways of Prussia will be connected from the eastern extremity of the Empire to the harbors of the German Ocean.

◆

SEWAGE DISPOSAL AT TORONTO, ONT., is the subject of a report by Mr. C. H. Rust, Cy. Engr. He recommends the construction of intercepting sewers, on the general plan proposed by Messrs. Hering & Gray, in 1889, and the provision of purification works in addition. The cost of the intercepting sewers is estimated at $820,000. Final disposal works are estimated at $910,000 for intermittent filtration, and $720.000 for chemical precipitation, with filtration of the effluent. The annual charges for filtration would be less than for precipitation. Before deciding on a purification system, Mr. Rust advises the employment of a consulting engineer.

◆

A DECISION OF THE SUPREME COURT of Illinois recently rendered gives the City Council of Chicago, Ill., the right to insist upon compensation for street railway franchises. The decision is a sweeping one, as it established the right of compensation without any limitations. The decision was given in the appeal of the Chicago General Ry. Co. against a judgment of $2,250 given the city. The ordinance under which the railway operates imposes an annual fee of $500 per mile of track and the company refused to pay this tax.

◆

CHEAPER ELECTRICITY IN NEW YORK CITY will without doubt follow the cut in rates just announced by the United Electric Light & Power Co., of that city. About a year ago the Edison company introduced a schedule which had as its maximum one cent per 16-c. p. lamp per hour. Discounts were given to customers burning their lamps for long periods, and it was claimed that this made the cost in some cases less than ½-ct. per lamp per hour. Small customers were required to pay one cent. The schedule just announced by the United Electric Light & Power Co. starts with a maximum of ¾-ct. per lamp hour, and grades down, according to the amount of current used and the time lamps are burned, to a minimum of 1-3-ct. per lamp per hour.

◆

TO HOLD ITS RIGHTS ON THE CANADIAN SIDE of Niagara Falls the Canadian Niagara Power Co., which is controlled by the Niagara Falls Power Co., is required to pay an annual rental of $25,000 to the commissioners of Queen Victoria Niagara Falls Park. This agreement was entered into in April, 1891, and further provides that the company shall have 10,000 developed horse power and water connections for 25,000-HP. by Nov. 1, 1898. Some months ago an extension of time was asked and allowed and the company was permitted to install two 500-HP. generators in the station of the Niagara Falls Park & River Ry. It has been reported in Canada that the company would voluntarily forfeit its rights, but on Oct. 18 the semi-annual rental of $12.500 was forthcoming, thus proving the company's intention to hold its rights to develope power on the Canadian side.

◆

AN ACETYLENE GAS LIGHTING PLANT has been installed at Milford, Pa., according to "Heating and Ventilation." The plant, like the village, is small. At present there are only some 3,000 ft. of mains, 3 ins. in diameter, or less, within the village, and one or two extensions outside. There are five generators and a gasometer, located in a small building. The generator is of the Troubetzkoy type, made by the Mechanical Engineering Construction Co., 63 Fifth Ave., New York city.

◆

NOISELESS MANHOLE COVERS, as they are styled by their makers, are in use in Philadelphia, and in some other cities, we believe. The main features of the covers are to have as large a part of their area as possible composed of the same material as that used for paving the street in which they are placed and the keeping of the street and cover at the same level. Thus, in asphalted streets, where they are principally used, the whole top of the cover, except the rim, is filled with asphalt. Further particulars regarding these covers may be obtained from A. L. Greger & Co., 315 North Broad St., Pa., and the Sanitary Engineering Co., Girard Building, Pa.

STEEL WAGON TRACKS FOR COMMMON ROADS at Scranton, Pa., are under discussion. It is reported that the Abington Turnpike Road Co., through W. W. Watson, has stated that it would lay a half-mile of the track as an experiment.

◆

A MEMORIAL TO RICHARD M. HUNT, the late architect, was unveiled in New York city on Oct. 31. This memorial is a semi-circular granite and marble bench set into the wall of Central Park, on Fifth Ave., near 71st St. It was erected by a committee representing the various architectural, artistic and literary organizations that recognized the efforts of Mr. Hunt to raise the standards of American architecture.

◆

AMERICAN EXPORTS OF WIRE NAILS are commented upon in the "British Iron and Coal Trades Review." This report from the United States to Europe has grown from 1,547,078 lbs. in 1888 to 22,894,099 lbs. in the fiscal year 1898. The growth in trade is exceptionally rapid in the last two or three years. In 1895 the exportations were 4,367,267 lbs.; in 1896, 8,031,927 lbs., and in 1898, 22,894,099 lbs. These American wire nails go to Germany, France, Belgium, Netherlands, the United Kingdom, Canada, Central America, West Indies, all South America, China, Japan, Asiatic Russia, Australasia, and British and Portuguese Africa.

◆

COMPRESSED PEAT FUEL is being made by the Canadian Peat Fuel Co., of Welland, Ontario, under the patents of Mr. A. A. Dickson, of Toronto. The peat is dried in the air and then disintegrated in a breaker revolving at a high speed, and is thus reduced to a powder without unduly breaking up the fiber. The peat powder is withdrawn from the breaker by an exhaust fan into a large hopper, and from this it descends into a machine which compresses it into cylinders 2 ins. diameter and 2 ins. long, under a pressure of 30 tons. It is thus reduced to one-sixth the bulk of the raw material. The machine has a capacity of 1½ tons of compressed peat per hour. This fuel is claimed to be non-friable and weatherproof, owing to its solidity and the external glaze imparted by friction in the forming-dies. The inherent moisture of the peat is reduced to 12%, and the weight of the fuel is 83 lbs. per cu. ft., as compared with 73 lbs. for bituminous coal and 93 lbs. for anthracite coal. No prices are quoted, but the fuel is said to have been successfully tested in competition with coal.

◆

A MINING AND INDUSTRIAL EXPOSITION will be held at Coolgardie, Australia, beginning March 21, 1899, and continuing at least two months, in which American manufacturers and mining interests are especially invited to take part. It is stated that special scope will be afforded for the exhibition of mining, timber and agricultural machinery, gold saving appliances, electric lighting apparatus, bicycles, household fittings and food specialties. The British Embassy at Washington, D. C., can furnish information concerning the exposition.

◆

THE SALT MINES OF WIELIEZKA, near Cracow, Poland, were mentioned in 1044 and have been worked since 1240. The first map of the mines was made in 1638 by Martin German, a Swedish mine surveyor. The eight shafts now in existence are from 207 to 985 ft. deep and the length of the levels now open is 345.000 ft., with 115.500 ft. of underground tram-lines. Between 1772 and 1892 about 3,000,000 cu. yds. have been excavated for the extraction of salt. Machine drills are now used and compressed powder is employed in blasting; about 1.187 lbs. of powder are used per ton of salt produced. The present levels are 7¼ ft. high by 6¼ ft. wide.

BOOK REVIEWS.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Proceedings of the 5th Annual Meeting, held in Toronto, Ont., Aug. 16-18, 1897. Vol. V. Cloth, 8vo.; pp. 337.

The Society for the Promotion of Engineering Education has now grown to a membership of 226. It consists chiefly of professors in engineering schools, but contains also a few engineers in private practice. It meets once a year, the meetings being held in the same place as the annual meeting of the American Association for Advancement of Science, but a few days earlier, so that members may conveniently attend the meetings of both societies. The following is a list of the principal papers and discussions in the present volume: "Engineering Laboratory Courses," by R. C. Carpenter; "A Course of Study in Electrical Engineering," R. B. Owens; "At What Point Should Students Engage in Specific Research," C. D. Marx; "Uniformity of Symbols in Engineering Text Books, Report of Committees, Methods of Teaching," W. H. P. Creighton; "Elective Studies in the Regular Engineering Courses," H. S. Munroe; "The Calculus for Engineering Students," F. W. McNair; "Chemical Engineering," J. M. Ordway; "The Teaching of Machine Design," J. J. Flather; "The Efficiency of Technical as Compared with Literary Training," T. C. Mendenhall; "A Course in French and German for Engineers," A. N. Van Daell; "The Extent to Which Metallurgy Should be Taught in Engineering Courses," M. E. Cooley; "Manual Training for Artisans," C. M. Woodward; "The Manual Training High School," T. W. Mather; "The Agricultural College in Its Relation to Engineering Education," C. S. Murkland; "Graduation Theses," I. O. Baker.

THE REPLY OF STATE ENGINEER ADAMS TO THE CANAL INVESTIGATING COMMISSION.

In our issue of Aug. 11 we published an abstract of the report presented by the Commission appointed by Governor Black to investigate the work of enlarging the Erie, Champlain and Oswego canals. A reply to that report and to the various charges made therein was made by State Engineer Campbell W. Adams, under date of Sept. 12, and we have just received a copy of this reply, a document of 89 printed pages. Inasmuch as the report of the Commission has been given publicity in our columns, we deem it only fair to present as fully as our space will permit the other side of the case as given in Mr. Adams' statement.

Preliminary Estimates of the Cost of the Work.

At the outset Mr. Adams points out the undoubted fact that the State Engineer's Department was not responsible for the fixing of the canal appropriation of 1895 at $9,000,000. The estimate of that department submitted to the Constitutional Convention of 1894, was $11,573,000, and this was specifically stated to be little more than a rough guess, since no surveys had been made or were available by which the cost of the contemplated improvement could be determined. Further, it was made on the assumption that 1 ft. could be dug from the bottom and 1 ft. placed on the banks without disturbing existing vertical or slope walls, an assumption which has proved wide of the mark. The fixing of the canal appropriation at $9,000,000, and, in fact, the drafting of the canal improvement law, was done by the Executive Canal Committee, which fixed on $9,000,000 for no better reason than that it was the largest round sum short of one represented by eight figures, and it was feared that if a larger sum were asked for the appropriation might be defeated.

Immediately after the result of the election was known, a force of engineers was made up, and set to work on the preliminary surveys and estimates. Some delay was encountered in getting sufficient men from the Civil Service Commission, and the force thus obtained was, Mr. Adams says, somewhat deficient in experience, but otherwise "unquestionably equal in personnel to any corps of equal size ever organized." This preliminary survey was cut somewhat short in deference to popular criticism of the amount of expenditures on engineering work. The estimates when finally made up in November, 1896, showed that the total cost of the improvement would be in the neighborhood of $15,000,000. This information was given to the Executive Canal Committee, but appears to have been withheld by them from the public. The State Engineer believed that these estimates included a great deal of work which, though badly needed, could possibly be deferred till further appropriations, and the estimates were returned to the engineers in the field with instructions to cut out all work that could possibly be held; this attempt to bring the work within the limits of the appropriation resulted in failure; but the State Engineer maintains it was conscientiously and honestly made. In any event the law was mandatory, and the engineers were compelled to proceed with the work, whether the funds in hand were sufficient to complete it or not.

The Specifications.

Messrs. North and Cooley, the Consulting Engineers to the Commission, criticised the specifications for the work, which were so drawn as to provide for payments to the contractor for each separate item of work done. Messrs. Cooley and North think it would have been better to have made fewer items of the work, thus lessening the amount of measurement and supervision necessary on the part of the engineers in charge. In reply Mr. Adams states that the specifications for the work were prepared as the result of extended conference between the State Engineer's office and all the division and resident engineers employed on the work, men who had been on the State canals from 3 to 30 years. He continues as follows:

> 1. The engineers suggest that this type of specification is somewhat antiquated. On the other hand it is believed that the great bulk of the public work in this country to-day is based on similar specifications, that is, a specification providing a separate rate of compensation for each of the units comprising the work, and it is still believed to be the best for this especial purpose for this reason;—it does not ask either the State or the contractor to insure against conditions which can not be foreseen, and, on the contrary, it provides for what it supposed to be an equitable compensation for the actual amount of work done—no more and no less.
>
> If the State asks the contractors to name a price for completed work to be done under risky conditions, as most of this work is done, the inevitable result would be higher prices. On the other hand, if the State asked for such prices and attempted to define the conditions in advance, and it was afterward found that those conditions developed otherwise than as stated, the contractor would surely claim additional allowance, and experience shows that the courts have and will allow such claims under such conditions whether the engineers do or not.
>
> Moreover, if these conditions prove to be less arduous than as defined, experience shows that the State would be unable to effect any saving. It is a rule that does not work both ways. Except in very rare cases, the prices for the work under these specifications are too low. The commission agrees that they "are as low as could reasonably be expected." They also admit that the resulting work is superior to similar work heretofore done on the canals. Witness the paradox: Poor specifications produce good work at low prices!

Considerable space is devoted to this subject, and Mr. Adams gives in detail his reasons for believing that it is better, in building vertical or slope walls, for example, to measure up and pay the contractor for all the work he does under the separate heads of excavation, sheet piling, masonry, back-filling, lining and embankment.

Earth and Rock Classification.

A large part of the Commission's report was devoted to a detailed account of the cases where contractors have been paid for material excavated as rock which should properly have been classified as earth. Mr. Adams is emphatic in his denial that the material in question was improperly classified. To combat the popular idea that a large part of the money on the canals has been spent in digging earth which has been paid for as rock, Mr. Adams presents figures in substantial harmony with some contained in the Commission's report, which show that the total amount of material other than solid ledge rock which has been excavated and paid for at rock prices amounts to 298,345 cu. yds. The average price for rock excavation was $1 on the middle division, $1.24 on the Eastern and $1.69 on the Western. Up to May 1, 1898, the total amount of material excavated was 6,060,097 cu. yds., of which about 731,000 had been returned as rock.

By the terms of the specification, earth excavation was declared to:

> Include removal of all clay, loam, sand, quicksand, gravel, pure, mixed or combined; boulders measuring less than one-half a cubic yard, dry vertical wall, slope wall, paving, docking and cribs, timber foundation of all descriptions and hard pan or soft or rotten rock which, in the opinion of the resident engineer, can be plowed.

Dry excavation of rock was defined to

> Include the removal of all solid or ledge rock and hard pan which, in the opinion of the resident engineer, connot be plowed, and all boulders measuring ½ cu. yd. or more.

Mr. Adams' reply to the charges of the Commission that a large amount of earth was improperly classified as rock is in general a specific denial. He avers that the plowing tests called for were faithfully made, and that records kept by the engineers to determine the cost to the contractors of excavating the hardpan classified as rock show that the cost was about the same as that of actual rock excavation. Concerning the charge that material classified as earth in one monthly estimate was afterward returned as rock in succeeding estimates, Mr. Adams says this was done to give the Resident Engineers (each of whom had about 100 miles of work under their charge) time to reach various portions of the work and reach a decision upon the nature of the material. Pending this decision, the local assistant engineers in charge returned all doubtful material as earth in their monthly estimates.

Embankment.

Under the specification there was no allowance for overhaul, but wherever materials had to be hauled over 1,000 ft. they were paid for as embankment, whether actually placed in the canal banks or dumped on spoil banks. The Commission thinks it would have been better to have paid directly for overhaul, and thinks that there has been a tendency to put material on spoil banks which would have been made use of had the contractor not received payment for the material so wasted as embankment. Mr. Adams' reply to this is that this use of the term "embankment" has been common practice on the State canal work for years, and that overhaul cannot be paid for on canal work as on railroad construction because to sort out the material suitable for putting in the banks requires hauling in all sorts of directions, and it would require a small army of engineers to record the measurements and the distances hauled. He further states that the great bulk of the excavated material from the canal prism, which it was supposed would serve for the necessary embankments, was found unfit for that purpose on its removal, and gives this as the reason why the embankment, which was only 739,374 cu. yds. in the preliminary estimate, had already, on May 1, 1898, reached 1,167,849 cu. yds.

Lining.

The Commission criticised the use of cinders as lining on some contracts. Mr. Adams holds that cinders constitute one of the very best of lining materials, and says that by their lightness, as compared with other lining materials, they have certainly saved the rebuilding of several structures that would have been forced into the canal by the weight of almost any other material available. He holds that because they could be, in some cases, obtained more cheaply than gravel by the contractor, was no reason against their use.

Money Expended for Ordinary Repairs.

The Commission estimated that about $1,500,000 had been spent for ordinary and extraordinary repairs out of the $9,000,000 appropriation, which should have been provided for from other sources; and it referred to this sum in its report as "improperly expended," Mr. Adams points out that since there was no "other fund" to draw upon, the canal engineers had to make necessary repairs from the $9,000,000 appropriation. If the work of deepening the canals endangered bridges, aqueducts and other structures, as it frequently did, it was necessary to repair them or run the risk of a break and serious damage. He contends that a real injustice has been done the Engineering Department by this statement, since the Commission knew that the work to be done was absolutely necessary.

The Commissioners' further charge that another $1,000,000 had been misspent, as a result of poor specifications, loose methods or improper management, he meets with specific denial, and declares that while absolute perfection is not attainable in any work of such magnitude, it is believed that the total amount improperly spent on the work does not equal the cost of the Commission's investigation.

Lock Improvement.

The State Engineer obtained working detail plans for three kinds of lift locks for Lockport, paying the following sums therefor:

Buffalo Engineering Co.	$19,079
Stowell & Cunningham (another style)	8,811
Dutton Pneumatic Lock & Engineering Co., for a pneumatic lock	14,500
Dutton Co., for plans for locks at Cohoes	7,000
	$49,390

The Commission held that this work was not properly a part of that contemplated by the $9,000,000 appropriation, and holds that it was not necessary to obtain complete working plans of three separate devices before choosing between them. Mr. Adams declares that the completion of the lock lengthening was mandatory by the terms of the law, and that at Lockport the only alternative to the adoption of a lift lock would be the closing of the canal for one season. He further says that when the plans for this work were ordered, it was believed that there would be money enough to build these locks from the $9,000,000 fund. After much study it was believed that three different types of lock were available at Lockport, and as none of these had ever been built it was deemed best to prepare detail plans of each type in order that an intelligent comparison might be made.

Berme Slope Walls.

Mr. Adams says that only 10½ miles of new slope wall has been built on the work, and then only where it was necessary to maintain the banks. The old slope walls could either be underpinned and saved or could be torn out to leave an earth slope. The former course was adopted, and it is believed that any other course would have subjected the engineers to severe and merited censure.

Water Supply.

Concerning the amount of excavation on the level above Lockport, Mr. Adams declares this was a necessity to give the canal sufficient cross-section to enable it to discharge sufficient water to feed the 62-mile level from Lockport to Rochester, without undue velocity of current. All the water used for milling purposes at Lockport is returned to the canal except that which is discharged into Eighteen-Mile Creek. The waste weir and waste gates discharging into this latter stream are necessary, however, to take care of surplus water, and if an honest man can be found to manipulate them, the State's interests will not suffer.

Besides replying to the general criticisms of the Commission, Mr. Adams takes up in detail and replies to many specific irregularities which were charged by the Commission. These, however, it would serve no useful purpose to present here, especially as the matter in controversy will probably be made the subject of judicial inquiry.

THE REPLY OF SUPERINTENDENT OF PUBLIC WORKS ALDRIDGE TO THE CANAL INVESTIGATING COMMISSION.

On Oct. 30 the Superintendent of Public Works, Mr. Geo. W. Aldridge, made public a reply to the charges made in the report of the Canal Investigating Commission. At the outset he calls attention to the fact that the report commends the character of the work done, and declares that the contracts were regularly awarded under actual and wide competition. He further says that the Commission "fails to find any condition, any official act, or any intimation that would warrant a suspicion that I have profited either directly or indirectly through the prosecution of this work."

Taking up the report in detail, he calls attention to the fact that the Commission did not pursue very far the question of who was responsible for the fixing of the canal appropriation at the inadequate sum of $9,000,000, and for leading the voters to believe that that sum would be sufficient for the work of deepening the canals to 9 ft. It appears to be clearly the case that the responsibility for this does not lie with either Mr. Adams or Mr. Aldridge, but with the Executive Canal Committee, and with this body, Mr. Aldridge points out, some of the members of the Investigating Commission were closely identified. He suggests a reason for the failure of the Commission to investigate this subject very far as follows:

> The member of Assembly who introduced the bill calling for the appropriation of $9,000,000, had in his desk, at the time that bill was introduced, a bill identical with that bill, except that it called for several million more dollars. The introduction of the bill was delayed pending a conference of gentlemen interested in the subject of canal improvement. The conference took place and the main subject of the discussion was as to whether the larger or smaller amount of money should be asked for. The line of the discussion did not run as to whether the work could be accomplished with the $9,000,000 instead of the larger sum, but rather which sum the people were the more likely to grant. I believe the thinking public will be able to see that there may possibly be a motive in the refusal and failure of the commission to satisfy the public on points of deception involved in the question of canal improvement. Perhaps, also, they will see that it was highly desirable, if not absolutely necessary, in order to blind the public as to the responsibility for this deception, to cast aspersions, accuse by innuendo and condemn by wholesale, officials having to do with the expenditure of the improvement funds, even though the work were well done, and even though no suspicion of dishonesty could attach to the public officials in order that they (those interested in canal improvement) might read their titles clear to further appropriations.

Continuing, Mr. Aldridge says that it is nothing strange if in the light of the experience already had with the canal work, better methods could now be suggested for doing some parts of it. "Hindsight is usually better than foresight." Nevertheless, considering the very unfavorable season in which the work had to be chiefly done in order not to interfere with navigation, he "challenges the Commission or the public in general to point to any work of similar magnitude where greater diligence has been shown or where the estimates have come as near to accomplishing the work required to be done as has been accomplished in this instance," and he presents the following comparison of the original estimates and actual costs of various notable public works:

	Cost.	
	Estimate.	Actual.
Erie Canal	$4,926,738	$7,143,789
Enlargement	23,402,863	32,008,851
Oswego Canal	227,000	565,437
Enlargement	1,926,339	2,511,992
Champlain Canal	871,000	1,746,062
Black River Canal	1,068,437	3,157 296
Hoosac Tunnel	1,948,557	20,241,842
Manchester Ship Canal	26,000,000	67,351,105
Chicago Drainage Canal	12,000,000	*37,671,652
Hudson River Improvement	2,000,000	†2,600,000
State Capitol, Albany, N. Y.	4,000,000	24,000,000

*This includes $27,303,216 already expended and an estimate of $10,358,436 to complete work.

†This amount is estimated as needed over and above the first $2,000,000.

Taking up the report seriatim, Mr. Aldridge denies that he had claimed that his responsibility for the character of the work done was limited to the masonry. He also denies, however, that he is in any way responsible for the character of the engineering work on the canals, or that he has discretion to withhold the payments to contractors upon the engineers' monthly estimates except he be in possession of convincing evidence that fraud is being perpetrated, by which the state is to suffer.

In proof that the inspectors as a whole faithfully performed their duties, Mr. Aldridge points to the Commission's declaration that "the quality of the work is generally good, and an improvement upon that heretofore done on our canals."

In reply to the Commission's criticism that there was at times delay in awarding contracts after the receipt of bids, Mr. Aldridge says that after bids were verified and tabulated, it was the practice to refer them to the State Engineer for an opinion as to whether the bids were unbalanced. Necessary absences of the officials in either department might cause some delay in the award of bids.

Mr. Aldridge defends his expenditures for advertising, and holds that the wide publicity thus secured bore its fruit in the very low unit prices under which it is admitted on all hands the contracts were let. If the competition secured by the wide advertising reduced the average price 1 ct. per cu. yd., the saving would pay the entire cost of the advertising.

Concerning the inspectors employed, Mr. Aldridge says that the entire force was subjected to civil service examinations, except at one exigency, when no candidates could be obtained through civil service methods. He denies that any inspector was appointed at any time for political reasons.

The reason why the material excavated from the canal prism was not used in raising the canal banks was that it was in most cases unfit for that purpose. It was, however, used so far as practicable to strengthen the rear of embankments.

Extra work and the overrunning of quantities in the actual work as compared with the engineer's estimate are reviewed by Mr. Aldridge, and he contends that the practice followed is that which is common in the execution of all public works, and that the State suffered no loss whatever. The carrying on of the work on the Jordan Level on a force-account basis was the only method by which it could possibly have been rushed through in time to have the canal ready for use at the opening of navigation.

Mr. Aldridge further replies to the criticisms of the Commission relative to the excavation west of Lockport, the filling of the old basin at Syracuse, and the making of "ordinary repairs" from the canal improvement fund, and concludes his report as follows:

> I wish to say finally that every expenditure from the $9,000,000 fund can be justified in a court of law. No work has been done and paid for out of the fund, excepting that which needed to be done and which is incident to the general improvement. The sweeping statement that a million dollars has been unlawfully expended I repudiate as false, as I do the other suggestion that a million dollars or more has been wasted. Because a sum aggregating upwards of two millions of dollars has been expended for work which hurried plans and surveys could not foretell as needing to be done, is not warrant for any man or any body of men to make the sweeping statement that that sum has been misspent.
>
> One of the eminent engineers attached to the commission has been so fair as to say that the whole trouble lies with the system. While I am willing to be judged by my acts I claim it as unfair that I should be held responsible for a system that has been the outgrowth of three-quarters of a century's conduct of the state's affairs. This same engineer has also said that the state engineer and myself have done as well as, and accomplished as much as, any othres could have accomplished under the same conditions; and also that the money paid out has procured as much work as could probably be expected. I desire to go farther and make the prediction that if the improvement is to be continued no better work will be obtained or less money expended for the same character and amount of work.

ANNUAL CONVENTION, AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The fifth annual convention of the Society was held on Oct. 26, 27 and 28, the place of meeting being the Arlington Hotel, Washington, D. C. At the opening session about 60 members were present, but the arrival of other members daily throughout the convention increased the total attendance to 75 or 80. The program was a long one, including a full score of papers, and special and standing committee reports on various questions of municipal improvements, besides the reports of officers, address of welcome, president's address, election of officers and other necessary business, which consumed the whole of one session and portions of two other sessions. In the technical part of the proceedings, the most attention was devoted to questions of sewerage and sanitation, roads and pavements, and water supply, and this report of the convention work will be divided under these three general heads, and the general head of miscellaneous without regard to the exact order in which the several reports and papers were presented. In this way all the information relating to each general phase of municipal work will be collected in one place so far as this report presents it.

Routine Convention Business.

The first session was devoted entirely to the opening exercises, and the transaction of routine business. After a few brief introductory remarks, Mr. Harrison Van Duyne, President of the Society, introduced Mr. John B. Wight, President Board of Commissioners, Dictrict of Columbia, who gave a brief address of welcome to the Convention. Mr. Wight referred to Washington as distinctly a residential city, but stated that it would possibly surprise most of the members to learn that, in proportion to its population, the city also stood fourteenth in the list of manufacturing cities of the country. Mr. Wight also described briefly the progress made by the city in municipal improvements and explained the fiscal system of the District of Columbia and the manner in which it was governed. Speaking of the improvements in prospect, he said:

> Plans are now perfected by which the steam railways will remove their tracks from the streets and do away with the objectionable and deadly grade crossings; the unsightly and unhealthy Eastern branch flats, which are such a menace to health, are soon to be reclaimed; a recent law of Congress will enable us, within a very short time, to compel every house to be connected with running water and supplied with the latest sanitary conditions; a careful study is being made of the subject, with the expectation that soon legislation will be passed enabling us to take down every overhead wire that now exists, and put it under ground.

After a fitting response to Mr. Wight's remarks, President Van Duyne read his formal address to the Convention. The President referred briefly to the meeting places of the four preceding conventions of the Society, and mentioned the value of the information which could be obtained by such visits to the different large cities of the country, and thus ascertaining by personal inspection the results of their systems of municipal organization and management. Turning to the more concrete questions of the Society's work, he said:

> At the convention held last year our committee on street paving recommended, among other things, that where a contractor was required to guarantee his work for a term of years, especially in asphalt pavement, the condition of the pavement at the end of the term should be specifically stated. The city of Newark, N. J., this year partly adopted these suggestions, and instead of paving with asphalt under specifications calling for a five-year guarantee with indefinite requirements, it now requires a ten-year guarantee under bonds given by a responsible trust company, and the exact condition in which the pavement is to be at the end of that term in order to be accepted is stated. Under the old specifications for several years only Trinidad Lake asphalt was used. Last year the bidders were limited to four different kinds, and this year, under the more severe and definite specifications, the door was thrown wide open to all asphalts. Any responsible company or individual giving approved bonds is given the contract, provided the bid is the lowest.
>
> The first asphalt laid in Newark was in the year 1890, and from that time until 1894 it cost about $2.85 per yd. This was laid by the Barber Asphalt Co., and virtually without competition. Last year the price got down to $2.35 per yd., and this year, with the ten-year guarantee, but open to all, the price has been about $1.50 per yd. The city, however, agrees to pay in addition to that amount 25 cts. per yd. for the second term of five years for maintenance and repairs.
>
> We have also required this year a five-year guarantee on oblong granite block pavement, notwithstanding which the price has been reduced from about $2.50 per yd. in 1893 and 1894 to $1.50 per yd. this year when laid on sand, and in like proportion when laid in concrete. Perhaps I should add that New York city, only nine miles away, stopped almost entirely its paving work this year, and that may have helped to reduce the price to the neighboring cities.
>
> The great advance made during the last few years in city development has taken a large amount of money, the annual outlay for expenses has been greatly increased, municipal bonds are becoming a burden, and as a natural result there is such an increase in the tax rate as to cause alarm to many citizens. During this same time in all our cities a wonderful advance has also taken place in the value of the franchises which have been given to so many companies, to use the public streets to carry on their business.
>
> These franchises are worth nearly as much as the land fronting on the streets through which their grants and privileges extend. They have a recognized value to buy and sell, and their earnings and dividends bear out that value; but when it comes to the valuation on which they pay taxes there is a wonderful drop, and the result is that they bear only a small part of the public burdens that properly belong to them, and the tax burdens of others are proportionately increased. I know of no reason why, according to the true value of these properties, they should not contribute their share to the support of the public schools, to the cost of maintaining our courts, and all the other expenses of city and state government, the same as other property.

The next business was the election of members, and 29 new names were added to the roll. The Secretary's report showed that during the past year the income of the Society had been $601.50, and its expenditures the same. In the report of the Treasurer, which followed, the fact was brought out, however, that this satisfactory showing of the Society's finances had been made possible only by the President paying $100 out of his own pocket, and by the Secretary not drawing his salary, which amounted to an additional $100. At present there was in the hands of the Treasurer an unexpended balance of $6.72. The report of the Finance Committee stated further that the present indebtedness of the Society was $210, or, deducting the $6.72 cash on hand, $203.28, and it recommended, in order to clear away this indebtedness, that the dues for the coming year should be increased to $5 for each member. Several further recommendations were made in the report of the Executive Committee, which was next read, all designed to place the affairs of the Society on a more satisfactory basis. All of these recommendations required changes in the Constitution of the Society, and the most important one was that cities should be dropped from the roll of membership and that each individual member should be charged an annual due of $5. These recommendations were adopted by vote of the Convention.

The following officers were elected to serve the Society during the coming year: President, Nelson P. Lewis, Brooklyn, N. Y.; First Vice-President, A. D. Thompson, Peoria, Ill.; Second Vice-President, P. H. Thomas, Parkersburg, W. Va.; Third Vice-President, B. H. Colby, St. Louis, Mo.; Secretary, D. L. Fulton, Allegheny, Pa.; Treasurer, John L. Kennedy, Nashville, Tenn., and Finance Committee, F. J. O'Brien, Oswego, N. Y.; F. A. Twamley, Grand Rapids, Mich., and G. S. Vichery, Bangor, Me.

By vote of the Convention, the city of Toronto, Ont., was selected as the place of meeting of the 1899 Convention of the Society.

Sewerage and Sanitation.

Report Upon the Utilization of Sewage of Vienna, Austria.—This was a translation by Capt. Lansing H. Beach, Engineer Commissioner, Washington, D. C., of the report of the special commission appointed to investigate the question of disposing of the sewage of Vienna, Austria, by utilization and especially to study its fertilizing qualities. The report was of great length and contained numerous tables and only the very briefest summary of its conclusions is possible here. The report stated that the fertilizing material in a cubic meter of Vienna sewage was worth from 3.5 to 15.7 kreutzers, a kreutzer being worth somewhat less than 1 ct. in American money. The commission considered that direct transportation of the sewage to the available land affording an opportunity for such fertilization was not feasible, and that a reduction to powder could not profitably be accomplished. The conduction of the entire sewage to the irrigation fields by canal was recommended as on the whole the best plan, but the commission concluded that while irrigation could be successfully carried out, the system could not be conducted under methods now known at an actual profit. These conclusions, of course, related to the conditions at Vienna only.

Sewerage of Baltimore.—In this paper Mr. Kenneth Allen, Principal Assistant Engineer, Sewerage Commission, Baltimore, Md., outlined briefly the system of sewerage, or rather lack of sewerage, in the city of Baltimore, Md., and described the system recommended by the special commission appointed in 1893 (Eng. News, Dec. 30, 1897). As will be remembered the commission considered either of three plans of disposal available: (1) Dilution in Chesapeake Bay; (2) chemical precipitation, and (3) agricultural filtration. The last named was considered the most perfect method of disposal, but on account of its great cost the commission recommended diultion in Chesapeake Bay as preferable for Baltimore. Mr. Allen stated that this method of disposal was, however, seriously objected to by the oyster trade.

Proposed Sewage Disposal System for Washington, D. C.—In this paper Mr. D. E. McComb, Superintendent of Sewers, Washington, D. C., gave an interesting historical outline of the development of Washington's system of sewers from the first drainage work of 1832 until the present year. Since 1890 the work had followed in all important respects the plans recommended by the board of engineers, consisting of Messrs. Rudolph Hering, Samuel M. Gray, and Frederic P. Stearns, which was appointed by Congress to devise a comprehensive system of sewerage for the city. The amount required to carry out these plans was $3,257,635, and up to the present time the sums expended and available for spending aggregated $772,000. At the present rate of expenditure Mr. McComb stated that the completion of the system as planned might be expected about the year 1925. The paper concluded with a brief description of the rules followed in the sewer construction of the district, from which we abstract the following items:

> Sewers between 8 and 24 ins. in diameter are made of stone-ware pipes laid upon a cradle of concrete masonry, the joints being covered with a concrete enveloping band. Above 24 ins. diameter they are made egg shape until the 4 ft. × 6 ft. size is reached, which is the largest regular section; sewers above that size are considered exceptional and are designed with reference to the location and conditions.
>
> In main sewer work that portion of the sewer which is below the springing line is constructed of concrete masonry, lined with a wearing surface of vitrified brick masonry from the bottom to a line midway between the bottom and the springing line. Above the vitrified brick masonry the lining is of ordinary brickwork, the same thickness as the vitrified brick masonry. In sewers 4 ft. × 6 ft. and smaller, stone ware inverted blocks are laid in addition to the lining of vitrified and ordinary brick masonry, described above. In a few cases of sewers having light gradients, constructed in dry ground, and designed to convey sewage only, unlined concrete sewer inverts have been constructed with satisfactory results. The arches of main sewers are constructed either of ordinary brick or concrete masonry, the selection being controlled by local conditions.
>
> Concrete masonry used in pipe sewer work and elsewhere in walls less than 6 ins. thick is composed of beach pebbles, each particle of which must pass through a 1½-in. ring, mixed with an amount of mortar (composed of cement 1 part, sand 2 parts) which shall be 30% in excess of the volume of voids in the gravel.
>
> Concrete masonry in more massive construction is composed of broken stone, each fragment of which must pass through a 2-in. ring, gravel and mortar. The amount of gravel used equals the volume of voids in the broken stone, and the amount of mortar is 30% in excess of the volume of voids of the mixed stone and gravel.

Some Observations on the Effect of Flushing Devices for Small Sewers—This paper, by Mr. A. E. Phillips, Assistant Engineer, Sewer Department, Washington, D. C., described briefly a short series of experiments made in Washington to determine the action of the discharge of flush tanks in respect to the velocity and depth of the wave produced. The substance of the paper was comprised in a half-dozen or so of diagrams and will be given more fully in a future issue. Briefly stated, however, the diagrams showed the discharge to have a true piston action, that is, the discharge assumed the form of a wave and progressed in this form the whole length of the sewers tested. The velocity of this wave, its volume and length, and the steepness of its front and rear faces varied with the grade of the sewer, and with other conditions. So far as they went, the experiments demonstrated the efficiency of flush tank discharges for scouring sewers of small diameter.

Discussion.—The discussion which followed these four papers was quite brief, and was confined principally to questions by the different members to make clear parts of the papers which had not been fully understood in their reading. In reply to one of these questions Mr. McComb stated that the cost of concrete sewers, as constructed in Washington, was to the cost of brick sewers of the same size about as 7½ to 9. Mr. Phillips stated that altogether there were in use in Washington about 100 flush tanks, all placed at the dead ends of small sewers. These tanks required inspection and repairs as did any other device, and when kept in good order they worked satisfactorily.

Streets and Pavements.

The consideration of the various questions under this heading was opened by a brief paper by Mr. N. P. Lewis, Engineer of Street Construction, Brooklyn, N. Y., which treated chiefly of questions relating to the construction and maintenance of pavements along and between the lines of surface street railways. The paper described the standard street railway track constructions used in Denver, Colo., Detroit, Mich., Cincinnati, O., Minneapolis, Minn., and Washington, D. C. Following Mr. Lewis's report, came a series of tables giving the cost of repairing asphalt pavement in Buffalo, N. Y., which were furnished by Mr. Edward B. Guthrie, M. Am. Soc. C. E. These tables will form a part of the city engineer's coming report, and will be published in that document. In this same connection, Capt. Lansing H. Beach, Engineer Commissioner, District of Columbia, announced that in the coming report of the commissioners to the President, similar figures would be published for all asphalt pavements in the city of Washington. The next paper read was entitled "The Proper Curbing of Streets," and was presented by Mr. Horace Andrews, City Engineer, Albany, N. Y. This was followed by a paper entitled "A Street Extension Plan for the Entire District of Columbia," by Mr. Wm. P. Richards, Assistant Engineer, Washington, D. C.

Relative Values of Paving Materials.—In this paper, Mr. Geo. W. Tillson, Brooklyn, N. Y., presented an attempt to provide a practical working plan for determining the best paving material for any given set of conditions. He divided the desirable qualities for pavements into eight, and allotted to each a certain percentage of the total value, which was, of course, 100. From such information as he could obtain, the writer then allotted to each of the more common paving materials a numerical standing, under each heading. This gave the following table of relative values:

	Values.							
	Standard.	Granite: A*.	Granite: B.†	Asphalt.	Brick.	Belgium.	Macadam.	Cobble.
Cheapness, first cost.	15	2	4	4	3	5	7	14
Durability	21	21	17	13	13	17	7	15
Ease of cleaning	15	11	8	15	12	7	5	2
Resistance to traffic..	15	7	5	15	11	5	5	3
Slipperiness	7	6	5	3	6	4	7	5
Maintenance	10	10	7	6	6	7	3	2
Favorableness, travel.	5	3	2	5	4	2	6	0
Healthiness	13	9	7	13	10	5	5	2
Total	100	69	55	74	65	52	44	43

*Concrete Foundation.
†Gravel and sand foundation.

Tree Planting in the Streets of Washington.—In this paper Mr. Wm. P. Richards, Assistant Engineer, Washington, D. C., stated that in Washington, unlike the practice in most cities, tree planting in the streets was carried on and controlled by the city authorities. The city had a nursery, in which it raised the trees for transplanting, and on an average from 1,000 to 3,000 new trees were planted in the streets each year. The paper enumerated the different kinds of trees which had been employed, and gave their relative value for street use. In order of merit, he placed silver maple, Norway maple and Eastern plane (Platanus orientalis) side by side. In the second rank came the gingko, or maiden hair tree, and the Western plane. Last of all came the American linden, the oak and the sugar maple, which demanded more care, and were especially suitable to wide parkings.

Electric Street Lighting.—The report of this committee was made by Mr. F. W. Cappelen, City Engineer, Minneapolis, Minn. Reviewing the list of cities from which figures of the cost of electric street lighting had been collected in 1896, the report stated that information recently obtained showed that about 30 of them had reduced the price per lamp. In an appendix the report reviewed the experience had with the municipal electric lighting plant at Detroit, Mich., quoting in full the editorial on the report of the Public Lighting Commission of Detroit, published in Engineering News, of Sept. 8, 1898.

Street Cleaning and Disposition of Garbage.—This paper, by Dr. A. R. Reynolds, of Chicago, Ill., was a short and somewhat superficial study of the question of garbage collection and disposal in the city of Chicago. Mr. Reynolds considered that preferably the city should collect the garbage, but in case the work was contracted for, separate contracts should be let for collecting the garbage proper and for collecting the ashes. He also favored regulating the junk trade, so as to make it give an income to the city. The disposal of garbage, Mr. Reynolds regarded as in an experimental stage. He spoke favorably of the possibilities of Lord Kelvin's plan for producing power from the burning of garbage, and gave a variety of figures going to show the value of the commercial products contained in garbage. Mr. Reynolds, however, failed to mention the counterbalancing cost of reduction.

Discussion.—The discussion coming under this division of the convention's work was confined almost entirely to the cost and maintenance of asphalt pavements, and to the closing paper on garbage collection and disposal. Dr. W. C. Woodward, Health Officer, District of Columbia, criticized the idea of separate contracts for collecting garbage and ashes. He thought that a single contract for the collection of both much preferable, for the reason that in the winter the collections of garbage were light and those of ashes were heavy, while in the summer the exact contrary was the case, and if a single contractor made both collections, he could utilize his labor and plant more efficiently by turning them first to one task and then to the other. In Washington, householders were required to keep the garbage and ashes separate and to deposit the garbage in metal receptacles, holding not less than ten and not more than thirty gallons. The collection of garbage, ashes and dead animals was by contract at a cost of $57,000. From April 15 to Nov. 1 daily collections were made, and from Nov. 1 to April 15 the collections were semi-weekly. Disposal was accomplished by towing the garbage down the river in barges and either dumping it, or more generally ploughing it under land for fertilization. The contractor for collection was also the contractor for disposal, and owned the land upon which the refuse was thus employed. The city had had experience with two forms of crematories during the past, and neither had been satisfactory under all conditions and at all times. Mr. Woodward doubted if there was much profit in garbage reduction with present methods, providing sanitary and inoffensive treatment was ensured under all conditions.

Mr. John Jones, Street Commissioner, Toronto, Ont., stated that in that city all garbage and refuse was collected by the city, it having its own plant of carts and horses, even including its own harness-maker, blacksmiths, etc. About 120 horses and carts are employed, and the bulk of the collections were in the winter months. In summer the extra horses were employed on the street sprinkling carts. The city had two crematories for burning its garbage and refuse. He believed that the municipality itself could collect its garbage much better and more cheaply than it could be done by contract.

Water-Works and Water Supply.

The various papers coming under this heading were introduced by a brief verbal report of the special committee on the subject, of which Mr. M. L. Holman, M. Am. Soc. M. E., of St. Louis, Mo., was the chairman. Mr. Holman considered that the great question in water supply, which at present demanded attention in the United States, and particularly in the more densely settled States of the East, was the protection and cleansing of this supply from impurities. He described the work which had had to be done in Europe along these lines, and outlined briefly the theory and methods of sand filtration so extensively used abroad. In the United States, he thought, the time had arrived when National legislation for the protection of sources of public water supply from pollution should be agitated. The questions to be considered were, first, the condition of such supplies; second, the remedy to be adopted, and, finally, the best method of enforcing this remedy. He urged that the Society should take the matter up, and use its efforts to secure adequate National legislation.

Electrolysis at Dayton, O.—In this paper, Mr. Harold P. Brown, New York, N. Y., described the very thorough investigations of damage by electrolysis of water mains at Dayton, O., which were outlined in our issue of Oct. 6, 1898. The conclusions of the paper were:

> (1) It will not be a mistake to follow Dayton's example and obtain complete and accurate information concerning the electrical, chemical and mechanical condition of your pipes, especially in the vicinity of the power house. The trouble may be confined entirely to the lead in the service pipes, and in the calking of joints on your mains; but even here serious damage may result if the matter is neglected for years.
>
> (2) Do not put down any more lead or wrought iron service pipes, as these are the first victims of electrolysis, and their replacing means ruin to pavements. Use instead wooden pipe, banded with a close spiral of hoop iron and covered heavily with asphaltum. This will stand the heaviest pressure in use and is not affected by electrolysis, since the hoop iron is low in conductivity, and is not electrically connected at the joints. Its cost is said to be reasonable, and it has a successful record of many years' service.
>
> (3) Use the same kind of pipe for new mains in any district in which a railway power house is likely to be erected and heavily paint the lead calking of cast iron mains, using asphalt or peroleum wax.
>
> (4) In the danger district along these lines of electric roads and on intersecting streets put into your water and gas mains two or more consecutive lengths of these wooden pipes, so as to break the electrical continuity of the mains and thus make their resistance greater than that of the rails. Fill in the space around them with broken stone and connect with drain if possible.
>
> (5) Midway between the wooden sections on each main attach insulated pilot wires, leading to a central office. Connect similar wires to the rails nearest the pipe and make daily electrical tests at times of heavy load. If any section shows positive to the rails, cut it at once into smaller sections and call upon the railway to rebond its line upon that street. This, with the proper electrical management of the railway feeder wires and apparatus, will effectively protect your mains.

The last paper coming under this heading was by Mr. L. W. Rundlett, City Engineer, St. Paul, Minn., and was on "The Coating of Cast Iron and Steel Riveted Pipes." Mr. Rundlett gave briefly such records of experience with pipe coatings as had been brought out since his more comprehensive paper on the same subject presented at Nashville, in 1897, and published in the 1897 "Proceedings of the Society."

The discussion was quite brief, and was confined principally to the paper on electrolysis. Referring to the recommendations of Mr. Brown for preventing electrolysis Mr. M. L. Holman, St. Louis, Mo., believed that the railways should be required to provide such perfect return circuits that no electricity could get into the ground. Mr. G. H. Benzenberg, Milwaukee, Wis., believed that the proper solution of the question was to recognize the fact that some electricity would certainly get into the pipes, and should be taken care of without damage to the pipes by leading wires from them to a connection with the negative pole of the dynamo. He also took pains to make his water pipes as perfect a return circuit as possible.

Miscellaneous Papers.

Taxation and Assessment.—Mr. August Herrmann, President, Board of Administration, Cincinnati, O., presented in his report upon this topic statistics covering taxation and assessment in 29 American cities, all having over 80,000 population. The figures were very complete, and they will be referred to more fully by Engineering News when they are available for more careful study and comparison.

Municipal Data.—The committee upon this subject, the chairman of which was Mr. C. C. Brown, City Engineer, Bloomington, Ill., advocated the establishment of a bureau of municipal data by the Federal Government, whose duty it should be to collect information concerning the various phases of municipal work, including public improvements, and present a report each year. This bureau, it was suggested, should be a branch of the census bureau, which should be made a permanent bureau. The report contained forms for reports for water-works, sewerage and street improvement work. Upon vote of the convention the executive committee of the society was instructed to take the recommendations of this report under consideration, with power to act in the matter as it deemed best.

The concluding report on "Yearly Review" was presented by Mr. G. H. Benzenburg, and as its caption indicates, was a general review of the field of municipal engineering for the year of 1898.

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TWO ELABORATE RAILWAY TRAINS for the Chicago and California service were on exhibition at Chicago last week. The "California Limited" of the Atchison, Topeka & Santa Fe Ry. consists of a baggage car (without front platform), buffet smoking car, dining car, sleeping cars, and observation car, the latter having a library, writing desks, etc. The specially interesting feature of the train is that it is lighted throughout by electricity, and has little electric reading lamps with frosted glass globes, set just above the backs of the seats. The current is generated for each car by a dynamo driven from one of the axles, a storage battery supplying the current when the car is at rest. This equipment is on the Moskowitz system (Eng. News, Oct. 29, 1896, and May 27, 1897). It was applied by the National Electric Car Lighting Co., of New York and Chicago, which has equipped a number of dining and sleeping cars of this road with the same system. On Nov. 4 the new "California Limited" of the Chicago & Alton, Iron Mountain and Southern Pacific railways made a trip to Joliet and back, with a number of invited guests representing the railways and the technical press. At Joliet a visit was made to the State Penitentiary. This train is very similar to that of the Santa Fe line, but is lighted by Pintsch gas and has compartment sleeping cars in addition to the ordinary sleeping cars.

◆

THE EIGHT-TRACK DRAWBRIDGE over the Chicago Drainage Canal, which has already been the source of much friction and litigation, as noted in our issue of Oct. 20, is again to be made the subject for new bids. As the appeal to the higher courts from the recent adverse decision will consume a great deal of time, and as another adverse decision would cause serious delay, the trustees have decided to invite new bids, but only upon the Scherzer type of bridge, according to the plans and specifications now on file with the chief engineer. This will avoid the trouble arising from comparing bids on structures of different types.

◆

A CIVIL SERVICE EXAMINATION will be held on Dec. 6, at 9 a. m., in New York and other cities where there is a local board of United States civil service examiners, to fill two vacancies in the grade of electrical engineer. One of these is at Fort Caswell, Wilmington, N. C., salary $75 per month, and the other is in the Engineer Department at Large at New York city, salary $150 per month. Those desiring to enter the competition should apply at once to the United States Civil Service Commission, Washington, D. C., for application blanks, Forms 304, 375 and 394.

◆

THE NEW NAVAL DRY-DOCK, soon to be built by the government at Boston, Mass., will have the following dimensions, according to a published interview with officials of the Navy Department: Length, 750 ft.; width on floor, 80 ft.; width at top, 114 ft.; width at entrance, 95 ft.; depth to floor, 40 ft.; depth on sill, 30 ft. It will be built of granite, or concrete faced with granite. The steel caisson-gate will be about 95 ft. long, 36 ft. deep and 24 ft. beam. The pumping plant will include three 45-in. centrifugal pumps. If built entirely of granite, about 576,000 cu. ft. of cut stone and 1,390,000 cu. ft. of rubble masonry will be required; if concrete faced with granite, the quantities would be about 256,000 cu. ft. cut granite and 1,710,000 cu. ft. of concrete. Bids are to be called for in a few weeks.

FLOATING A BOW-LESS STEAMER is a feat lately performed by the Liverpool Salvage Co. The steamer "Milwaukee," a cattle carrier of large dimensions, went on the rocks off the Aberdeenshire coast of England last September. It was found that the forepart was held immovable on the rocks, and the salvage company then determined to cut the hull in two, forward of the boiler-room bulkhead, and save the more valuable part of the ship. This was done by the aid of dynamite; and after the bulkhead had been strengthened by planks and bracing the after two-thirds of the hull, with engines and boilers, was towed into the Tyne, where a new bow will be built to the "Milwaukee."

◆

JAPANESE SHIPBUILDING is being rapidly developed. The Mitsu Bishi Co., of Nagasaki, has just launched the largest steamship built outside of American or European yards. This is the "Hitachi Maru," with 11,680 tons displacement, and a sister ship is being built. At the same port a new granite dock, 371 ft. long, has just been opened. The shipbuilding company mentioned employs 2,000 men, and the "Hitachi Maru" is rated at Lloyds at 100 A1.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred on Nov. 5, at the transfer junction in Council Bluffs, Neb., in which a Union Pacific freight ran, head on, diagonally into the Omaha and St. Louis passenger train. The freight engine struck the tender and baggage car, in which were several men. One person was killed and two were seriously injured.

◆

THE DEATH OF A LOCOMOTIVE ENGINEER while on duty occurred on the Chicago & Alton R. R. on Nov. 8 near Kansas City, Mo. The train, a fast freight, was running at full speed when the fireman, who had been busy in the tender, entered the cab and found the engineer dead.

◆

THE FALL OF A MINE CAGE at the mines of the Lehigh Valley Coal Co., Wilkes-barre, Pa., on Nov. 5, resulted in the death of 7 miners and the fatal injury of 3 others. The accident is said to have resulted from "overwinding," which caused a loaded car to drop upon another car containing 10 miners.

◆

THE COLLAPSE OF A THEATER ROOF in Detroit, Mich., on Nov. 5, killed, according to reports, 15 persons. The building was in course of construction when, without any warning, the heavy roof, supported by steel trusses, fell. The top gallery was carried down and all those in the building at the time were buried under the mass of brick and iron.

◆

AN EXPLOSION OF GAS in the United States Capitol at Washington, D. C., on Nov. 6, wrecked the Supreme Court room and several adjacent rooms, doing in all about $20,000 worth of damage to that portion of the building. First reports stated that a portion of the foundation of the building was badly damaged, and that the valuable law library was largely destroyed. It now appears that the destruction was limited to the interior of the rooms, furniture, fittings and a number of valuable records. The accident is attributed to a leaky gas meter, which permitted a large volume of gas to escape into the rooms composing the damaged section. In some way this was ignited and the explosion followed.

◆

THE "CROATAN," a Clyde Line steamer, was burned at sea on Nov. 1 while about 18 miles north of Cape Charles and 5 out of the 27 persons on board were drowned. The "Croatan" sailed on Oct. 31, south bound, and when 24 hours from port was discovered to be on fire. The flames spread so rapidly that, notwithstanding a smooth sea, it was impossible to launch the life boats, and the passengers and crew had to jump into the sea. They were rescued by a passing schooner.

◆

THE INVESTIGATION OF THE CORNWALL BRIDGE failure on Sept. 6, in which two spans of the new New York & Ottawa R. R. bridge across the St. Lawrence River, at Cornwall, Ont., were precipitated into the water by the failure of the masonry pier between them (Eng. News, Sept. 15, 1898), has disclosed the cause of the accident, according to press dispatches. The diamond drill borings which are being made into the foundation bed of the collapsed pier have shown that the pier was founded on a bed of hard pan barely 2 ft. thick, below which was a muddy deposit into which the drill sank 14 ft. without striking hard bottom. Further borings are being made to determine the conditions more exactly.

◆

AN UMBRELLA LIFT, for the Paris Exposition, is proposed by Mr. R. E. Sherman, of Chicago. It is to be a rival to the Ferris wheel already erected, and the design has been worked out by Mr. H. R. Hinchcliff, an engineer of Chicago. The plan calls for a steel structure 350 ft. high and 250 ft. in diameter when the "umbrella" is spread. There would be a central cylindrical framed stem, serving as a guide for a lower platform supporting ten braced ribs. At the ends of each rib would be a car with a capacity of 50 passengers. Steel cables run from the ends of the ribs to the top of the stem, and the hydraulic lifting power is applied from the moving platform at the bottom of the ribs. There would also be a rotary motion electrically controlled. Application for a site on the Champ de Mars is said to be under favorable consideration. The cars are supposed to make three trips per hour, with an average of 350 passengers per trip.

◆

A SEWAGE FARM OR FILTRATION AREA for the St. Denis Ward of Montreal is under consideration. It is said that plans and a bid for the construction of the work have been submitted to the city authorities by Mr. C. Janin, C. E., and referred to the City Surveyor, Mr. P. W. St. George.

◆

THE FIVE-YEAR GARBAGE CONTRACT at Chicago has again been declared illegal, this time by the State Supreme Court, on appeal by the city. The contract was for the removal and disposal of garbage. The city has been doing the work, pending the decision. Future action will depend, it is supposed, on the conclusions of a garbage commission, composed of the mayor, commissioner of public works and others. The ground for the decision is that the city cannot make a contract payable from yearly appropriations for a period of more than one year.

◆

A MUNICIPAL LIGHTING PLANT is under consideration by the city of Santa Barbara, Cal. The local private company, which has had a monopoly for 12 years, formerly received $156 per lamp per year for about a 5-hour service on a moonlight schedule. The present rate is $108 per lamp per year for 60 lamps for the same service. It is proposed in the design of a municipal plant to use the city water supply, which comes from the mountain under a heavy pressure, to operate turbines and the necessary electrical apparatus.

◆

ANOTHER THAMES TUNNEL, for foot passengers only, is to be built and the London City Council is asking for proposals. The tunnel would have a vertical shaft and stairway at each end and cross between the Poplar and Greenwich sides of the river.

◆

COMMERCIAL EDUCATION was recently discussed by the New York Chamber of Commerce, and it was generally admitted that present educational facilities for those contemplating a business career were inadequate. A special committee of five was appointed to prepare a plan for the establishment and development of a sounder system of education of this sort in the secondary and higher schools. It was pointed out that other nations, and especially Germany, are rapidly developing satisfactory systems of commercial training for young men and reaping marked benefits therefrom.

◆

THE PACKING OF THE AMERICAN COTTON BALE is again causing trouble abroad, regardless of the repeated warning of American consuls on this head. Reports from Liverpool say that English companies are refusing to insure against loss from "wet and mud damage" due to loose and badly packed bales of American cotton. It is estimated that the claims arising from cotton thus damaged and delivered at Liverpool during the last season will aggregate $500.000. The English insurance companies sent an agent to the United States to investigate the cause, and the blame is placed partly upon the producer and partly upon the transportation companies. A closer and better woven covering is urged; but the chief requisite seems to be greater care in both packing and transport, and some decrease in the belief that foreign nations must take our cotton "any how." Indian and Egyptian cotton is an active competitor and the splendid condition in which cotton from these countries arrives in England is in very sharp contrast with our own.

◆

ELECTRIC TRACTION ON NEW YORK STREET railways is rapidly growing. According to a late article in the "Street Railway Journal," nearly four-tenths of the entire Metropolitan system of lines was operated by electricity on Sept. 30, 1898. In the year ending June 30, 1898, about 34¼% of these lines employed cable traction, 20¼% underground electricity, and 45½% horse-power. Reducing the earnings and expenses to the mile basis the following comparison per car-mile is made:

	Gross earnings.	Total expenses.	Net earnings.
Cable lines, cts........	34.42	16.42	18.00
Electric lines, cts......	27.	10.25	16.75
Horse traction, cts......	27.35	17.87	9.50

While the electric lines thus show a less total expense for operation and maintenance than either cable or horse-car, the writer says that this statement may be somewhat misleading, owing to the fact that the electric lines are practically new, and cost for maintenance is only ⅛-ct. per car-mile, as compared with 3½ cts. on the cable lines and ¾-ct. on the horse-car lines. But the article also claims that the experience in New York demonstrates that the underground electric is better than cables in the large cities when traffic is dense and weather conditions favorable.

TWO RECENT MELAN ARCH BRIDGES.

The illustrations presented herewith show two Melan arch bridges erected for Mr. Frederick W. Vanderbilt on his private estate at Hyde-Park-on-the-Hudson, eight miles north of Poughkeepsie. They both cross Crum Elbow Creek, and while only 600 yds. apart, the scenery at the two locations required very different artistic treatment to harmonize the structures with their surroundings.

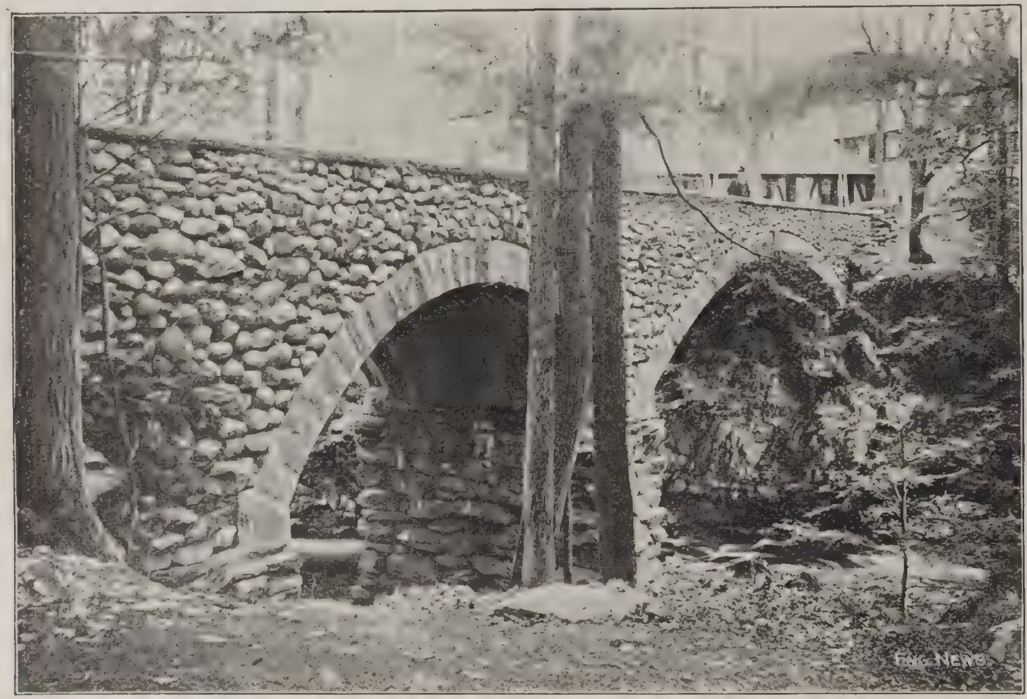

FIG. 1.—MELAN CONCRETE ARCH, WITH FIELD STONE FACING, ON GROUNDS OF FREDERICK W. VANDERBILT, HYDE-PARK-ON-HUDSON, N. Y.

Mr. Vanderbilt, after extended investigation, finally selected the Melan system of concrete-steel arch construction, not only on account of its lower cost with equal permanence as compared with voussoir stone arches, but also because of the ready adaptation of this style of construction to the varying architectural treatment required in different locations.

The structure shown in Fig. 1 with natural surroundings, was faced with unhewn field stone and boulders. It consists of two spans, 53 ft. and 26 ft. in the clear, respectively, and each 7.5 ft. rise, and is 17 ft. wide. The longer arch springs from the rock cliff to the pier and its concrete ring is 10 ins. thick at the crown, and 30 ins. near the springing line, and at right angles to the intrados, embedding five 7-in. steel I-beams bent to the curve of the arch. The shorter span springs from the pier to an abutment founded on a hard strata of gravel and clay. Its concrete ring is 8 ins. thick at the crown and 20 ins. near the springing lines, at right angles to the intrados, with five 5-in. steel I-beams, bent to the curve of the arch, embedded therein. The centers for this bridge were designed to suit the local circumstances.

The bridge shown in Fig. 2, being in a more improved part of the grounds, was given a more elaborate architectural treatment, all exposed surfaces being molded in Portland cement mortar. It has a clear span of 75 ft., with a rise of 14 ft. 8 ins., and a clear roadway of 16 ft., the total width of arch being 20 ft. The intrados is a curve of five centers. The wing walls on the four corners are curved outwards to give better approaches to the bridge and more easy and graceful connections with the driveways. The concrete arch ring is 15 ins. thick at the crown, increasing slowly towards the springing lines to a thickness of 21 ins. at a point 22.5 ft. from the center, and more rapidly from there to the abutments. Embedded in the arch ring are seven 9-in. steel I-beams characteristic of the Melan system, as shown in plan and sections.

One abutment is founded on solid rock, the other on reasonably hard strata of clay and gravel. The concrete in the abutments, spandrel and wing walls was proportioned 1 part Portland cement, 3 parts sand and 6 parts broken stone; near the springing lines of the arch the proportions were gradually changed to those used in the arch ring, which were 1 Portland cement, 2 sand and 4 broken stone. After the completion of the abutments the concreting of the arch was started simultaneously from both sides to the full width of the bridge, and work was continued day and night until the arch ring was completed and the spandrel walls carried up to the copings and expansion joints, in order to make the work monolithic and to avoid all signs of demarkation in connecting old with new concrete. Each of the four wing walls were then carried up as continuous work for the same reason, and expansion joints were provided between spandrel and wing walls to facilitate the free action of the arch under varying temperatures. The entire face finish is in concrete, as is also the balustrade. In all exposed faces, for a thickness of about 1½-in., mortar was used without the broken stone, but in all cases deposited at the same time as the concrete backing. In order to get a very fine finish, the lagging of the centers and all molds for spandrel and wing walls were neatly covered on the inside with a thin coat of plaster, which was oiled before any concrete was deposited.

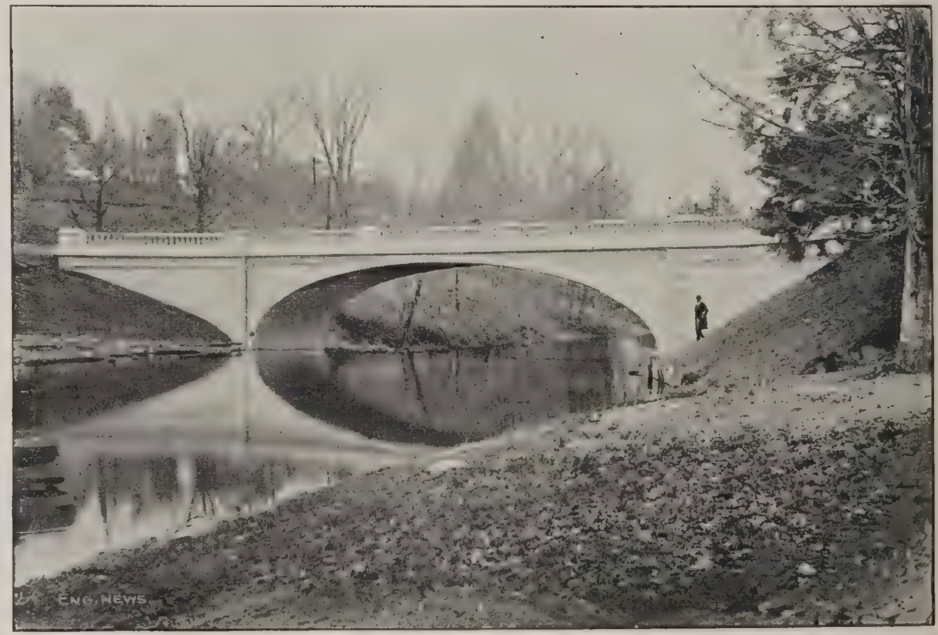

FIG. 2.—MELAN CONCRETE ARCH, WITH MOLDED CONCRETE FINISH, ON F. W. VANDERBILT'S GROUNDS, HYDE-PARK-ON-HUDSON.

The centers for this bridge were constructed to rest on two old piers, which were afterwards removed. The base of the balustrades and the posts were molded in place, but the balusters and top rails were molded or cast in iron or wooden forms, and afterwards set in place exactly as would be done with cut stone. In all parts of the balustrades, concrete, 1 to 2½ to 5, was used, except near the faces where the mortar was without stone.

Mannheimer Portland cement was employed in the two-span bridge, and in the abutments of the single span bridge; and Germania Portland cement for all the remainder of the latter, including the railing. Both bridges were designed and superintended during erection by the Melan Arch Construction Co., 35 Nassau St., New York city, who are also the owners of the U. S. patents covering the Melan arch construction.

THE NEW HYDRAULICS: AN ESSAY FOR ADVANCED STUDENTS IN THE ART, AND FOR THOSE WHO LOOK BENEATH THE SURFACE.

By Clemens Herschel,* Hydraulic Engineer.

To the graduate student or practitioner in hydraulics of the present day, there has always been something disappointing in the art. Here is a science which pretends to give rules and formulae for the discharge of water through orifices and over weirs, when in truth it only indicates what these rules should be, and are not. Instead of being a science founded on fact, and deduced theory, as it set out to be, it has degenerated into a prolix schedule of coefficients to be applied in hydraulic cases as they are met with. So numerous have these coefficients become, that their great number has defeated their very purpose. It has been found impossible to match cases as they arise with their appurtenant coefficients, and engineers have been obliged to practically ignore the most of them, and, instead of using them, to confine themselves in their practice to a very few selected simple cases. Instead of practicing under the guidance of a science of hydraulics, the working hydraulician takes for his mentors only a few simple hydraulic experiments, and by repeating with slavish exactness the apparatus used in the experiments to be followed, he manages merely to allow nature to do for him what she did years before for another. Any step, therefore, that will do away with or merely will reduce the range of the multitude of coefficients now found recorded in hydraulic writings for the practice of hydraulics, will benefit that science very much.

Hydraulics, to look at the situation from another point of view, has not hitherto been able to free itself from the apron-strings of its older sister science of hydrostatics. Instead of noting the conditions obtaining strictly for the water in motion which is to be observed, and confining himself to them alone, the modern hydraulician still encumbers his work with measurements based on, or derived from, a water level which belongs in the domain of the hydrostatics of the case in hand, rather than in that of its hydraulics. Such cases are the measurement of the head on a weir, by measuring from the level of still water upstream from the weir; and determining the head on an orifice, from the position of the orifice and the level of still water upstream from it. Inasmuch as this mode of procedure totally eliminates the form and shape of the weir or orifice—takes no account of the same whatever—the measurements thus taken being precisely the same for any and all kinds of weirs and orifices; and inasmuch as these different kinds of orifices do have, nevertheless, very different unit discharges, it becomes necessary to introduce a host of coefficients to cause this method of procedure to produce the numerous called for practical results.

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*2 Wall St., New York city, Oct. 5, 1898.

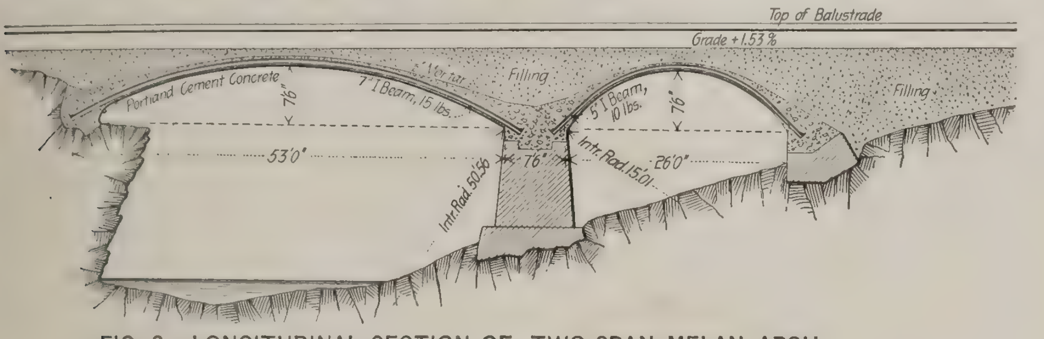

FIG. 3.—LONGITUDINAL SECTION OF TWO-SPAN MELAN ARCH.

But how would it be, were we in these cases to take measurements and observations which would themselves be influenced by the shapes of the orifices and by the velocity of the water passing through them? May we not hope, that the coefficients to be applied to formulae containing data thus obtained, would have a much smaller range and would be much reduced in number, to the manifest benefit of the art and science now spoken of? This has indeed already been shown to be the result of such a method of obtaining data, as will presently appear.

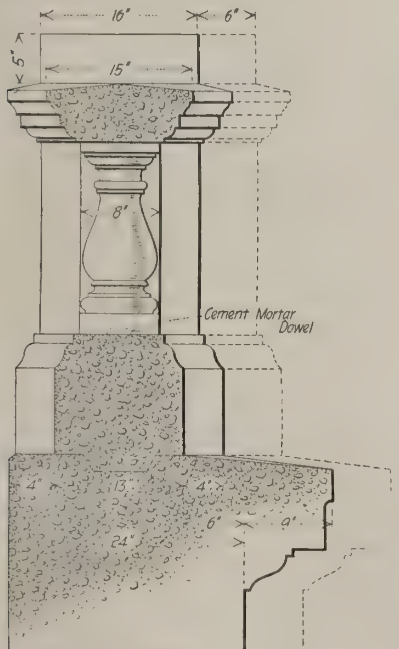

Fig. 5.—Detail Cross-Section of Balustrade for Single-Span Arch.

A method of doing hydraulic work in the manner alluded to must be the next great step to take in the development of practical hydraulics, and there are many signs of the times, plain enough to those who will see them, that point in the stated direction.

Emboldened by what to-day's leading hydraulician, Inspector General H. Bazin, of the Corps des Ponts et Chaussees, says on this point, p. 240, Annales des Ponts et Chaussees, 1898, the writer may claim to have done pioneer work in that direction by the invention of the Venturi water meter in 1886. As many know, this is an instrument whose gaging of a stream of water is based on the observed difference of water level in two piezometers; in which, therefore, static water levels do not appear at all. And it is also known that the range of value of the appurtenant coefficients was found to be surprisingly small. The Venturi water meter has been so often described, that in place of a further description reference is here made to leading articles upon it.*

Another set of experiments made and founded upon the observation of hydraulic heads are those of Mr. John R. Freeman, on the discharge of nozzles,† unhappily named by the author to be experiments made for the purpose of converting the nozzle into a water meter. But a nozzle can never become a water meter, properly speaking. The office of a nozzle is to discharge and waste or throw away water. The office of a water meter is to preserve the water measured, and to treat it as a thing of value. There must always be a large element of incongruity in any attempt to speak of a nozzle as though it were a meter, and much confusion of thought has no doubt followed Mr. Freeman's choice of title. But as an exhibit of the reduction of range, accompanied by an increase of accuracy, in hydraulic coefficients, when based on hydraulic, instead of on hydrostatic observations and measurements, and as a study of piezometer observations, Mr. Freeman's nozzle experiments are of great value.

A third series of such experiments have now been furnished by that Past Master in experimental hydraulics, Inspector General Bazin, in the last number of the Annales des Ponts et Chaussees, 2d trimestre, 1898, in the sixth article of the series describing his experiments on the discharge of weirs. By taking heights on the weir, as measured by means of a pressure tube laid in the body of the crest of the weir, and basing the formulae for the discharge of weirs on such hydraulic heights, instead of on heights derived from still water, which may be called hydrostatic heights, he gets again, as in the experiments above recited, a much smaller range of coefficients for his formulae. M. l'inspecteur general Bazin notes with pleasure that this method of observation and record gives more accurate results than the hydrostatic method, and is to be followed by preference.

Nothing is wanting, then, to enable engineers to use the method of hydraulic coefficients exclusively, except an advocacy and teaching of the practice, and a collection of the new coefficients, derived from experiment.

This article is intended to be an appeal, amongst other things, to engineers and others to begin the collection and publication of such new coefficients. Especially is this appeal addressed to the authorities having in charge the Cornell Hydraulic Laboratory. It has here an opportunity, in the writer's estimation, to practically found for all time a new science, and to make a most able beginning of the many benefits it may in good hands yet confer on mankind.

To illustrate still further the harvest waiting for future laborers in this field, attention may also be called to the conflict between the selected coefficients usually found, and the orifices, weirs, etc., met with in practice. The favorite coefficient is for an orifice or for a weir "in a thin plate"; and with reason; for no others can briefly be described. But the things to which such coefficients are to be applied persist in being almost anything else but holes or notches in "a thin plate."

The most of this contest would at once be done away with by the new hydraulics. It would be developed from experiments on orifices cut in the side walls of vessels of an appreciable thickness, and from choice, of a practical standard form, say a half circle in cross-section; but measuring heads from the indications of pressures at the crown of such a semi-circular edge and the hydraulic water level downstream; not from the static level upstream, to the static level downstream.

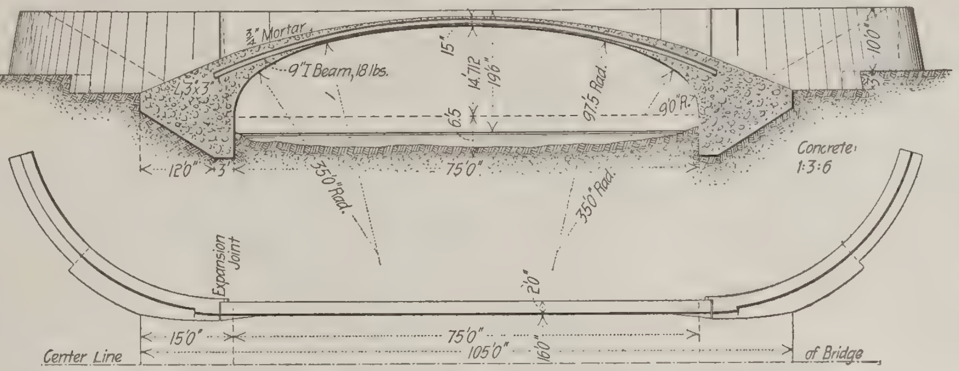

FIG. 4.—LONGITUDINAL SECTION OF SINGLE-SPAN MELAN ARCH.

If these words shall induce future experimental hydraulicians to make a specialty of piezometric observations, and of their application to all forms of discharge measurements, their object will have been attained. That the results will be most useful and beneficial to succeeding generations is the writer's firm conviction.

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THE CAPTURED SPANISH CRUISER "MARIA Teresa," raised by the government at Santiago, was abandoned at sea, on Nov. 4, during a storm, while on her way to the United States. The "Maria Teresa" was a 7,000-ton armored cruiser, built at Bilboa, Spain, in 1890; her engines developed 13,758 I. HP., and this gave her a speed of 20.25 knots. After the battle of Santiago, she was raised by the Merritt-Chapman Wrecking Co., under the superintnedence of Naval Constructor Hobson. She was towed into Guantanamo harbor, and after being patched up, she started for Norfolk, Va., under her own steam, on Oct. 29. She was accompanied by the repair ship "Vulcan" and the wrecking tug "Merritt." On Nov. 1, when about 310 miles from the port from which she started, and in 24° N. Lat. and 74.30° W. Long., she encountered a heavy northeast gale and labored heavily; under the strain many new leaks appeared at the butts and seams of plates; the water gradually gained until it came into the firerooms, and the ship was finally abandoned in a sinking condition. The "Merritt" returned to hunt for her after the tow line parted, but could not find her. It is supposed that in addition to the damage to the hull by going on the rocks, the firece fire on board this vessel heated and warped the deck-beams, which later contracted again, and that this action imposed great strains upon the hull of the ship and possibly partly sheared some of the plate-rivets. If this were the case the subsequent leakage at these plates under the strain imposed by the storm would explain the disaster. Later accounts say that she may be still afloat, or stranded on Cat Island, as a vessel answering her description has been reported in that neighborhood.

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*Trans. Am. Soc. C. E., 1887 and 1888; Engineering, March 9, 1894, and Aug. 14, 1896; Engineer, Jan. 4, 1895, and 1897, p. 210; Engineering News, June 15 and July 13, 1893; Annales des Ponts et Chaussees, 1898, p. 240; Journal fur Gasbeleuchtung (Schilling), vol. 40, 533; A Treatise on Hydraulics, by Mansfield Merriman, John Wiley & Sons, New York, 1895.

†Trans. Am. Soc. C. E., 1889, "The Hydraulics of Fire Streams;" and 1891, "The Nozzle as an Accurate Water Meter."

STEEL HEAD FRAME FOR THE PHILADELPHIA & READING COAL & IRON CO.'S MINES AT GILBERTON, PA.

By W. L. Cowles, M. Am. Soc. C. E.*

Among the latest and most interesting examples of the rapid extension of the use of steel in construction is its employment in the erection of head frames for mine shafts, which were formerly made of heavy timber framing. Several specimens of steel or iron head frames erected in earlier years are to be found in the coal regions of Eastern Pennsylvania, but within the past two years the development of this branch of structural engineering has been rapid, and a number of steel head frames have been erected in the vicinity of Wilkesbarre and Pottsville. The most recent practice in this line is exemplified in a steel head frame completed a short time since for the Philadelphia & Reading Coal & Iron Co. for their new water shaft at Gilberton, Pa., illustrations of which are presented here.

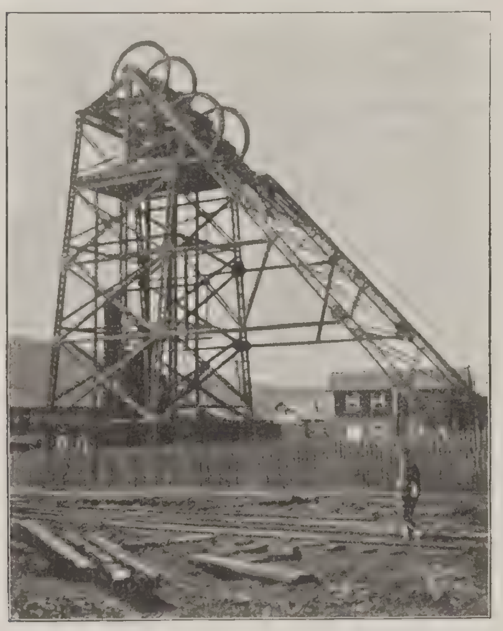

Fig. 1. Perspective View of Steel Head Frame for the Philadelphia & Reading Coal and Iron Mines, at Gilberton, Pa.

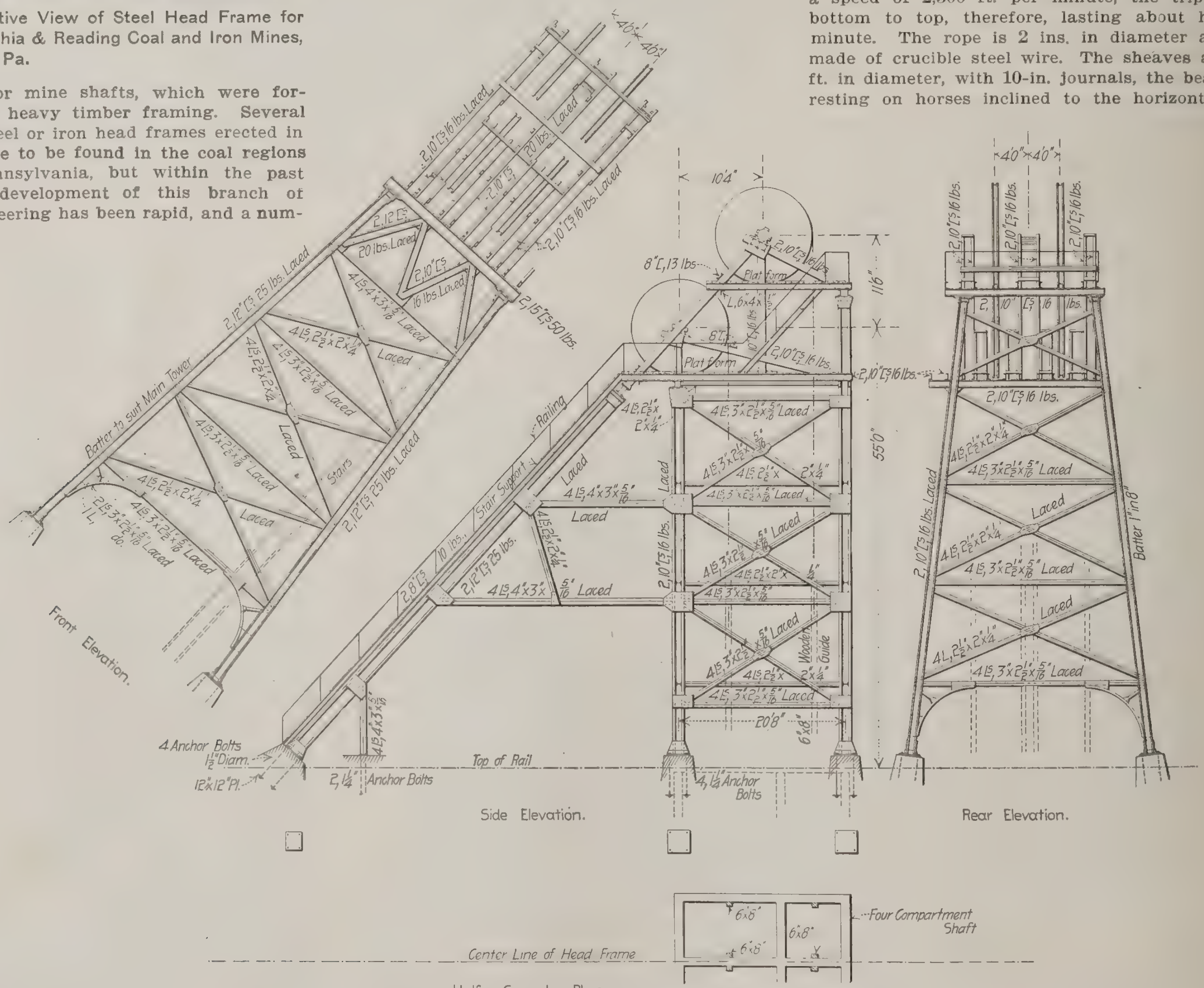

FIG. 2. ELEVATION OF STEEL HEAD FRAME FOR THE PHILADELPHIA & READING COAL AND IRON MINES, AT GILBERTON, PA.

Pottsville Iron & Steel Co., Builders.

Plans had been prepared for erecting this structure in wood, but an investigation of its cost as compared with the cost of a steel structure, taking into consideration the relative life of wood and steel based upon experience in first-class railway bridge work, led the company to accept the proposed plan for a steel head frame. The superior rigidity of the steel frame, being riveted throughout, over the timber framing which, being bolted, is subject to continual readjustment and tightening up on account of shrinkage and racking, also had great weight in deciding the company to adopt the steel construction.

The Gilberton shaft is 1,100 ft. in depth and is divided into four compartments. It is located in a valley between two hills, in each of which are extensive collieries, and is intended to drain all the workings by means of tunnels connecting them with the bottom of the shaft, replacing a large number of independent pumps now operated continuously at great expense.

The two compartments nearest to the engines are used for hoisting water and are served by the engine nearest to the shaft, while the other two are ordinarily used for hoisting coal and rock, although in case of emergency they can also be used for water. The special arrangement of the shaft renders it necessary to place the sheaves serving the two front compartments, or those farthest from the engines, in front of and higher than the sheaves for the two rear compartments, and the engine operating the former must likewise be placed behind and higher than the engine operating the latter.

The center plane of the back brace produced passes through the centers of the two pairs of sheaves, which are so located that the line of resultant pressure produced by the load in the shaft and the pull from the engine falls slightly below this plane, thereby avoiding all overturning moment and throwing nearly all the pressure produced by hoisting directly upon the back brace. The main tower, therefore, carries practically no load except that resulting from its own weight and that of the sheaves and their frames, and its principal office is to provide a substantial and well-braced support for the sheave frames and sheaves and, by means of heavy cross struts, a secure and rigid connection for the tops of the shaft guides. The bracing is stiff throughout, consisting of four angles, laced, in I-section both for horizontal struts and diagonals, and all connections are riveted. The back brace is securely held and stiffened by struts running to the main tower and, together with the feet of the tower, is anchored to the heavy masonry foundation by 1½ in. steel bolts.

From the fact that in operating the shaft one car or bucket of a pair is filled, while the other is light, the back brace is nearly always unsymmetrically loaded, a condition which is provided for by a system of trussing at the top of the back brace, which efficiently distributes the stresses. The frequent reversal of load causes a constant racking of the structure which necessitates the use of heavy and rigid lateral bracing.

Provision is made for a working load of 20 tons in each compartment of the shaft and the engines have a capacity for raising these loads at a speed of 2,300 ft. per minute, the trip from bottom to top, therefore, lasting about half a minute. The rope is 2 ins. in diameter and is made of crucible steel wire. The sheaves are 14 ft. in diameter, with 10-in. journals, the bearings resting on horses inclined to the horizontal, so that the resultant of the live load is nearly normal to them. These horses are thoroughly braced and the frames of which they form a part are so placed that those supporting the lower sheaves are between and in contact with those supporting the upper sheaves and, being well bolted together, the construction becomes quite homogeneous, affording the maximum of rigidity. Access to the sheave platforms for purposes of oiling and inspection is provided by means of a stairway following the slope of the back brace, and consisting of channel iron strings with white pine treads and protected by a substantial gas-pipe railing.

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*Keystone Bridge Co., Pittsburg, Pa., late Chief Engineer Pottsville Iron & Steel Co.

The head frame was built by the Pottsville Iron & Steel Co. from drawings prepared by their head draftsman, J. S. Branne, C. E.,† after the designs of the writer, who was at the time chief engineer for the company.

◆

AN ELECTRICAL SURVEY IN THE BOROUGH OF MANHATTAN.

It has heretofore been supposed that, inasmuch as New York city had been successful in preventing the building of electric railways operated by overhead trolleys on Manhattan Island, the water pipes, gas mains, etc., were free from the danger of rapid electrolytic corrosion.

In a paper just read before The American Institute of Electrical Engineers, however, the author shows that stray earth currents are to be found on the water and gas pipes in various parts of Manhattan Island, and in the part adjacent to the Harlem River and in the lower portion of the city these currents are sufficiently strong to furnish a possibility of serious injury to underground piping. The author of the paper, Mr. A. A. Knudson, began his investigations to determine whether any current from the conduit electric railway on Lenox Ave. was escaping from the conductors to the ground. It will be remembered that in this system the rails are not relied upon for a return conductor, but both positive and negative conductors are placed within the conduit and insulated. The tests showed that there was no ground current discernible from the conduit electric system; but that an overhead trolley railway in 135th St. was furnishing a very noticeable ground current, amounting in some cases to from 2 to 2¼ volts. In addition to this, a small but steady current flow was found with a potential of 1-30 to 7-30 volt, which was finally determined to proceed from an incandescent lighting system. This last current was found over a large area of the city.

As an illustration of the corrosive action of electric currents escaping from metal, the author gives the following:

Attention is now directed to the east side of this part of the city where another branch of the Union railway is located. Tests made here show even more pronounced results than at the branch running through 135th St. to the west side. It may be stated that the power-station of this road is located on the Bronx river in Westchester county.

Something more than a year ago when these tests were made, this branch had a terminus at Third Ave and 129th St., immediately in front of the Elevated Ry. station, the cars then passing over the Harlem river at the old wooden bridge, which is now being removed. The cars now pass over the public bridge recently opened, to the new terminal at Lexington Ave.

The maximum reading here was 10 volts, and the average 2 volts. The rails were positive to the elevated railroad pillars and to sewer and gas pipes. Tests on the Harlem bridge showed the same reading. A few days ago this locality was visited with a view of obtaining any further items which might be of interest for this paper, and workmen were found engaged in removing the rails of this very terminal.

Information was therefore obtained as to the results of electrolytic action on these rails (they having been positive). An impression was taken on paper of the exact size and shape of the end of one of the four rails which composed that terminal switch, the ends of the other rails all being in just about the same condition. Fig. 1 shows a comparison of the size and shape of the rail when new and its present condition; the position of the outlines as to each other being about as shown. From the condition of these rails now, it is quite plain that a large amount of metal has been removed from them by electrolysis. The rails were originally 70 lbs. per yd.; furthermore, the bottom sides of all these rails were cut by the current down to knife edges for several feet back from the ends. These edges were irregular in shape and somewhat jagged in appearance.

Another feature of interest is the condition of the crossbars or tie-rods which keep the rails in position. These bars, which were originally 1½ ins. wide by ⅝-in. thick, were nearly all so eaten away that the middle portion was missing, the ends protruding from the rails from 6 ins. to 12 ins.

The concluding portion of Mr. Knudson's paper referred to the stray trolley current of which he found evidences near the lower end of Manhattan Island, and his examinations to determine the effect which such a current might have on the Brooklyn Bridge. We print it, substantially in full as follows:

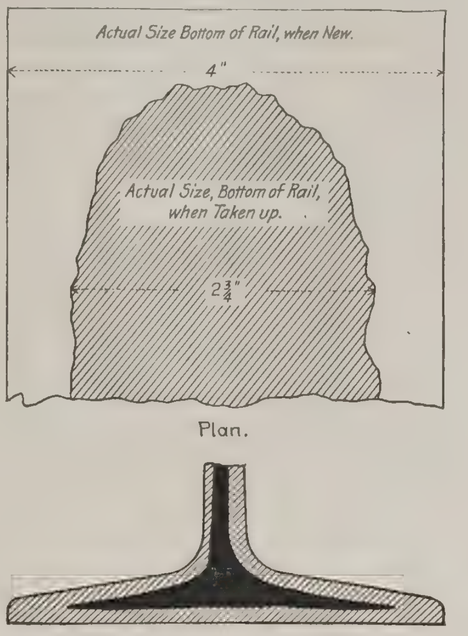
Actual Size Bottom of Rail, when New.
4"
Actual Size, Bottom of Rail, when Taken up.
2¾"
Plan.
Section.

Fig. 1.—Plan and Section Showing Electrolytic Corrosion of Ends of Rails at Terminal of Union Ry. 3d Ave. and 129th St., New York city.

Just why there should be indications of a trolley current in this part of Manhattan Island was difficult to understand, but after making further tests coming up on the east side, this current was found to come from the Brooklyn bridge. Having pointed out how an overhead trolley, using the water pipes and incidentally the rails as a return, such as is operated on 135th St., can spread its influence, so to speak, for a distance of over 20 blocks in either direction north and south, through various pipes, railway structures, etc., the existence of this current from the bridge permeating underground metals through a large portion of the lower part of the city, is accounted for.

The tests were continued at the New York entrance of the bridge, and at the pillars which stand in the street just west of the Third Ave. cable railway, I found the readings as follows: At one pillar a maximum of 3 volts, average 1½ volts, pillar positive to Third Ave. cable rails. At another practically the same reading. Further up Park Row at the corner of Chambers St., pillar positive to cable rails, 1 volt maximum; water positive to cable rails ½-volt; pillar positive to water ⅓-volt.

All of these tests were made nearly a year and a half ago. A few days ago, tests were made over this same ground, and at places where a difference of potential of 3 volts maximum existed at that time, it is now found to be 3 1-5 volts, pillars positive as before to rails of Third Ave. cable and also to water pipes, showing in all probability that this current has been during all this time actively and unceasingly passing down the pillars which support the "L" station at this place, as well as the bridge crossing the street, and out from their foundations to other metals as stated, with now a fifth of a volt more for good measure.

In the light of present knowledge on this subject the very serious question presents itself to any practical mind here present, in what condition would we expect to find the anchor bolts and iron foundations of these pillars, if excavations were made at their base?

In Mr. Farnham's excellent paper read before this Institute four years ago (Eng. News, May 3, 1894) he showed that but a small fraction of a volt was necessary to establish electrolytic action between metals. What then can be expected from an incessant action of from 1½ to 3 1-5 volts jumping out of these foundations during the past year and a half or perhaps two years?

Further tests at the New York entrance of the bridge at pillars nearest the four loop tracks, show that they are negative to rails of these tracks with maximum voltage of 3¼ and estimated average of 2¼. These tests were made on three different days at different times of the day, the highest maximum reading as above being taken at 4:45 p. m.

The other tests, one made during the so-called rush hour between 5:30 and 6 p. m., where a maximum reading of 2 1-5 volts noted at track 1, did not vary much from the tests made in the afternoon of another day at from 2 to 2:30 p. m. at track 4, where the voltage was found to be 2⅓ maximum. Previous to any use of electricity for operating cars on the bridge it had been known that current were escaping to that structure from trolley lines in Brooklyn, and passing over would find their way through the city by underground pipes, etc., and thence crossing the river arrive back to the power-station in Kent Ave.

The polarity of both of these railway systems now operated on the bridge, indicates that these currents escape from their lines, but it is also quite likely that currents are even now coming over the bridge as they were a year ago. Only an extended investigation would determine these points, even if it were desirable that they should be known.

Let us now take up the investigation made on the bridge to determine if possible the movements of straying trolley currents and their possible effect on the cable terminals. In view of the importance of this matter I regret not being able to make it more thorough than here stated, as it would involve not only a fortnight's work at least, but the shutting down of the bridge plant for a time, which could hardly be expected under the circumstances. Such facts are represented, however, as it was practicable to obtain.

In regard to the construction of the cable terminals; as most of us know, the main cables are made up of eighteen strands, or smaller cables, which are practically continuous, the wire running back and forth from New York to Brooklyn, passing through the holes at the ends of heavy steel bars or links at each place, and the ends of the single wire being finally fastened by a rigid screw coupling. These two rows of steel bars of nine each, which are attached to the cable strands, one row placed over the other, pass down with a graceful curve into solid stone masonry to the anchor-plates, and are secured to them by heavy steel bolts passing through the eyes at the ends. The anchor-plates are in shape somewhat longer one way than the other, each being a single piece of cast iron, weighing twenty-three tons.

Coming now to the tests, it will be noticed that there is no possibility of reaching the anchor-plates other than by connection through the cables themselves, and they being firmly attached to the structure, cables and all are practically one conductor; and a connection on the structure would mean connection with the cables, and consequently with the anchor-plates.

This point therefore being settled, the next thing was to obtain a suitable ground, and on the suggestion of Mr. C. B. Martin, the electrician of the bridge, one of the railway cables was used during that portion of the day when it was not in operation for hauling a bridge train. This was a convenient as well as a good ground, the cable surface being polished bright through friction in passing over the pulleys, it was possible to obtain a good contact, and as it passed over the large drums in the engine-room which were on foundations connecting with engines, water-pipes, etc., it was probably the best ground independent of the structure obtainable. The connection to the structure was made by the use of a 2-in. screw-clamp, the wire to the voltmeter being attached to it by the simple means of a screw and washer. Two of these clamps were generally used in nearly all of the previous tests, as they were found very convenient for attaching and detaching quickly to and from hydrants, pillars, etc. The first test under these conditions was made just over the Brooklyn anchorage, where the structure was found to be positive to the ground, with a difference of potential of 2¾ volts maximum, estimated average 1¾ volts.

At the Brooklyn tower another ground connection was made to a water-pipe, which ran down the side of the tower, and is intended for use in case of fire on the bridge. At this point the reading was 3¾ volts maximum, average 2¾, bridge structure was as before positive. At center of span, structure positive at first, with 2¼ volts maximum, but during the readings there were two reversals one of them only remaining long enough to obtain a reading, which was 1¼ volts maximum, structure negative. At the New York tower, structure positive to cable ground, with trolley variations ranging from ¾ths to 3 volts, average 2 volts. At New York anchorage: maximum 2¾ volts, average 2 volts, structure positive to ground.

Other tests were made to determine the polarity of the rails of the bridge trains, and they were found positive to the structure, the same as the rails of the trolley road heretofore tested. Let us now consider the question of the electrolytical conditions of the cable anchorages, as this point appears to be of high importance in this matter, if not the key to the whole situation in determining whether or not electrolytic action is going on. First: These anchorages are composed of solid stone masonry and are put together with the highest quality of cement; there is no brickwork or mortar in their construction.

2. The 23 tons of iron composing the plates are set about 80 feet below the top of the anchorage. The distance from the bottom of the plates to mean high water is 3 ft. 8 ins. at the New York end, 5 ft. at the Brooklyn end; there is no earthly matter, salts or alkalies, such as is found prevalent in the streets which go to make up an electrolyte, so I am informed, in any part of this structure.

I was at first apprehensive that on account of the comparatively short distance between mean high water and the plates at both anchorages there might be opportunity for salt water to reach the plates through seepage or capillary attraction and thereby produce such an electrolyte as to cause corrosion, but have been informed that it is not possible for salt water to reach these terminal plates on account of the distance from the river, the anchorages being over 900 ft. from the towers which stand at each side of the river. Even allowing 100 ft. for the salt water to work back, there is still ample margin as to distance before salt water can reach these plates.

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In view of the tests therefore that have been made showing the structure and the cables to be positive at both ends, it is quite possible that a portion of the currents straying from the trolley lines, and possibly from the bridge service, find their way out of the anchor plates through the dampness of the stone-work of these anchorages. The construction of these anchorages, however, is such, as I have endeavored to set forth, that it seems reasonable from the general construction of these piers that the mass of stone and concrete surrounding these plates will not constitute an electrolyte such as would favor electrolysis, and thereby cause corrosive action on them.

The damages already done and threatened to public works in England by electrolysis has led to the establishment of regulations to prevent such action in the future, and similar legislation may be expected in this country should these conditions be allowed to continue. One of the provisions in the regulations prescribed by the British Board of Trade may be of interest just here. It is to the effect that if the pipe is negative to the rails the potential difference shall not exceed 4.5 volts, and if the pipe is positive to the rails the potential difference shall not exceed 1.5 volts. This appears to be very liberal for the railways, in view of the experience in cities on this side of the water; it is probable, however, they will be made more stringent as future experience in this direction dictates.

I have purposely avoided elaborating any particular scheme for preventing damage by stray railway currents in this paper, for the reason that methods are perfectly well known to railway companies for confining currents to their proper conductors, such as efficient bonding, and providing a return that will leave no inducement for the current to seek underground pipes, in preference to a legitimate conductor. It is simply a question of additional expense. Referring to the incandescent light current which was found prevailing everywhere in this part of the city from the Harlem river to the Battery, passing between all kinds of underground metals, and some on the surface, I do not consider these currents as particularly dangerous at the moment on account of their low voltage, but as before stated, it having been established that a fraction of a volt difference of potential will cause electrolytic action, it then comes down simply to a question of time, when those straying incandescent currents will have to be seriously considered.

In conclusion, I wish to say that these remarks regarding possible damage to public structures through the action of electrolysis, have been made with no desire on my part to appear as an alarmist, but to present simple facts as found in these investigations. I believe that too little attention has heretofore been paid to this matter by any of us; perhaps for the reason that electrolytic action being invisible, as well as noiseless, it has thus escaped attention, and its baneful effects not fully appreciated. It is my opinion, however, that ordinary caution would suggest that periodical tests should be made in every city by competent parties where a trolley road using a ground return is in operation, and the reports placed before those having authority to deal with the matter. In this way threatened damage by electrolysis to water and other pipes, as well as bridges, might be arrested and finally controlled.

ANNUAL REPORT OF THE BUREAU OF STEAM ENGINEERING, U. S. N.

The annual report of Commodore Melville, Chief of the Bureau of Steam Engineering, to the Secretary of the Navy, covers a period of most unusual activity, and the report shows that this bureau has well met the extraordinary emergency demands placed upon it.

Including the $430,613, alloted from the national defense fund, the appropriations for steam machinery in the last fiscal year aggregated $6,665,613; but of this amount only $1,922,054 had been actually expended up to Sept. 1, 1898. The work immediately necessary on the breaking out of the war was not so much extensive repairs to ships in commission as the fitting out of every available ship in ordinary, with the view of getting some service out of each in an emergency. In three of the old monitors at League Island worn-out boilers were replaced by new ones in 30 days, by the Babcock & Wilcox Co.; and this was done without cutting the decks, the boiler sections being passed through the smoke-pipe openings. The greatest amount of labor was expended in fitting out 110 vessels of the auxiliary navy, purchased, chartered or transferred to the government. Few of these vessels were provided with evaporators or distillers, and they all required outfits of stores and tools. After leaving the yards a number of these ships were partially disabled, as a result of the novelty of the machinery to the crews and the emergency of war which made it necessary to start them out before the men were familiar with this new machinery. One result of this experience is the demonstration of the importance of modernizing and stocking the naval station at Key West, the least accessible of all our stations. Liberal appropriations should also be made at once for correcting faults developed at the various navy-yards and stations, both in building and machine tools.

The greatest amount of repair and outfitting work was done at the New York Navy Yard; and of the 86 vessels repaired there during the fiscal year, 73 were handled in 90 days. At the Norfolk Navy Yard 72 vessels were repaired and fitted out in the year; of which 46 came within the 90-day limit. At Key West repairs were made to 64 vessels in the last year, and to 37 more in July of the present fiscal year.

The report deals in detail with the condition of the machinery of our naval vessels completed and authorized prior to March 2, 1883, and in nearly every case engines and boilers are rated as "good." A similar report of conditions and progress is given of vessels completed or building during the year ending Aug. 1, 1898.

Under the head of material it is noted that nickel-steel engine forgings have been brought to a high degree of perfection; and seamless drawn steel boiler tubes have been made of a degree of excellence undreamed of a few years ago. These seamless drawn steel tubes, with wrought steel flanges welded on, are now substituted for the copper and brass steam and feed pipes on destroyers and torpedo-boats. Owing to the temperature corresponding to the high pressures carried on these boats the copper and brass pipes formerly used lost a large percentage of their strength. The change in the machinery of the new battleships of the "Alabama" class, without hull changes, necessitates the reduction of the thickness of the shell plates for cylindrical boilers. In the "Alabama" class this thickness had reached 1 7-16 in. in material, having a tensile strength of over 65,000 lbs., an elastic limit of over 35,000 lbs. and an elongation of 24% in 8 ins. Experiments have been made on a higher carbon steel, oil-tempered and annealed, which has a tensile strength of over 74,000 lbs., an elastic limit of over 40,000 lbs., an elongation of over 21% and a very satisfactory cold-bending test. With the higher pressures called for in the new battleships this steel would allow a slight reduction in thickness. With this high-grade boiler plate, nickel-steel bracing and rivets will be used.

The use of water-tube boilers is increasing in all foreign navies, and the experience of the last year would warrant us in using boilers of this type in all our ships, says Commodore Melville. That contracts for the new battleships were awarded on the basis of cylindrical boilers is explained as follows: The Bureau designed and was anxious to use water tube boilers; but, as it was decided that these ships should be practically identical with the "Alabama" class, without change in hulls, the use of the water-tube boilers would have involved a readjustment of hull weights to maintain the trim. But in the Department circular of July 26, asking for designs for higher speeds and greater endurance, builders were encouraged to use the water-tube boilers, as the easiest way to secure the desired rsults. The bids received on Sept. 1 justify this idea and it is practically certain that the new type of boiler will be used, and all machinery will be of the most modern type. The present demand upon the naval engineer for great power on small weight, to secure the higher speed deemed necessary, practically rules out the cylindrical boiler, on account of its weight and its inability to carry the high pressure needed. The tactical importance of water-tube boilers was demonstrated by the conditions existing at Santiago previous to and upon July 3. It was necessary for a long period that all the ships should be ready to develop maximum power in a few minutes. With cylindrical boilers this involved keeping all the boilers under steam, with heavily banked fires and the attendant large consumption of coal. Proper water-tube boilers, admitting of the rapid raising of steam with safety, remove this difficulty and place the fighting machine under better control. Another great advantage is that water-tube boilers can be replaced, or practically rebuilt, without disturbing the decks.

The experiments with liquid fuel, on the torpedo-boat "Stiletto," were very satisfactory, though the economy over coal was not high, owing to the fact that the machinery was not specially adapted to oil fuel. The oil used had a specific gravity of 0.85 to 0.87, a flash point of about 315°F. and a burning point of about 350°F. As a bunch of burning waste was extinguished when plunged into this oil, there can be no doubt of its perfect safety for use on board ship.

Uniformity in machinery in naval vessels, as divided into classes, is an especially important feature; as it permits a reduction in the number of spare parts, facilitates repairs and enables a transfer of crew to another vessel of the same class, ready to at once get the best work out of familiar machinery.

The repair ship "Vulcan," fitted out during this war, did invaluable service. This ship arrived at Guantanamo on July 1, and by the end of August she had made repairs on 63 ships and had furnished supplies to 60 ships. The "'Vulcan" was fitted with machine tools, cupola, forges, brass furnaces, etc., and carried a crew of 100 skilled mechanics. The usefulness of distilling ships was also proven in the war, though the two vessels thus equipped were not completed before active operations were over. It was shown that a multiple-effect evaporating machine could be made which would give 20 lbs. of fresh water for every pound of coal burned in the boilers; and such a vessel could supply 50,000 to 60,000 gallons of water per day and carry 3,000 tons of coal, supplying a large number of tank vessels and serving as a collier in case coal was more useful than water. The Bureau deems a distilling ship of vital necessity for a fleet of any size; and the cost of thus supplying fresh water is very much less than the purchase of water under any except the most favorable circumstances. Moreover, fresh water is absolutely necessary for the integrity of water-tube boilers.

The report deals briefly with the performance of the battleship "Oregon." Between March 6 and May 24 this ship steamed over 14,500 miles, stopping only for coal and not being delayed anywhere an hour through any derangement of the machinery. She stopped at Key West only for coal and at once joined the blockading fleet ready for service. While this is an unparalled record, the "Oregon" surpassed herself in the great battle of July 3. Always ready for service, she, on that day, speedily attained a power greater than that developed on her trial, and notwithstanding her greater displacement and foul bottom she reached a speed only slightly less than was then recorded. Had it not been for this wonderful speed, one, and possibly two of the Spanish ships might have escaped. Commodore Melville ascribes the credit for the performance partly to her builders, the Union Iron Works, for excellence of material and workmanship, but chiefly to the engineer department of the "Oregon" as organized and led by Chief Engineer Robert W. Milligan.

The performance of the two 1,000-ton gunboats, "Annapolis" and "Marietta," is also most favorably commented upon. Both of these ships have water-tube boilers, made by the Babcock & Wilcox Co., and both were commissioned in 1897 and have been over one year in service. The "Marietta" covered 13,000 miles at an average speed of 9.2 knots, and for several periods of about a week each the average was 10 knots. Yet, in both of these vessels the boilers are now in excellent condition and ready for any service; and at the end of her long voyage from the Pacific the "Marietta" only needed a few fire-brick, and the "Annapolis," after steaming thousands of miles, needed nothing.

The lessons of the war, for the steam engineering department are summed up as follows: The necessity of frequent tests under working conditions of the machinery of all vessels in reserve. All naval stations should be in positions of strategic value, and be properly fitted for repairs and provided with adequate quantities of non-perishable stores. Key West is such a station. Fresh water is almost as important as coal and distilling ships are a necessity. Every fleet should have a repair-ship. With more than two main engines, there should be three engines driving three screws, and not two main engines on each shaft. At Santiago the "New York" and "Brooklyn" had their forward engines disconnected on July 3 and could not stop to couple them. An accident to any part of either of the two engines on a shaft disables half the power; in the three-screw ship this fraction would be only one-third. There should be frequent trials under forced draft to keep the blowers in good condition and make the men familiar with working under maximum conditions. Until the day of the Santiago fight some of the ships had never been under forced draft since ther trial trips. The position ot these blowers is important, and they should not be put in pockets or corners in the fire-rooms to make space for other equipment. In the "Cincinnati," temperatures as high as 205°F. were noted in the fire-rooms. The personnel must be regulated by the class of the ship, and there must be a reserve of trained men and officers; a war of long duration would have greatly embarrased the government owing to the difficulty of supplying the places of disabled or invalided men. Volunteers, however, well trained in other ways, can not replace the regular officers. Finally our fighting ships must have the highest practicable speed, and 18 knots is now recognized as a standard in battleship construction.

NOTES ON THE SEWERS AND PAVEMENTS OF DENVER, COLO.

By W. P. Hardesty.*

Both the sewers and pavements of Denver, Colo., are of comparatively recent construction. Nearly all of them have been put down under supervision of the Board of Public Works since the latter was organized in 1889.

The sewers are divided into three distinct classes, as follows:

I. Public Sewers.—Up to May, 1898, 61,129 lineal ft. have been laid, at a total cost of $520,020. Of this there are 17,766 ft. of vitrified sewer pipe 8 to 24 ins. diameter; 15,211 ft. of oval brick, 1 ft. 11 ins. × 2 ft. 10½ ins. to 3 ft. 6 ins. × 5 ft. 3 ins.; 13,805 ft. of circular brick, 24 to 58 ins., and 13,298 ft., 70 to 94 ins.; also 1,049 ft. of 24-in. cast-iron pipe.

II. District Sanitary Sewers.—Work has been done in 20 districts from 1880 to 1897. The total cost has been $1,687,709, and the cost per lot of 25 × 125 ft. varied from $14.80 to $73.61. There is a total length of 1,066,829 ft., or 202.04 miles, divided as follows:

Vitrified pipe.			
Size.	Length, ft.	Size.	Length, ft.
8-in.	775,956	18-in.	17,701
9-in.	102,164	20-in.	5,269
10-in.	25,237	21-in.	9,076
12-in.	72,723	22-in.	1,759
15-in.	43,301	24-in.	7,039
Total pipe			1,060,225

Brick.			
Oval.		Circular.	
23 × 34½ ins.	1,740	21 ins.	6
18 × 30 ins.	1,320	24 ins.	2,639
		30 ins.	1,169
Total	3,060	Total	3,544

There are 67,816 Y's and 3,821 manholes.

III. Storm Sewers.—There are 13 storm sewer districts in which work has been done from 1890 to 1896. There are 19,788 ft. of vitrified pipe 8 to 24 ins.; 2,521 ft. of oval brick sewer, 2 ft. 10 ins. × 4 ft. 3 ins. to 3 ft. × 4 ft. 6 ins.; 10,003 ft. of circular brick 26 to 54 ins. diameter, or 32,312 ft. in all. There are 53 "Y's," 140 manholes and 233 basins. The total cost has been $157,268.

The total length of the three classes of sewers is 223.97 miles. Some sewer construction was done in 1880, but nearly all of it has been done since the beginning of 1890.

The most interesting and most expensive piece of work per foot is the extension of the Delganey St. public sanitary sewer, 8,290 ft. long. It is 94 ins. in diameter for 2,380 ft. when it is bifurcated, a branch or spillway discharging into the Platte River near by. Here the diameter is reduced to 70 and 77 ins. to the end. The grade to the spillway is 0.10, then it is 0.05. The spillway or storm overflow is designed to take care of all the excess of storm waters that enter before it is reached. The storm area drained is 300 acres, from which the estimated maximum flow is 188.4 cu. ft. per sec.; the sanitary area is 10,585 acres and the expected flow is 128.9 cu. ft. per sec. The standard construction of this sewer is of three rings of brick. The storm overflow is 10 ft. wide and is semi-circular. The actual cost of construction of both was $148,628.18, including $9,687.90 for river protection.

Paving.—The first street paving was done in 1890. There was a bitter fight made against the use of asphalt, both by newspapers and parties directly interested, but it was adopted and has proven so satisfactory that nothing else has been used except for the wholesale and manufacturing districts; 2.298 miles of sandstone and 11.761 miles of asphalt had been laid up to May, 1898. The price for the former ranged from $3.47 to $2.39 per sq. yd., and for the latter from $3.23 to $2.595. Asphalt is laid 2½ ins. thick on a 6-in. concrete base, and sandstone in blocks 6 ins. deep on 1½ ins. of sand on 6 ins. of concrete. The streets are 80 ft. wide, leaving 48 ft. for the paving and the gutters. Of this the street car companies have to pave between their rails (3½-ft. gage) and for 2 ft. each side, making 15.8 ft. The average arching of the pavements from the gutters to the center is 6 ins. To obtain sufficient fall for the gutters in many parts of the city, they are raised or lowered so as to make the height of the curb vary all the way from 4 to 10 ins., at the same time reducing or increasing the crown of the pavement. Prices have gradually come down, and last spring 1½ miles of asphalt paving was let to the Colorado Paving Co. at $1.80, including grading. The Denver Paving Co. also took work of the same class at $1.93. On the new 14th St. viaduct 2 ins. of Alcatraz asphalt on 6 ins. of concrete is being laid at $1.45.

AMERICAN NAVAL ORDNANCE AND ARMOR IN THE LATE WAR.

Naval ordnance in the American-Spanish war is reported upon by Capt. Chas. O'Neill, U. S. N., Chief of the Naval Bureau of Ordnance. Contrary to current opinions but little war material for the navy was purchased abroad; a number of minor caliber guns and some ammunition for them and a few torpedoes covered the foreign supply; all else came from the United States. Nevertheless, batteries and ammunition were placed on 107 auxiliary vessels purchased or otherwise acquired, and these vessels mounted an aggregate of 576 guns. Besides these, two new gunboats and twelve new torpedo boats have been armed since January last, bringing the total up to 121 vessels supplied with munitions of war in the emergency.

The main batteries of the U. S. regular naval vessels now number 564 breech-loading rifles, and the secondary batteries of these ships carry 1,023 guns of less than 4-in. caliber. Since the date of the last annual report, 112 guns, of from 4 to 13-in. calibers have been completed at the naval gun factory; or, 16 4-in., 54 5-in., 29 6-in., one 12-in., and 12 13-in.; besides this two 8-in. and 33 6-in. guns were converted into quick-firing rifles. Under contract with private establishments 37 4-in. guns and mounts have been partly completed, and forgings have been ordered for five 8-in., 20 5-in. 26 4-in., and one 3-in. guns. New designs adopted for future guns of all calibers are calculated to insure a much greater muzzle-energy than is now obtained from guns of like caliber.

Guns, mounts and their appurtenances have been severely tested during the war, and their performance has been in general thoroughly satisfactory. Some minor defects in the mounts of guns of small caliber have been, or are being remedied.

As soon as the war became imminent orders were at once given for large quantities of powder, projectiles, fixed ammunition, small arms and small guns for secondary batteries, and these orders were promptly filled. It was proposed by Engineer-in-Chief Melville to utilize bicycle and other machine shops in rapidly building 75 torpedo boats; but this plan was abandoned when Admiral Dewey, in Manila Bay, proved that the Spanish fleets could be defeated without them.

The lessons of the war, as to guns and armor, are covered in the following statement of Capt. O'Neill: While heavy guns in turrets must be regarded as one of the chief characteristics of a battleship, the greatest execution, except against the heaviest armor, may be expected from a number of quick-firing guns of small caliber. The larger guns demand a greater sacrifice of space and weight, to accommodate them and their protection, and are slower and less accurate in fire. Turrets do not protect the hull; the space within them is limited, and so is the field of view from the sighting-hood; the heat in them is intense in warm climates; ventilation is imperfect and elaborate machinery is necessary to operate them. Notwithstanding these drawbacks, heavy guns in turrets are recognized as a necessity; but the question of the maximum caliber to be used in them is now demanding the serious consideration of the Bureau.

The 13-in. gun, of 60½ tons weight and 35 calibers long, has a muzzle velocity of 2,400-ft. seconds with smokeless powder, and a capacity to penetrate, with a capped-projectile, 19 ins of face-hardened armor at a distance of 2,500 yds. This gun has been heretofore considered as the best type of heavy turret gun for our first-class battleships, and all, excepting the "Iowa," with her 12-in. guns, were so equipped. The development of the 12-in., however, has been so great and its power has been so much increased that the Bureau now recommends it as the maximum caliber to be installed on future battleships; and it proposes to supplement these 12-in. guns by a battery of 6-in. quick-firing guns in casements, and with a secondary battery of 6-pdr. and 12-pdr. guns. The present 12-in. gun weighs only 7½ tons less than the present 13-in. gun; but the reduction in size and weight of the turrets, barbettes and ammunition is very great. As to armor, the Bureau believes that 12 ins. is sufficient in view of the recent improvements in manufacture, and the necessity of distributing protection over a greater area than was formerly the practice.

Smokeless powder, made by the Bureau's formula from soluble nitro-cellulose, dissolved in ether alcohol, is successfully made and proven to be uniform in character and to possess good keeping qualities. This powder could have been furnished in considerable quantities during the war; but, owing to lack of time, it was impracticable to furnish complete outfits of this ammunition, and a few guns using brown powder would have nullified the advantages gained by using smokeless powder in other guns. Considerable quantities of smokeless powder are now provided, and hereafter all naval vessels will be supplied exclusively with this powder, excepting only a certain number of brown powder charges for practice work. This will use up the cheaper brown powder on hand. The government is now building a smokeless powder factory at Indian Head.

As showing the amount of work speedily accomplished by the Ordnance Bureau, we find that at the New York Navy Yard alone, 48 vessels were surveyed, transformed for war service, fitted with batteries, ammunition and ordnance outfits; and the guns, ammunition and outfits for 41 of these vessels were prepared and shipped in the ten weeks between April 15 and July 1, 1898. Freight trains loaded with ammunition were rushed to San Francisco and to Tampa on passenger train schedules.

TORPEDO BOAT DESTROYERS OF 35 KNOTS SPEED are being built by the Parsons Steam Turbine Co., of Wallsend-on-Tyne, England. One of these is for England and the other for a foreign country. These destroyers will be twice the length and six times the weight of the original "Turbinia," and there are reasonable expectations of attaining a speed of 40 knots. The advantages claimed for the turbine-type of destroyer, aside from great speed, are economy in coal consumption, which was 15% in the "Turbinia," traveling at ordinary rates; a great saving in engine space and weight; the absence of vibration; and the absolute command over the engine, as the "Turbinia" could be brought to a standstill in 40 seconds, and she could be quickly turned and handled while going at full speed.

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ADVERTISING RATES: **20 *cents per line. Want noticees, special rates, see page* 18** *Rates for standing advertisements sent on request. Changes in standing advertisements must be received by Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.*

A new evidence of the passing of the old barge canal as a factor in freight transportation under modern conditions is furnished by the announcement that the Delaware & Hudson Canal Co. is considering the abandonment of the famous old waterway, for the construction of which the corporation was originally organized. The Gravity R. R., completed by the company in 1829, is to be closed to traffic on Jan. 1 next, and it is not likely that the company will continue to maintain and operate the canal. For a number of years the traffic on the canal has been falling off, and it is said that only 250 boats were run last summer, where 1,400 boats once ran during the canal's prosperous days. A large proportion of the coal mined by the Delaware & Hudson Co. has been sent to the New York market over the Erie R. R. for several years; and it is now said that such traffic arrangements have been obtained that all the coal for the New York market from the company's mines will take this route.

It is plainly evident that a few years more will see the entire disappearance of the old-time canal barge as a vehicle for freight transportation. The 60,000-lb. freight car is a competitor which it cannot meet. The only ones of the old-time canals on which even a semblance of their old-time traffic is to be found are such canals as the Erie, where the taxpayers foot the bills for maintaining and operating the canal. Even here, however, the question of who is to carry on the traffic in the near future is a serious one. The profits to the canal boatmen for several years have been so meager that hardly any new boats have been built for some time; the old boats are fast becoming rotten and useless; and with the present uncertainty as to the future policy of the state respecting the canal, no new investments in boats to ply upon it are likely to be made.

◆

The proposition to erect a memorial of some kind to the late Col. George E. Waring, in testimony of the value of his services to the city of New York, and in a broader sense, to the cause of better municipal sanitation, is a project eminently worthy of consideration. By his masterly executive ability and strong personality, Col Waring introduced new methods, and organized on a new system the work of street cleaning and refuse disposal in New York city, and so greatly improved the sanitary conditions that the system which he established is likely to be perpetuated. His services to the city were, indeed, valuable, far beyond the salary which he received, as is indeed often true of the engineer's work. It is well that the value of his services should now be substantially recognized, if for no other purpose than to preserve the memory of an energetic and faithful public servant who intelligently and honestly performed his duty.

That Col. Waring died a poor man speaks much for his honesty in positions of large responsibility; but he leaves a widow practically unprovided for, and, if a memorial fund is to be raised, we heartily commend the method for disposing of this fund suggested by Ex-Mayor William L. Strong. Briefly stated, the project, as thus far outlined, is to raise a fund from among the friends of Col. Waring, and those who appreciate his services to New York, and his later services to the government, to put this fund in trust and to pay the income to Col. Waring's widow during her lifetime. After her death the principal can then be disposed of as may be deemed best; enther in erecting a monument, or, better, in endowing a department of sanitary engineering in some reputable technical institution. Whatever the final disposition of such a fund might be, however, if it is to be raised at all, its first object should evidently be to secure Mrs. Waring from want. Posthumous recognition of valuable public service is better than none at all; but it should at least take the form that will best carry out the wishes of the deceased had he survived.

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In our issue of Oct. 27, we noted the displeasure of the City Councils of Philadelphia because the Chief of the Water Department, Mr. John C. Trautwine, M. Am. Soc. C. E., did not complete the plans and specifications for the new George's Hill Reservoir as soon as they desired. Mr. Trautwine has now completed these plans, and in submitting them to the Director of Public Works, he has taken occasion to fully answer the charges of "contumacious conduct," etc., which were made in the Council sessions. He shows that the force of assistants which is allowed him comprises, all told, four draftsmen, at an average yearly salary of less than $1,200, and three rodmen at $2.50 each per day. With this force Mr. Trautwine, during the past summer has had to perform all the routine work of his department, and, in addition, prepare the following plans, estimates and reports: On Aug. 1 he was instructed by his superior officer to carry out a resolution of the city council calling for "plans and drawings and estimated cost of the filtration of all the water used by the city," and he was given just one month in which to do it. On Sept. 12, the site for the new reservoir, mentioned above, was approved, and on Sept. 15, Councils called for detailed plans for the reservoir, to be submitted at its next regular meeting, Oct. 6. About Oct. 20, Mr. Trautwine received a letter from the director of public works transmitting a resolution of the Select Council, calling for a report

> at the earliest possible time as to whether there is, within a radius of one hundred miles from the city, a supply of good water capable of furnishing this city with a sufficient storage quantity for 150 days, and whether the same can be stored and brought down by gravity and deposited in the city reservoirs for distribution. Also, report on the estimated cost of procuring such supply, together with any other information bearing upon the subject.

Mr. Trautwine is by no means the first engineer who has been overwhelmed with work, and then found fault with because he could not perform miracles. In fact, it is one of the greatest difficulties in carrying on work under state or municipal or national control that duties are assigned to public officials without the slightest question as to whether other demands on their time make it possible for them to perform them. In work under direction of a private firm or corporation, when an officer is given additional duties or special work, he is empowered to employ assistants enough to do it. But red tape prevents this, as a rule, in work under municipal or state control, and the man on whom the responsibility is laid has to struggle along as best he can.

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LESSONS FROM THE LOUISVILLE EXPERIMENTS ON WATER PURIFICATION.

The value of experimental work, especially when conducted on a sufficiently large scale to make the conditions comparable with those prevailing in practice, is seldom better illustrated than by the results of the Louisville experiments on water purification. From the advance pages of Mr. Fuller's report on this subject, reviewed in Engineering News of Oct. 27, it appears that had the Louisville Water Co. awarded a contract for filters of the current mechanical type at the outset, instead of making, as it did, an exhaustive investigation of their efficiency, the results obtained would have been unsatisfactory, at times, and the expense unnecessarily great. The reason for this is that the companies, whose apparatus was tested, did not, prior to these experiments, fully appreciate the magnitude of the task of purifying a water so variable in character, and so heavily charged with minute particles of suspended matter, as is the Ohio River, at Louisville. In other words, too much reliance was placed, at the start, on coagulation and mechanical filtration and too little upon sedimentation. A number of other points brought out by the investigation were, when taken together, of much practical importancee as regards both the cost of purification and the quality of the water, especially the uniformity of the results obtained.

It may seem surprising that after 10 or 15 years of experience with mechanical filtration, and the installation of a hundred plants, by various companies, it was deemed necessary to undertake an exhaustive series of experiments at Louisville before the water company felt warranted in adopting the system. But the facts are, as we have repeatedly pointed out, that the data were lacking which would enable an engineer to decide upon the capabilities of mechanical filtration. The filter companies themselves did not possess such data, for two reasons: (1) Because they, like most proprietors of patented systems, had such confidence in their filters that they thought much experimental work, outside the laboratory, unnecessary; and (2) because their energies have been concentrated more upon fighting each other in the courts, and in competition for business, than upon learning the limitations of their filters. Public officials and private water companies have done very little in the way of studying mechanical filtration, (1) because the various filters were regarded as proprietary devices, and (2) because of the general apathy that has prevailed, until recently, regarding water purification. This apathy has been remarkable, even on the part of officials having mechanical filters under their care, some of these never having taken the trouble to learn how much wash water they were using, while it is a rare thing to find a filter plant for which periodical water analyses are made.

When the Louisville investigations were begun, the only notable experimental test of mechanical filtration on record was the one conducted at Providence, R. I., in 1893-4, by Mr. Edmund B. Weston, M. Am. Soc. C. E., reviewed at length in Engineering News of April 16, 1896. This test was made on a small scale, and had other limitations besides. In addition, the water treated contained such small amounts of suspended matter, in comparison with the water of the Ohio River, as to throw little light upon this phase of the Louisville problem, where the removal of mud must accompany bacterial purification. Besides this lack of experimental data, there confronted the Louisville officials the fact that a large mechanical filtration plant at New Orleans had been rejected by the water company there, after installation and a long contract trial, on the ground that it did not remove the suspended matter in the Mississippi River water without the use of an excessive amount of coagulant. The courts sustained the contention and the filter company suffered a heavy loss.

In view of the meager data available, and the

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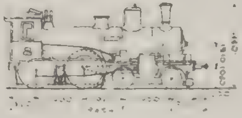


Fig. 1. State Ry. Saxony.

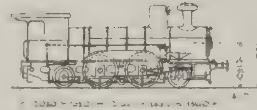


Fig. 2. Wurttemberg State Ry.

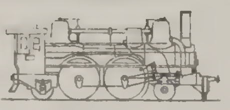
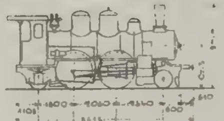


Fig. 3. Austrian State Ry.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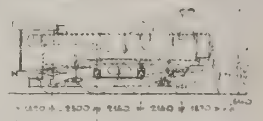


Fig. 5. Belgian State Ry.

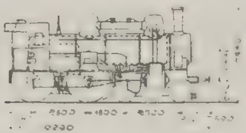


Fig. 6. Austrian State Ry.

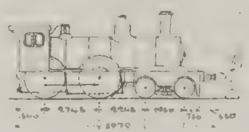


Fig 7. Holland Ry.

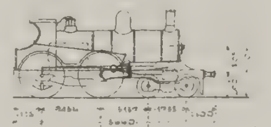


Fig. 8. Manchester, Sheffield & Lincolnshire Ry.

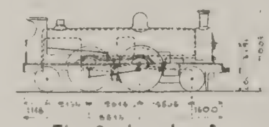


Fig. 9. London & N. W. Ry.

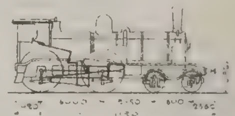


Fig. 10. Northern Ry., France.

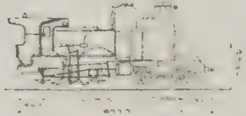


Fig. 11. Paris, Lyons & Mediterranean Ry.

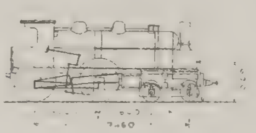
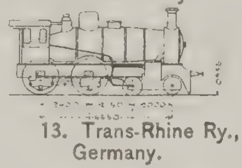


Fig. 12. Eastern Ry. of France.


13. Trans-Rhine Ry., Germany.

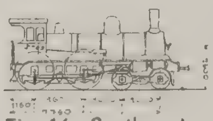


Fig. 14. Southwestern Ry., Russia.

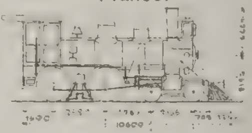
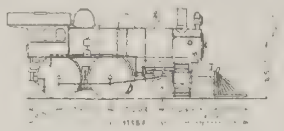


Fig. 15. Chicago, Burlington & Quincy Ry.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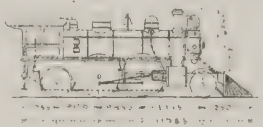
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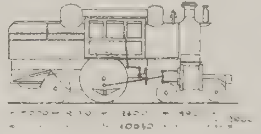


Fig. 18. Phila. & Reading R. R.

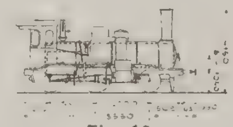


Fig. 19. Prussian State Ry.

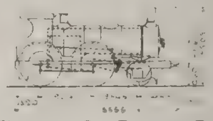


Fig. 20. Gr. Eastern Ry., England.

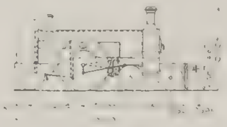
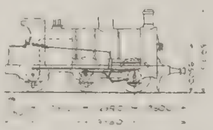


Fig. 21. Gr. Northern Ry.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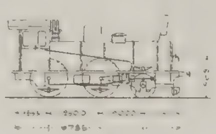
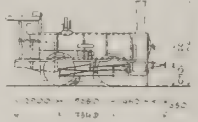


Fig. 23. Prussian State Ry.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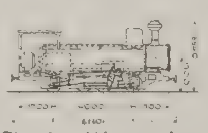
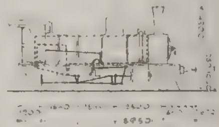


Fig. 25. Wurttemberg State Ry.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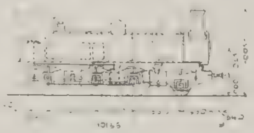
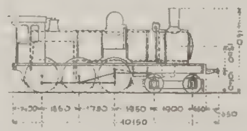


Fig. 27. Belgian State Ry.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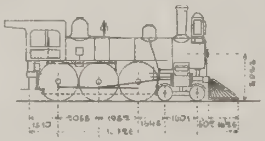
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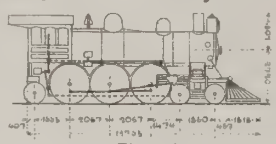


Fig. 30. C., M. & St. P. Ry.

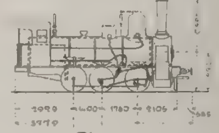
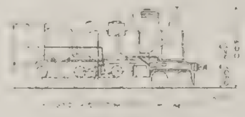


Fig. 31. Austrian State Ry.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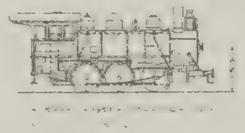
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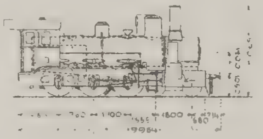


Fig. 34. Hungarian State Ry.

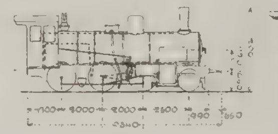


Fig. 35. Prussian State Ry.

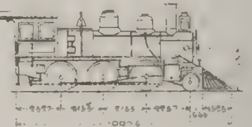
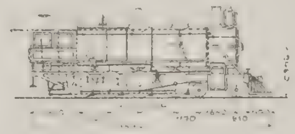


Fig. 36. Great Northern Ry., U.S.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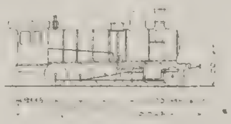


Fig. 38. Prussian State Ry

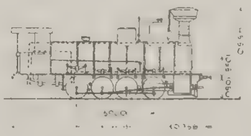


Fig. 39. Austrian State Ry.

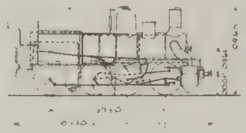
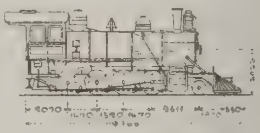


Fig. 40. Paris, Lyons & Mediterranean Ry.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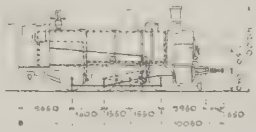
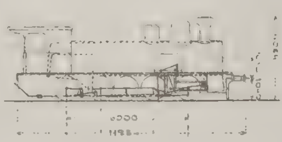


Fig. 42. Prussian State Ry.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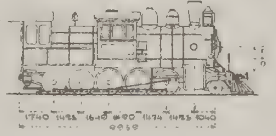
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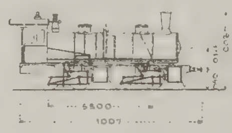
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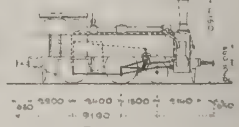
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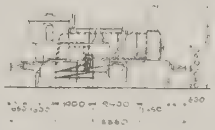


Fig. 47. Hanover Ry. Germany.

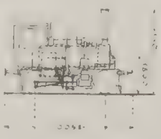


Fig. 48. Narrow Gage, Hanover Ry.

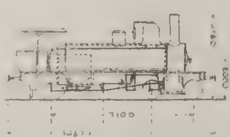


Fig. 49. Central Ry., Switzerland.

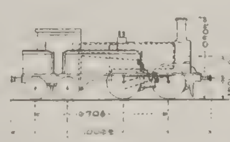


Fig. 50. South Eastern Ry., England.

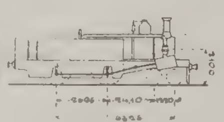


Fig. 51. London City Ry.

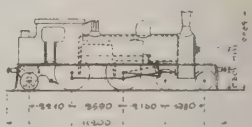


Fig. 52. London, Tilbury & South End Ry.

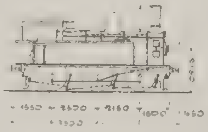


Fig. 53. Western Ry., France.

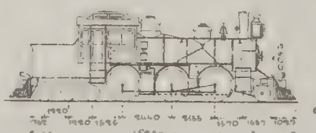


Fig. 54. Chicago & N. Pac. Ry.

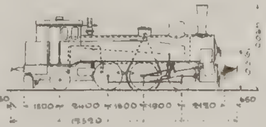


Fig. 55. Prussian State Ry.

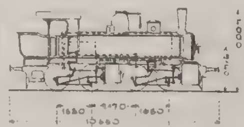


Fig. 56. Central Ry., Switzerland.

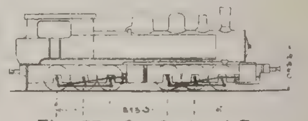


Fig. 57. St. Gothard Ry, Switzerland.

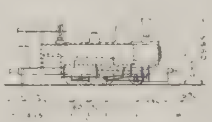


Fig. 58. System Hagans.

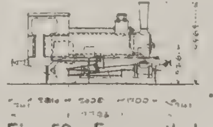


Fig. 59. Emmenthal Ry., Switzerland

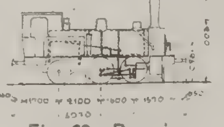


Fig. 60. Prussian State Ry.

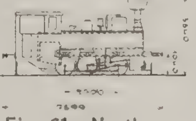


Fig. 61. Northern Ry., Austria.

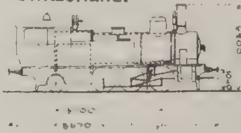


Fig. 62. Prussian State Ry.

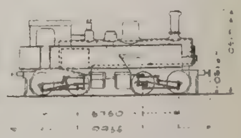
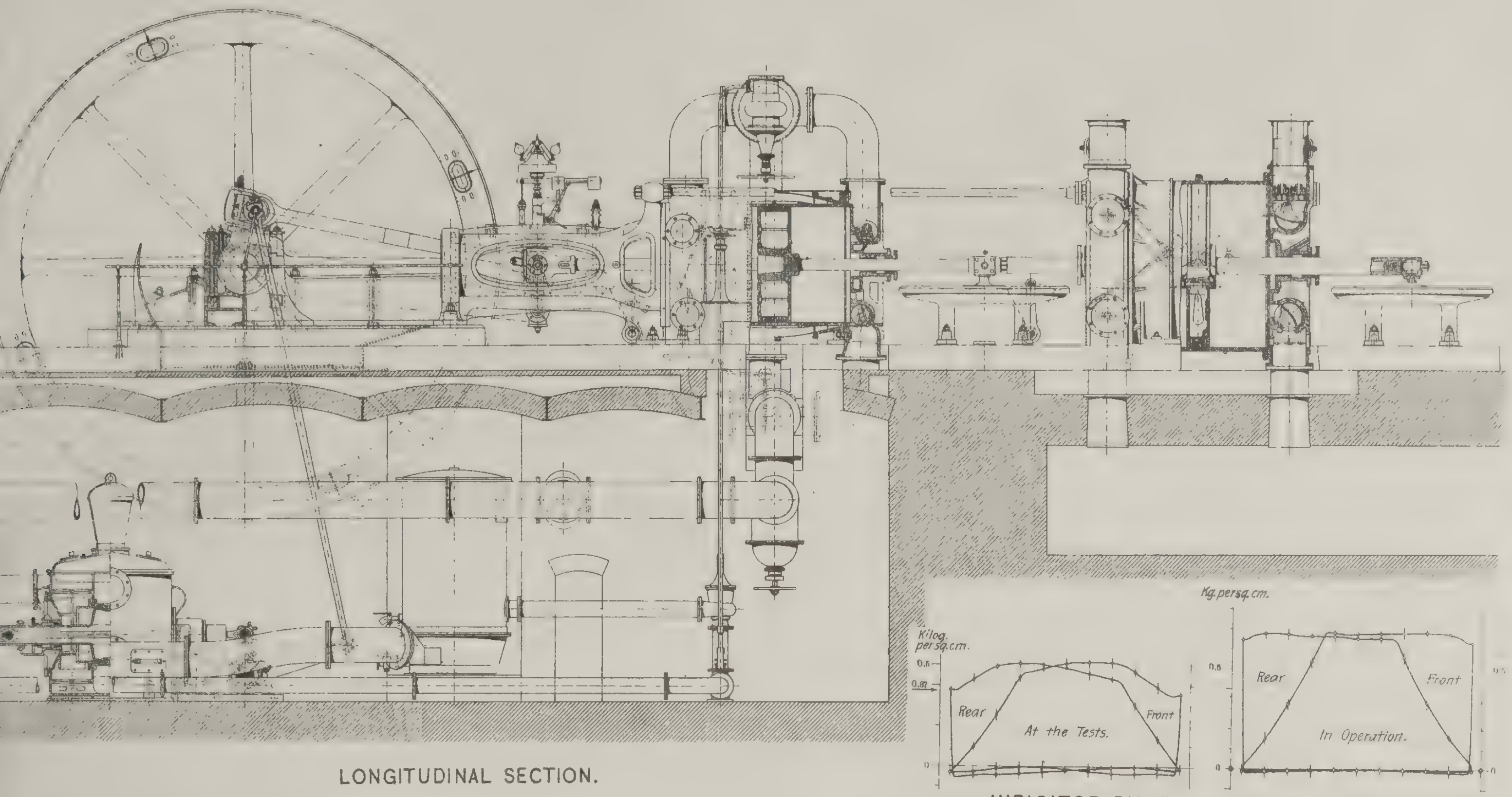


Fig. 63. Saxony State Ry.

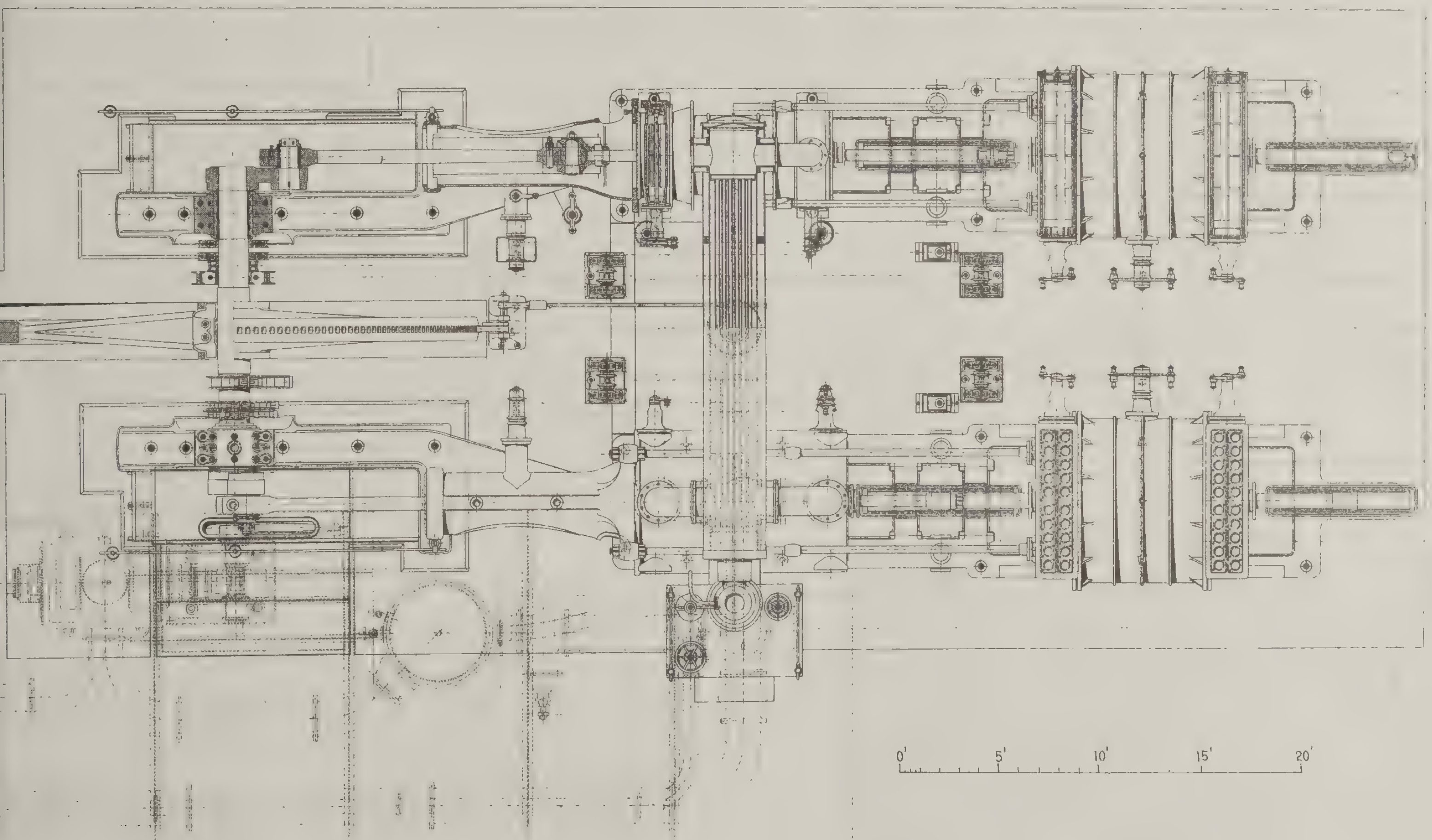
(FIGS. 48, AND 58 TO 63, NARROW-GAGE LOCOMOTIVES)

RECENT TYPES OF EUROPEAN AND AMERICAN LOCOMOTIVES.



LONGITUDINAL SECTION.

INDICATOR DIAGRAMS FROM AIR CYLINDER.



SECTIONAL PLAN.

CROSS-COMPOUND DUPLEX HORIZONTAL BLOWING ENGINE.

Built by Bolzano, Tedesco & Co., Schlan, Bohemia,
for the
Hungarian Iron Works, Krompach.

CHAS. HART, LITH., 36 VESEY ST., N. Y.

sad experience at New Orleans, it is not strange that the Louisville Water Co., and its able Chief Engineer, Mr. Chas. Hermany, M. Am. Soc. C. E., were unwilling to contract with any of the filter companies for a purification plant. Nevertheless, the indications were strongly in the direction of mechanical filtration, as best suited to the conditions at Louisville, because it was felt that a coagulant would be necessary for the removal of the suspended matter. Slow sand filtration alone was out of the question, on account of the rapid clogging of the beds and the vast amount of labor required to clean them, as had been determined experimentally by Mr. Hermany some ten years before the recent tests.

After ten months of experience with the filters of three different companies, each plant having been designed for a capacity of 250,000 gallons a day, the Louisville Water Co. felt the need of still further investigations to settle some questions raised but not answered by the filters tested. Finally, we understand, the company secured sufficient data to enable it to design a system of water purification which it believes will be efficient and economical. The details of this system are not given in the report, but its final conclusion indicates that a modified form of mechanical filter will be adopted, the facilities for sedimentation being greatly increased over those provided in any of the plants installed by the filter companies. Contracts have been let, since the report was written, for portions of the purification plant, but not for the filters proper.

The question naturally arises, have we now sufficient information regarding mechanical filtration to enable an engineer to say whether it is capable of doing the work required in any specific case, or are further investigations necessary? This suggests the broader question, whether water purification as a whole is now on as definite a basis as other branches of water supply engineering, say pumping machinery? We do not think it is, although it seems to be rapidly approaching that state. When the reports on the Pittsburg and Cincinnati experiments are added to the Louisville report and to the mass of valuable information emanating from the Lawrence Experiment Station and from foreign sources, there will certainly be no longer any ground for complaint of a scarcity of data regarding water purification. We have had a fair amount of information regarding some phases of sand filtration for a number of years, most of which has originated at Lawrence or abroad. At present the chief deficiency in American records relating to slow sand filtration is that they throw little light on the treatment of water carrying large quantities of mud, like the Ohio and Mississippi, and other Southern and Western streams. The Pittsburg and Cincinnati experiments will do much towards supplying these wants, as both were instituted largely for this very purpose, but with a realization that sedimentation would be necessary to supplement slow sand filtration. These later experiments, it is to be hoped, will also afford some comparative data regarding mechanical and slow sand filtration, although official statements as to this have not been made. It is known, however, that both systems were tested at Pittsburg, where the experiments were recently completed, Mr. Allen Hazen, Assoc. Am. Soc. C. E., being engineer to the commission on filtration. The Cincinnati tests, like those at Louisville, are being conducted by Mr. Geo. W. Fuller, Chief Chemist and Bacteriologist, under the direction of Mr. L. F. G. Bouscaren, M. Am. Soc. C. E., Chief Engineer of the new water supply. Both reports will probably be published promptly.

With the information outlined available, what we shall mostly need will be the detailed results obtained by full-sized working plants. As already stated, scarcely any regular periodical analyses of filtrates have been made in this country, and fewer yet have been published. The results obtained by the slow sand filtration plant of the city of Lawrence, Mass., are available, but the analyses are not made at very frequent intervals. Examinations of the water from the mechanical filter plant at Davenport, Ia., ware made at fairly frequent intervals, some time ago, for the Davenport Water Co. by Prof. E. G. Smith, of Beloit, Wis., but only portions of the results have ever been published, so far as we know. Prof. Smith also made some analytical studies of the effect of sedimentation of Missouri River water at Omaha and Council Bluffs, a few years back, but these figures, also, have not been made generally available. Valuable studies, extending over several weeks, of the work done and coagulant used by the mechanical filter plant at Lorain, O., were made not long ago, under the direction of Mr. Hazen, as will be seen by referring to Engineering News for Oct. 28, 1897. In our issue of June 4, 1896, there appeared a report by Dr. Thos. M. Drown, President of Lehigh University, on the removal of iron from ground water at Asbury Park, N. J., by means of aeration and mechanical filtration, the tests here also extending over a number of weeks.

When the sedimentation and slow sand filtration plant at Albany, N. Y., described in our issues of Feb. 10 and Oct. 20, 1898, is put in use we may expect to have some valuable figures regarding it, for a chemical and bacteriological laboratory are very wisely being provided as a part of the works. Soon other of the larger cities will have water purification plants in use, and doubtless they also will see the advisability of providing and operating analytical laboratories. The importance of frequent chemical and bacterial analyses in connection with purification plants can hardly be urged too strongly, both as a guarantee of good results and of economical design and operation.

While we are learning and expecting to learn so much about water purification from the various sources already open to us and likely to be open soon, five or ten years, at least, will probably pass before most of our largest and many of our smallest cities can safely install complete systems of water purification without making more or less preliminary experiments. Where large plants are to be constructed, the total expense of such tests need be only a small fraction of the capital charges and operating expenses for one year, and the tests may often more than pay for themselves in a single suggested modification in design. In many cases the only doubtful points may pertain to operation, rather than design, when the tests may be delayed until the plant is in use. In fact, the supreme test is daily use, and that is why any filter plant should be constantly under good engineering, chemical and bacterial supervision.

Reverting now to the specific lessons of the Louisville tests, we have as the most important the great value and necessity of sedimentation in the treatment of all waters high in suspended matter, the process also removing a large percentage of bacteria. But where the sediment is finely divided, or where a high degree of bacterial purification is necessary, sedimentation must be supplemented by filtration. Coagulation would also be necessary at Louisville and is now almost universally recognized as an essential part of mechanical filtration, at the high rates usually employed.

The proper amount of coagulant, or the optimum quantity, as Mr. Fuller terms it, is a subject demanding careful investigation for each water to be treated. At Louisville it was found that the clayey particles in suspension absorbed a large amount of sulphate of alumina, without any effect upon the water. This was at times as high as ¾-grain per gallon. On the other hand, this coagulant in excess of certain quantities may be worse than useless, as has been known for some time, since all in excess of that which the carbonates in the water are able to take up passes into the filtrate. There might be cases where the use of sulphate of alumina, or alum, in sufficient quantities for efficient work, would be objectionable on account of adding to the corroding and incrusting qualities of the water and increasing its hardness. At Louisville this would not be the case, with proper design and operation of the purification works. These possibilities are one of the many reasons for careful analytical studies in connection with each filter plant. Another point about coagulants is that they must be given a proper amount of time to act, depending upon the character of the water and, presumably, the nature of the agent. Uniformity in the rate of admission of coagulants is essential to good results and to economy. Mr. Fuller thinks each of the devices used for this purpose at Louisville in the experimental plants could be improved upon, either by modifications in design or by the substitution of a direct gravity feed, instead of some form of pump. Reliance upon passing a stream of water through a receptacle containing the coagulant is wrong.

For the Ohio River water, sulphate of alumina was found to be the best and cheapest coagulant available, after an exhaustive study of the whole range of possible agents. This coincides pretty generally with experience elsewhere, although there might be waters for which some other agent was better suited.

Another confirmation of the opinions commonly held by disinterested scientists who have given the matter sufficient attention to warrant sound conclusions is that the direct treatment of water by electrical currents is of little value. There were, however, such apparently good grounds for hoping that a coagulant might be produced by electrolytical, in preference to chemical, methods, that extended studies of the subject were made. Nearly all of the so-called electrical systems of water and sewage purification, it may be stated here, are such only in the electrolytical production of a coagulant at the purification works, and for immediate use, instead of buying it from a manufacturing chemist. The Louisville experiments showed that the cost of the electrolytical production of aluminum hydrate was not only excessive, but that this method was unreliable "on account of the very low and irregular formation of the hydrate." An iron hydrate could be produced much more advantageously than an aluminum, and would be somewhat cheaper, apparently, than commercial sulphate of alumina, but it could not be safely employed at Louisville because the water there at times is too low in dissolved oxygen to oxidize more iron than an equivalent of three grains of sulphate of alumina per gallon, which would be insufficient. If more iron were used, it would appear in the effluent. Iron and aluminum, the report states, are the only metals available for the electrolytical production of coagulants. Neither of these hydrates, when thus produced, increases the hardness, corroding or incrusting qualities of the water, as does the commercial sulphate of alumina.

LETTERS TO THE EDITOR.

Formulas for the Volume Enclosed by the Intersection of Two Cylinders.

Sir: From a careful examination of the various formulas for the volume enclosed by two intersecting cylinders, published in your issue of Oct. 6, it is apparent that five of the ten mathematical formulas given are identical. For, if in those submitted by Messrs. Baldwin, Comstock, Talbot, and Dean, we retain only the first three terms of the series, represent $\frac{a}{r}$ by P, give to π its numerical value and reduce, we shall obtain in each case the expression

$$0.3927\ a^3\ P \left\{1 + \frac{P^2}{8} + \frac{5\ P^4}{128}\right\},$$

Volume Enclosed by Two Right Cylinders Whose Axes sect at Right Angles.

r = larger radius; $P = \frac{a}{r}.$

a = smaller radius;

Values of the volume in terms of r obtained by retaining only the first three terms of each series and substituting different values for $P = \frac{a}{r}$ in the formulas submitted by

Value of P substituted.	True value.	Mr. Sherman.	Mr. Peterson.	Mr. Serviss.	Mr. Frescoln.	Mr. Thomas.	Messrs. Baldwin, Comstock, Talbot & Dean.
P = 1.0........	$0.475\ r^3$	$0.8\ r^3$	$2.6804\ r^3$	$0.4748\ r^3$	$0.4749\ r^3$	$0.466\ r^3$	$0.457\ r^3$
P = 0.8........	...	$0.2048\ r^3$	$1.833\ r^3$	$0.1504\ r^3$	$0.1586\ r^3$	$0.350\ r^3$	$0.344\ r^3$
P = 0.5........	...	$0.0268\ r^3$	$0.76\ r^3$	$-0.00625\ r^3$	$+0.0078\ r^3$	$0.2067\ r^3$	$0.203\ r^3$
P = 0.3........	...	$0.0033\ r^3$	$0.2795\ r^3$	$-0.01185\ r^3$	$-0.0044\ r^3$	$0.1214\ r^3$	$0.11916\ r^3$
P = 0.2........	...	$0.000646\ r^3$	$0.125\ r^3$	$-0.0066\ r^3$	$-0.0029\ r^3$	$0.0804\ r^3$	$0.0789\ r^3$
P = 0.1........	...	$0.0004\ r^3$	$0.031\ r^3$	$-0.00185\ r^3$	$-0.00087\ r^3$	$0.04\ r^3$	$0.0393\ r^3$

which is exactly the value from which my approximate formula was obtained by using 0.4 in place of the coefficient 0.3927.

Since five of the formulas agree so exactly, while the others are all dissimilar, it seems fair to assume that these five are correct solutions of the problem.

I desire to take exception to your published statement that formulas 4, 5 and 6 agree quite closely.

Having tested them carefully, I submit herewith a table showing results obtained by substituting various values for the ration $\frac{a}{r}$ in the nine principal formulas given:

From an inspection of the above table it will be seen that the last five formulas give practically identical results. Those of Messrs. Serviss and Frescoln give correct values only when $P = 1$ or $a = r$, and they agree with each other pretty closely when $P = 0.8$; but they both give negative values for the smaller values of P. Mr. Peterson's formula seems to come nowhere near the mark except when $P = 0.1$, and Mr. Sherman's is not "in it" at all.

Yours truly, Frederick M. Thomas.

Skaneateles, N. Y., Oct. 17, 1898.

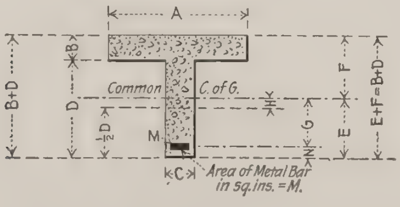
◆

A New Formula for Determining the Fiber Stresses in Concrete and Steel Beams.

Sir: The analysis of concrete beams reinforced by iron or steel, arranged in several ways, has been the subject of considerable discussion, and, although several formulas have been given in the columns of Engineering News (Eng. News. Jan. 3, 1895, and Oct. 21, 1897), some of them undoubtedly correct, the following, which, I believe, has not appeared in print, may be found to have some advantages. No originality is claimed for the analysis, but the formulas are arranged with a view to simplifying their practical application.

One method of analysis has aimed at determining the stresses after the concrete has cracked (failed in tension), because this occurs with "one-third the load required to develop the compressive strength of the concrete or elastic limit of the steel." To accomplish this the depth of the cracks is "assumed," the result therefore being true only for that depth. In a material like concrete it would be hardly safe to assume that repetitions of the load that first caused the crack would not extend it indefinitely, possibly up to the constantly changing neutral axis. This point can be determined and should be used for the depth of the crack. But the author of this method himself says "the factor of safety used in practice would always keep the working load well inside of this limit." To this, I think, all will agree. Therefore, the rational formula to use in proportioning concrete-steel beams, is one giving the working stresses. With these formulas the proper working unit stresses may be selected by the designer to suit each case. Ordinarily the unit tensile stress allowed for the concrete may safely be 75% of the ultimate tensile strength of the concrete when seven days old, or about 50% when 28 days old, and a decreasing percentage of the ultimate strength as the concrete ages.

In the examples given below I believe the ultimate breaking load would be from ten to twelve times the safe loads used. The only assumption made is of the value of the modulus of elasticity of concrete. This I have taken at 750,000, the result obtained by Professor Boek, in the Vienna experiments. This, however, can be determined for any given concrete when required.



Let I_s = moment in inertia of steel about the common center of gravity (area steel × 40).
" I_c = moment of inertia of concrete about the common center of gravity (area of steel × 40).
" E_s = modulus of elasticity of steel, = 30,000,000.
" E_c = modulus of elasticity of concrete, = 750,000.
" L_c = load on concrete.
" L_s = load on steel.
" c = proportion of total load sustained by concrete.
" s = proportion of total load sustained by steel.

Test, No.	Width, ins.	Thickness, ins.	Area, sq.in. Concrete.	Area, sq.in. Steel.	Common c. of g., above under side, ins.	I_c = for concrete, ins.	I_s = for steel, ins.	P. c. of load carried by Concrete, c.	P. c. of load carried by Steel, s.	Bending moment, in.-lbs.	Stress per sq. in. on Concrete, tension.	Stress per sq. in. on Steel, tension.	Remarks.
5.	42	3.5	147	0.52	1.60	153.25	1.245	75	25	43,500	341	13,550	
6.	42	3.5	147	0.52	1.56	155.20	0.960	80	20	43,500	350	12,300	
7.	41.5	3.75	155.5	0.52	1.68	187.90	1,060	81.5	18.5	52,500	382	13,150	
8.	42.5	3.75	159.2	0.52	1.69	191.50	1.080	81.6	18.4	45,000	324	11,050	
9.	41	3.62	148.3	0.52	1.60	168.50	1.140	78.7	21.3	52,500	392	14,500	Metal broke.
10.	42	3.75	157.5	0.52	1.72	188.30	0.770	86.0	14.0	69,000	541	15,300	
11.	42	3.81	160	0.52	1.69	200.90	1.380	79.0	21.0	60,000	399	14,900	Metal broke.
12.	42	4.50	189	0.52	2.09	322.80	2.140	79.0	21.0	63,000	324	12,600	
15.	42	4.75	199.5	1.04	1.96	410.00	3.980	72.0	28.0	139,500	480	19,100	
17.	42	3.87	163	0.52	1.72	210.50	1.410	79.0	21.0	67,500	435	16,600	
18.	42	4.00	168	0.52	1.84	227.30	0.930	86.0	14.0	87,000	604	17,600	Metal broke.
33.	42	4.50	189	1.74	1.74	367.20	3.270	74.0	26.0	127,500	445	13,800	
34.	42.5	3.82	162.2	0.52	1.71	203.5	1.31	79.5	20.5	51,000	340	12,700	
38.	42.5	3.75	159.2	0.52	1.66	193.4	1.35	78.0	22.0	75,000	502	19,700	
39.	43.	3.50	150.5	0.52	1.60	156.4	0.95	80.0	20.0	60,000	490	17,600	
40.	42	3.81	160	0.52	1.79	195.2	0.44	92.0	8.0	67,500	570	11,300	
41.	42	4.06	174	0.52	1.90	241.0	0.69	90.0	10.0	90,000	639	15,000	
42.	42	4.06	174	0.52	1.84	244.3	1.31	82.0	18.0	75,000	465	16,400	Metal broke.
43.	42	3.38	142	0.52	1.54	138.0	0.56	86.0	14.0	60,000	...	15,600	Metal broke.
44.	42	3.81	160	0.52	1.79	195.2	0.44	92.0	8.0	58,500	493	9,800	
45.	43	3.94	169.2	0.52	1.78	224.1	1.22	82.0	18.0	81,000	528	18,300	
56.	42	3.93	165.2	1.04	1.59	236.0	2.44	71.0	29.0	135,000	642	24,600	

Then

$$\frac{L_c}{L_s} = \frac{E_c\ I_c}{E_s\ I_s} = Y = \frac{I_c}{40\ I_s}.$$

and

$$c = \frac{Y}{1+Y}, \text{ and } s = \frac{1}{1+Y}.$$

If M = bending moment in inch-pounds, tension in concrete will be $= \left[\frac{M\ E}{I_c}\right] \times c.$

Compression in concrete will be $= \left[\frac{M\ F}{I_c}\right]$ c.

Tension in steel will be $= \left[\frac{M\ G}{I_s}\right]$ s.

The letters E, F and G refer to the figure, although the formulas are perfectly general. This figure represents one element of a floor, the beam and floor being built at the same time and monolithic. A is equal to the distance from center to center of beams. The values for seven different sections are tabulated below.

There have now been made a number of tests of concrete-steel beams, and it is quite likely that a careful and rational analysis of the results would suggest the use of other unit stresses than I have used in these examples. But as the formulas are general it is very easy to substitute other unit stresses whenever, in the opinion of the designing engineer, the state of knowledge on the subject indicates it. Mr. George Hill has presented in tabulated form 56 tests of concrete-steel slabs, in which the steel was in the form of "expanded metal." The concrete was of several different kinds, both as to ingredients and proportions. The "load producing first crack," as well as the "load at which metal broke," are given, and in the calculations given below I have used the smaller of the two, which is generally, but not always, the first mentioned.

The slabs made of cinder concrete are neglected because the modulus of elasticity for that is not at hand.

The modulus of elasticity of the stone and gravel concrete has been taken at one-fortieth that of steel.

The slabs for which the distance of the metal from the surface of the concrete at the center of the span was not clearly given, have of necessity been omitted.

This table shows the stresses developed in concrete and steel, for the load-producing rupture, on the tension side of the beam or slab, by the formulas

$$T_s = \frac{M\ G\ s}{I_s}, \text{ and } T_c = \frac{M\ E\ c}{I_c}.$$

Many tests of concrete beams have shown that they develop a tensile stress in the extreme fiber, by formula, about twice that of the tension tests. The above seem to correspond with those results very closely, but as no tension tests were given for the concrete in the slabs, they cannot be directly compared. The compression tests given are not applicable, since the ratio of tensile to compressive tests of concrete are very variable. (Tensile strength of concrete indicated, average = 230 lbs. per sq. in.) The low stress at which the metal broke may be attributed to tearing, due to its form, and to punishment by shearing and bending in its manufacture.

Albert W. Buel.

150 Broadway, New York city, Sept. 27, 1898.

Table Giving Dimensions, Moments of Inertia, Loads, Capacity in Bending Moments, Safe Span, and Quantities of Material Required for Concrete-Steel Beams.

Dimensions of beams in Inches. A.	B.	C.	D.	E.	F.	G.	H.	M.	N.	I_c for concrete.	I_s for met'l	Load on concrete, c.	Load on met'l s.	Capacity in bending moments, ft.-lbs.	Safe span in feet.	Concrete Cu.ft. per sq.ft.	Concrete Cu.yd. per sq.ft.	Lbs. of metal per sq. ft.
18	4	4	14	8.00	10.00	6.50	1.00	2.0	1.50	5,735	85	0.63	0.37	9,500	12.0	0.590	0.022	5.0
18	4	4	16	8.30	11.70	6.80	0.30	2.5	1.50	8,237	116	.64	.36	12,900	14.0	0.628	0.023	6.0
24	6	6	14	8.23	11.77	7.00	1.23	4.0	1.23	13,004	196	.62	.38	21,250	15.6	0.793	0.030	7.0
24	6	6	18	10.00	14.00	9.00	1.00	4.0	1.00	20,860	324	.617	.383	28,100	18.0	0.875	0.033	7.0
24	6	6	18	9.10	14.90	7.10	0.10	6.0	2.00	23,753	303	.662	.338	32,800	19.36	0.875	0.033	10.5
18	4	6	20	8.60	15.40	7.10	1.40	4.0	1.50	17,330	202	.68	.32	24,650	19.36	0.890	0.033	9.3
18	4	6	20	7.55	16.45	5.55	2.45	6.0	2.00	19,856	185	.728	.272	30,100	21.4	0.890	0.033	14.0

Note.—Allowed tension on concrete, = 100 lbs. per sq. in.; allowed compression on concrete = 500 lbs. per sq. in.; allowed tension on steel, equals 16,000 lbs. per sq. in. Safe spans given are for dead load of 150 lbs. and live load of 200 lbs. per sq. ft.

RECENT TYPES OF EUROPEAN AND AMERICAN LOCOMOTIVES.

(With full-page plate.)

The fact has been frequently noted that locomotive design in this country for the past quarter century has been tending more and more towards uniformity, and the half dozen or more standard types of locomotives which are in use in this country vary little in their design on different roads except in minor details. In Europe, however, notwithstanding the smaller mileage of railways and the fact that they are spread over a much smaller territory, the greatest diversity in design continues to exist. This fact is very well shown in a plate published in a recent issue of our German contemporary, "Der Praktische Maschinen-Constructeur," showing 63 locomotives in use on various European and American railways, all drawn to a uniform scale. We have reproduced this plate and the article accompanying it has been translated for us by Mr. Geo. L. Fowler, M. Am. Soc. M. E., and is printed below.

In considering the causes for the greater uniformity in locomotive design in this country, we are inclined to assign a first place to the work of such organizations as the Master Mechanics' Association, the various railway clubs and the various railway technical journals. Of course the political and social barriers between different countries in Europe has operated to hinder any such full and free interchange of experience between the mechanical officers of different railways as prevails in this country. It is also true, we think, without doubt, that variations from standard practice are easier to introduce on the other side, and especially on the continent, than in this country. The inventors who want to improve the locomotive are classed in the same category with beggars, peddlers and book agents, by the average American Master Mechanic. Anything in the way of complication is his especial abhorrence; while on the Continent, if we may judge from the looks of the locomotives, each new designer of complicated valve motions and similar mechanical curiosities is greeted with open arms.

It is a little curious, however, how steadfastly every railway on the other side refuses to accept two distinctive American features of locomotive design, the pilot and the headlight, and how every American railway as steadfastly persists in their use. Our English friends, who still persist in calling the pilot the "cowcatcher" used to gravely explain that it was necessary in America because the railways there were not fenced and the cattle and other wild animals roamed at large on the tracks; but though we have now a considerable mileage of track protected from trespass of this sort, nobody proposes to take the pilot off road locomotives and is not likely to. About the same thing is true of the headlight. Its value as a safety appliance is so well established that nobody in this country would think of discarding it. On the other side, however, they argue that they have always got along very well without pilots and headlights and have fewer accidents in proportion to the traffic than American roads. Hence they see no reason for using them.

Taking up now the article in our contemporary, we may remark that it gives credit for the greater portion of the drawings and data to a treatise on "Railway Technics of the Present Time," by Messrs. Blum, Von Borries and Barkhausen, which has just been published by C. W. Kreidel, of Wiesbaden. In denoting the type of a locomotive a fraction is used in each case, the numerator denoting the number of driving axles coupled and the denominator the total number of axles. Mr. Fowler's translation follows:

I.—Passenger and Express Locomotives.

Up to the year 1880, the majority of the locomotives on European railways were of the 2/3 coupled type. In the decade between 1880 and 1890, the 2/4 coupled locomotive was introduced, which ran more smoothly at high speed and put less strain on the tracks. In these new locomotives a four-wheeled bogie truck was placed beneath the smokebox; the driving axle was in front of the firebox and the coupled axle beneath or back of the same. Engines with three and four axles with only a single pair of driving wheels are still used principally in England; while in America, locomotives with three axles coupled are in common use.

Fig. 1 is a 2/4 coupled express locomotive of the State Ry. of Saxony. In common with many German engines, these locomotives have two outside cylinders, Heusinger valve motion, inside frames and fireboxes held by radial stays. The springs of the two driving axles are connected by equalizing levers; the bogie truck is fitted with four springs that are independent of each other and a ball-and-socket center bearing on a spring bolster so that the locomotive is carried on three points. By means of his system of intercepting valves von Borries can admit live steam into his large cylinder and thus increase the tractive power of the locomotive.

Fig. 2 is a 2/4 coupled express locomotive of the Wurtemberg State Ry. In order to secure a deeper firebox, there is no driving axle placed beneath it; the locomotive is carried by trailing wheels at the front and back with the two pairs of driving wheels set between them. The engine has three cylinders of the same diameter, whose cranks are placed at an angle of 120° with each other. The inside cylinder is the high-pressure cylinder, but live steam may be admitted to all three, so that a wide variation in the tractive force may be exerted. The trailing axles are connected with the tender from their center, so that curves of 500 ft. radius can be readily traversed by these locomotives. The steam pressure is 180 lbs. per sq. in.; the heating surface, 1,581 sq. ft. and the grate area, 21.3 sq. ft.

Fig. 3 is a 2/4 coupled Austrian passenger locomotive. The firebox is of the Belpaire type. The boiler is fitted with two domes, which are connected by an outside steam pipe. An outside pipe also runs from the forward dome to the steam chest. The tubes are of steel.

Fig. 4 is a 2/4 coupled express locomotive of the Pfälz Ry. The arrangement of the wheels is the same as in Fig. 2, but a Krauss truck is used, by means of which the forward axle will be set radially to a curve by the side movement of the front driving axle. Owing to the better arrangement of the cylinders, the running is smoother than in the preceding design. The steam pressure is 180 lbs. per sq. in.; the heating surface, 1,215 sq. ft., and the grate area, 19.4 sq. ft.

Fig. 5 is a 2/4 coupled locomotive of the Belgian St. Ry. In this locomotive all of the peculiarities which characterize the Belpaire system are to be found, namely: outside frames, cylinders with the Heusinger valve motion inside the frames, a large firebox spreading out to the back of the rear wheel and an inclined grate. The front truck axle is movable, and the cylinders are set at the extreme front end, an arrangement that is very detrimental to the stability of the engine. In order that fine coal may be burned the grate has a large area, namely, 51.6 sq. ft., but the heating surface is small, being but 1,204 sq. ft. The steam pressure is 150 lbs. per sq. in.

Fig. 6 is a 2/4 coupled express locomotive of the Austrian State Ry. It is a two-cylinder compound engine and is used in heavy express traffic on the main line. It is built upon the Gölsdorf plan, which provides for the admission of live steam to either end of the low-pressure cylinder. This is accomplished by means of two holes drilled in the valve seat, which are kept closed under ordinary conditions of valve travel, but which are opened when the point of cut-off is later than from 50 to 60% of the stroke. The wheelbase of the truck is very great, being 8 ft. 10¼ ins., and it is also set so far to the rear that it carries a large portion of the weight of the boiler, since an axle loading of 14½ tons must not be exceeded. The grate area is comparatively large (31.2 sq. ft.) because fine coal of a medium quality must be burned. This engine also has two domes connected by an outside pipe. The steam pressure is 195 lbs. per sq. in., and the heating surface 1,489 sq. ft., and the grate area 31.2 sq. ft.

Fig. 7 is a 2/4 coupled express locomotive of the Holland Ry. Co. This new Dutch locomotive resembles the English patterns and differs from them only in the use of inclined grates and Belpaire firebox.

Fig. 8 is a 2/4 coupled express and passenger locomotive of the Manchester, Sheffield & Lincolnshire Ry. The principal English lines have, in recent years, built a large number of locomotives with four wheels coupled and a bogie truck in front, and this is becoming typical of English practice. Owing to the good fuel which is available on most of the English roads, the boiler may be made comparatively small. The cylinders are inside and have one steam chest in common; the frames are also inside, and the springs are independent. The firebox is fitted with a long fire-arch and the crown is held by crown-bars.

Fig. 9 is a 2/4 coupled express locomotive of the London & Northwestern Ry. This locomotive is of the well-known Webb three-cylinder compound type. The two high-pressure cylinders are on the outside and are back of the forward wheels. The pistons of the outside cylinders turn the back driving axles and that of the low-pressure cylinder, which is beneath the smokebox, drives the forward axle. The driving axles are not coupled together. The steam distribution in the high-pressure cylinder is accomplished by means of a piston valve driven by the Stephenson link-motion; that of the low-pressure by a slipping eccentric. The tubes start from a combustion chamber in front of the firebox. The steam pressure is 180 lbs.; the heating surface is 1,413 sq.ft., and the grate area, 20.4 sq.ft.

Fig. 10 is a 2/4 coupled four-cylinder, compound express locomotive of the Northern Ry. of France. The same type is also used by some of the other great French companies. The two outside high-pressure cylinders are located back of the truck, and their connecting rods take hold of the crank-pins of the back driving wheels, while the low-pressure cylinders are set beneath the smokebox and their connecting rods take hold of the cranks of the forward driving axle. The cranks stand at an angle of 120° with each other in order to relieve the working parts to as great an extent as possible. The two pairs of cylinders can be worked perfectly independently of each other, which is a valuable quality in case of accident. The steam distribution is effected by means of the Heusinger valve motion. Live steam can be admitted to all of the cylinders in starting.

Fig. 11 is a 2/4 coupled compound locomotive of the Paris, Lyons & Mediterranean Ry. In size and general arrangement it is very siimlar to Fig. 10, as just described, but in the details of its construction it is very different. The boiler, for instance, is much shorter, the Serve ribbed tubes are only 9.8 ft., instead of 12.8 ft. long. The smokebox is 5 ft. 9 ins. long. In the firebox there is an arch of firebrick. The truck has a side play. The frames are carried on a wedge-shaped surface by means of which they can be brought back to their original position. All parts of the machine which present a resisting surface to the wind, are protected by wedge-shaped shields. By this means the resistance of the air is said to be decreased about 22* tons at a speed of 62 miles (100 km.) per hour.

Fig. 12 is a 2/4 coupled locomotive of the Eastern Ry. of France. For express service these locomotives are fitted with the double boiler of the Flaman type. The lower boiler, which is entirely filled with tubes, is really the water space, while the upper one forms the steam chamber. This boiler has 304 tubes, each 14.1 ft. long, giving it a heating surface of 1,809 sq. ft. As the firebox is formed of corrugated steel plates, it needs no further staying. The cylinders are outside and their pistons turn the back driving axles. The engine weighs 57 tons. In order to relieve the driving axles of a portion of the load that they would otherwise carry, the truck is set somewhat back, in spite of which the loading amounts to 33.4 tons, or practically 17 tons per axle.

Fig. 13 is a 2/4 coupled passenger locomotive of the Left Bank of the Rhine Ry. The characteristic feature of this locomotive is the boiler, which is of the Lentz type with a corrugated flue firebox. The boiler consists of three divisions, namely, two conical end pieces at the ends and a cylindrical connection between the two in the center. The sheets are welded together without any riveted joints. At the front end the boiler rests with the smokebox on the frames, at the back it is carried by two side stays. In front of the horizontal grate there is a space that serves as a combustion chamber.

Fig. 14 is a 2/4 coupled compound locomotive of the Southwestern Ry. of Russia. The engine has four cylinders, which are placed above the truck. On account of their lesser weight, the high-pressure cylinders are placed at the front. The steam first enters the small cylinder and then passes out through a large tube, which serves as a receiver, into the large cylinder upon the other side of the engine. This pipe passes through the smokebox. The steam distribution is effected by the Stephenson link-motion. Live steam can be admitted to the low-pressure cylinder through a small pipe on starting. The driving axles are loaded with but 13 tons.

Fig. 15 is a 2/4 coupled passenger locomotive of the Chicago, Burlington & Quincy R. R. The principal characteristics of the American machine are as follows: The main frames are formed of bars of iron or cast steel. The firebox is always made of steel, and, in case of the example given, the crownsheet is flat and is stayed on the Belpaire system. The cylinders are outside and above the truck. The valve seats are on top of the cylinders and the steam distribution is effected by means of the Stephenson link-motion with open links. The wheels are made of cast iron with steel tires. In order to prevent the throwing of sparks, the cylindrical smokebox is made very large and is fitted with spark arresters. A bell is used instead of a whistle. (So in the original.—Ed.) The steam pressure is 165 lbs. per sq. in.; the heating surface, 1,280 sq. ft., and the grate area, 24.7 sq. ft.

Fig. 16 is a 2/4 coupled express locomotive of the New York Central & Hudson River R. R. The large dimensions of the boiler make this engine still stronger than the preceding. The weight on the driving axles rises to what in European practice would be the unprecedented amount of 19 tons. These locomotives are used to haul the fastest train in the world between New York and Buffalo. The steam pressure is 200 lbs. per sq. in., the heating surface is 1,742 sq. ft. and the grate area is 30.1 sq. ft.

Fig. 17 is a 2/4 coupled express locomotive built by the Baldwin Locomotive Works, of Philadelphia, on the Vauclain system. The engine has four cylinders. Upon each side there is a small cylinder above a large one, the two are cast in one piece, and the steam is distributed in both by a single piston valve. The two piston-rods of each group take hold of a single crosshead, so that the steam works after the manner of a Woolf compound engine. In contradistinction to other American locomotives, these engines are not fitted with a bogie truck. The steam pressure is 190 lbs. per sq. in., the heating surface is 1,333 sq. ft., and the grate area is 24.7 sq. ft. (This is the "Columbia" locomotive, as most of our readers will recognize.—Ed.)

Fig. 18 is a 1/4 coupled compound locomotive of the Philadelphia & Reading R. R. This engine is also built on the Vauclain system. The driving axle is placed in front of the firebox, and carries the enormous weight of 21.6 tons. The firebox is placed above the back pair of wheels and occupies about one-half of the whole length of the locomotive. The grate is separated from the tubesheet by a firebrick bridge, so that a combustion chamber is formed in which the gases from the fire are mingled with the air, and these, with the particles of coal carried with them, are thus perfectly burned. The grates are slightly inclined and are formed of water-tubes, between each alternate one of which there is a bar of hard cast iron. The closed ashpan is opened from the rear. The position of the engineer is separated from that of the fireman.

Fig. 19 is a 2/3 coupled compound locomotive of the Prussian State Ry. The cylinders are back of the leading axle, and it is the rear wheel that serves as the main driver. The valve motion is of the Heusinger type; the receiver pipe is laid around the shell of the boiler. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,110 sq. ft., and the grate area 20.1 sq. ft.

Fig. 20 is a 2/3 coupled express locomotive of the Great Eastern Ry. For a long time this type of locomotive was the principal one used for express service in England. The cylinders are inside. The frames are outside. The springs are perfectly independent of each other. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,290 sq. ft., and the grate area 18.3 sq. ft.

Fig. 21 is a 1/4 coupled express locomotive of the Great Northern Ry. of England. The driving axle of this engine carries 18 tons, so as to obtain the necessary adhesive weight for starting. Such an exceptional loading as this is only allowable upon an exceedingly well built permanent way. In spite of the small dimensions of the boiler, the engine is comparatively heavy, 74,400 lbs. The cylinders are outside, and the driving wheels, with a diameter of 8 ft. 2 ins.. are the largest in the world. The steam pressure is 170 lbs., the heating surface is 1,025 sq. ft., and the grate area 17,7 sq. ft.

Fig. 23 is a 2/3 coupled passenger locomotive of the Prussian State Ry. This type of engine is still extensively used upon the railroads of Continental Europe. The cylinders are upon the outside and the frames and steam chests on the inside. This very simple construction labors under the disadvantage that, on account of the location of the heavy cylinders at the front end, the running of the machine is unsafe and the track must necessarily be very rigid. The valve-motion is of the Allen type. The crown of the firebox is held by radial stays. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,107 sq. ft., and the grate area is 19.4 sq. ft.

Fig. 24 is a 2/2 coupled locomotive for mixed service on the Oldenburg State Ry. Owing to their lack of stability and their small tractive power, these engines are but little used. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,007 sq. ft., and the grate area is 10.1 sq. ft.

Fig. 26 is a 3/4 coupled compound passenger locomotive of the Jura-Simpton Ry. The several Swiss railway companies make a very frequent adaption of that American type of locomotive known as the mogul, since it is very well fitted to work on lines with heavy gradients. It has three axles coupled, and one located in front ahead of the cylinders. The steam works in two cylinders only; and, by means of an automatic starting valve of the von Borries type, live steam may be admitted direct to the low-pressure cylinder. The cylinders and their steam chests are upon the outside. The springs of the first and second wheels are connected by a longitudinal and a cross equalizing lever; while those of the third and fourth axles are connected by equalizers at the sides. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,209 sq. ft., and the grate area is 16.1 sq. ft.

Fig. 27 is a 3/4 coupled passenger locomotive of the Belgian State Ry. The engine is remarkable for its weight. and is used for hauling heavy express trains upon difficult stretches of track. The very wide and very shallow firebox lies above the back axle, and has a firebrick bridge in front of the tubesheet, which is rendered necessary by the high grate. The Heusinger valve-motion is used. The cylinders are inside the frames and inclined. The support is from four points. These engines are capable of hauling 100 tons up a grade of 1 in 60 at a speed of 40 miles an hour.

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*This was probably intended for 2.2 tons.—Ed.

Fig. 28 is a 3/5 coupled four-cylinder, compound, express locomotive of the Baden State Ry. It is used for work on the long grades in the Black Forest. Here a locomotive of the "ten-wheeled type" was chosen, which is distinguished from the mogul by having a four-wheeled truck in front. The steam works in two high and two low pressure cylinders, as in the French compound locomotives. These locomotives were built by the Société Alsacienne, with the French engine as a pattern. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,204 sq. ft., and the grate area is 22.6 sq. ft.

Fig. 29 is a 3/5 coupled express locomotive of the Canadian Pacific Ry. This engine is a sample of the "ten-wheeled" type. All of the details are the same as those given for Fig. 15, with the exception that the crownsheet of the firebox is carried by crown bars. The steam pressure is 190 lbs. per sq. in., the heating surface is 1,344 sq. ft., and the grate area is 25.8 sq. ft.

Fig. 30 is a 4/6 coupled express locomotive of the Chicago, Milwaukee & St. Paul Ry. In order that the weight on the driving wheels might not be excessive, a third trailing axle is placed at the rear. This engine, which is the most powerful express locomotive that has up to this time been put into service, carries a steam pressure of 210 lbs. per sq. in., has a heating surface of 1,774 sq. ft., and a grate area of 33.3 sq. ft.

Fig. 32 is a 3/5 coupled locomotive of the Mediterranean Ry., of Italy. This engine was built as a ten-wheeler in order to climb the steep grades of the Apennines. The frames are inside and the cylinders and the steam chests outside.

Fig. 34 is a 3/5 coupled express locomotive of the Hungarian State Ry. This engine was built for the same service as the preceding, but with a compound action. The frames are outside and the boxes of the cranks play in them. The steam pressure is 195 lbs. per sq. in., the heating surface 1,530 sq. in., and the grate area 32.3 sq. ft.

II.—Freight Locomotives.

In order to utilize the whole weight of the locomotive for tractive purposes it is customary in Europe to couple together all of the wheels of their freight locomotives; in America, on the other hand, it is the practice to place a pair of leading wheels or a bogie truck in front, whereby the running of the engine is made much smoother and the motion on sharp curves easier. The number of coupled axles varies from three to five. Upon European roads with heavy grades, 3/3 or 4/4 coupled engines prevail, the latter being the ruling type for steep gradients in Austria, France and Russia. In England the Northwestern is the only road having 4/4 coupled locomotives, the other companies using the 3/3 coupled. In Germany and France they have now made some headway in the introduction of the 3/5 coupled locomotives, with a bogie truck at the front, in imitation of the practice of the United States. In America there are two types in use: the 4/5 coupled locomotives, known as the "consolidation" type, and the "mastodon" type, having five axles coupled. By the use of two sets of working parts with three axles coupled, as in the Meyer, Fairlie and Mallet systems, a still higher tractive power is obtained. The Hagan system has a strong and flexible mechanism.

Fig. 22 is a 3/3 coupled freight locomotive of the Lancashire & Yorkshire Ry. The noteworthy peculiarities of this locomotive are the shortness of the boiler, the long wheel-base, and the position of the cylinders inside the frames. The valves are placed on top of the cylinders and are driven by the Joy valve motion. There are no overhanging weights and, in spite of the long wheel-base, the engine rides very easily. The steam pressure is 170 lbs. per sq. in., the heating surface is 1,099 sq. ft., and the grate area 18.3 sq. ft.

Fig. 31 is a 3/3 coupled compound freight locomotive of the Austrian State Ry. For a number of years the 3/3 coupled freight locomotive was the only one used on the moderately heavy grades. Now they are only used on branch lines, since their short wheel-base and overhanging weights unfit them for speeds of more than from 28 to 30 miles an hour. The locomotive shown has a high tractive power; the starting apparatus is of the Golsdorf type, with valves driven by an outside Heusinger motion. The steam pressure is 180 lbs. per sq. in., the heating surface 1,290 sq. ft., and the grate area 12.9 sq. ft.

Fig. 33 is a 3/3 coupled locomotive built by the Schenectady Locomotive Works. This locomotive is used in America for switching purposes in railway yards, and is provided with a tender having a sloping tank at the back.

Fig. 35 is a 3/4 coupled compound freight locomotive of the Prussian State Ry. Like the mogul type of engines on the American roads, these engines have a single pair of wheels in front of the cylinder, and, on account of their weight, they are especially fitted for the hauling of fast freight as well as passenger trains on steep grades. The boiler, with its heating surface of 1,481 sq. ft., is very large, and the firebox is placed above the back axle. Both cylinders are on the outside; the steam pressure is 180 lbs. per sq. in., and the grate area is 24.7 sq. ft.

Fig. 36 is a 3/4 coupled freight locomotive of the Great Northern Ry. These locomotives resemble other American passenger locomotives in their construction, so that what has already been said of them need not here be repeated. Their steam pressure is 190 lbs. per sq. in., the heating surface is 1,236 sq. ft., and the grate area 21.3 sq. ft.

Fig. 37 is a 4/6 coupled freight locomotive of the Duluth & Iron Range R. R. The tractive power of this locomotive is very great, and the use of a four-wheeled truck causes it to take curves very easily. It is used for hauling iron ore in the Lake Superior region. The steam pressure is 190 lbs. per sq. in., the heating surface is 2,171 sq. ft., and the grate area 34.4 sq. ft.

Fig. 38 is a 4/5 coupled freight locomotive of the Prussian State Rys. In the 4/4 coupled Prussian locomotives the distribution of the weight is not particularly favorable, a fifth axle running in a truck has, therefore, been added. The cylinders are outside and slightly inclined. The valves are driven by an Allan motion placed inside the frames. The springs of the driving wheels are connected in pairs by equalizers. The steam pressure is 180 lbs. per sq. in., the heating surface is 1,484 sq. ft., and the grate area is 24.6 sq. ft.

Fig. 39 is a 4/4 coupled freight locomotive of the Austrian State Rys. Although belonging to an old system, this engine is still extensively used in Austria. The steam pressure is 165 lbs. per sq. in., the heating surface is 1,769 sq. ft., and the grate area is 24.6 sq. ft.

Fig. 40 is a 4/4 coupled, compound, freight locomotive of the Paris, Lyons & Mediterranean Ry. The engine has four cylinders, arranged with the low pressure cylinders (diameter 23.2 ins.) outside and the high pressure (diameter 14.2 ins.) inside. The Serve tubes have inner ribs, an outside diameter of 2.46 ins., and a length of but 9 ft. 10 ins. The driving wheels have a diameter of 59 ins., which is larger than that usually employed on freight locomotives. As a consequence of the use of the Serve tubes, the heating surface is comparatively large, 1,656 sq. ft., the grate area is 27.8 sq. ft., and, in all of the new locomotives of this company, the steam pressure is 225 lbs. per sq. in.

Fig. 41 is a 4/5 coupled compound locomotive of the Mohawk & Malone R. R. The arrangement of the axles is similar to that of the Prussian locomotive, Fig. 38. The locomotive is a characteristic example of the consolidation type. The steam pressure is 190 lbs. per sq. in., the heating surface is 1,838 sq. ft., and the grate area 32.3 sq. ft.

Fig. 42 is a 4/4 coupled compound locomotive of the Prussian State Rys. The first locomotive in Prussia with four axles coupled and intended for heavy freight service on steep grades was built in 1894. The frames are inside and the firebox is placed over the rear axle. The engine is fitted with the Allen valve motion, and, for starting or the exertion of the maximum tractive force, it is fitted with a von Borries intercepting valve. The cylinders have a diameter of 20.87 ins., and 29.53 ins., with a stroke of 24.8 ins. The other measurements are the same as in Fig. 38.

Fig. 43 is a 5/5 coupled compound freight locomotive for the Wurtemberg State Ry. The peculiarity of this locomotive consists in the fact that the two end axles can move into a radial position with reference to a curve, and, yet, are coupled together. This result was obtained by the use of the Klose system. The steam works in the three cylinders either with single expansion or on the compound principle. The steam pressure is 180 lbs. per sq. in., the heating surface is 2,129 sq. ft., and the grate area is 23.7 sq. ft.

Fig. 44 is a 5/6 coupled, compound, freight locomotive of the Erie R. R. This enormous engine was built by the Baldwin Locomotive Works, and it is intended for the Pennsylvania coal traffic. It is built on the Vauclain system, with one cylinder over the other. The diameter of the high pressure cylinders are 16 ins., diameter of the low-pressure cylinders 28 ins., and stroke of the piston 27 ins. The number of coupled axles and the weight put upon them (16 tons per axle) do not indicate good design. The firebox is very large and very long, is of the Wootten type, and is adapted to the burning of anthracite culm. As a result of their great length the engineer is stationed alongside the boiler, and there is another cab for the firemen at the back. The separation of the two men is a great disadvantage.

Fig. 45 is a 2/2 coupled compound freight locomotive of the Prussian State Ry. The frames are carried on two swivel trucks. The forward truck carries the low-pressure and the back the high-pressure cylinders. The parts of the engine proper are entirely separated from each other. The springs of each truck are connected by equalizing levers, so that the weight on the individual axles remains unchanged and the locomotive is carried on four points. This engine possesses great tractive power and flexibility. The steam pressure is 180 lbs. per sq. in.; the heating surface is 1,559 sq. ft., and the grate area is 20.4 sq. ft.

III.—Tank Locomotives.

The arrangement and proportions of tank locomotives vary according to the service for which they are intended. Tank locomotives are built either with ordinary frames or on the Krauss system whereby the frames are so arranged as to form the water tank. This portion of the review will be divided into two heads, in the first of which those tank locomotives intended for main line traffic will be described, and in the second those designed for branch lines.

(a).—Main Line Locomotives.

Fig. 46 is a 2/3 coupled passenger, tank locomotive of the Prussian State Ry. These engines, with ordinary plate frames and side water tanks, are used in passenger traffic on lines where the grades are light. The ease of running is injured by the weight of the overhang. The steam pressure is 180 lbs. per sq. in.; the heating surface is 968 sq. ft., and the grate area is 17.2 sq. ft.

Fig. 47 is a 2/3 coupled passenger tank locomotive of the Hanoverian Rys. The arrangement of the cylinders back of the leading axles in connection with the long wheelbase insures a very easy motion for the engine. The water tanks form a portion of the frames. The steam pressure is 180 lbs. per sq. in.; the heating surface is 897 sq. ft., and the grate area is 15 sq. ft.

Fig. 49 is a 2/4 coupled, compound passenger tank locomotive of the Central Ry. of Switzerland. The application of the bogie truck to tank locomotives has also been made in England, and the north of France, as well as in Switzerland. The engine shown here has ordinary frames with side water tanks. The steam pressure is 180 lbs. per sq. in.; the heating surface is 1,043 sq. ft., and the grate area, 17.2 sq. ft.

Fig. 50 is a 2/4 coupled passenger locomotive of the South Eastern Ry. The passenger traffic within the city limits of London requires a rapid acceleration, and the locomotive here shown is intended to do this. The tractive power is 10,230 lbs.; the steam pressure, 170 lbs. per sq. in.; the heating surface, 714 sq. ft. and the grate area, 15 sq. ft.

Fig. 51 is a 2/4 coupled freight locomotive of the London City Ry. A long wheelbase is obtained by placing the axles at either end of the firebox, which is 6½ ft. long. The cylinders are outside and inclined. When running through the tunnel the steam is exhausted into the feed-water, whence it naturally follows that the boiler must be fed by pumps. Since the running is done for the most part in tunnel, no shelter is provided for the engineer.

Fig. 52 is a 2/5 coupled freight locomotive of the London, Tilbury & South End Ry. It is designed for special freight traffic on lines with light rails. It runs in either direction with equal facility and readily passes around curves of short radius. The front end of the engine is carried by a bogie truck, and the back end by a single axle, which is held in position by springs. The steam pressure is 170 lbs. per sq. in.; the heating surface, 919 sq. ft., and the grate area, 15 sq. ft.

Fig. 53 is a 3/3 coupled passenger tank locomotive of the Western Ry. of France. The constructive proportions of the engine are good; it resembles the English types in size and appearance. Its three coupled axles enables it to work successfully upon steep grades. The steam pressure is 150 lbs. per sq. in.; the heating surface is 968 sq. ft., and the grate area is 14 sq. ft.

Fig. 54 is a 3/7 coupled passenger tank locomotive of the Chicago & Northern Pacific R. R. The engine is of the Forney type, and is used for suburban traffic out of Chicago. The weight in working order is 71 tons. Similar engines are now extensively used in the suburban traffic about other large American cities. The steam pressure is 190 lbs. per sq. in.; the heating surface is 1,462 sq. ft., and the grate area is 22.6 sq. ft.

Fig. 55 is a 3/4 coupled compound freight locomotive of the Prussian State Ry. The engine was designed to meet the requirements of a fast freight service and heavy passenger traffic upon steep grades. The boiler has a heating surface of 1,481 sq. ft.; a grate area of 24.7 sq. ft., and carries a pressure of 180 lbs. per sq. in. The forward axle is carried in a curved box in such a way that it has some side play.

Fig. 56 is a double 2/2 coupled freight locomotive of the Central Ry. of Switzerland. It is built on the Mallet system. The engine has a tractive power of 20,550 lbs. It is used on the line between Basle and Olten.

Fig. 57 is a double 3/3 coupled freight locomotive of the St. Gothard Ry. On the St. Gothard Ry. there are long grades of 1.4% and over, with curves of 1,000 ft. radius. Until recently two 3/3 coupled locomotives were always used for working trains over these grades, but they have now been supplanted by the locomotive here shown, which is a Mallet compound engine. The total wheelbase is 26 ft. 8 ins. The tractive power reaches the remarkable figure of 22,000 lbs. As the result of its great adhesive weight, it can haul a train of 220 gross tons up a 1.37% grade.

(b).—Tank Locomotives for Narrow Gage Lines.

Fig. 48 is a 1/2 coupled compound locomotive of the Hanoverian Ry. The engine has box frames, Heusinger valve motion, and the von Borries automatic intercepting valve. The steam pressure is 180 lbs. per sq. in.; the heating surface, 371 sq. ft., and the grate area, 8.6 sq. ft.

Fig. 58 is a 4/4 coupled tank locomotive of the Hagans type. It is designed for a gage of 2 ft. 11.4 ins., and to work on grades of 1.4%, and around curves of 130 ft. radius where it can haul 114 tons. The two forward axles are set in the main frames, while the two back ones are in a swivel truck. The Heusinger valve motion is used; the water tanks and coal bunkers are on the side next to the boiler, which carries a steam pressure of 180 lbs. per sq. in.; has a heating surface of 548 sq. ft., and a grate area of 9.1 sq. ft.

Fig. 59 is 2/2 coupled tank locomotive of the Emmenthal Ry. This system has been extensively introduced into Switzerland on account of its great simplicity. The engine works with a steam pressure of 150 lbs. per sq. in.; has a heating surface of 408 sq. ft., and a grate area of 7.5 sq.ft.

Fig. 60 is a 2/3 coupled locomotive of the Prussian State Ry. It is designed for work on branch lines at speeds of 18 miles an hour and over. The engine has a boiler that carries a pressure of 180 lbs. per sq. in.; has a heating surface of 817 sq. ft., and a grate area of 15 sq. ft.

Fig. 61 is a 3/3 coupled locomotive of the Northern Ry. of Austria. In spite of its light weight (28 gross tons) it has a tractive power of 8,800 lbs. The steam pressure is 165 lbs. per sq. in.; the heating surface, 580 sq. ft., and the grate area, 10.75 sq. ft.

Fig. 62 is a 3/4 coupled locomotive of the Prussian State Ry. On the line between Wiesbaden and Langenschwalbach there are grades of 1 in 30. These strong engines were built for such steep grades. The back axle runs in curved boxes and has some side-play. The engine is usually built with plated frames, side water tank, an outside Allan valve motion, and the air brake. The steam pressure is 180 lbs. per sq. in.; the heating surface is very large, being 1,450 sq. ft., and the grate area is 18.3 sq. ft.

Fig. 63 is a double 2/2 coupled compound locomotive of the State Ry. of Saxony. The Meyer system, upon which this engine is built, differs from the Mallet system in that each steam truck is free to turn over a center plate having a smooth upper surface. The engine, therefore, runs more easily over sharp curves, but it requires more joints in the steam pipes. The steam pressure is 180 lbs. per sq. in.; the heating surface is 925 sq. ft., and the grate area, 15, sq. ft.

THE ADOPTION OF A STANDARD KNUCKLE FOR M. C. B. COUPLERS.*

By P. H. Peck.†

I will give the Club facts and figures, gathered by close observation during the past seven years in heavy interchange of cars, to show why a standard knuckle should be adopted by the M. C. B. Association. If it were not for the interchange of cars by railways, the Interstate Commerce Commission and M. C. B. rules or standards would not be necessary. The more cars interchanged, the more standards are required in order that the cost of repairs may be kept at a minimum, and switching and delay to traffic avoided. As the volume of interchange has increased, new difficulties and dangers have arisen, and the M. C. B. Association was organized to devise means for overcoming these difficulties and dangers and the annoyances occasioned thereby. Rules governing the interchange were framed and standards adopted, and the adoption by the Association was followed by legislation on the part of both the state and national governments to compel the use of the standards.

We have standards for many parts of trucks, and standard drawbars, but the latter ends at the contour lines, leaving the most essential feature, the knuckle, not standard. The knuckle receives the shock first and is, therefore, most likely to be injured, and for this reason, if for no other, it should be interchangeable. Delays of several hours are frequently caused by having to set a car on the repair track to change the bar, because there may be no knuckle at hand which will fit the coupler head. With the link and pin bar such delays would not occur.

During the last few months I have endeavored to secure the names of the different knuckles in use at the present time and the numbers of different designs furnished by each coupler company. The result was a surprise to me. The following statement represents the result of my efforts in the direction referred to:*

M. C. B. Couplers and Knuckles in Use.

Weight of knckls, lbs.	Name of coupler.	Number of knuckles.	Weight of knckls, lbs.	Name of coupler.	Number of knuckles.
46	American	2	51	Erie	1
	Ajax	1	41	Elliott	1
49	Barfield	1		Foster	1
	Barnes	1	49	Forsyth	1
	Brown	1		Fox	1
54	Burns	1	38	Gould	1
46	Buckeye	3	38	Gallager	1
	Cowell	1		Gifford	1
48	Columbia	1		Gelston	1
51	Chicago	2	51	Hinson	2
35	California	1	41	Hinson	0
40	Champion	1	38	Hien	2
	Deetz	1		Imperial	1
64	Dowling	2	40	Interstate	1
57	Dowling	0	37	Janney	1
60	Drexel	2	37	Johnson	1
45	Detroit	1		Kling	1
43	Diamond	1		Laburt	1
52	Excelsior	1	61	Ludlow	1
	Edwards	1	50	Lone Star ...	1
36	Empire	1	50	Little Delaw're	1
42	Eureka	1	49	Mo. Pacific ...	2
37	Mather	1	54	St. Louis	2
48	Murphy	1	47	Smith	1
	Marks	1	66	Stand. improvd	1
53	New York	1	53	Smilie	2
43	National	1	51	S. H. & H.....	1
	Price	1	51	Safety	1
38	Pooley	1	50	Talbot	1
49	Perfected	1	50	Trojan	1
	Paragon	1	53	Tower	2
39	Peerless	1	50	Thurmond	2
	Pacific	1	46	Taylor	1
	Rickison	1		Timms	1
55	Standard	1		Union	1
49½	Solid	1	50	Vandorston ...	1
	Shomaker	1	34	Williams	3
	Saams	1	40	Williams	0
	Springer	1	45	Williams	0
	Simplex	1		Walker	1
			50	Washburn	1

This is a total of 77 bars and 83 knuckles; 9 bars having 2, and 2 bars having 3 knuckles each, and in only one instance will the knuckles interchange with each other. The average weight of the 56 knuckles, the weight of which is known, is 48 lbs.; the heaviest being the Standard, 66 lbs.; the lightest, the Williams, 34 lbs.

In order to have, in way cars or at interchange points, knuckles (one of each kind) averaging 48 lbs., it would require 4,464 lbs., which, at 3½ cts. per lb., would cost $156.24. To furnish one knuckle of each of the above kinds, at 16 different points and for 20 way cars, it would require 160,704 lbs., representing a value of $5,624.64.

I find, from the records kept in my office for the past 6½ years, that as the number of M. C. B. bars handled increased, the percentage of broken bars and of broken knuckles decreased, as shown by the following table:

		No. cars to				No. cars. to	
Year.	M.C.B. bars.	1 bar broken.	Knuckles broken.	Year.	M.C.B. bars.	1 bar broken.	Knuckles broken.
1892...	8%	377	2,476	1896...	42%	996	2,345
1893...	15%	385	1,684	1897...	48%	1,240	2,573
1894...	20%	424	1,609	1898...	59%	1,872	3,047
1895...	28%	620	1,663				

A large proportion of the breakage of knuckles occurs when an M. C. B. coupler is coupled with a link and pin bar, such breakages being most likely to occur in heavy trains. In some cases the coupling is made by the pin being placed through only the top hole of the knuckle and into the link; this either breaks the top lug off or breaks out the pin hole; in other cases the knuckles may be broken when two cars strike together and both knuckles are closed. Very few M. C. B. bars are broken when two of these bars are coupled together. Included in our own equipment we have 88 cars and 22 locomotives equipped with M. C. B. couplers; 32 cars equipped last year and the locomotives equipped within the last eight months. As yet we have had but one knuckle broken (that on a car) and that was caused by an accident. One of the engines equipped in this manner is double-crewed most of the time for service both night and day. This serves to illustrate that fact that the proportion of breakage to M. C. B. couplers on switching roads is much less than many believe to be the case.

I do not find, in actual practice, the trouble anticipated by Mr. P. Leeds, in his paper before the Central Association of Railroad Officers, as published in the "Railroad Gazette," of Aug. 12, 1898, viz.: Flange wear or crowding the flanges against the rail, or that the bar is not strong enough for our modern 80,000 and 90,000-lb. capacity cars. We handle hundreds of these cars and the number of breakages of couplers is no greater than with other cars. We do find, however, that when these heavy cars strike very hard, the load shifts, in some instances forcing the end out of the car, but not breaking the bar. I have seen cases of rear-end collisions and trains breaking in two, and have found that in such accidents the damage to M. C. B. bars was not one-fourth as great as that to link and pin bars. Cars are not as liable to telescope when equipped with M. C. B. couplers as when equipped with link and pin drawbars.

In regard to the handling of passenger equipment, we have five roads for whom we do the switching at Dearborn St. station, four of which use the M. C. B. bars, the fifth the Miller hook bar. It is possible to couple the M. C. B. couplers on short curves where the same is impossible with the Miller hooks. We have two engines equipped with the M. C. B. couplers in this service and we are able to couple the engine to M. C. B. bars at points where it is impossible to couple the Miller, with link and pin.

Finally, the trucks, draft rigging, drawbar stops, uncoupling levers and knuckle should be standard and interchangeable. The knuckle, most important of all, should receive immediate attention by the M. C. B. Association, and either the patent rights of a knuckle should be purchased by the Association, or six or seven of the best knuckles at present on the market should be adopted as standard; there are, at least, six or seven which are first-class. If something like this is not done before the law goes into effect, we will soon be in worse trouble in interchanging cars than we were in with the link and pin. A cored or hollow knuckle should not be considered; such knuckles are of no value whatever. It is only 14 months to the time the law takes effect, and something along the lines indicated in the foregoing should be done without delay.

Discussion.

Mr. Ira C. Hubbell (K. C., P. & Gulf Ry.).—I hope that the Western Railway Club will voice itself unanimously in favor of a standard knuckle, and also demand a reasonable, uniform price to all lines on all M. C. B. couplers.

Mr. Gustav Giroux (C., B. & Q. R. R.).—A point that ought to receive some attention soon, is the amount of play that can be allowed around the contour line before the coupler becomes unsafe. There is an M. C. B. gage that gives a minimum and maximum limit to this play, and its use is required by a few roads when buying new couplers; but is there no limit to this play after the coupler is put in service? There are hundreds of couplers in service which do not pass or meet the requirements of the M. C. B. gage.

It will pay to get couplers fitted together in a better manner and with as little lost motion as possible, because we all know a coupler wears loose too soon. Require that the contact parts of the coupler be smooth and clean, free from sand, grit or scale, and the coupler will work easier. I think that it would be much better for all roads to request the manufactureres not to paint couplers, but to put the cost of painting into producing smoother and cleaner castings and fitting the same together with more care; this would enable us to see who are turning out the best castings.

I hope that a standard diameter and length of pivot pin will be adopted; we now have pins 1¼, 1⅜, 1½ ins. diameter and find couplers made for 1½-in. pivot pin repaired with pins 1⅜ or 1½ ins. in diameter. Again, if a cotter or split key is put through the lower end of the pivot pin, I think we would not hear of so many pivot pins working out of place. I have seen a round coupling pin used for a pivot pin; also a knuckle of a certain coupler put in a bar of a different make; I have known repairs similar to the latter to cause breaks in the train three times in a distance of 38 miles.

I hope that the M. C. B. Association will get out very soon a standard specification, specifying not only what kind of a test couplers shall stand, but also specifying the length of guard arm, amount of play around contour lines (not only for new couplers but also for couplers in service), diameter and length of pivot pin and diameter of hole, thickness of knuckle through pivot-pin hole. and distance between lugs of bar, and that all parts shall be plainly marked at a specified place in such a manner as to enable ordering parts for repair.

Mr. A. M. Waitt (L. S. & M. S. Ry.).—I think no one will question the desirability of having a standard knuckle for couplers, but I think many will question the probability that we shall ever enjoy such good fortune. Mr. Peck has shown, in the table given in his paper, the great variety of knuckles, and, excepting two, none are interchangeable with those of other makes. On this account it seems to me that we are a long distance from anything like uniformity. I think that it would not be practicable to attempt voting into existence anything in the way of a standard coupler or a standard knuckle. It seems to me that uniformity in the M. C. B. couplers, or in the knuckles, can be accomplished only gradually and by educating people to appreciate what is the best. I believe we can, however, go a great way toward eliminating the poorer class of couplers and knuckles, either by bringing about the survival of the fittest, or in some other way reduce to a few the number of couplers in the market. That can only be done, I believe, by adopting a specification of some kind.

Mr. Peter H. Peck (C. & W. I. R. R.).—The solution that Mr. Waitt offers is one I have had in view, namely, accepting five or six couplers as standard. In the present state of affairs, roads that are using good couplers pay for the bad couplers. Mr. Waitt might, as he thinks, be using the best coupler, and Mr. Mackenzie might be using another best coupler; but if their cars get on a road which has a cheap coupler that was removed on account of a broken knuckle, the inspector will get rid of the bad coupler by replacing it with a good one, and the road using the good coupler has to pay for the bad one.

Mr. John Mackenzie (N. Y., C. & St. L. Ry.).—I think the larger roads are adopting what we may call a fairly good coupler. When an undesirable coupler is broken, a second-hand good coupler may be used in replacement and the undesirable ones will be driven out gradually, and it will be possible to carry less stock for repair.

Mr. Clement F. Street ("Railway and Engineering Review").—A few years ago a number of public tests were made by committees from this club and from the Master Car Builders' Association, which brought out weak points in some of the couplers submitted. Immediately after the tests several manufacturers started their pattern makers and engineers to work making changes which were beneficial not only to themselves, but also to the railway companies. These tests have undoubtedly aided in driving from the market a number of undesirable couplers, and it would seem to me that the revival of this practice would eliminate some of the poor couplers which are being used.

Mr. F. A. Delano (C., B. & Q. Ry.).—I agree with what has been said in regard to the impracticability of adopting even five or six standard knuckles. The Interstate Commerce Commission is flattering itself that it is compelling the use of an automatic coupler; and yet, if you talk to trainmen and switchmen, you will find that they do not regard the M. C. B. coupler as an automatic coupler. They will tell you that they have to ride the cars, both to couple and uncouple them, and to hang on by their eye-teeth to hold up the pin and to insure that the cars will uncouple while in motion. Surely, that is not the kind of coupler that the Interstate Commerce Commission thinks it is compelling the roads to put on. I would suggest the appointment of a committee to look into the whole question of better standards for couplers.

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*Abstract of a paper read at the October meeting of the Western Railway Club.

†Master Mechanic, Chicago & Western Indiana R. R., Chicago, Ill.

*We believe that some of the couplers included in this table are not of the M. C. B. type.—Ed. Eng. News.

Mr. H. R. Curtis (Latrobe Steel & Coupler Co.).—I think a great deal of the fault found with automatic coupler equipment is not due to the non-education of the Interstate Commerce Commission, but to the fact that a great many railways have followed the practice of buying and applying the cheapest coupler on the market. If the railways of the country had adopted and adhered to a standard test, they would not have had one-third of the many makes of automatic couplers that are now in service.

After further discussion the President was instructed to appoint a committee to investigate the general subject of standards for M. C. B. couplers. The committee appointed was composed of Messrs. Delano, Peck, Barr, Mackenzie and Fildes.

CONCRETE AND STEEL FLOORS FOR THE PETIT PALAIS DES BEAUX ARTS, PARIS EXPOSITION OE 1900.

This smaller palace of the fine arts occupies part of the site of the old Palais l'Industrie on the right bank of the Seine, in Paris. The basement and lower floors of this structure are interesting as examples of the Hennebicque system of floor construction in "armed-beton," or concrete and steel. The advantages claimed are that—with equal weights imposed, it has superior resisting qualities over floors made of iron and brick; and it is also expected to last longer than these because the iron employed is protected against rust by being completely embedded in beton. As described in "Le Genie Civil" these floors are of several types differing with their span.

For the smaller arches of 20-ft. span (Fig. 1) the beton mass presents a flat extrados, and an intrados that, with a rise of 9 ins., has a thickness of 3½ ins. at the crown and 12½ ins. at the springing point. For the larger spans of 24.11 ft. (Figs. 3 and 4) a series of armed-beton beams are used, 1.08 ft. wide by 1.41 ft. high, placed 7.6 ft. apart on centers; these beams support a floor of armed-beton of a constant thickness of 4 ins. The beams and floor are built separately, but form one mass.

The loads which these floors should carry are estimated as follows:

For the arched floor:	
Free load	1,540 lbs.
Flagging	220 "
Total per sq. meter.	1,760 lbs.
Total per sq. ft.	163.6"
For the floors with beams:	
Free load	2,200 lbs.
Flagging	220 "
Total per sq. meter	2,420 lbs.
Total per sq. ft.	225 "

These floors are to be tested by proof loads equaling one and one-half times these values; the rise must not exceed 1-800th of the span. A test of one of the floors with beams was made by loading it with 90,200 lbs. per beam, the equivalent of about 494 lbs. per sq. ft., and the maximum deflection at the crown was .9 mm.

As shown in Fig. 1 the armor in the arched type of floor is made of a series of beams placed at right angles to the axis of the arch and spaced one meter, or 3.28 ft. apart. Each of these beams is formed of two round iron rods, 17 mm. or .67-in. diameter; one of these rods is horizontal and only a few millimeters below the surface of the floor, and is built into the supporting walls. The other rod takes the curve of the arch, it is buried very near the surface of the intrados of the arch, and its ends are also built into the wall. The beam is then completed by adding a series of flat iron lattices, 30 × 2 mm., uniting the two round rods and tying them into the mass of beton, as shown. Upon the curved member of the beam, or arch truss, at intervals of about 8 ins., are placed a series of iron rods, 6 mm. or 0.24-in. diameter, running parallel with the axis of the arch. These latter rods are 25.6 ft. long, and at their extremities they pass the adjoining rods for a distance of about 2.3 ft., so as to avoid all danger from any lack of continuity perpendicular to the axis of the arch. Upon these longitudinal rods other rods of the same diameter, and spaced 13 ins. apart, are laid perpendicular to the first, so as to form a kind of network.

In the beam type of floor (Fig. 2) there are two systems of arming; one applied to the beams and the other to the floor. In the beams the armor takes the form of three longitudinal beams, or trusses, arranged somewhat like those in a suspension truss. In each there are two round iron rods, about 1 in. diameter; with one located horizontally and near the lower surface of the beam, and the other lying almost upon the first at the middle of the span and then rising at each end to the upper surface of the floor. These two rods are anchored in the supporting walls and are united to each other and to the beton mass by a series of flat bars, as shown.

The armor in the floor portion is made up of a series of round rods, 0.47-in. diameter, placed perpendicular to the direction of the beam and spaced about 8 ins. apart. These rods, alternately, are straight and running near the bottom of the floor, and bent so as to pass from the bottom of the floor span to the top surface of this span.

The beton employed in this work was made of 550 lbs. Portland cement to 400 litres, or 422.4 quarts of sand and 898 quarts of gravel. This beton was made on the spot, and was then spread upon a wooden falsework, which forms the mold for the intrados of the arch, and was rammed against the iron armor placed in position in advance. When the arch was completed the beton was allowed to set for eight days, when its resistance was sufficient to allow the centers to be removed. At the end of 30 days the set was complete, and the floor was then ready to be subjected to the prescribed test load.

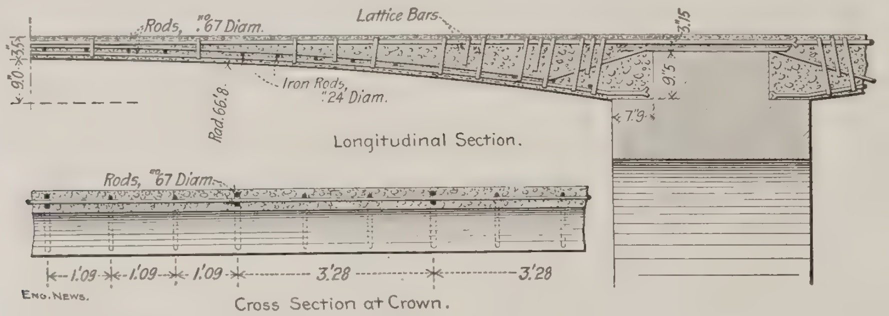
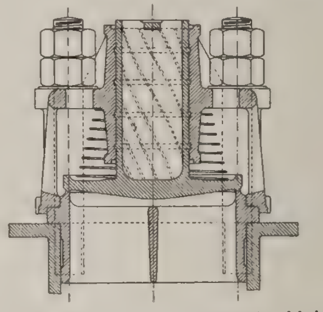


FIG. 1.—HENNEBICQUE ARCH SYSTEM OF STEEL AND CONCRETE FLOOR CONSTRUCTION FOR THE PETIT PALAIS DES BEAUX-ARTS FOR THE PARIS EXPOSITION OF 1900.

COMPOUND BLOWING ENGINE BUILT FOR THE HERNADTHALER IRON WORKS, KROMPACH, HUNGARY.

(With full-page plate.)

We show on our inset sheet this week an interesting horizontal blast furnace blowing engine built by the firm of Bolzano, Tedesco & Co., of Schlan, Bohemia, for the Hernadthaler Iron Works, at Krompach, Hungary. We have reproduced the engravings on our inset sheet, and those shown herewith from the "Zeitschrift des Vereines Deutscher Ingenieure," and the following description has been translated from the same journal by Mr. Geo. L. Fowler, M. Am. Soc. M. E.:

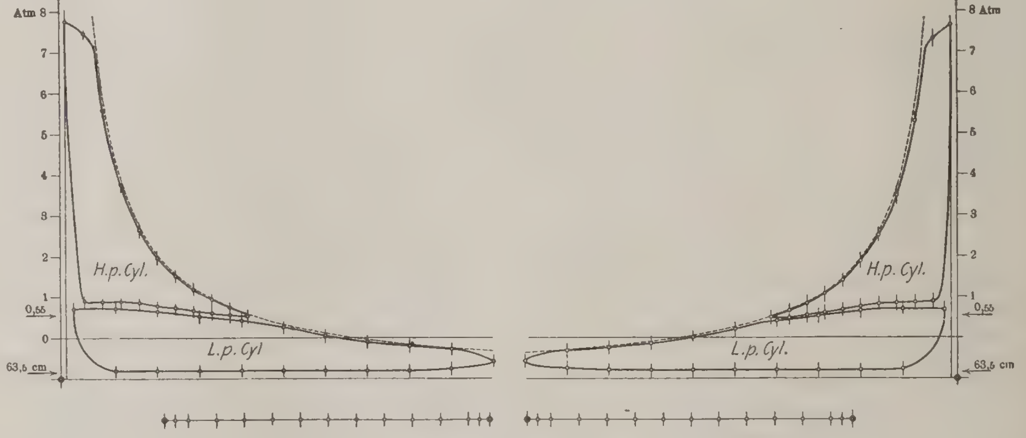


Vertical Section of Automatic Valve.

The specifications prepared by the purchasers of this engine required the valve-motion of the high-pressure cylinder to be controlled by a governor so that steam could be cut off up to half the stroke, or could follow the piston full stroke in starting the machine. Positive-moved valves were required on the air cylinders and they were to have a capacity of 28,250 cu. ft. of air per minute with the engine making 52½ revolutions, and a capacity of 26,840 cu. ft. per minute at 50 revolutions, and a maximum air pressure of about 10 lbs. per sq. in., the initial steam pressure being 112 lbs. and the steam expanding 8 to 1. The fly-wheel was to be so proportioned that the engine should run evenly and smoothly at 26 revolutions per minute, with steam of 82½ lbs. per sq. in., expanding 7 to 1, and the air pressure about 6.4 lbs. per sq. in.

As shown on the inset sheet, the engine is of the horizontal, cross-compound duplex type, and is fitted with Corliss valve-gear throughout. The cylinders are 35.43, 54.33 and 76.77 ins. diameter, with a common stroke of 55.12 ins. The piston rod of the air cylinder extends through the back head, and its weight and the weight of the piston is carried on slides in the front and rear of the air cylinder. The steam cylinders are jacketed, and the jacket is a riveted steel shell made in halves and secured to the cylinder, a special design of the builders. A reheating receiver is placed between the high and low pressure cylinders.

The valve gear is operated by three eccentrics, one driving the steam exhaust valves, one the steam admission valves, and the third the air valves. The valve motion is controlled by means of the Proell weight governor, which has two sliding weights. By changing position of these weights the speed of the engine may be varied about 10 revolutions per minute while the engine is in motion. By changing the driving wheel of the regu-



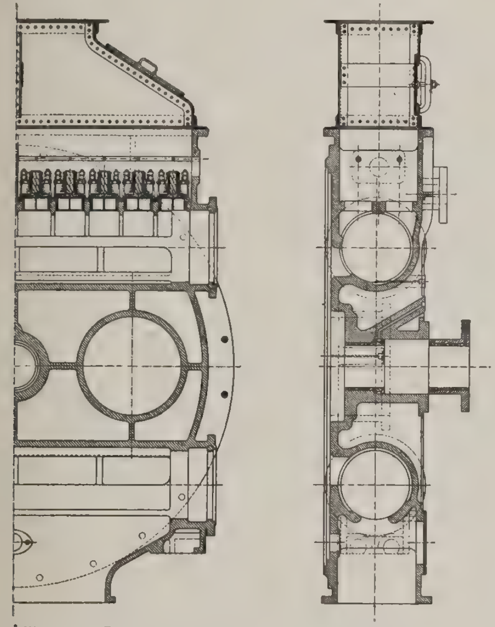
INDICATOR DIAGRAMS FROM STEAM CYLINDERS.

lator while the engine is at rest a still further change in the speed is possible, and a total range of speeds of 33 to 53 revolutions per minute thus provided for. The low-pressure admission valves have a fixed point of cut-off.

A most interesting feature of the engine is the arrangement of the air valves. As already stated, these are driven by a valve-gear of the Corliss type. The air enters through ducts in the masonry foundation, passes up through the inlet valves at the bottom of the cylinders, and is expelled through exit valves at the top. Besides the positive moved valves, automatic spring-actuated valves are placed on top of the cylinder. There are 20 of these at each end of the cylinder. These valves are rotated as they rise and fall by helical guides in the casings in which they work. The sectional area of the air passages at different points are as follows:

	Passages		Check
	Inlet.	Outlet.	valves.
Total area, sq. ins.	325.6	279.0	379.8
Ratio to net cross-section air-cyl.	1 to 14	1 to 16.4	1 to 12
Vel. air at 33 revs., ft. per min.	70.8	83.0	60.7
Do. at 53 revs., ft. per min.	113.5	132.8	97.1

It may be noted that the above engine speeds correspond to piston speeds of 300 to 486 ft. per minute.



½ Transv. Section. Long. Section.

Sections Through Air Cylinder.

Tests of the engine were made before its acceptance by the purchasers, and the results are summarized as follows:

Date of test, Aug. 20, 1897. Duration, 9 h. 55 mins.

M. E. P., high-pressure cylinder, lbs. per sq. in.	29.1
M. E. P., low-pressure cylinder, lbs. per sq. in.	7.7
M. E. P., air cylinder, lbs. per sq. in.	5.6
Revolutions, per minute.	37.5
Power developed, high-pressure cylinder, HP.	304.9
" " low-pressure cylinder, HP.	333.0
" " total HP.	637.9
Work done in air cylinder, HP.	547.1
Efficiency, %.	85.75
Steam consumption, lbs. HP. hr., inc. jacket & recvr	15.25
Excluding jacket and receiver	13.93

The steam diagrams are herewith reproduced. The vacuum in the condensers amounted to only 25 ins. on account of the temperature of the injection water, which ranged from 64° to 68° F.* The temperature of the air above the pressure valves was 132.8° F.

The suction lines of the left-hand diagram from the air cylinder on the inset sheet show some irregularity, which investigation proved to be due to a temporary change in the inlet passage, which caused eddies in the air current. The reservoir into which the air cylinder discharged was also so small that the pressure in the air cylinder rose considerably during the period of delivery. When the machine was put into actual use, however, both these defects no longer existed, and the card taken from the air cylinder as run in actual service (the right-hand diagram in the inset) shows excellent work in both the intake and discharge of the air.

RAILROAD SURVEYING IN TROPICAL FORESTS.

In a recent paper read before the Institution of Civil Engineers Mr. Frederic Shelford, Assoc. M. Inst. C. E., describes "Railway Surveying in Tropical Forests." This paper refers to rapid work performed in the location of railways in Africa, British Honduras and British Guiana. He divides the work to be done as follows: (1) The ride or march over several routes to determine the general route. (2) A reconnoissance survey, for approximate location on the route selected. (3) The location of the center line; with cross-sections of adjoining grounds. (4) The final staking-out.

The first rough survey is to gain general information concerning villages and towns, rivers and small water courses, notes on the geology of the country, a general idea of population, healthfulness of the country and general topography. A prismatic compass and aneroid are used, with distances estimated by noting the time of walking or riding. Rapid work is the essential point aimed at; but a trained observer can secure much valuable information in this way.

With the general route decided upon, a base is required to start the line. This is usually an existing path, road, timber pass or trade route; and the trade route or traveled path established by the natives, after long years of trial and the cutting of corners, is usually found to be the best for permanent location. As timber cutting is costly and occupies much time, it is to be avoided as much as possible. The instruments used were the miners' dial or compass, mounted on a stout tripod, with a plumb-bob and a ball-and-socket joint. This instrument costs only $30, so several may be taken along; it is light, and will stand rough treatment that would use up a more delicate instrument. The author says he never found a prismatic compass satisfactory; in hot, damp countries it becomes foul and slow in action and is apt to give false readings by the dial touching the top glass, when read several hundred times a day.

The chain used is a steel band tape, ⅝-in. wide, with the 1-10 meters marked by brass studs. This chain has no projections and will drag easily, but it must be constantly oiled to prevent rust. It is not very durable, but the author has used one tape in measuring 70 miles of railway.

The method of procedure is for one engineer to run the compass, and a reliable native is sent ahead as far as possible with a pole, other natives cut a pathway towards this pole until it can be seen from the compass. Trees are blazed and marked with a chalk at each turning. In bush country, 3 miles, 60 chains is a good day's work, as there is a long walk to camp and the work must be plotted in the evening. Distances are sometimes measured by a measuring wheel, though owing to rough and crooked paths this is not very accurate. Leveling is done by a dumpy level and two rodmen, with levels taken at every station and bench marks established. This leveling is done at about two-thirds the speed of running the line, and this gives the compassman one day in three for plotting work, etc. Cross-section lines are often surveyed by a pocket compass, fixed on top of a sharpened stick; and here an aneroid barometer is at its best for obtaining levels, as the whole line is measured in 20 or 30 minutes, and the atmospheric pressure has little time to vary.

Plotting the surveys, final location and staking-out for work, differ little from ordinary methods. The author reckons the cost of such surveys per mile, as follows, including instruments and equipment, but without traveling expenses to point of commencing work:

	Per mile.
Rapid reconnoissance survey of 200 to 400 miles; with a rough location of the railway, approximate estimate, statistics, etc.	$40.00
Cutting path through unknown forest, without roads or paths of any kind; with rough railway location.	70.00
Reconnoissance survey along trade routes; with numerous cross sections; careful location and leveling of line; close approximate estimate, etc.	80.00
Accurate reconnoissance survey; exact location of line; clearing the same, staking out, leveling, cross sections and complete working survey.	$600.00 to 650.00.

These results are deduced from actual surveys made in very hilly countries, where railway location is troublesome.

An ingenious method of permanently marking stations was used in British Honduras, the chief object being to reduce the material transported to the smallest bulk. It should be understood that pencil or paint marks cannot be put upon a freshly cut and bleeding blaze on a young tree, so as to last any time. The plan adopted enabled the station marks to be found after the lapse of two or three years.

The marking was done with copper nails about 1½ in. long. These nails were driven in about halfway and then bent over in various directions, to indicate the numerals from 1 to 9 inclusive, according to an arbitary code. A blaze was first cut on the tree in the form of a cross. A nail in the center of the cross indicated units; one in the right hand upper arm, tens; left hand upper arm, hundreds; bottom left hand arm, thousands, and bottom right hand arm, tens of thousands. The bending of the nails to indicate numerals may be on any convenient system. In that used by the author, a nail bent up and to the right at an angle of 45° with the vertical represented 1; horizontally to the right, 2; bent down and to the right at 45°, 3; bent down on the vertical, 4; down to the left of the vertical and at an angle of 45°, 5; to the left, horizontal, 6; to the left and up at 45°, 7; up on vertical, 8; driven in straight, 9. For zero the nail was omitted. For example, the number 1,385 only required four nails; and as the full number was only marked at every tenth station, about 10 lbs. of copper nails were sufficient to mark 70 miles of line. For a reconnoissance survey by a party of two engineers not less than 30 men and 9 mules were required; or, if no mules were available, 57 men; 3 men being taken as the equivalent of one mule. For a staking-out survey, with numerous side lines to be cut and heavy clearing to be done, 80 men can be easily employed. In a rapid survey where the camp is moved about every third day, carriers are wanted in addition to the above. About 12 natives will be sufficient for shifting camp every third day. The march down country to Lagos, after finishing the survey, required 250 natives to carry five Europeans, three sick men and all stores, tools and camp equipment.

For a party of two engineers the following instruments were found suitable and sufficient for these surveys. Two miners' compasses on solid legs and of the plainest pattern; two 12-in. levels; two 16-ft. leveling rods; three steel tapes, ⅝-in. wide, on reels; three sets of steel pins; two pocket compasses; two paceometers; one measuring wheel; 36 ranging poles, 10 ft. long, and two 3-in. aneroids. For plotting work, they carried: Scales, set-squares, one protractor, one parallel ruler, two drawing-boards, sets of drawing instruments, etc. The cost of the equipment, for instruments only, was about $450.

Great care must be taken in selecting the equipment, as no useless articles should be carried; but to fail to bring some essential article may mean the failure of the whole expedition and the waste of much money. The equipment must be packed into loads according to means of transport. For a mule, this load must not exceed 30 × 15 × 12 ins., in dimensions, and weigh from 200 lbs. to 300 lbs. in a rough country. With native carriers the weight is more important than the bulk; and this weight should not exceed 50 lbs. for a long march, and 80 to 100 lbs. for a march of a few hours. Engineers for such expeditions need some medical and surgical knowledge, as accidents are frequent when timber is being felled.

BOOK REVIEWS.

ENGINEERING CONTRACTS AND SPECIFICATIONS.—A Brief Synopsis of the Law of Contracts and Illustrative Examples of the General and Technical Clauses of Various Kinds of Engineering Specifications. By Prof. J. B. Johnson, M. Inst. C. E., M. Am. Soc. C. E., M. Am. Soc. M. E., etc. Second edition. New York, N. Y.: Engineering News Publishing Co. Cloth; 6 × 9 ins.; pp. 452; $3.50.

The first edition of this now well-known work was reviewed at length in Engineering News of Aug. 15, 1895, and about all that is called for here is a brief mention of the additions and revisions which have been made in the present edition. These comprise for the most part a very complete set of specifications for the machinery, track and overhead construction of electric railways for both cities and country towns, these having been drawn by two of the leading engineers of the country in this class of work. The book has been improved in size and appearance, and taken altogether, as we said of the first edition, it should find a large field of usefulness among engineers and contractors.

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*This would not account for the low vacuum. A temperature of 70° corresponds to a vacuum of 29.2 ins. A temperature of 126° corresponds to a vacuum of 25.85 ins.—Ed. Eng. News.

THE UNIVERSAL DIRECTORY OF RAILWAY OFFICIALS. Compiled from official sources by S. Richardson Blundstone, Editor of "The Railway Engineer." London: The Directory Pub. Co., 8 Catherine St., Strand, W. C. 8vo.; cloth; pp. 475; 10 shillings.

This is the fourth annual issue of this directory and it contains about 25 pages more in the directory than last year. It is stated that with the exception of the African-German colonies, it is believed that information respecting every railway in Africa is now included in the Directory. We are compelled to judge the book, however, by its treatment of United States railways, and on these the editor appears to have drawn the line at about 250 miles. Companies controlling less mileage than this are generally not included. This omission must, of course, be intentional, as the publishers undoubtedly have access to the many excellent and complete directories of American railways which are published, and we suspect no better reason exists for it than disinclination to increase the size and cost of the book. To be really honest, the publishers should frankly state that railways of less than a certain size are not included, or else refrain from calling their work "The Universal Directory."

WATER SUPPLY AND IRRIGATION PAPERS OF THE U. S. GEOLOGICAL SURVEY.—No. 12, Underground Waters of a Portion of Southeastern Nebraska, by Nelson Horatio Darton; No. 13, Irrigation Systems in Texas, by William Ferguson Hutson. Department of the Interior, Washington, D. C. Paper; 9 × 6 ins.; pp. 56 and 68, respectively.

These two separate pamphlets are issued by Mr. F. H. Newell, Hydrogapher in Chicago, in advance of the regular report, and for the convenience of those desiring to use their contents. No. 12 relates to a tier of counties, covering about 6,700 sq. miles of Southeastern Nebraska, and largely situated along the Platte River. In this region the annual rainfall is not large enough to always insure full crops, and the report treats of the geological formation and the water-bearing deposits which underlie nearly all of this area, at depths varying from 10 to 300 ft. No. 13 discusses, for the State of Texas, legislative enactments and the history of irrigation, the distribution of rainfall, and finally describes the irrigation, works and projects in that state. Both of these pamphlets are well illustrated by colored maps, half-tone photographs, plans and diagrams.

CALCULATIONS IN HYDRAULIC ENGINEERING.—A Practical Text-Book for the Use of Students, Draftsmen and Engineers. With numerous Illustrations and Examples. By T. Claxton Fidler, M. Inst. C. E., Professor of Engineering, University College, Dublin, Ireland. Part I. Fluid Pressure, and the Calculation of its Effects in Engineering Structures. Longmans, Green & Co., London, New York and Bombay. Cloth; 8vo.; pp. 153. $2.50.

The purpose and scope of this book are shown in the following quotations from the preface:

> This little book does not profess to be a treatise on hydraulics, but relates to those calculations which have to be made—many of them very frequently, and others perhaps more rarely, in connection with works of hydraulic engineering. . . . . It has been written in the language of practical men rather than in that of the schools or of the mathematician. In all cases, it has been the author's desire to discuss the rational groundwork of these problems in the simplest and plainest terms; and the student who happens to be accustomed to a more rapid mathematical treatment may perhaps find these preliminary discussions unnecessary; but they may nevertheless be acceptable to other students, whose training has been of a more practical kind, and whose ideas have been cast in a somewhat different mould.
>
> In dealing with the effects of fluid pressure, a good many of the calculations which have to be made are too simple to need any extended illustration in this book; and for that reason a great part of its contents is devoted to those problems which are not so simple, or to those which seem to have received but little consideration at the hands of other writers. Among these matters may be mentioned the forces which result from the axial fluid stress in a curved or in a straight pipe.
>
> The stability of floating bodies is treated with especial reference to engineering structures, such as floating docks, pontoons, and the caissons which are sometimes used for bridge foundations. . . . Some experimental measurements of the displacing forces, in the fluid arch and in the fluid column, are described in detail in the appendix, which also contains a short series of experiments upon the direct tensile strength of various forms of socket joints.

The author has made a valuable contribution to the literature of one branch of hydraulic engineering. The field he covers is a limited one, relating to hydrostatics only, and he by no means covers the whole of this subject, but the work as far as it goes is well done. Many of the problems in the book are rare and difficult, and the author's method of treating them is as clear and simple as the subject permits. The chapter headings are as follows: Practical Conception of Elementary Principles. The Action of Fluid Pressure of Uniform Intensity, Cylinders, Pipes and Bends under Uniform Pressure. The Buckling Tendency in Straight Pipes under Pressure. Fluid Arches. The Stability of a Line of Pipe. Hydrostatic Pressure of Varying Intensity. Floating Vessels. Bending Stresses in Floating Pontoons. The typography, illustrations and press work are excellent. We would suggest to the publishers that the leaves of the book should be trimmed. The use of uncut edges is carried too far when they are applied to engineering text-books.

U. S. GEOLOGICAL SURVEY.—18th Annual Report to the Secretary of the Interior, 1896-97. Charles D. Walcott, Director. In five parts. Part IV.—Hydrography. Washington, D. C.: Government Printing Office. Cloth, 11¼ × 7½ ins.; 756 pp.; maps, photographs and plans.

This is a full and very interesting report upon the following hydrographical heads: Progress report on stream measurements, by Mr. Arthur P. Davis; water supply of Indiana and the greater part of Ohio, by Mr. Frank Leverett; continuation of report on artesian waters of a portion of the Dakotas, by Mr. N. H. Darton, and storage reservoirs in the West, by Mr. James D. Schuyler. The book itself is the ninth annual report upon what has been known as the Irrigation Survey, authorized by Congress for the purpose of ascertaining the best means of utilizing the water resources of the arid and semi-arid sections of the United States. This Irrigation Survey was organized under the provisions of the Act of Congress of Oct. 2, 1888, and, under the title of "Water Supply and Irrigation Papers," a series of distinct bulletins has already been issued. Those published cover the following heads: Report of 1888-89, detail of organization and plans adopted; Report of 1889-90, a discussion of the hydrography and of the engineering surveys for canals and reservoirs, and a report upon the topography; Report of 1890-91, location and survey of reservoir sites, hydrography of the arid region, and discussion of irrigation in India; Report of 1891-92, water supply for irrigation, American irrigation engineering, engineering results of irrigation survey, and location of reservoir sites during year; Report of 1892-93, results of stream measurements, potable waters of Eastern United States, and natural mineral waters of the United States; Report of 1893-94, field work; Report of 1894-95, public lands and their water supply, and water resources of a portion of the great plains; Report of 1895-96, report of progress in the Division of Hydrography, underground waters of the Arkansas Valley in Eastern Colorado, water resources of Illinois, and artesian waters of a portion of the Dakotas. This list of subjects sufficiently outlines the scope of the survey and the general progress made.

The report of Mr. A. P. Davis, in the present volume, gives the discharge measurement of streams in nearly 20 states, as obtained by special resident skilled hydrographers. In these detailed reports we find the area of section, mean velocity discharge per second, drainage areas, run-off, etc., for rivers and their tributaries. While the list is by no means complete, a good beginning has been made in what will be of the greatest value to the hydraulic engineer. The territory covered is mainly west of the Mississippi River; though Georgia, Alabama, North and South Carolina, Virginia and West Virginia are included. In the report upon the Water Resources of Indiana and Ohio, by Mr. Leverett, we have a general statement of the physical conditions, with a contour map; a geological map and sections; a discussion of glacial ridges, and a map showing the Pleistocene Deposits on this territory, and the main drainage systems, separately treated. Underground waters and wells are studied in relation to the drift deposits; analyses of water are given, and the report continues with detailed observations on the water supply of cities and towns in Indiana and Ohio, as obtained from the latest authorities. Considerable space is given to rainfall data.

Irrigation by artesian well water in Eastern South Dakota is the substance of the report of Mr. Darton. He tells of the progress made, by counties; both in well-sinking and in irrigation. These South Dakota artesian wells are remarkable for their pressure; many of them showing pressures of 150 lbs. or more per sq. in.; or, the equivalent of a head of 350 to 400 ft. In a well sunk in 1896, at the Cheyenne Agency, the pressure is said to equal 205 lbs. per sq. in. The temperature of the waters of these wells reaches 94.9° F., as a maximum, with 70° to 80° as a common temperature. Though carefully studied, no satisfactory explanation has yet been found of the thermal conditions in the Dakota artesian basins. Chemical analysis shows that in the majority of the basins the waters have the character of surface water, and this would seem to prove that they are derived from local beds of sand and gravel in the drift formations, as some suppose. The volume of flow of the deep wells varies, with different diameters of tubing and local conditions causing partial clogging at the bottom. As shown on a map, the flow in gallons per minute for a 4½-in. outlet ranges from 10 to 2,000 gallons and more.

The paper of Mr. James D. Schuyler, M. Am. Soc. C. E., on "Reservoirs for Irrigation," is treated as we would expect it to be by an engineer of his ability and wide experience. He handles his subject under the main heads of rock-fill dams, hydraulic dam construction, masonry dams, earthen dams and projected reservoirs; and illustrates his paper with a large number of photographic views of completed work and work in progress, accompanied by plans and sections. In the case of many of the completed dams, Mr. Schuyler goes into the details of construction and cost, and the paper, in itself, forms an exceedingly valuable treatise on dam building and flume construction, under varied and difficult conditions. Many of these dams, however, have already been illustrated in this journal, and we shall later give more space than can be spared here to the illustration of several others that are worthy of especial mention.

ANNUAL MEETING OF THE AMERICAN INSTITUTE OF ARCHITECTS.

The 32d annual convention of this association was held at the Arlington Hotel, Washington, D. C., on Nov. 1-3.

The morning of the first day was devoted to the customary routine business attending the opening of a convention, which included a welcoming address by District Commissioner John B. Wight and the annual address by President George B. Post. Mr. Post expanded upon the advantages of selecting designs for government buildings by competition. In speaking of the work done in the past by the supervising architect's office, he said:

> Unfortunately these buildings are built with extravagant excellence and will stand for ages a travesty upon the art of the country, a reproach to the intelligence of those in power who have refused to listen to the urgent and repeated opinions of those qualified by education and experience to give advice, and have persistently neglected to use the means always at their hands to procure designs which should at least represent the average skill and economy daily shown by the architects of the country in private practice.

The report of the Board of Directors, among other things, called attention to the fact that the Institute in establishing its permanent headquarters in Washington was breaking away from all precedent and conducting what really might be called an experiment. This referred to the leasing of the historic "Octagon House" for a term of five years at an annual rental of $360. The object of this move is best expressed in the report of the committee having the matter in charge.

> That it afforded the broadest field for the institute to obtain national legislation in relation to art and construction; that it could here more efficiently advocate the establishment of a government testing station and a national architectural museum, and would be in a position to make its influence felt in the methods adopted by the government for procuring designs for national buildings.

The second day, Prof. W. C. Sabine, of Harvard University. read a paper entitled "Acoustics," in which he stated that the problem of securing an acoustically satisfactory auditorium depended upon three points. The first of these was the proper arrangement of reflecting surfaces, i. e., the walls and ceilings; the second, the avoidance of "interference;" the third, the prevention of the prolongation of the sound, which is due to improperly inclined walls, and an inadequate use of absorbent materials in the construction and furnishing of the halls. Relative to this latter point a chart was exhibited, which indicated the absorption power of different materials as follows:

Hair cushions on seats, per square yard, 2.03; heavy oriental rugs on floor, per square yard, .56; chenille draped as curtains, per square yard, 1.32; cretonne, hanging flat, per square yard, .33; canvas, hanging flat, per square yard, .71; hair felt against wall—half inch thick, per square yard, 1.00; one inch thick, per square yard, 1.8; two inches thick, per square yard, 2.4. Audience, per person, 1.3; individual man, sitting clear, 1.8; individual woman, sitting clear, 2.2.

The secretary read a paper by Adolph Cluss which emphasized the points brought out by Prof. Sabine.

The next paper, by Prof. G. P. Merrill, of the National Museum, "Remarks on Some Little-known American Ornamental Stones." was a review of the history of stone as a construction material and a description of a number of kinds of American stone suitable for building and ornamentation. The last paper of this session, "Peculiarities of Wood," by Prof. B. E. Fernow, Cornell University, was read by Mr. J. C. Hornblower.

The afternoon was devoted to an excursion to Cabin Johns bridge and vicinity, and in the evening papers were read on "The Place to Be Assigned to Jewish People in Architectural History," by Dr. Cyrus Adler, and "General Practice in Regard to the Employment of Electric, Heating and Ventilating Engineers," by H. G. Bradlee.

The latter paper advocated the employment of the engineer by the architect and not by the owner, and that the minimum commission should be 5% on all work costing over $10,000. The work of the architect is no longer confined to the design of a building which is architecturally beautiful, carefully planned and substantially constructed, but to-day he must equip the building with a complicated system of mechanical and electrical apparatus and must design and provide for a network of pipes, flues and wires running through all parts of the building. The architect of the modern building must be an engineer and must be familiar with mechanical, electrical and sanitary engineering in all its branches.

Pittsburg, Pa., was selected as the place of meeting for 1899, and the following officers were elected for the ensuing year: Pres., Henry Van Brunt; First Vice-Pres., W. L. B. Jenney; Second Vice-Pres., J. W. McLaughlin; Secy. and Treas., Glenn Brown; Directors, Frank Miles Day, Joseph C. Hornblower, T. D. Evans; for two years, Robert W. Gibson, Levi T. Scofield, W. M. Poindexter; for three years, Arthur G. Everett, of Boston; W. C. Smith, of Nashville; George B. Post.

The session of the last day was given over to a discussion of the By-Laws of the Institute and the consideration of reports.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

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THE JAPANESE BATTLESHIP "SHIKISHIMA" was launched by the Thames Iron Works & Shipbuilding Co. on Nov. 1. This will be one of the most powerful warships afloat when completed. Her dimensions are: Length, over all, 438 ft.; length between perpendiculars, 400 ft.; extreme beam, 75 ft. 6 ins.; depth, 45 ft. 2½ ins.; draft on 14,750 tons displacement, 27 ft. 3 ins. She will have a complete water-line belt of Harveyized nickel-steel armor 8 ft. 2 ins. deep and tapering in thickness from 9 ins. amidships to 4 ins. at the ends; above this is a 6-in. belt between the barbettes, extending to the main deck. The barbettes are 14 ins. thick, and the cross bulkheads, 12 ins. The engines are to develop 14,500 I. HP., and drive the ship at a speed of 18½ knots. As armament she will carry four 12-in. guns in two barbettes; 14 6-in. rapid-fire guns; 20 12-pdr. rapid-fires; 8 3-pdr. rapid-fires; 4 2½-pdr. rapid-fires; 8 Maxim guns, and 5 18-in. torpedo tubes, 4 of the latter under water. Her coal capacity, however, is only given as 700 tons.

◆

THE CRUISER "MARIA TERESA," abandoned in a storm on her way from Cuba to Norfolk, is now aground on Cat Island, in the Bahamas. The water is up to her between-decks, she has a list towards the damaged side, and is dismantled. Meanwhile the wrecking company's boats have gone to inspect her, and a court of inquiry is to be held to determine if her abandonment was justifiable. Later information gives little hope of her final rescue. The hull is badly strained and the engines and boilers seem to be immovably fixed upon the rocks of the reef.

◆

THE DESIGNS FOR THE FOUR NEW MONITORS for which Congress appropriated $5,000,000 at its last session are to be materially changed as the result of recent action by the Navy Department. The prices at which the contracts for the vessels were awarded left so large a margin that it has been decided to build bigger and better vessels. The principal features of the old and new designs are compared as follows:

	Old.	New.
Displacement, tons	2,700	4,000
Coal capacity, tons	200	400
Main battery	2 12-in.	4 10-in.
Horse-power	2,400	3,200
Draft	12 ft. 6 ins.	14 ft. 6 ins.

The speed in the new designs will be 12 knots, as in the old.

◆

THE LIFE OF MODERN NAVAL GUNS is commented upon by Com. Charles O'Neil, Chief of the Bureau of Ordnance in the Navy Department. The popular idea was that a heavy naval gun was out of service and dangerous after 100 rounds had been fired from it with service ammunition. As a matter of fact, in the war with Spain, some of our 12 and 13-in. guns have been fired 300 times, and are yet as sound as when they left the factory, and are free from serious impairment by erosion by gases. Of the smaller pieces, some have been fired 600 and 900 times, and they are still perfectly sound and are not eroded to any extent. The use of cordite hastens the erosion of the gun, but in the British Navy the gun is built with a core, which can be bored out and replaced when too much worn. Commodore O'Neil says that most of the guns now in use in our navy will only be withdrawn when they become obsolete; he thinks there is little danger of their being worn out in service.

◆

MACHINE GUNS, says General Joseph Wheeler, proved their efficiency and value in the San Juan fight. The four guns used in the battery commanded by Lieut. John H. Parker, of the 13th U. S. Invantry, were the regulation Gatling model of 1895, firing regulation Krag-Jorgensen cartridges at the rate of 400 shots per minute each. He lost one-third of his men but drove the Spaniards from their trenches; and, at 1,500 yards, drove the gunners from a 6.4-inch Spanish gun which was trained upon them. This is probably the first time in warfare that a field gun of that caliber was silenced by machine gun fire. The Spaniards left their heavy gun loaded and admit a loss of 50 men in trying to fire that last charge. From July 4 to July 11 two Colt rapid-fire guns and a dynamite gun, throwing 4½ lbs. of explosive gelatine, were added to the Gatling battery. The dynamite gun fire had the effect of driving the enemy from his trenches and the machine gun played havoc with the fleeing men. Gen. Wheeler advocates the creation of an individual arm of the service to be known as the Gatling Gun Corps.

◆

THE REPORT OF THE CHIEF OF ORDNANCE, General Flagler, for the last fiscal year, deals lightly with the late war with Spain. The expenditures of the Ordnance Department for the year were $29,858,783. From April to August the Department produced 250,000 sets of infantry equipments and 26,000 sets of horse equipments; and it met all the demands made upon it for small-arm ammunition. In answer to the criticism on the 45-caliber Springfield rifle used by many of our regiments, General Flagler says that while the single-fire Springfield was not so good as the magazine 30-caliber rifle, it was by no means as inferior as asserted. It fully met all the demands of an active campaign; the chief objection being the use of black powder in the cartridges. Smokeless powder is now being supplied for the Springfield rifle. General Flagler points out, as one of the lessons of the war, that 100,000 stands of arms should be procured at once, and the factories at Springfield and Rock Island should be equipped for turning out 2,500 stands per day; field and siege guns and equipments for an army of 500,000 men should also be held in reserve, as six months' time would be thus saved in an emergency.

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EXPERIMENTS WITH FLYING MACHINES, for use in war,are to be conducted by the Board of Ordnance and Fortifications, and the sum of $25,000 has been appropriated for this purpose. The experiments will be carried out by General Greely, of the Signal Corps.

◆

THE U. S. ARMY, IN THE WAR WITH SPAIN, reports Adj.-Gen. H. C. Corbin to the Secretary of War, numbered as follows: At the breaking out of the war the regular army consisted of 2,143 officers and 26,040 enlisted men. Under war legislation this number was increased to 2,332 officers and 56,365 enlisted men, including 5,365 men of the hospital corps. Regular army officers, to the number of 387, were appointed to different grades in the volunteer army. At its highest point the volunteer army numbered 8,785 officers and 207,244 enlisted men; in August, 1898. The aggregate strength of the whole army was thus 11,108 officers and 263,609 enlisted men. The casualties of the war were: 23 officers killed, 113 wounded; 257 enlisted men killed, 1,464 wounded. The total deaths from wounds and disease, to Oct. 3, were 107 officers and 2,803 enlisted men; or a little over 9 per 1,000 for the officers and 10 per 1,000 for the enlisted men.

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THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Nov. 15, near Trenton, Ont., on the Grand Trunk Ry., as the result of a misplaced switch. The Montreal express, west bound for Toronto, took the switch and ran head on into an east-bound freight. The accident caused the death of 12 persons and seriously injured as many more.

◆

A SERIOUS RAILWAY ACCIDENT occurred Nov. 10 on the Lehigh Valley R. R., near Wilkesbarre, Pa., as the result of a failure of the brakes. According to accounts the Buffalo express had orders to stop at a siding on the Wilkesbarre mountain to let an express from New York pass. On approaching the switch the brakes of the Buffalo express failed to hold the train, and it ran past the siding and collided with the approaching New York express. Five trainmen were killed and four injured. Newspaper reports state that the failure of the brake was due to an accumulation of wet leaves upon the rails.

◆

A SALT WATER FIRE PROTECTION SERVICE has been established in Boston for a limited area. A line of pipe has been laid to a point near the post-office and a number of hydrants placed on it. Pumping is done by an engine on a fireboat. This, it is hoped, is the beginning of a comprehensive system of independent fire protection for the business district of the city. Such a system has been advocated for a number of years.

CARBIDE OF CALCIUM AND ACETYLENE GAS are not favorably looked upon by the Boston Manufacturers' Mutual Insurance Co. Its circular for October contains a "Caution" from which we extract the following:

> The purpose of this caution is to call upon each and all of our members not to make use either of carbide of calcium or of acetylene gas without full advisement and consultation at the time the proposed application is to be made. It may happen that the uses of these materials may be made safe. At present they are not deemed so. Therefore, the introduction of either, without the consent of the underwriters, would make an alteration in the condition of the risk not contemplated in the original contract.

A new method of lighting by kerosene oil is also mentioned in the circular, without giving its name, "because there are elements of merit in the process," and it is suggested that no new method of lighting be permitted even for experiment, without consultation with the insurance company.

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THE COOLGARDIE STEEL PIPE LINE, in Western Australia, will be constructed by G. & C. Hoskins, of Sydney, and Mephan Fergusson, of Melbourne and Perth. There will be 328 miles of 30-in. steel pipe, with longitudinal joints made under patents owned by Mr. Fergusson, presumably after the plan described in our issue of June 9, 1898, as employed on the Adelaide water-works. The total contract price is about $4,990,000, or $350,000 less than the engineer's estimate. The plans for this work, which includes a storage reservoir and a pumping plant to deliver 5,000,000 gallons of water a day through the pipe line, were made by Mr. Chas. G. O'Connor. M. Inst. C. E., Perth, Western Australia. The work was described in our issue of Feb. 10, 1898, and the pipe line was discussed editorially in our issue of Feb. 17 and Oct. 13, 1898.

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THE PURCHASE OF THE WATER-WORKS of the eight companies supplying London is recommended by the water committee of the County Council, providing parliamentary authority can be obtained. Early possession is advised, the price to be paid the companies to be determined by arbitration. Authority is also desired to connect the systems of the several companies, in order to prevent a repetition of the recent water famine in East London. The committee also recommends that parliamentary sanction be asked for introducing a new supply from Wales at an estimated cost of some $80,000,000. It states that the drouth of the last season proves that the late Royal Commission on Metropolitan Water Supply over-estimated the yield of the Thames and Lea and therefore were wrong in assuming that those streams would be sufficient to supply the Metropolis until 1931, at least without an unwarranted expense for storage. A second Royal Commission is now investigating the subject of a metropolitan water supply.

◆

THE DAY-LABOR PLAN of carrying out municipal work, practiced of late by the London County Council, is reviewed by an earnest friend of the system, Mr. J. W. Martin, in "Municipal Affairs," for September. The cause leading the council to adopt this system, according to Mr. Martin, was a combination of contractors to maintain high prices in order to break down the wage-rules established by the council. These rules are termed by Mr. John Burns "the Magna Charta of Labor." They provided for trade union wages for all skilled labor and for a minimum of 12 cts. an hour for unskilled labor, whether employed by the council or by contractors. The trade union wages were already paid by many London employers, so in this particular the council merely placed itself in line with numerous private concerns. The rate of 12 cts. an hour for unskilled labor, Mr. Martin says, was above the market rate, but how much above he does not state. A while ago the moderates achieved considerable control in the council, and succeeded in "starving" the works department, but now the progressives are strongly in the ascendency, and Mr. Martin states the department is in danger of being overfed. The London "Contract Journal," we have observed, is opposed to the works department of the council,which has charge of all the work not done by contract.

◆

SEWAGE DISPOSAL in nearly all the coast towns of England is by the discharge of the crude sewage into the tidal water, but generally with some storage during rising tides. Thus, of 36 towns, only 6 have any system of purification, 3 of these employing chemical precipitation, and the other 3 sedimentation, or screening. Of the 25 towns reporting some storage, this is effected in tanks only in 9 cases, the other instances being the use of enlarged sewers near the outlet, or simple backing up of the sewage in the main sewers by the tides. The above information is taken from a paper read at The Sanitary Institute, by Mr. H. Bertram Nichols, Assoc. M. Inst. C. E., and published in the London "Contract Journal."

◆

THE METRIC SYSTEM is being considered by the Danish Diet, with a view of substituting it for the confusing Danish system of weights and measures. The general opinion is that the metric system will be adopted and the law establishing it will at once go into effect.

THE GOODWIN DUMP CAR.

The great amount of work being done by railways in the improvement of their lines, by means of widening banks and cuts, reducing grades, ballasting, filling trestles, etc., which involves the handling and dumping of large quantities of material, has led to the introduction of various types of dump cars, designed to effect facility and economy in the handling and dumping of this material. We have from time to time described a number of these cars, and the work which they perform, and in the present article we describe the most recent type of the Goodwin car, which has been used on some extensive works.

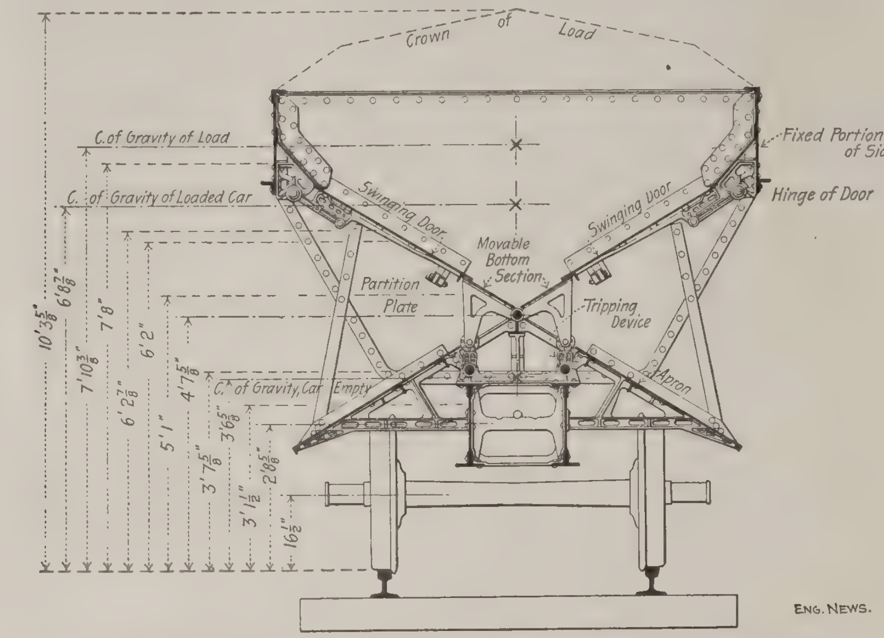

FIG. 1. CROSS SECTION OF GOODWIN DUMP CAR (SIDE DUMP ONLY).

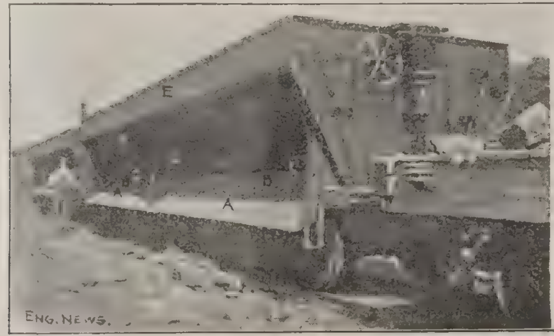

Fig. 2. Car in Running Position.

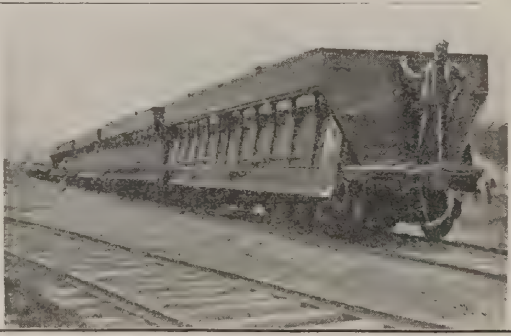

Fig. 3. Cars Dumped at Side.

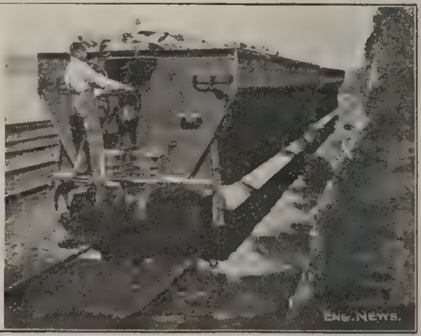

Fig. 4. Ready to Dump by Hand.

THE GOODWIN DUMP CAR. Goodwin Car Co., New York City, Builders.

This car was first patented in 1872 by Mr. John M. Goodwin, and has since been greatly improved on the lines of modern car construction. A four-wheel car of this design, built of iron, and having a capacity of 30,000 lbs., was exhibited at the Columbian Exposition, 1893, and in the past few years new and larger cars have been introduced. These cars are built by the Goodwin Car Co., 96 Fifth Ave., New York (and with a western office at 115 Dearborn St., Chicago), and we are indebted to that company for photographs and particulars of these latest cars.

The Goodwin dump car, as now built, is constructed entirely of steel and malleable iron, and will discharge the whole or a part of its contents between the rails or on either side of the track. There are two plate-girder sills, 21 ins. apart, c. to c., these girders being 18 ins. deep at the middle and 9¼ ins. at the ends. From each sill extends an inclined floor or apron, which serves to deliver the charge clear of the track and of the axle boxes. The space between the sills is left clear for dumping the load between the rails. The ends and end sills are supported by the plate girders, and the ends are connected by top side plates 18 ins. deep. A middle transverse bulkhead divides the car body into two compartments, which can be dumped independently. The bottom of the hopper or body is composed of swinging doors on each side, hinged at the top and inclined inward at a flat angle. These doors do not meet when closed, but rest on two narrow central movable sections on each side of a longitudinal shaft, about 15 ins. above the sills. By turning the shaft, one or other of these narrow sections is made to incline downward towards the apron instead of upwards, thus releasing the door on that side, which will then swing out to a vertical position, while the load slides under it and over the apron. The aprons are hinged on a line nearly over the wheels, and in order to dump between the rails the inner portion is swung up and out, so that when the door is released it strikes against the raised apron, and the contents of the body fall between the sills. Some of the cars, however, are made to dump only at the sides, and these have no movable section to the aprons. The dumping and closing devices may be operated by compressed air or by hand power, and are under control, so that the load may be discharged slowly or rapidly, as desired, and while the train is in motion.

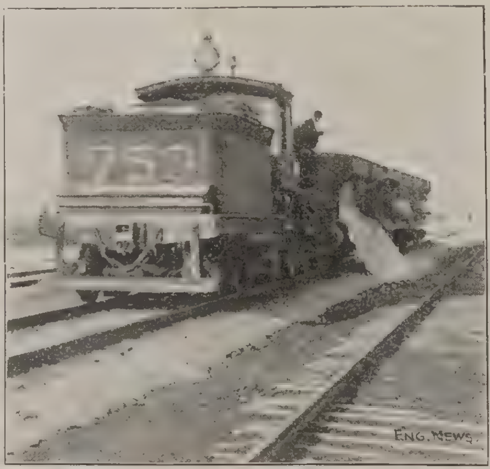

Fig. 5. Dumping Stone Ballast from Goodwin Cars, Illinois Central R. R.

The cars are mainly used for ballasting and filling, but are claimed to be suitable for carrying grain, coal, coke, ore, and other bulk freight. For grain service, an adjustable steel top is fitted, while for carrying coke a steel railing or crate is attached to increase the height of the fixed sides. These cars have been used for ballasting and filling on the New York Central R. R., the Pennsylvania R. R., the Lehigh Valley R. R., and the New York, New Haven & Hartford R. R., and on the lake front work of the Illinois Central R. R., at Chicago. They have been used for trestle filling in New York harbor by the U. S. Government, and on numerous large contracts for filling by different contractors, including the Globe Construction Co., of Cincinnati. Some of them are now in use on the excavation work for the great Jerome Park reservoir for the water supply of New York.

Fig. 1 is a cross-section of a side-dumping car, showing the positions of its center of gravity when loaded and unloaded. Fig. 2 is a view of a side and center-dumping car in position for carrying the load. In this view, A is the fixed portion and B the pivoted portion of the apron, C is the opening for dumping between the sills, D is the middle bulkhead, E the fixed portion of the top, and F F the swinging doors (pivoted below the sides E) which form the bottom. At the end may be seen the horizontal wheel for dumping the car by hand, while to the right of this is the air pipe and cock for dumping the car by air pressure. Fig. 3 shows the car after its load has been dumped from one side, the swinging doors now hanging vertically. Fig. 4 is an end view of the car, with the man ready to dump the load by hand. Fig. 5 shows the car in use for ballasting on the Illinois Central R. R. The broken stone ballast is being dumped while the train is running at a speed of eight miles per hour.

The cars are mounted on diamond-frame trucks of special design, having steel bolsters, and are fitted with hand and air brakes. They have also the Williams M. C. B. couplers, and a special design of draft rigging with double springs.

The principal dimensions of the cars are:

Length over end sills	35 ft. 11 ins.
Width over all	8 " 10 "
Height, rail to top of sill	3 " 6 "
Height, rail to top of car	8 " 6 "
Wheelbase, truck	5 " 0 "
Wheelbase, total	28 " 9 "
Wheels, cast-iron, 600 lbs.	2 " 9 "
Journals	4¼ × 8 ins. or 5 × 9 "
Carrying capacity	80,000 lbs., or 125,000 lbs.
Cubic capacity (with load crowned 10 ins.)	28.8 cu. yds.
Cubic capacity with top crates	37.0 "

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STEAM OMNIBUSES OR STAGES for use in London are proposed by the London Steam Omnibus Co., which is now inviting subscriptions for its stock. The De Dion & Bouton system is to be employed, which system has been successful in some of the motor carriage trials in France. Coke or petroleum may be used for fuel. One omnibus has been put in use for experimental service, and is said to show great economy over the two-horse omnibuses which are so extensively used in London. The same company also proposes to operate similar vehicles on country roads and for long suburban routes, using either the De Dion & Bouton, the Panhard & Levassor or the Daimler (petroleum motor) systems. The cost of operation per month, including wages, cleaning, licenses, and all expenses, is estimated at $160 for the horse omnibus, $127 for the steam omnibus, and $99 for the petroleum omnibus; the cost for the two latter being 73% and 62% of that for the former. It seems very doubtful, however, whether the time has yet arrived for a business sufficient to give satisfactory financial returns.

PORTABLE PNEUMATIC RIVETERS IN SHIP-BUILDING.

At the recent New York meeting of the Society of Naval Architects and Marine Engineers, Mr. W. I. Babcock, Manager of the Chicago Shipbuilding Co., read a paper on the above subject. This company is equipped to drive every rivet in a ship by power machines, operated by unskilled labor; and Mr. Babcock gives a history of the development of portable riveting machines in shipbuilding at his company's works.

A beginning was made with a stationary steam riveter, with a horizontal ram and a 5-ft. gap, and it was used for such pieces of work as could be brought to the machine and handled by a chain hoist working on an overhead trolley. This riveter has driven 1,800 rivets in 10 hours, at a cost not exceeding ½ ct. apiece, or a saving of 2¼ cts. over the labor scale rate for driving such rivets by hand.

For the first portable machines, compressed air was used, as it was feared that the severe climate might interfere with hydraulic power. Moreover, the air-power could also be used for calking and chipping hammers and drills or reamers, and an air-compressing plant was a necessity anyhow. Compression bow riveters, such as are used in bridge shops, were first tried; but they were too light for the work and too difficult to handle about a ship. In 1896, some experimental rivets were driven with an ordinary pneumatic calking hammer, at the works of the Lassig Bridge and Iron Co., in Chicago. This was tried in the shipyard and the method was found to be feasible; but the blows of the hammer were so heavy and continuous that it was impossible to "hold-on" the rivets by the ordinary hand hammer, which was fairly jarred off the rivet-heads. A pneumatic "holder-on" was then devised, of simple construction. It was simply a cylinder, into which air was admitted and then forced out a piston with a cup to go over the rivet-head; by screwing a piece of pipe to this device it was easy to obtain a bearing, or resistance for this cylinder among the longitudinals in the double bottom of lake steamers.

The next step was to connect the hammer and holder-on by a horse-shoe frame, as shown in Fig. 1. A variation in the device is to mount the hammer itself as a piston in a cylinder, to which air is admitted to force out the hammer as the point of the rivet is beaten down. A plain die is used on the other side, and this die can be small enough to go into contracted places. As arranged for various depths of gap, these machines weigh as follows: 9 ins., 83 lbs.; 51½ ins., 160 lbs.; 70 ins., 220 lbs. In the larger machines the bow is made of a piece of wrought-iron pipe.

These machines do better work than hand riveting. In the first place, it requires constant watchfulness, in hand work, to prevent the men from knocking the head over at once, instead of striking the first blows exactly in line with the axis of the rivet and properly filling the rivet hole. With the machine, the blows of the hammer are naturally in line and they are so rapid that "plugging" is accomplished before the point is formed. As the machine work is quicker, the driving is completed before the rivet has lost its heat and the contraction afterwards draws everything firmly together and strengthens the joint by friction between its parts. Then in a ship, there are many places where there is not sufficient space to swing a hammer, or where the rivet can only be gotten at from one side. In these places hand riveting is never what it should be; while these considerations do not affect the machine.

In deck, tank and outside shell rivets, with countersunk flush points, a machine with a separate pneumatic holder-on is employed; and three men and a heater-boy will drive from 800 to 1,000 of these rivets in a working day. In the case of bulkhead rivets, with full or button point, the combined hammer and holder-on can be fastened to the end of a beam which slides loosely on a central supporting stud bolted to the bulkhead, with an adjustable stud-bolt at the other end of the beam governing the distance of the hammer-die from the rivet-point; and thus a number of rivets may be reached at one setting. The pneumatic holder-on may be similarly mounted on the other side of the bulkhead. For flush-pointed rivets a very different arrangement is required. As in hand-work, the varying thicknesses of plating, liners, butt-straps, frame flanges, etc., and the amount of countersink in the plate, make it impossible to gage the length of rivet under the head that will exactly fill flush to the plate surface. Here the hand method is practically followed; the rivet is beaten down with surplus metal crowded off to one side; this metal is then chipped off by hand or by a pneumatic chipping chisel, and the rivet is properly finished on the point. To do this, some freedom of motion must be given to the hammer, so that it is possible to incline its axis, to properly crowd the metal to one side and facilitate chipping. For this purpose hammers are mounted on gimbals; or, so mounted in a frame that while the die is held in position against the rivet the lower end may be given a rotary motion; or, the hammer may be mounted on trunnions and the beam carrying it turned on its own axis and moved forward and back longitudinally. Mr. Babcock thinks the second method not so good as gimbals, and he had never tried the third.

Still another method of driving countersunk flush rivets is to fasten the hammer immovably to the end of the beam, as in the bulkhead riveter; and the flat-faced die has a central 3-16-in. hole drilled in it. When the rivet is beaten down some of the hot metal enters the hole and the result is a projectng teat on the rivet-head, with the remainder of the surplus metal flattened out equally on all sides. This surplus metal is removed by a face milling tool, which also has a central hole fitting over the teat and holding the tool in position. The milling tool is driven by a pneumatic drill, and after the point of the rivet is milled down flush with the plate the teat is easily cut off by the blow of a hand hammer or a cold chisel. This rivet is not, however, quite "shipshape" in finish, and it is difficult to get a milling tool of the right shape to properly cut it. In the yard of the Chicago Shipbuilding Co. the first method described is alone used, as the most satisfactory.

For bottom rivets the beam is hung by a bolt through its center, on which it rotates, to a trolley running inside of a slotted pipe bolted to the bottom of the ship; this enables the operator to reach many rivets at one setting.

For side riveting the machine is attached to a counterweighted horizontal pipe, hung from pulleys above inside of flat iron guides bolted to the ship's sides. For the bilges the hammer beam is again a horizontal pipe fastened to a double frame which fits the bilge and travels on trolleys above and below.

Mr. Babcock says that it is the unanimous opinion of the hull inspectors that the machine rivets are first-class in every respect, and make better and tighter work than those driven by hand. Adding cost of air, repairs, etc., the saving is from 1 to 2 cts. per rivet over piece-work prices for hand-riveting, and averages 1¼ cts. This means a saving of from $4,000 to $5,000, over hand-work, in an ordinary 4,000-ton lake steamer. An important advantage is that unskilled labor can, with these riveters, successfully replace skilled labor of a class hitherto regarded as indispensable, and correspondingly troublesome with regard to strikes, etc.

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THE FIREPROOFING OF WOOD FOR THE NEW UNITED STATES BATTLESHIPS.

The terrible experience of at least two of the Spanish cruisers in the naval battle off Santiago added to the destruction by fire of the Chinese vessels in the battle of the Yalu River, in the Chinese-Japanese war has, as many of our readers are aware, brought about the decision to construct our new battleships with fireproof or non-inflammable wood. This order applies to the first-class battleships "Maine," "Missouri" and "Ohio," and is a direct reversal of the policy previously determined upon, which was to use the material for interior construction only, as the result of the experience in peace service with the monitor "Miantonomoh" and the gunboats "Helena," "Newport," "Vicksburg," "Wheeling," "Princeton," "Wilmington," "Nashville," "Marietta" and "Annapolis," all of which were finished with fireproof wood at the time of their construction in 1895-7. The objections raised to the use of fireproof wood on these vessels were briefly as follows: Fireproof wood is heavier, much harder to work, and not so strong as the untreated material; the contained chemicals corrode metals, which come into contact with the wood, prevent the wood from taking paint, and injure clothes kept in drawers made of it. These objections were investigated in 1897 by a board of naval officers, which sustained them in a majority report to the Navy Department, and also advised that the use of fireproof wood on war ships should be abandoned. In a minority report, however, Chief Naval Constructor Hichborn, of the Board of Investigation,

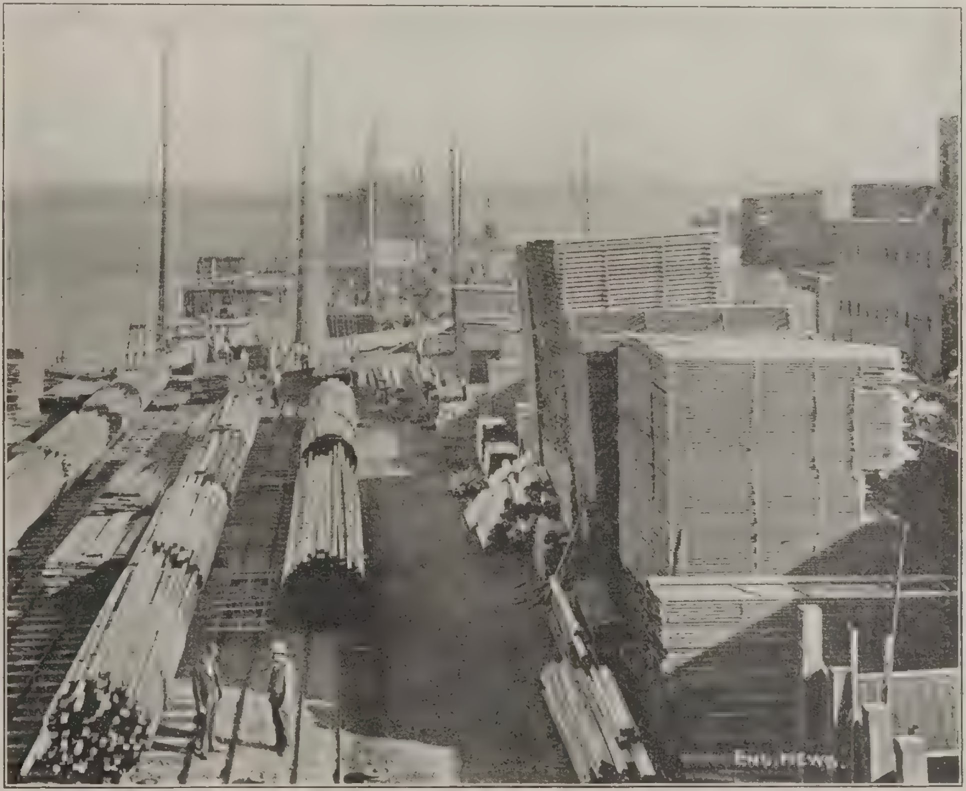


FIG. 1.—YARDS SHOWING LUMBER IN STORAGE AND LOADED ON CARS READY FOR FIRE-PROOFING.
Electric Fireproofing Co., New York, N. Y.

took a contrary position, claiming that the objections raised were not warranted by facts and urging the great value of non-inflammable wood fittings and finishing in time of battle as compared with such minor objections as really existed. The question rested in abeyance until the fight at Santiago showed that if war ships are to resist successfully heavy fire from modern batteries it is of the greatest importance that any woodwork about the superstructure should be made non-inflammable.

The employment of fireproof wood on so extensive scale as is contemplated in the recent orders of the naval authorities is sufficient to make a description of the method of its preparation of interest to engineers, and we have collected from various sources such information of practical interest as is available concerning both the process of fireproofing and the actual fireproofness, durability, strength, etc., of the wood after undergoing this process. It is also apparent that if fireproof wood shall prove to be what it is claimed to be, viz.: non-inflammable, with its strength and durability and the various other qualities of the natural material uninjured, naval construction is evidently only one of many fields of usefulness. In timber construction generally, and in fireproof building construction particularly, the advantages of such a material are many.

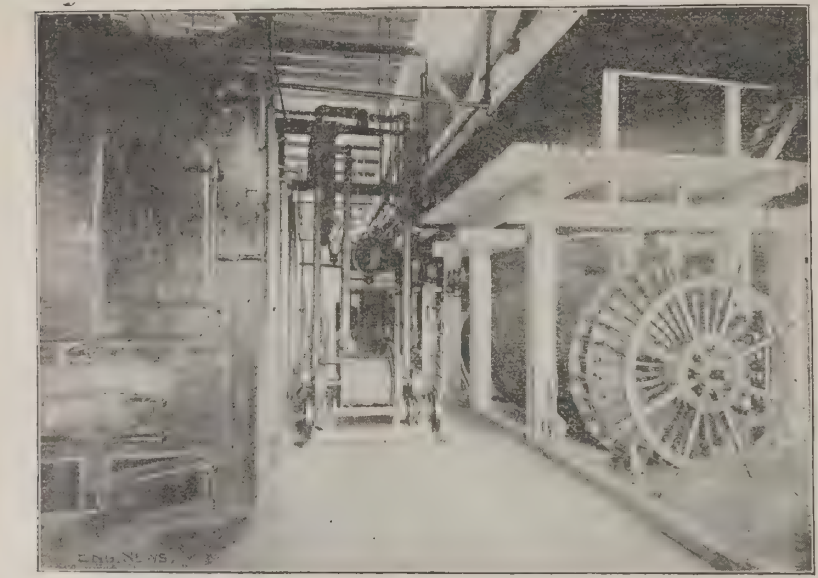


FIG. 2.—INTERIOR OF WOOD FIREPROOFING PLANT, SHOWING CYLINDERS, WITH SOLUTION TANK OVERHEAD, AND THE PIPING SYSTEM.

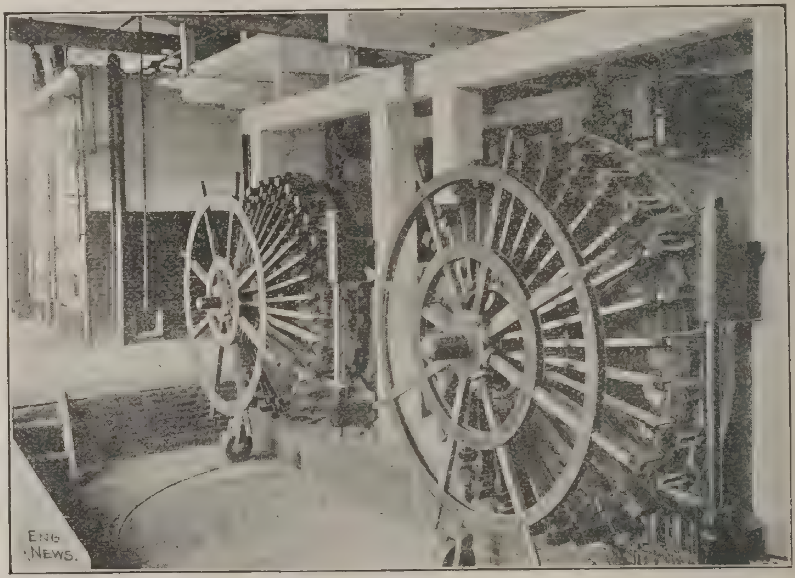


FIG. 3.—INTERIOR OF WOOD FIREPROOFING PLANT, SHOWING CYLINDER HEADS AND COVERS.

Turning now to the process which is employed for fireproofing wood for United States war vessels, it can be described in a general way as resembling very much the process of creosoting timber to preserve it from decay. The timber to be treated is placed in an air-tight cylinder and enveloped in an atmosphere surcharged with aqueous vapor at a temperature of from 110° to 200° F., until its pores or cells are opened. The moisture is then evaporated from the wood by creating a vacuum in the cylinder. When the evaporation is completed the cylinder is filled with the fireproofing solution consisting of phosphate of ammonia and sulphate of ammonia, with, in some cases, other chemicals, and pressure is applied to force the solution into the pores of the wood. After this saturation the wood is thoroughly kiln-dried at a temperature of from 85° to 125° F., which solidifies the chemicals contained in the pores. More complete details of the process and of the plant used to conduct it will be given further on, but right here it will make some features of the work more clear if we consider another phase.

The end which is sought in fireproofing wood is not merely to render it non-inflammable, but to do this without injuring its structural and decorative qualities. To preserve the strength, elasticity and life of the wood its cellular structure must not be broken down or injured in the process of filling the cells or pores with the fireproofing liquid. This requires a thorough knowledge of the age, texture, condition, etc., of each kind of wood treated, for all of these things affect the strength and toughness of the fibers, and, therefore, their resistance to injury. To fill the pores of a crooked-grained, gnarled piece of oak with the fireproofing solution is an entirely different task, for example, than filling pores of a straight-grained stick of white pine; the quantity of solution required is different, the pressure necessary to force it into the wood is different, and the preliminary processes of saturation and evaporation likewise differ.

The first work in the process of fireproofing wood, therefore, is to sort the timber according to its various natural and acquired characteristics. This being done, it is put through the successive treatments of saturation, evaporation, impregnation and kiln-drying with such particular characteristics of manipulation as previous experiment and experience have determined to be necessary to secure the best results for wood of its kind and condition. It will be seen at once that the success of fireproofing wood depends largely upon the intimate knowledge of woods and experience in their treatment which the operator possesses.

The plant at which the fireproofing of wood for the new battleships is being done is located on the East River front, between 19th and 20th Sts., in New York city, and is owned by the Electric Fireproofing Co., which controls the process. Figs. 1, 2 and 3 are views of the plant. Fig. 1 shows the yard for the storage and shipment of lumber, with a number of charges of treated and untreated material loaded on the cars ready for further processes; Fig. 2 is a view inside the plant showing one of the cylinders, the solution tank above it, the steam and other piping, and other apparatus, and Fig. 3 is a nearer view of the front ends of the two cylinders showing the construction of the covers or doors.

The cylinders are 105 ft. long and about 7 ft. in diameter, and hold when filled about 15,000 ft. B. M. of timber. The material of the cylinders is steel ¾-in. thick. Referring to Fig. 4, a, a, are rails upon which the cars loaded with lumber are run into the cylinders. Below the trucks and the bodies of the cars when they are in the cylinder is the steam coil d, d, which runs the whole length of the cylinder. Adjacent to these coil pipes is an apertured pipe e also running the full length of the cylinder. This pipe e brings steam to the cylinder and the apertures in it increase in size from the points of entrance of the steam so as to deliver the same quantity of fluid at all points. The pipe e connects with a pipe f, which leads outside of the cylinder to a T-coupling g, to which a pipe h is connected on one side. This pipe h leads from the pressure pump and serves to bring liquid to the cylinder from the pump. A pipe i connects to the opposite side of the T and serves to admit steam to the cylinder through pipes f and e at the appropriate time and to exhaust the same therefrom. This pipe has a number of branch pipes k, l, the source of the steam supply being connected to l and k being the exhaust pipe.

The mud drum B of the cylinder is connected to the cross coupling C by the arm m, the opposite arm n being a vent to clear the mud drum. Connected to the arm m' of the cross coupling is a pipe D, which is provided with a valve d' and leads to the bottom of the tank containing the fireproofing solution, and connected to the opposite arm n' is the pipe F which serves to return the unused liquid from the cylinder to the supply tank. Along the top of the cylinder are a number of pressers G, which, when screwed down upon the top of the lumber, hold it firmly in place.

The method of operation is then as follows: the lumber being in the cylinder and the cover firmly closed, a depth of 3 ins. to 6 ins. of water is introduced; all the valves except those in the steam pipe are closed, and steam at low pressure is introduced by means of the pipes l, i, g, f and e and through the water into the cylinder. This process continues for from one to eight hours, the temperature being maintained from 110° to 200° F., depending upon the kind of wood being treated and is very important, its purpose being to open the pores of the wood and fill them with moisture. Aqueous vapor at a low temperature is employed. If live or dry steam at a high temperature is used it has been found that the wood is discolored, and its elasticity and tensile strength are reduced. Moreover, the action of the heat is to seal rather than to open the pores of the wood, forming an impenetrable outer shell to the timber, and preventing the introduction of the fireproofing fluid. The mild action of the aqueous vapor, on the contrary, opens up the pores of the wood like a sponge.

The process of saturation being completed, that of evaporation is begun by gradually inducing a vacuum in the cylinder to exhaust the moisture from the pores of the wood, and leave them open for the entrance of the fireproofing fluid. This vacuum is broken about every three hours to allow the accumulated moisture to be drawn off from the cylinder, and it is kept up until the lumber is dried. When the work of evaporation is finished a final vacuum of from 20 ins. to 28 ins. is induced in the cylinder, and the fireproofing solution is then admitted to the cylinder from the tank above it. Care is taken to have the temperatures of the timber and of the solution the same, as this facilitates the impregnation. The fluid is allowed to fill the cylinder completely, and at first the pressure is only that due to the head of the liquid and to the vacuum. Finally, however, the liquid is shut off from the tank, and the pressure pump is started, forcing liquid into the cylinder through the pipe k. Gradually the wood takes up the fireproofing solution, and when the gages show that it has absorbed all it can hold, the remaining liquid is drawn off.

The final step is to kiln dry the treated timber. This is done slowly at a low temperature, not more than 125° F. Particular importance is claimed for this low temperature process of drying. Greater heat, it is asserted, tends to make the wood brittle and to discolor it, while temperatures of from 85° to 125° F. preserves all the elasticity and life of the natural material. Except for the low temperatures employed, the process of kiln drying presents no differences from the process ordinarily used.

The process of fireproofing wood as conducted by the Electric Fireproofing Co. is perhaps sufficiently described in the preceding paragraphs. At the present time the company is treating regularly the following timbers: Mahogany, cherry, butternut, walnut, red oak, sycamore, maple, birch, pine, ash, spruce, elm and white wood. The charge of fireproofing is the same for all kinds of wood, $50 per M. ft. B. M., exclusive of the final kiln drying. The company either furnishes the wood fireproofed at the usual market price plus $50 per 1,000 ft., or will fireproof wood furnished by others to order.

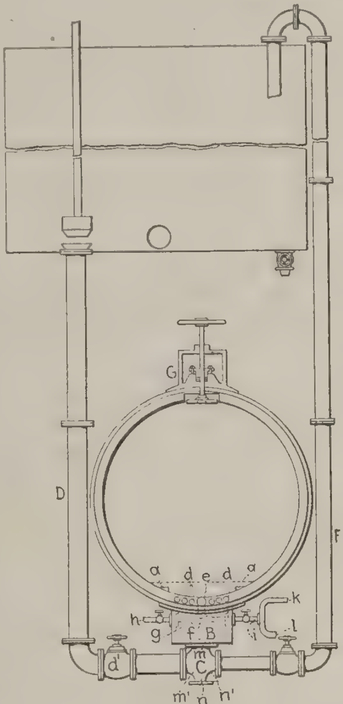


Fig. 4.—Diagram Cross-Section of Cylinder and Solution Tank Illustrating Operation.

Although generally spoken of as fireproof, wood which has undergone the process described is more correctly described as non-inflammable. When exposed to flame the wood chars, and will, if the flame be continued, be completely carbonized. Non-inflammable, however, is pretty certainly obtained. Shavings and splinters of the treated wood held in an alcohol flame will char, but will not catch fire nor retain the flame when removed; in fact, the glowing coal on the charred wood almost immediately goes out upon removing the source of heat. Small test buildings built of the treated wood and having kindling saturated with oil piled inside and around them, have been fired in New York (Eng. News, Aug. 29, 1895) and in London, and have shown almost as perfect non-inflammability. The standard for fireproof wood adapted by the United States Navy Department, and to which all the treated wood supplied for the new battleships conforms, is that, "when dry and subjected to heat of 600° F., it will remain non-inflammable and absolutely safe against spread of fire from point of contact."

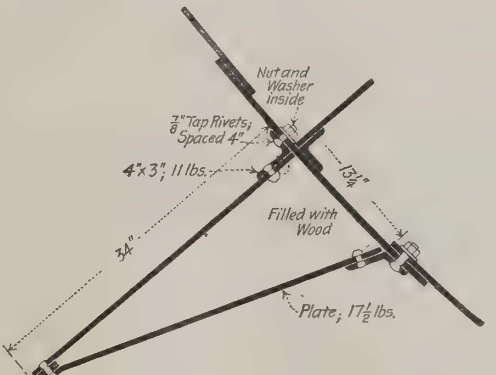
The fireproofing material contained in the wood is solid and non-volatile, and the fireproof quality of the wood is, therefore, claimed to be permanent. Even by long continued soaking, it is stated, the fireproofing material is not injured or withdrawn. The material is also claimed to have no injurious action upon paint or varnish, or upon nails driven into or hardware attached to the woods, provided it is thoroughly dried. It, however, makes the treated wood slightly darker than its natural color. The treated wood is also harder and somewhat heavier, and as a consequence is harder to work, but by a proper tempering of the tools this difficulty is easily overcome. In respect to the strength of wood which has been fireproofed, we find records of tests made in the laboratory of Stevens Institute, Hoboken, N. J., and at the Watertown Arsenal. In the Stevens Institute tests of both Oregon pine and yellow pine showed a loss of from 2.4% to 12.6% in transverse strength by being fireproofed. White pine, however, showed an increase of 7% by being fireproofed. In compressive strength both white and yellow pine showed a loss due to fireproofing of from 6.4% to 9.2%. In tension, however, white pine and yellow pine showed gains in strength of 19.6% and 24.2%, respectively. In tests made at the Watertown Arsenal for transverse strength both white pine and white wood showed a gain from fireproofing. These results do not agree very well, because, it is stated, of the difference in degree of heat applied in the kiln drying, which is a matter easily corrected, but they show generally that the wood is rendered somewhat more brittle by the fireproofing treatment. It is pointed out that these tests were made some time ago, and it is stated that the recent improvements in the process of fireproofing have corrected many of the former objections.

In conclusion it may be stated that so far as we have been able to ascertain, the Electric Fireproofing Co., illustrations of whose plant we present herewith, and its offspring the British Non-Inflammable Wood Co., are the only concerns which now manufacture non-inflammable wood on a marketable scale.

BILGE KEELS AND ROLLING EXPERIMENTS.

At the sixth general meeting of the Society of Naval Architects and Engineers, held in New York last week, Asst. Naval Constructor Lawrence Spear, U. S. N., presented a paper with the above title. He stated that the original designs for the battleships "Oregon," "Indiana" and "Massachusetts" called for bilge keels about 30 ins. deep; but to facilitate docking these keels were omitted in building. This omission was at the time in line with the best foreign practice, and theoretical considerations led to an underestimation of the steadying effect of bilge keels of any practical dimensions as applied to slow-moving ships of large displacement and inertia.

But while these ships were nearing completion foreign practice, and, especially, that of England, underwent a change, as the result of comparisons of sister battleships with and without keels. Experience with the "Oregon" class at sea showed that some steadying influence was necessary; though the maximum inclination of the "Oregon" herself never exceeded about 22°, under a long, low swell. Bilge keels were put on the "Oregon" in January, 1898. These keels had a maximum depth of 34 ins. near the ends, tapering to 14 ins. amidships. The comparison in rolling effect, with and without keels, is shown in the following table:



Section of Bilge Keel Fitted to U. S. Battleship "Oregon."

	Keels, Without.	Keels, With.
Date of trial	Dec. 30, 1897.	Feb. 17, '98.
Draft, forward	22 ft. 9½ ins.	22 ft. 9 ins.
" aft	23 " 8½ "	23 " 8 "
" mean	23 " 3 "	23 " 2½"
Displacement, tons	9,810	9,790
Metacentric height, feet	3	3
Mean period, single swing, secs.	7.6	7.83
Weight of coal, tons	115	50
Weight of ammunition, tons	26.7	26.7
Bilge keels, number	0	2
Length		207 ft. 6 ins.
Greatest depth		34 "
Least depth		14 "
Total area		830 sq. ft.
Effective radius,		34.4 ft.

Except as above stated, conditions were alike in both cases. At slack water, and practically no current, with ship moored and without keels, 350 men running across the deck caused an inclinaton of about 7° from the vertical; with 200 men acting in conjunction with the 8-in. turrets, an inclination of nearly 6° was reached. Without bilge keels the rolling was practically isochronous within the range of experiments. With bilge keels, the period for single swing decreased slightly with the amplitude of roll. As measured by the radius of gyration, the period without keels was 7.6, and that with keels, 7.83, a difference of a little over 3%.

The results of the observations were plotted as "curves of declining angles" and "curves of extinction," and these were compared with corresponding curves for the first-class English battleship "Revenge," in light condition. It is noted that the "Oregon," starting at an inclination of 6°, required, without keels, 60 swings to reduce this inclination to 2°; while with keels the corresponding extinction required only 10 swings. For the "Revenge" the corresponding figures were 45 and 8. Taking the extinction value of the "Oregon," without bilge keels, as unity, the curves gave the following results at an inclination of 5° from the vertical:

"Oregon," light, no keels	1.0
"Revenge," light, no keels	1.32
"Oregon," light, with keels	7.36
"Revenge," light, with keels	8.18

The "Oregon's" loss of range per swing with this inclination is thus over seven times greater with keels than without; and this figure holds approximately true for any other angle within the range of experiments. In the case of the "Oregon," the same forces that would produce an unresisted roll of 20° would only produce one of 6° with the keels in place. In the case of the "Revenge" these figures were about 18° and 6°; or, broadly speaking, the roll, with keels, under identical conditions, would only be one-third as great as without them.

Generally speaking, it appears to be pretty well established that the entinction work done by keels may be divided under these three main heads: (1) Increased wave-making resistance; (2) disturbance of natural stream line motions about the ship; (3) direct resistance of plain surfaces of keels. As yet we have no data on which to base a quantitative division of the total resistance under these three heads; but it can be easily shown that the third is a comparatively small factor. Constructor Spear then mathematically stated, on the assumption of the late Mr. Froude, that 1.6 lbs. per sq. ft. is the resistance of the keel harmonically oscillating at a mean speed of 1 ft. per second, that the direct resistance of the keel is responsible for but a small part of the work done in steadying the vessel. As the third effect is practically unsolvable, with the data at hand, it is recommended that tank experiments be made so that naval architects may later obtain some emperical formulae sufficiently accurate for general design.

While service conditions prevented fuller trials of the "Oregon," the English experiments proved, what was to be expected, that the bilge keels had an increased effect when the ship was under way, and that the steering qualities were improved and tactical dimensions were decreased by the addition of keels.

STANDARDIZED CAST-IRON DRILLINGS FOR ANALYSIS.

The Committee appointed by the American Foundrymen's Association to establish a Bureau for the distribution of uniform standardized drillings, has issued a circular saying that it is now able to distribute a range of samples that it is felt will meet the indorsement of managers and chemists employed in all branches of the iron industry, pertaining to the making or use of pig iron.

The standardized samples now ready for distribution cover the following determinations: Silicon, sulphur, manganese and phosphorus, one each of a low, medium and high range; total carbon and graphite, one determination each; titanium, three determinations; in all, 17 determinations, made on four samples.

The samples are designated as A, B, C and D. Sample A, which has been ground to pass a 40-mesh sieve, gives one total carbon and one graphite. Sample B gives a low silicon, a medium sulphur, a low manganese, a phosphorus within the Bessemer limit, and a titanium. This has been passed through a 20-mesh sieve. Sample C gives a medium silicon, high sulphur, medium manganese, medium phosphorus and a titanium. This has also passed a 20-mesh sieve. Sample D gives a high silicon, low sulphur, high manganese, high phosphorus, and a titanium, and has passed through a 40-mesh sieve.

The drillings were obtained from castings made after the plan described by Mr. West in his paper before the Pittsburg Foundrymen's Association, June, 1898. The drillings were prepared under the supervision of Prof. C. H. Benjamin, and the standardizing under that of Prof. A. W. Smith, both of the Case School of Applied Science, Cleveland. The chemists engaged in standardizing the four samples are Messrs. Booth, Garrett & Blair, Philadelphia; Prof. A. W. Smith, and Cremer & Bicknell, Cleveland, O., and Andrew S McCreath, Harrisburg, Pa.

The standards are sold at the price of $5.00 per lb., and in no instance will less than 1 lb. be sold. The samples are packed in bottles, holding one-third of a pound and delivered in cases holding three or four bottles, according to the desires of a subscriber. One pound of the samples should furnish enough material for 36 complete analyses, or at least 200 separate determinations. The analyses of the samples, A, B, C and D will be sent separately by mail, so that they may be placed upon bottles or kept private, as desired by the subscriber.

About 35 leading laboratories have already subscribed for samples. Orders for samples may be sent to any member of the following committee: Thos. D. West, Chairman, Sharpsville, Pa.; Dr. R. Moldenke, 48th St. and A. V. Ry., Pittsburg, Pa.; James Scott, Lucy Furnace, Pittsburg, Pa.; P. W. Gates, Gates Iron Works, Chicago, Ill.; E. H. Putnam, "The Foundry," Detroit, Mich.

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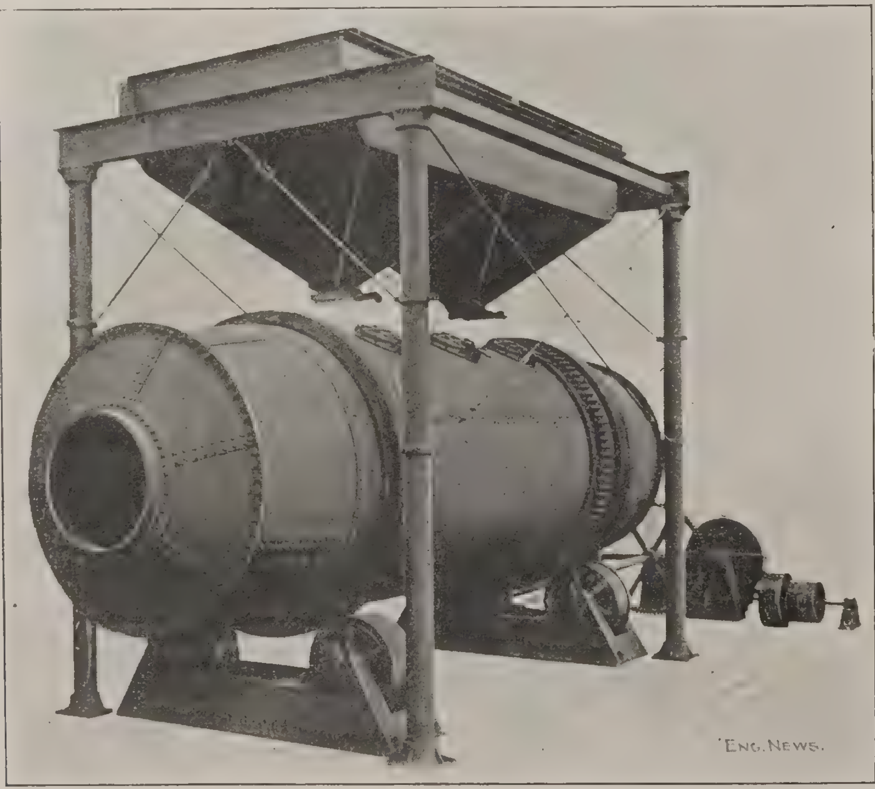
ROTARY FURNACES FOR ROASTING ORES.

The accompanying cut represents one of six large Bruckner rotary furnaces for treating ore, which are probably the largest ever built. Each furnace is 28 ft. long and 8 ft. 6 ins. diameter, with an end opening of 3 ft. 4 ins. diameter. Its capacity is about 20 tons of ore. Around the shell are two circular bearings or roller paths, which rest upon four 34-in. rollers in the bed-plates. Lateral motion is prevented by having one pair of the rollers made with double flanges. The total weight, including the charge, which is carried by the rollers, is 101,000 lbs. An iron frame supports two hoppers, and the furnace has three doors in the shell. Two of these are for receiving the charge from the hoppers, while the third is to facilitate the discharge of the roasted ore.



20-TON ROTARY ROASTING FURNACE. Gates Iron Works, Builders, Chicago, Ill.

The furnace is revolved by a pinion gearing with a circular rack attached to the shell. The pinion is carried by one of the bed-plates and is driven by a spur gear and worm-wheel and worm-shaft, the latter being on the shaft of the belt pulleys. Two belts are used, one for high speed and the other for low speed. The furnace makes about one revolution per hour while roasting and six per hour when discharging. Six of these furnaces have recently been built for the Canadian Smelting Works, at Trail, B. C., by the Gates Iron Works, of Chicago, and we are indebted to the builders for the above information respecting them.

* * *

ELECTRIC POWER IN THE NEW PRINTING PLANT OF THE W. B. CONKEY CO., HAMMOND, IND.

The recent removal of the large printing plant of the W. B. Conkey Co., from Chicago, Ill., and its re-establishment in new buildings at Hammond, Ind., has given the opportunity for one of the most comprehensive applications in this country of electricity to the work of a printing house. This new plant is fully described in a paper read before the Chicago Electrical Association, on Nov. 4, 1898, by Mr. Geo. A. Damon, and we abstract from that paper the following facts of general interest.

The reasons which first of all led to the removal of the firm's plant from the city to the suburbs was the saving which it was found could be effected in many ways. In the city taxes were necessarily high, and the insurance rates large on such property. Another great disadvantage of the city plant was the cost and delay of cartage through the congested city streets to and from the railway depots. The necessity of artificial lighting, and, also, the fact that the power transmission as established was expensive, were also important factors in deciding the change of location. To secure adequate natural light, in fact, especial attention was given to the design of the new building.

The plant at Hammond, as finally erected, consists of a single story building, 520 x 450 ft. The roof is of the weaving shed or saw tooth type, and all its windows are glazed with frosted glass and are placed at an angle looking toward the north. Every 29 ft. of roof space provides 11 ft. of light. Owing to the angle of the roof the direct rays of sun are kept out of the building, which is thus lighted by the soft reflected rays from the northern sky. The entire roof is built up of light structural steelwork resting upon cast-iron columns spaced 29 ft. c. to c. one way, and 16 ft. c. to c. in the other direction. The height of the trusses above the floor is 12 ft.

The generator plant consists of two engines and three 100 K-W. 225-volt generators connected on the Arnold system, described in Engineering News of Jan. 26 and Aug. 28, 1898. The power is conveyed to 95 motors distributed as follows:

		HP.
	Electrotype Foundry.	
17	Motors, belted or geared to dovetailing machine, trimmers, planers, roughers, saws, routers, black leaders, molding machines, beveling machines, blowers and jig saws	21
1	Direct-connected to electroplating dynamo	10
	Bindery.	
15	Belted to shafting driving folders, book-covering machines, trimmers, sewers, wire-stitchers, sewing machines, case makers, embossers, rounding and backing machines	52
2	Direct-connected to shafting driving cutters and smashers	10
8	Individual motors belted to knife-grinders, tying machines and gluing machines	18.5
	Stock Room.	
2	Belted to shafting driving cutting machines, rotary board cutters, grinding machines, sizing machines and bevelers	6
	Heating Apparatus.	
1	Belted to blower fan to heat office	12
	Machine Shop.	
1	Belted to line-shaft driving machine tools	10
	Composing Room.	
1	Belted to shaft driving type-setting and distributing machines	3
	Press Room.	
6	Belted to job presses, ink grinders and bronzing machines	5.5
41	Directly attached to presses	173
	Total horse-power of motors installed	321

The motors are of the Lundell type. Each motor is made with one field coil, which is entirely protected by the form of the field casting. The armature is of the ironclad type with removable form-wound coils. The motors have a steady neutral point of commutation, and do not spark under sudden changes of load. The motors directly attached to the presses and shafting are multipolar, narrow in width, with a relatively large circumference of field frames. The commutator, like the armature, is narrow and of large diameter, with a large number of bars.

Besides the improvement in lighting, ventilation and cleanliness, and the advantages of a more perfect control of the various machines, the new plant has exhibited a notable saving in fuel. Mr. Damon in his paper states that the result of the operation of the new plant is that only about one-third of the amount of coal is burned that was required before the move was made. A part of this saving, he says, however, must be attributed to the design of the power plant, with its modern equipment, so that just how much economy has been gained by the operation of the purely electrical part of the plant cannot be definitely determined.

The Corliss engine was furnished by the Atlas Engine Co.; the motors, by the Sprague Electric Co.; the motor, controllers and starting boxes by the Cutler-Hammer Mfg. Co., and the switchboard and wiring by the Western Electric Co. Mr. George C. Nimmons was the architect of the building, and Mr. Bion J. Arnold, M. Inst. C. E., was Consulting Electrical and Mechanical Engineer.

* * *

TEST OF THE BULKHEAD SEPARATING THE ENGINE ROOMS OF THE BATTLESHIP "ILLINOIS."*

By J. J. Woodward, M. Soc. N. A. & M. E.†

The specifications for the U. S. battleships "Kearsarge," "Kentucky," and "Illinois" require all watertight compartments to be tested by filling the compartments with water under a head; and the most important bulkheads, whose strength it was desired to test in this manner by actual water pressure, were the center-line longitudinal bulkheads existing between the engine rooms and fire rooms on the vessels in question. These bulkheads were all of large size, and the head of water directed to be used for the test was 5 ft. greater than the normal load water-line of the ship. This corresponded to a water level during test of 28 ft. 6 ins. above the keel. The bulkheads were all of approximately the same depth, namely, 23 ft. 5⅞ ins., and they were very strongly supported on all sides, being limited at their bottom by the inner bottom of the ship, and at their top by a heavy protective deck, which was formed by two thicknesses of ½-in. steel plating and an upper thickness of 1¾ ins., all three riveted together in an efficient manner. The ends of the bulkheads were also well supported by complete transverse bulkheads extending across the ship.

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*Abstract of paper read at the sixth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, Nov. 10 and 11, 1898.

†Naval Constructor, U. S. N., Newport News, Va.

As all the work had been carefully inspected during construction for general workmanship (which was found to be entirely satisfactory), and the principal point it was desired to determine was whether the scantlings of the bulkheads, as built, were ample for the work they had to perform, it was considered that if one bulkhead was tested and shown to be entirely satisfactory, that the other bulkheads would be considered as satisfactory, subject to passing a test with hose, for local defects in calking. As the length of the bulkheads separating the engine rooms was greater than those separating the fire rooms, and were consequently of the greatest area, since all of them had the same depth, the bulkhead separating the two engine rooms on the "Illinois" was chosen for the test for strength.

The volume of one engine room being such that to have filled it with water would have resulted in a possible injury to the general structure of the vessel which, at that time, was on the blocks of the building slip, it was decided to make the test by building in the port engine room a wooden cofferdam, placed about 3 ft. 9 ins. from the center-line bulkhead under test, the cofferdam being made of 5-in. plank. In this manner the weight of water necessary for the test was reduced to a very moderate amount, and it may be remarked in passing, there was no difficulty (with the exception of a slight amount of leakage, which occurred during the first test, on account of a defect in calking the plank), keeping up the pressure desired for the tests. It should be stated further that the water level of 28 ft. 6 ins. above the keel, required for the full test, was obtained by means of a small stand-pipe connecting with the water space within the cofferdam, through a circular hole in the protective deck. The bulkhead was subjected to three series of tests by filling the space between the cofferdam and the bulkhead with water, and carefully measuring the deflection on all stiffeners corresponding to different heads of water.

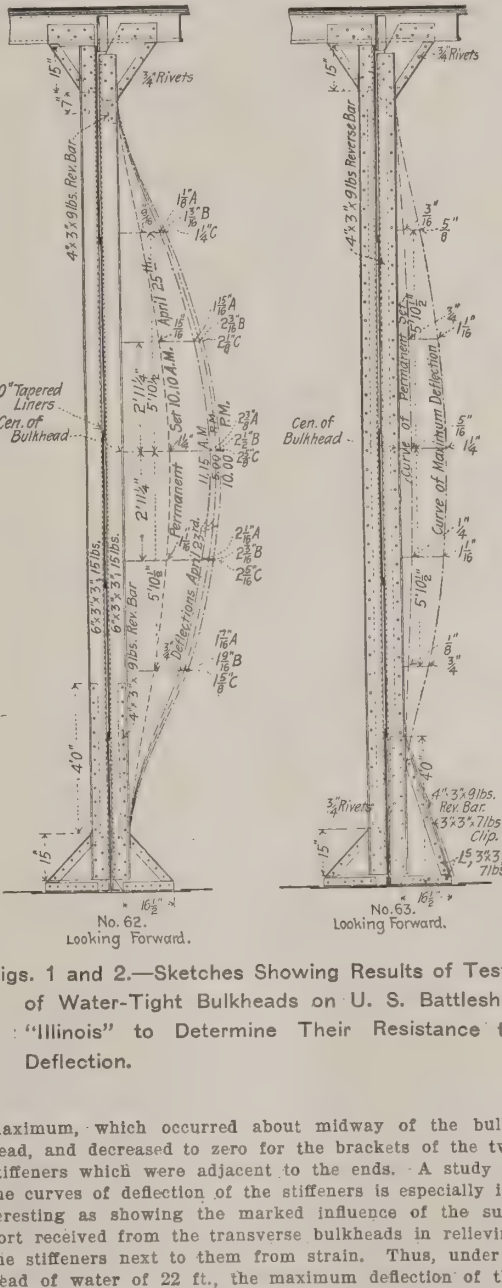
First Test.—Before the test, the actual shape of the bulkhead was carefully determined by measuring on each stiffener the distance from a vertical reference plan parallel to the center-line of the ship, these measurements being taken at three points, respectively, 5 ft. 10 ins., 11 ft. 8 ins., and 17 ft. 6 ins. above the top of the inner bottom plating, the measurements being taken on the side opposite the cofferdam, so that corresponding measurements could be made after the space between the cofferdam and the bulkhead was filled to different water levels

On beginning to fill the cofferdam space with water, no appreciable deflection could be noticed until the head of water had reached a height of 8 ft. above the inner bottom plating. At that height, however, a slight deflection was measured, and the filling of the cofferdam space then proceeded with, the water levels being maintained constant for heads of water corresponding to the heights of 12 ft. 9 ins., 16 ft., 18 ft., 20 ft. and 22 ft. above the inner bottom, measured as described, for such lengths of time as permitted the three measurements on each stiffener to be taken for the deflection corresponding to such heads of water. These intermediate water levels correspond, approximately, if we add the depth of the inner bottom space, to the 15 ft., 19 ft. 3 ins., 23 ft. 3 ins, and 25 ft. 3 ins. water-lines of the ship.

A careful examination of the behavior of the bulkhead while under test, showed that up to a head of 18 ft. the deflection increased very regularly, and, as well as could be judged, the material forming the center-line bulkhead had not, up to the head of 18 ft., been strained beyond its elastic limit. Between the heads of water of 18 and 20 ft. the deflections increased much more rapidly, and, as well as could be judged, the elastic limit of the material was passed somewhere between these two points. Between heads of water of 20 and 22 ft., the deflections of the stiffeners increased very rapidly indeed, though up to the latter head no leak showed at any of the butts or seams, although a few drops of water went through four or five rivets. Just as the water level reached the head of 22 ft., the lower brackets of the Z-bar stiffeners connecting them to the inner bottom plating buckled badly, as did also the brackets at the upper end of the stiffeners, where connected to the beams of the protective deck. The buckling of both upper and lower bracket plates decreased rapidly for the stiffeners near the ends of the bulkhead. At this head also the local deflection of the plating between the stiffeners was observed, and found to be very small, the maximum deflection in 4 ft. being ¼-in.; it, of course, being understood that the deflection referred to is that caused by the bellying of the plate between the Z-bar stiffeners, and is therefore more properly defined as the difference in the total deflection of the plating at such points situated midway between stiffeners and the corresponding deflection of the stiffeners themselves.

On attempting to increase the head of water above 22 ft., it was found that on reaching a head of 22 ft. 4 ins. the maximum deflection of the stiffeners increased very rapidly; the increase due to the 4 ins. additional head of water, and also the time element of the test, had resulted in an increase of maximum deflection from 2 13-16 ins. to 3⅝ ins. Under these circumstances and in view of the buckling of the lower brackets of the stiffeners, the test of the bulkhead was discontinued at this point, it being manifest that it could not stand a pressure due to the full head of water required by the specifications.

After the water had been entirely run out of the cofferdam, the deflections of the various stiffeners of the bulkhead were measured, and the stiffeners and brackets on the opposite side of the bulkhead, which had been in the cofferdam space and so could not be examined during the progress of the test, were then carefully inspected, and it was found that no rivets had been sheared, and the bracket plates remained perfectly plane, and, as far as could be determined, had not been permanently deformed. The heel, however, of the 3 ins. × 3 ins., 7-lb. angle clips connecting these brackets to the inner bottom plating were drawn away from the plating at the outboard ends of the clips to the extent of nearly 3-16-in. at the maximum, which occurred about midway of the bulkhead, and decreased to zero for the brackets of the two stiffeners which were adjacent to the ends. A study of the curves of deflection of the stiffeners is especially interesting as showing the marked influence of the support received from the transverse bulkheads in relieving the stiffeners next to them from strain. Thus, under a head of water of 22 ft., the maximum deflection of the forward end stiffener is approximately 1 3-16 ins., and the after end stiffener deflected 1½ ins., whereas the stiffeners in the central portion of the bulkhead deflected 2 11-16 ins.



Figs. 1 and 2.—Sketches Showing Results of Tests of Water-Tight Bulkheads on U. S. Battleship "Illinois" to Determine Their Resistance to Deflection.

Second Test.—In the second test the bulkhead was stiffened by re-enforcing the bracket plates at the upper and lower ends of the stiffeners with a 4-in. × 3-in., 9-lb. reverse-bar on the opposite side of the outer flange of the Z-bar stiffener (Fig. 1). The object of this test was clearly to demonstrate that the cause of the first failure of the bulkhead had been the want of strength of the stiffeners themselves, and not that of the brackets connecting the Z-bars to the inner bottom plating and the protective deck. The failure of the lower brackets had undoubtedly been the determining cause of the rapidly increasing deflection of the bulkhead at the time the testing was suspended during the first test, and it was desired to establish beyond doubt that additional strength was required for the stiffeners themselves, and that satisfactory strength of bulkhead could not be obtained by simply increasing the strength of the gussets themselves. The ship's main drain and other piping prevented the size of the brackets being increased at all on the starboard side of the vessel and, for this test, they were kept of the same size as in the previous test, but stiffened as described. The general method of conducting the test was similar to that previously followed, except that deflections of the stiffeners were measured at five points in the height of every stiffener.

Up to a head of 8 ft. above the inner bottom, the deflections were inappreciable. After that head, deflections were recorded with heads of 12 ft. 9 ins., 16 ft., 18 ft., 20 ft., 22 ft., 22 ft. 6 ins., 23 ft., 23 ft. 5⅞ ins., 24 ft., 24 ft. 6 ins., and 25 ft. 2⅝ ins., the latter height corresponding to a head of 5 ft. above the normal load water-line. At the latter head of water three records of the deflections of the bulkhead were taken; the first of these records was taken as soon as this head of water was reached, at 11.15 a. m.; the second one at 5 p. m., and the third at 10 p. m. Forty-five hours after the bulkhead was relieved from water pressure, a record of its permanent set was taken.

An examination of the records of this test shows the same general conditions as in the first test, in so far as concerns the influence of the transverse bulkheads upon the deflection of the stiffeners at the ends of the bulkhead under test, but that the additional stiffening given the brackets had been sufficient to prevent their buckling during the test; moreover, when the brackets in the port engine room were examined it was found that there was no measurable deformation of either bracket plates or angles as had previously been the case. In view, however, of the fact that under the pressure required by the specifications, namely, of a head of water of 5 ft. above the normal load water-line, the deflection of the bulkhead constantly increased with the length of time it was under test, it was evident that the stiffeners were strained beyond their elastic limit, and it was therefore decided materially to increase their strength. This was done by carrying a 4-in. × 3-in., 9-lb. reverse-bar for the full length of the stiffener, and of the brackets at both head and heel; and, in addition, by adding for the lower bracket a second clip for securing the bracket plate to the inner bottom plating, also a short reverse clip on the edge of the bracket plates, so that the strength of the new end connections would be proportioned to the strength of the reinforced stiffener.

Third Test.—The test was conducted in the same manner as the previous series. Up to a head of 12 ft. 9 ins. no deflections were observed. Above that head, deflections were recorded for 16 ft., 18 ft., 20 ft., 22 ft., 24 ft., and 25 ft. 2⅝ ins. At the maximum head of 25 ft. 2⅝ ins., or 5 ft. above the normal load water-line, three sets of measurements of deflections of the stiffeners were taken; the first of these records was taken as soon as the maximum head of water was reached at 1 p. m.; the second at 5.30 p. m., and the third at 10 p. m., the maximum head of water being maintained continuously until the last measurement was taken. Each of these records gave the same deflection for the stiffeners; in other words, the deflection of the bulkhead did not increase at all in nine hours, while under the test head of water called for by the specifications. The results of this final test may, therefore, be summarized as follows:

(1) There was no appreciable increase of deflection under the maximum head of 25 ft. 2⅝ ins. with a lapse of time of nine hours.

(2) The maximum deflection observed on any stiffener was 1¼ ins., and the maximum permanent set, measured twelve hours after the bulkhead was relieved of water pressure, was 5-16 of an inch.

(3) The maximum deflection of the bulkhead plating between stiffeners, observed during the test, was ⅝ of an inch, and after the test there was a corresponding permanent set of about ⅛ of an inch.

(4) The stiffener brackets in the starboard engine room showed no signs of buckling during the test. After the water had been pumped out of the cofferdam space, the brackets in the port engine room were examined and were found to be in perfect condition, no permanent deformation of any kind having occurred for either the bracket plates or the angles.

It was therefore decided that the strength of the bulkhead, as finally stiffened (Fig. 2), was thoroughly satisfactory, and the remaining nine similar bulkheads on the "Kearsarge," "Kentucky" and "Illinois" were reinforced in a similar manner.

The observation of the actual test, together with other similar experience, leads me to express my belief, first, that for bulkheads in which general strength to prevent collapse and not absolute water-tightness, is required, a wider spacing than the usual 30 ins. spacing is permissible, and that this increase may extend to as much as 4 ft., it being, of course, understood that the strength of the stiffener bars ars suitably increased; secondly, that in bulkheads in which the length is great relative to the depth, if subjected to considerable heads of water pressure, better results will be obtained if one or more deep belt stiffeners are worked in connection with intermediate stiffeners of moderate weight, rather than that all the stiffeners should be uniform depth and strength; it being, of course, understood that the spacing of all stiffeners here referred to may be as much as 4 ft. between any two of them. Such a general arrangement of stiffeners can be made lighter for a given strength than with a uniform spacing and weight of stiffeners, such as exists in the center-line bulkhead whose tests have been described.

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The Navy Department has done well in revising and improving the plans for the four new monitors ordered at the last session of Congress. It would do still better if it should induce Congress to repeal this appropriation and allow the $5,000,000 to be used for some type of vessels which would be a real addition to our naval strength. The fact is that the monitor is an obsolete type of warship; and it is ridiculous for the United States to continue their construction. In the appropriation bill by which their construction was authorized, they were referred to as "harbor-defence vessels"; and it is conceivable that in the smooth waters of a harbor, a monitor might give a good account of itself in a naval engagement. But naval battles are no longer fought in harbors and are little likely to be in the future. There was a period when the construction of harbor-defence vessels was appropriate. That was when the range of naval ordnance was so small that the defences of a harbor were placed in the harbor itself. At a later date, too, the rapid advance in the power of guns made all the old-time masonry forts obsolete, and it was necessary to meet ship with ship for purposes of defence. Now, however, the invention of the high-powered rifled mortar and the disappearing gun carriage and the perfection of systems of submarine mines have entirely revolutionized the science of naval attack. Nearly all the important harbors of the world are to-day absolutely impregnable. Modern naval vessels are powerless against modern land fortifications. Warships are designed, therefore, only to attack the vessels of an enemy, and that attack must be made in the open sea, not in the smooth waters of a harbor.

Of what use, then, is the monitor? Our naval officers found by experience in the recent war —what they knew before—that the monitors were worse than useless to take part in fleet actions. On the long voyage of Sampson's squadron to Porto Rico and back, the monitors of the fleet held the other vessels back, and were generally more of a nuisance than all the rest of the fleet combined. The only thing left for the monitor to do, then, is to operate independently; but in this field, too, it is equally ineffective. It can neither catch any vessel which it can whip or run away from any of superior force. It offers a shining mark for torpedo boats, since it has too little secondary battery to make the attack of such vessels dangerous, and its slow speed makes it a good mark. Finally, it is so unsteady that good shooting from its guns is practically impossible in a seaway; its low free-board and quick roll subject it to peril at every storm, and life upon it at sea is constant misery for officers and crew. In view of all these well-known facts, it ought to be possible to secure a repeal of the law ordering the construction of these vessels. The taxpayers of the country will have no objection to seeing $5,000,000 come back to the treasury; or, if it is desired to use it for the increase of the navy, let us at least build vessels of modern type, instead of vessels which are obsolete before they are begun.

The present agitation over the effect of the Chicago drainage canal upon the water supply of St. Louis would be more impressive if there were not reasons for believing that it is prompted, to some extent, by other than sanitary considerations, and if those city officials most directly responsible for the purity of the water supply and the welfare of the city were not either silent or very convervative in their comments on the subject. It seems rather late in the day to demand a national investigation of this matter, now that so many millions have been spent and the work is so nearly done. There have been similar attempts before, but they came to nothing.

Whatever the real merits of the case, it is certain that Chicago is only one of many cities already polluting the water flowing by St. Louis, and that the latter city does not call in question its own conduct in discharging its sewage into the same stream, for the benefit of Memphis, New Orleans and other cities below. The new drainage canal will undoubtedly result in sending more of the Chicago sewage towards St. Louis than now goes in that direction, but it will greatly increase the dilution. The law requires a flow of 20,000 cu ft. of water per minute in the canal for every 100,000 population, or over 1,800 gallons per capita per day, so the sewage starts out more than 300 miles above St. Louis with much dilution. This dilution is gradually increased as Illinois is traversed. Before St. Louis is reached the Mississippi and Missouri dwarf the original volume of sewage to insignificant proportions.

But for all this it is perfectly proper for St. Louis to inquire how much its water supply is going to be endangered by any disease germs that may survive the conflict for life during the long journey from Chicago. The reduction in the original number of disease germs will be immense, since they die, rather than multiply, out of their natural element, and will be deposited along the bed and banks of the stream for more than 300 miles; there, too, to succumb to adverse influences. The number that may finally reach the St. Louis intake will be scattered through hundreds of times the original volume of the water that conveys them. It is quite probable, though we do not pretend to have definite information, that towns of comparatively insignificant size, not far above St. Louis, will endanger its water supply more than the discharge of the Chicago drainage canal, while if the latter is to be feared far greater danger has existed for years from the sewage of Chicago, St. Paul, Minneapolis, Omaha, Kansas City, and scores of smaller places in the Mississippi drainage area.

Settling basins and filter beds were recommended for St. Louis by the late Mr. Jas. Kirkwood, some thirty years ago. Certainly, if they were needed then they would be of far greater value now. The settling basins were provided and they have been included, on a larger scale, in the new works for St. Louis. Studies for filtration have also been prosecuted there for some years past, and doubtless a filter plant will be installed inside of five or ten years. In any event, St. Louis should not rely too much on national action, which is likely to be slow, at best, so great is the inertia to be overcome in all attempts at national sanitary legislation. When they feel that the proper time has arrived, we believe the city officials of St. Louis will come forward with plans to fully protect the water supply. To many outsiders it seems as though the time had already arrived.

Elsewhere in this issue is given a brief abstract of a paper describing a recent application of electricity to factory operation which clearly shows some of the advantages to be derived by substituting individual electric motors for the usual array of shafts, pulleys and dust-disturbing belts.

The plant in question is that of a large Chicago printing establishment, which has recently been moved to Hammond, Ind., where an entirely new plant has been erected. This was built from plans which, with one important exception, seem to have been prepared with unusual care, so far as we can judge from a somewhat cursory examination. The one exception referred to is the placing in one enormous building, under a single roof covering a space of about 218,000 sq. ft., all the departments of a great manufacturing plant. So far as we can ascertain from the published descriptions and illustrations of this building, there is nothing whatever to prevent a fire starting in any part of this great room from sweeping over every part of it, destroying the entire plant and very likely proceeding with such rapidity as to give many of the operatives no time to escape.

We call attention to this, not for the purpose of criticising this particular manufactory, which may, perhaps, have safeguards against the spread of fire of which we are not informed, as to emphasize the fact that very few factory buildings are planned with equal attention to all the different details that should be considered in the design. The chances are that the proprietor has one particular thing into his mind as the thing of all importance, and other matters receive minor consideration. For example, in the W. B. Conkey plant, referred to above, the matter of securing the best possible light seems to have been the controlling consideration. To obtain this, the saw-tooth or weaving shed roof has been adopted, notwithstanding the well-known objections to it in a climate of heavy showfalls; and the entire plant has been placed on the ground floor, and in a single building. The fire risk that is involved in this we have already alluded to; and it is also apparent that the maintenance account for keeping in repair this great area of roof will amount in a few years to a large figure. By making the structures two stories instead of one story in height, and placing the various departments in separate buildings connected by covered runways, the roof area and the ground floor area subject to rapid decay would have been nearly halved, the lighting might have been made almost equally good, communication between different departments might have been made equally easy, and the danger of a total fire loss of the whole plant might have been greatly reduced.

The textile manufactories are almost the only ones in the country which have come to fully appreciate the fact that in the matter of fire protection an ounce of prevention is worth a pound of cure, and that the time to prevent the destruction of a plant by conflagration is when it is first laid down on the drawing board. In other manufacturing industries far too little attention is paid to planning for fire protection, the owner or superintendent generally sees to it that the arrangements for communication and transport throughout the plant suit his ideas and leaves the rest to the architect. In nine cases out of ten the architect is a local man, who has never made any special study of the requirements for heating lighting, fire protection, etc., in factory buildings. Under these circumstances it is not strange that money is wasted in some directions and squandered in others, and that poor light, defective and uneconomical heating facilities and standing invitations for the spread of fire are far too common, even among those modern factory plants which are pointed to with pride by their owners as models of good construction.

The excellent form of annual report of waterworks systems adopted years ago by the New England Water-Works Association, and used by quite a number of works in and out of New England ever since, seems to have been overlooked

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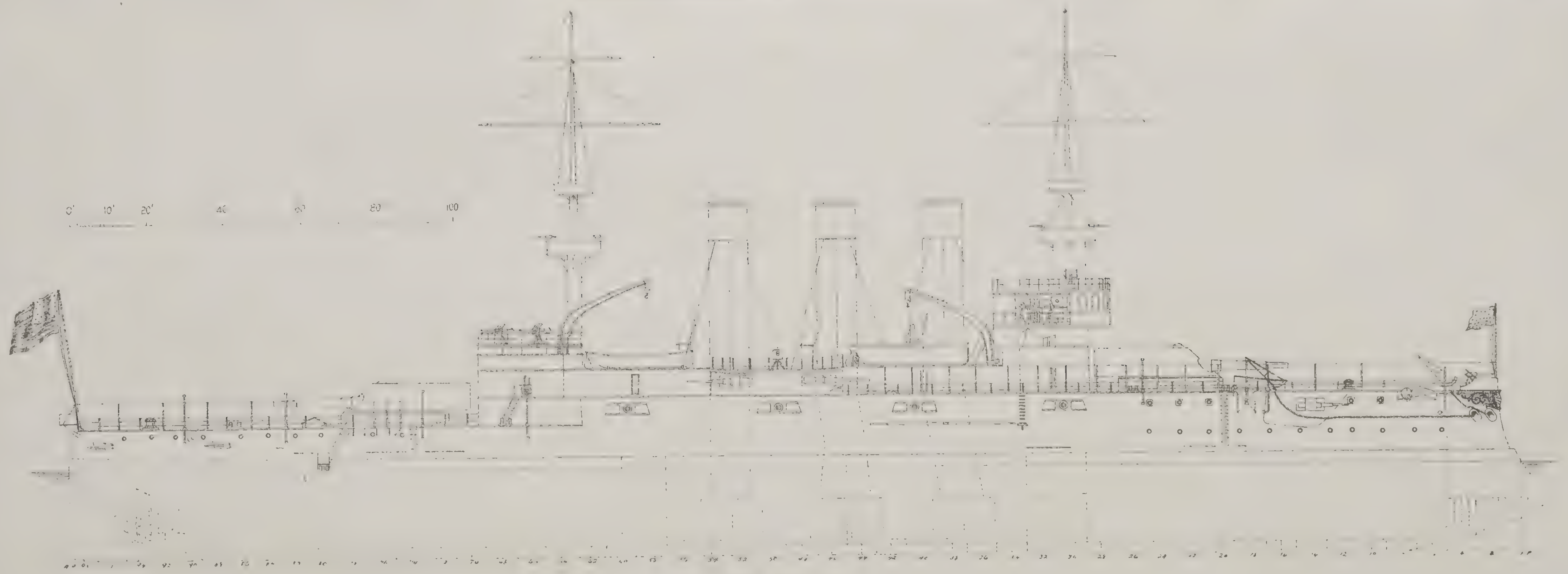

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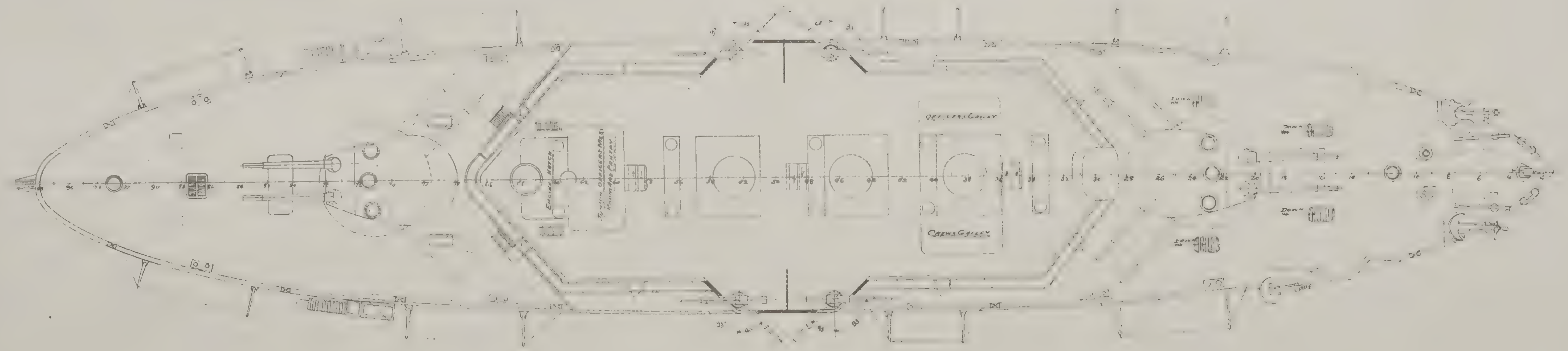

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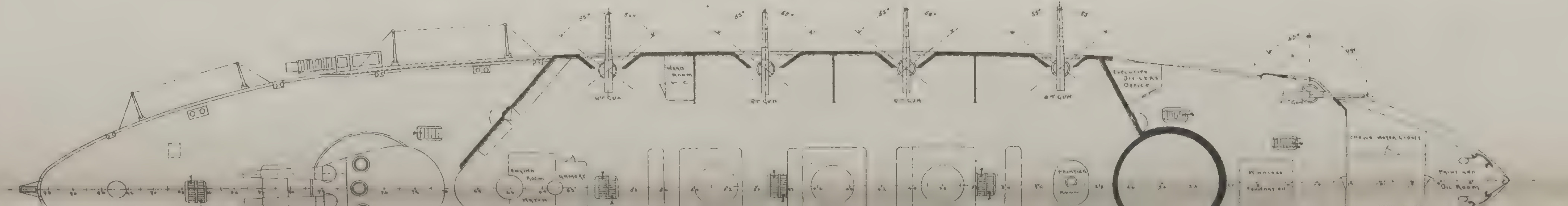

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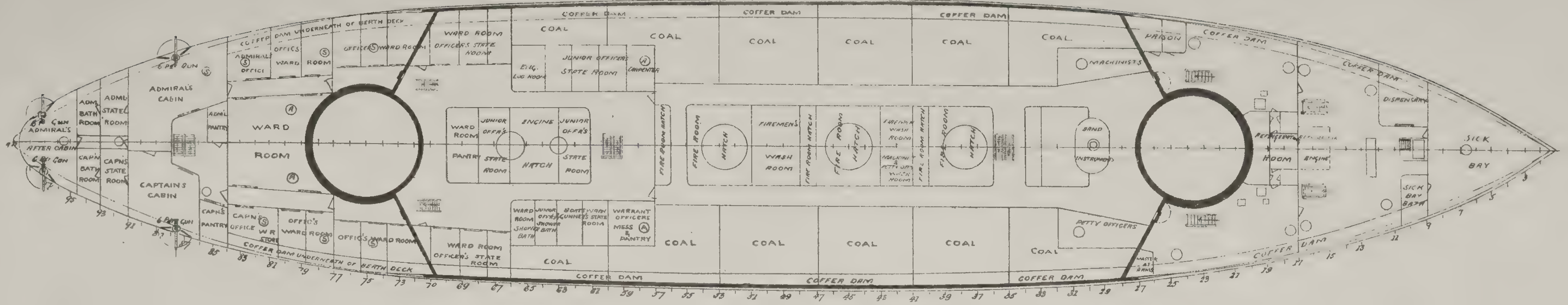
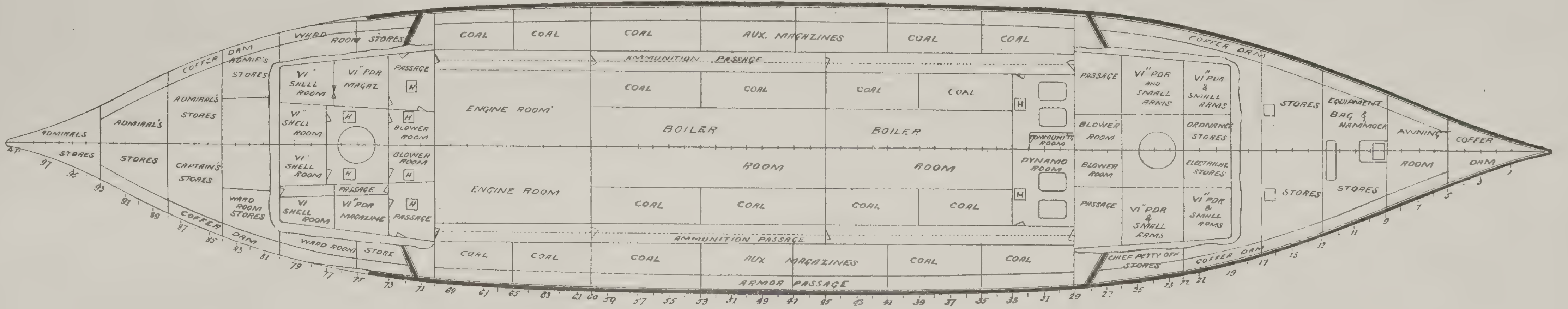


PLAN OF BERTH AND PROTECTIVE DECKS.



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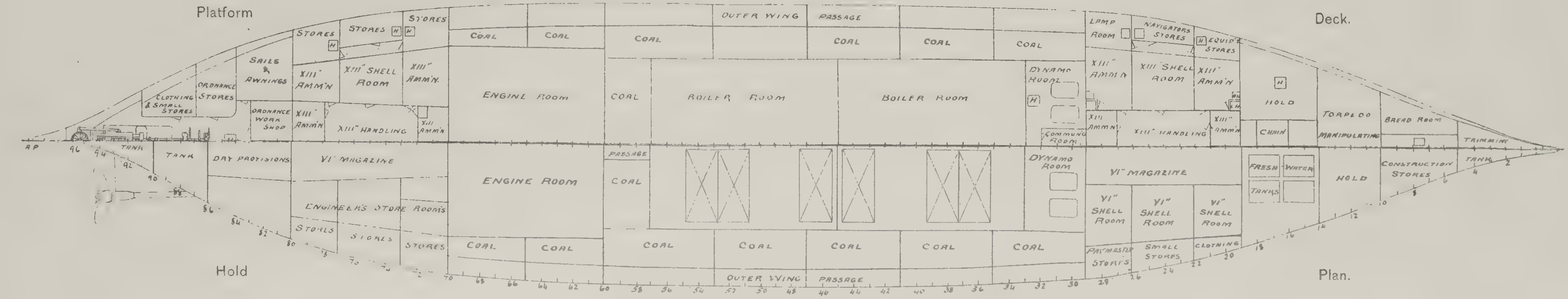

HALF PLANS OF PLATFORM DECK AND HOLD.

PLANS FOR THE NEW U. S. BATTLESHIP "MAINE."

(Reproduced from Drawings Accompanying Paper by Philip Hichborn, Chief Constructor U. S. N. Read before the Society of Naval Architects and Marine Engineers.)

CHAS. HART, LITH., 36 VESEY ST., N. Y.

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in the discussion of forms for such reports at the recent meeting of the American Society of Municipal Improvements. The proposed new form appears to be a good one. Perhaps it contains some valuable features not included in the old one, but probably more would have been gained by bringing the old one to the attention of the association and recommending its adoption. Without an actual count of items it appears that the new form is longer than the old one. Many of the water-works using the New England form do so only after abbreviation. Until the compilation of municipal statistics under a uniform system is made compulsory, and entrusted to competent central administration, all attempts at uniformity should proceed along simple and easy lines, and the aim should be to increase the use of such existing forms, as are meritorious and well-established, rather than to secure the adoption of new ones.

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THE NEW RAILWAY CONSTRUCTION OF 1898.

The steady decrease in railway construction in the United States which followed the "boom" years of 1886 to 1888, seems to have reached its lowest point in the figures of 1895, and to be now turning into a slow and healthy increase. The best available information indicates that the mileage of new railway line completed during the twelve months of the calendar year now drawing to a close will not fall far short of 3,000 miles. In 1895, according to Poor's Manual, 1,603 miles of new railway were built; in 1896, 1,668 miles, and in 1897, the greatly increased total of 2,094 miles. With 3,000 miles of new road, the year 1898 will present the largest figures of new construction since 1892, when 4,419 miles were built.

A general survey of the new work of 1898, shows the South and Southwest to have been the fields of greatest activity, while in the New England states, with one exception, construction has been almost nil. Important individual lines have been built in Maine, Pennsylvania, North Carolina and California, but it is the states of Alabama, Texas, Louisiana, Arkansas, Oklahoma, Missouri and Minnesota, all essentially Southern and Southwestern states, with one exception, which exhibit the longest lines and the greatest aggregate mileage of new road. Canada and Mexico have both added somewhat to their railway mileage during the year. Most of the new Canadian work has been done in the far western provinces, and the most notable single line is doubtless the new extension of the Canadian Pacific Ry. through the Crow's Nest Pass of the Rocky Mountains (Eng. News, March 10, 1898), to reach the rich Kootenay mining districts. The wilderness opened up by this line is exceeded only by that penetrated by the new narrow gage line to the Klondike, by which Alaska for the first time adds her quota to the new railway construction of the United States.

It may be of interest at this time to describe some of the more prominent of the new lines of 1898, using as a guide our weekly railway construction news columns, about one-half of the items in which are edited from official communications, and are, therefore, quite certainly accurate. It is not our intention to discuss the numerous more or less doubtful projects or such lines as have advanced no further than the surveys or grading. A number of these projected lines will doubtless be built, some of them, perhaps, before the close of another year, but this will depend entirely upon the financial backing which their promoters may succeed in securing.

One of the largest and most important pieces of work on this year's list of new construction is the Allegheny & Western Ry., which is to be an extension of the Buffalo, Rochester & Pittsburg R. R. From the old terminus of the main line at Punxsutawney, the new line will run to New Castle, via Adrian and Butler, Pa., a distance of 98 miles. Work is now well under way between Punxsutawney and Butler, and its farther extension to New Castle is projected in time to run trains over the entire route by next June. On this first section to Butler, a tunnel 2,317 ft. in length has just been finished, having taken five months to complete; track-laying has been commenced, and good progress is being made on the bridge, with a total length of 1,500 ft., which is to be built across the Allegheny River at Mosgrove. Excavation is progressing on a deep cut at Lyons farm, containing over 250,000 cu. yds. of material, and grading is active all along the stretch of six miles, from this cut to the Allegheny River, which is said to be one of the heaviest pieces of railway work in this country. Two steel viaducts will be built within 1½ miles of Adrian, one having a maximum height of 95 ft., and the other of 102 ft. At the "Devil's Gulch," one mile east of Adrian, there will be a steel culvert with a fall of more than 40 ft.; over this culvert there is an embankment 100 ft. high. In constructing this line the maximum grade employed is 1 per cent., compensated for curvature, and the rails used weigh 100 lbs. to the yard. The tunnel excavation and much of the grading and trackwork are being done by the Pennsylvania Construction Co., of Curwensville, Pa., under the supervision of Mr. J. M. Floesch, of Kittanning, Pa., as chief engineer.

Closely connected with the new Allegheny & Western R. R. is the Cleveland & New Castle extension of the Lake Erie & Western R. R., from Cuyahoga Falls to Youngstown, O., and thence to New Castle, Pa., a distance of about 80 miles. Contracts for the construction of this road were let in August in two sections, to Streeter & Co., of Chicago, for the portion between Akron and Niles, and to Ryan & McDonald, of New York, for the portion between Niles and New Castle. By means of the Allegheny & Western and this extension, the Brice system proposes to establish a new trunk line between Chicago and New York. The chief engineer of the Cleveland & New Castle extension is Mr. J. H. Pirkey, of Youngstown, O.

The Washington County R. R., in Maine, is also a project of considerable magnitude. This is an entirely independent line which, when completed, will connect Ellsworth and Calais, via Machias, Me., a distance of 116 miles. The work is being carried on in two sections, one of which, from Ellsworth to East Machias, a distance of 60 miles, has been mostly ballasted, while the other, extending to Calais, is being graded. Construction began about a year ago, and it was expected to open the first section for operation by Nov. 1, 1898. The company has acquired the St. Croix & Penobscot R. R., a short line running out of Calais, and it will also build a new branch from a point near Calais to Eastport. Besides opening up a new timber section in Maine, the line will make important connections with the Maine Central R. R. at Ellsworth, and with the Canadian Pacific Ry. and other Canadian railways at Calais. The promoters of the enterprise are Mr. George A. Curran, of Calais; and Mr. J. P. McDonald, of Knoxville, Tenn.; while Washington county assisted to the extent of $200,000 in bonds. Mr. William Barclay Parsons, of New York, was the chief engineer.

Two large railway extensions that have been completed this year are the Fosston branch of the Great Northern Ry., and the Kulm branch of the Minneapolis, St. Paul & Sault Ste. Marie Ry. The former line extends from Fosston to Deer River, Minn., and is 98 miles in length, and by means of the Duluth, Superior & Western Ry., which has recently been purchased, and another extension of 28 miles from Cloquet to the Nemadji River Bridge, this branch will gain an entrance into Duluth for the Great Northern Ry. and provide a continuouos line through northern Minnesota. Work was completed about the first of September. The Kulm branch, which was opened for traffic on October 17, runs from Kulm, in Le Moure county, to Hebard, Emmons county, N. Dak., a distance of 77 miles, where a junction will be made with the old grade of the Aberdeen, Bismarck & Northwestern Ry., which was partly graded in 1887 from Aberdeen, S. Dak., to Bismarck, N. Dak. The prime object of these two extensions is to accommodate the grain traffic from the Northwest to the Great Lake ports and the eastern seaboard.

In the southwest, one of the longest extensions is the St. Louis & Oklahoma City branch of the St. Louis & San Francisco Ry. The route is from Sapulpa, Ind. Ter., to Oklahoma City, via Stroud, Chandler and Wellston, a distance of 103½ miles. The contract to construct the line was let last February to Messrs. Johnston Bros. & Faught, of St. Elmo., Ill., who in turn sub-let the work to about a dozen contractors. On Aug. 1 our official reports showed that most of the grading has been completed, and about 75 miles of track laid. Mr. J. F. Hinckley, of Sapulpa, Ind. Ter., is the Chief Engineer.

The El Paso & Northeastern Ry. is another southwestern project well advanced towards completion. Starting from El Paso, Tex., on the Southern Pacific Ry., the line takes a northeasterly direction through a thinly settled region of New Mexico to White Oaks, at which place a junction is expected to be made with a projected extension of the Pecos Valley R. R. from Roswell. Of the entire distance of 165 miles, 86 miles are now ready for operation; work on the main line has stopped temporarily, it is stated, pending the construction of a 16-mile branch to timber lands across the route. Messrs. George S. Good & Co., of Lock Haven, Pa., received the contract for the work last December. The financiering of the project had not been entirely settled on October 1. The New Mexico Railway & Coal Co., of New York, which owns extensive coal mines in Arizona, is chiefly interested in this railway. Mr. H. A. Sumner, of El Paso, is chief engineer.

In California the most important work of the year is, doubtless, the final completion of arrangements which will insure the entrance of a new trans-continental railway into San Francisco, which city, notwithstanding the competition of its younger rivals in Southern California, and in Oregon and Washington, still remains the chief distributing center for the Pacific coast. All classes in California have long been restive under the monopoly of rail transportation in the state which the Southern Pacific Co. has long held, and the outcome was the building of the San Francisco & San Joaquin Valley Ry. in 1895, '6 and '7, extending from Stockton, on the Sacramento River, where steamer communication with San Francisco exists, southward about 235 miles through the most fertile farming section of California. During the present year the extension of the line from Stockton to San Francisco has been undertaken, and is now nearing completion, and arrangements have been completed by which the Atchison, Topeka & Santa Fe Co. acquires control of the road, and thus secures the entrance to San Francisco which it has for some time desired. To connect its present line with the new road, the Atchison will have to build an extension from its present terminus at Mojave to Bakersfield, or else secure trackage rights from the Southern Pacific for the use of its road between the two places.

The heaviest work on the Stockton-San Francisco extension is the "Franklin" tunnel, over a mile in length, now being driven through the Contra Costa Hills, 30 miles from San Francisco. Work is being carried on from both ends through a hard indurated clay, somewhat approaching slate, and considerable timbering is required throughout. Foley Bros. & Muir, of St. Paul, Minn., were awarded the contract in last February, and it was estimated that about 17 months would be required to complete the work.

The most important new line constructed in Canada is without doubt the extension of the Canadian Pacific Ry., by the construction of the Crow's Nest Pass and the Columbia & Western (Eng. News, March 10, 1898). Most of the track has now been laid on the Crow's Nest Pass line, from Lethbridge, N. W. Ter., to Nelson, B. C., at Kootenay Lake, a total distance of 287 miles. From Nelson to Midway a line is now in operation which will connect the new line with the Columbia & Western, now being built westward 105 miles. The completion of this latter line, and of a proposed branch from Midway to Penticton, and thence to Hope, will provide another transcontinental route much shorter than the present main line, which makes a long detour to the north.

The construction in this locality is of an extremely varied nature. The first 80 miles of the Crow's Nest Pass runs through what is called a prairie country, but it requires some heavy grading and much bridge work. On the next 25 miles the line reaches the summit of the Rockies, and there is considerable rock work. From the summit westward for 16 miles the work is also heavy, and includes two tunnels and a half-dozen bridges. The next 37 miles consists of earth and rock work, with a great deal of heavy clearing, and two 100-ft. bridges. Elk River is crossed by a three-span bridge, each span being 150 ft. long, and from here to the East Kootenay River and Wardner, about 23½ miles, the earthwork is again heavy, and three more bridges are required. From Wardner to Cranbrook, 23½ miles, the line passes through a park-like country, with the exception of five miles through the Isidores Canyon, where heavy rock excavation is again required. Thence to Moyie Lake, and along its east shore more difficulties are met with, requiring another 500-ft. tunnel, and then, after crossing the Moyie River and following the valleys for about 24 miles, another 35-mile section is reached requiring considerable excavation and trestle working. In this work the maximum grades are only 1%, and the maximum curvature, 12°. The manager of construction has been Mr. M. J. Haney, of Toronto, with headquarters at MacLeod, Alberta, N. W. Ter.

Turning now to a somewhat more general consideration of the geographical distribution of new railway construction, we find in the New England and the Middle Atlantic states a noticeable dearth of new work, other than that of the Washington County and the Allegheny & Western lines, already described. About 15 miles of new track have been laid in New York from Moira to the St. Lawrence River, by the New York & Ottawa Ry. This same company, however, has about 53 miles of new line on the Ontario side of the river, between Cornwall and Ottawa. In Pennsylvania several new branches and short extensions have been built to coal and timber districts. Such a line is the so-called Clearfield Southern, from Belsena Mills to Clearfield Bridge.

In the South Atlantic States, there are 40 miles of new work on the Richmond, Petersburg & Carolina Ry., and 22 miles on the Norfolk, Virginia Beach & Southern, in Virginia. The contract for constructing the Little Coal River Ry., a coal line 50 miles in length to be built in West Virginia, has been awarded, and in North Carolina, there has been about 125 miles of new track actually laid, with more to follow, on the Cape Fear & Northern, the Raleigh & Cape Fear, the North Carolina Midland, the Aberdeen & Ashboro, and the Carolina & Northwestern Rys. Extensions have also been built by the Carolina Midland Ry., in South Carolina; the Southern Ry., in Georgia, and to the Atlantic, Valdosta & Western Ry., in Florida.

In the Central Northern states most of the work has been in Ohio and Michigan on the Detroit & Lima Northern Ry., and its feeders. The building in the Gulf and Mississippi states has been more active. About 150 miles of track has thus far been laid in Alabama alone, with good prospects of more to follow before the close of the year. Among other lines being extended are the Alabama & Tombigbee, the Mobile, Jacksonville & Kansas City, and the Mobile & Ohio railways, which latter has completed its important connection between Jackson, Miss., and Birmingham, Ala., a distance of 167 miles, although most of the work of construction was carried on in 1897. The Yazoo Delta Ry., in Mississippi, has also been extended about 35 miles, and over 100 miles of track has been laid in Louisiana on the Louisiana & Northwestern, the Louisiana & Arkansas, the Southern Pacific and other lines.

In the southwest some of the railways which have added new mileage are the Kansas City, Osceola & Southern, from Osceola to Bolivia, 38 miles, in Missouri; the Arkansas, Louisiana & Southern, the Little River Valley and the Mississippi, Hamburg & Western Rys., in Arkansas, and the Colorado Valley, Chicago, Rock Island & Texas, and the Guadaloupe Valley railways, in Texas, which built in all about 150 miles. In Kansas extensions were built to the Kansas & Southeast, and the Hutchinson & Southern; in Colorado, to the Denver & Rio Grande and to the Golden Circle; in New Mexico, to the Pecos Valley, and in Oklahoma, to the Choctaw, Oklahoma & Gulf and other railways.

Of the Northwestern States, Minnesota has the greatest mileage of new track to its credit, viz., 175 miles, most of which is on the Great Northern Ry. In the other states of this section, extensions have been built to the Duluth, Mississippi River & Northern, the Muscatine, North and South, the Brainerd & Northern Minnesota, the Duluth & Northern Minnesota, the Gaylord & Ruby Valley branch of the Northern Pacific, and the Wyoming & Missouri River lines.

The work in the Pacific States, other than that on the San Francisco & San Joaquin Valley, which is most worthy of notice, is the 58-mile extension of the Gila Valley, Globe & Northern, from Geronimo to Globe, Ariz., a 17-mile extension of the Columbia Southern Ry., in Oregon, and the Union, Cove & Valley Ry., in Oregon. In Canada the only other company than the Canadian Pacific which has had important new extensions built is the Coast Ry., of Nova Scotia, which is being extended from Yarmouth towards Halifax.

In Mexico much important work has recently been done. President Diaz, in his annual message, delivered in the last part of September, states that since April the Mexican railway systems have increased by more than 314 kilometers (195 miles), of which 60 kilometers belong to the Mexican, Cuernavaca & Pacific; 60 to the Mexican Central, between Jiminez and Parral, which was later on completed for the whole distance of 89 kilometers on October 9; 40 to the Mexican National; 25 to the Mexican International on its branch between Reata and Monterey; and the remainder to other lines. Since this report, ten miles of track have also been laid on the proposed Chihuahua & Pacific Ry., which is being built by New York capitalists from Chihuahua to the Pacific coast, via Guerrero, a distance of 600 kilometers (372.6 miles).

LETTERS TO THE EDITOR.

The Advantages of Blower Systems for Drying Materials.

Sir: The letter of Mr. E. L. Ballard, in your issue of Nov. 3, regarding the use of blowing fans instead of steam pipes for drying tobacco, attracted our attention, and as your comment on it seemed to imply that heat was necessary the same with as without the fan, and the subject is one that should interest every one who has to do with drying brick, lumber, starch, leather, tobacco, etc., we wish to add to the remarks already made.

The drying of any substance is simply the absorption from it of a portion of its moisture by means of a dryer surrounding medium. The natural method of drying is by placing the substance in the air and allowing the moisture to be absorbed by the air. The proportion of moisture absorbed will depend either on the amount of moisture already in the air or on the quantity of air present. Now, the amount of moisture that the air is capable of absorbing increases with its temperature, and the quantity of air depends on the size of the room relative to the amount of moisture in the article to be dried or on the current of air that passes by, absorbing and carrying off moisture as it goes.

Man soon learned that drying was facilitated by heat, and until within a few years the commonly recognized method of hastening drying has been by heating the air by steam pipes or otherwise, and thus increasing the capacity of a given volume of air to absorb moisture. A blowing fan accomplishes the same object by increasing the volume of air passing by the article to be dried and at the same time allows of better regulation.

Any drying, to be successful, must begin slowly and be hastened only when the inside of the article has become partly dry, in order to prevent cracking the surface or staining it by the coloring matter in the water dried out of it. If the surface of the article is made dryer than the normal air in which it is to be used, it becomes "dead" and brittle and will never regain its natural elastic condition. Overdrying is much more apt to occur if done by heat than by a fan with air at normal temperature. Some thick articles like brick or lumber may require a certain degree of heat to start the moisture from the inside toward the surface, but thinner articles, like leather or tobacco, keep their elastic qualities better if dried at a low temperature, and this can only be done in all conditions of the atmosphere without moulding by a fan.

The secret of successful drying lies in the ability of the man who does it, not in the method. Some form of hygrometer is almost a necessity in the beginning, as the whole process of successful drying depends on the relative humidity of the air, or its substitute, regulation of quantity. In commercial drying, where the quantity of material to be dried is always placed in a comparatively small room, it is necessary to use heat or a fan to prevent moulding, but the principal consideration is time, and the intelligent use of a fan will do the drying in about half the time that would be needed with heat only, and leave the material in better condition.

Yours truly,
Given & Aldrich,
Civil and Mechanical Engineers.
Birmingham, Ala., Nov. 8, 1898.

Automatic Couplers for Air Brake Hose.

Sir: In your issue of Oct. 27, in discussing the merits of automatic air hose couplers, you say that "automatic car couplers were introduced largely to illiminate the danger to life and limb incident to coupling moving cars by hand, but the brake hose cannot be coupled until the cars are already coupled, and are very rarely coupled up while the cars are in motion in the yard." As a man having experience, I will endeavor to show you wherein you err, and that automatic hose couplers are not as unimportant as your article would indicate. To make a coupling with the old link and pin coupler was not much of a feat for an experienced man. In fact, good railway men would prefer them to the present mixture of types. Of course, when we get automatic car couplers universally introduced, this feature will be overcome. The facts are that the "protection of life and limb" is only incidentally an issue in the introduction of the automatic car coupler. Every trainman, however, looks forward with joy to the time when automatic car couplers will be the only couplers in use, and they also appreciate the fact that the danger of car coupling will be greatly eliminated when that time arrives, and do not so very much care what the motive may be for the improvement. However, to return to the air hose coupler, it may be imagined by those not actively engaged in the train service that air hose are not coupled or uncoupled while cars are moving. This, however, is a mistake, and I will endeavor to show you the necessity of improvement along this line, if the lives of human beings are worth an effort to save.

It is a fact that many lives are lost yearly by trainmen in making hose couplings, and any automatic arrangement that can be utilized will be hailed with delight by the writer. Five trainmen make a trip when cars are coupled and uncoupled without coupling and uncoupling hose when cars are moving. I have in my mind now two co-employees who were killed outright, one in coupling and the other in uncoupling hose. The one killed while coupling was doing so while the train was being made up in the yard, and in order to have the "air" ready to inspect when the train was "thumbs up." While making the coupling a "cut" of cars struck and caught him, drew him under and killed him. The other was uncoupling hose while the train was moving, and was caught by the wheel on the truck of the following car, drawn under and killed. Trainmen follow this practice to expedite the work, and as a rule they are the men who worked at railroading before air brakes came into use, consequently it seems to take so long and to consume so much unnecessary time to wait for cars to come to a stop before coupling and uncoupling hose, when compared with previous work when the automatic brakeman was unknown. For instance, you are switching a train, hose all coupled and train pipe charged, and you want to cut off one or more cars. You swing in with a foot on each brake beam, shut off the angle cocks, and reach down and lift up on the hose until it becomes uncoupled. Then all you have to do is to pull the pin and there you are, i. e., if you don't slip and fall under, then, there you are any way. You may say that this is unnecessary risk, but when the chief dispatcher is asking, "what is delaying you?" or "why don't you get out? You are laying out No. 150," or some other question familiar to "old timers," all kinds of schemes are resorted to in order to hasten the work and avoid a "jacking up," which is not pleasant. And this coupling and uncoupling of air hose is one of the schemes most commonly resorted to. So "all hail" to the automatic hose coupler. "Sivart."

Grand Junction, Colo, Nov. 5, 1898.

The Engineers' Work in the Santiago Campaign.

Sir: I was gratified to find in the Oct. 13 number of the Engineering News a valuable article by Mr. Chibas relative to the work of the engineers in the Santiago Campaign, accompanied by a well-done and useful map reduced from the official information showing the position of the troops in the vicinity of Santiago. I also note with satisfaction your editorial comment. As a matter of fact, much injustice has been done by some newspaper writers and others in commenting upon the practical work of the Santiago campaign, for the reason that the actual situation was hardly at all understood by others than those of the military authorities more immediately responsible for the execution of the military plans.

The Santiago campaign was a particularly rough, and, in a sense, hazardous enterprise, in a tropical region, meagerly known as to topographic details, at the sickly season, and with troops which, while they possessed mental and physical attributes of a high order and an admirable discipline, were ill prepared to meet the special difficulties of locality and climate. It was practically a race between the physical endurance and military spirit of the men and the destructive malarial influences that were lying in wait for them. It resolved itself into a question of time. Had full preparations for landing and movement, such as wharf and railroad, wagon road and bridge construction, been practicable, as in fact it was not, it would still have been entirely inexpedient to lose time on them. The work indicated would have taken at least a month under the most favorable circumstances, and the immediate consequence of this delay in completing the military enterprise would have been that the army would have been on its back prior to the surrender instead of after, and in all probability we should not have accomplished our results at all. In fact, the disembarkation of the troops was accomplished within 48 hours; and sufficient horses and mules to serve the immediate purpose, together with three days' rations, were put on shore in another day; and this included the transfer and disembarkation of 3,000 Cubans in addition to our own forces It will be admitted, I presume, after looking at the matter broadly, that the results sought in the campaign were in every sense thoroughly attained, and this after all is the main object of a military enterprise, and minor matters must be waived in the presence of an urgent military exigency.

For the comparatively rough engineering that was required, General Shafter had at his disposition his Corps Engineer, Colonel Derby, regularly assigned to him, and two companies of engineers in addition, including eight engineer officers with several others detailed at various headquarters, and these gentlemen performed in the fullest measure all the engineering work that was practicable or expedient, including the multiplied reconnoissance work, which, to great extent, was conducted under maximum topographical difficulties, and often under fire in the immediate presence of the enemy.

My own direct connection with this work, involving these minor details, was therefore unnecessary, and I was given command of a brigade at the front, where General Shafter believed that I could be of greater service to him. This enabled me to give personal attention to the military engineering proper, namely, the laying out and construction of the investing trenches, by which, in fact, the ultimate surrender of the Spanish army was finally compelled.

I state this in view of the paragraph below the middle of the third column on page 227 of Mr. Chibas' interesting and valuable article, in which he states that the trenches in the Santiago campaign were not laid out by the engineers, but were constructed by the troops of the line, under the direction of their own officers. While this is perfectly correct, it might lead to a misapprehension, because it so happened that my brigade held the extreme right, and I was specially charged by the division commander, General Lawton, with the designing and construction of the entrenchments.

I enclose you a copy of your map, which I have been glad to use as a matter of official record, a duplicate having been sent to the Adjutant-General and to the Chief of Engineers. On this map I have made certain corrections and additions.

First: Adding the position on the left of my line at Caney of the 2d Battalion of the 22d Infantry, one of the regiments in my brigade, occupying an extremely important point where it was enabled to completely cut off the retreat of the Spaniards by commanding the only possible means of exit by road.

Second: By adding the position occupied by General Sanchez's troops on the west side of the bay, across the Cobre Road. General Sanchez was under my orders and stationed in connection with my brigade.

Third: Showing the several positions (4 in number) occupied and entrenched by my brigade. A portion of the entrenchments between positions 1 and 2, and all of the entrenchments between positions 3 and 4, were also prescribed by me, and, to a considerable extent, executed by Cubans under my direction.

These matters are of interest to yourselves and to others as matters of engineering history and record, for which reason I have taken the liberty of communicating with you on the subject, and sending you the corrected chart, which is enclosed. Yours very truly,

William Ludlow,
Major-General, U. S. A.

Army Building, New York, Nov. 4, 1898.

(As it is practically impossible to reproduce and correct the maps published in our issue of Oct 13, we here attempt to verbally indicate the corrections and additions made by Gen. Ludlow, reference being made to the maps as published: In the first map, showing conditions on July 1, the position of the 2nd Bat., 22nd Infantry, at Caney, is changed to a point on the road leading from Caney to San Miguel. The camp of the 1st Brigade, 2nd Division, on June 30, is also shown on the Siboney road, at the south tributary to the Rio Seco, just east of La Reconda. On the map of July 14, the following additions are made: The headquarters of the Cuban General Sanchez are shown at Dos Caminos, on the Cobre Road, leading out of Santiago, and his troops occupied the point on this road marked "cemetery." Gen. Ludlow also indicates the four successive positions occupied by the 1st Brigade, 2d Division, on the dates named, as follows: (1) July 2 and 3, at San Juan Hill; (2) July 4 to 7, near position on map, marked by " Light U. S. Battery, 4 guns, Col. Theaker"; (3) July 8 to 10, at position marked or 12 I, field battery 71,"; (4) July 11 and Aug. 13, northwest of Santiago, with right wing resting on the "cemetery," and left wing extending to and including the 2d Mass. Regt.—Ed.)

Notes and Queries.

Apropos of the recent discussion in these columns of the relative resistance to corrosion of iron and steel, a correspondent writes that plumbers prefer iron to steel for underground or enclosed work, and states that iron stovepipes outlast those of steel by several years.

In publishing an abstract of the paper of Mr. A. L. Adams, M. Am. Soc. C. E., on "Wood Stave-Pipe," in our issue of Oct. 27, an error in numbering figures 1 and 2, in the paper as it appeared in the Transactions of the American Society of Civil Engineers, was reproduced in this journal. These figures should be transposed, and Fig. 1 should be Fig. 2, and Fig. 2 should be Fig. 1.

CONCRETE AND STEEL FLOORS FOR THE PETIT PALAIS DES BEAUX ARTS; PARIS EXPOSITION.

In the article with the above caption printed on p. 302 of our last issue, the illustration of the beam system of construction (Fig. 2) was accidentally omitted. We therefore insert it here and refer our readers to the second column of p. 302 in our preceding issue for a description of the construction. It may also be noted here that in the fourth paragraph of the article as printed, in stating the requirements of the test, it should have read that the "deflection" must not exceed 1-800th of the span, instead of the "rise."

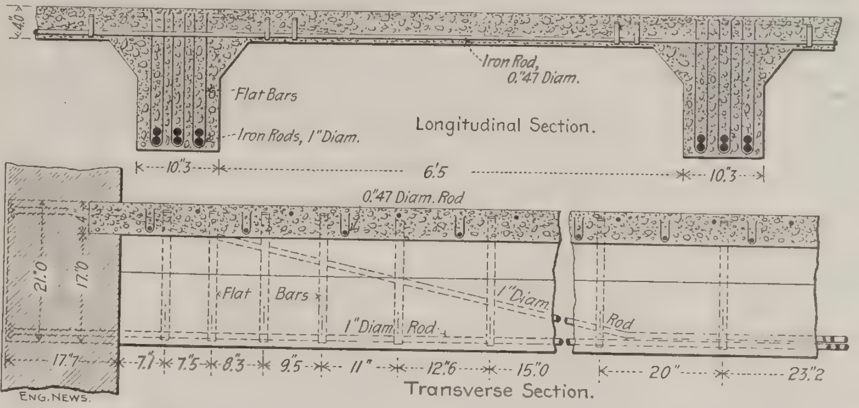


FIG. 2.—HENNEBICQUE BEAM SYSTEM OF STEEL AND CONCRETE FLOOR CONSTRUCTION FOR THE PETIT PALAIS DES BEAUX-ARTS FOR THE PARIS EXPOSITION OF 1900.

NOTES FROM THE ENGINEERING SCHOOLS.

University of Illinois.—A visit to the Engineering Department of the University was made on Nov. 11 by a large number of the members of the Western Society of Engineers and other visitors, including several of the trustees of the University. The party came by a special train on the Illinois Central R. R., arriving at 1 p. m., and leaving again at 6.30 p. m. At the engineering building the visitors were received by President Draper and the staff of professors, and luncheon was served in the physics laboratory.

The party was conducted through the building and then through the woodworking shops, machine shops, electrical and mechanical engineering laboratories, laboratory of applied mechanics, the new central boiler-house for the heating plant, and finally to the new library building, which was designed by Prof. Ricker, Dean of the College of Engineering, and one of the earliest graduates of the university.

The party was conducted by President Draper, assisted by Professors Baker, Breckenridge, Pence and others. After a tour of inspection, the party assembled in the physics lecture room, and brief speeches were made by the President, and by Messrs. L. P. Morehouse, Richard Price Morgan, R. W. Hunt, Isham Randolph, H. W. Parkhurst and Prof. I. O. Baker.

Massachusetts Institute of Technology.—The new building just erected for the use of the Institute will be called the Pierce Building, in honor of the late Hon. Henry L. Pierce. Mr. Pierce was a member of the Corporation from 1885 until the time of his death. He was a leader in a line of business making large demands on science; and he always expressed a keen interest in the Institute, its ideas and work, as shown by visits and suggestions, and by his frequent and liberal gifts. His various benefactions amount to $770,000 to Oct. 31, 1898.

The circular of the Lowell Free Courses in the Institute of Technology is now ready for circulation. Among the timely courses given are: "The Structure and Strength of Ships," by Prof. Peabody; "The Computation of Earth Work," by Prof. Allen; "Sanitary Science and the Public Health," by Prof. Sedgwick; "Mechanism and Gearing," by Prof. Merrill; "English Composition," by Prof. Bates; and the usual mathematical courses and electrical testing laboratory exercises by Prof. Laws.

University of Nebraska.—The north wing of a new building, known as "Mechanic Arts Hall," has been dedicated with appropriate exercises, including addresses by President Chaplain and by Morgan Brooks, the recently-appointed professor of electrical engineering. The building is of brick, plain, but substantial, and cost a little over $30,000. It will require at least $60,000 more to complete it as planned.

Prof. O. V. P. Stout, head of the civil engineering department, who has been engaged throughout the summer and fall in constructing a flume and power station for the Ingold Placer Mining Co., of Boulder, Colo., is now at his place in the University. Adjunct-Prof. Geo. R. Chatburn has had charge of the department during his absence.

THE NEW U. S. BATTLESHIP "MAINE."

(With two-page plate.)

At the annual meeting of the Society of Naval Architects and Marine Engineers, held in New York last week, a paper was presented by Commodore Philip Hichborn, Chief of the Bureau of Construction and Repair, U. S. N., on "Designs of the New Vessels for the U. S. Navy." We reprint that portion of it relating to the three new battleships, recently placed under contract, in full below, and have reproduced upon our inset sheet the drawing of the new "Maine," which accompanied Commodore Hichborn's paper:

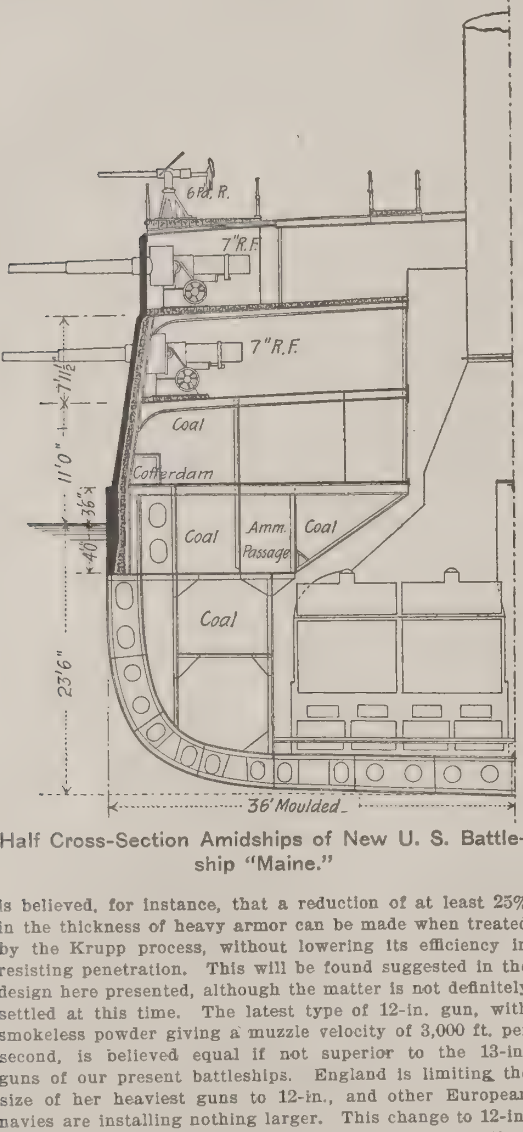
Believing that the "Alabama" class represented an efficient type, the Department, in issuing circulars and plans for the three battleships appropriated for, concluded practically to duplicate that class as regards size, speed, armament, etc. It was decided, however, to invite bidders to submit their own designs, offering preference—other things being equal—to bids guaranteeing the highest rate of speed and greatest coal endurance, without exceeding the total weight of engines, boilers and coal, or the space allowed therefor, as provided in the Department's plans and specifications.

The result was highly satisfactory. The designs submitted, after some revision, provided, in effect, an 18-knot vessel 20 ft. longer and of 1,000 tons greater displacement, but in other respects conforming to the original plans and specifications, excepting, of course, the changes in design of boilers and engines to meet the additional requirements of power on the weight allowed.

The preliminary acceptance of these propositions had to be followed by a revision of plans and specifications before any contract could be drawn. At the time of preparing my paper this work was still in the hands of the builders, and I regret having been therefore unable to obtain plans and particulars as complete as I should have liked. General plans of the "Maine," intended to accompany the contract, were received in time to allow their utilization in illustrating the paper, and will be found appended. While there will probably be some variation from these plans in the other vessels, as regards the type of boilers and engines, they may be considered as fairly representing the class, and an examination will show that, in general, the vessels will be enlarged and speedier types of the "Alabama."

General dimensions and particulars of this design are tabulated below. As remarked in the introduction, however, very little of this information can be considered as absolutely accurate or fixed, as a great deal of it is the result of only the preliminary design and calculations. The machinery details, it must be remembered, are for one of the three designs only.

A clause in the contract provides suitably for the making of certain changes in armor and armament, within six months, such changes being suggested by recent developments in the manufacture of armor and guns. It is believed, for instance, that a reduction of at least 25% in the thickness of heavy armor can be made when treated by the Krupp process, without lowering its efficiency in resisting penetration. This will be found suggested in the design here presented, although the matter is not definitely settled at this time. The latest type of 12-in. gun, with smokeless powder giving a muzzle velocity of 3,000 ft. per second, is believed equal if not superior to the 13-in. guns of our present battleships. England is limiting the size of her heaviest guns to 12-in., and other European navies are installing nothing larger. This change to 12-in. guns is therefore to be expected in the designs in question, and the number of 6-in. guns will, of course, be increased as a consequence—probably to 16. The secondary battery provided in the "Maine" design has been increased over that of the "Alabama" class, on account of increase in the length of the vessel. The number of 6-pdr. guns stated may also be changed somewhat.



Half Cross-Section Amidships of New U. S. Battleship "Maine."

One very important improvement in the new battleships will be the installation of under-water torpedo tubes. There will be two of these submerged tubes in a single compartment fitted up for the storage of eight 17-ft. torpedoes and appliances for handling and operating the same. The war heads will be conveniently stowed in a separate compartment. We have been rather tardy in adopting the submerged discharge for torpedoes, but the matter has been made the subject of considerable study and some experiment, so that it is to be hoped that our first attempt at this difficult installation will be more successful than some of the early efforts of European designers in this connection.

It is interesting to note, under the schedule of weights given below, which represents the vessel in trial condition, in which she is to attain a speed of 18 knots, the relatively large amount of coal, ammunition and stores to be carried on trial. The total coal bunker capacity is also very large, it being fixed at 2,000 tons. This, of course, involves the closest possible stowage, and the figures cannot therefore be compared with those based on loose stowage, as given out for our previous battleships. It will also be seen by comparison between the estimated collective I. HP. and the total heating surface of the boilers, that the number of square feet of heating surface per horse-power is over 3.6. These figures, of course, are only estimates as yet.

Considered as a whole, however, the "new designs" for battleships—with the slightly lengthened hull and general arrangement of the "Alabama" class, with the immense addition in engine power, and with the improved armor and armament likely to be fitted—certainly embody the very best features known to naval science. It is of special importance that the improvements in design have been accomplished with practically no sacrifice in draft, in which respect these ships will have an advantage of from 18 ins. to 2 ft. over vessels of their same class and size in Europe. The fact that the contract price for hull and machinery for the "Maine" class will exceed by less than 10% that of the "Alabama" class speaks well indeed for the progress of the shipbuilding art in this country. The contract time, furthermore, has been reduced.

Dimensions and Particulars.

Hull.

Length on load water-line	388 ft.
Length over all	393 " 9 ins.
Breadth, molded....72 ft.; extreme	72 " 2½ "
Freeboard, forward	20 "
Freeboard, aft..13 ft. 3 ins.; amidship	20 " 3½ "
Mean draft, with 1,000 tons coal and all stores and ammunition	23 " 10¼ "
Corresponding displacement (trial)	12,500 tons.
Speed per hour in knots	18
Area amidship section	1,637 sq. ft.
Area load water plane	21,000 " "
Tons per inch immersion	52
Moment to alter trim 1 in	1,050 ft. tons.
Wetted surface	35,572 sq. ft.
Mean draft, with all provisions, stores, ammunition, and 2,000 tons of coal on board	25 ft. 6 ins.
Corresponding displacement	13,500 tons.
Metacentric height (at 25 ft. 6 in. draft)	4.20 ft.
Range of stability at same	68°
Maximum righting arm	2 ft. 5 ins.
Maximum righting moment	32,535 ft. tons.
Angle of maximum righting arm	36°

Armament.

Main battery	4 13-in. B. L. R., 14 6-in. R. F.
Secondary battery— 20 6-pdr. R. F., 6 1-pdr. R. F., 4 Gatlings, 1 field gun.	
Height of guns above 23 ft. 10¼ in. L. W. L.:	
Axis of forward 13-in. guns	26 ft. 1½ ins.
Axis of after 13-in. guns	18 " 7½ "
Axis of 6-in. guns, main deck	15 "
Axis of 6-in. guns, upper deck	22 " 4½ ins.

Thickness of Armor.

Water-line belt, amidships:	
To 1 ft. below 23 ft. 6 in. L. W. L.	12 ins.
Bottom	8½ "
Height above 23 ft. 6 in. load line	3 ft. 6 "
Total depth of belt	7 " 6 "
Side armor above main belt	5½ "
Superstructure armor	6 "
Turret armor (13-in. gun)	17 and 15 "
Barbette armor	15 " 10 "
Protective deck armor	2¾ to 4 "
Conning tower armor	10 "

General Schedule of Weights.

Hull and fittings	4,836 tons.
Armor and bolts	2,933 "
Protective deck armor	600 "
Armament and ammunition	1,058 "
Machinery, with water	1,396 "
Equipment	199 "
Outfit and stores	478 "
Coal	1,000 "
Total	12,500 tons.

Machinery.

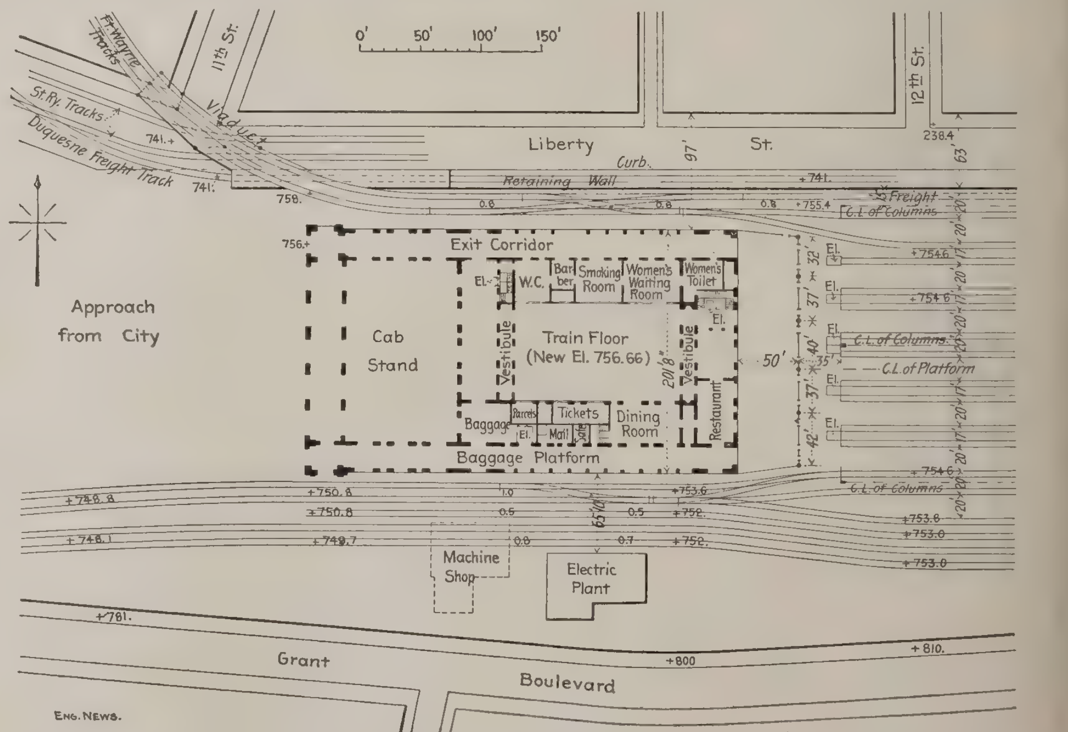
Vertical, inverted cylinder, direct-acting, triple expansion engines, in two water-tight compartments:	
Collective I. HP. of propelling, air-pump, and circulating-pump engines.	16,000
No. of revolutions at this power	126
Cylinder diams., ins	38½, 59 and 92
Length of stroke, ins	42
Cooling surface, main condenser	9,600 sq. ft.
Cooling surface, auxiliary condenser	800 " "

Boilers.—24 Niclausse water-tube type, in three groups of 8 boilers each. Each group is subdivided by the center line bulkhead. Each boiler will have 15 elements of 24 tubes, the whole number of elements being 360 and the number of the tubes 8,640.

Total heating surface	58,104 sq. ft.
Total grate surface	1,353 " "
Working pressure (gage) lbs. per. sq. in.	250

NEW STATION OF THE PENNSYLVANIA R. R. AT PITTSBURG, PA.

The Pennsylvania R. R. has for several years past been expending vast sums of money upon the improvement of its road and its terminals, and is now about to undertake the reconstruction of its Pittsburg terminals at a cost of probably over $1,500,000. This work will include the elevation of its tracks through the city, and the construction of a handsome new station on the site of the present station. We show a general plan of the new arrangement, from which it will be seen that there are to be both through and stub tracks, the station building having tracks on three sides, with the street approach on the other side. The main floor of the new station will be about 12 ft. above that of the present structure, and the elevations of the different tracks, etc., are marked upon the plan. The Pennsylvania R. R. proper comes in at the east end of the station. The Pittsburg, Fort Wayne & Chicago Ry. comes in from the northwest, crossing the Allegheny River. The Pittsburg, Cincinnati, Chicago & St. Louis Ry. comes in from the southwest, crossing the Monongahela River.



GENERAL PLAN OF NEW TERMINAL AND STATION FOR THE PENNSYLVANIA R. R. AT PITTSBURG, PA.

Wm. H. Brown, M. Am. Soc. C. E., Chief Engineer D. H. Burnham, Architect.

On the Liberty St. side will be two through tracks of the Pittsburg, Fort Wayne & Chicago Ry., brought in on a curve from 10th St. and the Allegheny River bridge. These tracks cross Liberty St. by a viaduct. One of them will be a freight track, outside the trainshed. The other will run through the trainshed, and will also connect with another passenger track. A double crossover will facilitate train movements. There will be a retaining wall along Liberty St., the street level being 14.4 ft. below that of the tracks. The Duquesne freight track will remain at the street level, being separated from the roadway by a curve, and will cross the tracks of the street railway just beyond the station.

On the Grant Boulevard side of the station will be four through tracks, two of which will be entirely independent of the station tracks, while the other two will connect with two of the station tracks by means of crossovers. This side of the station is against the slope of the hill, Grant Boulevard being from 30 to 55 ft. above the tracks. On this side of the building will be the electric power station.

The trainshed will be 550 ft. long and 225 ft. wide c. to c., of the outer lines of columns. It will cover twelve tracks, and six platforms, each of the latter being 20 ft. wide. There will be three through tracks and nine stub tracks in the trainshed, with baggage elevators at the ends of the latter. A transverse platform 85 ft. wide extends from the headhouse to the ends of the tracks, for the full width of the building, and at 50 ft. from the headhouse is an iron fence with gates. This forms a 50-ft. concourse to effect a distribution of the crowds and serve as an auxiliary to the waiting room.

The station proper or main building, will be about 360 ft. long and 201 ft. 8 ins. wide, with a height of four stories in the main portion, 235 × 155 ft. At the city approach, and extending the full width of the building, will be a covered way about 25 ft. wide, opening into a carriage concourse, 90 × 150 ft., beyond which is a vestibule containing entrances to the main waiting hall and to the baggage room. In the center of the main building will be a grand hall or waiting room, 135 × 80 ft., with a vestibule at each end, one opening upon the street entrance and the other upon the main platform or concourse. On one side of this hall will be the railway and sleeping-car ticket offices, parcel room, dining room, restaurant, mail room and baggage room. Beyond these will be a covered baggage platform about 20 ft. wide. On the other side of the main hall will be the smoking-room, women's room, toilet rooms and barber shop, outside of which will be a corridor 20 ft. wide for passengers going from the trains to the street. In each side of the building will be stairways and elevators communicating with the several floors.

While this general interior arrangement is a very common one, it seems to us to be open to serious objection in that it makes the waiting room the main thoroughfare to the trains and the principal place for the transaction of business. Passengers who are waiting for trains are, therefore, continually disturbed by the noise and bustle, and while there is a separate waiting room for women, there will be apparently no place where men who are sick, weak or weary can rest in quiet. It seems to us that it would have been better to make this great hall narrower, with ticket, parcel and news rooms opening upon it, and with waiting rooms separate from it. This general arrangement has been adopted in some stations, notably in the Park Square station at Boston, much to the comfort and convenience of the traveling public.

The approach will be a broad space paved with asphalt, and it is proposed to run branch tracks from the street railway on Liberty St. up to one side of the station.

The entire planning of the new terminal system, with its station and track elevation, has been done under the direction of Mr. Wm. H. Brown, M. Am. Soc. C. E., Chief Engineer of the Pennsylvania R. R., to whom we are indebted for the plan and the view of the building. The architectural design was prepared by Mr. D. H. Burnham, of Chicago.

The stations and trainsheds of the Pennsylvania R. R. at Jersey City and Philadelphia have been described and illustrated in our issues of Dec. 27, 1890; Sept. 26, and Oct. 3, 1891; Oct. 6 and 13, 1892, and June 1 and 8, 1893.

A CHAIR OF MUNICIPAL ENGINEERING and a lectureship of municipal hygiene has been established at University College, London, under provisions made by that eminent sanitarian, the late Sir Edwin Chadwick. Prof. Osbert Chadwick, M. Inst. C. E., son of the founder, remarked during the exercises accompanying the ceremony, that the title of sanitary engineer has been appropriated by the plumber and glazier, making the title, municipal engineer, necessary as a substitute.

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THE CIVIL SERVICE EXAMINATION to select two electrical engineers, announced on page 289 of our last issue, has been cancelled by the Civil Service Commission. Hereafter the subject of electrical engineering will be optional in junior civil engineer examinations for the Engineer Department at Large (War Department), so that persons qualified as electrical engineers may have an opportunity to have their qualifications tested. The junior civil engineer examination will be given next spring. Applications and information in regard thereto may be obtained after Jan. 15, 1899..

◆

THE LAKE SUPERIOR & MICHIGAN CANAL CO. is being incorporated at Lansing, Mich., and surveys are being made. The chief promoters are Messrs. D. C. Dennison, A. H. Parker and C. W. Parker, all of Chicago. They hope to utilize a glacial valley occupied by a series of swamps, and estimate the cost of the canal at about $4,000,000. But Mr. L. E. Cooley says that the best topographical maps show a divide between the two lakes about 300 ft. high; and it would not pay to lock over this divide, even if water were available—which he doubts.

◆

THE TENNESSEE RIVER IMPROVEMENT ASSOCIATION will hold its annual meeting at Chattanooga, on Nov. 23; General Joseph Wheeler is President, and will preside.

◆

TWO CAST-IRON LIGHT-HOUSES are to be erected on the Norwegian coast, at Okso and Utvar. Each will be 85.28 ft. high and 27.22 ft. in largest outside diameter, tapering to 14.76 ft. at the top. Besides a basement ring, each will be made of 16 sectional rings of cast-iron bolted together; the plates will be 30 mm., or 1⅓ ins. thick at the bottom, and for other courses 1.1 ins. The rings have inside flanges, 12 plates to the circle.

◆

NEW OCEAN STEAMER TRACKS, for North Atlantic vessels, have been adopted by the steamship managers, as the result of a recent conference in London. Two, instead of three tracks, as at present, were decided upon. From Jan. 15 to Aug. 14 the west-bound track will be from Fastnet, or Bishop's Rock, on the great circle course, to the crossing of meridian 47° W., in latitude 42° N.; thence, by either rhumb line or great circle, to a position southward of Nantucket lightship; thence to Fire Island, when bound for New York; or to the Five Fathom Bank South lightship when bound for Philadelphia. From Aug. 15 to Jan. 14, the westward course would cross meridian 49° W., in latitude 43° N. The eastward course, at all seasons of the year, would cross meridian 70° W., at latitude 40° 10′ N. From this crossing, from Jan. 15 to Aug. 23, the course would cross meridian 47° W., in latitude 41° N., to Fastnet, or to Bishop's Rock. From Aug. 24 to Jan. 14, the latter course would cross meridian 60° W., in latitude 42° N.; thence by rhumb line to cross meridian 45° W., in latitude 46° 30′ N.; thence to Fastnet or to Bishop's Rock, as the course lies for the Irish or the English Channel. All of the steamship lines agree to this arrangement.

MEETING OF THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.

The 6th annual meeting of this society was held Nov. 10-11, at the House of the American Society of Mechanical Engineers, in New York city.

At 10.30 a. m. President Clement A. Griscom called the meeting to order, and Secretary Francis T. Bowles read his report, which also included the financial status of the society. He stated that 50 applications for membership had been received, and that there was a balance of $7,000 in the society's treasury. The list of candidates presented by the Council was passed upon by acclamation, after which the officers for the past year were re-elected, Mr. G. W. Dickie, of the Union Iron Works, being substituted for the late John F. Parkhurst, as member of the Council. Following this, Mr. Griscom, the president, read a brief address, in the course of which he said:

> The past year has been one of exceptional interest to the members of the society. The laurels won on the decks of the warships built in the shipyards of the United States have electrified the world, and the marvelous victories gained reflect credit which can well be shared by our gallant naval officers with the designers and builders of the ships, which they commanded.
>
> The demands made by the government in the war with Spain for colliers, water boats, troopships, hospital ships, supply vessels, guard boats, blockading vessels, scout and cruisers largely exceeded the supply found in our merchant marine. The navy purchased about 110 vessels of various classes, and the War Department chartered and purchased about 100 important steamships, and these 200 vessels, ranging in size from yachts to ocean liners, were fitted for war purposes with incredible despatch, and upon the whole in a most effective manner.
>
> An enormous public interest has been awakened in the performance of this so-called "Auxiliary Navy," and the practical lesson the country has received from the late war leads me to repeat what I had the honor of saying to you in 1894.
>
> It should be understood that a modern naval force, with all its multitude of equipment, arms, munitions and accessories, cannot be produced on the spur of the moment, but is the product of naval architects, steel makers, and a host of others whose skill can only be obtained by experience. It must not be overlooked that the personal element in warfare as in peace is an all-powerful one, sometimes predominating, sometimes secondary, but always of the greatest importance, and, therefore, an adequate navy is necessary, not only for the actual representation of power and force, but also to secure to our officers and men that superior nautical training only to be obtained by such continued experience at sea as made heroes of Hull, Decatur and Farragut.
>
> The full development of a naval force, however, is not possible unless the growth of the merchant marine has kept pace with the naval development. The words of Sir Nathaniel Barnaby, "No nation can maintain an efficient navy without a prosperous commercial marine to support it," has still the force of an axiom. It should not be overlooked that, in time of war, the conversion of fast mail steamers into armed cruisers is generally recognized among all maritime nations as a most formidable means of offence or defence for any country so fortunate as to possess them; moreover, to provide for the expansion of naval personnel rendered necessary in time of war, there must be a well-trained merchant marine to draw upon, and those nations which have not encouraged shipbuilding and shipowning in times of peace must inevitably suffer from their shortsighted and narrow policy when confronted with a powerful hostile fleet.
>
> It is not too hopeful to predict that one of the results of the war, resulting in the acquisition of distant insular territory, will exercise a marked effect upon our shipbuilding industry; indeed, it may be the turning point from which this nation may commence to regain its once proud position as a shipbuilding, shipowning and seafaring people; and it is very happy testimony to your skill as naval architects and marine engineers that several orders have already come from foreign nations for warships of the first class, and it is well known that foreign shipbuilders and capitalists have commenced seriously to examine with interest the advantages of this country for shipbuilding.

The reading of papers began with one by Mr. Arthur B. Cassidy, entitled, "The Standard Navy Boats." This paper briefly reviewed the various types of small boats, such as dories, whale boats, surf boats and the like, and then described the several types of steam launches and boats now adopted by the United States Navy Department as standard for use on all naval vessels.

In the design of these boats the four essentials in order of importance are: Safety, weight, comfort and speed. Just how these requirements are met was fully explained, as were also a number of constructional details. Two tables were included; one, giving the maximum number of men, weight of provisions and water and freeboard, when loaded, of the standard described; and the other giving the sail area, area of load water line, etc., for the same boats. These figures range from 64 men, 640 lbs. of provisions and 505 sq. ft. of sail for the 33-ft. launches, to 10 men, 100 lbs. of provisions, and 126 sq. ft. of sail for the 18-ft. dinghies. The statement was also made that at present there were in use in the navy 1,000 boats of all classes, the life of any one of which would not average more than 10 years. Accompanying the paper were 21 plates giving the constructional details of a number of designs of each type of boat mentioned, and 16 full-page half tones, taken from actual boats.

The discussion was introduced by Mr. H. De B. Parsons, who asked what the author's experience with folding boats had been. Such boats were used by foreign navies, and also by the merchant marine. Mr. W. P. Stephens remarked that the area of sail provided appeared small, and it seemed to him could be increased with material advantage.

Capt. J. W. Miller also considered an increased sailing power desirable, and he suggested the use of a centerboard with suitable stiffening. His experience with 12 boats used in connection with the New York naval militia convinced him that the boats now used were not good sailers.

Col. E. A. Stevens asked if metal boats had been tried by the navy. He also understood that cypress planking was at one time used, but that it had been abandoned, and wanted to know why.

Lieut. W. P. White mentioned a report of a board appointed to investigate the question of small boats which was published in the "Proceedings of the Naval Institute." He considered that the rig of these boats needed attention. It was unnecessary to adopt small sails for safety since safety depended largely upon the handling and not upon sail area.

Mr. John G. Tawresey said that there were so many conflicting elements to be provided for in the design of these boats that it was difficult to suit all. Injuries in stowage, hoisting and lowering, and the blast of guns all tended to shorten the life of boats. At present he had charge of the largest boat shop in the navy, and he was therefore in a position to appreciate the excellence of the present type. Metal boats had been tried in the navy and abandoned. Centerboards were not used because of the additional weight and the infrequent need of sailing close to the wind. It must be remembered that these boats are not intended for sailing craft. The present designs suited three out of four officers.

Secretary Bowles said the present boats were the outcome of an enormous amount of experience and were a compromise between the builder and the user, whose ideas were naturally somewhat antagonistic.

The second paper, by Assistant Naval Constructor Lawrence Spear, U. S. N., entitled "Bilge Keels and Rolling Experiments, U. S. S. 'Oregon,' " was then read by Prof. W. F. Durand. It is abstracted separately on another page of this issue. The discussion was opened by Mr. J. G. Tawresey, who said that the arguments advanced for abandoning the bilge keel did not meet the approval of practical men. That the reduction of rolling was due to wave making by the bilge keels there could be little doubt, and it is well known that the best method of creating model waves was by oscillating a plane. He considered that the bilge keels did not disturb to any extent the natural wave lines of the vessel.

Prof. W. F. Durand read a discussion of the paper, calling attention to the difference in results obtained by the use of present formulas and the actual values obtained by the test described. The bilge keel was not a plane, and the formulae at present in use were very unsatisfactory.

Secretary Bowles stated that a few years ago bilge keels were placed on all of the large vessels of the navy. Recently, for various reasons, several battleships had been built and launched without these keels, with the result that these vessels were not really safe, and it was necessary that keels be put upon them. He ventured to say that in the future no battleships would be built without bilge keels.

Asst. Naval Constructor R. M. Watt mentioned that the "Massachusetts," was keeled in 16½ working days at the Brooklyn Navy Yard, under Mr. Bowles.

The next paper, "Portable Pneumatic Riveters in Shipbuilding," was then read by its author, Mr. W. I. Babcock, President of the Chicago Shipbuilding Co. This paper is abstracted elsewhere in this issue.

Mr. T. F. Newman said he had used pneumatic percussion riveters in connection with the construction of vessels for the revenue marine service, and the government inspectors passed such work readily. Where it was necessary to mill rivets, as in the case of shell riveting, he had found the saving only about 25%.

Mr. John Platt called attention to the methods of hydraulic riveting used in England, and remarked that he was surprised to find people still using blows instead of steady pressure here. He thought that large rivets could not be driven by purcussion riveters. The Holland & Wolff works use an immense crane which spans the vessel. Pendant from this crane are six 40 to 50-ton riveters, which are used to rivet framing, etc. In England and Ireland hydraulic riveters are extensively employed. To prevent freezing crude glycerine was used in proportions of ⅓ glycerine to ⅔ water. He had no doubt, however, but that for small work percussion riveting was satisfactory.

Mr. Tawresey believed percussion riveters could do all sorts of riveting in a rapid and satisfactory manner. The noise was, of course, disagreeable and had a bad effect on all concerned, possibly increasing costs slightly.

Mr. L. R. Pomeroy asked what were the limitations of percussion riveting. He knew several locomotive builders had tried pneumatic riveters and had later given them up because they could not get steam tight joints with them.

Mr. Babcock, in answering the various statements and questions, said that he had closed 1-in. rivets, but he knew of several cases where rivets up to 1¼ ins. had been set with the same style of hammer that he used. This need not be the limit, however, as it was simply a question of sizes of hammers. The air-pressure at the end of the hose should not be less than 100 lbs., and they were now putting in machinery which would give 125 lbs. He preferred pneumatic to hydraulic riveting, because of its simplicity and general applicability. The Harlan & Wolff traveling crane is very heavy, and only of use for only certain kinds of work. He admitted that the noise of percussion riveters was objectionable, but said that there was practically no limit to their use, it being almost as easy to operate a 10-ft. gap as a 4-ft. one.

In one vessel recently riveted up by hand 51,306 shell rivets were used, each costing 3.99 cts. In another instance 74,493 shell rivets were placed by the percussion riveter, mounted upon the frame described in the paper, and cost 2.96 cts. per rivet. In response to a question, he stated that as far as he could see there was no reason why long rivets could not be driven in this way.

Afternoon Session.

Immediately after calling the meeting to order, the President introduced Capt. Wm. H. Jaques, who presented a series of stereopticon views of foreign submarine boats, and the American boat "Holland."

The regular programme was resumed by Secretary Bowles reading a paper by G. W. Dickie, entitled, "Torpedo Boat Destroyers for Sea Service, with Special Reference to the Conditions that Prevail on the Pacific." In this the author said:

> A torpedo-boat destroyer must possess other qualities than those necessary for the destruction of torpedo boats. The destroyer must be a sea-going vessel, able to remain at sea with the fleet to which she is attached or to make independent voyages.
>
> The work of the torpedo-boat destroyer is to prevent the torpedo-boat attack, and is, therefore, performed in open water. She must keep the sea with the attacking fleet, watching every place of refuge for a torpedo-boat. She must, therefore, possess speed equal to that of the torpedo boat; a battery powerful enough to destroy her; sea-going qualities to enable her to keep a watch in spite of weather. She should be able to cover long distances at a high rate of speed and in stormy weather. The fleet to which she is attached should not be delayed and hampered by guarding her from harm; she ought, instead, to be able in all kinds of weather to act as a scout in advance of the fleet, keeping tho larger vessels informed as to the whereabouts of a possible enemy. Such would be an ideal torpedo-boat destroyer.
>
> It cannot be said that the present type of torpedo-boat destroyer comes near meeting these requirements. Quite a large number of destroyers now meet the requirements in the matter of speed, if required for a short time only, in smooth water, and if she is in good order; but the one quality of speed has been made paramount to all other qualities to such an extent that the full speed can only be reached when the conditions are such that the sea-going qualities can be neglected.
>
> The great distance between harbors on the Pacific Coast and the almost universal condition of rough water along the coast from Point Conception in the south to Cape Flattery on the north, with only one place of refuge, renders it necessary that any vessel for practical service outside the harbor of San Francisco or the smooth waters of Puget Sound must have good sea-going qualities and be able to remain outside in all conditions of weather.
>
> The qualities necessary for this service are not possessed in any degree by the present type of torpedo-boat destroyer. While they have made voyages of considerable length at sea, they have done so usually under the care of a larger vessel. They have needed extra care, both in watching the weather, taking advantage of every shelter that lies in the way.
>
> The 420-ton destroyers lately ordered by our government are a decided improvement in this class of vessel, but we do not think they are fitted even yet to meet the special conditions of service on the Pacific.
>
> The annexation of the Hawaiian Islands requires a much greater radius of action for such a vessel, and, we think, a different treatment. In fact, we maintain that if 30 knots or over is aimed at as the supreme speed, a sufficiently staunch sea-going vessel cannot be produced in the present state of the art, and that the present so-called 30-knot torpedo-boat destroyers have not, in fact, the speed with which they are credited as being available when required.
>
> If these boats and their machinery were made more substantial, so that their full power could be exerted at any time and without risk, and the hull stand a moderate sea without danger, the 30-knot boat, by reason of the extra displacement, would drop to about 27 knots; yet we venture to assert that such a boat, ordered to reach a point at sea, say 100 miles distant, in the shortest possible time, would reach the objective point in less time than the regulation 30-knot boat that is said to get a horse-power in 50 lbs. weight of machinery. A large proportion of naval vessels rated at high speeds, especially those over 20 knots, have obtained such speeds under conditions that cannot be reproduced when the speed is most needed, and a good, reliable, heavy-engined, 16- or 17-knot boat may outstrip them in a fight.

Mr. Dickie then outlined plans for a destroyer of 640 tons displacement and 7,000 I. HP. with a maximum speed of 25 knots and a sustained sea speed of 15 to 20 knots. He provided an armament of six 6-pdrs., two 4-in. rapid-fire guns and two submerged torpedo tubes aft of the engine room. He believed such a boat would show better speed under regular service conditions than any of the so-called 30-knot torpedo-boat destroyers, and for sea-worthiness, habitability, or fighting capacity would far outrank them.

The discussion of this paper was opened by Mr. Platt, who took exception to the use of the term "Torpedo-boat Destroyer." The craft described should properly be called a "Torpedo Cruiser." The boat outlined by the author possessed many desirable features, but he saw no reason for limiting the speed to such a low figure. He had been present at the test of an English destroyer of [illegible] tons, which had made 27 knots in a rough sea and against the wind or 32 with the wind. Such a boat would easily make 30 knots in moderate weather. Further, in English practice, it was customary to limit other matters, such as coal consumption, the maximum at present allowed being 2½ lbs. per horse-power.

In answer to a question by Mr. Stevenson Taylor, Mr. Platt stated that speed ratings were obtained, in the case of such boats, by averaging 6 runs over a measured mile between points. During these runs the turns of the screw were accurately determined, and thus data obtained from which the speed can be obtained at any time by knowing the turns of the screw.

In connection with this discussion the first topical question "The Utility of Torpedo Boats and Has the Submarine Boat a Place," was introduced, and Mr. Bowles read a letter from an officer who had commanded torpedo boats during the recent war. The opinion seemed to be that the torpedo boat was of great utility, but that a lack of drill and an insufficient complement of officers and men, accustomed to the handling of such boats, had made them of considerably less service than they might otherwise have been. The systematizing and standardizing of boats and equipment and the careful selection and drilling of the crews was strongly advocated.

Lieut. A. P. Niblack, in a letter, compared our torpedo boat system with the careful and complete methods of foreign countries, and regretted that the custom of hauling the boats out of the water was being adopted here.

A letter from Lieut.-Commander Kimball, who commanded the torpedo-boat division of the North Atlantic Station during the recent war advocated the submarine boat. He stated that if it be admitted that the torpedo is of use, then the submarine boat which is no more than a torpedo with a human mind directing its movements in place of the usual automatic devices, would be of far more service. If trenches and mines are useful or necessary on land, it was quite as essential to take advantage of the protection afforded by the water. The submarine boat is the only kind of inexpensive boat that can move up close to an enemy. Such a boat with a crew of five men could attack land batteries and enter harbors. It could make blockades ineffective, destroying mines, etc.

Capt. John Lowe spoke in favor of the submarine boat, and pointed out how much time, money and anxiety would have been saved had the United States had such a boat at Santiago. He believed that the future would see submarine despatch boats, gunboats, and observation boats.

Assistant Naval Constructor R. M. Watt, who had had charge of the repairs of the torpedo boats sent to the New York Navy Yard, considered the "Morris" the ideal type of torpedo boat, operating from a base. He favored only one type of torpedo boat, about 100 tons, and would then at once jump to vessels of 400 to 500 tons, building a vessel about as outlined in Mr. Dickie's paper for service as a scout or despatch boat. Mr. C. D. Mosher did not think the time had come for standardizing torpedo boats. The speed and power for a given displacement were yearly increasing, and we must have as high speeds as our enemy. Handling had a great deal to do with the poor showing of our boats. At present experiments were being conducted in England by Mr. Parsons, which, if successful, might revolutionize torpedo-boat construction.

Mr. J. G. Tawresey spoke as an unbeliever in torpedo boats. He admitted their moral effect, but based his views largely upon the fact that at present there were no indications that torpedo attacks would be successful. He would not be afraid of torpedo boats in the open sea. He was of the opinion that torpedo boats were entirely too light for any sort of sea service. Under special conditions they might be dangerous antagonists, but conditions must be taken just as they exist when the chance to fight occurs. So far, they had been used simply as dispatch boats and not with the best of success. They should not in any case be used for any other than the designed purpose.

Mr. F. L. Du Bosque favored the standardization of torpedo boats so that a man, when ordered from one to another, could at once perform his special duties properly. Water tube boilers on some torpedo boats had proven a success, and there was no inherent reason why all should not prove successful, if properly handled. The great trouble was that the boilers on a torpedo boat were used spasmodically.

Mr. John C. Kafer considered the construction of torpedo boats faulty. They never did what was expected of them, and the speeds credited to them were not reached in actual service. He did not favor any boat that could only keep up its speed from three to five minutes.

Mr. R. M. Watt called attention to the fact that in a torpedo-boat attack it was contemplated to have, say, half a dozen boats start from different directions. In the Battle of Manila two improvised torpedo boats started from 4,000 yds., and one of them succeeded in getting within 1,200 ft.

Mr. Stephenson Taylor considered the trouble due largely to the make up of the crews, most of them being men not familiar with the tools they were using. The "Scorpion," for instance, gave no trouble until taken by the government.

Mr. Bowles explained that the service of a yacht under ordinary conditions and the conditions imposed upon the converted yachts employed in Cuban waters was entirely different. Most of the vessels on the blockade were forced to use salt water at times in the boilers.

Mr. F. Meriam Wheeler then read a paper, entitled "Econmoy Test of a Unique Form of Feed Pump,' which will be abstracted in a later issue of Engineering News.

In discussing this paper Lieut. Walter M. McFarland, Engineer Corps, said that it must be remembered that the service of engines in the merchant marine and in naval vessels was entirely different. In the former they were started up and ran continuously for 6 or 7 days, while in the latter they might be started or stopped every five minutes. Hence it was that the converted vessels gave so much trouble. It was, therefore, necessary to have the various pumps separate from the main engines and leave the engines free to propel the vessel alone. Whatever form of pump was adopted must be designed with an idea of saving weight and economizing coal.

November 11.—Morning.

This session began with the reading of a paper, entitled "The Steam Yacht as a Naval Auxiliary," by Mr. W. P. Stephens.

> The work of reconstruction which has been under way in the United States Navy for the past 15 years has been limited almost entirely to the strictly fighting arm of the service—the battleships, cruisers and torpedo craft. Indispensable as they are, these of themselves do not constitute a perfect navy, in fact they are of comparatively little use without a large attendant fleet of auxiliary craft; transports, colliers, water boats, repair ships, supply ships, hospital ships, and small craft for various uses.
>
> The condition of the Navy at the outbreak of hostilities between the United States and Spain may be briefly summed up as strong in its personnel; comparatively strong

in fighting vessels, guns and armor; and absolutely unprovided with auxiliaries of all kinds. Of all the urgent work demanded both ashore and afloat, nothing was more immediate and pressing than the creation of an efficient fleet of auxiliaries.

The possibilities of the yacht fleet at the present time for conversion to war uses were, even from a theoretic standpoint, far from promising. Many of the vessels were ill-fitted in model for real service at sea; there was a lack of displacement for the added weights of armament and ammunition, of berthing space for crew, of bunker space, and suitable locations for magazines. The nominal speed, in many cases low in itself, was not realized even in smooth water, and in a sea there was a serious loss of the average working speed. There was no protection, no distilling apparatus; the capacity of the water tanks was generally inadequate, and the decks were not designed to withstand the shock of guns. The draught as a rule was greater than was necessary or desirable. The nature and extent of these defects were fully realized at the outset, but under the circumstances there was no other course but to take the yachts as they were and to make the best of them. All things considered, they have done their work quite as well as was to be expected; they have served a certain necessary purpose, and they were capable of doing even more had it been required of them. The work of the yachts, their success and failures taken together, with the work of other small craft, such as tugs, lighthouse tenders, etc., impressed into the same service, seems to indicate the desirability of the creation of a new type of small auxiliary not at present recognized on the Navy List. The speed may be placed at not over 18 knots. This, however, is not to be measured by the conventional yacht standard by which an 18-knot steam yacht takes the wash of a good 12-knot tug, but means a reasonable approach to the designed speed under ordinary service conditions at sea, and the ability to keep with the fleet even in bad weather. The model should possess seagoing qualities of the highest class; the draught should be limited to 11 or even 10 ft., as a maximum; the construction should be durable, with ample scantling both to carry the armament and to insure a long life with ordinary care in laying up; the engines should be strong and reliable, the bunker space as large as possible, and, as deck and side protection will probably be impracticable, especial attention should be given to the water-line protection of machinery and magazines through their location and the disposition of the bunkers.

The intended uses of this class call for three sizes: for sea work, as despatch boats and tenders, and for picket duty, vessels of not over 800 tons displacement. The next size to be of about 400 tons displacement. The third size, for harbor patrol service, to be of about 200 tons. A speed of 15 knots would suffice for this service, but they should be capable of towing a vessel out of possible danger.

In the discussion, Capt. Jacob W. Miller said: Although we were fighting a nation in the late war which did not make a second line of defense necessary, the yachts did not meet the conditions required. The yachts were purchased at maximum prices, and we could have got boats better fitted for the work if the same money had been expended some years ago. Yet the pick of the yachts in the United States were taken. None of the yachts could do over 10 knots continuously for 24 hours. There was not sufficient breathing space for the crew on converted yachts, and they were not rough and ready enough. Boats for harbor work must be strong enough to permit running up alongside of sailing vessels that are drifting in mine fields. Converted yachts were serviceable in very few particulars. He did not favor three types of such vessels, and considered two quite sufficient, one for inner patrol work, and one for outer.

Mr. J. G. Tawresey, who was a member of the Auxiliary Cruiser Board, said: The orders given to the Board was to select vessels that would act as "eyes to the fleet." We had to take such vessels as were available. As fighters they were makeshifts, filled with objectionable features. For one thing, they were tinder boxes. I want to emphasize the fact that we cannot improvise a navy from yachts and tugs. There was a very useful field for such a boat as suggested by the author, and the design presented would, he thought, quite fill the want.

Mr. John Platt called attention to the fact that no fast gunboats had been built in this country. A speed of only 18 knots for a vessel of 850 tons was very low, as it was quite possible to get 22 knots. The British Government had built a large number of torpedo gunboats with speeds ranging from 18 to 22 knots.

Mr. Bowles felt that there was a decided need of such a boat as was described in the paper, but a speed of 16 knots, provided it could be kept up, was sufficient. Referring to the lack of crew space on the converted yachts, Mr. Bowles said that as all the naval militia wanted to see service, the boats were often over-crewed. He favored only one size of boat, because experience had shown that the wrong size was always around when an emergency arose.

Lieut. W. P. White considered the inshore patrol or mine-field protection to be a function of such sea-going tugs as the government could impress, and it was out of the question to maintain a fleet of small boats for this purpose. The armoring of scout boats to any extent was inadvisable. In time of peace the various vessels should carry more than their war complement, so that in emergencies the extra men could at once man auxiliary or new vessels. The manning of vessels with entire naval militia crews was, he thought, poor policy, and it was far better to send them out as part of the regular crew of vessels in service. Battleships were of the first importance, and hence money should first be put into their construction, leaving despatch boats, etc., until later.

Mr. W. P. Stephens, in closing the discussion, said he did not mean to insist upon three classes. There might only be two classes, the larger being represented by the boat designed by Mr. Dickie. Lower speeds should be used and engines and other apparatus employed which could be successfully operated by inexperienced men.

In the absence of Chief Constructor Philip Hichborn, the Secretary read the opening paragraph of his paper on "Designs of the New Vessels for the U. S. Navy." That portion of the paper pertaining to the new battleships is given elsewhere in this issue. In speaking of monitors, torpedo boats, etc., Mr. Hichborn said:

> Since our last meeting, practically every type of vessel the government possesses has been put to the test in engagements with the enemy. There is no record, so far as I know, of the failure of any vessel to fulfil all expectations. The wonderful success attending these naval engagements has impressed the country at large with the value of, and the necessity for, an efficient Navy. Congress responded to this sentiment promptly and liberally, and within the past 6 weeks contracts have been made for 3 additional battleships, 4 coast-defence monitors, 16 torpedo-boat destroyers, and 12 torpedo boats. A full ship-rigged sailing vessel was also authorized as a practice ship for the Naval Academy, and is already under way.
>
> Monitors.—In appropriating for four coast-defence monitors, Congress did not contemplate providing vessels equal in size to the double-turreted monitors now in commission, the cost of hull and machinery being limited to $1,250,000.
>
> The bill provided that the vessels should have either one or two turrets, and it was found advisable to develop the design on the basis of a single turret mounting a pair of 12-in. guns. The trial speed is specified as 12 knots.

The paper then briefly outlined some of the important features of this type of monitor, but the information given is now of little value since within the last few days the Department has decided to use double turreted monitors carrying four 10-in. guns.

> Torpedo Boats and Destroyers.—The portion of the appropriation bill providing for these vessels authorized the construction of "16 torpedo-boat destroyers of about 400 tons displacement," and of "12 torpedo boats of about 150 tons displacement," all to have "the highest practicable speed." The designs prepared in the Department for the destroyers cannot be referred to any particular type. The midship section approximates to the oval form largely adopted by the French. The sections toward the stern are original, though resembling somewhat the form given by Thorneycroft to his twin rudder boats of some years ago. In addition to coal abreast the machinery, there will be the protection of 12½-lb. nickel-steel plate over a portion of the deck and on the sheer strake. The forward conning tower is of ½-in. nickel-steel plates. The vessels carry a battery of two 12-lb. and five 6-lb. guns, with two long torpedo tubes, mounted on the midship line.
>
> In both the torpedo boats and destroyers, the wood has been required to be fire-proofed and its use reduced to a minimum. The vessels will be lighted throughout by electricity and fitted with searchlights. Special attention will be paid to adequate ventilation, and every comfort and convenience consistent with the type will be supplied.

The Secretary suggested that the question of the utility of monitors be discussed in connection with the discussion on the paper just read.

Capt. William C. Wise said:

> It is my belief that the "Puritan" is the finest fighting ship in the United States Navy to-day. She could battle with a whole fleet. With 20 "Puritans" we could defend the whole coast.

Prof. Cecil H. Peabody discussed briefly the disposition of armor on monitors and battleships. He did not favor standardization of battleships and torpedo-boats beyond those built at any one time, since standards at times interfered with progress.

Col. E. A. Stevens asked if the conditions during the battle of Santiago were normal enough to permit the records of hits given the Spanish vessels being used for future design. If so, it would seem that such heavy armor was unnecessary for the large shells did not seem to hit.

Afternoon Session.

At the afternoon session the first paper presented was "Methods of Securing Watertight Work," by Assistant Naval Constructor H. G. Smith, U.S.N. The paper referred especially to ship construction, but as some portions of it are of general interest to all designers of riveted work, we shall abstract it in a future issue.

To facilitate discussion, since the general subjects were the same, the next paper, "Tests of the Strength of a Longitudinal Bulkhead Separating Two Engine Rooms," was then read by its author, Naval Constructor J. J. Woodward, U.S.N. This paper is abstracted on another page of this issue.

In discussing the papers, Naval Constructor J. G. Tawresey said that there should only be one kind of bulkhead—a strong and absolutely water-tight one. Historically there might have been two classes, the tight and the leaky, but in the future only the tight should be accepted. It must not be understood that the navy alone found leaks, for they were just as troublesome in the merchant marine. He considered that a good deal of the blame for leaky bulkheads could be laid to the draftsmen.

Professor Peabody considered the experiments described in the papers just read, as very important. He thought the Navy Department should conduct a series of experiments and put the data obtained in form so that it could be used for future design.

Mr. T. F. Newman saw no reason why bulkheads and ship's bottoms could not be made absolutely tight. On the Great Lakes they managed to secure such tight work that in many instances where the outer plating of the double bottom of vessels carrying grain had been injured, not more than 30 or 40 bushels of grain would be damaged, owing to the tight inner bottom

Mr. John C. Kafer thought that bulkheads were made to keep out the bulk of the water, and except in tank steamers, there was no need of builders going to great trouble to stop every little leak, provided the bulkheads were strong enough to stand the strain.

Col. E. A. Stevens asked what conditions were imposed in the United States service. In the British service he understood that the stiffeners must be strong enough to stand all strains without depending upon the sheeting.

In reply Mr. R. M. Watt read a letter showing how the stiffeners and bulkheads were calculated for the "Texas," and a comparison of the bulkheads of a number of United States vessels.

Mr. Bowles objected to placing 50% of the blame for leaky bulkheads upon the draftsman. The trouble was that after a bulkhead was made tight it was drilled full of holes by the machinists and electricians.

Mr. J. J. Woodward objected to any plan of bulkhead bracing that would weaken the protective deck, and said that where there was a conflict between the fighting strength of a vessel and a small amount of leakage, the latter should be disregarded. In response to a question, Mr. Smith said that in the test of the double bottom of the "Brooklyn" the time and labor of five men was required constantly for 14 months.

Owing to the short time remaining, the paper of Mr. Walter A. Post, on "An Electrically Operated 150-Ton Revolving Derrick," was read by title only. This paper will be abstracted in a later issue of Engineering News.

The last paper of the meeting, "Stability of a Battleship Under Damaged Conditions," was read by its author, Prof. C. H. Peabody. This was a report of a series of tests made with a small wooden model representing a battleship with its superstructure removed. The model, with inclining apparatus in place, was ballasted so that it floated at the proper water line, and so that it had the proper metacentric height. Then blocks, representing the parts or compartments laid open to the sea, were cut out and lead weights were fastened in place to compensate for the wood removed. Then various measurements were made to determine the initial stability and the stability at various angles of heel. The facts developed were illustrated by a series of diagrams, and a number of curves. Discussing the paper, Mr. Woodward suggested that in an actual battleship the superstructure could be made to assist in keeping the vessel afloat. Professor Peabody considered that the many openings in the superstructure would prevent its adding to the buoyancy of the vessel, should it start to capsize.

The discussion of the following topics was then taken up:

> First.—Under the circumstances of the blockade at Santiago, which was the more economical method of maintaining the boilers in readiness for immediate action—banking the fires or keeping them spread but very thin?
>
> Second.—Can you give any data as to the cost in coal of maintaining the engines and boilers in readiness for immediate service?

Mr. John C. Kafer read a letter from Chief Engineer Milligan, of the "Oregon," which stated that the fires on the "Oregon" were spread thin. There being from 24 to 27 tons of coal burned per day. The "Iowa" used banked fires. Mr. Kafer considered banked fires more economical, but not so advantageous for quick steam making, as keeping them spread.

Lieut. Walter M. McFarland presented some figures showing the coal consumption on the "Indiana," "Massachusetts," "Oregon," and "Iowa." These were in part:

	Tons.		Lbs.	
"Indiana"......	34.7	per day. or	7.21	per sq.ft. grate per hr.
"Iowa"........	35.16	" "	5.2	" "
"Massachusetts"	29.4	" "	6.5	" "
"Oregon".......	24.91	" "	4.35	" "

Note.—The "Iowa," "Massachusetts," and "Oregon" had spread fires.

This was, therefore, an indication that spread fires were also more economical, and there could be no question about the enormous tactical advantage.

Mr. Lewis Nixon presented a resolution to the effect that papers be invited on the subject of "Life Saving at Sea" and that two such papers be selected and printed in next year's "Proceedings." Motions thanking the various officers were passed, after which the final adjournment was taken.

In the evening fully 200 members and guests assembled at Delmonico's to participate in the annual banquet, which proved quite as successful as the business meetings had been. President Clement A. Griscom acted as toastmaster and the following is the list of toasts:

"The President of the United States;" "Our Navy; It Has Justified Its Existence and Glorified the Nation," Harvey D. Goulder; "Our Commercial Marine, Its Development and Extension is a National Necessity," Hon. George F. Edmunds; "The Naval Militia," Capt. J. W. Miller; "Naval Architecture," Lewis Nixon; "Marine Architecture," Lieut. Walter M. McFarland; "Our Manufacturers," Theo. C. Search. Personal toasts were: Charles H. Haswell, Charles Ward, William H. Webb.

On Saturday the members of the society enjoyed an excursion to South Bethlehem, Pa., through the courtesy of the Bethlehem Iron Co. The party, to the number of about 100, boarded two special cars provided by the Bethlehem Company, and attached to the regular Lehigh Valley Express, which left Jersey City at 8.20 Saturday morning. Immediately upon arriving at South Bethlehem the special cars were run into the yard of the Bethlehem Iron Works, and the entire party was transferred to a train of flat cars provided with seats. On this observation train the inspection of the works was made.

Starting at one end of the property, which is just one mile long, the party was taken past the scrap pile, where waste pieces of armor plate, stubs of ingots, etc., are stored for possible future use, into the forge shop, a building about 1,900 ft. long. In the main portion of this great building is a 5,000-ton Whitworth hydraulic forge, which was at work upon a steel jacket for a 12-in. coast defense gun. The wonderful power of this press, its quiet operation, the accuracy of its work and the skill with which its many movements were controlled by the few operators, was a revelation to many present.

Further on the powerful pumps necessary to give the 2,250 lbs. per sq. in. needed for the press were seen. A smaller press, 1,300 tons, but of the same type, was also in operation cutting off the end of a good-sized ingot. Continuing, the observation train and party passed the line of open-hearth furnaces, with capacities of 30 to 50 tons, and came to a halt beside the ingot casting pit, where the fluid compressed ingots, for gun forgings, engine shafts and the like, are made. This consisted of a pit about 20 ft. deep, in the center of which stands a 9,000-ton vertical hydraulic press. Fortunately for the visitors, an ingot was just being cast, so the whole operation could be seen by all. At one side of the great press stood a cylindrical flask built up of heavy cast-steel sections, bolted together and lined with refractory material. Over this a ladle holding about 15 tons of molten steel was run and the vent in its bottom opened, allowing a jet of liquid steel about 2 ins. in diameter to flow out and gradually fill up the vertical flask. When sufficiently filled, the flask, with its liquid steel contents, was slid over and centered under the hydraulic press and the pressure of 9,000 tons was gradually applied. Under the influence of this pressure, which is allowed to remain for six hours, the metal is compressed and the possibility of injury by air or gas bubbles is largely removed.

The next shop visited was the machine shop, where gun work was in progress. This building is 1,400 ft. long, and is filled with enormous planers, boring mills and other heavy machinery, most of which was engaged upon disappearing gun carriages for coast defense guns, and upon large size guns and mortars and a variety of engine shafts.

In another shop, devoted to armor plate work, the party was fortunate enough to see the great 13,000-ton press forging an armor plate. In this shop also the immense 125-ton steam hammer, now abandoned, stands as a monument to past methods and modern improvements.

Next the visitors were conducted to the department where common plates are Harveyized. A steel plate about 8 × 10 ft., intended for a large vault, was withdrawn from the furnace and placed over a large vat. A system of perforated pipes was swung over the plate, and when the proper temperature was reached water was turned on. In summer it is necessary to use ice water to ensure a proper chill, but at this season of the year ordinary river water is suitable.

The next move was to the tempering building, where engine shafts, gun tubes and long or thin pieces likely to bend and temper unevenly in a horizontal position are supported vertically in a gas blast furnace. The party arrived just in time to see a jacket for a 12-in. gun lifted from the heater, shifted over and rapidly lowered into a large cylindrical tank of oil, where it was to remain for from 5 to 6 hours. As the red-hot tube, fully 20 ins. in diameter and 20 ft. long, dropped into the oil there was next to no flame, and when once immersed only a small amount of smoke escaped from the oil surface.

In the armor plate trimming shop, the next one inspected, great slabs of steel armor, some flat and others curved, were having their edges beveled or squared up in planing machines. Such plates as had been hardened could only be planed down to the hardened surface, and emery wheels, either automatic or mounted upon flexible shafts for hand use, were employed to finish the hard edges. Plates as yet unhardened were being sawed, the saws consisting of steel disks some 4 or 5 ft. in diameter, with a series of separate cutting tools mounted around their circumferences. These saws advanced at the rate of about 4 ins. per hour, a rather lively rate, considering the fact that they were sawing tough steel from 12 to 14 ins. thick.

By this time the calls of the inner man were heard, and those in charge piloted the party to the office, where things to eat and drink were served and disposed of without stint, not, however, being served on armor plate. After a full inspection and realization of this department the special cars were again boarded and a quick return was made to New York, where the party disbanded, after a most instructive and delightful day.

BOOK REVIEWS.

Note:—In the review of the new edition of Johnson's "Engineering Contracts and Specifications" in our last issue the price of the book was, by an error, printed as $3.50. It should have been $3.00, which is a reduction of $1 from the price at which the first edition was sold.

COMMERCIAL RELATIONS OF THE UNITED STATES WITH FOREIGN COUNTRIES DURING THE YEARS 1896 AND 1897.—In two volumes. Vol. I. issued from the Bureau of Foreign Commerce, Department of State, Washington. Cloth; 9 × 5¾ ins.; pp. 1,283.

The introduction of this book proposes to show that the "International isolation" of the United States, so far as industry and commerce are concerned, is made a thing of the past by the logic of the change in economic conditions. We are now a competitor in the world-wide struggle for trade, and can no longer afford to disregard international rivalries. The report then commences the detailed review of the world's commerce, based upon data chiefly obtained from our consular agents. This volume deals with Europe, Africa, America, Asia, Australasia and Polynesia. The report covers character and amount of exports and imports, finances, trade conditions, transportation systems in many cases, and a vast mount of information useful to the American exporter.

CALCUL DES CONDUITES D'EAU.—Par Georges Davies, Conducteur au service des Eaux de Paris, Licencie es-sciences. Encyclopedie Scientifique des Aide-Memoire. Paris: Gauthier-Villars & Sons. Paper; 7½ × 4½ ins.; pp. 194; illustrated. Paper, 2.50 francs; boards, 3 francs.

The author commences his work by a discussion of the theory of the flow of water in pipes or conduits, under different conditions; gives the formulas of Prony and Darcy and recommends the employment of the latter under the conditions stated; he also notes the formulas of Weisbach, Ganguillet and Kutter, M. A. Franck, Manning, Unwin and Lampe. Succeeding chapters discuss conduits with reservoirs, variable diameters, distribution from various points on the pipe line, and miscellaneous questions arising in the supply and control of water in pipes. His final chapter treats of the study of distribution systems, arrangement of pipes, discharge, diameters and loss of head, syphons, etc. He closes with a number of tables of coefficient velocities, discharge, etc., as deduced from Darcy, Maurice Levy and Flamant. The work is chiefly theoretical and mathematical, with a few actual examples noted. The author does not enter into the details of practice in the form of pipes, valves and general appliances in pipe distribution.

STREET RAILWAY ROADBED. By Mason D. Pratt, Assoc. M. Am. Soc. C. E., and C. A. Alden, Assoc. M. Am. Soc. C. E. Street Railway Publishing Co., New York. Cloth, 6 × 9 ins.; pp. 135; 157 illustrations; $2.

As stated in the preface, the subject matter of this book is largely made up from contributions of the authors to the "Street Railway Journal," "Engineering News" and the Proceedings of the Am. Soc. C. E. About one-third of the book is given up to a historical review and a consideration of what governs the shape of rails. In this portion are some 50 line cuts representing sections of rails and angle plates showing the gradual increase in web depth and the changes of form of head and base. There are also about 30 cuts under the title of "What Governs the Shape of Rails," and the T-rail as adapted to street railways is also considered. This is followed by a discussion of track fastenings and joints, curves, special work and guard rails. The remainder of the volume is devoted to a discussion of the advantages of spiral curves, in connection with which is given a series of tables and formulas and remarks on the design of special work. The last chapter consists of a set of skeleton specifications for street railway tracks.

Considering the book as a whole we feel compelled to criticise it in several points. For instance, in the chapter on joints, cast joints and electric welded joints are barely touched upon, while "bonding," a very important matter where electric roads are concerned, is not even mentioned. We find no mention either of the recent practice of laying rails directly upon longitudinal concrete footings and discarding the use of ties. Aside from several such defects the information contained under the various headings mentioned will doubtless be of considerable assistance to those having to design or construct street railways. The principal value of the book rests in the chapters on curves and the design of special work.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES, issued by the Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn. Leather; 6 × 3¾ ins.; pp. 196. $1.25.

Of the many metric conversion tables issued, this is by far the best and most convenient that has ever come to our notice. The actual work of calculating the tables and reading the proof has been done by Mr. A. D. Risteen, Associate Editor of "The Locomotive" and late of the computing division of the U. S. Coast and Geodetic Survey. This in itself is a guarantee of the care and accuracy with which the task has been performed. The history of the meter is given in full, together with a general discussion of the units derived from the meter. Then follows a table of metric units, the U. S. equivalent and the logarithm to be applied in working from this data. A full list of the tables inserted in this handbook is as follows: The units reaching 100 in each case and two tables being given under each head from metric to U. S. standards and from U. S. to metric; centimeters to inches; meters to feet; meters to yards; kilometers to miles; square centimeters to square inches; square meters to square feet; square meters to square yards; square kilometers to square miles; hectares to acres; cubic centimeters to cubic inches; cubic meters to cubic feet; cubic meters to cubic yards; cubic kilometers to cubic miles; cubic centimeters to U. S. fluid ounces; liters to U. S. liquid quarts; liters to U. S. gallons; liters to British liquid quarts; liters to British gallons; liters to U. S. dry quarts; cubic meters (steres) to U. S. bushel; grammes to grains; grammes to avoirdupois pounds; kilograms to avoirdupois pounds; grammes to troy ounces; kilograms to troy pounds; milliers to short tons; kilograms per square meter to pounds per square foot; kilograms per square centimeter to pounds per square inch; kilogram-meters to foot-pounds; calories to British heat units; calories to foot pounds; force de chevaux to horse-power; grammes in a cubic centimeter to ounces in a cubic inch; kilograms in a cubic meter to pounds in a cubic foot; milliers in a cubic meter to short tons in a cubic yard, milligrams in a liter to grains in a U. S. gallon; comparison of Centigrade and Fahrenheit thermometers. This list, better than a page of comments, conveys an idea of the useful range and application of the tables. The equivalents in both metric and U. S. measurements, are carried out to three places of decimals in the regular tables, and to six, or even eight places, in the special table of metric equivalents. Though the tabular numbers run only to 100 the equivalents of any number can be readily obtained, as explained in the chapter on "The Use of the Tables." The great usefulness of this little book has already been proven in the short time it has been in this office.

THE HEAT EFFICIENCY OF STEAM BOILERS; Land, Marine, and Locomotive. With Tests and Experiments on Different Types, Heating Value of Fuels, Analyses of Gases, Evaporation and Suggestions for Testing Boilers. By Bryan Donkin, M. Inst. C. E. With numerous tables, plates and illustrations. London: Charles Griffin & Co., Ltd. Philadelphia: J. Lippincott Co. Cloth; 8vo.; pp. 311.

The author of this book says in his preface that he has had frequent opportunity during the last 25 years of making tests on steam boilers, and that as his tables of results increased it might prove useful as a collection of facts, if thrown into the shape of a book. To his own tests he has added those of many other experimenters, and he has thus "thrown" together in tabular form the figures of no less that 425 experiments in English and other boilers. We quote the following from the preface:

> It is mainly by collating and comparing a large number of reliable tests, that the principles governing combustion and efficiency in different types of boilers can be determined. The author hopes, therefore, that his contribution to the heat question, by breaking comparatively new ground, will lead the way, and incite others to make more complete collections of careful boiler experiments, the only mode in which the subject can be thoroughly and practically studied.

We hope that Mr. Donkin's book will "incite others" to do nothing of the kind, and that his "collection" will remain for many years to come the most extensive collection in existence. It is one thing to have a mania for making collections and quite another to have the faculty of studying the collection after it is made. Mr. Donkin is a good collector and tabulator, but his study of the collection, as far as we can judge from the book, is meager and unimportant. The tables occupy 100 pages; the chapter on discussion of the trials and conclusions only six. The most important conclusion drawn is the following:

> The efficiencies vary, even in the same type of boiler, owing to very different working conditions. Thus in Cornish, externally fired, they ranged from almost the highest, 81.7% to 53%. Again, Lancashire, internally fired, show, under favorable conditions, an efficiency of nearly 80%, while they also give the lowest, viz., 42%.

This conclusion is important but it is not at all new, for the author quotes from Mr. Barrus's book on "Boiler Tests," published in this country several years ago a practically identical conclusion as follows:

> The general conclusion as to economy of different types of boilers depends much more upon their proportions and upon the conditions under which they work than upon their type With suitable proportions and favorable conditions the various types give substantially the same economic results.

An interesting statement concerning air supply to the coal on the grate is as follows:

> The only right method of testing the efficiency of a given grate with a given coal and draught is to analyze the gases of combustion and thus to ascertain the percentage of air in excess or the reverse. If too much has been admitted to the grate the bars should be arranged nearer together; if too little they should be spaced out further apart.

We venture to say that there is not a boiler user in Great Britain who is likely to follow Mr. Donkin's advice in this particular and that Mr. Donkin himself would not follow it if he were in charge of a boiler. What he or any one else would be most likely to do, if his analysis of the gases showed that too much air was passing through the fire, would be to increase the thickness of the bed of coal on the grates, and to take extra care that there were no "air-holes" in the fire.

Besides the tables of tests and the very brief statement of conclusions drawn from them the book contains a fair compilation of information on classification of types of boilers, on fire grates, on mechanical stokers, on feed water brakes, superheaters, feed pumps, etc.; discussions on combustion, on the transmission of heat through boiler plates, on smoke prevention; descriptions of testing apparatus; notes for making boiler tests, etc. An appendix contains illustrations of all the principal forms of ancient and modern boilers. On the whole the book is a valuable collection of interesting facts concerning steam boilers, although it is far from being as good a treatise on steam boiler efficiency as we should expect from the author.

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THE TWO LARGEST VESSELS yet designed for the ore trade on the Lakes have just been contracted for by the Bessemer Steamship Co. The first is a steamer, to be built by the Globe Iron Works Co., of Cleveland, O., 475 ft. long, and 50 ft. beam, with quadruple expansion engines. The second is a barge, 460 ft. long, 50 ft. wide and 30 ft. deep, to carry 7,500 tons on 17½ ft. draft, to be built by the American Steel Barge Co., Superior, Wis.

◆

THE LARGEST ORDER FOR WATER-TUBE BOILERS ever given in this country, so far as we are aware, is that which the Cramp Co., Philadelphia, has just given to the Stirling Co., of Chicago, for the water-tube marine boilers for Russian war vessels, now under construction at the Cramp yards, amounting to about 35,000 HP.

◆

THE REDUCTION IN THE COST of producing iron and steel in the United States, since 1880, is commented upon by the English "Iron and Coal Trade Review." According to that journal, the labor cost of producing crucible steel, in 1860-'65, was about $75 per ton, and is now not over $2.40. Between 1880 and 1890, the labor cost of producing a ton of pig-iron was more than twice what it is now, broadly speaking. The raw material also costs less. Lake Superior ores, at Pittsburg, have fallen from $8.40 to $3.60 per ton in comparatively recent times, and coke, at Chicago, has fallen from $7.20 to $2.88 and $3.60 per ton. The wages cost of producing a ton of pig iron, at Pittsburg, less than 25 years ago, was fully $4.80; to-day it costs from 48 to 72 cts. in the best managed works. Twenty years ago mine owners wanted $2.40 a ton profit on ore, for the highest grades; to-day they will accept less than 24 cts; and the same decrease in profits demanded applies to the pig iron maker, the coke manufacturer and the producer of finished products. The writer says that the success of the American iron and steel producers is due to their vigorous and persistent attention to business administration, in mining, manufacture and transportation.

◆

STANDARD STEEL BRIDGE PLANS FOR CHINA are being made by C. F. Loweth, M. Am. Soc. C. E., Chief Engineer of the Davenport & Rock Island Bridge, Railway & Terminal Co., of Davenport, Ia. The structures range from small plate girders to 200-ft. spans. They are being made for the Chinese Railway Administration.

◆

NEW YORK'S OCEAN TONNAGE, says the N. Y. "Journal of Commerce," is only exceeded by that of London. For the fiscal year 1898, the aggregate tonnage of vessels entering and declaring at New York was 15,337,142 tons; this is only approached by the year 1880, with a tonnage of 15,041,083 tons. The condition of the carrying trade, for 1898, is shown as follows, for entering vessels: 449 American sailing vessels, 231 686 tons; 282 American steamships, 720,553 tons; 787 foreign sailing vessels, 531,295 tons; 2,817 foreign steamships, 6,277,878 tons; total, entering, 4,335 vesels, carrying 7,761,412 tons. The vessels clearing from New York in the year numbered 4,727, in about the same proportions as above, and they carried 7,575,730 tons. As compared with English ports, for 1897, we find a total inward and outward movement of 15,797,659 tons for London, and 11,261,051 tons for Liverpool. In 1883 and 1892, however, New York surpassed London in the aggregate of tonnage.

◆

A TORPEDO-BOAT SPEED COURSE, one measured mile in length, has been located by the Navy Department on the Delaware River, below the mouth of Christiana Creek. All torpedo boats hereafter built on the Atlantic coast will be tested for speed over this measured mile; the course allows one mile more in which to get up speed and another mile in which to slow down.

◆

THE SPANISH CRUISER "REINA MERCEDES" was sunk in Santiago Bay by the Spaniards by opening the sea-valves, reports Lieut. Lucian Young, U. S. N. Her hull is otherwise in good condition, and is resting on the edge of the channel bank, with 110 ft. overhanging deep water. Lieut. Young thinks that by plugging the valves she could be pumped out and raised. The latest accounts indicate the final abandonment of the Spanish cruiser "Maria Teresa," raised at Santiago and wrecked on Cat Island on her way to Norfolk.

◆

THREE OF THE SPANISH SHIPS SUNK AT MANILA are to be raised by a Hong Kong firm of wreckers and put in thorough repair for $500,000, according to a contract just made by Admiral Dewey. These ships are large gunboats; two, the "Isla de Cuba" and the "Isla de Luzon," are 200 ft. long, 30 ft. beam and 11½ ft. draft, with a displacement of 1,040 tons each. They are built of steel, have twin screws, a good protective deck and a battery of six 4.7-in. Hontoria guns, four 6-pdrs, two 1-pdrs., two Nordenfeldt guns and three torpedo tubes. The speed is 15.8 knots under forced draft. The other, the "Don Juan de Austria," is 210 ft. long, 32 ft. beam, 12½ ft. draft and 1,152 tons displacement. She was built at Carthagena in 1887, and her armament includes four 4.7-in. Hontoria guns, four 6-pdrs., one machine gun and two torpedo tubes. These vessels are to be raised under the superintendence of Naval Constructor W. L. Capps, U. S. N.

◆

THE BUFFALO RIVER IMPROVEMENT, in Buffalo, N. Y., has reached the stage of completion of plans and specifications, which are now to be submitted to the Board of Public Works with a request for the issue of proposals. This work contemplates the widening, straightening and deepening of Buffalo River, between Hamburg St. and the east city line, and also of Cazenovia Creek, from its junction with the river to Cazenovia St. The plan for the river proposes a bottom width of 230 ft. to the creek, 150 ft. beyond the creek, and 120 ft. in Cazenovia Creek. The sides are to be diked 15 ft. above the normal water surface, and the estimated quantity of material to be moved is 3,000,000 cu. yds. The estimated cost of dredging is about $700,000. Five highway and six railway bridges, crossing these streams, will have to be altered. Bids may be advertised for shortly, though there may be some opposition from the railway companies affected.

◆

THE SEA-WALL AT CHICAGO, which was built to protect the Lake Shore drive, has been broken away by the waves of the recent severe storms on Lake Michigan, and a gap of about 80 ft. in width has been formed. The wall is of concrete, with a foundation of piling. There are two rows of piles, those of the front row being set close together, and those of the back row 4 ft. apart. The space between them was filled with bundles of brush, covered with rubble stone. A decking of several layers of plank on top of the piles forms the base for the concrete wall. The spaces between the piles in the front row were wide enough to allow of a steady wash of the water, disturbing the ground and allowing the brush and stone to settle and wash out. The horizontal and vertical action of the waves of a high sea soon breached the foundation and overturned the wall. This result appears to be due to the fact that the work, like other public works in Chicago, was not properly executed. The design originally prepared by Gen. Fitz Simons included a revetment at the toe of the wall, and a line of sheet piling in front of the revetment, thus preventing any wave action from reaching the foundations. The stone filled crib work of the bulkhead wall for the future Lake Front Park received little if any damage during the storms.

◆

DEFECTIVE SEWER WORK on the intercepting sewers in Chicago has been charged by a local paper, the principal charge being that some of the brick rings, especially in the invert, are laid without cement, and also that the work is done without properly draining or pumping out the trench, so that the invert is built in mud and water. The charges were insisted upon so strenuously, that Mr. McGann, Commissioner of Public Works, consented to have an inspection made by an engineer appointed by this newspapers. Gen. Sooy Smith, M. Am. Soc. C. E., accepted the appointment, and had openings cut in the walls of the North Side sewer. His report states that the materials and workmanship are good, except that at one or two points the middle ring of brick was laid without mortar or with a less quantity than the outer rings. He further stated that this lack of mortar in the middle ring "was a defect such as sometimes creeps into brickwork in sewer linings in spite of the best intentions and instructions of the contractors, and the vigilance of the inspectors in charge of the work." The newspaper which made the charges, however, now complains that the invert was not examined, that the inspection was not made at the points where it had reported bad work, and that none of its representatives were with the inspecting party.

◆

The MOST SERIOUS RAILWAY ACCIDENT of the week occurred Nov. 18, on the Pennsylvania R. R., just east of the Hackensack River, near Jersey City, N. J., and caused the deaths of 11 track laborers, and the injury of as many more. The gang was at work on the west-bound track and moved over to the east-bound track to let a train pass. The noise of the passing train prevented their hearing an approaching east-bound express, and the dense fog, which prevailed at the time, hid it from their sight.

◆

TWO FATAL ACCIDENTS, due to low hanging arc lights, recently occurred in Baltimore, Md., and have served to arouse the question of responsibility and whether the Police Board had authority to compel electric light companies to place arc lights at a safe distance above pavements. Mr. G. R. Gaithers, Counsel to the Board, states that:

> It is clear that whenever such lights are so placed as to endanger the lives of the persons who use the streets, such lights become a nuisance and should be removed, or the parties causing the nuisance punished. Anything which endangers the safety of persons lawfully passing over a highway is an obstruction and indictable as such.
>
> I am of the opinion that your honorable board should instruct the members of the force to notify any company having arc lights in a position which is dangerous to the public safety to remove them to a proper and safe position, and in the event of the failure of any company to do so, to lay the matter before the state's attorney with the evidence, so that an indictment may be found by the grand jury against the offending parties.

◆

A CONTRACT FOR 15,000 ELECTRICAL HORSE-power was closed on Nov. 21 between the Union Carbide Co. and the Niagara Falls Power Co., the power to be delivered some time next summer. This great block of power is the product of three of the big dynamos in the great Niagara central station. The existing works of the Carbide Co. will be continued, but in order to utilize the additional amount of power, immense new works will be constructed at once. The buildings will be located on the power company's lands near the trestle of the Niagara Junction Ry. and north of the Erie and Central tracks. One of the buildings will be two stories high and over 800 ft. long.

◆

PAYMENT FOR ALLEGED DAMAGE by electrolysis has been made by the Consolidated Street Railway Co. to the city of Atlanta, Ga. The amount was small, only $16.91, and was paid under protest in settlement of two bills presented by the city for damages to its water mains or services. The council passed an ordinance, not long ago, requiring all electrical companies in Atlanta to keep their currents off water and other pipes.

◆

IN REGARD TO INDUSTRIAL ENTERPRISES IN Cuba, Special Commissioner Robert P. Porter, reports to the President that little can be done until the sanitary conditions can be improved in all the industrial centers. For the commercial prosperity of Cuba, and for that of the Southern part of the United States as well, the germs of yellow fever, existing in all the larger Cuban towns, must be destroyed. Mr. Porter recommends the appointment of a commission of experts, including engineers of skill and experience, which shall make a sanitary survey of Havana and Matanzas, and report what can be done to stamp out yellow fever in these cities.

◆

PROGRESS ON THE TRANS-SIBERIAN RAILWAY is reported as follows by the London "Times": By the Russian-Chinese treaty of September, 1896, a large part of the old line to Vladivostock, by way of the Amour River, was abandoned, and a new line laid down from Stretensk across Eastern China, or Manchuria, directly to Vladivostock. But, as a consequence of the establishment of the Russians on the Gulf of Pe-chi-li, the terminus is now Port Arthur, and the latest route leaves the old line at Chi-Tai, about 300 miles from Lake Baikal and far west of Stretensk. The rails are now laid to Listvenitchoie, on the west bank of Lake Baikal; the large ice-breaking ferryboat, for taking trains across the lake to Masova, is under construction, and in the coming spring, the line around the lake will be commenced. East of Lake Baikal the rails are being laid at the rate of four miles per day. Train service with Europe commences at Irkoutsk; from this point west to Krasnoiarsk the line is being operated, but is not finished, and the Oka and Ienissei rivers are crossed in boats. West of Krosnoiarsk the line is in complete working order. The trip from Moscow to Lake Baikal, second-class, costs about $24 and occupies about 12 days; first-class carriages only go once a week as far as Tomsk, and ordinary trains go once a day to Krosnoiarsk, and three times a week to Irkoutsk. All cars, however, are provided with reclining chairs, for sleeping purposes.

TRIPLE-EXPANSION PUMPING ENGINE AT OGDENSBURG, N. Y.

By Charles A. Hague, M. Am. Soc. M. E.*

(With two-page plate.)

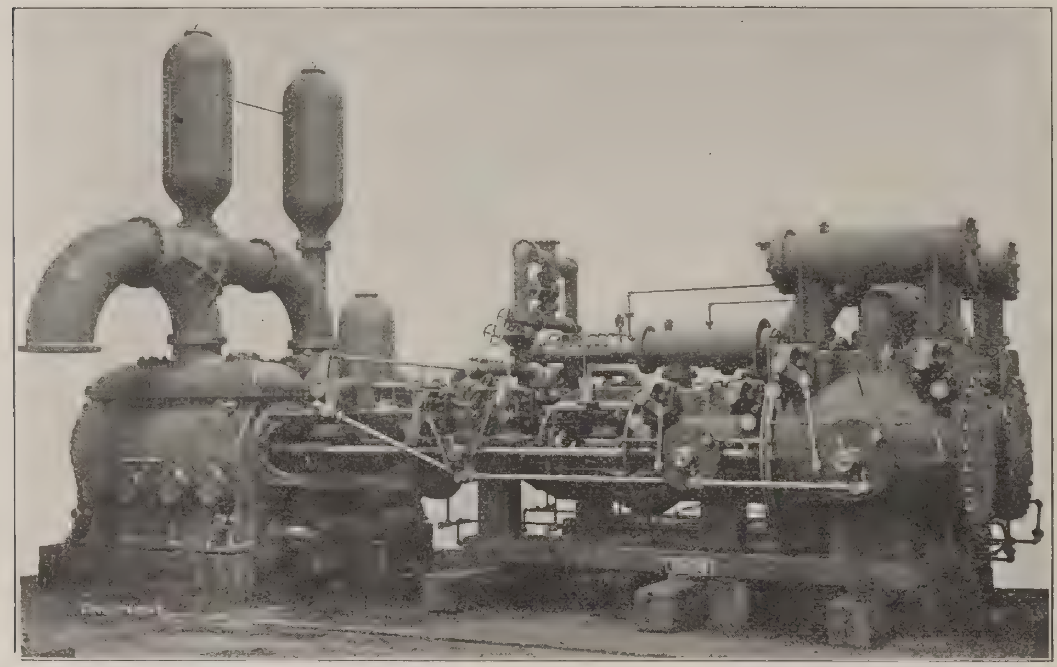

FIG. 1.—VIEW OF TRIPLE EXPANSION PUMPING ENGINE AT OGDENSBURG, N. Y.
The Snow Steam Pump Works, Buffalo, N. Y.

This engine, just installed by the Snow Steam Pump Works, of Buffalo, N. Y., in the pumping station of the Ogdensburg City water-works, represents the most advanced practice in the type technically known as low-duty triple expansion. The engine is of the horizontal condensing duplex direct-acting class, with a high, an intermediate, and a low pressure cylinder on each side of the machine, each set of cylinders operating a double-acting plunger contained within separate water cylinders; the water cylinders being connected to common suction and delivery pipes by means of cross pipes, in the usual manner.

Each high pressure cylinder has a diameter of 16 ins., intermediate, 23 ins., and low pressure, 40 ins. The pump plungers each have a diameter of 23¼ ins., the common stroke of all being 36 ins. The steam distributing valves are of the semi-rotative, or "Corliss" type, and are arranged as follows: At each end of the high pressure cylinder is a valve for the double purpose of admission and exhaust, while directly above each of these valves is placed an independent cut-off valve, thus reducing the clearance to a low percentage, and as the low piston speed permits of considerable restriction in the port area, the valves are made comparatively short, thereby eliminating to a great extent the corners formed by the spaces usually found in this form of steam valve, having ports of a length equal or nearly equal to the diameter of the cylinder, such as would, of course, be necessary at high piston speeds. At each end of the intermediate and low pressure cylinders are similar valves, with the exception of the cut-off valves, which are omitted on the latter two cylinders.

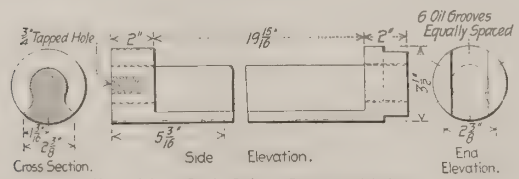

Fig. 11.—3 1-2-in. Steam Valve.

The point of cut-off in the high-pressure cylinder is determined by the ability of the engine to finish its stroke at the various speeds at which it may be running, the higher the speed the shorter the cut-off, and although in any event no very short cut-off can be obtained, still it is sufficiently early to produce an economy which well repays the addition of the two high-pressure cylinders to the ordinary type of compound condensing direct-acting engine, when the conditions of investment of capital forbid a much more costly type of compound engine. The theory of cut-off in this type of pumping engine seems to be that a certain percentage of the stroke at its terminal end may be cut off, regardless of the distance this point may be from the beginning of the stroke, and, therefore, the length of the stroke of the engine comes into play as an important factor in designing the best proportion of engine for any particular service, the arguments put forward by different makers failing to agree as to the length of stroke desirable, although there is little doubt that the number of strokes per minute is quite as prominent a factor of high efficiency as the feet traveled per minute. After being released from the high pressure cylinder the steam passes through reheating receivers to the intermediate cylinder, where it follows the piston full stroke; is again released, passes through a second reheating receiver and into the low pressure cylinder, where it also follows the piston throughout the stroke; is again released and goes to the condenser. The intermediate and low pressure cylinders are steam jacketed, the high pressure cylinder being without such protection.

The main valves of all the cylinders are driven from wrist plates, as in Corliss engines, the cut-off valves of the high pressure cylinder being operated by means of a pair of sliding blocks fitted to a sort of rocking "V," these blocks being capable of simultaneous adjustment by means of miter gears and a hand wheel, so as to vary the point of cut-off to suit the speed of the engine. The wrist plates which actuate the main valves are driven from rock shafts, these rock shafts being driven in turn, as is usual in the "duplex" machine, by having each side of the engine drive the main valves for the opposite side. The cut-off valves are driven from the same rock shafts, but so connected that each side of the engine operates its own cut-off valves. A feature worthy of note is the arrangement of the pins on the rock shaft arms from which the valve-gear is given motion, these pins being enlarged above the ordinary to an extent which permits of the driven rod passing directly through the body of the pin, thereby retaining all pressures directly in the center lines of force and entirely removing any tendency to bend or spring the rods.

The intermediate and low pressure steam cylinders are fitted with cushioning valves in the usual manner, but their use may be entirely obviated by the proper adjustment of the point of cut-off in the high pressure cylinders to suit the engine's speed, the cut-off valves being adjustable as a group or each individually, so that irregularities of strokes may be corrected at any single point without interfering otherwise with the operation of the engine.

In connecting the steam pistons, the high pressure and intermediate are attached to a single rod which extends through the forward head of the intermediate and the back head of the high pressure, then out through the front head of the high pressure; metallic packing being used in the stuffing boxes; the rod is then secured to the main cross-head, which rides upon a shoe running in a guide between the steam and water ends of the engine. The back head of the intermediate cylinder has no opening through it, and is removable into the low pressure cylinder, the intermediate and low being butted and secured together. The low pressure piston is attached to the main cross-head by means of long side rods passing out through the front head of the low pressure cylinder within the annular space defined by the difference in diameter between the low and intermediate cylinders, thence the rods pass forward until they reach the cross-head.

Another peculiar and rather commendable feature of the engine is found in the heavy cast-iron bed-plates extending under the entire steam ends; these bed-plates being solidly bolted to the foundations, and the cylinders permitted longitudinal movement upon the pedestals formed upon the bed-plates, so as to compensate for expansion and contraction; the water ends being securely bolted to the foundations.

The condensing apparatus consists of a jet condenser, with an independent single cylinder steam-driven air pump with a steam-thrown valve; a part of the overflow from the air pump is diverted into a small hot-well, and thence taken by an independent boiler feed pump and sent to the boiler; the exhaust from the steam ends of the air pump and the boiler feed being economically utilized through the medium of a feed water heater. The injection pipe leads from within the screenbox of the main suction pipe so that a sudden and undue drop in the water level in the well will rob the condenser of water and so break the vacuum before the main suction is in danger of losing its water. This is especially desirable for the reason that the river is at times heavily charged with water-soaked sawdust from mills above, which will at times completely obstruct the screens.

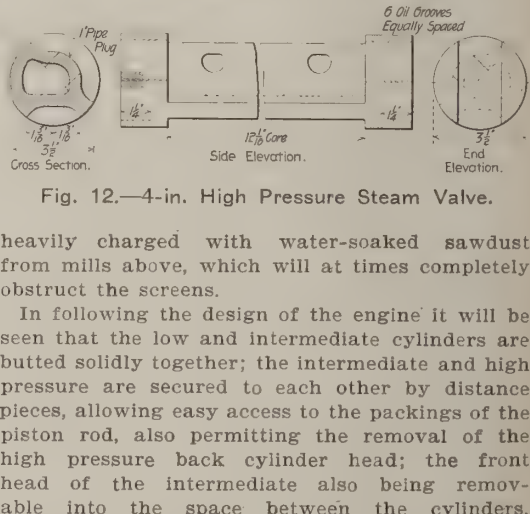

Fig. 12.—4-in. High Pressure Steam Valve.

In following the design of the engine it will be seen that the low and intermediate cylinders are butted solidly together; the intermediate and high pressure are secured to each other by distance pieces, allowing easy access to the packings of the piston rod, also permitting the removal of the high pressure back cylinder head; the front head of the intermediate also being removable into the space between the cylinders. In the arrangement of the pumps proper, the structural connection between the front end of the high pressure cylinders and the water end is by heavy cast-iron frames, these frames supporting the rock-shaft bearings, and also the cross-head guides, leaving convenient access to the various details.

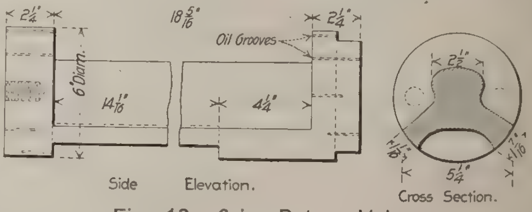

Fig. 13.—6-in. Rotary Valve.

The cross-head is of cast steel and is carried upon a bronze shoe, thus relieving the piston and plunger rods of all cross straining due to weight. It is made exceptionally heavy and strong, thereby affording ample strength and at the same time adding to the inertia of moving parts. The middle eye of the cross-head is of two sizes, one taking the high pressure piston rod and the other the main plunger rod; the outer eyes being provided for the low pressure rods.

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*Consulting Engineer, 39 Cortlandt St., New York city.

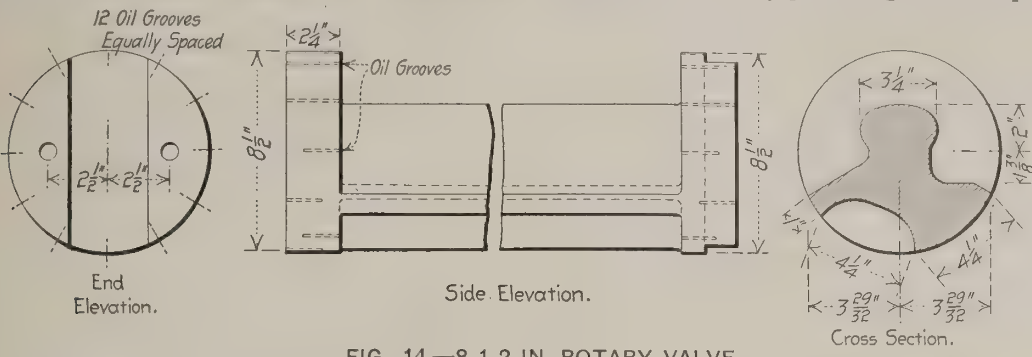

FIG. 14.—8 1-2-IN. ROTARY VALVE.

The water end consists of two separate pumps of the regular construction generally found in this class of work, but with liberal valve area permitting probably with the limited suction lift here found, a speed of 50% in excess of that called for in the contract. The pumps are heavy enough to carry 100 lbs. pressure continuously in case of fire. A special feature of the water end is the location of the cross suction pipe directly beneath the outer ends of the pumps, so as to reach the supply well without undue deflection, and also to make a clear and clean floor about the engine possible. In carrying out this feature, partly made necessary by the limited space lengthwise of the engine, the pumps are arranged to overhang the foundations nearly half their length, this overhang being met by the introduction of heavy I-beams which extend from the shortened foundation to a thick stone wall forming a part of the older and original building.

Some peculiar characteristics of the water of the Oswegatchie River in the shape of coarse sawdust, etc., make it desirable to use unusually efficient screens, and to let all surplus water flow by, the pumps only taking through the screens the actual quantity of water sent into the distribution, instead of attempting to screen all of the water entering the well. To effect this result, and at the same time afford ready access for removing and clearing the screens without interfering with the running of the engine, a special design of screen box with very liberal areas of screening surface is used, the passage of water through the meshes of the screens being at the rate of about 0.1 cu. ft. per second per square foot of screen, with the engine at full speed. It has been found by experiment that this rate of flow will not produce sufficient current to overcome the gravity of the water-soaked impedimenta, so that the worst that can happen would be a very slow accumulation of refuse at the bottom of the well, and provision is made to remove the most of this during the operation of the engine, by the use of a 12-in. "blow-out." The screens are of iron wire, ⅛-in. mesh.

In the main pumps, owing to the tannic acid qualities in the water, the plungers and rods are covered with brass, the pump sleeves through which the pump is worked are lined with brass, and all of the essential features of the pump valve outfit are also of brass.

The cross-delivery pipe is located midway of the length of the pumps, has easy curves, and joins the main delivery pipe at the left-hand side of the water end, this main pipe of 20-in. diameter being provided with a check valve opening downwards, and a gate valve just below the check, the pipe passing through the floor and out of the building through the basement wall. The hand wheel of the gate is within easy reach of the floor, and the entire arrangement apparently reaches the height of convenience and economy of space, the latter item having been held constantly in view on account of the environment.

The top speed is fixed by means of an automatic pump governor, so that it is impossible for the engine to "run away" by a sudden or considerable decrease of the water pressure. There has been no formal duty test made as yet, because of the reluctance of the city authorities to interfere with the engine in its regular service, during the refitting of the rest of the plant which is now going on, but the preliminary experiments indicate that 80,000,000 foot-pounds duty will be slightly exceeded, the guarantee under the contract being 75,000,000 per 1,000 lbs. of steam.

There is also being installed in this plant a pumping engine to be driven by water power, of unusually large size, possessing some special features to adapt it to the situation, embracing special arrangements for the admission and screening of the water, suction and delivery pipes, etc. This "power pump" is to be operated by two 48-in. turbine wheels, with the transmitting shafts fitted with friction clutches so as to meet the exigencies of domestic and fire services under "direct pressure" with promptness and certainty.

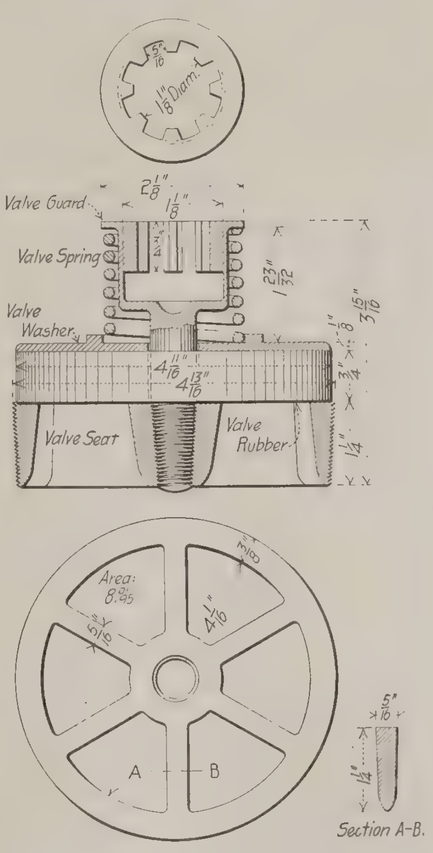

Fig. 15.—4 3-4-in. Pump Valve.

* * *

SPECIFICATIONS FOR STRUCTURAL STEEL AND RAILS.*

By Wm. R. Webster, M. Am. Inst. M. E.

The specifications for American structural steel and rails are, on the whole, very satisfactory. Some, of course, are behind the times; but common practice of to-day gives a much better material than they call for. On the other hand, there are specifications in which the physical and chemical requirements do not agree, or that call for an extremely high elastic limit or other results, which cannot be obtained by the ordinary methods of manufacture and testing. Specifications of this kind cause the manufacturers temporary trouble, but soon adjust themselves, either by the engineer coming out frankly and modifying them, or giving instructions modifying the point at issue, though still adhering to his printed specification. The latter method is much to be regretted, as the specifications are very misleading and the steel accepted under these modifications never has and never will meet the original requirements.

Our government specifications, at first, gave the manufacturers considerable trouble; but when they found that the requirements of these specifications had to be lived up to in every particular, they were forced to improve their methods in each department, and, as a result, there has been a gradual improvement in the quality and finish of structural steel, due to more uniform methods of manufacture, the most important being the control of the finishing temperature, as more steel was formerly spoiled by being finished at too high temperature than in any other way.

The quality of steel depends (1) on its chemical composition; (2) on the treatment it receives in the course of manufacture; and we are learning year by year better to distinguish the results due to each. To-day, at some of the mills, they are getting results that were formerly considered impossible. I refer to rolling the steel into finished product which meets all the requirements of the most rigid specifications, without stopping to make any preliminary tension test whatever. The steel is not allowed to get cold from the time it is cast until it is rolled into the finished product. This, of course, is a great saving of fuel and increases the output. This great advance has been brought about by close observation of the methods of manufacture and the establishment of the relations between the chemical composition and the physical properties. The analysis of each heat is made while the ingots are still in the soaking-pit. The ultimate strength is estimated from its chemical composition, then the heat of steel is rolled on orders where it will apply, due allowance, of course, being made for the thickness of the finished product.

I have made a special point of the heat treatment of steel in connection with work, as the quality of the finished product depends more on it than is generally admitted or understood, and I consider that it is now the most promising field of experiment and research. To-day we hear less of the mysterious failures of steel than ever before, as when a faiulre occurs in the shop or elsewhere, examination shows that in nearly all cases the trouble has been caused by improper treatment, and indicates the necessary improvements required in shop methods to avoid a recurrence of the trouble. In order to prove this, good material has been taken and similar failures have been produced at will by the same treatment. This has brought about in many shops as great an improvement in their methods of working the steel as in its manufacture. The net result of all this is that the consumer is to-day getting a better structure than ever before.

Recent careful scientific investigations have given us valuable information of the character and properties of steel, but there yet remains the important work of showing the direct relation between the results of these investigations and the every-day processes and results obtained in our mills and shops.

There is considerable room for improvement in our ordinary methods of testing structural steel. The conditions under which tests are made should be reduced to a standard as regards the pulling speed and the relation of the width of test piece to thickness of the material. About three widths would be sufficient to cover all ordinary thicknesses and they could be used without materially increasing the cost of the present methods of preparing test pieces. We also need some simple machine for making impact tests, as our ordinary tension tests do not give us all the information required as to the quality of the material to resist shock.

Too much importance is paid to the quench bends. In some cases the cold bends have been entirely omitted and the quench bends considered a reliable test as showing the quality of the material. Now this is all wrong; as soft steel which has been finished at too high temperature, and thus rendered brittle so that it will not stand the ordinary cold bends, may be restored by the heating, and the carbon being so low that the subsequent quenching does not harden this class of material, it then bends 180° flat on itself. Material accepted under these conditions has failed under subsequent shop work. Such material would have been rejected at the mills had the ordinary cold bends been made.

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*From a discussion before the Franklin Institute, Philadelphia, Nov. 23, 1898.

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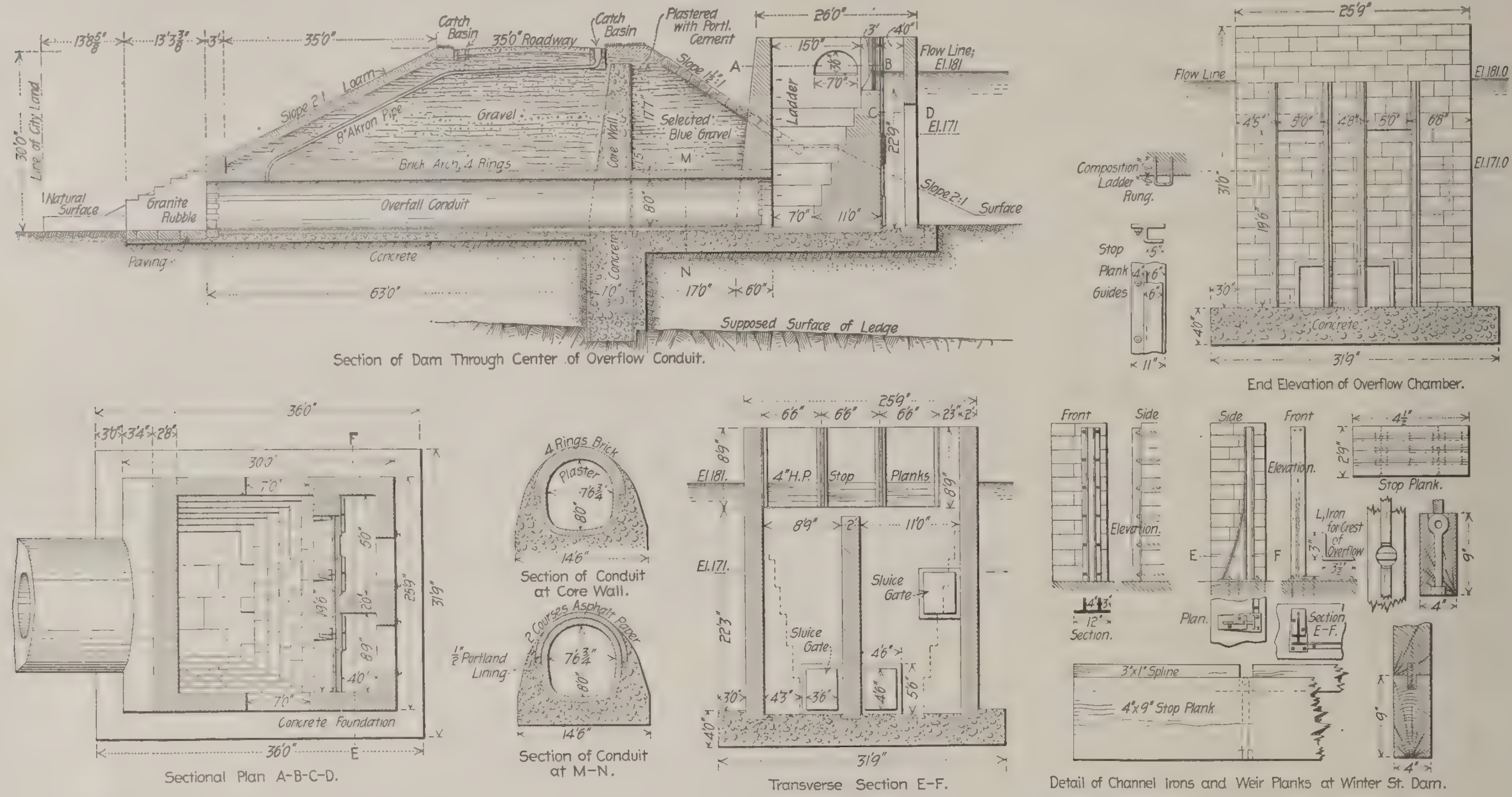
THE POSITION OF PITTSBURG IN THE STEEL trade is thus stated by Mr. Andrew Carnegie, at a recent banquet tendered to him by the Pittsburg Chamber of Commerce:

> There is not a district in this world to which the Pittsburg District cannot to-day send steel and pay the freight and deliver that steel as cheap or cheaper than it can be made at the point of delivery, if we except Colorado, to which the freight is greater than the difference in cost of manufacture at the two points. Should the South be successful in its present attempt to manufacture steel, we may have to except another point. Colorado excepted, the Pittsburg District has the whole world to-day at its feet. Pittsburg is indeed the steel city. I believe Pittsburg to be the best distributing point in the United States. She sits here, with one wing covering the East, the other the West, her beak dipping into the lakes upon the North, and her tail flapping in the Gulf of Mexico in the South. All points of the compass are within her easy reach and all tributary to her. She has that surest element of all for success, an enormous home market for her raw products and the largest army of the most efficient skilled labor in the world.

SPECIAL FEATURES OF THE RESERVOIRS AT THE CAMBRIDGE, MASS., WATER-WORKS.

Within the past few years the city of Cambridge, Mass., has made some extensive improvements to its water-works. Among these are two new reservoirs, storage and distributing, respectively. The Hobbs Brook storage reservoir has a capacity of about 2,500,000,000 gallons, a water surface of 558 acres, and a drainage area of 6.6 sq. miles. The reservoir filled for the first time in a remarkably short period, or between Dec. 16, 1897, and Aug. 20, 1898. The rainfall meanwhile was 33 ins., 71½% of which was, therefore, impounded.



Section of Dam Through Center of Overflow Conduit.

Sectional Plan A-B-C-D.

Section of Conduit at Core Wall.

Section of Conduit at M-N.

Transverse Section E-F.

End Elevation of Overflow Chamber.

Detail of Channel Irons and Weir Planks at Winter St. Dam.

FIG. 1.—DETAILS OF AERATING AND OVERFLOW CHAMBER AND OVERFLOW CONDUIT, HOBBS BROOK RESERVOIR, CAMBRIDGE WATER-WORKS.

Mr. L. M. Hastings, City Engineer.

Overflow and Aerating Chamber, Hobbs Brook Reservoir.

The water from this reservoir flows down the natural bed of the stream, reaching it through the overflow and aerating chamber and the conduit extending through the dam, shown in detail by Fig. 1. Views of the chamber are also shown by Figs. 2 and 3. When the water level rises to a point 3 ins. above the stop planks on the aerating weir it flows through the arched openings at the side of the chamber. When it reaches an elevation 3 ins. higher still the storm relief overflow, or waste weir, 25 ft. in length, comes into service. This waste weir is shown at the left, in Fig. 3.

It may be added that the entire bed of this reservoir was stripped of soil and muck, necessitating the removal of some 1,900,000 cu. yds. of material, nearly all of which was handled by carts at from 16 to 22 cts. per yd., the latter price being paid for most of the work. This, we presume, explains the presence of the boulders in Fig. 3, although some of them may have been hauled in for the slope paving.

The Payson Park Reservoir, Gate House and Asphalt Lining.

There is a fine gate house at the Payson Park reservoir, as shown by the view, Fig. 4. The most interesting feature of this reservoir, however, is the asphalt lining, which was recently exposed for the first time after having been covered with water for about two years. The bottom of the reservoir was originally composed of 6 to 9 ins. of concrete. This proved to be of inferior quality, but as it seemed too good to tear out it was covered with asphalt. The concrete was first thoroughly swept. Then a thin coat of refined Bermudez asphalt, 95% pure, was applied with mops and brushes, as a binder. After this a lining of ½-in. of hot Bermudez asphalt concrete was applied. The concrete was composed of 50% of refined asphalt, 90% pure; 46% of limestone dust, and 4% of flux. This was slung on from dippers, as shown by Fig. 5, the motion being something like that of a man swinging a scythe. Usually the mixture was applied in two or three layers before it was thick enough. The material was bought from Richard Upham, of New York, and applied by Simpson Bros., of Boston. The contract prices were as follows: Refined asphalt for priming coat, $40 per ton; balance, $27.75 per ton; both f. o. b. at Cambridge. Labor, priming coat, ¾ cts., and ½-in. coat, 3½ cts. per sq. ft.

The above information was obtained from Mr. L. M. Hastings, City Engineer of Cambridge, and engineer for this work, by a member of the editorial staff of this journal, who visited the Hobbs Brook reservoir last September. Mr. Hastings kindly offered, at that time, to send us some notes on the appearance of the asphalt lining upon exposure, which he did under date of Oct. 1, as follows:

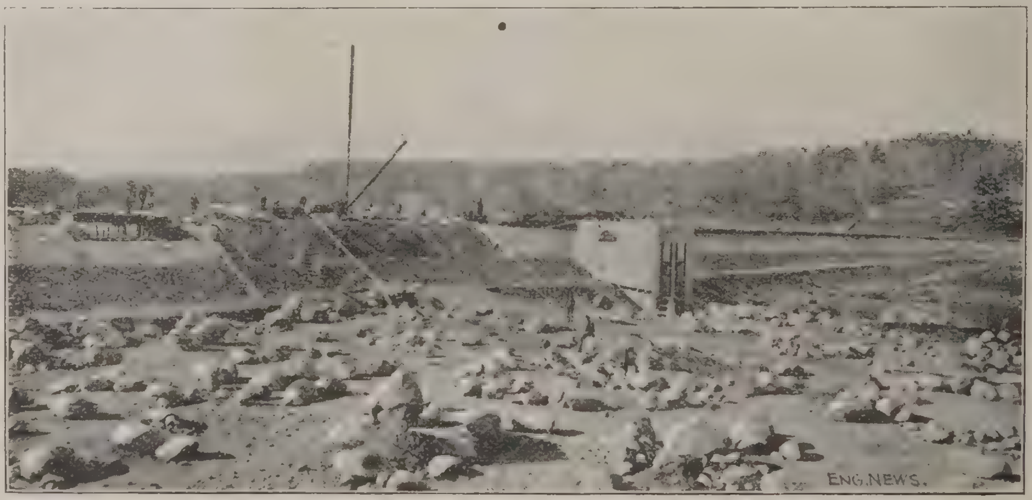


FIG. 2.—VIEW OF DAM, UNDER CONSTRUCTION, INCLUDING OVERFLOW AND AERATING CHAMBER AND WASTE WEIR.

> The asphalt lining of the bottom for the most of the area looks finely, just as well as the day it was laid—bright, sound and hard. Across one end and near the partition wall, however, a very curious thing happened. Numerous blisters appeared in the black lining, which appeared lifted or blown up away from the concrete floor in sizes from 4 or 5 ft. in diameter to 2 or 3 ins. These lifted up to a surprising height, 2 or 3 ft., I should think in some cases, until the sheet of asphalt, originally ½-in. thick, was drawn out very thin. These burst or were punctured and then subsided with a wrinkled appearance. They were all filled with water. From 11 to 13 ft. of water was kept in the other part of the reservoir. The cause of this action is undoubtedly one of two things, or perhaps a combination of each: The inward pressure of ground or spring water, or the pressure of the water from the other compartment of the reservoir, which may not be pefectly tight. When the reservoir was built no water was encountered in the bottom. and so no underdrain was laid. Where the lining of asphalt was not subject to this outside influence, it is in a highly satisfactory condition.

* * *

METHODS OF SECURING WATERTIGHT WORK IN SHIP CONSTRUCTION.*

By H. G. Smith.†

It is an impossibility to make all compartments of a vessel absolutely watertight; they can only be made practically so, and when a certain degree of perfection is reached it is a waste of time and labor to proceed further. However, in order to secure practical watertightness, it is necessary to demand absolute watertightness, discretion being left to the Inspection Officer to say when a test is satisfactory. A slight weeping of rivets or joints is immaterial, and more damage is often done in trying to repair them than by leaving them as they are. All compartments that are unsatisfactory at the first test should be refilled after having been stiffened if necessary, and thoroughly recalked throughout.

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*Abstract of paper read at the sixth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, Nov. 10 and 11, 1898.

†Assistant Naval Constructor, U. S. N., Philadelphia, Pa.

Specifications require that all material shall be calked metal to metal where possible. This is done either by hand or by pneumatic tools, and, when carefully done, I have been unable to detect any difference in the character of the work in the two cases as far as watertightness is concerned. The custom of chipping the edge of an angle bar before calking appears to be unnecessary. Equally good results were obtained on the U. S. S. "Alabama," where the bars were chipped and calked and where simply split and calked. There are many cases where it is necessary to adopt other means than calking for securing watertight work. Some joints are never accessible for calking after the material is fitted and riveted; while others do not prove satisfactory if calking alone is depended upon. Watertight floors in wake of liners on outside plating and inner bottom; bulkheads or decks, in wake of plating of two or more thicknesses; the connections of framing behind armor to the armor shelf, are examples of the second case, and require the use of stopwaters. Various substances are used for this purpose, amongst which may be mentioned the following, viz:—Tarred hemp felt, plain or soaked in red or white lead; canvas soaked in red or white lead; sheet rubber; sheet lead; red lead putty; hempen or lamp-wick gaskets, soaked in white lead; asbestos; lead wire, and in some cases copper wire. Any one of these is satisfactory in a particular case, but different classes of work require different stopwaters. Where the joints of material are close fitting, or can be well drawn together in riveting, a strip of tarred hemp felt is generally used. This is the case with most of the lighter material, one-half inch thick or under, in hull work. Where the parts connected are very rigid, and are apt to stand some distance apart when riveted, a layer of felt is next to useless, as, being thin, it is not compressed between the plates. In these cases a thick layer of some plastic substance, such as red-lead putty, should be used. This will fill all the spaces between the parts as they are drawn together, and on hardening will form a solid joint. Rubber, lead, canvas, asbestos, etc., are principally used in connection with pipe work. In order more thoroughly to test the efficiency of the various materials used as stopwaters, the following experiments were made:

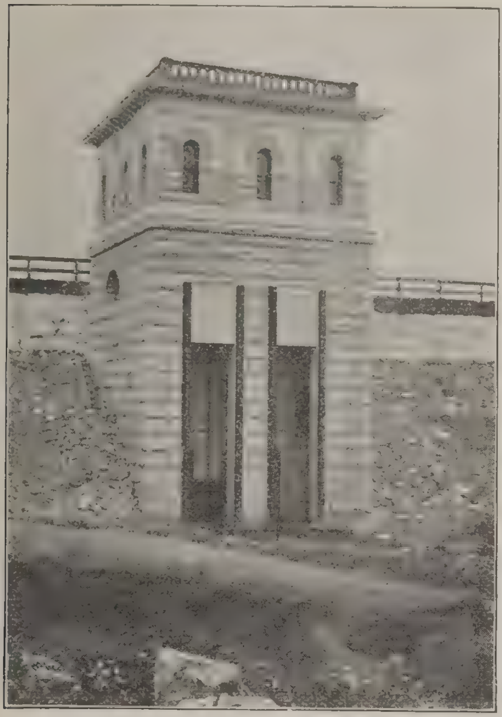


Fig. 3.—View of Overflow and Aerating Chamber.

A cast-iron bend was fitted with blank flanges, in each of which holes were cut, over which smaller flanges could be fitted, using different materials as gaskets. This improvised water tank with its flanges was placed in the open air, where it would be exposed to all kinds of weather. A stand-pipe, fitted with a funnel at its upper end, and about 35 ft. high, was connected to the tank. Water was poured in and the flanges set up until they were quite watertight under a pressure head of 35 ft. The tank was allowed to stand about 3½ months, water being added at intervals to maintain the pressure. At the end of this time all joints were broken, an examination made of the stopwaters, and their condition found to be as follows:

(1) Tarred hemp felt, plain; in thoroughly good condition, no leakage having taken place. (2) Canvas soaked in red lead; quite dry and in thoroughly good condition. (3) Asbestos; some leakage, and where this occurred the material was moldy and partially decayed. (4) Red-lead putty; thoroughly dry, being frozen to the metal, making practically a solid joint. No leakage had occurred. (5) Tarred hemp felt soaked in red lead. The joint was in good condition, except in one place, where a slight leak had occurred. At this point the felt was slowly working out of the joint. (6) Rubber; this gasket had squeezed out somewhat at the edges, and had lost its elastic qualities, but was still effective.

All the joints were now made up anew, light plates that would admit of deflection being used instead of the heavy flanges, and each joint made with new material of the same class as before. After watertightness had been secured with 35 ft. pressure head, the bolts in each flange were eased off until a slight leakage took place. The apparatus was allowed to stand about two months, water being added frequently to maintain the pressure. It was then disconnected and the joints re-examined. The results were as follows:

(1) Tarred hemp felt, plain; slightly rotted. (2) Canvas soaked in red lead; in very good condition, no decay. (3) Asbestos; moldy and somewhat decayed. (4) Red-lead putty; in excellent condition. (5) Tarred hemp felt soaked in white lead; considerably decayed, but not in bad shape. (6) Rubber; somewhat decayed.

Although not extensive nor of sufficient duration to be entirely satisfactory, these tests show in a general way what may be expected of the above materials; that all of them may be used in particular cases and some of them in any case liable to be encountered in ship construction. Red-lead putty is an excellent stopwater, and can always be relied upon. It should be used where there is any doubt as to the proper one needed. It can be made by mixing dry red lead with white-lead paint.

Tarred hemp felt generally makes a very good stopwater if used with discretion. Where constantly subjected to the action of water, however, it is liable to be squeezed out of the joint. Canvas soaked in red lead makes an excellent gasket for sea-valve connections to outside plating or in the joints of piping. Asbestos is used where joints are subject to heat and some substance not easily burnt out is required.

Natural Rust Joints.—Where the parts have not been painted, as between a rivet and the edge of the hole, rust joints will form in a very short time after the application of water pressure, which, if the leaks be but slight at first, will soon become quite tight. If left to themselves, many of the trifling leaks will thus soon disappear. Although not a desirable way of producing watertightness, rust joints cannot be prevented from forming, and the results are satisfactory. I have not ascertained that any material damage has been produced from this cause, but it shows the importance of painting as far as possible all faying surfaces of material, as it is fitted, to prevent corrosion, which will otherwise occur and which might prove serious. It is preferable to test all compartments before they are painted, as the leaks are more easily located.

A coat of paint, or a layer of cement, however, has very little effect in stopping a leak. In two or three cases where compartments were tested in very cold weather, even a heavy coating of ice was insufficient to keep the water from oozing through under pressure, where leaks occurred.

Fig. 5.—Placing Asphalt Lining on the Payson Park Reservoir, Cambridge, Mass.

All countersunk-head rivets should be calked at the head. My experience has been that the head of a countersunk rivet is very rarely tight unless calked. This is due to the fact that the angles of countersink on the rivet and in the plate are somewhat different, the head of the rivet not entirely filling the hole unless very carefully driven. The difference between the case of the countersunk head and the pan head rivet, then, is, that the former is apt to bear against the plate along a line only, and not over a surface, as in the case of the pan head rivet, with consequent greater danger of leakage. Again, the head of a countersunk rivet usually projects beyond the hole, and if leakage occurs, it is generally necessary to chip off the head before the same is accessible for thorough calking. I consider it desirable to avoid the use of these rivets as much as possible.

In bulkhead work much better results are obtained by lapping the butts and seams than by strapping them. Bounding angles and all staple angles and collars should be fitted double, i. e., on each side of the bulkhead. For good results this is imperative. When fitted on one side only the calking is invariably broken when the pressure is applied on the calking side, and it is necessary to fit additional staples or plate collars to remedy this after the bulkhead is completed and tested. The plates, as far as possible, should have their seams parallel throughout. The stiffeners or girders should be fitted in the direction of the shorter length. It is not advisable to fit a horizontal girder or stiffener on a very long bulkhead, unless the same can have cross ties to other bulkheads. Greater stiffness can be attained by putting the same weight of material into a number of shorter vertical stiffeners. If single bounding bars be used, the butt straps to same should be on the opposite side of the bulkhead from the bars themselves, with a liner fitted at the back of the bar at the bottom of the plate, and the ends of the bar calked. Flanged brackets at the bottom of stiffeners give less satisfaction than brackets and angle clips, as the flanged plate has a tendency to straighten when the stiffener is in tension. At the top of a stiffener, where there is less pressure, a flanged plate is generally satisfactory. When stiffened principally on one side, the bulkhead apparently stands better when deflected away from the stiffeners than when toward them.

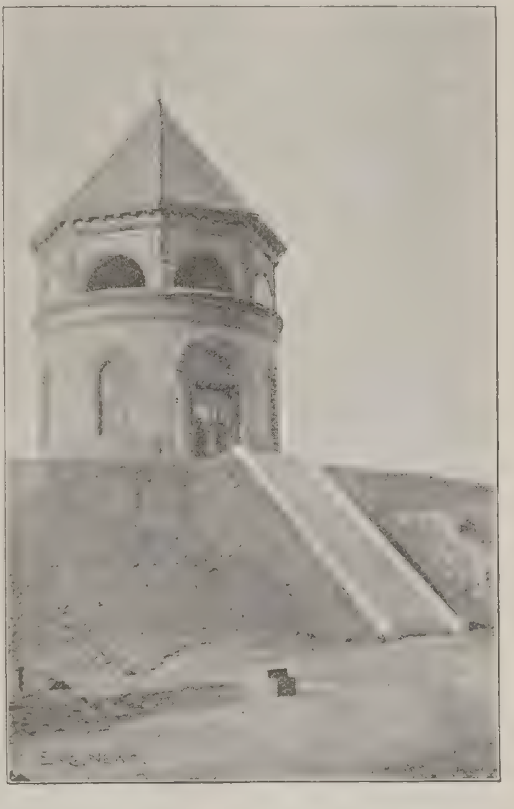


Fig. 4.—View of Gate House, Payson Park Reservoir, Cambridge, Mass.

Summarzing the conclusions already reached, there are certain very important features which, if more generally adopted, will undoubtedly give a much more efficient watertight subdivision of vessels. These are:

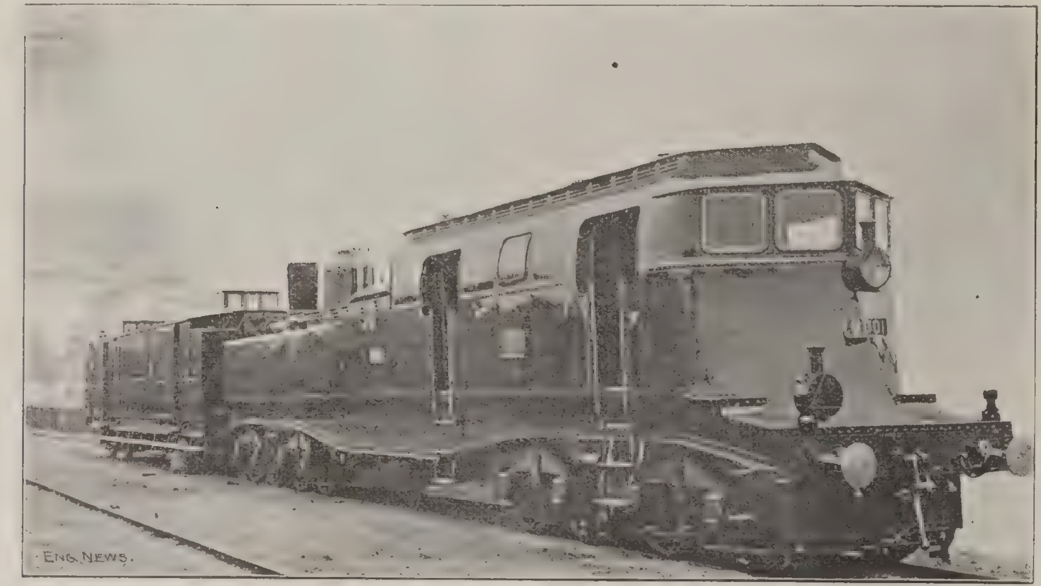
(1) Fitting of efficient rigid bracketing to all stiffeners on bulkheads below the water-line. (2) Fitting of double bounding and staple angles to such parts of all bulkheads as may be below the water-line. (3) Fitting of a vertical stiffening bar or double staples on all water-tight floor plates of a certain size (depending upon the class of vessel), except where the plate is in direct line and adjacent to a bulkhead above. (4) Fitting of the protective deck in two thicknesses instead of three. (5) Fitting of all plating behind armor in one thickness instead of two. (6) The use of double riveted lapped butts and seams instead of strapped butts and seams in the case of the inner bottom, platform and splinter decks and all bulkheads. (7) As an alternative to No. 6, the fitting of a stuffening bar along the seams in the case of all light flush plating fitted with straps.

The first three of these items are imperative, Nos. 4 and 5 very important, and the others desirable. In connection with these must be mentioned a general increase in the stiffness of certain important bulkheads, as already discussed. This I consider the most important feature of all.

THE HEILMANN ELECTRIC LOCOMOTIVE.

About five years ago there was heralded to the world the introduction of a self-contained electric locomotive on a French railway, which was in effect a combination of power station and motor car, and was claimed to combine exceptional properties of speed, power and economy. This machine was invented by Mr. J. J. Heilmann, of the Heilmann Works, manufacturers of steam and electric plant, of Paris, France. The technical papers were not enthusiastic over the design, an analysis of which failed to show advantages commensurate with the disadvantages. The machine was tested in experimental and regular train service on the Western Railway, under the supervision of Mr. Clerault, Superintendent of Motive Power, and "satisfactory" results were reported. In 1896, two more machines, of improved design, were built, and have been tried on the same railway, but the results of these trials have not been made public.

We have recently received from Mr. Drouin, Engineer of the Heilmann Works, particulars of these engines, and the following description of the old and new locomotives will interest many of our readers. We also reproduce herewith a photograph of one of the new locomotives, which shows also a special water-tank car which is attached for long runs. It will be seen that in its external appearance the machine would impress the average observer as a cross between a snow-plough and a military car for a Cuban railway.



VIEW OF THE HEILMANN ELECTRIC LOCOMOTIVE AND ITS WATER CAR ON THE WESTERN RAILWAY OF FRANCE.

The first locomotive on this system, named the "Fusee Electrique" (or "Electric Rocket") was tested in 1893-94 (Eng. News, March 15, 1894). It had a heavy girder framing, and was mounted on two eight-wheel driving trucks. At the rear end was a Lentz boiler, with water tanks on each side, while at the forward end was a 600-HP. horizontal compound steam engine (placed transversely to the longitudinal axis of the machine) running at a speed of 360 revolutons per minute. The engine drove a six-pole dynamo furnishing current to eight motors (one at each axle), while another engine drove a small exciter of constant potential. The engine was controlled by varying the exciter current by means of a rheostat, and was reversed by means of a commutator which reversed the current. The forward part of the engine was enclosed by a large cab. The weight of this engine was about 114 tons, or an average of about 7 tons per wheel.

According to the report made by Mr. Clerault to the International Railway Congress of 1895, the engine has hauled a load of 420 tons for test, and has also hauled trains of 206 tons and 80 tons (exclusive of the engine) at 21½ miles and 29½ miles per hour, respectively, on a grade of 0.8%, 7½ miles long. This was in experimental service on the line between Havre and Beuzeville. On the line between Paris and Mantes, 34.7 miles, the engine hauled regular and experimental trains of 60 to 80 tons at regular express speeds, the maximum speed recorded being 67 miles per hour. The engine was said to be very steady on the track. The coal consumption was gradually reduced from 24.5 to 13.2 pounds per mile. For five trips with trains of 61 and 69 tons (behind the engine), the average consumption was 20 lbs. per mile; 0.114 lbs. per mile per ton of total load (173 to 183 tons), or 0.323 lbs. per mile per ton of net train load (61 to 69 tons).

In 1896, two more of these engines, but of greater power, were built by the Call Company to the design of the Societe de Traction Electrique. These locomotives, as shown by the accompanying cut, are in general similar to the first, having an iron underframe mounted on two eight-wheel driving trucks, with the engine and dynamo at the forward end and the boiler at the rear end of the frame. The wheels are 3.8 ft. in diameter. A metal cab is built over the machinery, and is brought to a point at the front to lessen the air resistance. The total weight is 120 tons, or 7½ tons per wheel, but the machinery has a much greater capacity than that of the former locomotive, having a steam engine of 1,350 I. HP. as compared with 769 I. HP. It is to be noted, however, that for long runs the new engines have to haul specal cars, mounted on two four-wheel trucks and carrying 24 tons of water. One of these cars is equipped with four electric motors, and may be used as an extra engine in hauling very heavy trains.

The new 120-ton locomotives are 61 ft. long over the frames, 8 ft. 10 ins. wide over all, and 13 ft. 9 ins. high from the rail to the top of the smokestack. They have a total wheelbase of 50 ft. 6 ins., the truck wheelbase being 13 ft. 6 ins. The boiler is of the locomotive type, with Belpaire firebox, and is fixed at the middle, the ends being supported on expansion bearings. It has 351 tubes, 1¾ ins. diameter and 12 ft. 6 ins. long. The grate area is 36 sq. ft., and the total heating surface, 1,995.6 sq. ft., of which latter the interior surface of the tubes represents 1,818.4 sq. ft. The coal bunkers are on either side of the boiler, and the water is carried in a tender, as already noted. The engine is of the Willans vertical compound type, having six sets of tandem cylinders (or twelve cylinders in all), the high pressure cylinders being 12 × 16 ins. and the low pressure cylinders 19.2 × 16 ins. This engine runs normally at 400 revolutions per minute, the cranks running in a closed chamber containing oil and water. A separator on the steam pipe prevents water from getting into the cylinders.

At each end of the engine shaft is a six-pole dynamo, furnishing a current of about 1,000 amperes at 450 volts, or of double that intensity for a brief time. These dynamos are coupled in parallel. They are inclosed in steel casings, having suitable manholes and openings for ventilation. They were built by Brown, Boveri & Co. The exciting dynamo is a four-pole machine, which also serves to light the train, furnishing a current of 140 amperes at 115 volts. It is driven by a two-cylinder simple Willans engine of 28 I. HP., having cylinders 8.64 × 5.08 ins., and running at 550 revolutions per minute. On each driving axle is mounted a four-pole motor, rated for 125 HP. (or 1,000 HP. in all), at a speed of 62 miles per hour.

The machine is said to ride very steadily, owing to the absence of the ordinary reciprocating parts and to the balancing of its multi-cylinder vertical engine. Although it can develop considerable power, it does not seem capable of hauling very heavy trains, or of attaining any exceptional speed. One advantage claimed is an economy in coal consumption, but the information furnished us gives no particulars of any work in hauling heavy trains. An engine of 120 tons, with a huge tender in addition, ought to be able to do some real work, but we have no information as to the character of the tests or results obtained.

For general purposes, however, we may compare the figures already given for the first Heilmann electric locomotive with those of some new steam locomotives for fast passenger and freight service on the Great Northern Ry. These engines are of the ten-wheel type, having three driving axles. As shown by recent tests, they can haul passenger trains of 157 tons and freight trains of 417 tons at speeds of 49½ and 34 miles per hour on a division where the maximum grades are 2.2% and the average grade is 1.23% for 48 miles. The weight of engine and tender is 132 tons, and during the test the coal consumption was 152 and 241 lbs. per mile for passenger and freight trains, respectively, making 13.2 and 8.3 miles per ton of coal. From these figures we obtain for the passenger service 0.53 lbs. per mile per ton of total train, or 0.96 lbs. per mile per ton of the net train load. For the freight service the figures per ton per mile are 0.44 lbs. for the total train, or 0.58 lbs. for the net train. In comparing these figures with those of the "Electric Rocket" it must be remembered that the latter represented 62 to 65% of the total train load, while the steam locomotive (and tender) represented only 45.7% of its total passenger train, and 24% of its total freight train.

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THE LOWELL TEXTILE SCHOOL.

The annual catalogue of the Lowell, Mass., Textile School for 1898-99, contains information which should be of interest not only to those connected with the textile industries, but to others who are students of educational and social science. In the recent address by Prof. J. B. Johnson, on "A Higher Industrial and Commercial Education" (Eng. News, Aug. 18, 1898), he criticised our existing educational systems as lacking in the very element which it is the object of such schools as the one at Lowell to furnish, viz.: a scientific training especially suitable for the manufacturing industries. In that address he said:

> The most essential conditions of our future material prosperity are, as I conceive them, a specific scientific training for the directors of each and every kind of manufacturing and commercial activity. The imperial and paternal government of Germany has worked out this problem to a most fruitful issue, but probably no other country could duplicate it. England has been trying for ten years to do so, but with poor success; instead of highly educating a few leaders and directors of industry and commerce, they are vainly trying to raise the whole class of apprentices and clerks by a wholesale system of shallow night-school instruction. The great question for us to solve is how to obtain a corresponding scientific training for our industrial officials.

This great question is the one which, as far as the textile industry is concerned, the Lowell school is attempting to solve. As far as we can judge from the catalogue, its plans have been laid broad and deep, with a full knowledge of the scope of the problem, and after a thorough study of the European textile schools, and of the textile school which is developing successfully in Philadelphia. The trustees of the school are incorporated by act of the Massachusetts legislature, and the incorporators are directors or officers of great textile corporations in the state, with an aggregate capital of over $25,000,000. The school was opened Jan. 30, 1897.

The object of the school is to give instruction in the practical knowledge necessary in the cotton, woolen, worsted and other textile industries, in sciences and art as applied to these industries. The equipment consists of high grade machinery specially built to afford facilities for experimental work, and of such variety as is never found in any one textile mill. When all the machinery already arranged for is installed the equipment will be more extensive than that of any other textile school either in America or Europe. The work of the school is carried on in four directions: Day classes, evening classes, popular lectures, and women's department, each adapted for different sets of students. In the day classes there are four separate courses, each of which requires three years for its completion. They are: The cotton manufacturing course; the woolen manufacturing course; the designing course; and chemistry and dyeing. One term of preliminary instruction is given in the first year, consisting of principles of mechanism, machine drawing, textile calculations, elementary designing and elementary chemistry. Towards the end of this term each student elects which of the four regular courses he will follow in his subsequent studies. The evening classes are intended to give instruction to those who are engaged in the mills during the day, to enable them to perfect their knowledge of the branches in which they work, or to acquire knowledge of other processes. Five separate courses are given in evening classes covering the manufacture of cotton and woolen yarns, weaving on all varieties of looms; designing, cloth construction, analysis, and reproduction, color, and textile calculations; and chemistry and dyeing. Popular illustrated lectures on subjects connected with the textile industries are also given, and there are day classes for women in art subjects, especially in textile designing. The tuition fee charged for the day classes is $100 per school year, or $50 per half-year term. The fees for the evening classes vary according to the course. Tools, instruments, textbooks, etc., for students in the day classes cost from $10 to $15. The plant of the school now arranged for will cost $75,000. That the school is already a success so far as number of students is concerned appears from the list of students, numbering 257 in all, of whom 72 are day students. Of the latter 3 are graduates of universities, 6 of schools of technology, 32 of high schools, 13 of grammar schools, and 18 passed entrance examinations, or gave evidence of proficiency.

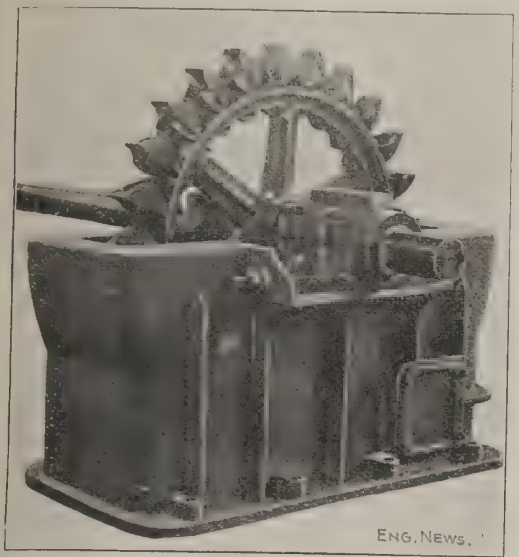

Fig. 1.—A New Impulse Water-Wheel. Patented by Daniel Hug, Denver, Colo.

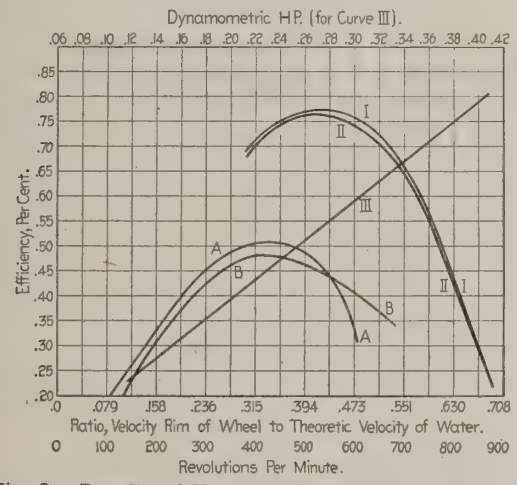

Fig. 3.—Results of Tests of Hug Water-Wheel Under a Head of 57.66 ft.
Curves I., II., III.; Tests with 1-2-in. Nozzle.
Curves A, B; Tests with 1-4-in. Nozzle.

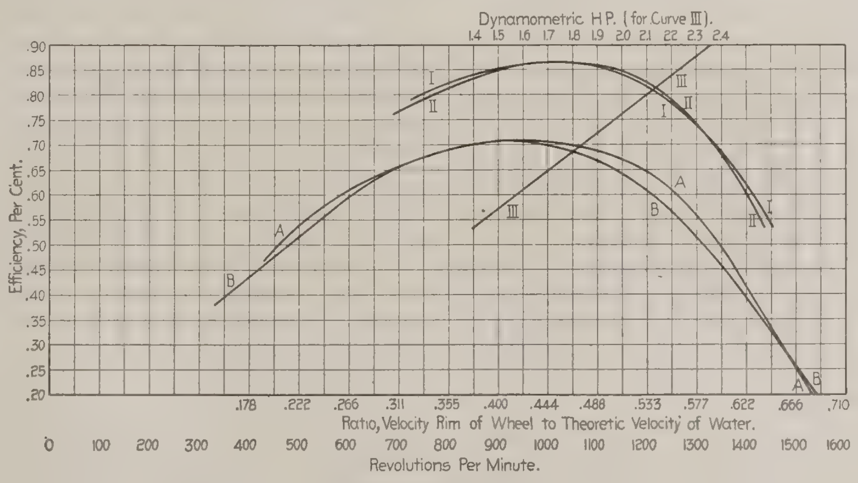

FIG. 4.—RESULTS OF TESTS OF HUG WATER-WHEEL UNDER A HEAD OF 182.23 FT.
Curves I., II., III.; Tests with 1-2-in. Nozzle.
Curves A, B; Tests with 1-4-in. Nozzle.

The school staff is as follows: Wm. W. Crosby, S. B., Principal, and Professor of Mechanics; Fenwick Umpleby, Professor of Textile Design and Fabric Structure; Louis A. Olney, Professor of Chemistry and Dyeing; Edgar H. Barker, Professor of Woolen and Worsted Spinning; Charles C. Hedrick, Professor of Cotton Spinning; Vesper L. George, Professor of Decorative Art; William Nelson, Professor of Weaving. We are indebted to Prof. Barker for a copy of the catalogue.

We shall watch the future progress of this school with great interest.

TESTS OF A NEW IMPULSE WATER-WHEEL.

We illustrate herewith a new form of impulse water wheel, recently invented by Mr. Daniel Hug, of Denver, Colo., and covered by U. S. Patents Nos. 576,828 and 576,849, Feb. 9, 1897. The principal feature of this wheel, which distinguishes it from the Pelton and other impulse wheels in which the buckets are carried on the circumference of the wheel, is the form of the buckets. The form is clearly shown in the illustration. The nozzle is so placed as to throw the jet horizontally into a bucket which is at the lowest point of its travel, and the jet on striking the V-shaped partition in the bucket is split into two halves, which are diverted upward and outward by the curved form of the interior of the bucket. The discharging passage gradually contracts toward the outlet, so that it has to a certain extent the function of a nozzle, the flow of the water being thus retarded while its reactionary power is transmitted to the walls of the bucket. Another feature of Mr. Hug's wheel is a "protector," or frame, closely surrounding the bucket, and into which the bucket discharges the water, so that none of the water is thrown upwardly or carried over the top of the wheel.

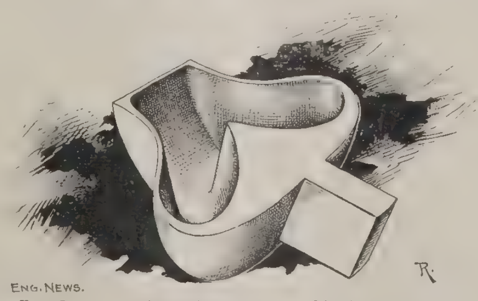

Fig. 5.—Perspective Sketch from Model of Bucket of Hug Water-Wheel.

Several of these wheels have been built by the Denver Engineering Works Co., Denver, Colo., and have given good results in practice. A 12-in. wheel was recently sent to Prof. R. C. Carpenter, of Cornell University, for a complete test with different sizes of nozzle and different heads. We have been favored with a copy of the report, which is one of the most elaborate reports of a water-wheel test that we have ever seen. Tests were made both with and without the frame, showing in some cases a considerable increase of efficiency when the frame was used, but in other cases the increase was unimportant. We give herewith some diagrams in which the results of some of the tests are shown graphically. The efficiencies reached over 85% when the conditions of load, size of nozzle, etc., were favorable, appear to us to be quite remarkable for so small a wheel. The range of power through which the efficiency remains high, as shown by the plotted diagrams, is also, we believe, exceptionally good. It is interesting to note that in all the tests the efficiency was directly proportional to the horsepower developed, as is shown by the inclined straight line plotted on each of the diagrams.

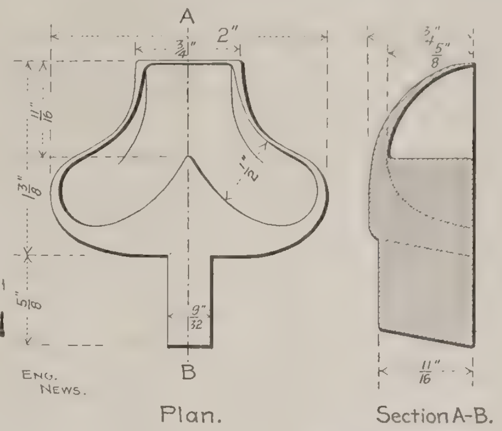

Fig. 2.—Elevation and Plan Drawn from Model of Bucket of Hug Water-Wheel.

Mr. Oscar Knapp, 207 Ross St., Brooklyn, N. Y., is representing Mr. Hug in the East.

* * *

THE ATTEMPT TO FORM A POOL, or agreement, by the steel rail manufacturers has failed. Judge E. H. Gary, president of the new Federal Steel Co., said concerning it: "There was no idea of forming a pool. During the week the steel rail manufacturers of this country have been striving to reach a fair and equitable working agreement in regard to division of territory and prices. But at to-day's meeting it was found that it was not possible to reach an agreement, and the plan was abandoned. I think, however, that there is a disposition among steel rail manufacturers to live up to prices, while there is a lack of complete harmony of action just now."

The difficulty seems to have been the refusal of the Carnegie Steel Co. to enter the agreement on the terms proposed.

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A notable feature of the new charter of the city of Baltimore is that all contracts are to be awarded by a special board, instead of by the department for which the work is to be done. This board consists of the mayor, comptroller, city register, city solicitor and the president of the second branch of the city council. Proposals must be invited for all work and supplies costing $500 or over, and the contract must be awarded to the "lowest responsible bidder." It seems very doubtful, especially in view of the provision quoted, whether the advantages of this plan will equal its disadvantages. The function of the board is simply to decide who is the lowest responsible bidder. To what contractor the work must go, regardless of whether the lowest bid is too high to give a reasonable profit, only, or too low to secure good work. Perhaps some bidders will be more careful, under this plan, not to bid too low, since the board of award will not be able to show them any favors in the execution of the contract, without collusion between this board and the department having the work in charge. In fact, here seems to lie the principal advantage of the plan, possible increased difficulty in making "deals," because there are two sets of men instead of one to arrange with. But the check does not apply to the frauds which may be practiced in the execution of the work. As to who is the "lowest responsible bidder," the department in charge of the work is better fitted to judge than the board of award. Of course, the advice of this department can, and probably will, be secured. If its advice is followed, the board of award is likely to be a more or less perfunctory body. If its advice is not followed, and the final estimates promise to exceed the original ones, the department involved knows it can, at least, divide the responsibility with the board of award, and thus may be slack in holding the contractor to terms or avoiding extras.

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The Heilmann locomotive power-station, or power-station locomotive, which we describe in another column, is one of the most ambitious attempts to apply electricity as a motive power in ordinary railway service which has ever been put into practice. Three engines have been built, two of which have been in use about twelve months, but no information as to their performance is available. Each engine consists essentially of a 1,350-HP. Willans engine, a large boiler, two 600-HP. dynamos, and eight 125-HP. motors, each motor being mounted on one of the driving axles. Great advantages in power, speed and economy are claimed, while the fact that the engine carries its own power plant makes it independent of conductors and central stations. In a brief discussion on the original Heilmann locomotive, in our issue of March 15, 1894, we took occasion to point out a fact that is often overlooked by advocates of electric locomotives. This fact is that the steam locomotive generates power at a much lower cost than any stationary steam plant. Mr. Heilmann uses what is practically a stationary plant, or power-station, which operates under the disadvantage, however, of being carried bodily from place to place. Some of the published accounts, however, state that the new engines were built for use on a certain branch of the Western Ry. If that is the case, it seems most probable that, if electric traction was desired, better economy could have been obtained by the establishment of a stationary central station and an overhead wire, or third-rail conductor, than by the use of the self-contained electric locomotive. It is easy to see, however, why this has not been done. The railway company is not likely to be considering the question of electrical traction except in a very general way, and has no intention of incurring expense for plant for this purpose. It has simply allowed the inventor of this machine to use a certain part of its tracks, and has directed its engineers to make careful tests of the performance.

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A favorite argument made in favor of the electric locomotive as a future certainty, is that the extensive introduction of the electric motor car on street railways is but an indication of its future introduction in ordinary railway service. This argument, however, is very easily answered by a comparison of the traffic and requirements of electric railways with those of ordinary steam railways. A little investigation will show that, almost without exception, the electric motor car or locomotive operates under conditions which are entirely different from steam railway service, and which would prevent the economical operation by steam locomotives. The electric railways form in fact a class of themselves, and cannot be considered as ordinary railways which have adopted a new motive power. A frequent service of cars at certain hours on suburban lines or a less frequent service on country lines, cannot well be operated to advantage by ordinary steam locomotives, although the recent introduction of steam cars for light traffic on branch lines has opened a new field for the economical use of steam power. On elevated railways, electric traction can ensure certain economies, but an equally important consideration is the elimination of the noise and dirt from locomotives, which consideration has little or no bearing on ordinary railways. The electric locomotives on the Baltimore & Ohio R. R. are for hauling trains through a long city tunnel, to avoid the inconvenience and discomfort due to smoke from steam engines, but this work is not comparable with ordinary railway work. In fact, all electric railways thus far built have been for purely local traffic. So far as we know, the Heilmann engine is the only attempted application of electricity as a motive power for ordinary railway service, and it must be confessed that the published results give no reason whatever to expect more extended use of the machine. In view of the enormous capacity of modern steam locomotives in point of speed and hauling power, and in view of the close attention that is being given to means of obtaining increased economy in operation, we see no reason to expect the application of the electric locomotive to ordinary railway service.

The progress thus far made toward the creation of a commission to revise the building laws, as provided in the Greater New York Charter, is summarized as follows in a statement recently sent out by the Charity Organization Society:

> A resolution was introduced some months ago, and has passed the Council, providing for a commission of eight members, of whom there shall be one carpenter, one ironworker, one plumber, one mason, one engineer, one architect, one representative of the Board of Fire Underwriters, and one representative of the Corporation Counsel, ex-officio. In the Board of Aldermen this resolution has been referred to a joint committee, consisting of the standing committees on Law, Public Health, and Public Buildings, Lighting and Supplies. To this joint committee has also been referred another resolution on the same subject, introduced by Alderman Folks. This latter resolution provides for a commission of 19 members, which is to include the three Commissioners of Buildings, the Chief of the Fire Department, a representative of the Corporation Counsel, ex-officio; a representative of the Board of Fire Underwriters, two representatives of the Tenement House Committee of 1894, a sanitary engineer, a civil engineer, five architects, two lawyers, and two practical builders. This proposed commission, therefore, consists of five representatives of city departments, seven experts (architects or engineers), two tenement house reformers, two lawyers and two practical builders.

The Society strongly urges that the important work of revising the building code shall not be turned over to a commission constituted almost wholly in the interest of builders and contractors, as would be the case if the first-named resolution were adopted; and approves the commission provided for by the second resolution.

As we pointed out in our issue of Jan. 20, 1898, the excellence or the reverse of the new code will depend very much upon the character and ability of the commission which shall formulate it. Of the two commissions which are proposed, the larger will, we think, appeal to engineers and architects as presenting the greatest number of favorable features. The preponderating position of the building interests in the commission of eight and the manifest unwisdom of asking these interests to form a law for the regulation and restraint of their own business for the sake of the public health and safety, seem to decide its inferiority, as the Charity Organization Society well says. The commission of 19, while somewhat unwieldly in point of numbers, gives, on the contrary, due representation to all interests without giving a preponderating influence to any single one. It also provides the necessary strong element of expert knowledge in the large number of engineer and architect members, which it specifies. Further, the larger commission will permit a proper representation of the needs of the suburban and semi-rural portions of the city as well as those of the residence, tenement house, and office building districts. The value of the new code, after all is said, however, will depend upon the character and ability of the expert members of the commission. Many of the conditions of the present building laws can be remedied successfully by expert engineers only, who are thoroughly familiar with the latest advances made in the knowledge of the strength and endurance of materials, and who will apply this knowledge with an unbiased mind. Engineers can do much toward securing the appointment of such men, and if they choose to neglect the opportunity, they have little cause to blame anyone but themselves should the new code perpetuate the well-known crudities and unwise and oppressive restrictions that occur in the present building laws.

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THE PASSING OF THE CANAL.

In our issue of Nov. 10, in commenting on the prospective abandonment of the famous old Delaware & Hudson Canal, we referred to the probability that a few years more will see the entire disappearance of the old-time canal-boat as a vehicle for freight transportation. Men now living can remember when the canals of the Middle States were important avenues for passenger transportation, as well as carriers of all classes of freight. The passenger traffic forsook the canals at an early period in the history of the railway; the general merchandise traffic soon followed; and for many years the only business left to the canals has been the carriage of the cheapest and coarsest class of bulk freights. Even in this field, however, the continual cheapening of rail transportation has gradually drawn business away from the canals. The Erie Canal during the pres-

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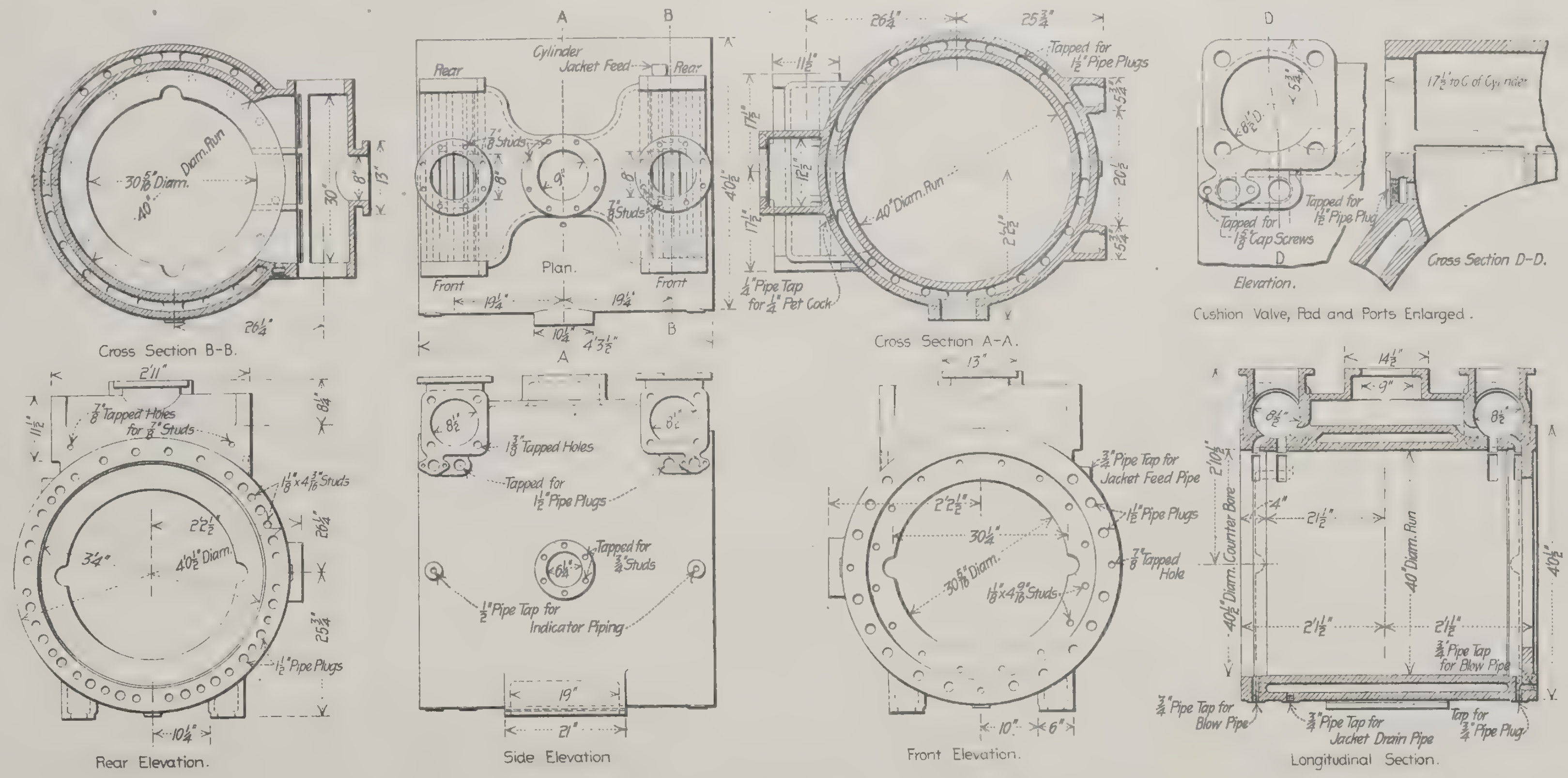


FIG. 7. 40x36 IN. STEAM CYLINDER.

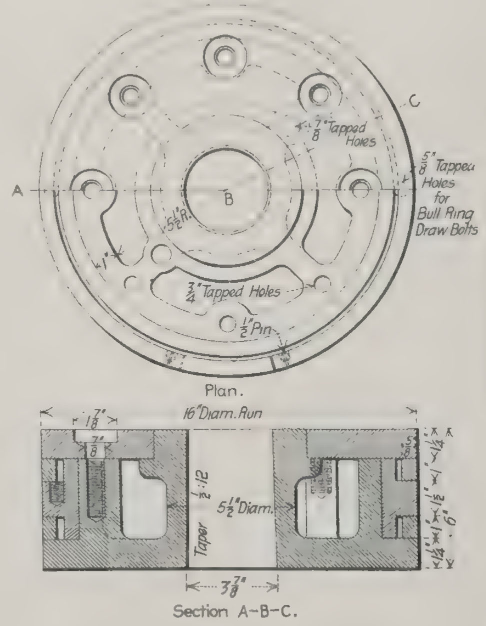


FIG. 8. 16 IN. PISTON.

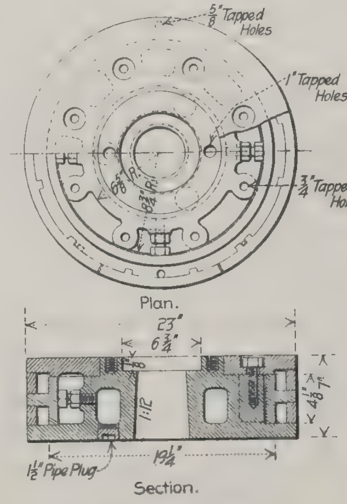
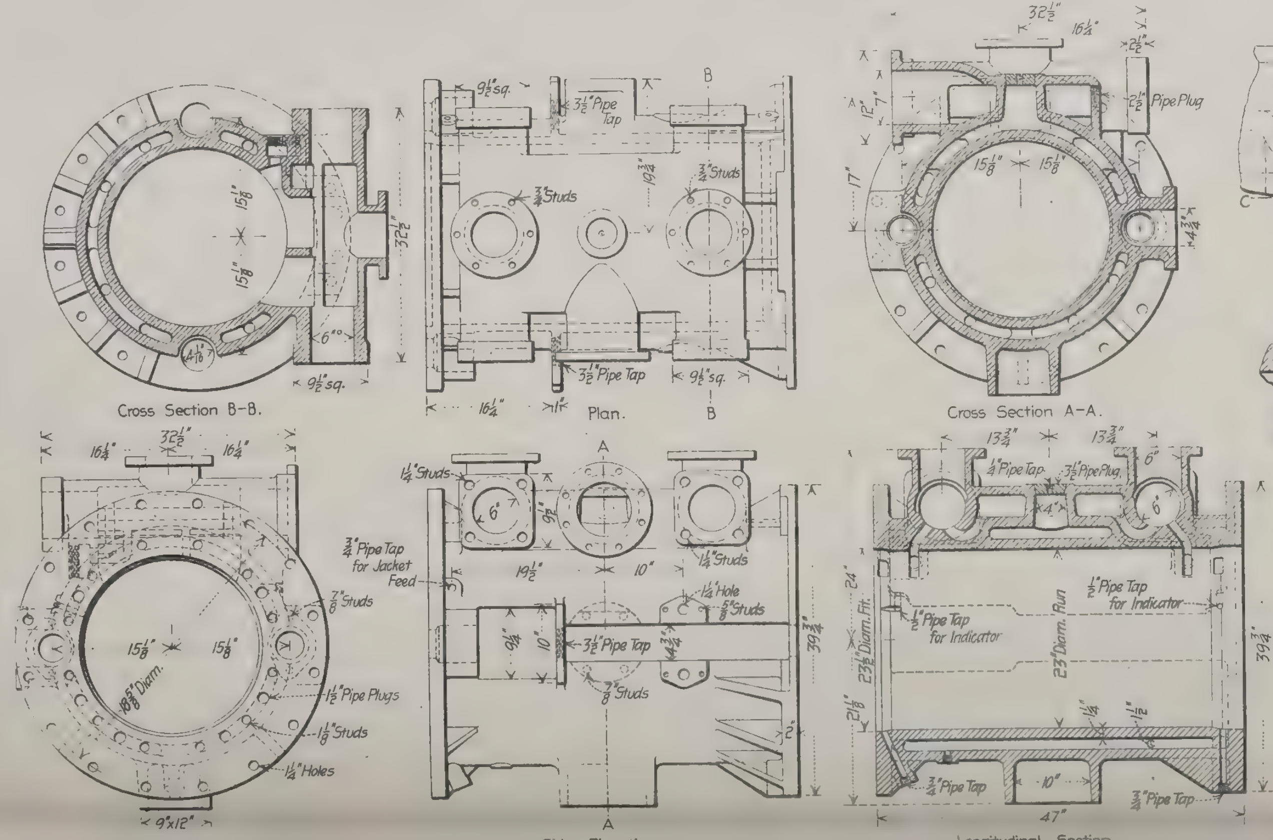
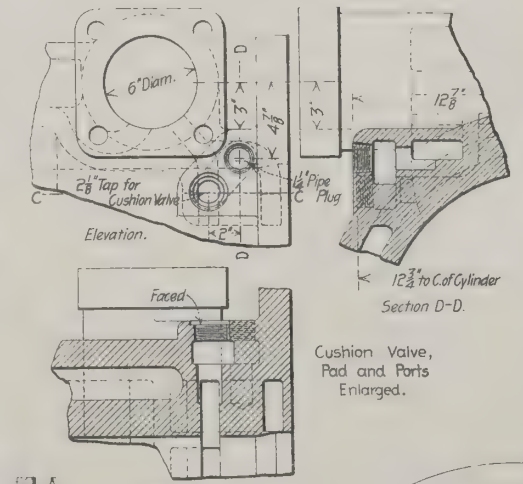
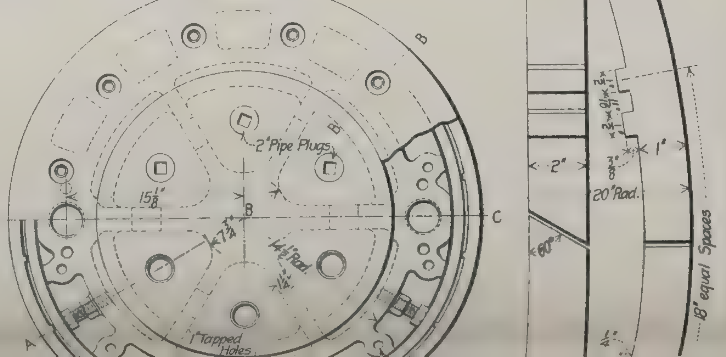


FIG. 9. 23 IN. PISTON.





Cushion Valve, Pad and Ports Enlarged.



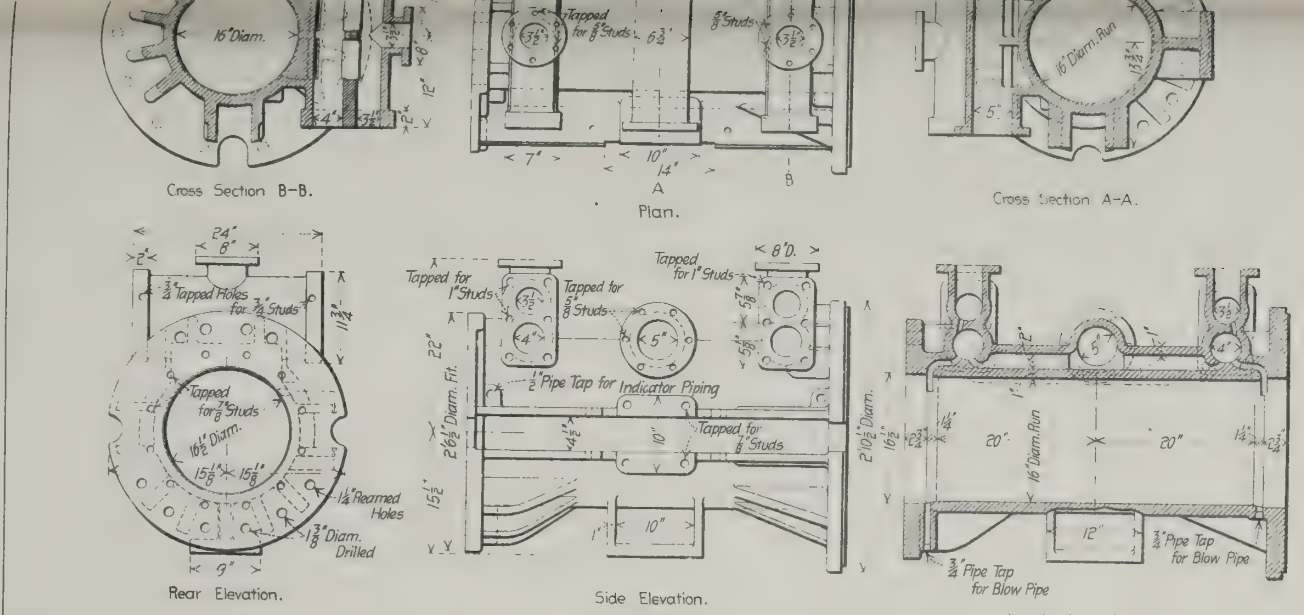


FIG. 5. 16x36 IN. STEAM CYLINDER.

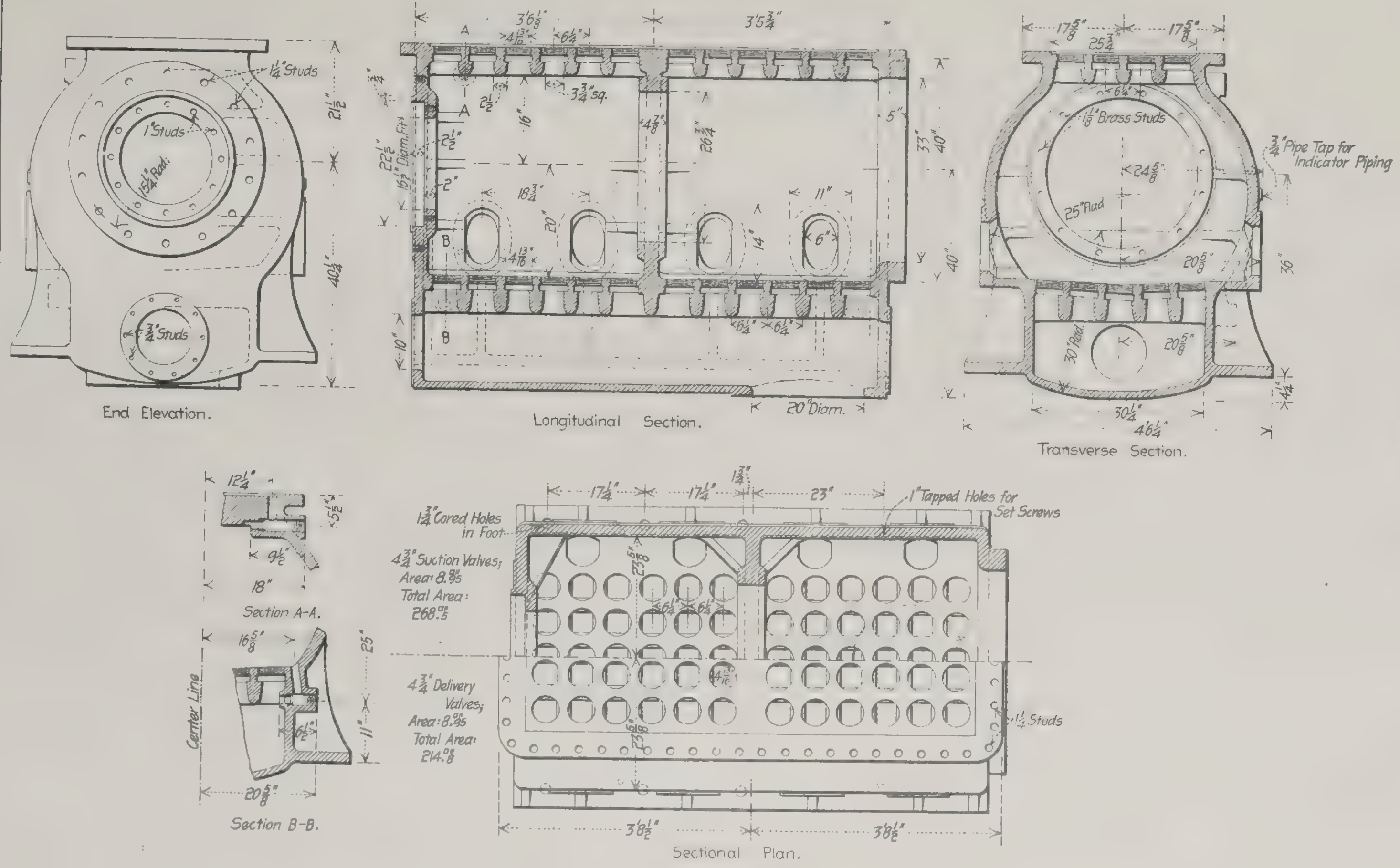


FIG. 2. 23x36 IN. PUMP CYLINDER.

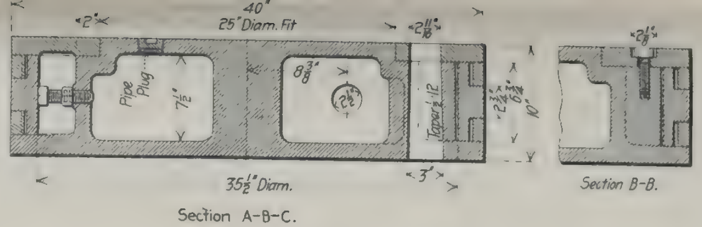


FIG. 10. 40 IN. PISTON.

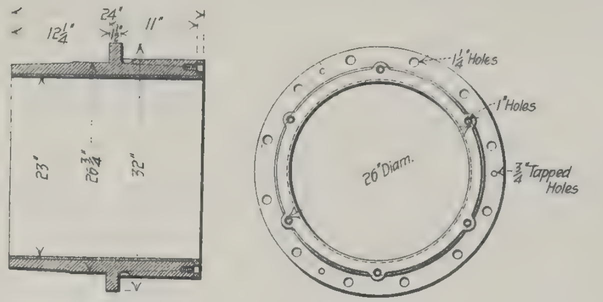


FIG. 4. 23 IN. PLUNGER RING.

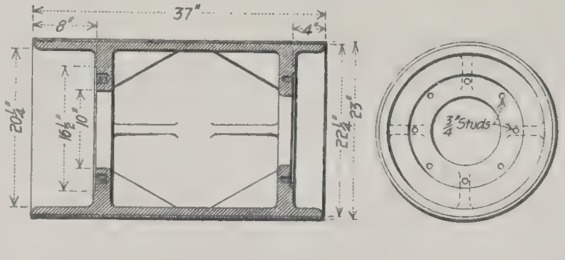


FIG. 3. 23 IN. PLUNGER.

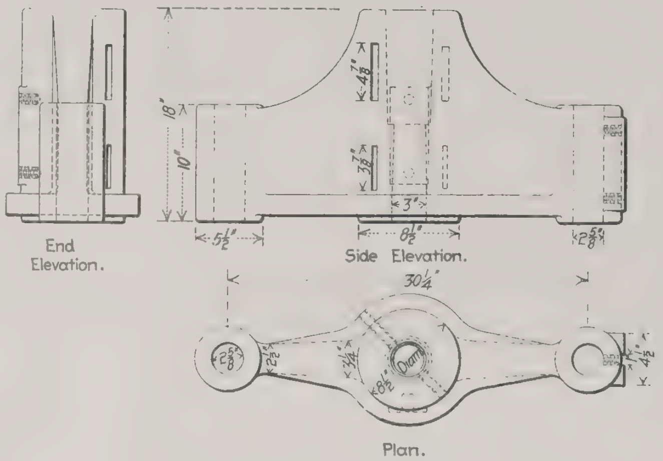


FIG. 16. MAIN CROSS HEAD.

TRIPLE EXPANSION PUMPING ENGINE AT OGDENSBURG, N. Y.

Built by The Snow Steam Pump Works, Buffalo, N. Y.

CHAS. HART, LITH., 36 VESEY ST., N. Y.

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ent season has carried hardly any wheat, notwithstanding the enormous shipments of this cereal to Atlantic ports; yet wheat was one of its chiefest items of traffic only a few years ago. Over 36 million bushels of wheat were transported on the New York state canals in 1893; but during the present season canal shipments of wheat to New York to Oct. 1 aggregated only 40,000 bushels.

Closely following the announcement of the prospective abandonment of the Delaware & Hudson Canal comes the news that Maryland has decided to dispose of all its interest in the old Chesapeake & Ohio Canal, which has cost the state first and last about $25,000,000. It was offered for sale by the state three years ago; but the only bids received were rejected. The only value of the canal at the present time is as the right of way for a railway line to parallel the Baltimore & Ohio; and it is probable that that company will endeavor to secure it to prevent such an outcome.

The question is often asked why the river and canal transportation routes in this country have been gradually abandoned, while in Europe, notwithstanding the fact that a network of railways covers the country, the traffic on both artificial and natural waterways is steadily maintained. An answer to this question which has been given so often that it has come to be generally believed, is that in the United States the railway companies at an early period secured control of canals for the purpose of wrecking them as transportation routes and getting rid of their competition. There is doubtless a certain amount of truth in this statement, and there was much more truth in it a score of years ago than at the present day. But it is not the real underlying reason for the decadence of water transportation routes in this country. The real reason is that under American commercial conditions freight can be moved at less cost by rail routes than by any system of river or canal transportation. When we say this we speak, of course, in a general way. For such traffic as the transport of coal down the rivers of the Ohio valley, for example, the river transportation, by reason of the peculiar methods by which it is conducted, is cheaper by far than any possible rail transportation. These and similar exceptional instances, however, do not affect the truth of the general statement.

It is of interest to inquire the reasons why rail transportation in this country is so much cheaper and water transportation is so much more expensive than in Europe. First and most important is the larger capacity cars, and more powerful locomotives of American railways, permitting the hauling of heavier train loads. The great volume of traffic and the long hauls make these large cars and long trains possible and economical, as they would not be in a country of smaller area, or one in which the products of different sections are not interchanged on such an enormous scale. Only those intimately familiar with railway matters appreciate the great advancement that has been made in railway practice in the United States during the past two decades. American railway managers have led the world in adapting the railway to the transportation of the cheapest class of bulk freights. Compared with American practice, foreign freight traffic seems like toy railroading.

Another thing which has made possible the cheap movement of freight in this country is the fact that so far as freight traffic is concerned, the railways of the country are operated as a single system. The interchanage of freight cars between different railway companies, enabling a car to travel from one end of the country to the other without transfer of its lading, has saved literally billions of dollars in the cost of handling freight traffic since it was established. Nowhere else in the world is there anything like such a vast system of freight car interchange in operation.

Still another reason why railways have superseded water routes in this country is that all our machinery for the production and distribution of goods is suited to rail rather than to water transport. Most American manufacturing plants of any size have railway sidings and spur tracks running into their yards and often into the buildings themselves, so that raw material is received and finished goods are loaded without any wagon transportation. Comparatively few manufactories except those in seaboard cities or on the Great Lakes are located on a water front.

In the United States the railway has preceded civilization over a large part of its area. The railway and not the river was the original avenue of transportation, and in the building of manufactories, warehouses, etc., everything has been planned with a view to the use of the railway. In Europe things are quite different. European cities with their warehouses were built before the railway era, and convenience to water transportation routes influenced the location of most of them.

The real underlying reason, then, for the abandonment of barge canals in this country is not, as has been so frequently asserted, the political and financial manipulation of the railway companies. The real reason is that bulk freights can under American conditions be carried more cheaply by rail than they can on rivers or canals.

The average railway freight rate per ton-mile for the United States, according to "Poor's Manual," was 1.057 cts. in 1885. In 1897 it had fallen to 0.783 ct. Had the freight shippers of the United States paid the same freight rate per ton in 1897 that they did in 1885, the railways would have increased their profits by more than $268,000,000. This enormous reduction in the charge for carrying freight was made possible by the great increase in the average freight train load. Notwithstanding the fact that the railways received on the average only three-fourths the money for carrying a ton a mile in 1897 that they did in 1885, the average earnings per mile run by freight trains were actually greater in 1897.

We are aware that the past is not a sure guide to future. It is certain that so rapid a reduction in freight rates as has gone on for the past thirty years cannot take place in the future. On the other hand, there is no reason to believe that a final limit has been reached in the cost of transporting bulk freights by rail. Steel cars, and still more powerful locomotives, economies in the methods of loading and unloading cars, and better terminal facilities are some of the means by which further savings will certainly be made.

We do not look for any considerable reduction in the rates on high-class merchandise and "less than carload" shipments. On traffic of this sort the railways are now charging probably less than the total cost of transportation. We do believe, however, that in the handling of bulk freights in great quantities on through shipments, by the use of special rolling stock and, perhaps, of specially-built lines of railway, opportunities exist for the movement of freights by rail at a cost much lower than has yet been deemed possible. Remembering that it is in the coarsest and cheapest class of bulk freights alone that the canal is claimed to be able to compete at all with the railway, it is easy to see that in the near future the old-time barge canal, which is already at the limit of its usefulness, will be left far behind in the competition.

In the light of the plain and well-known facts, which are above enumerated, what would be thought of a company which should propose at the present day to build one of the old-time barge canals as a business venture? Its promoters would be deemed fit candidates for a lunatic asylum. They would be told by financiers that the day of canals is past. That they might as well try to exploit anew the cable system for street railway traction, just when the last of the cable machinery is going to the scrap heap, to be replaced by electric traction, as to propose the building of a new barge canal.

We do not know of any private company which proposes at the present day to build a barge canal; but we do know that the United States government is now actually engaged in constructing such a canal between the Illinois and the Mississippi rivers, in calm disregard of the fact that the day of usefulness for such a waterway has passed. Upon this piece of monumental folly the government has already expended about $2,000,000; and if it carries the work to completion about $8,000,000 to $10,000,000 additional will be thrown away.

It may be of interest to trace the history of this work. During the '70's a large amount of agitation was carried on in the States of Iowa, Illinois, Wisconsin and Minnesota to induce the general government to undertake the building of a canal from the Mississippi River at or near Rock Island, Ill., eastward to the Illinois River, where the existing Illinois & Michigan Canal would continue the waterway to Chicago. Various Boards of Trade and other commercial organizations, both in the West and in the East, adopted resolutions favoring the project; and finally in the early '80's, Congress made a small appropriation for a survey of the route. In the Report of the Chief of Engineers for 1883 we find a record of the survey, together with a statement of the commercial advantages which the new route was to offer. The chief argument for the canal was that it would in effect extend the advantages of the cheap freight rates to and from the East, which Chicago enjoyed to the whole territory covered by the upper Mississippi. A large part of the argument for the canal was based on the idea not that the canal itself would carry the traffic, but that its competition would compel the railways to reduce the rates on the traffic which they carried. As evidence of the need of a reduction in the railway freight rates, a table was given of the average freight rates per ton-mile on several of the leading railways running west from Chicago. We present these figures here, and have added to them the corresponding figures for the same companies for the year 1897, as follows:

Railway.	Average freight rate per ton mile, cts. 1882.	1897.
Ill. Central	1.41	0.67
Chicago & Alton	1.03	0.76
Chicago, Burl. & Quincy	1.19	0.86
Chicago, Rock Island & Pac	1.22	0.97
Chicago & Northwestern	1.46	1.09
Chicago, Milwaukee & St. P	1.77	1.01

It will be seen at once that even if it were worth while to build the canal 15 years ago as a lever for reducing freight rates, it does not at all follow that it would be worth while to-day for the same purpose.

Other changes in commercial conditions have greatly altered the aspect of this canal enterprise since it was first projected. At that time Chicago was the outlet for the whole Northwest. The wheat of Iowa and Minnesota and such part of Dakota as was then under cultivation was gathered at St. Paul and Minneapolis and shipped thence to Chicago. The ports at the head of Lake Superior had hardly begun to cut any figure in the grain movement. In 1880 the total receipts of flour and grain at Chicago aggregated 165,855,000 bushels, while Duluth had only 7,617,000 bushels. In 1896, the ports on Lake Superior sent eastward 90,700,000 bushels of grain and 8,800,000 barrels of flour. Thus the whole Northwest, for the supposed benefit of which the Hennepin Canal was originally planned, has now a far better outlet to the east by way of Lake Superior than it could ever have by way of Chicago.

Again, it was supposed by those who originally promoted the Hennepin Canal enterprise that the railways west of the Mississippi would deliver their products to canal barges at the various river towns. It was not foreseen that the railways which collected this grain would prefer to carry it through to the lake port of its destination, and would arrange their freight rates to accomplish this in any event. Neither was it foreseen, though it ought to have been, that it would cost actually less to haul a loaded car from the Mississippi River to Chicago and discharge its lading there than it would to load a little canal barge, tow it over the long stretch of river and canal navigation, handle it in the long chain of locks of the Hennepin and Illinois River canals, and finally deliver its contents to the Chicago elevator. These locks, we may add, are alone sufficient to make traffic through the Hennepin canal absurd as a business proposition.

We need take no more space, however, to prove that this enterprise has long lost the little reason for existence that it once had. The fact is that the public has for years taken no interest in, and has forgotten all about, the Hennepin Canal. Probably nine-tenths of the members of the Chambers of Commerce and Boards of Trade that once adopted strong resolutions in its favor, would now be puzzled to tell where it is. If Congress, in a spasm of wisdom, should decide to drop the whole enterprise where it stands, and refuse to throw good money after bad any longer, we venture to say that no protest would be heard except from the few who hope to profit by the government's expenditure on the work.

Returning now to our general subject of the transfer of traffic from the canals to the railways, it is of interest to note the experience of Canada. The Dominion has expended about $80,000,000 on its canals, and its total revenues therefrom are about $340,000 per annum. The interest on the original outlay, most of which is still represented by bonds, and the cost of maintenance and operation form one of the heaviest items in the government's expenses, and so far as the canals are beneficial, the benefit must be sought in the indirect returns. Some of the canals along the St. Lawrence and the Welland and Sault canals have traffic enough to justify their existence, but the branch canals, such as the Rideau and the Trent, are admitted to be no longer worth the cost of keeping them in repair and operating them. The Trent Canal is still under construction, but appropriations for it are made year after year merely to give the district in which it lies a share of the "pie," not because anyone believes in its commercial value. The Rideau Canal in 1895 cost for maintenance, operation and interest on its cost about $280,000. The total traffic which it carried was 88,700 tons, most of it cordwood and lumber, and the tolls amounted to about $7,000. As for the St. Lawrence canals, they are being enlarged to admit vessels of 14-ft. draft, to accommodate through traffic from the Lakes to the seaboard, and in the hope of diverting a large volume of the traffic which now goes to United States ports. How far they will be successful remains to be seen; but many believe that they will never carry sufficient traffic to justify the millions that have been expended upon them.

In conclusion, it is of interest to note what one of the ablest of American business men, Mr. Andrew Carnegie, has recently said concerning the relative economy of canal and rail transportation. In his speech before the Pittsburg Chamber of Commerce on Nov. 10, Mr. Carnegie spoke of the projected deep waterway from Lake Erie to the Ohio River, as follows:

> Touching the all-important matter of transportation leads me to refer to my connection with the project for making Pittsburg a lake port by water communication. It has been pointed out that I was the first to suggest in a speech to the legislature that the abandoned canal should be replaced by a deeper one which should lead the waters of Lake Erie into the Ohio. Conditions, however, have changed. Such has been the progress of railway development that, if we had a canal to-day from Lake Erie through the Ohio Valley to Beaver, and it was opened free of toll like the Erie Canal, we could not afford to put boats upon it.
>
> I have never concealed my opinion that even if we had a 15-ft. ship canal, the large lake steamers would not come to Pittsburg. It takes a steamer carrying 7,000 tons of ore to live at present rates—within five years, the lake carriers will be of 10,000 tons, and it will be much cheaper to transfer its cargo at the lakes into smaller boats than to attempt to send the monster through the canal. But more than this, it is cheaper to-day to transfer the ore to 50-ton cars and bring it to our works in Pittsburg over our railway than it would be to bring it by canal.
>
> I do not wish to appear even by silence to be considered a party to any attempt to entice private capital to invest in building a canal between Pittsburg and the lakes, because I am convinced that this capital would be entirely lost; if the canal were completed, the existing railroads could and would perform its service cheaper and more satisfactorily, because they can run all the year round.

It should be especially noticed that the proposed Lake Erie & Ohio River Canal, to which Mr. Carnegie refers, was not to be a small barge canal such as we have discussed above, but a waterway of 15 ft. depth, able to carry good-sized steamers and barges. We have ourselves felt that there was at least a chance that such a waterway from Lake Erie to Pittsburg might prove a financial success, although we have seen small prospect of its actual construction. If Mr. Carnegie is correct, however, and the 50-ton freight car is a cheaper carrier than the boats on such a canal, then is it all the more certain that all the old-time small barge canals are doomed to early abandonment, no matter how much money may be expended on them from state or national treasuries.

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LETTERS TO THE EDITOR.

The American Railway Engineering and Maintenance-of-Way Association.

Sir: In your issue of Nov. 3, in commenting on the recent preliminary steps taken to organize an association of Engineering and Maintenance-of-Way officials of American railways, I am sorry to note that your criticism was unfavorable to the formation of such an organization. Your main objection appears to be that there are already sufficient numbers of engineering societies to engross the attention of the professional engineer, and that the new society or association is superfluous.

As Secretary of the newly-formed association I have had rare opportunity to note the widespread interest which the mention of this association has enlisted from the purely engineering and maintenance-of-way officials of the American railways. Out of perhaps 400 communications, only about 3% have expressed any opposition to the formation of a Maintenance-of-Way Association.

To the writer it appears that there is as much need for an association to deal with maintenance-of-way matters as there is of a Master Car Builders' and Master Mechanics' Association, which treats of equipment, or an American Railway Association to discuss questions of transportation.

The railways of the United States are properly divided into three sub-operating departments, which are Maintenance-of-Way, Maintenance of Equipment, and Conducting Transportation. Taking into consideration the general expenses, the proportion of expense in operations of the railways is about as follows:

Maintenance-of-Way	19.5%
Maintenance of Equipment	15.5%
Conducting Transportation	54.0%
General	11.0%
Total	100.0%

The expenditure of the 19.5%, or a sum equal to $150,000,000 to $200,000,000 annually in the Maintenance-of-Way department of railways deserves as much consideration at the hands of the officials in charge of such departments as the $100,000,000 to $125,000,000 expended in the Maintenance of Equipment Department but as a matter of fact, the latter department gives more attention to uniformity of methods and aims more to a united or uniform system for the entire railway mileage of the country than the Maintenance-of-Way department. It is true that this is largely due to the necessity of interchange which prevails in the Rolling Stock department, and which does not apply to the other department; but it cannot be successfully contradicted that a Maintenance-of-Way Association, embodying in its organization the best talent in its particular line, would result in a vast amount of good to American railways. It is this cause that has brought the Maintenance of Equipment department to its present high state of development and efficiency.

The matter of supreme importance is to organize the Maintenance-of-Way Association along proper lines. Many favor the membership to be by railway companies, or an organization similar to the American Railway Association and the Master Car Builders' Association. Others, and by far the larger number, favor an individual membership restricted to railway engineers and maintenance-of-way officials above a prescribed grade, excluding all engineers from eligibility who are not directly connected with railway maintenance-of-way work. For they contend that it is to be a specialty, having for its aim the advancement of the theory and practice of railway engineering and maintenance-of-way work, which is a field broad enough in its extent to merit the sole attention of the association. Those contending for company membership hold that the results of the association would be adopted by the various railways more readily than if such results were the opinions of an association of individuals as members—in short, the benefit to accrue to the railways would be to the maintenance-of-way department what the American Railway Association is to the transportation department.

It is apparent, therefore, that the future of the organization depends upon its being launched on proper lines, and the subject is of such vital importance to the railways that it should receive the serious thought not only of the maintenance-of-way officials, but of all officers having charge of railway operation, and a full attendance at the meeting in Buffalo, in March, 1899, is desirable. Respectfully,

L. C. Fritch,
Secretary American Railway Engineering and Maintenance-of-Way Association.
Washington, Ind., Nov. 15, 1898.

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Notes of an Engineer in Colorado.

Sir: The railroads entering Leadville present a fine opportunity for a study of the different types of mountain roads, and for a comparison of the merits of direct alinement and heavy grades vs. longer lines and easy grades. The Denver, Leadville & Gunnison and the Colorado Midland roads are fair samples of the first type, and the Denver & Rio Grande standard gage of the second.

The D., L & G. (narrow gage) has an 11,500 elevation at Boreas and one nearly as high at Fremont Pass, and has much 4% grade and a heavy snow-fall in the winter to battle with. Formerly Leadville was reached by a branch from Buena Vista, 35 miles south of Leadville. Though this line was 28 miles longer (179 miles) than the present one, it had but one 10,000 ft. elevation, no snow to bother and only 2% grades. The road has never paid since the branching off point was changed from Buena Vista to Como. This road continues from Buena Vista on southwest to Gunnison, climbing up to the Alpine tunnel through the Continental Divide at an elevation of 11,623 ft.

The Colorado Midland is the most notable example of broad gage roads belonging to the first type that can be found. The main line from Colorado Springs to New Castle is 234 miles long and cost between $19,000,000 and $20,000,000. The greater part cost about $100,000 per mile, and the line is said to have been the most expensive to construct of any in the world. The country is very difficult. The maximum grade is 4%, reaching from Manitou Iron Springs to Cascade Canyon, and it is equated on curves at the rate of 0.06 ft. per 100 ft. The maximum curvature is 16°. For the remainder of the line the maximum grade is 3%, including that over the Continental Divide. The distance from Colorado Springs to Leadville is 135 miles. (From New Castle to Rifle—13.4 miles—the Colorado Midland uses the track of the Denver & Rio Grande, and from there to Grand Junction—62 miles—they both run over the Rio Grande Junction Ry.). The Midland has a total trackage of its own of 357 miles, including several branches.

About 17 miles west of Leadville the line crosses the Continental Divide. As first built, the road pierced the divide with the Hagerman tunnel, but afterwards the Busk-Ivanhoe tunnel was built. (Eng. News, Jan. 17, 1891, and Aug. 25, 1892.) The Hagerman tunnel is 2,061 ft. long, and is at an elevation of 11,528 ft. The high line running through here was very expensive to operate, so that in July, 1890, work was begun on the Busk tunnel, the first trains running through in December, 1893.

It was estimated that there would be a saving of maintenance charges of $70,000 per year by doing away with the surface line. There were 13 snow-sheds, aggregating a mile in length, and 12 bridges and trestles—one of them 1,200 ft. long and 84 ft. high. Besides the maintenance charges there were the delays by snow and the loss of patronage due to the same; by the new line there was also the saving of 7 miles in distance, 580 ft. in elevation and about 2,000° in curvature to go to lightening the operating expenses. So when it was calculated that the tunnel could be built for $1,000,000, the railway company readily guaranteed the 7% on the cost of construction to the Busk Tunnel Ry. Co. The cost, however, was $1,250,000, and the Colorado Midland Ry. Co. contracted to pay 25 cts. for each passenger and each ton of freight hauled through the tunnel.

The railway company went into the hands of a receiver about 1894. but was reorganized the latter part of last year. The receiver, Mr. Geo. W. Ristine, was elected president and general manager, and at once went to work to try to break the contract in the courts. An offer was made to pay 3%, and then 4%, in place of 7%. The parties seem to now be in a fair way to agree. The Colorado Midland has been running trains over the old route, over the summit, for a year or two past. Most of the track had been torn up, and this had to be replaced and the trestles and snow-sheds put into shape before using.

The west portal of the Busk tunnel has an elevation of 10,945 ft., while the summit overhead the tunnel is about 12,000 ft. The tunnel cross-section is 15 ft. wide by 21 ft. high, while that of the older Hagerman tunnel is 15 × 19 ft. The maximum grade on both sides of the divide is 3%.

Turning now to the Denver & Rio Grande road, we find that it has followed the main drainage channels of the country as far as possible, thus securing water grades for its lines. While this has usually lengthened the general route, the avoidance of sharp curves and heavy grades has more than compensated for it. Thus from Colorado Springs to Leadville by the Colorado Midland is 138 miles, and it is only 157 miles from Pueblo by the Denver & Rio Grande, though Pueblo is 45 miles south of Colorado Springs and the general route is much longer. Again, from Leadville to Glenwood by each line is about 90 miles. The general route by the Denver & Rio Grande is longer. The maximum grade for west-bound trains on the Denver & Rio Grande is 1.42%, and 3% for the Colorado Midland, being 3% on the west slope for both roads. The maximum curvature on both sides of the divide on the Colorado Midland is 16°; on the Denver & Rio Grande it is 10° on the east side and 12° on the west side.

The operating expenses, due to much easier grades, lighter curves and less snow, and also the maintenance charges due to much less trestling to keep up, show very much in favor of the Denver & Rio Grande. This road has 10° maximum curves (except one of 12° in the Royal Gorge) and 1.42% maximum grades (compensated) for its three-rail line from Denver to Pueblo and on to Leadville. Leadville is not on the main line, and only passenger trains run through it. West-bound trains leave the main line at Malta for Leadville, and in the 5 miles there is a rise of 620 ft., with a maximum grade of 3%, requiring a helper engine. Continuing on west, the main line is reached at Leadville Junction.

Leadville.—Leadville has been a noted mining camp since 1876, when the silver and lead carbonates which gave it its present name were discovered. The original camp of California Gulch produced nearly $5,000,000 in gold from the placers between 1859 and 1862, after which it was nearly abandoned. Between 1876 and 1896 the Leadville district is said to have produced precious metals to the value of $206,000,000. Among the mines which have given celebrity to the town are the Little Pittsburg, which went far toward making the fortunes of several of the wealthiest men in Colorado; the Robert

E. Lee, which yielded $118,000 in a single day; the Maid of Erin, Little Johnnie and many others. The carbonate deposits, of which the city is the center, are said to cover an area of 60 miles in length north and south by 10 miles in width. Over 30,000 mining locations have been made near the city, but the production has all come from about 50 mines. Since the slump in silver, Leadville, of course, has suffered severely; and from June, 1896, to March, 1897, a great strike of the miners was on that paralyzed the industrial interests of the town for the time and threatens to have left permanent bad effects.

Many of the largest mines here lie in the "Leadville Basin," being known as "down town mines" in distinction from those on the high mountains east of town. In all these mines, no sooner do the shafts reach the level of the ore bodies than enormous bodies of water are encountered. These have for years been pumped out at a cost of thousands of dollars per month. During the strike the operation of pumping this water out got to be decidedly monotonous, so the owners of some of the larger mines pulled their pumps, when the mines soon filled up. Others followed suit, so that at the present time there is but one small property in the entire area operating, which ships about 25 tons of iron ore per day to Pueblo.

The Leadville Pumping Association has been formed, composed of the owners and lessees of all the ground in this basin, for the purpose of pumping out the water and keeping it drained for a period of eight years, the expense to be divided equitably. Sufficient machinery has been bought, and $90,000 has been subscribed by the members and the merchants of the town for prosecuting work. It is figured that it will take fully three months to drain the workings now, and then then over a month to retimber and clean the shafts and drifts. As the state was put to an expense of about $300,000 in maintaining order during the labor troubles, it has been a very expensive strike all around.

Of late years manganese iron ores have come to be an important part of the product. One mine ships from 100 to 200 tons per day to the Illinois Steel Works, and also ships heavily to the Bessemer Steel Works at Pueblo.

Since 1893 much attention has been paid to prospecting gold properties in this region, with the result that extensive bodies of gold ore have been discovered. The center of the gold bearing territory is Breece Hill, north of California Gulch. The Little Johnnie mine here is said to be the greatest gold mine in the country to-day.

I took a trip into the Yak tunnel, that is being bored into Breece Hill for the purpose of tapping the rich ore bodies and to serve for transportation and drainage for the different mines passed through. The tunnel is now in 7,000 ft., and has only lately pierced the Breece Hill region. It will strike the tunnel company's property, located on the top of Breece Hill, at a depth of 1,275 ft. It is to be extended for 7,000 ft. further, or 14,000 ft. in all. All water encountered is drained or pumped into the tunnel to be drawn out through the mouth in California Gulch. Near the mouth of the tunnel is the air compressor plant, which is operated by water power obtained from a supply main for the city water-works that passes by here. The 335 ft. head produces about 85 HP. when water is plentiful, and the discharge water is returned to the main to pass on down to the city.

The total output of ore of all kinds at Leadville has lately averaged about 1,800 tons per day. The Arkansas Valley Smelting Co.'s smelter is one of the largest in the West, and that of the Union Smelting Co. is also quite large. These work up much of the ore that would not pay to ship.

The Leadville water-works are owned by a private company. Mr. C. N. Priddy is superintendent. Owing to the high altitude there is much difficulty in keeping the system in operation during the winter. Until 1895 the east fork of the Arkansas River (the only considerable stream of this locality) was tapped by an open ditch, called the Oro ditch. Then the water company laid a 36-in. wooden pipe line in this ditch. The pipe draws water from the river and is 33,000 ft. long. It follows the ditch all the way except for one cut through a ridge and one inverted siphon across a gulch, called Evans Gulch. The former shortens the line from 6,130 ft. to 1,570 ft. The latter is 900 ft. long and sustains a static head of 100 ft. at the bottom and a hydraulic head of 46 ft. The hydraulic grade line falls 11 ft. to the mile. The banding varies from 75 ft. per 100 ft. at the head to 225 at the end (where the static head is 66 ft.), and 375 at the bottom of the siphon. The pipe line discharges into a reservoir near Stray Horse Gulch, that runs through the north part of town. The pipe was built of Louisiana pine staves. Mr. Thos. W. Jaycox. M. Am. Soc. C. E., of Leadville, was the engineer.

There is a 50 million gallon reservoir on Big Evans Gulch and a 25 million one on Empire Gulch. These and the Iowa Gulch—all from the range east of town—are the additional sources of supply.

In the operation of the distribution system much ingenuity is displayed in the keeping of the pipes clear of ice. All service pipes are enclosed in a double wood box, with air space between. Steam hose is let down the stop box and the pipe thawed out when frozen. The service pipes are lead or galvanized iron, extra thick. A steam engine for thawing out mains and hydrants is in constant use during the winter. The hydrants are tested every day. They are double-case, and when frozen the barrel or inside part is pulled out and steam is forced onto the ice at the bottom. When the mains freeze, a hole is bored down into the pipe where needed and the steam hose inserted. The nozzle of this has one jet in front and four behind, the reaction of the ones behind forcing the hose along through the ice as fast as melted large enough, and the rear jets also melt the surrounding ice left behind as it travels. The hose is extra thick, to avoid cooling too fast. All pipe is buried 6 to 7 ft. deep, but this does not prevent freezing.

The headwaters of the Arkansas (near Tennessee Pass) often freeze up, thus cutting off the supply from that source for months at a time. During the last winter, from the beginning of November to the end of February, only once or twice did the temperature at the headwaters reach as high as the freezing point. January, February and March are usually the low water months.

The distribution system has 156 Holly single and double nozzle 6-in. hydrants, with 4-in. connections to street mains. Nearly all mains are not less than 6-in.

Glenwood Springs and Aspen.—Resuming the journey west from Leadville over the Denver & Rio Grande, the Tennessee Pass tunnel is reached at 6 miles. The old narrow gage grade that passed over the summit is plainly visible for a long ways each side of the tunnel. This is the summit of the Continental Divide, the drainage running on the east to the Atlantic and on the west to the Pacific. The tunnel is about a half mile long, and is timbered. On leaving the west or north end a descending grade is begun that reaches to Minturn, 25 miles. The average fall is over 100 ft. per mile, with a maximum of 3%. The road does not rejoin the old narrow-gage route until several miles from the tunnel, the latter having much more development and lighter grades. It then enters the valley of the Eagle River. At 10 miles, Pando tunnel—cut through solid granite—is reached. Below this is an interesting piece of railway construction, where the Eagle River is diverted through a cut across a ridge that separates it from another valley. This leaves room for the railway to occupy the entire bottom of the river valley until the side valley joins it about a half mile down. The diversion is quite inexpensive. It was made for the purpose of retaining the ruling gradient of the road, which made it necessary to cut below the natural channel of the river in the valley.

There is much attractive scenery all the way, and passing Red Cliff—a noted mining town—the Eagle River Canyon is entered. This extends to Minturn—8 miles—and is grandly picturesque. Miners' cabins can be seen at the mouths of tunnels and drifts hundreds of feet above the track. The town of Gilman, which is simply a collection of cabins, reminding one of the cliff-dwellers, is said to be 1,000 ft. above the bed of the canyon.

About 20 miles above Glenwood the canyon of the Grand River is entered. This is a peculiar and picturesque canyon, the rocks being of volcanic origin. Just below the mouth of this, Glenwood Springs is reached. I stopped over here for two nights, taking a run up to Aspen and return in the day time. Glenwood is justly noted for her splendid health-restoring springs and balmy climate. On account of its being in a park protected by mountains on all sides, the winter climate is quite mild, and it is said that many invalids live in tents the entire season. Nearly all tourists who journey this way stop over, so that the resort receives much free advertising. A long double-decked bridge crosses the river and railway track here, connecting the town proper on the south side with the springs and park and the great Colorado Hotel on the north side. The whole place is well lighted by electricity at night.

Glenwood Springs is thought to be the first place in Colorado to have a lighting plant operated by water power. The plant was installed more than ten years ago, and has been in constant and successful operation since. The station is on the north bank of the river, just between the vapor cave and the big spring, and the freedom from dust and smoke are quite befitting qualities with such beautiful surroundings. The water supply is taken from "No-name" Creek, at a point 3 or 4 miles distant, giving a head of 380 ft. There are four 36-in. Pelton wheels, operated by single deflecting nozzles, using hand regulation. Each wheel develops 125 HP. at 500 revolutions per minute. There are two 25-K-W. Brush direct-current and one 30-K-W. Brush incandescent lighting machines; also one 30-K-W. Brush alternator and one 60-K-W. Westinghouse alternating arc light generators. 3,000 incandescent lamps and 65 arc lamps are supplied. The lighting machines are belted to the water wheels at 3 or 4 to 1, and the speed of the latter is varied to suit the current desired. The water supply of Glenwood is also furnished by the same company and from the same source.

The distance from Glenwood to Aspen by the Denver & Rio Grande is 41 miles. The railroad runs southeasterly and follows up the Roaring Fork River all the way, traversing a pleasant valley with considerable farming and truck gardening.

Aspen is west of and only 28 miles from Leadville in a direct line, though by the route we have come it is 131 miles. The Aspen Silver mining camp is second only to that of Leadville. The town is situated at the foot of the slope of Aspen Mountain, near the junction of Hunter's, Castle and Maroon creeks with the river. The elevation is 7,775 ft.

The hills surrounding the town are rich with veins of silver, some of which reaches to $1,800 per ton. The Mollie Gibson is said to have been the richest mine in the world, while the Smuggler, Emma, Aspen and others are quite noted.

The Mollie Gibson has paid over $4,000,000 in dividends. The choicest bodies of ore have evidently been worked out, as no dividends have been paid since Jan. 1, 1895. Some of the veins in this mine have been almost pure silver.

Aspen has sadly felt the effect of the fall in silver. The annual production was formerly $8.000,000 to $10,000,000 per year, but in 1897 it was only $3,000.000, or about one-fourth that of the state.

The tributary creeks of the Roaring Fork River afford fine opportunities for the production of water power, which have been fully utilized. The electric lighting of the town and the suply of light and power to many of the mines and mills has been made possible at a very reasonable cost, whereas the use of coal would be quite expensive. There are two companies here producing and supplying electric light and power on a large scale.

I. Roaring Fork Electric Light & Power Co.—This company has two plants, one on Hunter's Creek and one on Castle Creek. The former plant was put in operation in 1889, and was one of the first attempts to operate the machinery in mines and mills by electrical transmission on a scale of any magnitude. Hunter's Creek comes into the river from the east and the power plant is located on the river at the east end of town. Water is diverted from the creek through a covered flume to the face of a mountain overlooking the city, where it is discharged into a wooden tank. From here a steel pipe line 18 to 14 ins. diameter and over a half mile long leads directly down to the power house. The fall is 900 ft., and the working pressure used is about 365 lbs.

The power is developed by eight Pelton water-wheels, 24 ins. diameter, which run at 1,000 revolutions and have a maximum capacity of 175 HP. each. Only six of these are at present in use. The light plant consists of three 30-K-W. Brush arc dynamos, two 100-K-W. Brush incandescent dynamos and three 60-K-W. Westinghouse alternators. There were formerly two Edison power generators, but the use of these and the arc light machines has been discontinued, and only incandescent lighting is done from this station now. When the water supply here is low, a current of electricity is brought over from the company's Castle Creek station, supplying an Edison motor, and thus supplementing the power required. A steam plant for a reserve in case of emergencies is also in place here, but it has not been called on for five of six years. A voltage of 110 is used at the direct current machines, while 1,000 volts are used at the alternating current machines, and this is stepped down to 50 volts at suitable places for lighting. The entire town and many mines and mills are lighted from this station.

The Castle Creek station of this company is located on Castle Creek, at the west end of town. The waters of both Maroon and Castle creeks are utilized. The plant was erected in 1893. Castle Creek is the largest of the creeks, but the water has to be divided with other users. So part of the supply is taken from Maroon Creek, giving a head of 312 ft. The supply from Castle Creek is under a head of 330 ft. This head is obtained within a distance of about a mile, the water being conveyed in a covered flume for part of the way, from the end of which a 24-in. pipe leads down to the station.

The five Pelton wheels are all on one shaft running the length of the bnuilding. These are about 5 ft. in diameter, but vary slightly to give the same speed with the two different heads. About 250 HP. is developed at each wheel. The wheels are provided with friction clutch couplings for operating independently. The speed is 300 revolutions per minute.

There are five 200-K-W. Brush generators driven direct from the main shaft by friction clutch pulleys. The power house is about 50 × 100 ft., giving plenty of room for a convenient arrangement of machinery. This plant distributes power to a number of mines within a radius of 5 miles. The general manager of the company is Mr. C. E. Doolittle, who has made some notable improvements in speed governors for water-wheels.

II. People's Electric Light & Power Co.—The plant of this company is located on Castle Creek, over a mile above the one last mentioned. Water is supplied through a box flume 2½ × 5½ ft. and 2 miles long. This has a fall of 8 ins. per 100 ft. It discharges into a penstock, from which the pressure pipe leads down to the station. This pipe is 3 ft. in diameter at the head and 2 ft. at the foot, and gives a static head of 190 ft. and a working pressure of 80 lbs. The power house has two rooms, the north one containing the machinery for producing power and the south one that for producing light. There are two 5-ft. double 4-in. nozzle Pelton wheels of 300-HP. capacity each, running at 230 revolutions and driving four 100-K-W. Edison generators at 666 revolutions.

For lighting there are two 3-ft. double-nozzle Pelton wheels of 75 HP. each, driving a 60-K-W. Thompson-Houston alternator and a 25-K-W. Thompson-Houston arc light machine. The former is a 1,100 volt, 1,100 light machine, the voltage being reduced to 52 by transformers at certain points. The arc dynamo supplies 50 lights.

Closely allied with the electric company is the Castle Creek Tunnel & Power Co. This company is engaged in driving the Newman tunnel for mining development, the mouth of which is quite near the electric station. Power and light for the prosecution of the work are furnished from the station. A 9-ft. Pelton wheel drives a Norwalk Iron Works air compressor, with cylinders 22 and 16 × 24 ins. They are direct-connected, and the speed varies from 45 or 50 to 80 or 90 revolutions, the capacity being 125 HP. The compressor supplies air to the drills at the face of the tunnel. A small 110-volt machine also supplies light to the tunnel. The face is now about a half mile in. Mr. Geo. S. Newman is president and manager of both companies.

The ARMORED CRUISER "INFANTA MARIA TERESA."

Built at Bilbao, Spain, 1893, by La Sociedad Anonima de Los Astelleros del Nervion. Captured in the Battle of Santiago, July 3, 1898. Wrecked on Cat Island, Bahamas, Nov. 5, 1898.

The water supply of Aspen is furnished by the Castle Creek Water Co., taking water from both Castle and Hunter's creeks. The supply is, of course, all gravity. A pressure of 100 lbs. is obtained from the former creek, and from the latter (the supply of which runs short during low water on account of being used by other powers) it is 125 lbs.

While in Aspen I took a trip into the great tunnel being driven by the Cowenhoven Mine Tunnel & Drainage Co. This tunnel taps a number of mines on its way, besides serving to drain the ground overhead. The parties working the different mines pay so much per car to the tunnel company for hauling their ore out. The minimum charge is $1.25 for low grade ore, and it increases rapidly with the grade or value of the ore. Waste rock is hauled for 25 cts. per car. The cars holds about 3,000 lbs. and 10 are hauled in one train.

The tramway is double-tracked, and rigid rules are enforced regarding the use of it and of the tunnel by the workers in the mines and others. Wherever connection is made with a mine a side track is put in, and the ore is slid down through a chute or brought into the cars on a level, as the case may be. The tunnel is now in nearly 2½ miles. An average of 9 to 11 ft. is driven per day of three shifts. The best record was made last May, when 428 ft. was driven.

Compressed air is supplied to the two air drills at the front by an air compressor plant at the mouth, and incandescent lighting for the tunnel is also supplied. Through all earth and insecure rock the tunnel is timbered with 10 × 10-in. posts and caps. The tunnel falls towards the mouth about 6 ins. per 100 ft., and a box drain between the tracks carries the water drained from the mines. This tunnel when completed will have a length of over 5 miles, and will open into a different valley on the opposite side of the range, whence it is intended to build a railway to a more direct connection with the Denver & Rio Grande main line. W. P. H.

Salt Lake City, Utah, Sept. 1, 1898.

Notes and Queries.

"Common Logarithm," Washington, D. C., will receive a reply to his letter if he sends us his name and address.

F. A. L., Carlyle, Ill., wants the address of a maker of small water motors, which will run steadily under pressures varying from 20 lbs. to 80 lbs. per sq. in., and drive generators for electric lighting.

A correspondent writing from Barnet, England, states that the brief description of the railway accident given on page 241 of our issue of Oct. 20 is incorrect. He states that the accident occurred at Wrawby Junction, near Brigg, some 200 miles from London, and resulted from some timber projecting from a freight train standing on a parallel track.

We have received a letter from Mr. C. F. Petersen, regarding the several formulas for determining the volume enclosed between two intersecting cylinders, published in our issue of Oct. 6. He also replies to the criticism of his formula made by Mr. Thomas in a discussion of these formulas published in the issue of Nov. 10. Mr. Petersen in the original solution which he sent us gave several formulas of different form, and in the communication just mentioned he states that the one selected and printed as his solution of the problem was not the proper one. The letter is too long to publish in full, so we give only the final formula, which he says is correct to within 1 in the third decimal place, and compares very closely with those suggested by Messrs. Baldwin, Comstock, Talbot, Dean and Thomas. The formula is:

$$\text{Volume} = \frac{a^4}{r}\left\{0.393 + \left[\frac{a}{r}\right]^2 0.082\right\}.$$

We regret that the limits of our space and the press of other matters will not permit further presentation of this subject, and we must, therefore, close the discussion with this note.

In connection with the discussion on the relative corrosion of steel and wrought iron, raised by the query of R. S. W. in our issue of Oct. 8, 1898, Mr. Alfred M. Mosscrop, Assoc. M. Am. Soc. C. E., refers the parties to an article in Engineering News, of Nov. 15, 1894, as one of the most complete on this subject. It is an abstract of a paper presented to the Institution of Civil Engineers by Mr. Thomas Andrews, on "The Effect of Stress on the Corrosion of Metals." Mr. Andrews concludes that when wrought iron and various steels are exposed to the action of sea water for a long time, and without liability to other than local galvanic action, the steel showed the greatest corrosion, the wrought iron having an advantage of about 25% in this respect. The corrosion also increased in the steel as the percentage of combined carbon was greater. He also found that galvanic action between wrought iron and steel largely increased the total corrosion in both metals. He also says that stress considerably affects the corrosion, and "unstrained" metal, being softer, is the most liable to corrosion. But the experiments also indicate that the action of local galvanic currents between strained and unstrained parts of a forging, bar, or plate, tends to increase the corrosive action.

THE CAPTURED SPANISH CRUISER "MARIA TERESA."

We show herewith an excellent half-tone view of the cruiser "Maria Teresa," whose unfortunate loss while on her way to the United States we have already recorded. The engraving, which we have reproduced from the "Zeitschrift des Vereines Deutscher Ingenieure," of March 27, 1897, shows the vessel as she appeared when in commission in the Spanish Navy. Her dimensions and general particulars have been so frequently published that we do not repeat them here, further than to note that the armor and armament of the vessel really entitled her to rank as a second-class battleship, and her speed of 20.24 knots attained in a four hours' contract trial in September, 1893, placed her in the front rank in the class of armored cruisers.

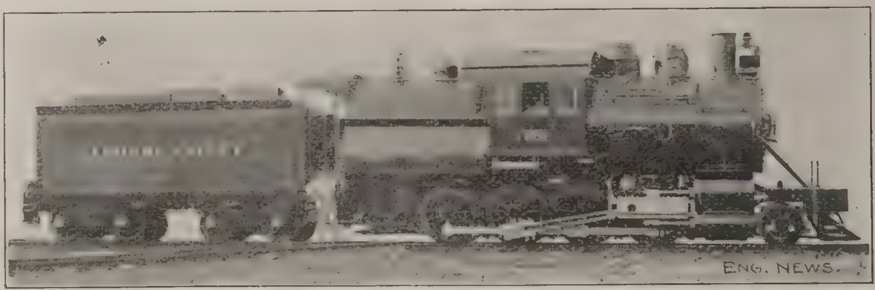
* * *

COMPOUND CONSOLIDATION PUSHER ENGINE; LEHIGH VALLEY R. R.

On many railways the profile is such that heavy train loads can be economically hauled over the greater part of the line, but at certain points there are steep grades which would limit the ordinary train load or make it necessary for the trains to be divided at the foot of the grade and taken up in sections. In order to ensure the economy due to the transportation of large train loads, and to avoid delays incident to splitting the trains, powerful pusher engines are frequently employed to help the trains up these grades, and we illustrate this week a large engine of this type recently built for the Lehigh Valley R. R. by the Baldwin Locomotive Works, of Philadelphia, Pa.

It is to run from Coxton to Fairview, 27 miles, without taking water. Its guaranteed hauling capacity is for 1,000 tons of train load behind the tender, at an average speed of 17 miles per hour, on the mountain cut-off.

The engine is of the consolidation type, on the Vauclain four-cylinder compound system, with balanced piston valves. It is fitted with the Wooten firebox for hard coal, the cab being placed at the junction of the boiler barrel and firebox. The dome (with whistle at the side) and sandbox (with air jet device) are mounted on the boiler barrel, while the bell and safety valves are mounted over the firebox. A footboard extends from the cab to the boiler head, and the fireman on the tender deck is sheltered somewhat by a canopy. The crosshead and slides are protected by a casing. The tender is of large size, and is mounted on a pair of Fox pressed steel trucks. The engine is shown in the accompanying cut, and its leading dimensions and particulars are as follows:



COMPOUND CONSOLIDATION PUSHER ENGINE; LEHIGH VALLEY R. R.

S. Higgins, Superintendent of Motive Power. Baldwin Locomotive Works, Builders.

Compound Consolidated Pusher Engine; Lehigh Valley R.R.

Running Gear:	
Driving wheels (8), diameter	4 ft. 7 ins.
Truck wheels (2), diameter	3 " 0 "
Tender wheels (8), diameter	2 " 9 "
Driving wheels centers	4 " 1 "
Journals, driving axles, 9 × 12; Truck axles	6 × 12 "
Journals, tender axles	5 × 9 "
Wheelbase—Driving	15 ft. 0 "
Total engine	23 " 10 "
Engine and tender	55 " 0½"
Weight in Working Order (without fire or men):	
On driving wheels	202,232 lbs.
On truck wheels	22,850 "
Engine, total	225,082 "
Tender, empty, 45,250 lbs.; loaded	120,918 "
Engine and tender	346,000 "
Cylinders: Number	Four.
Diam. and stroke of h. p., 18 × 30 ins.; l. p.	30 × 30 ins.
Valve gear: Type	Link motion.
Slide, valves, style	Balanced piston.

Boiler: Type	Straight top.
Diameter, barrel, inside smallest ring	6 ft. 8 ins.
Thickness, barrel plates, ⅞-in.; smokebox tube plate ½-in.	
Working steam pressure	200 lbs.
Firebox: Type	Wootten.
Length, inside 10 ft.; width, inside	9 ft.
Depth, at front. .5 ft. 2⅝ ins.; depth at back. .5 ft. ⅛-in.	
Thickness, side and back plates	⅜-in.
Thickness, crown plate, ..½-in.; tube plate	¾-in.

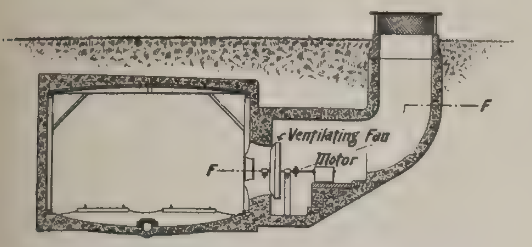
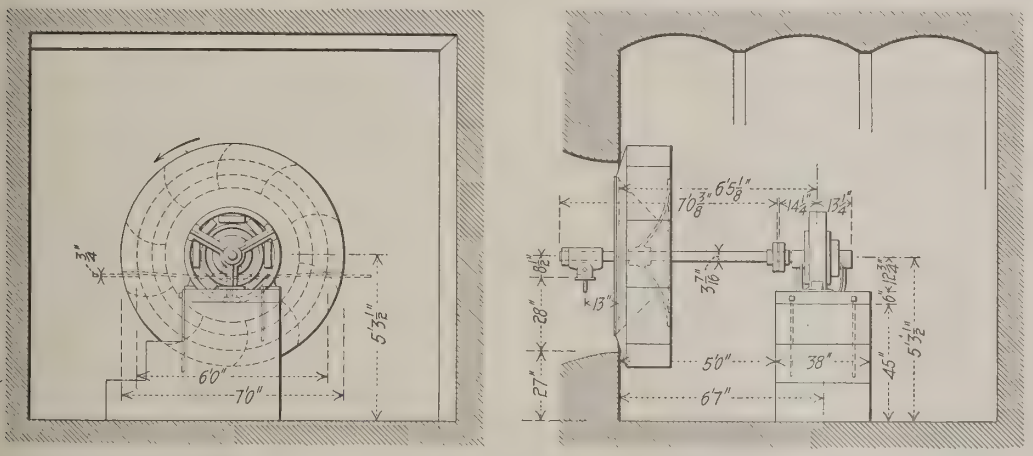


Fig. 1.—Cross-Section of Two-Track Portion of Boston Subway, Showing Ventilating Chamber.

Tubes: Number	511
Diameter, outside	2 ins.
Length over tube plates	14 ft. 7¾ "
Heating Surface and Grate Area:	
Heating surface, tubes (interior area)	3,890.6 sq. ft.
" firebox	215.0 "
" total	4,105.6 "
Grate area	90.0 "
Miscellaneous:	
Limit of width	10 ft. 3 ins.
Limit of height	15 " 4 "
Capacity of tender tank	7,000 gallons.

VENTILATION OF THE BOSTON SUBWAY.

We illustrate herewith the method used for ventilating the Boston Subway. The sectional view, Fig. 1, reproduced from the first report of the Boston Transit Commission, 1895, indicates the general arrangement adopted for the two-track portion of the subway. For the four-track portion the fan chamber is larger, containing two fans, and discharging into a stack 11 ft. 6 ins. diameter. The other cuts, showing one of the fans and its attached motor, have been made from drawings furnished by the B. F. Sturtevant Co., Boston, Mass., to whom we are also indebted for the following description:



End Elevation.

Side Elevation.

FIG. 2.—7-FT. VENTILATING FAN, WITH ELECTRIC MOTOR USED IN THE BOSTON SUBWAY.

Designed and Built by B. F. Sturtevant Co., Boston.

In the past the ventilation of railroad tunnels or subways has had for its principal object the removal of smoke and gas discharged by the locomotives employed for traction purposes. But with the advent of electric power and its wide application to street car propulsion, the most important objection to underground transportation has been removed.

Nevertheless, there still remains, as has been clearly demonstrated in the Boston subway, the necessity of a positive and continuous change of air for the double purpose of maintaining its purity and of so regulating its humidity as to prevent the deposition of moisture and the chilling of passengers and employees. This latter feature is of the utmost importance, as is readily shown by the fact that the dew-point of air of 90° F., having a relative humidity of 70%, is about 79° F. That is, if with an external temperature of 90°, there be but a slow and uncertain movement of the air within the subway, it may be readily cooled through 10° or more, thereby become saturated, and not only cause great inconvenience by the constant dripping from all structural work, but become a positive menace to health. A rapid change of air, such as may be secured by mechanical means, serves to equalize the internal and external temperatures, and to prevent the maintenance of a humid atmosphere. At the present time periodical readings of temperature and humidity are being taken under the direction of the Transit Commission, and the results will undoubtedly appear in their forthcoming report.

The original designs of the Boston Transit Commission contemplated the introduction of electrically-driven fans at suitable points along the route. Four of these have already been constructed and installed by the B. F. Sturtevant Co., of Boston, two near West St., and two between Hollis and Eliot Sts. The former location is practically midway between the Boston and Park St. entrances, at each of which there is ample opportunity for the free ingress of air. The space coming under the control of the fans at this point is about 1,050,000 cu. ft. The Hollis and Eliot St. section contains about 900,000 cu. ft.

The fans were, in each case, designed to have a capacity equivalent to an air change in each section once in about 15 minutes. The drawing shows one of the fans at the Hollis and Eliot St. chamber.

The fans are all of the Sturtevant cone type, each consisting of a cast iron conoidal center, with annular back plate of steel attached thereto, and a series of reverse curved steel plate blades or floats, tapering from inlet to periphery, attached to the annular back plate and to the front plate containing the inlet opening. In its course through the fan the direction of the air is gradually changed from axial to radial, the curvature of the blades being such as to offer the least resistance to the passage of the air and to secure the highest efficiency.

The two fans between Hollis and Eliot Sts. are each 7 ft. in diameter, and were designed to each deliver 30,000 cu. ft. of air per minute, when operated at 175 revolutions per minute, and to require an expenditure of about 7 HP. each for their operation under ordinary atmospheric conditions. At one-half the speed the power expenditure would be about 1 HP. Both of those values will naturally vary with the density of the air and the existing temperatures within and without the subway. The two fans near West St. are both 8 ft. in diameter, each designed to deliver 37,000 cu. ft. of air per minute, at 170 revolutions, with a power expenditure of about 10 HP., and to require 1.25 HP. when driven at half speed.

Each fan is provided with an electric motor of special Sturtevant M. P. 8 type, direct-connected to the fan shaft by an insulated coupling. The armatures are of the drum type, thoroughly ventilated and rendered moisture-proof by being saturated in japan and thoroughly baked after having been effectually insulated with mica and oil-cloth. They are shunt wound for maximum speed at 550 volts and arranged for series or a parallel operation, having a starting and regulting resistance giving different speeds for each combination. The maximum temperature rise for 10 hours continuous operation is limited to 45° for the armature, and to 50° for the commutator or fields.

Each motor is mounted on a substantial insulating base frame, constructed of Georgia pine, thoroughly filled to prevent absorption of moisture, and anchor bolted to the concrete foundation.

AN IMPROVEMENT IN RAIL JOINTS.

One of the rail joints of the bridge or base-plate type, which was somewhat extensively used at one time, was the Heath joint, which consisted of one bar forming a base-plate and angle bar and one plain splice bar. The former was stiffened by a vertical pocket stamped down from the middle of the plate. This joint was applied on a considerable mileage of the Atchison, Topeka & Santa Fe Ry., but the results were not satisfactory, and the further use of the joint was abandoned.

The reason for this is stated to have been that the joints were designed by men who were inexprienced as to the requirements of track material, and that the bars did not fit the rails to which they were applied. In the drawing furnished by the railway company, a variation of 1-32-in. from a perfect fit was allowed at both the top and bottom bearing, while these bearings were very narrow. The joints were made according to the drawings, and these conditions are shown in Fig. 1, which represents the joint as made for the 66-lb. rail of the A., T. & S. F. Ry.

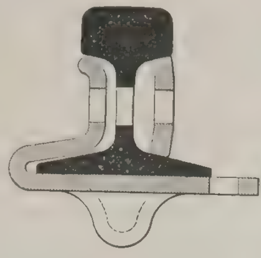


Fig. 1.—Old Heath Rail Joint on 66-lb. Rail; A., T. & S. F. Ry.

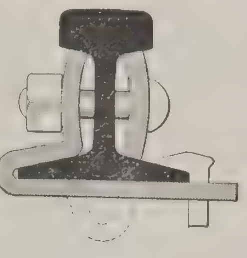


Fig. 2.—New "Common-Sense" Rail Joint on 65-lb. Rail.

This form of joint has recently been re-designed and more carefully manufactured so as to get an exact fit and a wide bearing on both the head and base of the rail. The improved design, as applied to the 65-lb. rail of the so-called Am. Soc. C. E. section, is shown in Fig. 2. The joint is made from boiler plate steel, and forms a bridge support, as well as taking the place of tie-plates on the joint ties, while the plate is made wide enough for spike holes instead of slots; thus acting more surely to prevent creeping. The curved form of the splice bars is claimed to ensure a tight bearing upon the rail and a tight grip of the nut.

The improved form of joint is being introduced by the Common-Sense Rail Joint Co., 304 Tacoma Building, Chicago, Ill., whose factory is at Chicago Heights. For the drawings from which our illustrations are made we are indebted to Mr. W. E. Dorwin, Manager of the company.

THE NEW COAST SURVEY STEAMER "PATHfinder" will be launched at the yard of Lewis Nixon, Elizabethport, N. J., on Dec. 7. This vessel is 196 ft. long over all; 165 ft. long on water line; 33⅓ ft. beam; about 20 ft. deep, and has a displacement of 875 tons. The average speed will be 12 knots, and the boat is especially designed for work in Alaskan waters.

THE SEA-GOING BATTLESHIP "WISCONSIN," to be launched this week by the Union Iron Works, of San Francisco, was contracted for on Sept. 19, 1896, for $2,674,950, for hull and machinery; the keel was laid on Feb. 9, 1897, and the contract calls for completion on Sept. 19, 1899. She is classed as a sea-going coastline battleship, and her general dimensions are as follows: Length on load water-line, 368 ft.; extreme beam, 72 ft. 2½ ins.; mean draft, 23½ ft.; 11,525 tons displacement, and 6,802 tons gross tonnage. She will have twin-screw vertical triple expansion engines of 10,000 I. HP., and a contract speed of 16 knots. Her side armor is 16½ ins. thick at top, tapering to 9½ ins. at the bottom, and 13¾ ins. thick at the water-line; the two turrets are 17 and 15 ins. thick, and the barbettes 15 and 10 ins. thick. The protective deck is 3 ins. thick forward and 4 ins. aft on the slopes, and 2¾ ins. thick on the flat. She will contain 12,464 cu. ft. of corn-pith obdurating material. The main battery includes four 13-in. guns, in two turrets, and 16 6-in. rapid-fire guns. The secondary battery has 16 6-pdr. and four 1-pdr. rapid-fires, one Colt and two machine guns; there will be four Long-Whitehead torpedo tubes. She will carry 40 officers and 449 men. Above the belt-armor she has 5½ ins. of steel protecting the 6-in. gun positions. She is divided into about 300 water-tight compartments, each of which may be separately pumped out, or ventilated by forcing in air; and she has more than 80 auxiliary engines. Bilge keels are provided. The axis of the forward 13-in. guns is 26½ ft., and the after 13-in., 19 ft. above the water surface; the 6-in. guns are from 15 to 22½ ft. above this surface.

THE SUMATRA OIL WELLS are failing, according to a report made by U. S. Consul Everett, at Batavia. The old wells are giving out more quickly than new ones are bored. This state of affairs is said to be due to the conservatism of the Dutch government, which will not permit foreign capital to develop the oil fields, which are among the richest in the world.

ECONOMY TEST OF A UNIQUE FORM OF FEED PUMP.[*]

By F. Meriam Wheeler, M. Soc. N. A. & M. E.[†]

During the past few years considerable attention has been given to the subject of steam economy of the auxiliary machinery on steam vessels, particularly those on warships, where a saving of coal has much to do with the steaming radius of the vessel. Under favorable conditions, as, for instance, in the full power trials of the United States warships, it has been found that in the case of the main feed pumps the average indicated horsepower developed by such pumps is about ½% of the I. HP. of the main engines. I mention this fact to show that feed pumps use more power than any other pumps of a vessel. It will therefore be seen that the feed pump is quite an important auxiliary, and everything should be done to improve its economy in the use of steam. For this reason I have given considerable attention to the subject, and take pleasure in now bringing to the notice of the Society the "economy test of a unique form of feed pump" recently conducted in England, in which the economy was quite remarkable compared with that of the ordinary type of steam pumps usually employed for feeding boilers.

It has been shown by tests that the steam consumption of a feed pump of the duplex type (the one most commonly in use in the vessels of the U.S. Navy) will average about 120 lbs. per I. HP. per hour. In the tests made on the "Minneapolis" the very best economy shown in the case of the main feed pumps was a little over 93 lbs., while the poorest showing was over 200 lbs. per I. HP. per hour. The particular pump my paper refers to did its work with an expenditure of only 52 lbs. of steam per I. HP. per hour, which, considering the fact that it was quite a small unit, is a most excellent showing.

The test referred to was conducted by experts connected with the engineering department at the works of the well-known engine builders, Messrs. Willans & Robinson, at Rugby, England, and was for the benefit of the British Admiralty.

The feed pump tested consisted of a pair of Blake "Simplex" vertical double-acting steam pumps arranged on the cross-compound plan, with h. p. cylinder 6 ins. diameter, l. p. cylinder 9 ins. diameter, two water cylinders 3½ ins. diameter and all 8-in. stroke. The steam is first used in the 6-in. cylinder, and then expanded into the 9-in. cylinder. I desire to call attention to an important feature of this arrangement of pumps in that it has all the advantages of the duplex system, so far as the continuous flow of the water is concerned, and yet either side can be run as a separate pump in case of accident to the other side. Then again, the economy of compounding is secured with but two steam cylinders instead of four, as would be the case of a compound duplex pump. Therefore, there is less loss of steam from cylinder condensation and clearance is reduced to a minimum, as the valve gear of one pump is not operated by the opposite pump, as in the duplex system; consequently, one side can make a full and complete stroke without interference from the other side of pump.

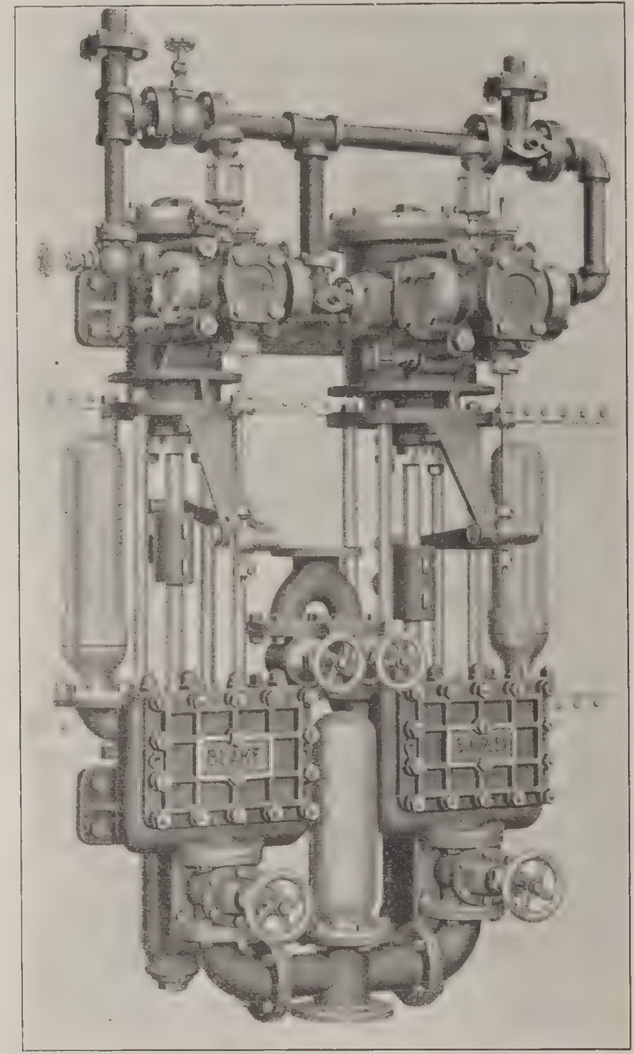


FIG. 2. PERSPECTIVE VIEW OF BLAKE "SIMPLEX" BOILER FEED PUMP.

The Geo. F. Blake Mfg. Co., New York City, Builders.

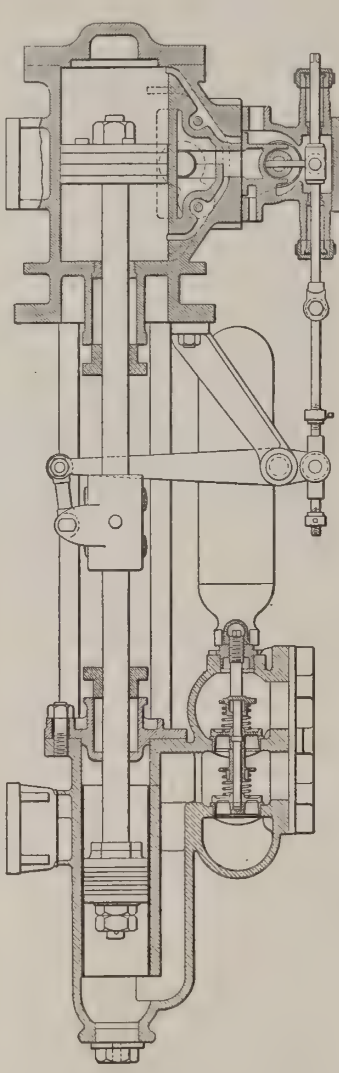
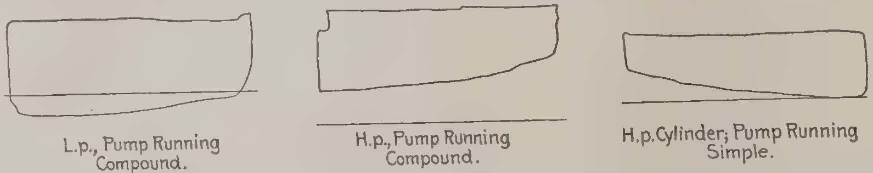


Fig. 2. Vertical Section Through One Side of Blake "Simplex" Boiler Feed Pump, Showing Steam Mechanism.



L.p., Pump Running Compound.

H.p., Pump Running Compound.

H.p. Cylinder; Pump Running Simple.

FIG. 3.—INDICATOR DIAGRAMS TAKEN FROM STEAM CYLINDERS; PUMP OPERATING COMPOUND AND SIMPLE.

(h. p. = 120-lb. spring; l. p. = 50-lb. spring.)

Two tests were made: First, by running the pump compound; and, second, by shutting off entirely the low pressure side and running the high pressure side as a simple pump. As mentioned above, the economy of the pumps when running compound was at the rate of 52 lbs. weight of steam per I. HP. per hour, while the economy of the pump running as a simple pump was at the rate of 93.41 lbs. per I. HP. per hour. The following are the particulars:

	Compound.	Simple.
Duration of test, minutes	20.55	28.35
Double strokes per min., each side	40	54
Average length of strokes, ins	8.06	8.05
Initial steam pressure, lbs. per sq. in.	112.5	67.5
Mean steam pressure, lbs. per sq. in. h. p. cyl.	58.06	62.2
" " " " l. p. cyl.	30.28	....
Power developed by h. p. cyl., HP	2.54	3.96
" " l. p. cyl., HP	3.07	....
Total power developed, HP	5.61	....
Total weight of steam used, lbs	100	175
Weight of steam per hour, lbs	292	370
Weight of steam per hour per I. HP., lbs	52.04	93.41

The steam-valve mechanism is very simple, and is shown by the sectional view of the pump herewith. It will be seen that the valve rod (so called) has no valve directly attached to it as is usual; it merely rotates the auxiliary piston, which latter combines within itself the auxiliary valves. This rotating motion is a great advantage, as it frees the auxiliary piston from possibility of sticking for any reason, causing the pump not only to be positive in its action, but securing uniformity of wear. The rolling movement given this auxiliary piston by means of the "valve rod" and the intermediate swinging pin or tongue, opens and closes the auxiliary ports, which, in turn, control the steam to operate the auxiliary piston, moving said piston back and forth across the main steam cylinder. The auxiliary piston, like the main piston, is packed with spring rings.

A plain D slide valve is attached to this auxiliary piston, which valve supplies steam to the main cylinder through the two sets of ports, i. e., the main steam ports and the starting ports. By this cross arrangement of steam chest and valves, the pump can work just as well vertically as horizontally.

As regards the amount of steam that can be saved by this system, there is no doubt but what the pump will save its own weight in coal in 24 hours steaming. With larger size pumps, and with steam pipes covered, the economy of the "Simplex" compound would be even better than that shown in these tests.

Taking the case of a large trans-Atlantic steamer developing 30,000 I. HP., which I understand will be the engine power of the new White Star S. S. "Oceanic," now building, the amount of coal that could be saved on a trip (say, of 5½ days) would be about 77 tons by the use of a system of feed pumps of this cross-compound "Simplex" type, as compared with the simple system of feed pump. This saving in coal not only represents an expenditure of many dollars, but also considerable saving of space which could be made available for cargo or other purposes affording a revenue, thus not only saving money at one end but adding at the other.

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[*] Condensed from a paper read at the annual meeting of the Society of Naval Architects and Marine Engineers.

[†] 93 Liberty St., New York city.

* * *

DYNAMOMETER CAR OF THE C., C., C. & ST. L. RY. AND THE UNIVERSITY OF ILLINOIS.

Among the most important tests made to determine the efficiency of locomotives in actual service are those made by means of a dynamometer car, in which is recorded the actual power exerted by the engine in hauling its train, as well as the various conditions under which the engine is working.

The Department of Mechanical Engineering at the University of Illinois has taken up this matter in connection with the practical training of its students, and has recently equipped a new dynamometer car built by the Cleveland, Cincinnati, Chicago & St. Louis Ry., which will be used in the interests of both the engineering students and the railway company. The car, shown in Fig. 1, resembles a freight caboose car. It is 36 ft. long, mounted on passenger car trucks, and is equipped with M. C. B. couplers and the Westinghouse brake. Its weight is about 36,000 lbs.

While the principal equipment of the car is the automatic apparatus for recording the pull on the drawbar of the locomotive, a number of other appliances have been fitted up in order that road tests of locomotives may be made in a safer and more satisfactory way than when all the observationstions are made on the locomotive. With this car attached, only three observers will be required on the engine, namely: two at the indicator and one at the calorimeter in the cab. In addition to this, the placing of the instruments in the dynamometer car avoids the time and trouble of changing them from one engine to another, while tests can be made of any engine by simply fitting it with the indicator and calorimeter and attaching the car. The instruments can also be more carefully mounted and the readings taken more easily and accurately in this way.

The interior view, Fig. 2, shows the Boyer speed recorder and the Metropolitan recording gage. On the drum of the latter are recorded the strains upon the drawbar. Other instruments are also shown in position. The speed recorder is driven from one of the car axles, in the usual way, and the drum of the recording gage is also driven from the same connection, the clock-work having been removed and suitable reducing gear substituted. Beyond the table, in Fig. 2, against the side of the car, are the 8-in. dynamometer cylinder and its connections, shown in Fig. 3. The piston has cup leather packing, and the piston rod has U-leather packing.

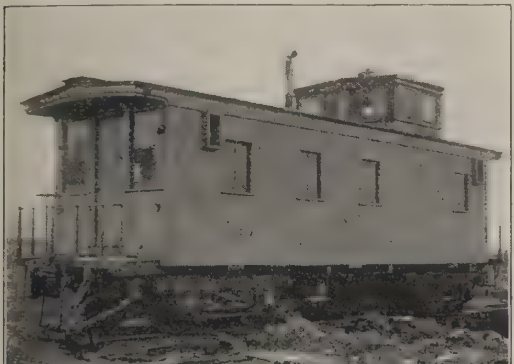


Fig. 1.—Dynamometer Car of the Cleveland, Cincinnati, Chicago & St. Louis Ry. (P. & E. Division), and the University of Illinois.

The cylinder is filled with oil in front of the piston, so that the pull on the drawbar is taken by the oil, and the pressure per square inch is recorded by the gage, which is graduated to 1,000 lbs. The drum of the gage is about 5 ins. diameter, and is removed by the recording arm at different speeds, according to the gearing used. The highest speed so far used is 6 ins. per mile. The second hydraulic gage, which is attached to the same pipe, is graduated so as to give a direct reading of the pull in tons upon the drawbar. We are informed that during a recent test the variation of the recording pen was not over 5 lbs. at speeds above 12 miles per hour. At lower speeds there was more variation, corresponding to the actual conditions, while at the lowest speeds the revolutions of the engine could be counted upon the diagram. A change in the position of the reversing lever or throttle valve makes a noticeable change on the diagram.

When the car is put out of use, the oil in the cylinder is forced back to the elevated storage tank in the corner of the car by admitting air from the auxiliary reservoir of the brake apparatus into the cylinder from above. This is done by the pipes shown in Fig. 3, and any leakage past the piston can be forced into the tank in the same way. When the cylinder is empty, the pull on the drawbar is taken by the draft springs, as usual, the piston then moving nearer the front of the cylinder, but it cannot, under any conditions, strike either end of the cylinder. When the car is to be used for testing, the oil is pumped into the cylinder. The duplex air gage is connected to both train pipe and auxiliary reservoir. In order to prevent any air pressure upon either side of the piston, the two air vent cocks near the globe valves in the air pipes are left open during tests.

While the dynamometer has not yet been calibrated, it is thought that there are but slight losses due to friction. The pointer of the gage moves continually to and fro, slowly and without vibration, and the piston has a continual slight motion, due to variation in the pulling strains and to vibrations of the car. A record is made on the gage even when the dynamometer car alone is being hauled.

The following records are automatically made upon special charts: (1) Boiler pressure; (2) Speed, miles per hour; (3) Pull on the drawbar; (4) Time of passing mile posts. Other records made from observations and readings of the instruments are as follows: (5) Pressure in steam chest; (6) Pounds of water delivered to the boiler; (7) Revolutions of driving wheels per minute; (8) Air pressure in auxiliary reservoir; (9) Air pressure in train pipe. The car will eventually be equipped with electric apparatus, switchboard and signal bells, and arrangements will then be made for recording many other observations on a special chart. These will include the following: (10) Time of taking indicator diagrams; (11) Position of reversing lever; (12) Position of throttle valve; (13) Temperature of escaping gases; (14) Number of weighed bags of coal delivered to the fireman; (15) Direction and velocity of the wind.

The car has been operated on the first division of the Peoria & Eastern Ry. (C., C., C. & St. L. Ry.), between Springfield and Indianapolis, 140 miles, and it is expected that much information of value to the motive power and operating departments will result from the tests. It is soon to be used for making tests with the double-header freight trains between Urbana and Pekin, Ill., 86 miles.

The arranagements for the construction of the car and the conduct of the tests were made by Mr. J. P. Barnard, General Manager of the Peoria & Eastern Division of the Cleveland, Cincinnati, Chicago & St. Louis Ry., and Prof. L. P. Breckenridge, head of the Department of Mechanical Engineering at the University of Illinios. The car was built at the railway company's shops at Urbana, Ill., under the direction of Mr. John McClurg, Division Master Mechanic, and the apparatus was installed under the direction of Asst. Prof. Van Dervoort, of the University.

* * *

JOHN WORRALL KEELY.

John W. Keely, whose name has become familiar the world over as the inventor of the so-called Keely Motor, died on Nov. 18 at his home in Philadelphia, after a brief attack of pneumonia. Mr. Keely was over 71 years of age. He was born in Philadelphia (or, according to one account, in Chester, Pa.), Sept. 3, 1827. Little is known concerning his early life, but according to the most reliable accounts, he seems to have drifted from one occupation to another, at one time an upholsterer, at another a druggist's assistant. His first work in the development of the now famous "Motor," according to his own account, was done while he was the leader of an orchestra, and became interested in the subject of the harmony of sounds and sympathetic vibrations.

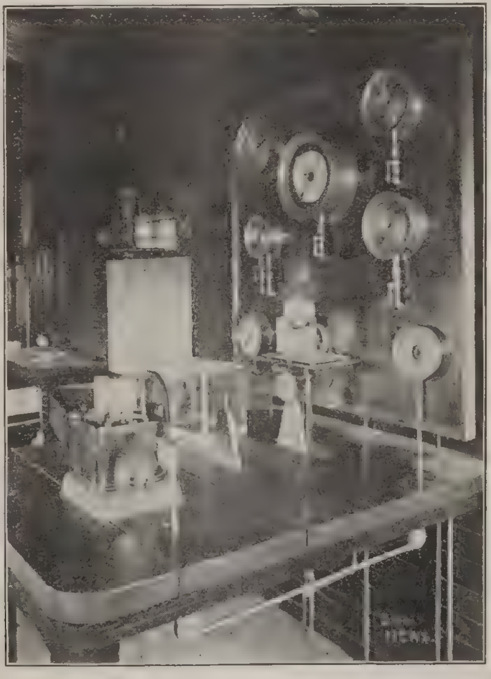


Fig. 2.—Interior of Dynamometer Car Showing Speed Recorder and Gage.

His first invention appears to have been made in the early '70's, and we know little more concerning its nature than that it was exhibited in a bathtub. In 1874 he had completed an apparatus which produced a vapor of great expansive force. This vapor was claimed not to be produced by heat, electricity or chemicals. Exhibitions of this apparatus were made, and were so convincing to those who witnessed them that a corporation known as the Keely Motor Co. was organized with a capitalization of $5,000,000. The stock of the company was rapidly disposed of, and has been bought and sold to a greater or less extent on the exchanges ever since. The stock was never, so far as we can find, offered for sale to the general public, with the accompaniment of a prospectus in the way that most fake enterprises are floated. The principal holders of the stock were those who had visited Keely's workshop and witnessed his demonstrations, and these were generally eager purchasers. Not a few men sunk the better part of their fortunes in the enterprise. The money paid into the treasury of the company appears to have nearly all been expended for the carrying on of the experiments; and in the building of the various machines which were constructed. Mr. Keely, himself, if one may judge by all appearances, lived in the plainest and most frugal style; and the workshop in which all his experiments and exhibitions were made was shabby and comfortless in all its appointments.

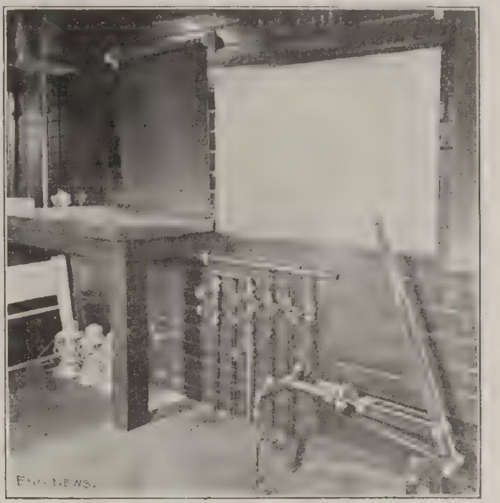
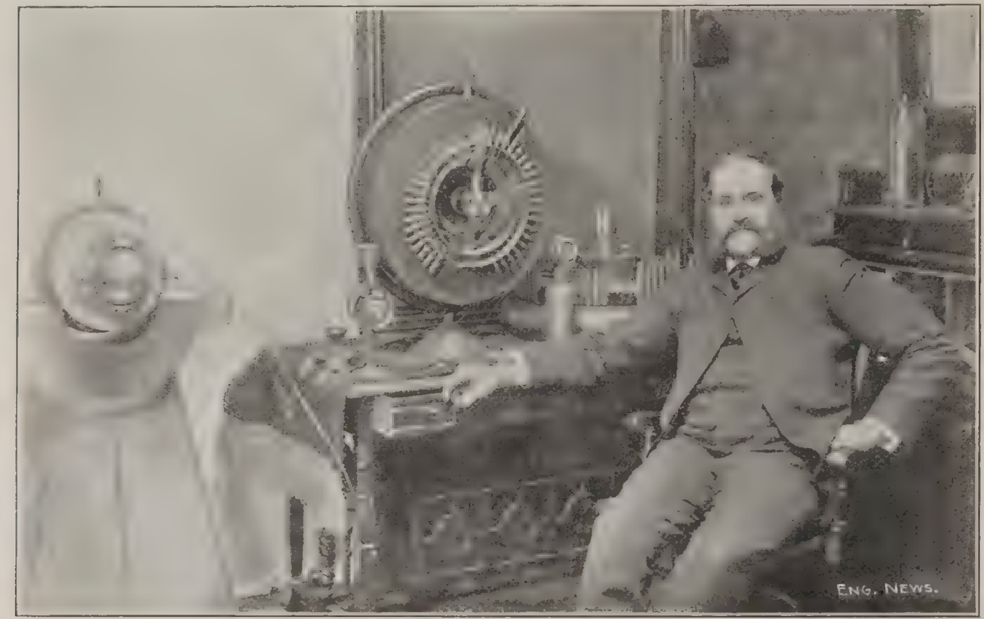


Fig. 3.—Dynamometer Cylinder and Connections.

We cannot attempt at this time to describe the work which Mr. Keely did or claimed to do save in the most general way. One misconception concerning it arises from the fact that his invention, if such it may be called, was termed "the Keely Motor." Properly speaking, there is not, and never has been, an actual Keely Motor, meaning by that term a machine adapted to act as a prime mover and develop power for the propulsion of machinery. Certain machines that he has devised have been shown in motion under his hands; but, admitting them to be genuine, they have been nothing more than laboratory exhibits of the crudest order. In fact, the ignis fatuus which Mr. Keely pursued for a quarter of a century, and which he always beheld with unbounded faith only a few weeks or months away, was "a commercial engine." From a personal knowledge of his work extending over a period of nearly ten years, we can say that we have never seen any more than mere possibilities that any of his inventions or discoveries, admitting them to be genuine, would ever possess commercial value, except as discoveries in science. Those who founded the Keely Motor Co., and who stood closest to the inventor all through his quarter century of work, undoubtedly believed otherwise, and Keely himself had the most perfect confidence in his ability alone and unaided to solve every difficulty that stood between him and the long-sought "commercial engine." To those who watched most carefully the various experiments which Mr. Keely performed, however, it seemed clear that if he had, as he claimed, made discoveries of new forces in the ether waves, his knowledge of them was of the vaguest sort, his control over them was uncertain, and their application by him to useful commercial work was in the highest degree improbable.

And now comes the question, were Mr. Keely's experiments and demonstrations genuine? Was the force which set his apparatus in motion produced from heat, electricity or hidden reservoirs of stored energy, by the methods with which modern physicists and mechanics are familiar, or did it, as he claimed, proceed from some hitherto unknown source? To put the question in another way, could another mechanic, using only known physical methods of generating and transmitting power, duplicate his apparatus and accomplish with it the same results?

In the minds of the general public, this question has long been answered, and the "Keely Motor" has been held to be a gigantic fraud, notable chiefly for its long life. Keely's name will undoubtedly go down to history as that of the greatest pseudo-scientific humbug of the nineteenth century. Whether this verdict is a just or an unjust one, the death of the inventor leaves as an unsolved riddle. It is true on the one hand that Keely never, so far as we know, with one possible exception, submitted all the apparatus by which he performed an experiment to such a thorough examination in detail by competent experts, simultaneously with the experiment, as would remove the last possibilities of doubt as to its absolute genuineness and the entire absence of fraud. It is true, on the other hand, that those who witnessed his experiments, and who were competent to judge of them, were almost invariably completely nonplussed and unable to explain the things they saw according to ordinary physical laws. If Mr. Keely performed his experiments by fraudulent means, he was certainly one of the most clever and ingenious mechanics and electricians who ever lived. If he was a genuine discoverer, he lost the fame that might have been his by his eccentric insistence on secrecy, and refusal to submit to investigation. We can, perhaps, sum up the whole matter by saying that Keely's experiments and methods generally had most of the earmarks of a fraud; but it confounded the ablest men who examined his work to tell how it could possibly be accomplished by fraudulent means.



John W. Keely

At some other time we may give our readers in more detail an account of the investigations which have been made by members of the staff of this journal, in endeavoring to solve the mystery of Keely's work. The above, however, summarizes the only conclusions that have been reached.

The accompanying portrait of Mr. Keely, sitting in his workshop, with his peculiar apparatus grouped about him, is reproduced from a photograph taken in 1889, for which we are indebted to the courtesy of Chas. B. Collier, Esq., of Philadelphia, who has been for a quarter of a century Mr. Keely's attorney and intimate associate.

AN ACHIEVEMENT IN CASTING TEST BARS is described by Mr. Thomas D. West in a paper to be read before the Pittsburg Foundrymen's Association on Nov. 28. Mr. West is a member of a committee of the association which is making a most extensive research into the qualities of cast iron. It has prepared patterns for casting 200 test bars of different sizes and shapes, ranging from ½-in. to 4 ins., square and round, half to be made in dry sand and half in green sand. The patterns are to be sent to eleven different foundries, working on different grades of iron. It is most essential that the 200 bars of each cast be made under identical conditions as to quality of iron and temperature of pouring, and these conditions have been secured by the method Mr. West describes in detail in his paper. The molds are all set so as to cast the bars on end, and placed near together in a pit 18 ft. long, 8 ft. wide and 2 ft. 8 ins. deep. Parallel to the main runner on one of the longer sides of the bed, and separated from it by an iron plate placed edgewise, there is a basin, 15 ft. long by 12 ins. deep, made to hold three tons of melted iron. This basin is first filled with metal from the ladle, and then the iron plate is lifted 2½ ins., so as to allow only clean metal to flow into the runner. The success of the arrangement was complete. From the time the inlet plate was lifted until the 200 bars, weighing 3,780 lbs., were all poured, scarcely 20 seconds elapsed, and no bars were lost. This first set of bars was cast at the foundry of the Westinghouse Electric & Mfg. Co., at Wilmerding, Pa.

◆

THE ARCHITECTURAL PLANS for the University of California, under the Phebe Hearst donation, were submitted to an international commission, made up as follows: For France, J. L. Pascal; for Germany, Paul Wallot; for England, R. Norman Shaw; for the United States, Walter Cook; for the University of California, J. B. Reinstein. This commission closed its examination of plans at Antwerp on Oct. 4, and it unanimously admitted to final competition the plans of the following architects and firms: Messrs. Barbaud & E. Bauhain, E. Benard, Paris; Prof. F. Bluntschli, Zurich; D. Despradelles & Stephen Codman, Boston; R. Dick, Vienna; J. H. Freedlander, New York; G Heraud & W. C. Eickmuller, Paris; Howard & Cauldwell, Howells, Stokes & Hornbostel, Lord, Hewlett & Hull, Whitney Warren, all of New York. In addition the commission recommended that the plans of the following architects be purchased for the University: Joanny Bernard & Robert, and Charles des Anges, of Paris; Ernest Flagg, of New York, and Skjold Neckelmann, of Stuttgart. The final meeting will be held in California in June, 1899, and the commission will there select the final plans.

◆

THE NEW WATER TUNNEL AT CHICAGO is again to be the source of litigation between the city and the contractors. The controversy is over the work on Section No. 3 of the land tunnel, the contractors for which are Weir, McKechney & Co. The original contract price of 1895 was $350,080, but up to date the city has paid $592,789, and the work is not yet finished. When Mr. Joseph Downey was Commissioner of Public Works he refused to continue payments for masonry filling in large excavations outside the tunnel section. The contractors took the matter into court, but the Supreme Court decided that they were not entitled to any compensation for excavation or backfilling outside of the tunnel proper. The contractors had, however, been misled to some extent by the profiles and borings furnished by the city, and the court decided that an extra sum must be paid where the excavation was partly in rock and partly in earth. The contract price was $2 per cu. yd. for rock excavation, but after the above court decision an agreement was made for $6 per cu. yd. where both rock and earth were encountered, with $10 per cu. yd. for masonry backfilling. This was approved by the city council, and on this basis the contractors are now endeavoring to claim "extras," while the city claims that much of the work was done purposely with a view to such extras. It is charged that after the proper section had been excavated, inclined drill holes were driven so as to bring down great masses of material above the roof, and to include both rock and earth in the excavation. Affidavits to this effect have been made by the city engineer and his assistants on the work, and by consulting engineers, who have been called in. The city engineer also charges that the directions issued by him and his assistants have been wilfully disregarded by the contractors, and that they have left the work in bad condition, without masonry lining, thus endangering the work and the buildings over the line of the tunnel. After paying several bills the Commissioner of Public Works, Mr. L. E. McGann refused to make any more payments, and on Nov. 10 ordered the work stopped. The contractors at once took the matter to the courts, where it is now being tried.

◆

RIVER GAGINGS IN OHIO are under consideration by the U. S. Geological Survey, and Mr. F. H. Newell, Chief of the Hydrographic Division, has recently visited Columbus to see about the work. Within the past year or so the State Board of Health has made a few gagings on three streams in Ohio.

◆

MUNICIPAL OWNERSHIP of water-works at Topeka, Kan., was decided upon at a special election on Nov. 12. The question was on authorizing the city council to issue bonds to buy or build works. The total vote was light, but the majority in favor of municipal ownership was decided, the vote being 1,703 for and 616 against. Within a few days prior to this action at Topeka, popular votes in favor of municipal ownership were cast at Alliance, O.; Meadville, Pa., and Barrie, Ont. The latter place is also about to establish a municipal electric lighting plant. It is reported that on Nov. 12, the authorities of Pasadena, Cal., and representatives of two water companies which now supply the city agreed on a plan for the purchase of the water-works by the city.

◆

A NEW WATER-WORKS PLANT FOR DENVER has been reported on by Mr. J. B. Hunter, City Engineer. The estimated cost of a large storage reservoir, settling basins, filter beds, supply main and distribution system is $5,700,000. The value of the present plant of the Denver Union Water Co. is estimated by Mr. Hunter at $3,764,000, on the basis of the present cost of duplication, and without allowing for the franchise. The company has offered to sell its property to the city for $9,000,000. The mayor has recommended that steps be taken to provide for an election to vote on $6,000,000 of bonds for buying or building works.

◆

A NEW CROP OF WATER-FILTRATION ORDINANCES is springing up at Philadelphia, three bills having been introduced in the select council the other day. Several more ordinances are promised for Dec. 8. Two of the ordinances provide for contracting for specific systems, and one calls for bids under plans to be furnished by the city.

◆

THE NUMBER OF BACTERIA in London crude sewage is 3,899,000 per cu. cm., at the Barking outfall, and 3,527,000 at the Crossness outfalls, according to the average of a number of recent counts by Dr. A. C. Houston, made early this year, under the direction of Dr. Frank Clowes, Chemist of the London County Council. The range at Barking was from 7,260,000 on May 3, to 513,000 on April 15; and at Crossness, from 5,290,000 on March 2, to 2,410,000 on April 20.

◆

THE ELECTROLYTIC MARINE SALTS CO. dies hard. A committee appointed in August to investigate its affairs has made a report against a receivership, but recommending that a committee of citizens take the company's business in hand, with power to test the Jernegan process for getting gold from sea water, and to disentangle the legal snarl into which affairs have drifted.

◆

A NEW METAL TRACK SIGN now being used to some extent on the Pennsylvania lines, the Missouri Pacific and the Wabash R. R., consists of an angle iron post, set in a section of 8-in. sewer pipe, to which it is secured by braces and a collar on the pipe. The pipe is buried in the ground and filled with concrete or earth well tamped, the bell of the pipe giving a good area for the foundation, so that the post will remain vertical. Sheet iron targets of any desired form or size are riveted to the iron post. These signs are manufactured by the Mathews Woven Wire Fence Co., of Jacksonville, Ill.

ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

VOL. XL. No. 22.

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THE EQUIPMENT OF THE ARMY, in the late war, is reported upon by Quartermaster-General M. I. Ludington. In 3½ months an army of 275,000 men was uniformed, armed and equipped with supplies, and an army of 16,000 men was sent to Cuba. In the war period the animals purchased cost $3,871,690; wagons and harness cost $358,449, and 83,078 tons of coal were purchased. The movement of troops by rail aggregated 17,863 officers and 435,569 men. The department chartered on the Atlantic coast, to June 30, 43 vessels, with a total of 104,201 tons and these had a carrying capacity of 1,287 officers, 22,335 men, 6,746 animals, and the arms, ammunition and camp subsistence and medical supplies; four water-boats, of a total capacity of 820,000 gallons, tugs and barges were added to this fleet. On the Pacific coast 14 ships were chartered, aggregating 41,152 tons, capable of carrying 629 officers and 13,059 men, and their stores. These vessels cost $186,632 for fitting up; and there was paid for the service of these ships $1,007,952 on the Atlantic side, and $319,764 on the Pacific side. After June 30, other vessels were chartered or purchased, increasing the total tonnage to 111,099 tons, and the carrying capacity to 25,000 men on the Atlantic; and to 61,287 tons and 20,000 men on the Pacific. Fourteen ships, aggregating 61,298 tons, were purchased for $5,431,000; including other vessels and lighters bought, the aggregate expenditure on this account was $6,476,300.

◆

MEDICAL STATISTICS OF THE AMERICAN-SPANISH War, as reported by the Surgeon-General of the U. S. Army, stand as follows: From May to September, inclusive, and representing an army of 167,168 men, there were reported in full 1,715 deaths. Of this number 640 were due to typhoid fever; 97 to malarial fevers, and 363 to diarrhœa and dysentery. The death-rates of May and June—.46 and .70, were not in excess of those of the army in peace times; in July the rate reached 2.15 for the month, or 25.80 per 1,000, which does not much exceed that of well cared for cities. But in August the rate became excessive, or 4.08 per month, or 48.96 per 1,000 per year. In September the conditions improved and the death-rate fell to 2.45, or 29.40 per year. The records of the Civil War show that a high death-rate in August was generally continued for months after, and Dr. Sternberg ascribes the improvement noted in September to the stricter sanitary measures adopted.

◆

THE FIRST VOLUNTEER REGIMENT of Engineers, largely made up of men from New York, arrived from Porto Rico, on the S. S. "Minnewaska," on Nov. 24. In Porto leading to it, at Guanica; it rebuilt many masonry bridges on the military road between Ponce and Albonito, destroyed by the Spaniards; built an ice-making plant at Ponce, and also a water-works system, and did other work of similar character.

◆

FIFTEEN NEW WARSHIPS are asked for by Secretary of the Navy Long, in his annual report. These are classified as follows: Three sea-going battleships of about 13,500 tons trial displacement, estimated at $3,600,000 each, exclusive of guns and armor; three armored cruisers of 12,000 tons trial displacement, esetimated at $4,000,000 each, exclusive of guns and armor; three protected cruisers of 6,000 tons trial displacement, estimated at $2,120,000 each, without guns or armor, and six cruisers of 2,500 tons trial displacement, estimated at $1,141,800 each, exclusive of armor and armament. This fleet would cost over $36,000,000. The Secretary deems these vessels necessary, and he asks that construction be commenced at once. He also recommends to Congress the revival of the grades of Admiral and Vice-Admiral; a new system of rewarding merit and conspicuous service by naval officers; the amalgamation of the line and the engineering staff of the navy; the transfer of all military transport service from the War to the Navy Department; the encouragement of a national naval reserve maintained by federal appropriations; and the addition of 99 officers in the new line of the navy. Of the $29,973,274 appropriated to the Navy, out of the national defense fund, $618,447 remains unexpended. The maximum fighting force of the navy at the close of the war was 196 vessels of all kinds, manned by 24,132 men. The total naval casualties during the war were 17 men killed and 84 wounded; of the latter, 54 went back to duty, and one died of his wounds.

◆

CRUISERS OF MODERATE TONNAGE, with great speed, many guns, but no armor, promise to be a favorite warship of the future. As a direct result of the lessons gained from the Santiago fight, Russia is said to have ordered several 3,000-ton ships with 25-knot speed and heavy guns; and England is reported to be building five 3,000-ton cruisers with 25-knot speeds. The Russian Vice-Admiral Makoroff, head of the navy department, is reported as saying that the Spanish cruisers were provided with well-placed heavy armor, but it could not avert their destruction; they lost the battle because they were lacking in gunners and in guns. Admiral Makoroff argues that with given great speed and heavy armament, four 3,000-ton unarmored cruisers are more advantageous in war than one 15,000-ton ship.

◆

THE FOUR NEW MONITORS, according to plans finally adopted by the Naval Construction Board, on Nov. 23, are to have single turrets, with two 12-in. guns, as originally planned; but will be lengthened 27 ft., giving an added displacement sufficient to permit bunker capacity for 200 tons more of coal. The contractors have agreed to lengthen the vessels for the sum of 103,145 in addition to the original contract price.

◆

THE SHELLS USED BY THE UNITED STATES NAVY, the guns for firing them and the powder charges in each case, are given in the following table:

	Shells.				Guns			Total
Designation.	Diameter, ins.	Wght, lbs.	Length in ins.	Ch'rge contain'd, lbs.	Wght, lbs.-tons.	Lgth in ft.	Firing chrg, lbs.	cost of firing once.
1-pdr.	1⅜	1	3⅝	200*	100	5	...	$1.12
3-pdr.	1⅞	3	6¼	900*	500	7	...	.....
6-pdr.	2³/₁₆	6	8⅝	1,400*	920	9	...	5.70
4-in.	4	33	12¼	2	1½	14	14	....
5-in.	5	50	16¾	3	3⅓	17	30	33.00
6-in.	6	100	20¾	4½	6	21	50	40.00
8-in.	8	250	22⅜	11	15	29	115	65.00
10-in.	10	500	30	20	28	31	240	....
12-in.	12	850	36	40	45	37	425	....
13-in.	13	1,100	42	50	60	40	550	296.00

*Grains.

Note.—For 13-in. armor-piercing projectiles the total cost of firing is $588.00.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred, Nov. 27, on the Boston & Maine R.R., near South Berwick, Me., in which the engineer and fireman of a snowplow engine lost their lives. The plow was being pushed through the heavy snow when it suddenly left the track. The engine followed, going down an embankment and burying the engine crew in the wreck.

◆

A BOILER OF A RIVER STEAMER EXPLODED near Stockton, Cal., on Nov. 27, killing 6 men and injuring 10 others.

◆

SOME AMMUNITION EXPLODED in a house in Havana, Cuba, on Nov. 28, killing or seriously injuring 38 persons. The house contained a considerable quantity of powder, and five rooms filled with obsolete types of cartridges. Those injured were engaged in emptying the cartridges, the intention being to sell the powder.

◆

A LARGE ICE-BREAKER, for use on the Baltic Sea, has been launched in England for the Russian government. The vessel has a bow-propeller, to assist in breaking the ice, and the stern is provided with a recess in which the bow of a ship to be towed can be lashed. This boat is built for the purpose of attempting to keep traffic moving in the Baltic in winter; and besides convoying merchant ships, the breaker can itself carry a large cargo.

◆

ANOTHER OLD CANAL IS TO BE ABANDONED. The Pennsylvania Canal Co., controlled by the Pennsylvania R. R. Co., announces that the consent of the legislature will be asked to the abandonment of the Juniata Division, extending up the Juniata Valley from its junction with the Susquehanna to Newton Hamilton. The entire system of the Pennsylvania Canal Co., 248 miles in extent, carried 250,526 tons in 1897, and earned $59,662. Its operating expenses were $58,405, and the charges for interest and taxes were $151,022. The section which is to be abandoned is a part of the famous old Pennsylvania state canal system and was originally a link in the through line of transportation from Philadelphia to Pittsburg in connection with the old Portage Railroad over the Alleghenies. It was sold by the state to the Pennsylvania R. R. Co. in 1857.

◆

THE PORT ARTHUR CANAL CHANNEL & DOCK CO., says a Beaumont, Tex., item, has received a favorable decision in the Supreme Court of Texas in the injunction suit brought by the property holders near Port Arthur. The decision is claimed to remove all objections to the completion of the ship-canal now under construction, with 4½ miles practically finished. The right to condemn land, under the canal company's charter, was questioned and an injunction was granted by a Jefferson county court.

◆

THE PASS-A-LOUTRE CREVASSE, at the mouth of the Mississippi River, was closed on Nov. 13 by the contractors, Stewart & Co., of St. Louis, after one year's very hard work. The work done was to sheet-pile a length of 7,000 ft. across the Pass. The work was accepted by the U. S. Engineers, and on the next day, a heavy storm caused two breaks—of 102 ft. and 68 ft., respectively—in the eastern wing of the sheet-piling. The loss, amounting to about $8,000, will fall upon the government, but it would have little effect upon the general purpose of the work if these breaks were never closed, as the main body of water is now diverted into the Southwest Pass. The sum of $250,000 was appropriated for the repairs at Pass-a-Loutre; of this sum $195,000 was paid to Stewart & Co., $10,000 was used in surveys of the Southwest Pass, and the balance was practically consumed in incidental expenses. Another appropriation from Congress will thus be needed to close the last breaks.

◆

THE NEW YORK ANTI-TICKET SCALPING law has been declared unconstitutional by the Court of Appeals of that state, which has just handed down a decision in the test case brought by a New York city scalper shortly after the law went into force in 1897. The court's decision is based on an opinion written by Chief Justice Parker, and the court stood four to three in declaring the law unconstitutional. In his opinion Judge Parker says:

> The provisions of the statute in question have reference to the selling of valid tickets, regularly issued by a transportation company. Can the legislature declare such sales to be fraudulent or prohibit them on the ground that it tends to prevent fraud? It is not contended that the business of ticket brokerage is in itself of a fraudulent character. The business can be honestly conducted, and the most that is asserted is that there are some men engaged in the business who have imposed on the public. The same assertion can be made with equal truth of every business, trade and profession. The real motive for the enactment of this law, it is suggested, is to enable transportation companies to keep others with which they may enter into pooling arrangements from secret violation, which is frequently the outcome under the present ticket brokerage system. The granting of monopolies or the exclusive privilege to corporations or persons has been regarded as an invasion of the rights of others to follow a lawful calling and an infringement of personal liberty from the times of the reigns of Elizabeth and James. Argument certainly is not needed in the light of decisions of this court to support the assertion that the "liberty" of this relator (Tyroler) and other citizens of this state to engage in the business of brokerage on passage tickets is sought to be interfered with by the state under consideration; for brokerage in such tickets has been a lawful business for many years. The statute is in contravention of the state constitution, and is void unless its enactment by the legislature constituted a valid exercise of the police power.

As stated the anti-ticket scalping law was passed in 1897, after a hard fight, the scalpers contesting its passage by the legislature at every step. The test case just decided was brought almost immediately after the law went into force. Ticket scalping meanwhile has gone on about as actively in New York city, at least, as before.

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TWO NEW FAST EXPRESS TRAINS between New York and Washington, composed of observation, parlor, cafe, smoking and dining cars, the entire equipment being especially made for the service by the Pullman Company, have recently been put in operation by the Baltimore & Ohio R. R. The two trains will leave New York and Washington simultaneously at 3:30 p. m. each day, and they will be exact counterparts in every respect. The parlor cars are 70 ft. long and have 34 seats. They have wide vestibules with anti-telescoping device; empire decks, steam heat, Pintsch gas, air pressure water system, and all modern improvements. The observation, cafe and smoking car is of the same general exterior appearance as the parlor cars, except that the observation end is recessed with a deep platform. The full seating capacity of this car is 33 persons, including 14 chairs in the smoking compartment. All the cars are richly equipped and decorated, and the train will be called the "Royal Limited."

◆

THE PLATINUM PRODUCTION OF RUSSIA, according to Mr. W. R. Holloway, U. S. Consul-General at St. Petersburg, for the year 1897, was over 95% of the entire amount mined in the world, or about 6 tons. Most of this came from the following mines:

Mines of	Count P. P. Shuvaloff	1 ton 396	lbs.
"	Count Demidov San Donato	1 ton 144	"
"	J. Burdakov & Sons	1,512	"
"	Kolly.	1,404	"
"	Andreieff heirs	1,188	"
"	Koenigsberger	1,008	"
"	P. A. Konukhoff	792	"
"	19 small proprietors	1,620	"

EARTH SLIPS ON THE JORDAN LEVEL MARL BEDS OF THE ERIE CANAL.

By Geo. A. Morris.*

Beginning at Otisco or Nine Mile Creek, the Erie Canal for about four miles west runs through low, swampy land, comparatively level and about at the elevation of the present tow-path, making the canal a through cut, 11 ft. deep. At the surface the formation is a covering of muck, and below is found marl over a soft clay, then a cemented gravel. The marl is generally near the surface, but the cemented gravel varies from 2 ft. below surface to 65 ft. below. The valley is narrower at the eastern end (about one-half mile) and widens out on the north side of the canal to about 1½ miles. The old canal followed the foot hills on the south, but on the enlargement the alinement was changed to make long tangents. During the construction of the enlargement three firms of contractors were compelled to abandon their contracts, because of earth slips caused by the subsidence of the marl beds, and the work was finally completed by the State under force account, and after many difficulties had been overcome.

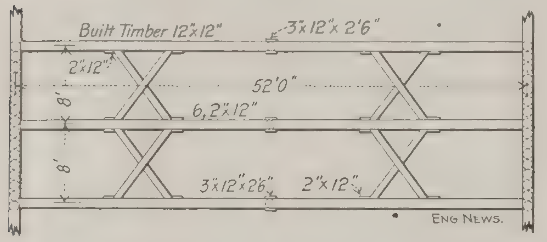

Fig. 1.—Original Method of X-Bracing Struts Across Canal Prism Through Jordan Level Marl Beds.

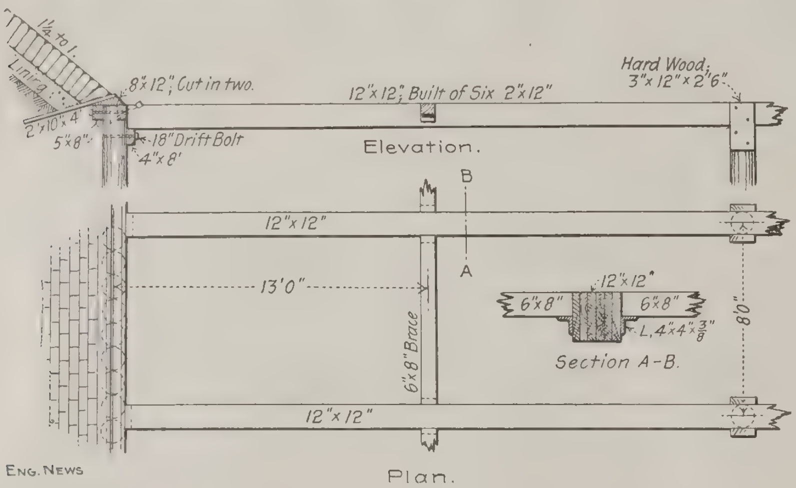

FIG. 2.—ADOPTED METHOD OF BRACING STRUTS ACROSS CANAL PRISM THROUGH JORDAN LEVEL MARL BEDS.

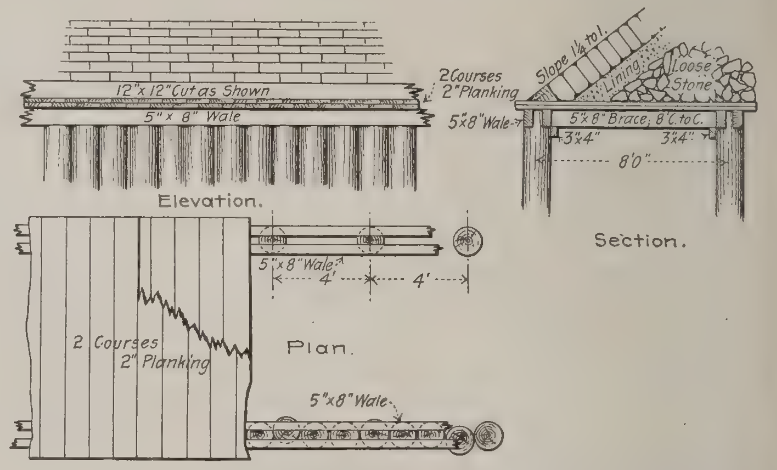

FIG. 3.—METHOD OF UNDERPINNING SLOPE WALL THROUGH JORDAN LEVEL MARL BEDS.

The stratum of marl is of varying thickness, the limit being about 15 ft. The following table gives the elevation of the top of the marl as actually shown from cross-section notes, datum being 1 ft. below the new canal bottom.

Station 208 = + 10 Station 240 = + 6 Station 410 = + 10
Station 220 = + 12 Station 368 = + 10 Station 420 = + 8
Station 238 = + 14 Station 380 = + 13

The marl and clay can be readily handled when dry, but when wet the mixture weighs from 80 to 83 lbs. per cu. ft. An excellent quality of Portland cement is made from equal parts of marl and clay by the semi-humid process. The "Engineering Record" of July 16, 1898, has the following analysis of this material as it is used by the Empire Portland Cement Co.:

	Per cent. Marl.	Per cent. Clay.		Per cent. Marl.	Per cent. Clay.
Si O_2	0.26	40.48	Mg O Co_2....	0.38	0.99
Al_2 O_3, Fe_2 O_3	0.10	20.95	Loss, ignition.	4.64	8.50
Ca O Co_2....	94.39	25.80			

As the elevation of surface of the water during navigation is 2 ft. lower than the tow-path and the latter is about on the level of the swamp, the canal necessarily had to take all the drainage. When the contractors commenced to excavate in the prism they built coffer-dams across the channel at short intervals and diked the sides, then used powerful steam pumps to drain their work. When the pressure from the sides was removed, the pressure from above would raise the material in the bottom (similar to squeezing paint from a paint tube) and it was soon discovered that more material was being removed than was shown on the cross-sections and that the slope walls were sliding into the canal and that the berme and tow-path banks were settling. Immediately it became necessary to devise means for stopping the sides and to confine the material. Various plans were suggested, but they all carried a considerable expense with them. Different methods that were economical in design were tried, each taking time to try the experiment. Piles were driven 8 ft. c. to c. with waling piece and sheet piling, then 4 ft. c. to c., then a close row of piles, but the piles would not enter into the cemented gravel, and as the material had become thoroughly saturated, they would lean over into the canal and occasionally would pop up out of the ground (Fig. 4). It was finally decided to abandon the attempt for that season and to drive a close row of piles during the season of navigation, then when the water was drawn in the fall, to put on a waling piece to start the slope on, and to build only a short stretch at a time. This course was adopted. The piles were driven during the summer, but as the piles did not penetrate into the cemented gravel, and the material around the piles was in solution, it was soon discovered that we would have to resort to an original and expensive plan and place struts across the canal, as shown in the accompanying plans. We found that the method of X-bracing (Fig. 1) was expensive and that the brace at right angles to the strut (Fig. 2) would answer. The latter was adopted. The plan as finally adopted proved very successful and was used for 3,700 ft. of canal in one place and 500 ft. in another.

The greatest difficulty was encountered between Stations 370 and 410, and occupied our attention during both closed seasons, but during the first season the adjoining swamps were full of water. During the season of 1898 a drainage ditch was made on both sides of the canal, emptying into Nine Mile Creek at the east end and White Bottom Creek at the west end. This ditch took all surface drainage, so that the only water in the canal was from percolation, which was considerable. Because of this drainage ditch about two miles of slope wall was built on both sides of the canal without using struts, but with only a close row of piles with a waling piece to start the wall upon (Fig. 3). This portion had formerly caused the most trouble and cost the most to build, and we had anticipated that it would be the most difficult to handle. But inside of two months the prism was excavated to grade and two miles of full depth wall built on both sides. This work was prosecuted by digging the excavation trench for the waling piece, putting the waling piece in place, and building the wall ahead of the prism excavation. Another advantage this work had in its favor was that it was done in the latter part of March, April, and the first of May.

The difficulties encountered on this section of the canal were so many and varied, that it is difficult to describe them in general, for the reason that until the struts were used all we had done proved unsuccessful in the aggregate, although quite a number of the plans used proved successful under certain conditions. A severe cold winter, instead of a very mild one, would probably have eliminated any of the difficulties, and the work would have been done wihout any additional cost or without any one being aware that there was a suspicion of what actually did occur.

In one of the photographs sent with this article (the photograph is too dim for engraving.—Ed.) is shown a pile with the head very near to the bottom of a 30 ft. pile-driver. The piles used for a long distance either side of this point were 42 ft. long. In describing the driving of this pile, I will state that what is true of this one is also true of all the others. When this pile was raised the head was 12 ft. or more above the top of the leads. As soon as the fastenings were removed, the pile settled with its own weight into the marl until its head was below the top of the leads. A small rope was fastened to the pile and two men pulled it down to where the hammer could be placed upon it, and with simply the weight of the hammer it settled to where it is shown in the photograph. A light blow drove it to the cemented gravel layer. There was a crust a few inches thick over this layer which the pile could be driven through, but which then became so hard that great care had to be taken not to hit the pile too heavy a blow, as it was liable to break it, or throw it out of line, and a pile out of line could not be forced back. The only remedy was to pull it and redrive it. Some of the piles that were driven to resistance have lifted to the extent of 8 or 10 ft., as shown by Fig. 4, which also shows how they would move bodily into the canal. Just before the opening of navigation in 1897, the tow-path in stretches from 500 ft. to 1,500 ft. in length settled anywhere from 2 ft. to 8 ft., and in all cases where it broke away from the main land it was a vertical fracture.

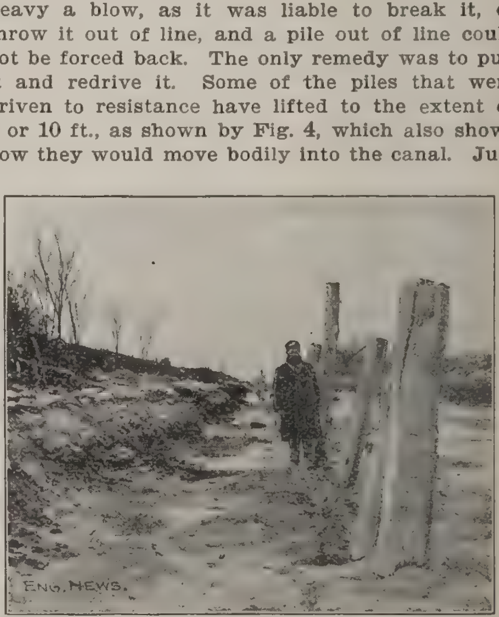

Fig. 4.—View Showing Manner in which Piles Rose and Tipped After Driving, Jordan Level Marl Beds.

At Newport Bridge we encountered a difficult

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*Resident Engineer, Erie Canal Improvement, Syracuse, N. Y.

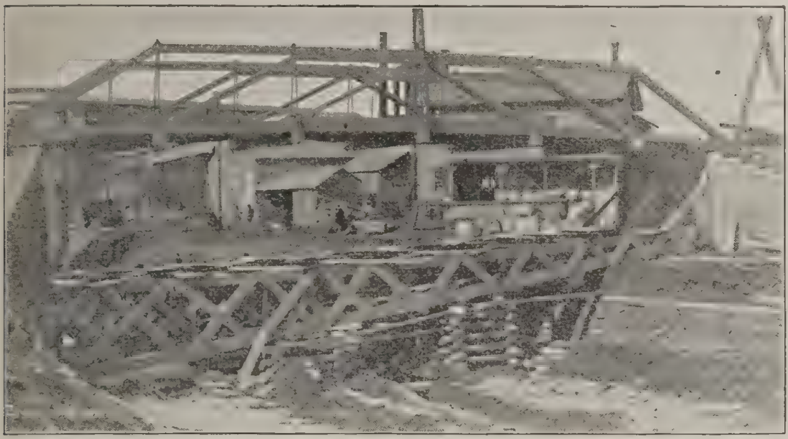

FIG. 5.—VIEW SHOWING SINKING OF VERTICAL WALL AND MANNER OF BRACING BRIDGE ABUTMENTS TO PREVENT SLIDING.

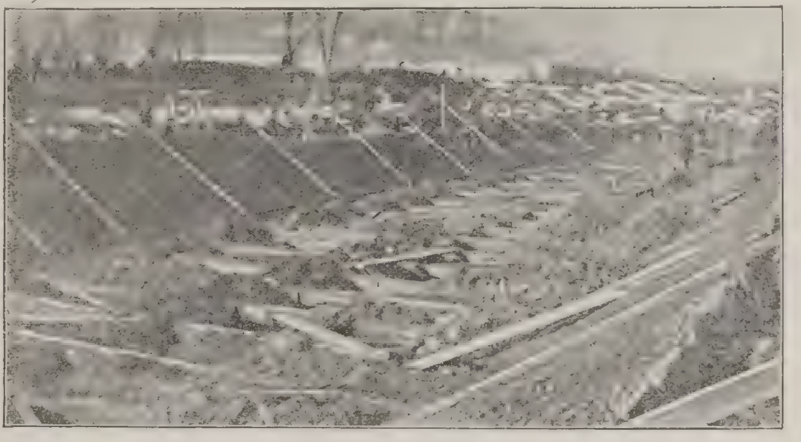

FIG. 6.—VIEW OF CANAL PRISM, SHOWING BOTTOM BRACES IN PLACE AND SLOPE WALLS UNDER CONSTRUCTION.

problem in rebuilding the abutments, vertical wall on tow-path side and slope wall on berme. Before the bottom courses of the old abutment on the berme had been removed in winter of 1896-'97, great fissures were discovered running either side of the excavation. We removed all of the excavated material from the bank and drove piles at the foot of the slope wall, but the fissures extended and the banks began to settle, the wall sliding toward the canal and pushing the piles we had driven with it. Great cracks exhibited themselves in the foundation to Dwyer's Hotel. We drove piles 50 ft. long as near to the hotel as the pile-driver could approach it, but they moved bodily toward the canal.

Under the foundation to the berme abutment piles 57 ft. long were driven with two courses of 12×12-in. hemlock foundation timbers securely fastened on them. On this the masonry was built. Cinders were used as back filling. When the back filling was about half completed the abutment moved bodily into the canal about 3 ft. and settled about 6 ins. It is supposed that the bottom of the piles remained stationary, and that the tops leaned all together, as the abutment did not move on the timber foundation and did not get out of line. As the bridge was in place when the abutment moved, the parapet walls on both abutments were destroyed. We immediately put four struts across the canal between the foundation of the berme abutment and the vertical wall on the tow-path side and below canal bottom. These struts remained until this spring.

The slope wall, however, kept sliding into the canal and finally laid flat. Two close rows of piles were driven 6 ft. apart, capped and floored with two courses of 3-in. plank, to make a foundation to start the wall. The embankment to build the wall upon was made of loose stone and coarse gravel from 4 ft. to 16 ft. back. Even with this precaution the wall would settle in one place and push out in another, and was rebuilt the second time in March and April, 1897, and in December about 300 ft. of the upper 4 or 5 ft. had to be relaid.

The vertical wall on the tow-path side kept settling all summer, and notices had to be put up cautioning the boats to keep on the berme, as the wall as it settled on top would raise on the bottom. In order to maintain the tow-path the contractors kept adding stringers and filling in with cinders during the whole season of navigation. In Fig. 5 it will be seen how much the wall settled below the tow-path. It was, of course, necessary to rebuild this piece of wall. Great vertical fissures developed running parallel to the tow-path, which kept growing wider, and the ground for 150 ft. each side of the bridge settled, in some places 2 ft., for 30 ft. back. We began the foundation and wall at the point furthest away from the bridge and worked toward it, meeting under the strut. Struts were used across and under the canal between the foundations of the vertical and slope walls, and between abutment and vertical wall.

The cost of this work is, of course, known, but whether it would benefit the public or not is a question not easily answered. The contract prices were used in paying for everything that could be measured. As there was no known way of ascertaining the amount of excavation, it had to be done under a force account. The cost of redriving piles, rebuilding foundations and walls, rehandling of all kinds of material, building runways and coffer-dams, keeping ditches open, and the many other items too numerous to mention or remember, all went toward the aggregate cost. The contract prices were reasonable, being as follows:

Excavation, cts., per cu. yd.	27½
Embankment, cts., per cu. yd.	30
Lining, per cu. yd.	$1 00
Piles, delivered and driven, cts., per lin. ft.	18 to 25
Hemlock timber, per M. ft., B. M.	$16.00
Spruce timber, per M. ft. B. M.	$17 00
Bridge abutment masonry, per cu. yd.	$7.00
Vertical wall in Portland cement, per cu. yd.	$5.00
Slope wall, per sq. yd.	$2.47
Portland cement concrete, per cu. yd.	$5.00

There was a deduction for all material found in the work that could be used. Mr. M. B. Palmer, of Clinton, N. Y., was the Assistant Engineer in charge of the work for about a year, and then Mr. Wm. B. Landreth, M. Am. Soc. C. E., of Cortland, N. Y., was in charge for nine months, or until the contract was completed.

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COMPOUND ENGINE IN THE POWER-HOUSE OF THE BUDAPEST ELECTRIC RAILWAY.

(With full-page plate.)

The stationary engine illustrated in our insert sheet is one of three which are in use in Budapest, Hungary, in the power-house which furnishes current to the electric street railways and the underground railway. It was designed and built by L. Lang, of Budapest. The "Zeitschrift der Vereines Deutscher Ingenieure," from which we reproduce our cut gives a very brief description of the engine, from which we take the following:

The engine has its cylinders arranged on the Collmann system, which affects the balancing of the reciprocating parts, the two cranks being set at 180°. A vertical engine of similar construction was in operation at the Electro-Technical Exhibition at Frankfort in 1891. The diameters of the cylinders are 18 and 32 ins., the stroke is 33 ins. The normal speed is 135 revolutions per minute; this number can be varied 6% either way. The high pressure cylinder is fitted with the Collmann valve gear.

An inspection of the cut shows that this engine possesses many features that are quite novel to most American readers. Among them we notice especially the following: The fly-wheel is "dished" like a cart wheel, apparently with the object of getting its center of gravity closer to the bearing than is the case with the common wheel. The cylinders are placed neither tandem nor alongside, but in echelon, the high pressure cylinder being both forward of the low pressure cylinder and alongside of the piston-rod of the latter. With the cranks at 180° this arrangement is more compact than the cross-compound plan, at the same time making it possible to balance the reciprocating forces and to divide the work between two cranks, which cannot be done with the ordinary tandem engine, although it is very successfully done with the Wells balanced compound engine, which has two tandem cylinders, the low pressure piston having two piston rods, the high pressure cylinder lying between them. The valves on the high pressure cylinder are of the poppet valve type, controlled by a fly-ball governor, and multiported slide valves are used on the low pressure cylinder. Each cylinder has four valves, and all the valves are driven from eccentrics carried by a secondary shaft, which is driven by a miter-gear from the main shaft.

While the engine is no doubt well designed, and embodies many good ideas, it is likely to impress an American engine builder as being very complex and costly for a moderate sized stationary engine, only 18 and 32 ins. × 23 ins. stroke, and he will probably doubt the need of balancing such an engine, as to its reciprocating parts, when it is run at a piston speed of only 518 ft. per minute.

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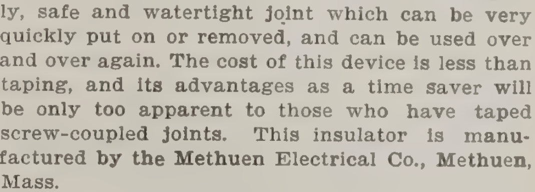
A HANDY INSULATOR FOR JOINTS IN WIRE.

We illustrate herewith a novelty in the way of an insulator for use in connection with railway motors, or in fact wherever the common brass sleeve screw coupling is used to splice wires. At present whenever a motor is removed from the truck, for repair or any other purpose, the insulating tape which has previously been carefully wound about these screw couplings has to be cut and thrown away. This entails the use of new tape, and as there are from four to six such connections for each motor, the time consumed is also quite an item. The device here illustrated consists of a tube oval in section, composed of semi-hard rubber, which is slipped over the screw coupling, and two flexible end caps which hug the wire and close down into grooves in the oval shell, as will be seen in the figure, thus making a sightly, safe and watertight joint which can be very quickly put on or removed, and can be used over and over again. The cost of this device is less than taping, and its advantages as a time saver will be only too apparent to those who have taped screw-coupled joints. This insulator is manufactured by the Methuen Electrical Co., Methuen, Mass.



Longitudinal Section of the Osgood Insulating Cover for Screw-Coupled Wire Joints.
Methuen Electrical Co., Methuen, Mass., Makers.

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THE NORTHEAST WATER TUNNEL AT CHICAGO was completed Nov. 21 by the contractors, Messrs. Fitz Simons & Connell. The land sections of the tunnel, known as the northwest land tunnel, are not yet completed, and there is litigation pending over this part of the work. The lake section will, however, probably be used during the winter, as the intake crib has been specially designed with a view to preventing trouble from ice.

RECENT IMPROVEMENTS IN CENTRIFUGAL PUMPS.

By J. Richards.*

The writer in 1896 was called upon to prepare designs of pumps for the great drainage plant, or plants, at New Orleans, and after a careful examination of the various means, other than centrifugal pumps, for raising and impelling large and variable volumes of water, came to the conclusion that the conditions, including the relative efficiency of different methods, made the use of centrifugal pumps preferable. This opinion was shared by Mr. Charles Brown, C. E., of Basle, Switzerland, who acted as my colleague, and who is, perhaps, the most eminent authority in such matters that can be referred to.

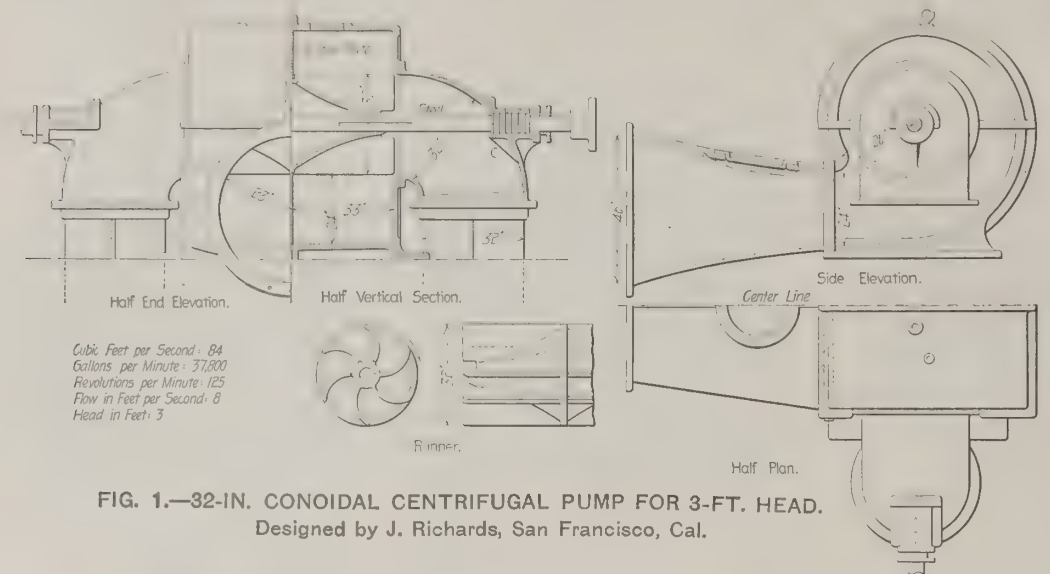

FIG. 1.—32-IN. CONOIDAL CENTRIFUGAL PUMP FOR 3-FT. HEAD.
Designed by J. Richards, San Francisco, Cal.

The power to impel the pumps at the various stations, scattered over the city and on the line of outfall, was in most cases to be transmitted by wires from a central power station and applied by electric motors, and therein arose a serious impediment in the adaptation of the speed of the pumps to that of the electric motors to drive them. A large number of motors were required, aggregating, as now remembered, over 7,000 HP., and the economic limitations of the speed or rate of revolution for the motors was such that the pumps had to be adapted accordingly.

As the proper circumferential speed of centrifugal pumps differs only in a slight degree from the velocity due to the head, being about $8.5 \sqrt{H}$, in feet per second, and as the head in some cases was only a few feet, pumps constructed on the ordinary lines were out of the question. The impellers to produce the required speed became less in diameter than the suction pipes to convey the water at a velocity of 8 ft. per second.

This difficulty led to the adoption of the "Conoidal" system which it is the purpose of this article to explain. The name "conoidal" was applied by Hon. Henry H. Bates, of Washington, D. C., and relates especially to the impellers, as will be explained hereafter.

Reverting further to the designs of the pumps for the drainage works at New Orleans, these were prepared under the impression that the machinery could not be submerged. Fig. 1 represents a pump to raise 84 cu. ft. per second, or 37,800 gallons per minute under a head of 3 ft., the pump and motor making 125 revolutions per minute.

The drawing with the dimensions given make the construction so clear that no explanation is required except in respect to the impeller. This, it will be seen, is a double conoidal spindle, provided with the usual vanes. It is buoyant in the water to the extent of its displacement, which about equals its weight, thus relieving the pump shaft from the pressure due to the weight. It will also be seen that the conoidal form distributes the work equally over the width of the impeller from the inlet to the center, completely changing the course of all the water before it reaches the center. To provide against any possible lateral disturbance around the impeller, a diaphragm (a) is introduced so that the two sides of the pump will operate independently and balance the thrust on the shaft.

The impeller is of the same diameter as the bore of the pipes, and the vanes have, in this case, no entering curves because the field of the water's revolution extends back into the suction pipes to some distance not yet determined by experiment. The discharge way was a rectangular parallelogram 66 by 24 ins., as shown in the drawing. The pump illustrated is of average size, many of them being larger.

After preparing the designs for the New Orleans draining plant, I proceeded to investigate this system of constructing centrifugal pumps, not only in respect to their being driven by electric motors, but for all purposes to which such pumps are applied. This investigation led to the development of tables for proportions so as to bring the design of the pumps as nearly as possible within an organized system of manufacture.

Fig. 2 is a drawing to scale of a conoidal pump of 10 ins. bore, or discharge, adapted to average conditions for heads from 10 to 50 ft., but as modification for the various heads is required in order to attain full efficiency, the tables referred to had not only to include constant dimensions and quantities, but also variations therefrom. The system is about to be subjected at San Francisco to regular trials for efficiency, the results of which will in due course be published. The letters on the drawing refer to tabulated dimensions.

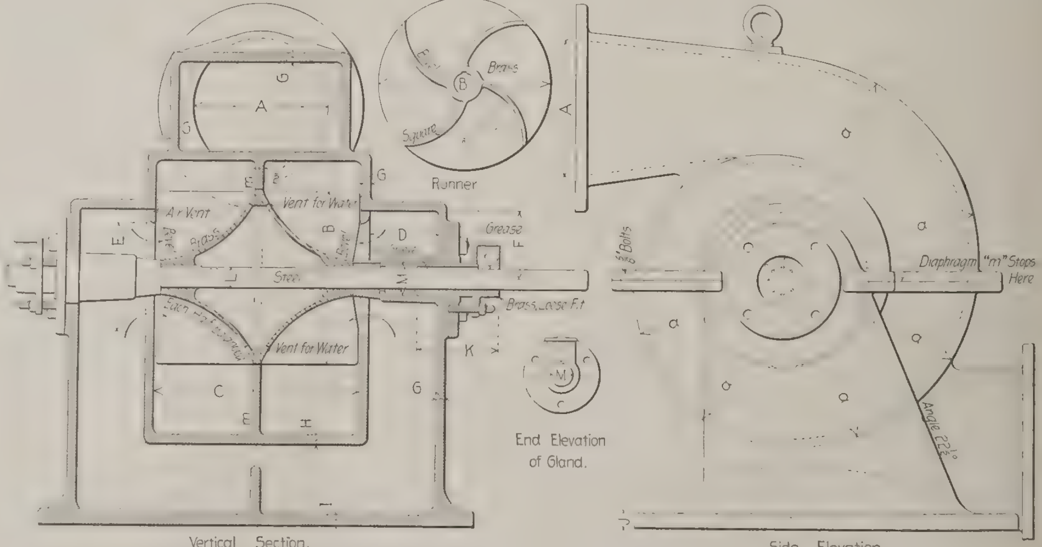

FIG. 2.—CONOIDAL PUMP FOR HEADS FROM 10 TO 50 FT.

Fig. 3 is an elevation of a conoidal centrifugal pump erected for pumping from a ditch or river, and gives the contour and appearance, which is quite uniform for pumps from 5 to 60 ins. bore.

The most important conditions in centrifugal pumping are the efficiency, endurance, and first cost, and as may be seen by examination of the drawings, the two last-named features have due recognition in the present system. Endurance can be inferred from construction, but the calculation of cost is more intricate. It may be explained from some rules of common application. For example: The relative dimensions, weight and cost of a rotative machine of almost any class or type, are inversely as the speed of revolution. The cost of centrifugal pumps is roughly as the square of their extreme dimensions; that is, a pump standing 6 ft. above its base will cost four times as much as one that measures 3 ft. above its base, and so on. By these rules it may be seen that the conoidal system will greatly diminish the cost of pumps for a given volume of water, because their dimensions are in most respects reduced inversely as the rate of rotation.

The technical features affecting efficiency could be discussed here, but as a good deal may be disclosed by experiment, this part of the subject will be laid over for a future article.

THE GEOGRAPHIC WORK OF THE COAST AND GEODETIC SURVEY.

By John F. Hayford,* Assoc. M. Am. Soc. C. E.

(With full-page plate.)

The United States Coast Survey first became permanent in 1832, although the original act providing for a survey of the coast and making an appropriation for that purpose was passed in 1807. A formal reorganization took place in 1843. In it the plans for the survey which had been formulated and acted upon in former years by F. R Hassler, the first Superintendent, were continued in force. The scientific organization of the Survey may, therefore, be properly said to date from 1832. The survey was to be made primarily for the benefit of commerce, was to extend twenty leagues from shore, and special observations were authorized even beyond that limit, as far as the Gulf Stream, when in the opinion of the President such observations might be especially valuable to the commercial interests of the United States.

In the course of time the Coast Survey proved to be an organization of such vigor, its results proved to be so uniformly trustworthy, and there were found among its officers men of such acknowledged ability, that the scope of its duties was gradually but steadily widened to include a great variety of operations allied in various ways to its original duty. Now, after a little more than a half century of activity, the Survey finds itself rendering more valuable benefits to commerce, by way of making the navigation of the coasts safe, than ever before; and also finds itself actively engaged in many other forms of geographic work.

The requirements of the original acts of organization of the Survey might, perhaps, be considered to be fulfilled when accurate charts of all parts of the coast had been made. This, the fundamental work of the Survey has been carried on vigorously and steadily. Commencing with a few of the more important regions on the Atlantic coast the work of chart making was gradually extended until the charts now cover (although the original surveys do not) every part of the Atlantic, Gulf and Pacific coasts of the United States, and a large portion of the Alaskan coast. From time to time, as the interests of commerce demanded, the surveys in certain special localities and important harbors have been repeated in greater detail, and the new information embodied in new charts—often of larger scale than before. Meanwhile the commercial interests involved have increased to such an extent that the demand for surveys for charting purposes is as great as ever, resurveys in greater detail in some regions and original surveys in regions where the charts now depend upon compiled data.

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*22 California St., San Francisco, Cal.

*Expert Computer and Geodesist, U. S. C. & G. S., Washington, D. C.

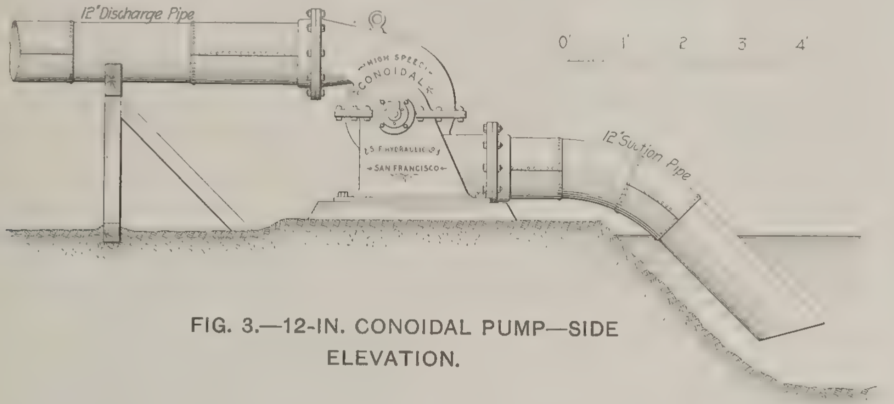

FIG. 3.—12-IN. CONOIDAL PUMP—SIDE ELEVATION.

The Survey at present issues over 500 different charts and maps varying in scale and character according to the objects for which they are designed. Nearly all of them belong to one of four general classes, viz.; 1st, sailing charts, on a scale of 1-1,200,000, which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea; 2d, general charts of the coast, on scales of 1-400,000 and 1-200,000, intended especially for coastwise navigation, and showing the configuration of the shore, the positions of islands, rocks, and shoals, the light-houses, life-saving stations, and other natural and artificial landmarks; 3d, coast charts, on a scale of 1-80,000, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors, and to recognize the beacons, buoys and light-houses by their distinctive features and positions; 4th, harbor charts, on large scales, intended to meet the needs of local navigation. The work of the Coast Survey is closely co-ordinated to that of the Light-House Board, and all changes in lights, beacons, or buoys, are promptly indicated upon the charts by correcting them up to date by hand entries at the last moment before they leave the office. The charts, except certain editions classed as preliminary, are printed at the Survey office from copper plates made by the Survey's corps of expert engravers. They will stand the closest scrutiny as to the accuracy and neatness of work upon them as well as to the reliability of the information which they furnish. That the mariner appreciates these charts is indicated by his demand in ordinary times for 25,000 of them per year, at a cost to him of about $11,000. Another 25,000 or more are distributed annually to various departments of the government and to libraries.

The Coast Survey charts are a reliable basis upon which to design proposed harbor improvements, and they have been extensively so used by the Corps of Engineers of the Army. In those cases in which one or more resurveys of a harbor have been made the charts are of unusual value in this connection, for the changes observed to have taken place in the intervals between surveys serve to indicate what changes must be guarded against in the future, and what favorable changes may be relied upon, and to indicate the probable effect of proposed structures upon depths in their vicinity.

The officers of the Survey have made accurate topographic surveys of 38,000 square miles, mainly in connection with the work of making charts.

In addition to the charts the Survey now issues the "Coast Pilot" in nine quarto volumes, and other volumes are now being prepared. The "Coast Pilots" are issued for the same purpose as the charts, to conduce to safety in navigation. They give, in elaborate detail, descriptions from the mariner's point of view of the coast, of the shores of harbors, of the character of available anchorages, and of the known dangers to navigation, together with sailing directions for entering harbors. The volumes are illustrated by views of portions of the coast which may serve as landmarks, and by portions of charts.

When considering the contributions of the Coast Survey to geographic science, it should be kept in mind that its charts and "Coast Pilots" are in the main the results of original surveys and observations, made by its own officers, the data compiled from other sources forming but a small proportion of the whole. These original surveys have, as a matter of course, brought to light hundreds of shoals, banks, sunken rocks and other dangers to navigation which were before unknown. In several cases they have also incidentally made known unsuspected safe channels for entering harbors. The main ship channel now used in entering New York harbor was discovered by a Coast Survey party during its regular operations at a time when a much poorer channel was in use and was supposed to be the best. A Coast Survey party operating at the mouth of the Yukon during the past summer discovered a new channel carrying a depth of 8 ft. across the bar at low water. This channel will save much time and distance, and a trans-shipment, for vessels of sufficiently light draft to use it.

A study of the tides forms an essential part of the work of charting a coast. Along this line the Coast Survey has been particularly active, both in taking observations and in making tidal predictions. Over one hundred stations have been occupied with self-recording continuous-record gages, and the total length of such record is equivalent to a continuous record for more than three hundred years at a single station. In addition to this, short series of readings have been taken from staff or box gages at 2,500 different stations. Based upon these observations upon our own coasts and upon the compiled results of observations upon foreign coasts, the Survey publishes annual volumes of tidal predictions for the whole world. The volume for 1899 shows the predicted time and height of every high and low water throughout the year for 24 stations in the United States and for 46 foreign stations. These primary predictions are based upon a harmonic analysis of records from self-recording gages. In those cases in former years in which the predictions have been carefully compared with the actual tides as subsequently observed, the discrepancies developed have been so small that it is probable that they were due almost entirely to meteorological causes. These primary predictions are extended to about 3,000 secondary stations, with various degrees of accuracy, by means of tidal differences and ratios derived from short series of observations at those stations.

The shores of the ocean, and the bottom near the shore, are continually being modified by the action of waves, currents and winds. The Survey has rendered important service both to geographic science and to commerce by carefully noting such changes in certain localities, and by noting the mode of operation of the causes which produced them. The safety and efficiency of public works for the improvement of harbors often depend upon an accurate conception of these causes.

One of the most interesting problems of physical hydrography is that presented by the Gulf Stream. What explanation can be given for the existence of this great current of unusually warm and salty water; apparently acting as one of the controlling factors in the climate over an ocean and upon the coasts of two continents; seemingly resistless in its motion, and yet so sensitive to disturbing forces that in its current the varying effect of the moon's attraction has been detected? Through the observations made by the Survey the status of this problem has been greatly changed. Formerly it was easy to find a theory which would seem to explain the few observed facts, and accordingly many theories were extant and unrefuted. Now, such an abundance of facts are on record that none of the old theories seem to be adequate, and no satisfactory new theory has presented itself. The scientific world seems in this matter to be in a healthy state which is prophetic of true progress, viz., it is realized that while the facts so far established are sufficient to prevent unqualified acceptance of any extant theory, many more observations are necessary to satisfactorily refute old theories or establish a new one. The principal facts which have been established by the Survey depend upon soundings along the track of the stream and in the Gulf and Caribbean Sea; numerous and accurate observations of the density and temperature of the water at a great many points at all depths in the stream and the Gulf, serving to show the vertical as well as the horizontal distribution of these elements; and finally, observations of the current itself. The current observations are remarkable for the fact that they have been extended to great depths, never before explored by a current meter.

The mariner relies to such an extent upon the magnetic needle that a study of terrestrial magnetism is a necessity in connection with the duty of chartering the coasts. In harbors a knowledge of the dip and intensity is needed, as well as of the declination, in connection with the process of adjusting ship's compasses. Nearly all of the early, and many of the modern, surveys in this country having for their purpose the fixing of property lines were made with the compass, and therefore an accurate knowledge of the geographical distribution and secular changes of the magnetic declination in the interior of the country is of great practical value as a means of preventing and settling property disputes. The determination of the magnetic declination for the purposes of the mariner at various points along the coast formed the small beginning from which has developed a great magnetic survey which covers the whole country and which has proved to be of great scientific as well as practical value.

The operations of this magnetic survey may conveniently be classified as, 1st, magnetic observations by the officers of the Coast and Geodetic Survey; 2d, the compilation of results obtained by outside parties; 3d, the systematic correlation, discussion, and publication of the accumulated data.

Officers of the Coast and Geodetic Survey have made magnetic observations at some 1,200 stations distributed over the whole country (a few also in foreign countries), and many of these stations have been reoccupied several times with a view to determining the secular changes and to keeping the magnetic information up to date. Continuous series of observation have also been made at five stations (usually with self-recording instruments) covering a period of several years at each. These observations, together with those compiled from other sources, have served to determine the geographical distribution of the magnetic declination, dip, horizontal and total intensity for the whole United States, and a more or less extensive knowledge of their secular variations at many stations. The declination, which it is most desirable to know for practical purposes, has been determined at 3,500 stations, and there are 118 stations at which its secular variation has been determined by observations at 13 widely separated epochs on an average. The series of appendices to the annual reports, in which the carefully digested results have been published from time to time, form an unrivaled repository of magnetic information pertaining to the United States. Assistant C. A. Schott, the author of this series, had recently been awarded a prize of 5,000 francs ($1,000) by the French Academy as a recognition of the scientific value of his researches in terrestrial magnetism.

From the beginning, the surveys of the coast were based upon triangulation of a secondary and tertiary order in the immediate vicinity of the hydrographic and topographic operations. The desirability of an adequate control over this coast work when it extended over great distances led to the execution of primary triangulation extending some distance inland. Later, as the desirability of connecting the Atlantic and Pacific surveys became evident, and as it also became evident that inland triangulation was of value to the states traversed by it and to various inland interests, the transcontinental triangulation was projected, the Coast Survey was directed to furnish accurate geographic positions to the several states, and the name of the organization was officially changed from Coast Survey to Coast and Geodetic Survey (in 1878).

At the present time the triangulation covers an area of 350,000 square miles and determines accurately the geographic positions (latitudes and longitudes) of nearly 29,000 points. See full-page illustration showing areas covered by completed triangulation, together with reconnoissance and proposed triangulation. The elevations of 2,800 of the triangulation stations have been determined by measured vertical angles. In connection with the triangulation, over 5,000 miles of precise leveling has been done, and this serves to fix the elevations of more than 1,000 permanent bench marks, and to control the elevations derived in part from trigonometric leveling.

A geodetic survey is geographic work on its grandest scale, for it furnishes a measurement of the earth as a whole, even though the area covered by the survey may be but a small portion of the earth's surface. Aside from two other short arcs (8° in aggregate length) the Coast and Geodetic Survey has now nearly complete an oblique arc from Calais, Me., to Fort Morgan, Ala., 22° of a great circle or 1,500 statute miles in length, and an arc of the 39th parallel 48½° or 2,600 statute miles in length. These four arcs have an aggregate length measured on a great circle of 57°, whereas the combined length of the available arcs (measured by various nations) used by Clarke (in 1880) in deriving the figure of the earth was 82°. Evidently the United States is an *active* member of the International Geodetic Association. It is also noteworthy that the different Coast and Geodetic Survey arcs are all connected so as to form a single system, and therefore have greater weight, or efficiency, in the determination of the earth's figure and size than they would have if disconnected.

The figure and size of the earth are derived from the results of a triangulation by comparing the geodetic latitudes, longitudes and azimuths with the astronomical values of those quantities as directly observed. On the oblique arc, 14 telegraphic longitudes, 48 azimuths, and 61 latitudes have been observed; while on the transcontinental (39th parallel) arc the numbers are 35 telegraphic longitudes, 73 azimuths, and 109 latitudes. A few of these determinations are common to the two arcs.

The study of the station errors developed when these astronomic measures are compared with the geodetic measures also furnishes an interesting contact point between geodesy and dynamic geology, for the limiting magnitude of the station errors is a measure of the strength of the earth's crust—if it is permissible to use the word "crust" in the present state of our knowledge. Geologists have shown that in the past there have been immense quantities of material transported in various ways to considerable distances along the earth's surfaces, by glacial action and the action of running water, for example. Such transfers of material must produce stresses in the rigid (?) earth and must also produce station errors, the distribution of matter being changed from what it must have been when the whole globe was made up of fluids and the station errors were each zero. In those cases in which the transportation is continuously in one direction, as for example, that caused by running water, the stresses and the station errors must go on increasing indefinitely unless there is a yielding on the part of the rigid (?) earth. Any yielding and counter transference of material beneath the surface must reduce both the stresses and the station errors. The station errors furnish, therefore, a measure of the accumulated amount of transportation in those regions in which such amount is small; and furnish a measure of the strength of the material composing the earth in those regions in which the accumulated amount of surface transportation is very large and the station errors and stresses have both been reduced by yielding until the stresses could be borne by the material.

The formation of the great telegraphic longitude net, covering the United States and spanning the Atlantic, is a geographic feat worthy of especial note. This great net comprises no less than four transatlantic telegraphic determinations (1866, 1870, 1872, 1892), serving to connect the longitude system of this country with Greenwich and Paris. The whole system, including the European connection, is composed of 45 stations connected by 72 determinations of difference of longitude. The average value, without regard to sign, of the corrections to the separate determinations arising from the least square adjustment of this great net is only one-fiftieth of a second of time, and the maximum value is $0.^{s}069$ (to a determination in 1866). The probable error of an adjusted longitude difference is $\pm 0.^{s}024$.

In that grandest of geographic undertakings, the measurement of the earth as a whole, another method of attack is by the use of the pendulum for the measurement of gravity at various points upon the earth's surface. The activity of the Coast and Geodetic Survey along this line may be inferred from the fact that its observers have occupied over 60 home stations and 28 foreign stations.

The importance of a geodetic survey can not be properly judged by the number of points directly established by it. It bears the same relation to other surveys covering the same territory that the Supreme Court does to lower courts. Its results are of such a high degree of accuracy that it stands in the position of a court of last resort among surveys; it serves to prevent too great an accumulation of error in other surveys; to decide as to the right when two or more determinations by different surveys disagree; and to furnish indisputable points of departure for new surveys. It is in this relation to other surveys that the great geographic value of a geodetic survey lies. To the geodetic survey must properly be ascribed a part of the value of every survey based upon or controlled by it.

The relations of the Geodetic Survey of the United States to other surveys may be illustrated by a few instances taken almost at random. The Massachusetts State Survey, serving among other purposes to fix the township boundaries, is based upon the work of the national geodetic survey; two of the latest municipal surveys, that of Baltimore and that of the Borough of the Bronx* (a part of Greater New York), are based upon and controlled by the geodetic work of the Coast and Geodetic Survey; the topographic work of the United States Geological Survey is based upon triangulation by the Coast and Geodetic Survey in the regions covered by their triangulation; disputed portions of many of the state boundaries have been finally fixed by the Coast and Geodetic Survey. Among the latter cases, and within the last ten years, may be mentioned the oblique portion of the California-Nevada boundary now being located and marked after years of disputes and resurveys by various parties; a portion of the Maryland-Virginia line; the north boundary of Delaware; and the Indiana-Ohio boundary. The surveys on the part of the United States in connection with the disputed Alaskan boundary have been made by the Coast and Geodetic Survey.

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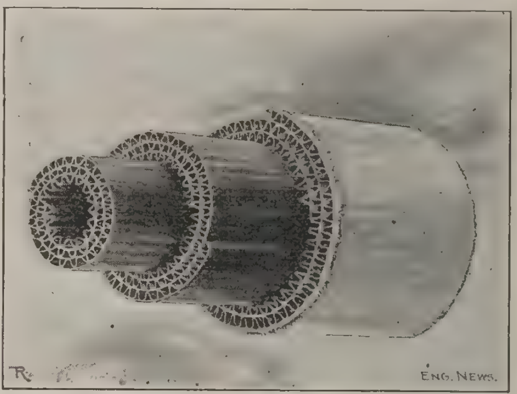
*Eng. News, May 19, 1898.

AN AIR CELL PIPE COVERING.

The pipe covering shown in the accompanying illustration, known as the "Gast Air Cell Covering," is designed to insulate effectually ammonia or brine pipes. It consists of corrugated and flat sheets of light straw board made up together in the form of split tubes. In placing the covering, after the pipe is clean and perfectly dry, the first section is sprung about the pipe, drawn tight, and the flap cemented down with paste or glue. The second and third sections are placed in the same way, except that each is slipped back, as shown in the cut, so that joints are broken. The total thickness of the covering for pipes up to 1½ ins. is 1½-in.; above this 2 ins. is used. The coverings are made in 3-ft. sections, the outer one having a canvas cover. In making elbows, tees and short bends a special filler with molded covers is used.



Corrugated Paper Insulating Covering for Pipes.

The peculiar construction forms a series of small air cells, one overlapping the other, the whole precluding the outside air from gaining access to the pipe. In this way no moisture can reach the pipe, and the formation of frost or ice on its exterior is, therefore, impossible. At the same time the circulating liquid is practically unaffected by temperature changes of the atmosphere or surrounding objects. The covering is also recommended for protecting water pipes from freezing in cold weather. It is made in sizes to fit ½-in. to 8-in. pipe, the former costing about 40 cts. per ft. and the latter $1.25 per ft., when in place; the other sizes ranging between these limits. The New York Fireproof Covering Co., 26 Cortlandt St., New York city, are the manufacturers. A steam pipe covering employing the same principle, using, however, asbestos paper instead of the corrugated straw board, is manufactured by the same company.

THE TRAINING AND WORK OF THE ENGINEER.*

By Chas. Wallace Hunt, Pres. Am. Soc. M. E.

A change has been taking place of late years in the work required of professional engineers. This has largely come from the development of our manufacturing establishments from the position of being a minor factor in our economic life, to being one of great importance, and the necessary employment of skilled engineers to conduct their technical affairs.

The engineer of the user and the engineer of the maker have widely different duties. Consider how different may be the information required in practice by two classmates, whom we will designate as "A" and "B," who graduate from college as engineers. "A" secures a position in the engineering department of a city, and commences his work, which may be the designing of a new water pumping station. His college course has fitted him for the work. His text-books were suited to problems of this character. He finds abundant information on all branches of the subject in data published in the proceedings of scientific societies, in technical literature, and in annual reports of city departments. The forms of contracts to be entered into are at hand, all found elaborately drawn, with every point safeguarded, and need only a little selection and adaptation to suit his case. They place in his hands the power to decide absolutely and without appeal all questions which may arise in carrying out the work.

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*Extract from the Presidential Address before the American Society of Mechanical Engineers, Nov. 29, 1898.

WEATHER TABLE FOR OCTOBER, 1898. (Furnished to Engineering News by the Department of Agriculture.)

	Stations.	Temperature. (Degrees Fahrenheit.)				Wind.			Precipitation—Rain or melted snow. (Inches.)		
		Average.	Max.	Min.	Range.	Velocity in miles per hour. Average	Velocity in miles per hour. Max.	Direction at time of max. velocity.	Total.	Heaviest in 24 hours	No. of rainy days
Northern Cities.	Northfield, Vt.	46.6	80	20	60	8.2	34	S	2.87	1.02	14
	Portland, Me.	50.0	81	31	50	8.2	37	S	5.90	1.63	13
	New York City	57.6	80	38	42	14.3	52	NE	9 14	1.55	12
	Pittsburg, Pa.	56.0	86	32	54	6.1	20	SE	3.84	1.46	11
	Chicago, Ill.	50.6	75	30	45	18.3	63	SE	3.26	0.86	16
	Omaha, Neb.	50.0	82	27	55	9.5	30	NW	2.54	0.87	8
	St. Paul, Minn.	45.8	81	26	55	8 6	30	SE	5.81	1.74	10
	Duluth, Minn.	43.8	79	28	51	11.4	34	SW	3.39	1.00	12
	Bismarck, N. Dak.	39.4	67	19	48	11.5	46	W	2.66	1.18	9
	Average	48.9	79	28	51	10.7	38	—	4.05	1.26	12
Southern Cities.	Washington, D. C.	57.8	83	30	53	6.6	28	E	3.54	1.04	12
	Louisville, Ky.	58.2	90	31	59	8.3	32	S	2.85	1.02	12
	St Louis, Mo.	56.0	86	32	54	10.7	39	SW	4.34	1.48	13
	Savannah, Ga.	67.6	89	39	50	10.2	60	NE	4.46	2.85	12
	Kansas City, Mo.	53.4	89	30	59	10.5	33	NW	4.40	2.61	7
	Jacksonville, Fla	70.0	90	40	50	8.3	60	W	6.74	3 59	17
	Chattanooga, Tenn.	59.0	87	32	55	7.4	34	SW	4.08	1.42	11
	New Orleans, La.	67.6	89	43	46	8.4	35	NW	1.77	1.07	6
	Memphis, Tenn.	60.8	90	35	55	10.4	40	SW	3.14	1.27	9
	Palestine, Tex.	66.1	97	34	63	6.4	36	NW	2.42	1.00	8
	Average	61.6	89	35	54	8.7	40	—	3.77	1.74	11
Western Cities.	Helena, Mont	40.8	65	21	44	7.2	37	SW	1.10	0.37	8
	*Port Crescent, Wash	47.2	60	32	28	3.5	20	SW	4.80	1.62	19
	San Francisco, Cal.	61.2	81	50	31	7.6	30	W	0.86	0.45	4
	Salt Lake City, Utah.	48.2	76	30	46	5.2	34	SW	1.57	0.74	4
	Santa Fe, N. Mex.	49.4	73	22	51	6.1	30	NE	0.54	0.54	1
	Denver, Colo.	49.0	84	20	64	8.3	40	SW	1.05	0.54	6
	Yuma, Ariz	—	—	—	—	—	—	—	—	—	—
	Average	49.3	73	29	44	6.3	32	—	1.65	0.71	7

* Port Angeles closed, station moved to Port Crescent, 10 miles distant.

"B" obtains employment in the engineering department of a manufacturing corporation, which in due time estimates and submit tenders for the pumping plant for which "A" has issued specifications. He will find that the form of contract proposed by "A" has many minute and carefully worded clauses to bind and limit the supplier. The tender to be submitted for the work must in its scope and wording protect the interests which "B" represents not only in a general sense, but in every one of the clauses of the proposed contract. Every obscure phrase and every adjective used by "A" must have definite consideration and be clearly defined in both an engineering and legal sense. "B" here finds that the information derived from his college course is largely inapplicable, and there is no technical literature which he can use, either as a general guide for making a form of tender or the proper expressions to use to define or limit the obscure clauses or words found in the specification.

Looking at the subject from a purely technical point of view, we see quite as great a variation in their work. "A" would require only a general knowledge, while "B" would require the most thorough and exhaustive information of the qualities of constructive materials, and shop practice available in that particular location. The farther we carry the comparison of their work, the more clearly it is seen that the educational requirements are becoming more complex to correspond with the growing specialization of engineering work.

Engineering Practice Abroad.

There is another phase in engineering practice represented by the duties of "A" and "B" which now becomes interesting if the work of American engineers is to take the place in the world at large to which the indications now so plainly point. In other countries it is a common practice for "A" to make all the general designs and all of the details, and the supplier has no responsiblity either for the design or for the efficient working of the plant when completed. If errors or omissions are found in the drawings or specifications, the cost of the changes required are paid by the purchaser, in the usual bill for extra work. In this case the duties of "B" are small or disappear altogether.

American Engineering Practice.

The American practice is tending to the method of making the requirements issued by "A" of a general character which will cover the results sought, and leave to the supplier, 'B," the work of designing the particular means to accomplish the desired end. Business has become of such a magnitude, and so complex that one mind cannot fully grasp, and readily handle, the new discoveries, new materials and new practices, which now come so rapidly. For efficient and economical results, each phase must be handled by an expert. There will be many "B" engineers to respond to the requirements of "A," and each will present for consideration different ideas, different materials, and different shop practices. "A" must select from these various plans and details submitted, the one which best promises to fulfill the requirements. It is a division of labor between "A" and "B," each of whom, by tastes and training, is especially fitted for his part of the work. We may paraphrase their duties by saying that "A" is a judge, "B" is a counsellor.

Post-Graduate Needs.

At the present time we cannot expect our technical schools, painstaking and perfect as they are, to prepare both "A" and "B" fully for such new and varied duties, or even to have their instruction in the practice of engineering fully abreast with the latest practice, or at least not until progress in the arts and sciences has substantially ceased. It takes time for a new practice or a new result to be recorded, published, considered, and adopted by the teaching staff. This difference between the teaching and the engineering practice of the day is not only an indication of progress in engineering, but in some measure an index of its rate. The student then must expect, as a normal proceeding, to supplement his graduating acquirements by further study, together with association with his professional brethren, in order to place himself abreast of the times, and to be fitted for the most effective and useful service.

Engineering theory and practice are rapidly extending with the general advancement of our economic interests, and the engineer, whether he be a young graduate or otherwise, who does not make use of the modern aids to information, among which are to be counted scientific societies and literature, and a personal association with his brethren, with the innumerable hints and suggestions which come from these, will soon be found struggling with what seems to him adverse fate, but what, in reality, is inferior knowledge, behindhand knowledge; or, plainly speaking, ignorance greater or less. The engineering world has passed by him, and he must then view the working out of the law of the survival of the fittest, with what grace he may.

The advance made in the accumulation of useful data and more accurate knowledge in practical engineering gained one season, is presented to a scientific society the next, and still later it will be embodied in text books for the instruction of students who are soon to take our places and carry on our work. Until attention is called to the subject, we are not likely to realize that in their essential parts the great bulk of the engineering data available to us now have been first presented to a scientific society, and there permanently preserved until the time came for their utilization or application. It is from this great fund of information, principally accumulated during the last century, that we draw upon for the materials for our textbooks, our general treatises, and our engineering handbooks.

Scientific associations aim to add to the great fund of information available to every engineer the world over, and not for the benefit of a limited clientage. The greater the availability and the publicity given to the published proceedings of a scientific society, the more nearly has the society accomplished the chief object of its existence.

Industrial Progress.

It has long been evident that we are making rapid progress in perfecting our manufacturing machinery, as well as organizing and developing our industries, thus constantly increasing the efficiency of our labor, until we have lately reached a point where an hour's labor with its facilities produced more of our principal products, and transported them further, than an hour's labor would do in any other part of the world.

Commencing under adverse conditions and developing in a field of restricted capital, with scarce and high-priced labor, engineering in America has applied the forces and materials of nature to the uses of man in a characteristic way. Freedom from mediæval traditions and the hampering conditions found in the older countries, left them substantially free in the choice of means to accomplish their end. Influenced as our engineering has been by the experience and the work of other parts of the world, yet we cannot escape the fact that its development was essentially independent, and in some phases unique. Improvement has followed improvement in technical matters, profits and savings have been added to the capital invested in our industries until the continent, two hundred years ago an untraversed wilderness—one hundred years ago a struggling nation—struggling with industrial difficulties and serious political problems—has triumphed over these early limitations, and has developed into a nation which, in numbers, prosperity, and wealth takes a prominent position among the great nations of the world.

Effect on the Mind and Character.

The life of the engineer has a full measure of the labors, the trials, the discomforts, and the disappointments which are found in this, as in every other walk of life. But it also has the successes which come from well-directed labors. It is not, however, either the useful work or the successes of life which bring happiness. It is man's ideals which make him happy.

Whichever way engineering may develop as time rolls on, its elevating influences are constantly at work on the mind and on the character. The work is carried on under unchangeable laws, which must be rigorously applied and adhered to, or failure is sure to result. Man builds to master, to resist, or to guide the forces of nature. If he has rightly judged the conditions, his work stands as a permanent monument of the fact; but if otherwise, the irresistible laws of nature will develop the defect and discover his ignorance, incompetence, or error to every observer.

Hence he laboriously seeks out the unseen laws and forces, then expresses the revelation in a workable form for his daily use. He tests his materials with painstaking refinement. He measures electric resistances with an accuracy now reaching the point of one in four millions, time to the one three-millionth part of a unit, divides a circle with a mean error not exceeding the one-millionth of the circumference, makes surfaces 6 ins. square with a variation from absolute flatness of less than one-two hundred thousandth of an inch, rules lines which vary from absolutely perfect spacing by only one-three millionth part of an inch, sees clearly the spectrum of samarium when one part is diluted with three million parts of lime, and surveys lines 11 miles long in the open air with an average variation in three measurements of only four-tenths of an inch.

The Basis of Ethics.

The effect of living and working in such a sphere of action, where it is inconceivable that an engineer could knowingly be otherwise than exact in his work, should tend to influence the whole trend of his life and character, and makes them to a greater or less degree a reflex of his daily work. He of all men has the most unchangeable and exalted basis for his ethics—the clearest of all knowledge of the disastrous results which will surely follow the violation of law. The very qualities of his mind which makes his work a pleasure and a success will all tend to bring his every act into compliance with the inexorable laws of the universe. If it is otherwise, and his conduct is not guided by the laws of right doing and right thinking, and his ethics not in accordance with them, then, and to that extent, he is not an engineer—not one who is skilled in the application of the forces of nature to the uses of man.

THE METHOD OF ERECTING EGYPTIAN OBELISKS has long puzzled the student of Egyptian antiquities, and the numerous documents and wall-pictures found do not explain it. In a late issue of "Construction Moderne," Mr. J. C. Kruseman suggests a possible method of handling blocks of stone weighing as much as 1,000 tons, and sometimes 131 ft. high and 10 ft. square at the base. These blocks were also placed on pedestals considerably raised above the actual level of the soil. Mr. Kruseman finds that these obelisks were generally placed in front of pylons or temples. He believes that the Egyptians first built a slightly inclined causeway of sand or other material, equal in height at one end to the obelisk to be erected; ending at the end in a strong wooden crib, and leaving a space between the crib and the temple for the obelisk. The base was then built and the space between the temple and the crib was about half filled with sand; and on the face of the crib a strong inclined chute was constructed leading to the base. The obelisk was then rolled up the incline on hard wooden rollers; and, with tackle leading to the temple, it was then allowed to tilt over the front of the crib, falling into the sand and guided by the chute. By slowly and carefully digging away the sand and hauling on the top of the obelisk it would thus be gradually sunk, until it would finally rest on its base.

A VENEZUELAN EXPOSITION, of natural, agricultural and manufactured products and works of art, will be held at Caracas, from Jan. 1 to April 27, 1900. The exposition is also to include methods of education, social economy, hygiene, public charity, colonization, etc.

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The greatest discrepancy between the engineer's estimates and the actual expenditure in the work upon the Erie Canal Improvement under the $9,000,000 appropriation occurred on Contract No. 4 of the Middle Division, located on the Jordan level of the canal. According to the Canal Investigating Commission, the bid on which this contract was awarded amounted to $154,471 at the quantities named in the preliminary estimate. Up to May 1, 1898, the State had expended $581,879 on this contract.

The difficulties encountered in carrying on the work on this contract, and the methods tried for overcoming them are described on another page of this issue by Mr. Geo. A. Morris, Resident Engineer of the Middle Division of the Erie Canal. The difficulties of building and maintaining embankments upon deep beds of soft material such as bogs and marshes are pretty well known to most engineers; but so little has been done in canal construction during the present generation that many engineers have forgotten probably that it is even more difficult to dig and maintain a water-carrying ditch through a bog than to build an embankment across it.

It is of interest to note that the sliding banks on the Jordan Level of the Erie Canal were closely paralleled by the heavy slides on the new Soulanges Canal in Canada, which occurred a year ago (Oct. 26, 1897). The latter were much greater in extent and occurred suddenly, while the earth movements on the Jordan Level were comparatively slow. Both, however, are examples of the difficulties involved in canal excavation through certain soils, especially when saturated with water. It is proper also to point out at this time when engineers are engaged on estimates for such important works as the canals at Nicaragua and Panama, and from the Great Lakes to the ocean, that the difficulty in making and maintaining canal excavations through the troublesome materials above referred to increases rapidly with the depths which the excavation must reach. Abundant experience was had, in fact, at Panama, in the excavation of the sea-level section through the marshes on the Atlantic side, with the difficulties in economical ditch digging under such conditions. One huge Slaven dredge is said to have worked at one time for several weeks without moving from her position, the weight of the mud which she discharged upon the banks continually crowding in the banks and raising the bottom as fast as the material was excavated.

◆

It sounds like the boom times of a dozen years ago to read that the United States Commissioner of Railroads proposes that the Government shall construct "a first-class, double-track air-line railway," from Kansas City, Mo., to San Diego, Cal. Probably most readers will be puzzled to know who and what the U. S. Commissioner of Railroads may be. The public and all railway men are fairly familiar with the Interstate Commerce Commission; but not one in ten thousand, probably, knows anything about the Commissioner of Railroads. We may explain, then, that he is an appendage of the Interior Department, and his duties appear to consist in watching to see that the government-aided Pacific railroads meet their obligations to the Government—and drawing his pay. Since the Union Pacific was reorganized, and the Government's lien was wiped out, the Commissioner's time seems to have hung heavily on his hands, and we presume he has hatched this scheme for a Government railway to amuse his leisure hours. To do him perfect justice we will give the substance of his argument for the enterprise in his own words:

> The annexation of the Hawaiian islands, and the probable control of the Philippine and Ladrone islands, must open up new trade relations of such growing proportions with them as to so materially increase the business of all the bond-aided roads that it is within the scope of reason to anticipate their ability at an early date to pay principal and interest of their debt to the United States.
>
> The vast volumes of wheat and other cereals which now find their way from the middle-western grain prairies to Asia and to other countries of the western hemisphere, via the Atlantic seaports, will, in a very few years, reach these same destinations via Pacific seaports, and with this changed condition will come vastly increased tonnage and revenues to all the trans-continental lines. The diversion of this very traffic on this idea is now receiving the careful attention and consideration of the executive and managing officials of some of the leading lines between Chicago, St. Paul and other middle-western grain centers and the Pacific slope.
>
> It may be timely just now to suggest that the government construct and operate a first-class double-track railway from Kansas City, Mo., to San Diego, Cal., by air-line route. This will open the shortest line, measured by the map, from Boston, New York and Philadelphia to the Pacific coast, along and near the coal fields of the east and of the west this side of the Rockies, and making the most direct line from our great commercial centers to the Sandwich islands and the Philippines.
>
> This, with other lines now working overland, may prove ample for the wants of commerce to the Pacific coast and the Orient, holding trade and travel within our borders pending the experiment of a canal through the fevered climate of the isthmus.
>
> As trade increases it may develop the importance of a direct and a similar line to Seattle, in Washington state. St. Louis, Mo., is a little south of the direct line between New York and San Diego, but the topographical features of the country indicate that possibly a better route may be found from that point, and the bridge over the Mississippi River at St. Louis may prove an important consideration. A survey, therefore, by direct lines should be made from each on these points.

It is news to us that "vast volumes of wheat and other cereals" were being shipped from the Mississippi Valley to Asia. The Nicaragua Canal people have averred all along that one great object for their canal was to carry California's surplus wheat crop to a market in the East, because there was not enough market for it on the other side of the Pacific. However, if any such heavy traffic as the Commissioner anticipates is to be thrown upon the transcontinental railroads, it will not be necessary for the Government to undertake railway construction on its own account to add to their number. Private enterprise can safely be relied upon to furnish all the railways that the traffic can support; and public opinion will very promptly condemn any attempt to involve the Government in new Pacific railroad subsidies or construction.

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The Washington Patent Law Association has recently reported upon the various bills pending in Congress for the amendment of the patent laws; and has secured the opinions of a large number of patent attorneys and officials familiar with the work and needs of the patent office and of the courts which try patent causes. The Association has found that general agreement exists upon three points in connection with proposed patent reforms. These are (1), the necessity of carefully studying out some plan to put into the best shape the mass of material piled up in the United State patent office, so that a thorough search might be made by the examining corps, by attorneys making validity searches and by the public generally in search of information; (2), that there are now too many appeals in contested causes in the patent office; (3), that the present arrangement of circuit courts of appeals as courts of final resort is a failure in the patent system, and that one final court is wanted whose rulings will cover territory co-extensive with the grant.

From the first of these conclusions there can surely be no dissent, and we can go further and say that the only possible method of effecting the desired end is through just such a classification of patents by their subject matter as the Patent Office has put into use. At the last session of Congress an appropriation was made for the purpose of improving and perfecting the present classification, and we may expect that no small amount of good will be effected by this. This classification, however, applies of course only to existing United States patents. It is at least worth considering whether the U. S. classification might not be extended and applied to existing British patents. The cost of doing this would be well repaid by the saving in the labor of the examining force and by the greater certainty which would attach to the final allowance of a patent. Of course the classification might be still further extended to cover existing patents issued by other countries; but the difficulty and expense in making use of these patents on account of the necessity of translation would probably prevent them from being generally used by the corps of examiners. The work would be of great value to all seeking to learn the state of the art in a particular field of invention; but if Congress should go so far as to make existing patents in the English language available for consultation, it would do considerably more than anyone expects.

◆

A MODEL CITY CHARTER; THE REPORT OF A COMMITTEE OF THE NATIONAL MUNICIPAL LEAGUE.

In no one point has popular government, as it is carried on in the United States, been more criticised, than in its conduct of the affairs of cities. It is also true, we believe, that more hard work has been done in the endeavor to improve municipal administration than in any other field of governmental reform. State governments and our national government have gone on with little change in their methods of administration, in many cases, since their original establishment; but our cities have many of them had the most kaleidoscopic changes in the organic laws under which they are ruled, and the search for a city charter which shall make good government most easy and misrule most difficult still goes on.

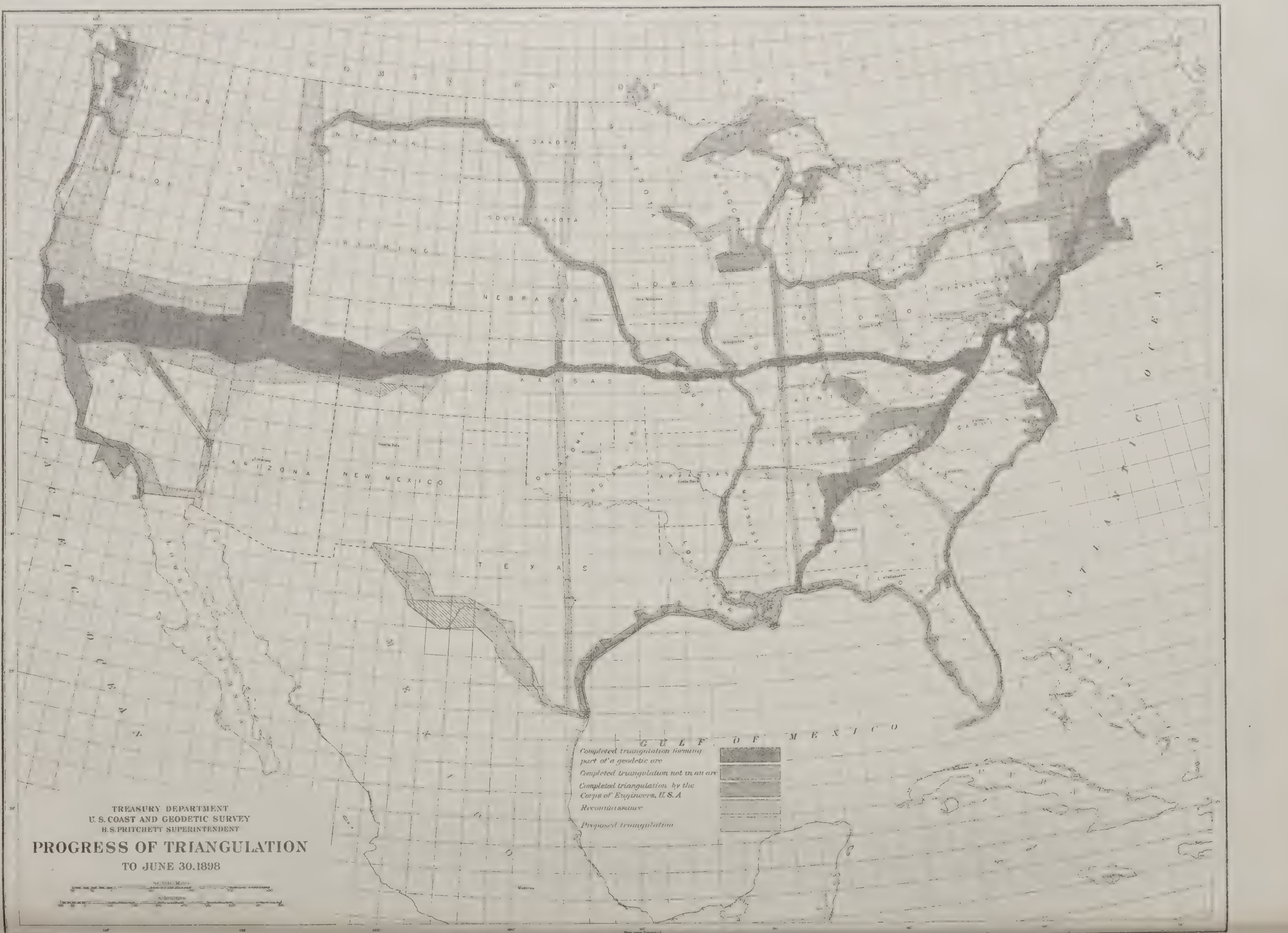
Up to the present time, however, the progress in city charter amendment has been too often a case of the blind leading the blind. Self-styled reformers have urged this or that change in a city charter, and have failed to foresee that certain evils as well as the expected benefits would attend the change. There has been need for a painstaking investigation by competent experts to determine just what form of administration will most conduce to good government. Such an investigation has now been made, and its results are made public at this week's meeting of the National Municipal League, at Indianapolis.

At previous conferences the good and bad points of American municipal government and charters have been discussed at length by many of our ablest students of municipal reform. At the meeting in Louisville, in May, 1897, the following resolution was adopted:

> Resolved, That the Executive Committee appoint a committee of ten, to report on the feasibility of a municipal program which will embody the essential principles that must underlie successful municipal government and which shall also set forth a working plan or system, consistent with American industrial and political conditions, for putting such principles into practical operation; and such committee, if it finds such municipal program to be feasible, is instructed to report the same, with its reasons therefor, to the League for consideration.

In accordance with this resolution a committee was appointed, but with only seven members, as follows:

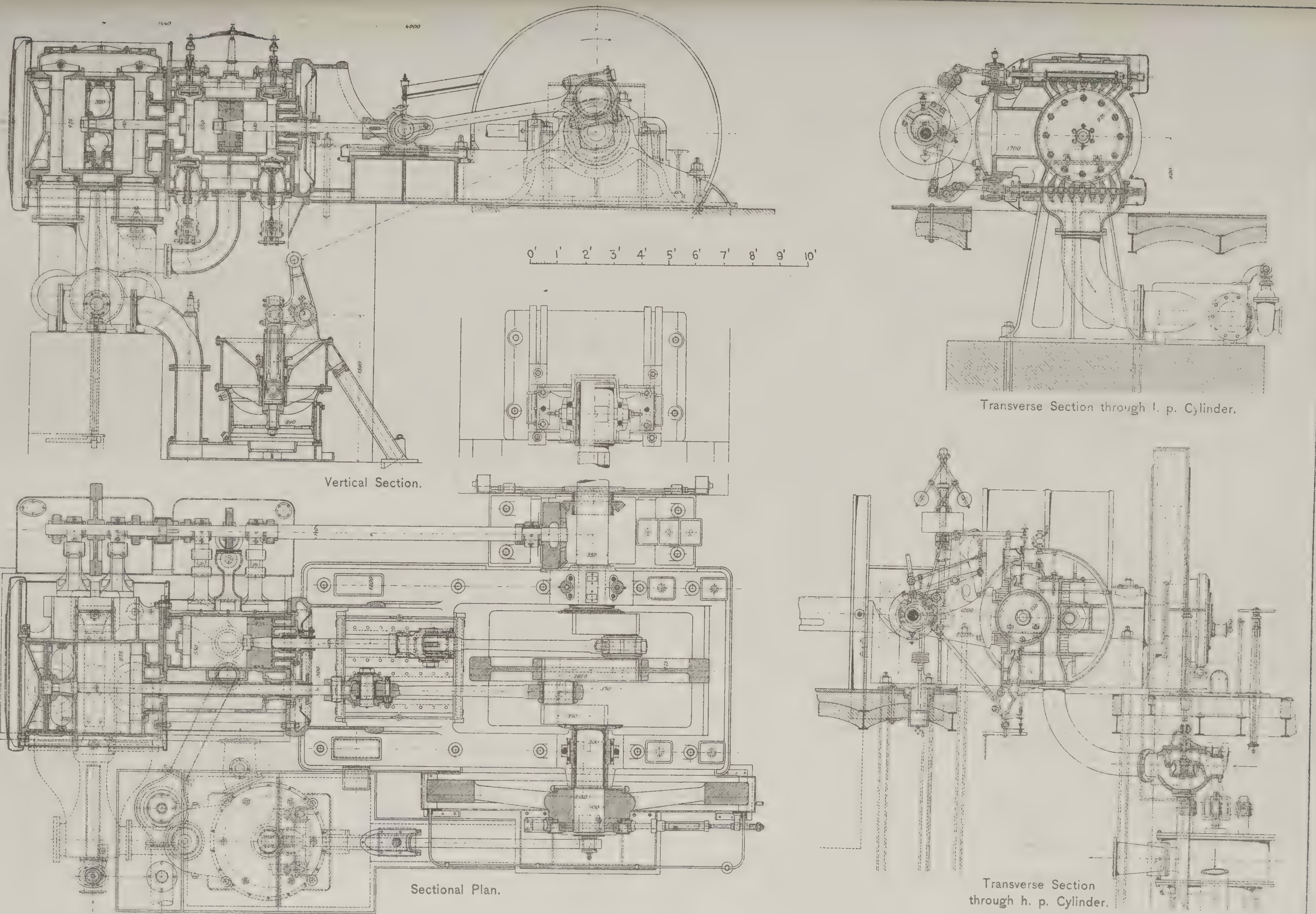
Messrs. Horace E. Deming, Albert Shaw and



TREASURY DEPARTMENT
U. S. COAST AND GEODETIC SURVEY
H. S. PRITCHETT SUPERINTENDENT

PROGRESS OF TRIANGULATION

TO JUNE 30, 1898



Vertical Section.

Transverse Section through l. p. Cylinder.

Sectional Plan.

Transverse Section through h. p. Cylinder.

COMPOUND ENGINE IN THE POWER HOUSE OF THE BUDAPEST, HUNGARY, ELECTRIC RAILWAY.

Designed and Built by L. Lang, Budapest.

CHAS. HART, LITH., 36 VESEY ST., N. Y.

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Prof. Frank J. Goodnow, of New York; Geo. W. Guthrie, of Pittsburg; Chas. Richardson, Prof. Leo. S. Rowe and Clinton Rogers Woodruff, of Philadelphia. Through the courtesy of the last-named gentleman, who is Secretary of the League, we have received an advance copy of the report, supplemented by papers by Messrs. Deming, Goodnow, Shaw and Richardson, and also a paper by Mr. Woodruff, reviewing "The Advance of the Movement for Municipal Reform." The report and papers,with anticipated discussion, will occupy the principal part of the attention of the conference at Indianapolis this week.

Although the report has been the subject of much individual effort, and of many conferences between the different members of the committee during the past 18 months, the committee believes "there is haste in leisure," and recommends that the program, papers and discussion be referred by the conference

> to a committee to be appointed by the executive committee of the league, with instructions to complete the work thus begun and to report, for action, a municipal program at the next meeting of the league.

We have thought it best to place the main features of this program before our readers, a large proportion of whom are in close touch with municipal affairs,, as citizens, officials, or in a business way, while few, if any, of them are not indirectly affected, for weal or woe, by good or bad city government. The committee recognizes, and distinctly states, that it is in the technical, administrative side of municipal affairs that much of the best work has been done, a statement that all thoughtful persons, and many of our readers, especially, will confirm.

The committee found that while many of the features of its program are already included in some municipal charter, constitutional amendments would be necessary in most states before all the features could be adopted. The committee, therefore, submits what may be termed a "blanket" constitutional amendment, from which each state may select what is necessary. This shows both the thoroughness of the work done and the magnitude of that which must of necessity be left to others. Every one who has given the matter attention knows how difficult it is to secure constitutional amendments, especially when the prejudices and perquisites of rural legislators are involved. But it is often well to know in advance the difficulties in the way. Municipal reform is becoming a mighty force, which only needs direction, if it keeps on the increase, to insure a fair measure of success regardless of the obstacles it encounters. As already intimated, much of this program can be put into effect without constitutional amendments, while the most sanguine person does not, or certainly should not, expect a program like this to come into universal use in such a republic of republics as ours, where not only several score of states are concerned, but several thousand municipalities as well. The greatest value of any such program must lie in its exposition of the principles involved. Few cities are likely to immediately abandon their present form of government and begin wholly anew under a new charter. We think, however, that no higher praise could be given the committee than the statement that it has come marvelously near presenting an outline of government capable of universal adoption. The reason for this is that it has confined itself to an outline, instead of falling into the common error of going largely into details. A few broad and deep underlying principles, based on wide experience and observation. are presented in sufficient fulness to warrant their ready comprehension and their observance, when once adopted.

The first one of these foundation principles we shall name is that a city charter should confine itself to matters of State, as distinct from local policy, leaving the latter for the municipalities to work out, each in accordance with its local needs, and in the light of experience. Such a plan makes unnecessary and inexcusable that continual legislative interference which is the bane of city government. It also renders it perfectly feasible for cities with a wide range of population to work under one general municipal incorporation act. The extent to which this plan would simplify and clarify state legislation is amazing, as will be appreciated when one reflects, as the committee suggests, on the vast mass of special municipal acts passed by many of our legislatures each year. With a few exceptions these acts may be divided into three classes: (1) Those prepared by and in the supposed interests of the municipality concerned, vouched for by some member of the legislature and railroaded through with little or no change. As such acts are generally prepared by some one not legally responsible, and are enacted without any feeling of moral responsibility, they are likely to be highly objectionable. (2) Bills prepared by individuals or "rings" to compass some private end, which are passed under the party whip or by "log-rolling." (3) Bills prepared to meet local demands but contorted to aid the ends of party managers or to satisfy rural or local prejudices.

To put a final end to all such legislation would be a great benefit to the communities concerned, and it would enable legislators at our state capitals to give more adequate and statesmanlike consideration to the other measures that come before them.

Realizing that the mere removal of the necessity, real or apparent, for special legislation would not be sufficient, the program prohibits all acts not applicable to all the cities or inhabitants of the state, except such as may be passed by a two-thirds vote of all the members of the legislature, and then either approved by a two-thirds vote of the council of the city affected, or passed by the legislature over the veto of the city council by a two-thirds vote of all its members, "which two-thirds shall include three-fourths of the members of the legislature from districts outside the city or cities to be affected." This provision will go far towards satisfying those who feel that in case of emergencies the legislature should be able to pass special municipal legislation, either to meet peculiar local needs or to furnish a check upon local officials when all other means fail. It will be noted that the municipal corporation act itself can be amended at any time, either directly, or by independent legislation, provided such changes or additions are not contrary to the constitutional amendments and apply to all the cities or inhabitants of the state.

To give still more elasticity to the program, where most needed, it is proposed that cities having a population of 25,000 or more may frame their own charters, subject, of course, to the principles laid down in the constitutional amendments.

It may occur to some that with such broad general powers and such freedom regarding details, the government of different cities would take on still more of that regrettable lack of uniformity which already prevails. But it is more probable that the opposite result would follow, for in the first place we should have a large increase of uniformity by the adoption of the same act of incorporation, and next the program recognizes the existence and provides for the continuation of the exercise of supervisory powers on the part of central or state admisistrative boards, like State Boards of Health. Besides this, city controllers, or heads of the finance departments, officials with great powers, are required under the program to report fully to some state official on the financial operations and conditions of each city, in accordance with forms prepared by the state official.

Before leaving the general subject of state control, by legislative or other means, attention should be called to one point forcibly brought out by the report: Extremes of state legislation in local affairs are often nullified by what may be termed local legislation by municipal officers. That is to say, the legislature goes into the details of local legislation, and even of local administration, but its mandates are left to local officials for execution. They use their discretion in the matter, and to that extent usurp legislative power. If the state wishes to exercise administrative powers, for the sake of uniformity or any other reason conducing to the general welfare, it should do so through central administrative bodies.

This brings us naturally to another important principle laid down in this municipal program, viz.: That the legislative and administrative powers of a municipality should be placed in separate hands to the greatest possible extent. We have not space to go into this matter, nor does it seem necessary. The program aims to effect this separation by vesting all legislative powers in the council and all administrative powers in the mayor, and in administrative departments created by the council, but with their members appointed by the mayor. All but the heads of such departments must be chosen by the mayor from lists of candidates certified to by civil service commissioners, these officials also being appointed by the mayor. Each civil service appointment is to be made by the mayor from the three highest names on the list of available candidates, preference to be given to citizens, if of equal rank or grading, honorably discharged from the army or navy of the United States.

Examinations of unskilled laborers are to relate only to "their capacity for labor and their habits as to industry and sobriety."

Probably some persons will feel that the heads of departments should be recognized at least to the extent of providing that they may express to the mayor their preference for some one of the three available candidates in any case, but in considering this matter it should be remembered (1) that the intention of the program is that the mayor and the heads of all departments shall be in harmony, hence the mayor would naturally consult the heads; and (2) that we must divest our minds of the picture, now so common, of a clean sweep of employees with each change of administration, and think of the whole administrative force as very largely continuous. Promotions in the service are to be made in order of merit and seniority, in accordance with rules established by the Civil Service Commission, and the program has the following to say regarding tenure of office:

> No officer or employee in the administrative service of the city shall be removed, reduced in grade or salary, or transferred because of the religious or political beliefs or opinions of such officer or employee; nor shall any official in the administrative service of the city be removed, reduced, or transferred without first having received a written statement setting forth in detail the reasons therefor; a duplicate copy of such statement shall be filed in the office of the Civil Service Commissioners, and at the option of the official who shall have been removed, reduced or transferred, such statement of reasons, together with the reply thereto made by the officer removed, shall be made a matter of public record in the archives of the city. Subject to the foregoing provisions of this act, all persons in the administrative service of the city shall hold their offices without fixed terms and subject to the pleasure of the mayor.

The last sentence, coupled with other provisions of the program, seems to mean that heads of admistrative departments, as well as subordinates, are to hold office until removed for cause, which cause shall be neither political nor religious. The only difference between the appointment of heads of departments and their subordinates would also seem to be that the mayor can select the heads in entire independence of the civil service commission or examinations of any sort. This plan should give great stability to the whole administrative machinery of a city, resulting in trained public servants of high technical ability, where such are necessary, and a high grade of efficiency on the part of all the employees, since all know they will be retained if faithful and able and are very liable to have to go if not. It would lift a load of anxiety from many an engineer, superintendent of water-works, streets or sewers, for instance, if he knew he were not liable to lose his position at the next election.

The only appointment made by the city council, except those pertaining to its own officers and servants, is the city comptroller, or head of the finance department. But while the council is shorn of all appointments save these, its functions in other respects are very greatly increased, as compared with the general American practice at present. All legislative functions are lodged in it, instead of being deposited, as is now so common, in boards of public works and other bodies having both legislative and administrative powers. Two other additions to the dignity and importance of the individual councillor are (1) that the legislative body is composed of but one branch, and (2) that the term of office is for six years. The acts of the council are subject to the mayor's veto, but this may be overridden by a certain majority (left blank in the program). The mayor, and not the council, prepares the annual budget, and the council cannot increase, but it may decrease, any item. On the other hand, the council makes specific appropriations of available funds, which the mayor may veto in whole or part, but the veto may be overridden. The total indebtedness and the percentage of the tax rate to the total valuation of the city are to be limited in the charter, but the fixing of the limit is left to the discretion of the state legislature. Debts for revenue-producing works are to be excluded in determining whether the city has reached the bonded debt limit, while reports on this and other financial matters are to be made by the city comptroller to a state officer or commission, and are designed to place each city's officers under some surveillance.

The policy of each city as to municipal ownership of water-works, lighting plants, street railways, and all such undertakings, either through purchase or construction, is left to the council, and the exclusion of debts for these purposes from the aggregate used to determine the debt limit gives councils more scope in this matter than they ordinarily have.

When franchises are granted they must be in the nature of leases for 21 years, with a payment to the city of a percentage of the gross revenue, and provisions for ultimate acquisition of the works in question, the price to include nothing for the value of the franchise, and the method of determining the purchase price to be stipulated in the franchise. To the end that the city shall be possessed of full information regarding all franchise-holding companies, such companies must report fully to the city their financial transactions, and these reports shall be public records. To render the omission of such reports less likely, and to ensure the inclusion of the desired figures, the program provides as follows:

> The accounts kept by a city shall, among other things, be designed to show in each case of a grantee of a franchise from the city rendering a service to be paid for wholly or in part by payments by users of such service:
>
> (1) The true and entire cost of construction, of equipment, of maintenance, and of operation thereof;
>
> (2) The amount of the cost collected annually from users of the service, and the character and extent of the service rendered to users in consideration for the payments by them;
>
> (3) The amount of the cost collected annually from taxpayers as such, and the character and extent of the service rendered the city in consideration for the amount paid annually for such service by taxpayers.

We have urged for years that franchises should be limited as to length, and be drawn with more care for the interests of the cities concerned. We have also pointed out, if we remember correctly, the advantages to both companies and cities of having greater publicity in the accounts of franchise companies. These advantages are seen and appreciated by some holders of such franchises and corporation lawyers.

A novel feature of the program, so far as American practice is concerned, is the provision that heads of departments, ex-mayors and mayors, may participate in the deliberations of the council; of course they cannot vote. The councilmen are to serve without pay, and to be elected on a general ticket, instead of by wards or districts.

One feature of the program which is open to objection is the limitation of all contracts for services or material to five years. There are some services which can be rendered much more economically to the city under a contract for a longer term of years, such as garbage disposal, where an expensive cremation or reduction plant must be provided. Under a five-year contract the risk of failure to secure its renewal must be offset by higher prices. The same thing is true to a large extent of electric lighting contracts.

Somewhat in the same category is the provision that all bonds must be redeemed within 20 years. Indebtedness for some purposes might very properly be extended over a longer period, depending, somewhat, upon the life or availability of the thing acquired. Thus, real estate or water rights, which will appreciate, rather than depreciate, in value, and serve future generations, might be paid for in longer term bonds than those issued for a pumping plant. But the time limit on both contracts and bonds is right in principle, and it must be remembered that this is a propaganda of principles rather than of detailed requirements.

Finally, it is to be noted that the program provides for municipal elections separate from state or national elections; for minority, proportional or other form of representation in the city council, to be determined by the vote of the people, either when the question is presented to them by the council, or by a petition signed by a certain percentage of the qualified electors; and that all nominations to elective offices are to be made by petition signed by legally qualified voters. The last provision is designed to vest the nominating power in the people instead of in the managers of the political machines.

LETTERS TO THE EDITOR.

Comparative Economy of "A" Type and Riveted Trusses for Short Spans.

Sir: The article published in your issue of Aug. 25, 1898, "Bridge Work on the Kansas City, Pittsburg & Gulf R. R.," contains a description of the patented "A" truss designed for short spans, and gives stress sheets, details, etc., for 100-ft. single track through spans as actually built in 1893. The advantages claimed for this type are, to quote the article referred to, great rigidity in all directions, ease and cheapness of erection, and economy in metal when structures of this type are compared with structures of other types having equal strength and rigidity. The inventor "considered the ordinary through Pratt truss too light and vibratory, and the riveted truss as then built, clumsy, unscientific and uneconomical." The faults of the short span Pratt truss were so well known in 1893 that it is safe to say that this type had about ceased to be used for 100-ft. spans at that date, but an examination of some of the riveted bridges designed in 1893 or constructed previous to that year will show that the criticisms applied to this type are not well founded.

The span shown in Fig. 1 is one of several built for a leading railway in the latter part of the year 1891. These spans were designed for a live load approximating that used in the design of the "A" type spans described in the article referred to, but were built of iron and were consequently heavier than if they had been built under "steel" specifications. An examination of the drawing does not reveal a want of science or an appearance of clumsiness either in detail or in general design. Fig. 2 shows a span designed in 1893, but not built. The span was designed for practically the same live load as the "A" type span and the sections proportioned for "steel unit stresses." Comparing the trusses and upper bracing of the span with the "A" truss, since the flow and lower lateral system could be made the same for both spans, we find a difference in both weight and stiffness in favor of the riveted type as follows:

	Type "A."	"Rvtd." Type.	Difference.
Weight, trusses and upper bracing, lbs.	66,900	50,700	16,200
Calculated max. live load, deflect'n, ft.	0.0453	0.0377	0.0076

With such a difference in both weight and deflection favorable to the "riveted" type it would seem that this type is by far the best for such crossings and has the additional advantages of presenting a pleasing appearance to the eye, which cannot be said of the "A" type. In the matter of erection the only difference would be in driving about 800 more rivets in the riveted type than the "A" type, a small disadvantage when the additional stiffness obtained by using rigid joints is considered. Should the riveted span be made to weigh the same as the "A" span the additional metal thrown into bracing or into the trusses would increase its rigidity greatly, a point in which it already has the advantage with its lighter weight.

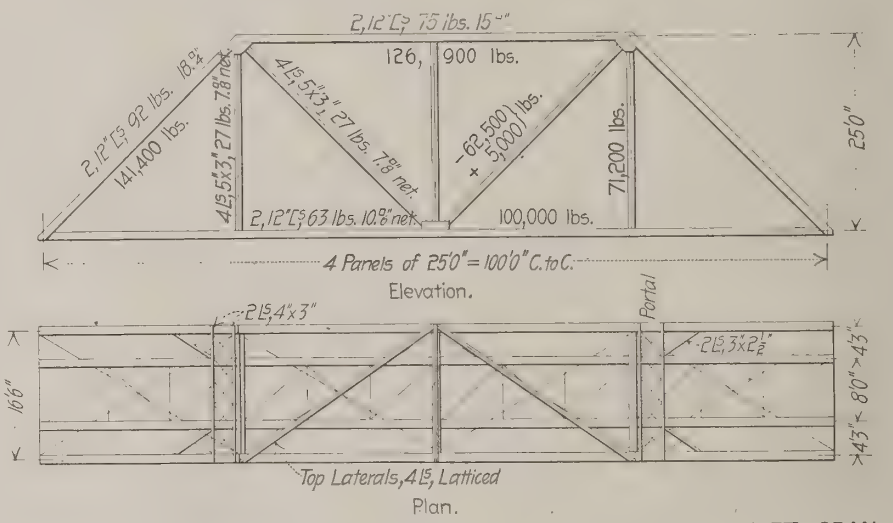

FIG. 1.—WROUGHT-IRON RIVETED TRUSS RAILWAY BRIDGE OF 100-FT. SPAN DESIGNED IN 1891.

Respectfully yours,
H. C. B.

Philadelphia, Pa., Oct. 1, 1898.

(In accordance with our usual practice, we submitted a proof of the above letter to Mr. Waddell, and we append his reply below.—Ed.)

Sir: In answer to H. C. B.'s letter of Oct. 1, I would state that his principal point was well taken, in that the type of bridge he illustrates is good. I have been using it for the past year or two, and have found it very satisfactory. However, it was not in common use in 1893, and can hardly be said to be so to-day. My disparaging remarks concerning the riveted trusses of those days referred to the lattice girder or multiple intersection truss.

H. C. B.'s comparison of weights appears to be faulty, showing as it does that the A truss requires 16,200 lbs. more material than does the riveted truss. As a part of my office records, I have just completed a book of diagrams of weights of fixed spans of all ordinary kinds for all classes of the "Compromise Standard System of Live Loads for Railway Bridges," designed in strict accordance with the specifications of "De Pontibus." Referring to this I find the following weights of metal for 100-ft. spans of Class X, which is the standard adopted by the Kansas City, Pittsburg & Gulf Ry. Co., the owner of the structures under consideration:

A truss span........................	1,240 lbs. per lin. ft.
Riveted truss span	1,190 " " "
Difference in favor of the latter =...	50 lbs. per lin. ft.

or 5,000 lbs. for the span.

This extra weight of metal is more than offset by the more expensive field riveting of the lighter bridge.

I must acknowledge that the result of my assistant's computations in respect to the weight of metal in these two types was a surprise to me, as I had not hitherto recognized such great economy of metal for the riveted type. As for the deflections, theoretical figures don't amount to much, especially on such short spans. H. C. B. finds maximum deflections of 0.54-in. and 0.45-in. for the A-truss and the riveted truss, respectively. The engineer who put up one of my 100-ft. A-truss spans found only 0.31-in. with the heaviest load he could get on the bridge, so it is safe to conclude that the maximum load would not have brought the deflection up to 0.4-in.

One great advantage of the A-truss bridge is the ease, rapidity and economy in its erection, while nothing that I have ever seen can beat it for rigidity. Moreover, its appearance is by no means unpleasing to the eye, as H. C. B. claims it is; at least, this is what everyone tells me who has examined this type of structure, and the accompanying view of one of the A-truss bridges erected on the line of the K. C., P. & G. Ry., as above noted, will also enable each reader to judge for himself to some extent in this respect.

Very respectfully yours,
J. A. L. Waddell.

Gibraltar Building, Kansas City, Mo., Nov. 12, 1898.

An Opportunity for Bridge Engineers to Practice Engineering Ethics.

Sir: We have heard a good deal about the "ethics" of the engineering profession from time to time, but beyond mere academic discussion nothing has been accomplished toward a code of action, and probably nothing ever will be from the nature of men and things, and from the fact that engineering is as much a business as a profession. While abstract preaching on such matters cannot be crystallized into concrete organized action among engineers, it has, however, its value in quickening the conscience, so that the individual may aspire to a greater reverence for the golden rule, and a respect at least for the eighth commandment, "Thou shalt not steal," which last injunction, by the way, was the sole platform on which a great political campaign was recently fought in an adjoining state.

The above remarks are apropos of the circular of the Quebec Bridge Co., issued to the bridge builders of this country. This circular affords the profession as represented by our great contracting firms an opportunity to exhibit the extent of their interest in the ethics of the profession. The Quebec Bridge Co. has in view one of the most difficult technical problems of bridge building ever presented to the profession. With a gall unparalleled, it has issued an invitation to contracting engineers to come to its aid and expend large sums of money to furnish it brains and experience, and binds itself to nothing in return therefor. It is known that this company has yet to be financed, and the magnitude of the enterprise makes it very doubtful whether it is commercially warranted, even with a liberal government subsidy or guarantee, which is hoped for, but not secured. The invitation is accompanied by an elaborate set of specifications covering the requirements which must be met, such as loads, strains, spans, grades, etc. Several variations of design are asked for under different conditions, any one of which is a special computation, involving vast labor. They will graciously receive anything in the suspension bridge or cantilever line, the only two possible directions in which the problem can be met.

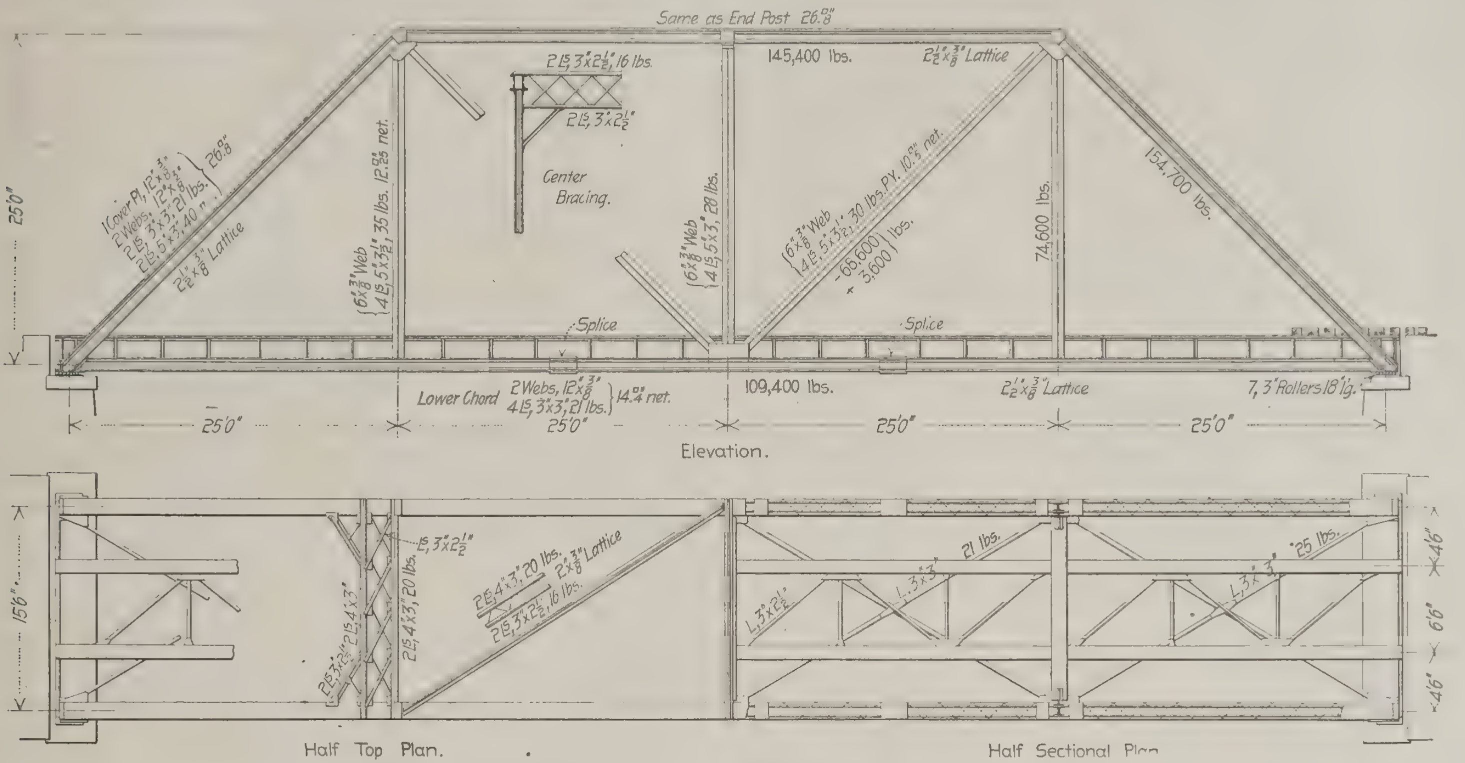

FIG. 2.—STEEL RIVETED TRUSS RAILWAY BRIDGE OF 100-FT. SPAN DESIGNED IN 1893.

This is a deliberate attempt to get something for nothing, and to obtain practical information at a great cost to everybody foolish enough to furnish it, with which the bridge company will endeavor to formulate a plan of financing on which to appeal to capital. If our contracting firms are fools enough to put at the disposal of such a concern as the Quebec Bridge Co., without compensation or a pledge of any kind, their computing room, and their drawing room, for three or four months, with their accumulated experience of years, they will only have spent their money for the pains, and receive a polite thank you (possibly) from the bridge company. It may be urged that the above method is pursued as a matter of common practice and is therefore not dishonest or immoral. In answer it may be said that most corporations furnish their own plans complete on which tenders are invited, and in other cases, when the contractor furnishes his own plans, it is for corporations prepared to proceed with their work, and on the understanding that the competition invited has a conclusion in a definite award. A contracting company will sometimes back an enterprise in promotion, spending large sums in plans and engineering, for a possible reward to accrue to itself alone, but this is its own affair and is dishonest to no one. But a cold-blooded attempt in cunningly appealing to the business instinct of greed and competition, for the purpose of obtaining, free of cost and obligation, the accumulated experience of the country, simply to find out what can be done so as to get something tangible to go before capital on which absolute cost can be predicted, should be met by our American contracting engineers with indignant refusal. If the engineers of the bridge company are unequal to design a structure to meet the problem, the honorable course to have pursued would have been to have offered a prize or prizes for the best plan, or better, to have selected some half dozen concerns or engineers of established reputation, paying them at least the cost of their outlay for preparing their plans, and submit the competition to a board of engineers for selecting the best and most suitable; the selected plan to be adopted and paid for, either by award of the contract to the successful party or on a per centage basis usual for such works.

It would seem as if the Quebec Bridge Co. were financially unable to pay for the information they are seeking, specifically avoiding, as they do, all obligation of any kind, and until they are in a position to bind themselves to a conclusion which would afford some protection to competing parties, it is sincerely hoped that our great engineering firms will let the enterprise severely alone, not only in the interest of good professional morals, but also of their own pockets. To be made use of is bad enough, but to be made use of at a cost of some thousands of dollars, without the slightest contingent promise even, is a good deal worse.

A. P. B.

New York, N. Y., Nov. 14, 1898.

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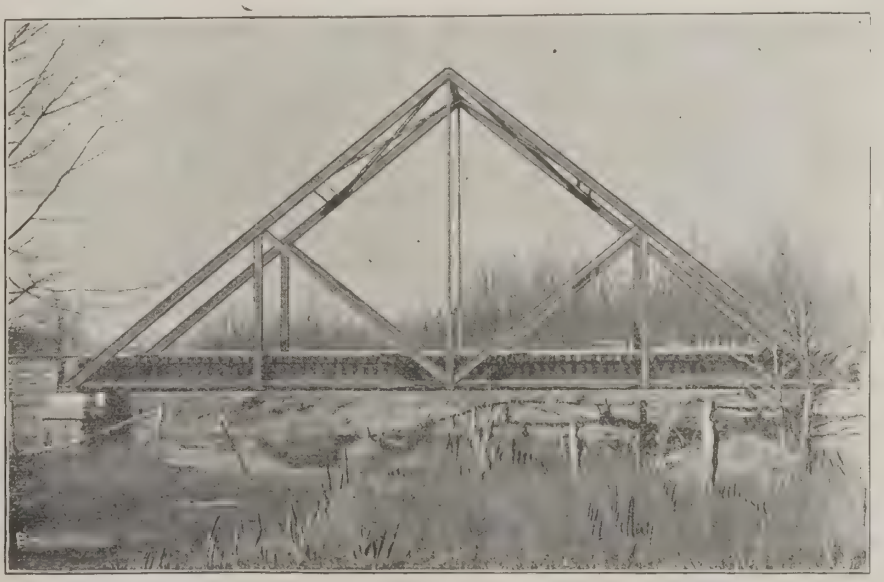
(According to our usual practice, we submitted a proof of the above letter to the Quebec Bridge Co., Ltd., with the privilege of replying in the same issue to the criticisms contained in it. We append the reply received from the Secretary of the company.—Ed.)



100-FT. SPAN A-TRUSS BRIDGE ON KANSAS CITY, PITTSBURG & GULF RY., NEAR JOPLIN, MO.

Sir: The action for which the Quebec Bridge Co. is so severely arraigned before the tribunal of public opinion, is the fact of having at once invited tenders and competitive designs for a cantilever or a suspension bridge, without furnishing more than a general plan and general specifications. Your correspondent, A. P. B., condemns such a method as being a transgression of the law of ethics which he suggests should govern the engineering profession, but his own admission that there is not, and probably never will be, a written code to the effect he aims at, should have extenuated in his own judgment the gravity of the offence, if any. Particular cases are very seldom dealt with by the simple use of abstract principles or aphorisms, and with a little reflection, very rash applications of the eighth commandment would sometimes be avoided.

The undersigned hastens to repudiate, in behalf of the Quebec Bridge Co., any such intent or motive as is so freely imputed to the latter by your correspondent. The procedure decided on, to ask at once for competitive designs and tenders, was no "deliberate attempt to get something for nothing," but the natural outcome of circumstances about which A. P. B. manifestly knows nothing. It was adopted purely and simply because it then seemed to be the speediest arrangement for the purpose in view. The prize competition system was not entertained, because it does not generally bring up the same reliable class of respondents as if coupled with a formal invitation to tender for the work. In the first case, a scale of money reward is offered for the two or three first best designs, because designs alone are in view; in the second, the prize, being the letting of the contract to the most deserving, is generally considered well worth the risk. At all events, I beg to affirm that the decision to ask bridge building firms to tender on their own designs was taken in good faith, with no such dishonest aforethought as is imputed by A. P. B., and that it was arrived at only after it had been ascertained that the arrangement would be accepted as perfectly honorable by a sufficient a number of big contracting companies to justify us in calling for tenders in that manner. As to those, if any, who would be inclined to share A. B. P.'s opinions on professional dignity, their course is very easily traced: it is to refrain from tendering, but it is no reason for attacking our bridge company in the way A. P. B. does, any more than for describing as fools those who are willing to compete at once for the designing and the construction of our bridge.

As to the financial aspect of the question, on which your correspondent bases his whole argument, we squarely deny his right and qualifications to discuss it. His imputation that this company, composed as it is of 200 of the best citizens of Quebec, is unable to pay a few thousand dollars for the technical information it requires, and that it attempts to collect that information by crooked ways without any practical intention to use it, plainly shows he does not know what he is talking about. He surely does not contend that a private company ought to take the public in the confidence of its internal arrangements. How then can he speak of this company's inability to finance, and of the special conditions of its understanding with capitalists, as well as with the government and the city of Quebec? I have just now explained that, at the time the tenders were advertised for, it was with the express purpose to save time and to award a contract on the best competitive design thus secured, after due analysis by a board of competent engineers, in order to be ready to start work as early as possible next spring. I fail to see what dishonesty there is in such proceedings. Your correspondent admits himself that "when the contractor furnishes his own plan, it is for corporations prepared to proceed with their work." Such being our case, his whole argument falls to the ground, and he might have spared your readers his eloquent, though unjustified, sermon on professional ethics.

Ulric Barthe,
Secretary Quebec Bridge Co., Ltd.

Quebec, Canada, Nov. 25, 1898.

NOTES ON THE DEFINITIONS OF SOME MECHANICAL UNITS.*

By William Kent, M. Am. Soc. M. E.

The following paper has been suggested by recent discussions in the Society for the Promotion of Engineering Education, in which considerable difference of opinion was shown to exist between the physicists and the engineers in regard to definitions of the commonly used terms: force, mass, weight, etc.

If a body at rest, but free to move, whose mass is M, be acted on by a constant force, F, during a time, T, it will acquire at the end of the time a velocity, V.

The equation of the four quantities, M, F, T and V, is

$$F\ T = M\ V,$$

provided that the magnitude of the units in which these four quantities are measured, in any system of measurement, is such that the unit force is that force which will give the unit mass unit velocity in unit time, so that we may write

$$1\ F = \frac{1\ M \times 1\ V}{1\ T}.$$

From the equation F T = M V, we may obtain the four equations:

$$F = \frac{M\ V}{T}.\quad (1);\quad T = \frac{M\ V}{F}.\quad (2);\quad M = \frac{F\ T}{V}.\quad (3);$$

$$V = \frac{F\ T}{M}.\quad (4);$$

and from these four equations we may obtain definitions of the four unit quantities, each in terms of the other three, as follows:

(1) Unit force is that force which will give unit mass unit velocity in unit time.
(2) Unit time is that time in which unit mass will acquire unit velocity when acted on by unit force.
(3) Unit mass is that mass which will acquire unit velocity when acted on by unit force for unit time.
(4) Unit velocity is that velocity which unit mass will acquire when acted on by unit force for unit time.

These four statements, however, are not really definitions. They are simply expressions of arithmetical equalities. They have their analogues in the definitions based on the electrical formula C = E ÷ R, in which C is current in amperes; E, electro-motive force in volts, and R, resistance in ohms. Thus, unit current is that current which unit electro-motive force will cause to flow through unit resistance. Unit electro-motive force is that force which causes a current of one ampere to flow through one ohm. Unit resistance is that resistance through which one volt will cause to flow a current of one ampere.

These three definitions, as well as the four first given, are examples of reasoning in a circle. The definition of each quantity is expressed in terms of the other quantities. We may have other definitions, however, in which each term is defined independently, without reference to the other terms. Thus, in electricity unit current may be defined as that current which will deposit in a given time a certain amount of silver from a standard solution; unit electro-motive force as the electro-motive force existing between the poles of a certain standard cell; unit resistance as the electrical resistance of a certain piece of metal under certain standard conditions.

So in mechanics, unit mass may be defined as the mass of a certain piece of metal, such as the British pound, or the gramme. Unit force may be defined as that force with which the standard pound is attracted to the earth at London, or as some fraction—say, 1 ÷ 32.2 of that force; or, it might be defined as that force which will stretch a certain spring a certain distance, or, as that force which will elongate a certain steel bar a millionth part of its length. Unit velocity may be defined as the quotient of a certain distance divided by a certain time, the distance being the length of a certain piece of metal. Unit time may be defined as 1-86,400th part of a mean solar day, or, as the time in which a certain pendulum makes one vibration at London.

Referring again to the equation F T = M V, and choosing our units so that the unit force is that force which in unit time gives unit velocity to unit mass, we may obtain the following statements of the relation of the four unit quantities, F, T, M, V:

F × T = M × V

1 poundal acting for 1 second on 1 lb.
gives a velocity of 1 ft. per sec.

1 lb. " " 1 second on 1 massal
gives a velocity of 1 " " "

1 " " " 1 second on 1 lb.
gives a velocity of 1 gravital per sec.

1 " " " 1 timal on 1 lb.
gives a velocity of 1 ft. per sec.

The term "poundal" has been used by some English writers on mechanics. The terms "massal," "gravital," and "timal" have been invented for the purposes of this paper only. It is to be hoped that they will never be used in the text-books, and that the term "poundal" will soon be expunged from those text-books which have adopted it.

One pound force is the force with which gravity acts on the standard pound at London; 1 poundal is 1/32.19 of this force; 1 lb. mass is the mass of the standard pound; 1 massal is 32.19 lbs.; 1 gravital is 32.19 ft.; 1 timal is 1/32.19 of a second.

In the C. G. S. system, we have

1 dyne acting for 1 second on 1 gramme
gives a velocity of 1 cm. per sec.

1 gramme " " 1 second on 981 grammes
gives a velocity of 1 " " "

1 " " " 1 second on 1 gramme
gives a velocity of 981 " " "

1 " " " 1/981 sec. on 1 gramme
gives a velocity of 1 " " "

The "dyne" is a term used in the text-books. It is the force with which a mass of 1/981 gramme is attracted by gravity at Paris. New names might be invented for the quantities 981 grammes and 1/981 sec. 981 centimeters is 1 gravital, or 32.19 ft.

Out of the eight statements given above, we may select those that are most convenient for any given purpose, such as engineering practice, and throw away and forget the others, since the unnecessary multiplication of formulas, terms and definitions only gives rise to mental confusion and error. In engineering, with English weights and measures the third statement is practically the only one that is needed, and, translating the useless term gravital into its equivalent, we may write it: A force of 1 lb. acting on 1 lb. mass for 1 second, gives it a velocity of 32.19 ft. per second.

It may be convenient in electrical or stellar physics to use the dyne, or its multiple, the megadyne, but there seems to be no use in English measurements for the poundal, nor do we need any such terms as the gravital, the massal or the timal.

Prof. John Perry, in his work on "The Calculus for Engineers," London, 1897, says:

> I venture to say that there is not one practical engineer in this country who thinks in poundals, although all the books have used these units for 30 years.

The word pound is used in two senses, as the unit both of force and of mass (or weight). This need introduce no confusion, for whenever it may be necessary to make a distinction, we may say a pound force, a pound mass, or a pound weight.

We may rigidly define the pound force as the force which gravity exerts on the standard pound (a piece of metal) at London. The pound mass, or weight, is the standard pound itself.

It will be noticed that we cannot express the relation F T = M V in terms of the pound (or gramme) unit of mass and force, the second of time and the unit of velocity 1 foot (or 1 centimeter) per second, but in the English system we have either to introduce the numerical coefficient 32.19 or 1/32.19, and in the French system 981 or 1/981; or else, to invent a new unit such as the poundal, dyne, gravital, etc., in order to obtain an equation. If our unit of distance were 32.19 ft. of 9.81 meters, instead of 1 ft. or 1 centimeter, then we could express the equation without such a coefficient or new term, but the benefit would be infinitesimal in comparison with the confusion that would result from the introduction of a new unit of length. There is just as much reason, however, for using a new unit of length, such as a gravital, meaning 32.19 ft., as there is in using a new unit of force, such as the poundal.

The word mass, in what is said above, has been used in the sense in which it is used in the text books on physics, but it is used in another sense by most writers on engineering, namely, as the quotient arising from dividing the weight of a body at London by 32.19, or by dividing its weight (defined as the resultant of the attraction of gravitation upon it), at any other place by the acceleration due to gravity at that place, say 32.16 at latitude 45° at the sea level.

Some confusion often arises in the minds of engineering students from the use of the word mass in these two senses, and a like confusion sometimes results in the two senses in which the word weight is used. The definition of weight, above given—the resultant of the attraction of gravitation—is not the definition used in commerce or in engineering. The common definition of weight is quantity of matter as determined not by bulk (which is one meaning of the word quantity), but by weighing it; that is, comparing it by means of an even balance or platform scale with a standard weight, such as the pound. In common language, we say that we weigh a body; determine how much it weighs; obtain its weight in pounds, and these pounds are standard units of weight, so declared by act of Parliament, and so defined in the dictionaries. Modern writers on physics, however, say that this language is all wrong; that we should use the term mass instead of weight, when we refer to quantity of matter, and not to the attraction of gravitatation upon it. We should therefore say, perhaps, that we mass a body; determine how much it masses; obtain its mass in pounds, and that the act of Parliament was in error when it called the standard pound a weight and not a mass.

The definition of mass, commonly used by engineering writers, and sanctioned by such authors as Weisbach and Rankine, is the quantity of matter as expressed by the term W ÷ g, in which W is the weight of the body at London (either the attraction of gravitation on it at London, or its quantity as determined by comparing it with the standard pound anywhere on earth), and g is the London value of g, or the acceleration due to gravity at London, or 32.19. If, however, the weight of the body is that determined by weighing it on a spring balance standardized at London (which is not done in commerce or in engineering in the United States), then the mass would be the weight so determined, divided by the value of g at the place where the weighing is done.

The engineer uses the word weight in the sense in which the common people use it, and have used it ever since the word was known in the English language, and in the sense in which the physicist uses the word mass. The engineer uses the word mass to mean weight divided by 32.19, usually taken as 32.2.

Formulas commonly used by the engineer are

$F\ S = \frac{1}{2}\ M\ V^2$, formula for energy;
$F\ T = M\ V$, " " momentum;
$F = M\ A$, " " force causing acceleration;
$V = \sqrt{2\ g\ S}$, " " falling bodies, or for height due to velocity.

In the first three of these formulas the engineer always uses the pound as the unit of the force F, and for M he substitutes W, the weight in pounds, divided by 32.2. In the fourth formula, for accurate work, he must use the value of g for the latitude to which the particular problem in hand applies.

The difference between the physicist and the engineer is merely one of definition. There may be no objection to the physicist using for his own purposes the terms and definitions which he finds most useful or convenient, but it is an open question whether the physicist has the right to denounce the engineer's terms and definitions as improper, or whether it is advisable for the text-books used in teaching mechanics to engineering students, to use the definitions of the physicist instead of those of the engineer. The use of the term "poundal" is especially objectionable, for it is not used anywhere outside of the text-books, in any art, industry or profession. Much confusion in the minds of students of mechanics would be avoided if the term were denounced and dropped from the language.

A HOTEL IN SAN FRANCISCO BURNED to the ground on Nov. 24, causing the loss of five lives, the injury of four persons, and the destruction of over $2,000,000 worth of property. It is understood that the fire started in the café kitchen, and at the time there were several hundred guests and employees in the hotel. The building, owned by E. J. Baldwin, was completed in 1877, at a total cost of about $3,000,000, including ground. It was irregular in shape, being 200 × 400 × 300 ft. and 6 stories high, and it contained a theatre and several large stores on the ground floor.

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THE LOSS OF THE STEAMER "PORTLAND," of the Boston & Portland Steamship Co., off Highland Light, Mass., occurred in a severe storm on Nov. 27. The entire crew and all passengers, numbering about 117, were lost. The accident is attributed to a breakdown in her machinery, which allowed the vessel to drift onto the shore during the severe storm of Saturday and Sunday. The "Portland" was built in 1890 at Bath, Me., and was a side-wheel steamer 250 ft. long, 42 ft. beam, and 13 ft. deep, with a net tonnage of 1,317.

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A SUIT FOR INFRINGEMENT of the Hyatt patent on the use of a coagulant in connection with mechanical filters has been brought against the Jackson Filter Co., of St. Louis, by the New York Filter Mfg. Co. A hearing will be held on Dec. 13, in the U. S. Circuit Court, Eastern District of Missouri.

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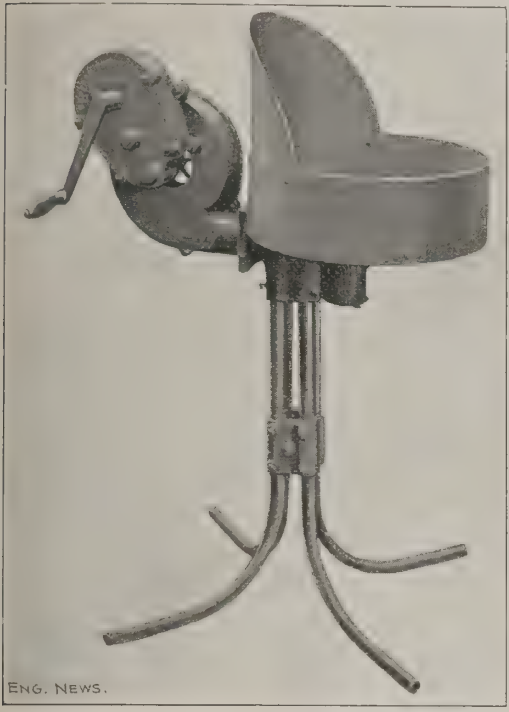
*A paper read before the session of Mechanical Science and Engineering of the American Association for the Advancement of Science, Boston meeting, August, 1898.

A PORTABLE FORGE WITH DETACHABLE PARTS.

The accompanying cut illustrates a new portable forge, manufactured by the Buffalo Forge Co., Buffalo, N. Y., which has some interesting features. For convenient packing and transportation it may readily be taken apart by loosening the clamp on the legs and the set-screws at the base. The crank is rigidly fixed to the shaft, which drives the gears enclosed in the dust-proof case, but the gear-case and the blower are both detachable from the tuyere pipe. No belts or chains are used in the driving gear, which consists of four spur gears, the two larger wheels having respectively 108 and 90 teeth, and the two pinions each 16 teeth, thus increasing the speed 37.96 to 1. The blast wheel is 9 ins. diameter, with five curved blades riveted to a sheet steel flange on each side. With 30 revolutions of the crank shaft per minute the peripheral velocity of the blast wheel is 2,684 ft. per minute.



Portable Forge, with Detachable Parts.

Manufactured by the Buffalo Forge Co., Buffalo, N. Y.

The body of the fire pan is made of No. 14 sheet steel. The total weight of the forge set up for use is 125 lbs. When taken apart and packed for easy carrying, it may readily be carried about scaffolding by one man. The gears are machine cut, the fan wheel is balanced, and the bearings are well finished, all contributing to ease of operation.

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THE BURSTING OF SMALL CAST-IRON FLY-WHEELS.*

By Chas. H. Benjamin, M. Am. Soc. C. E.†

Of late years the failure of large fly-wheels have become alarmingly common. Every month brings its record of one or more disasters of this sort, some of them entailing loss of life and serious destruction of property. It is not the purpose of this paper to discuss the causes of such accidents, further than to notice the fact that the high belt speeds and close regulation required in electric plants have been indirectly responsible. Many of the fly-wheels have failed on account of excessive speed due to disarrangement of the governor and consequent racing of the engine. In some instances it has been difficult to determine the cause on account of the destruction and excitement at the moment. In no small number of instances, however, the wheels have burst at speeds but slightly above the normal and when the factor of safety was apparently ample.

Mr. James Stanwood, of this Society, was the first to point out the condition of stress existing in a fly-wheel rim and to show that the bending due to centrifugal force might reduce very materially the bursting speed (Trans. A. S. M. E., Vol. XIV., p. 251). This subject was further developed by Professor Lanza, and the probable amount of stress due to bending was indicated as well as its effect upon rim joints (Trans. A. S. M. E., Vol. XVI., p. 208). It occurred to the writer that a series of experiments on small cast-iron wheels might throw some light on the causes of failure and lead to more rational formulas for design.

The quality of the metal in a small wheel is better than in a large, and the stresses due to uneven cooling are much less. The linear speed of rim at which a large wheel will burst will therefore be less than that obtained by experiments on small wheels.

The experiments about to be described were conducted under the immediate direction of the writer at the laboratories of Case School of Applied Science. The wheels were all of cast iron and were clean, perfect castings. Two diameters were used, 15 and 24 ins., and each wheel was a scale model of some actual fly-wheel designed by a reputable firm. The wheels numbered 1 to 10 had solid rims, with the exception of No. 5. Wheel No. 11 was a special wheel, as will be explained later. The wheels numbered 12 to 17 had each two joints in the rim and were 24 ins. in diameter. All the wheels numbered from 1 to 10 were reduced models of a solid-rim fly-wheel 10 ft. in diameter now in use on a 12 × 30 Allis-Corliss engine in the laboratory. The wheels numbered 12 to 15 were models of the same wheel on a larger scale, with rim joints designed by the writer. The two wheels numbered 16 and 17 were models of the fly-wheel of a Corliss blowing engine. Tables I. and III. give the dimensions of the wheels in detail.

To give to the wheels the speed necessary for destruction, use was made of a Dow steam turbine capable of being run at any speed up to 10,000 revolutions per minute. The turbine shaft was connected to the shaft carrying the fly-wheels by a brass sleeve coupling, loosely pinned to the shafts at each end in such a way as to form a universal joint, and so proportioned as to break or slip without injuring the turbine in case of sudden stoppage of the fly-wheel shaft.

One experiment with a shield made of 2-in. plank convinced us that safety did not lie in that direction, and in succeeding experiments with the 15-in. wheels a bomb-proof constructed of 6 × 12-in. white oak was used. The first experiment with a 24-in. wheel showed even this to be a flimsy contrivance. In all subsequent experiments a shield made of 12 × 12-in. oak was used. Even this shield was split repeatedly and had to be re-enforced by bolts. The wheels were usually demolished by the explosion. No crashing or rending noise was heard, only one quick, sharp report, like a musket shot.

The determination of the speed offered some difficulties at first, it being too great for the successful use of a counter or tachometer. A commutator of one break was arranged on the fly-wheel shaft and this connected through the battery circuit with an earphone in an adjoining room. This arrangement worked satisfactorily, giving a clear, musical tone, and the number of vibrations corresponded closely to the speed as measured by a reducing counter shaft and speed counter. It was soon discovered that the audible tone produced by the machine itself when running at a high speed corresponded exactly to the tone in the ear-phone, and consequently the ear-phone was discarded. Two observers, having trained musical ears and provided with tuning forks, had no difficulty in determining the pitch within half a tone, the quarter tones being estimated. The error due to this method did not exceed 5%. The bursting speed of the wheels having rim joints was too low to produce a musical tone with any distinctness, and it became necessary to resort to the tachometer, a counter shaft reducing the speed from two to three times being employed.

Fifteen-Inch Wheels.

Test pieces cast from the same ladle as these wheels were broken in the testing machine, and the following average values obtained for the breaking strength: Tension, 19,000 lbs. per sq. in. Cross-breaking, 39,000 lbs. per sq. in. These wheels were all turned on the face and edges of the rim, and were carefully balanced by winding copper wire around the arms near the rim.

The shape of fracture at the outer ends of the arms in all the wheels usually indicated that the rim broke first midway between the arms, and that then the two parts of the rim flew outward and broke off at the arm.

Wheel No. 5 had two joints in the rim at opposite extremities of a diameter. The strength of the joints was designed to be one-third the tensile strength of the solid rim, but the wheel burst at only 2,925 revolutions per minute with a centrifugal tension of less than one-fourth that of the solid wheels.

Nos. 6, 7 and 8 had only three arms, every other arm having been removed from the pattern before casting. The object of this was to show more clearly the bending of rim due to centrifugal force.

Wheels Nos. 9 and 10 were of the original six-armed type, but with rims turned down to exceeding thinness. The results are summarized in Table I. An examination of the column containing the value of v in feet per second will show that as the segments of the rim between the arms become weaker as beams, either through increase of length or decrease of thickness, there is a falling off in the bursting speed.

TABLE I.—Particulars of 15-in. Wheels Tested.

No.	Area rim, sq. ins.	Weight of wheel, lbs.	Bursting speed: Revolutions per min.	Bursting speed: Feet pr sec. = v.	Centrif'g'l tension = $\frac{v^2}{10}$.	Remarks.
1.	1.4	20.87	6,525	430	18,500	
2.	1.3	20.44	6,525	430	18,500	
3.	1.23	19.12	6,035	395	15,600	Thin rim.
4.	1.04	16.62	5,872	380	14,400	Thin rim.
5.	....	20.87	2,925	192	3,700	Joint.
6.	1.38	19.25	5,600*	368	13,600	Three arms.
7.	1.23	16.56	6,198	406	16,500	Three arms.
8.	.95	13.68	5,709	368	13,600	Three arms.
9.	.75	12.68	5,709	365	13,300	Thin rim.
10.	.65	13.00	5,709	361	13,000	Thin rim.

*Doubtful.

Note.—The diameter of the wheels ranged from 14½ to 15⅛ ins. The breadth of rim was 2 ins., except Nos. 9 and 10, 1⅞ ins. The area of the arms was 0.46-sq. in. Nos. 6, 7 and 8 had three arms, the others six arms.

To determine to what extent the strength is affected by bending, values of $\frac{v^2}{10}$ have been calculated. As has been shown by Mr. Stanwood in the paper before referred to, this expression represents approximately the tensile stress on the square inch of section of rim due to the centrifugal force, for cast iron. By comparing these values with the tensile strength of the iron, viz., 19,000 lbs. per sq. in., the amount of stress due to bending may be estimated. This difference varies from 500 lbs. per sq. in. in Nos. 1 and 2 to nearly 6,000 lbs. per sq. in. in Nos. 9 and 10—being greatest in the wheels with thin rims or few arms. None of these wheels, however, except No. 5, would have been unsafe at the usual limit for fly-wheel rims of 100 ft. per second. Wheel No. 10 would have had a factor of safety of over 12 at that speed.

Twenty-four-Inch Wheels.

No. 11 was a special wheel which had been in actual use. This wheel burst at 3,670 revolutions per minute, or a peripheral speed of 385 ft. per second, which corresponds well with the average speed of the 15-in. wheels. The explosion was very violent, and completely wrecked the shield. The quality of the iron was unknown, save that it appeared clean and close-grained.

Flanged Joints.

The wheels numbered 12 to 15 were of the same model as the 15-in. wheels on a larger scale, but each wheel had two internal flange joints in the rim, midway between the arms. The joints were all carefully planed and the holes drilled to match. The wheels were not turned on the face, but were balanced the same as the others.

The bolts used were of steel, and samples of each broken in the testing machine gave the results shown in the table.

Wheel No. 12 burst at a speed of less than 1,800 revolutions per minute, but the exact speed was not recorded. The flanges broke, but the bolts were uninjured, except for a slight stretching.

No. 13 was a duplicate of No. 12 in every way. The bolts were uninjured but the flanges broken through the bolt holes. The flanges of the pattern were then strengthened by adding ¼-in. to the thickness, the bolts remaining the same.

In wheel No. 14 the bolts failed.

In No. 15, bolts ⅜-in. in diameter were used. The flanges of one joint were badly broken, the bolts remaining whole. The second joint was uninjured.

The results are summarized in Table II. It will be noticed that the rim speed is about one-half that of a solid wheel, and therefore the centrifugal tension about one-fourth. The joints in all the wheels were carefully made, and were relatively stronger than many joints in fly-wheels which are running to-day in our mills and shops. The centrifugal tension at the joint would be greater than that given in Table II., on account of the weight of finages and bolts. At a rim speed of 100 ft. per second these wheels would have a factor of safety of about 3 6-10, which is altogether too small.

TABLE II.—Particulars of 24-in. Wheels Tested.

No.	Shape and size of rim. Bre'dth, ins.	Shape and size of rim. Depth, ins.	Shape and size of rim. Area, sq. ins.	Weight of wheel, lbs.	Flanges. Effective breadth, ins.	Flanges. Efctive area, ins.
11.	2⅛	1.5	3.18	75.25	....	....
12.	4¹/₁₆	.75	3.85	93.0	2.8	1.92
13.	4	.75	3.85	91.75	2.75	1.89
14.	4	.75	3.85	95.0	2.75	2.58
15.	4¹/₁₆	.75	3.85	94.75	2.5	2.34
16.	1.2	2.1	2.45	65.1	...	....
17.	1.2	2.1	2.45	65.0	...	....

Notes.—No. 11 was a solid rim wheel. Nos. 12 to 15 had internal flanges bolted. Nos. 16 and 17 had linked joints—No. 16 with three links, and No. 17 with two. The flanges of Nos. 12 and 13 were 11-16-in. thick; Nos. 14 and 15, 15-16-in. Each joint was bolted with four bolts, 15-16-in. diameter, except No. 15, which had ⅜-in. bolts.

By testing machine:

Tensile strength of cast iron = 19,600 lbs. per sq. in.
Transverse strength of cast iron = 46,600 lbs. per sq. in.
Tensile strength of 5-16 bolts = 4,000 lbs. each.
Tensile strength of ⅜ bolts = 5,000 lbs. each.

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*Condensed from a paper presented at the New York meeting of the American Society of Mechanical Engineers.

†Professor of Mechanical Engineering, Case School of Applied Science, Cleveland, O.

TABLE III.—Failure of Flanged Joints.

No.	Area of rim, sq. ins.	Effect. area flanges, sq. ins.	Total strength bolts, lbs.	Bursting speed. Revs. per min.	Bursting speed. Feet pr sec. = v.	Centrifugal tension. Per sq in. $= \frac{v^2}{10}$	Centrifugal tension. Total, lbs.
11.	3.18	.....	......	3,672	385	14,800	47,000*
12.	3.85	1.92	16,000	.....	...	......	......†
13.	3.85	1.89	16,000	1.760	184	3,400	13.100†
14.	3.85	2.58	16,000	1,875	196	3,850	14,800§
15.	3.85	2.34	20,000	1,810	190	3,610	13,900†

*Solid rim. †Flange broke. §Bolts broke.

Linked Joints.

Wheels numbered 16 and 17 were of the familiar rolling-mill type, with the joints connected by steel links over cast-iron lugs, the links being heated and shrunk on. The dimensions of the lugs and links are given in Table III.

Wheel No. 16 had three links to each joint, one on each face and one inside. Each joint broke on one side, through the rim, without shearing the lugs or breaking the links.

In No. 17 the link was omitted from the inner lug, leaving but two links to each joint. On one side the rim broke as in No. 16; on the other side the lugs failed by breaking off. It is impossible to say which joint failed first. No. 16, with three links, broke at a speed 66% in excess, and No. 17, with two links, at a speed over 50% in excess of that of the wheels with flanged joints.

The strength of the rim at the weakest section is apparently in excess of the strength of the links, whereas it was the rim that failed in each case. It must, however, be remembered that the links were under direct tension, while the rim was subjected to bending in addition.

At 100 ft. per second the factors of safety for Nos. 16 and 17 would be 10¼ and 8 4-10 respectively.

Conclusions.

1. Fly-wheels with solid rims, of the proportions usual among engine builders and having the usual number of arms, have a sufficient factor of safety at a rim speed of 100 ft. per second if the iron is of good quality and there are no serious cooling strains.

In such wheels the bending due to centrifugal force is slight, and may safely be disregarded.

2. Rim joints midway between the arms are a serious defect and reduce the factor of safety very materially. Such joints are as serious mistakes in design as would be a joint in the middle of a girder under a heavy load.

3. Joints made in the ordinary manner, with internal flanges and bolts, are probably the worst that could be devised for this purpose. Under the most favorable circumstances they have only about one-fourth the strength of the solid rim and are particularly weak against bending.

In several joints of this character, on large fly-wheels, calculation has shown a strength less than one-fifth that of the rim.

4. The type of joint exemplified in Nos. 16 and 17 is probably the best that could be devised for narrow-rimmed wheels not intended to carry belts, and possesses when properly designed a strength about two-thirds that of the solid rim.

It is gratifying to notice the fact that since the subject of joints in fly-wheel rims has been so thoroughly ventilated during the discussions before this Society, several of our prominent engine builders have changed the designs of their wheels by bringing the rim joints opposite the ends of the arms.

TABLE IV.—Failure of Linked Joints.

		No. 16	No. 17
Lugs.	Breadth, ins.	0.45	0.44
	Length, ins.	1.0	.98
	Area, sq. ins.	.45	.43
Links	Effect. breadth, ins.	.57	.54
	Thickness, ins.	.327	.380
	Effective area, sq. ins.	.186	.205
Maximum rim area, sq. ins.		2.45	2.45
Net rim area, sq. ins.		1.98	1.98
Strength of links, lbs.		30,540	20,360
Strength of rim, lbs.		38,800	38,800
Bursting speed, revs. per min.		3,060	2,750
Bursting speed, ft. per sec = v.		320	290
Centrifugal tension.	Per sq. in. $= \frac{v^2}{10}$	10,240	8,410
	Total	25,100	20,600
Remarks		Rim broke.	Lugs and rim broke.

By Testing Machine: Tensile strength of cast iron = 19,600; transverse strength of cast iron = 40,400; average tensile strength of each link = 10,180.

The experiments which have just been described, although at times a trifle too exciting, were interesting from first to last. The writer hopes to supplement them by others on models of the more recent rim-joints, and would be glad to receive any suggestions.

The more this subject is agitated, the less shall we have occasion to mourn the destruction of life and property on account of faults in the design of this most necessary element of the steam engine.

A NOTE ON THE STRENGTH OF WHEEL RIMS.[*]

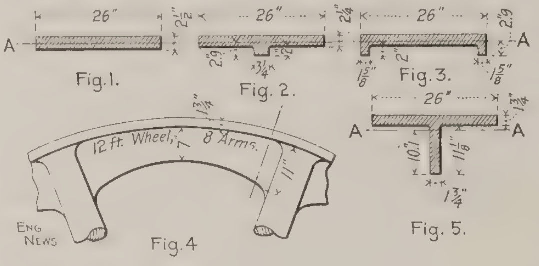
By Albert K. Mansfield, M. Am. Soc. C. E.[†]

On p. 5 of Mr. Supplee's translation of Releaux's "Constructeur" occur these words: "It is upon this point that the peculiar strengthening effect of ribs depends, and which makes their use so advantageous in cast-iron construction."

Then illustrations follow to support the fact that ribbed construction increases strength, that is, is economical of material; but it is not shown there, nor elsewhere to the present writer's knowledge, that this is not universally the case, but that the exact contrary may be the fact.

This may best be pointed out by a practical illustration: The moment of resistance[*] of the rectangular section of Fig. 1 is $\frac{bh^2}{6}$ or $\frac{26 \times 2\frac{1}{2}^2}{6} = 27.07$, AA being the neutral axis.

Now let ¼-in. of the thickness of this section be formed into a rib 3¼ ins. thick, as shown by Fig. 2. Preserving the same total area as before, this rib becomes 2 ins. deep, making the total depth of the section 4½ ins. The neutral axis will be found to be located as shown in the figure, and from a well-known formula the moment of resistance is found to be 18.64; that is, the least moment of resistance, or the moment of inertia divided by the greatest distance of fiber from the neutral axis.



Fly-Wheel Rims of Various Section.

The section has therefore been weakened by the ribs; in fact, unless it represents the special case of a cast-iron beam loaded so that the extreme fiber is subjected to compression, it is only about two-thirds as strong as before. It is seen, therefore, that under some conditions ribbing does not have a strengthening effect. It would clearly be useful to generalize this matter in such a way as to make it easy for the designer to determine when and to what extent ribbing may or may not be resorted to with advantage, but that is beyond the purpose of the present writing.

If we separate the rib of Fig. 2 into two ribs and place them at the ends of the section as in Fig. 3, we have, without change of strength, a section similar to that often used in the construction of wheel rims. The bending moment of such rims, due to centrifugal force, acts with maximum effect near the wheel arms, in such way as to cause tension at the extreme fiber. It will be clear, therefore, that such ribs in such place may make the wheel weaker than it would be if they were not employed. It is not meant that wheels cannot be ribbed in this manner to their advantage, but rather that it is necessary to take care that they are not thus ribbed to their disadvantage. There are many wheels in service which have been strengthened in this negative way.

The destructive accidents which have occurred to large wheels have led to bringing cast iron into disrepute as a material from which to construct such wheels. This fact, coupled with that pointed out above relative to rim-flanges, has led the present writer to the use of the method of ribbing wheels illustrated in Fig. 4, which seems to fill all requirements, enabling cast-iron rims to be made as strong as may be practically desired.

Maintaining the same face of wheel and total area of section as before, let us employ ¾-in. of the thickness of rim in forming a rib 1¾ ins. thick at center of rim; the section then becomes as shown by Fig. 5. The neutral axis of this section is at line AA, and the moment of resistance becomes 77.5, which is nearly three times as strong as the section of Fig. 1, and more than four times as strong as the flanged section of Fig. 3. Of course, a further increase of strength may be obtained by adding to depth of flange.

Now the section of Fig. 5 is taken to represent that next the arms, in which (the case being that of a built-in beam uniformly loaded) the extreme fiber is under tension. The mid-section between arms, however, while acted upon by an equal moment (when the cross-section is uniform), is bent in an opposite direction; therefore the extreme fiber is compressed, which, for equal strength, enables the flange at this point to be reduced, because cast iron is twice as able to resist compression as extension. The modulus of resistance at this point may therefore be one-half as great as at the arms, which will be found to correspond with a flange depth of about five-eighths of that at arms, or in this case about 7 ins.

The proportions are shown in Fig. 4. Almost any desired strength may be attained by this method. It has several other advantages over uniform flanges at edges which will readily occur to designers or wheels.

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[*] A paper presented at the New York meeting of the American Society of Mechanical Engineers.

[*] [This is more correctly the "section modulus." The moment of resistance is the section modulus multiplied by the resistance per square inch at the extreme fiber.—Ed. Eng. News.]

[†] Mechanical Manager, Buckeye Engine Co., Salem, O.

FORM FOR REPORTING THE RESULTS OF BOILER TESTS.

The Committee of the American Society of Mechanical Engineers, appointed in 1895 to revise the standard code of 1885 for trials of steam boilers, has presented in pamphlet form its report at the meeting held in this city this week. A year ago it presented what was called a "Preliminary Draft of Report," prepared by a sub-committee of four out of the nine members of the committee, requesting full discussion and criticism. In our issue of Dec. 9, 1897, we printed from this "preliminary draft" those sections which differed materially from the code of 1885. In the final report now presented, which, however, is still "subject to revision" before being printed in the volume of Transactions, the amendments to the 1885 code which were in the "preliminary draft" are retained, with a few corrections of more or less importance. The principal new feature of the report in its present shape is the insertion of a "Short Form of Report" of the results of a boiler test, containing only 31 items, as an alternative to the longer form presented last year, which contains 74 items. The short form is recommended for commercial tests and as a convenient form of abridging the longer form for publication when saving of space is desirable. We reprint this "Short Form" below:

Data and Results of Evaporative Test,

Arranged in accordance with the Short Form advised by the Boiler Test Committee of the American Society of Mechanical Engineers.

Made by................on...........boiler, at..........
to determine ....

Grate surface	sq. ft.
Water-heating surface	"
Superheating surface	"
Kind of fuel	
Kind of furnace	

Total Quantities.

1. Date of trial	
2. Duration of trial.	hours.
3. Weight of coal as fired	lbs.
4. Percentage of moisture in coal.........	per cent.
5. Total weight of dry coal consumed.....	lbs.
6. Total ash and refuse	"
7. Percentage of ash and refuse in dry coal	per cent.
8. Total weight of water fed to the boiler.	lbs.
9. Water actually evaporated, corrected for moisture or superheat in steam.......	lbs.

Hourly Quantities.

10. Dry coal consumed per hour.	lbs.
11. Dry coal per hour per square foot of grate surface	"
12. Water fed per hour..................	"
13. Equivalent water evaporated per hour from and at 212° corrected for quality of steam	"
14. Equivalent water evaporated per square foot of water-heating surface per hour	"

Average Pressures, Temperatures, Etc.

15. Average boiler pressure	lbs. per sq.in.
16. Average temperature of feed water.....	deg.
17. Average temperature of escaping gases..	"
18. Average force of draft between damper and boiler............	ins. of water.
19. Percentage of moisture in steam, or number of degrees of superheating...	

Horse-power.

20. Horse-power developed (Item 13 ÷ 34½)	HP.
21. Builders' rated horse-power............	"
22. Percentage of builders' rated horse-power	per cent.

Economic Results.

23. Water apparently evaporated per pound of coal under actual conditions. (Item 8 ÷ Item 3).........................	lbs.
24. Equivalent water actually evaporated from and at 212° per pound of coal as fired. (Item 9 ÷ Item 3)..........	"
25. Equivalent evaporation from and at 212° per pound of dry coal. (Item 9 ÷ Item 5)	"
26. Equivalent evaporation from and at 212° per pound of combustible. [Item 9 ÷ (Item 5 — Item 6)].................. (If Items 23, 24 and 25 are not corrected for quality of steam, the fact should be stated.)	"

Efficiency.

27. Heating value of the coal per pound...	B.T.U.
28. Efficiency of boiler (based on combustible)	per cent.
29. Efficiency of boiler, including grate (based on coal)	per cent.

Cost of Evaporation.

30. Cost of coal per ton of 2,240 lbs. delivered in boiler-room	$
31. Cost of coal required for evaporation of 1,000 lbs. of water from and at 212°..	$

MEDICAL OUTFIT AND INSTRUCTIONS FOR AN ENGINEER IN THE TROPICS.

In the "Medical Fortnightly" of Nov. 15, we find an interesting letter by Albert L. Ashmead, M.D., of New York city, describing a medical outfit which he prepared for his brother, Mr. Percy H. Ashmead, C. E., who has recently sailed to Ecuador to fulfil an engagement as topographical engineer on the line of the Guayaquil & Quito R. R As many of our readers are likely to see servic in tropical countries during the next few years, we reprint in full Dr. Ashmead's description of this outfit, which, it is of especial interest to note, can all be carried in a box only 9 × 12 × 6 ins. in size:

Two porte caustics; to stop a bleeding point; to stimulate a sore that heals too slowly, etc.

Iodoform gauze 10 per cent; as a dressing for wounds, cut off as much as may be required.

Sun cholera mixture tablets; for diarrhea, one every two hours until the diarrhea is checked.

Triplex pills (blue mass, aloes and podophyllin); for torpidity of the liver in the tropics; when there is constipation take one of the pills at bedtime.

Permanganate of potash pills (2-grain); in case of snake bite, take one, and follow at once with a tumbler of water. Repeat every hour. In gonorrhea, dissolve one in a tumbler of water, and use as an injection. As a surgical wash in the same dilution, apply on cotton to the part affected.

Chronic acid solution (1 to 100 parts of water). This is the Orfila prize remedy for viper bites. Use as a wash with absorbent cotton, to the snake bite wound, at once after the biting.

Solution of chloride of gold (1 in 60 parts of water). This is Calmette's remedy for snake bites. On being bitten, after washing the wound with the above acid solution, inject 10 minims (or drops) with the hypodermic syringe, in the sound skin, near the wound; repeat the injection after one hour.

Solution of chloride of lime (Merck's pure 1 in 60 parts of water). This is another of Calmette's remedies. In snake bites, after washing the wound with the chromic acid solution, and injecting in the neighborhood of the wound, the chloride of gold solution (10 minims), inject with the hypodermic syringe, 10 minims of this solution, beneath the sound skin, near the wound. Repeat after an hour's interval.

These three local remedies, the chromic acid wash, the hypodermic chloride of gold, the hypodermic chloride of lime, must be fortified in case of snake bite, by the internal administration through the mouth, of a permanganate of potash tablet (followed by a glass of water) every hour.

Callodion with 2½% salicylic acid. In insect stings paint over the skin, and also in certain skin eruptions, with a piece of cotton wrapt around the end of a stick.

Callodion with 10% idioform; use as a dressing for wounds, painted on the wound, with cotton on the end of a stick, or with camel's hair pencil.

Calomel and soda tablets (each one grain); to stimulate liver, correct disordered stomach, relieve colic, correct torpidity of liver when stools are clay or gray colored, to cause a flow of bile, and when diarrhea refuses to yield to sun cholera mixture treatment, take three of these tablets at a dose. If diarrhea is present, continue taking sun cholera mixture tablets, one at a dose, as before ordered in diarrhea.

Mercury with chalk (12 sample powders, 5 grains each, and one-half ounce in bulk in bottle). In tropical dysentery, with bloody mucus, with straining at stool, with abdominal pain, before bloody mucus stooling, take a five-grain powder, with a five-grain Dover's tablet, every two hours. Continue until the character of the stools change; that is, becomes natural, either brown or green. Watch the gums, if taken more than a day, so as not to salivate. Should blood and mucus appear again in the stools, after having been once checked, or should the straining and the pain return, go through the same course of treatment again. It may be noted here that no case of tropical dysentery can be cured without this course of mercury.

Muriate of pilocarpine, 1-20th grain tablets. One tablet is to be taken by the mouth, and then again after four hours, unless the prostration and the sweating should be excessive. In case of pleurisy, in pernicious congestive malarial fevers, a tablet of pilocarpine.

Dover's tablets, 5 grains each. In dysentery, a tablet with a mercury and chalk 5-grain powder, to be taken every two or three hours. In coughs or colds of every kind, give a tablet every two or three hours (without mercury and chalk), or on going to bed, two tablets at a dose. For fever, malarial or any other, give a tablet every three hours, with a quinine pill.

Quinia Sulph. tablets, 5 grains each. While in the tropics take one every night, even when you are well. In case of chills and fever, take two at night, and one every three hours. In case of congestive malarial fever, or a fever which does not yield at once to this treatment, give two pills every four hours (supplemented by the hot pack, the patient to be wrapped in a sheet wrung out of hot water), until 100 grains of quinine have been taken. While administering quinine, add morning and night five tablets of calomel and soda. If the fever does not yield in two or three days of this treatment, give one calomel and soda tablet every two hours until the mouth is sore from the mercury, and at night time, a purge of one triplex pill. If the purging appears too severe, check it with a sun cholera mixture tablet after each purging.

Carbolized vaseline (1 in 8) for dressing wounds, and for piles.

Surgical needles (half round, 6, assorted) and thread.

Styptic cotton (one bottle) for nose bleed of the Andes, etc. Ointment oleate of bismuth, as a mild dressing for inflamed skin or burns.

One hypodermic syringe, with instruction how to use it.

One can of mustard leaves, for counter-irritation.

Three two-inch roller gauze bandages.

Three three-inch roller gauze bandages.

One pair dressing scissors.

All to be packed in a wooden box with absorbent cotton (one-half pound) 9×12×6 inches. A copy of Dr. Paul Gibier's pamphlet (Bulletin Pasteur Institute, January, February, March, 1897), serum-therapy in snake poisoning, etc., was added to the package.

THE NEW YORK MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The annual meeting of the Society, which is being held this week at its house in New York city promises to be as largely attended as was the meeting a year ago, which was the largest in the history of the Society. The meeting was informally opened on Tuesday afternoon, Nov. 29, by the gathering of many members in the spacious parlor, which was for the time being a smoking room, and was formally opened at 9 p. m. in the auditorium, when the retiring president, Mr. Charles Wallace Hunt, delivered his annual address, a portion of which will be found elsewhere in this issue.

On Wednesday morning a business session was held, at which were presented the annual reports of the council, tellers and committees. The tellers reported the election of 22 new members, including 2 promoted from the associate grade, 4 associates, and 13 junior members.

The new officers elected were announced as follows: President, George W. Melville, Chief Engineer, U. S. N., Washington, D. C.; Vive-Presidents, E. D. Meier, St. Louis, Mo., George R. Stetson, New Bedford, Mass., and B. H. Warren, Pittsburg, Pa.; Treasurer, Wm. H. Wiley, New York; Managers, E. C. Felton, Steelton, Pa., R. H. Soule, Philadelphia, Pa., and A. M. Goodale, Boston, Mass.

The Annual Report of the Council contains many matters of interest. Among them are the appointment of a new committee to consider the subject of Standard Pipe Unions, to confer with similar committees of the Railway Master Mechanics and Car Builders' Associations; and the appointment of a committee to report on Standardization or Unification of the Methods of Testing Steam Engines. A letter has been received from the British Institution of Civil Engineers, expressing its desire to welcome the members of the Society in England in 1900 on the occasion of their visit to the Paris Exposition. The membership of the Society now consists of: honorary members, 14; members, 1,395; associates, 123; junior members, 349; total, 1,881. The financial report shows receipts during the year, $32,406; disbursements, $31,755; cash balance, $698; uncollected accounts, $4,486; unpaid bills, $485. Assets over liabilities, $51,285, of which $23,600 is invested in 5% bonds on the building of the Mechanical Engineers' Library Association, and $24,107 is in the volumes of printed proceedings of the Society. The outstanding indebtedness of last year, $3,200, has been wiped out. The Library Association reports net assets of $1,194 in cash and $10,700 in books and manuscripts.

The report of the committee on a standard code for steam boiler trials was presented in pamphlet form. We give an extract from the new code in another column.

After the business session, professional papers were presented for discussion as follows: "Note on Strength of Wheel Rims," by A. K. Mansfield. "The Bursting of Small Cast-Iron Fly-Wheels," by Prof. C. H. Benjamin. A brisk discussion followed this paper, which was participated in by many members, including John Fritz.

A luncheon was served in the building at the close of the session, and the afternoon was left free to members to visit places of interest, to meet socially in the parlors or to attend to other business. In the evening the annual reception and conversazione of members and ladies was held at Sherry's, 44th St. and 5th Ave.

A THIRD BRIDGE OVER THE EAST RIVER, possibly at Blackwell's Island, is advocated by Mayor Van Wyck, and he requests the Board of Public Improvements to take such action, as to location, plans and construction, as may be necessary before the project is submitted to the Municipal Assembly. He recommends crossing over Blackwell's Island. Some complications may arise, as the New York & Long Island Bridge Co. already has a franchise for a bridge at Blackwell's Island. It has built piers on Long Island and Blackwell's Island; but the company is somewhat entangled in the settling up of the Corbin estate, which controls the enterprise. The new assessed valuation of real estate in Greater New York, raising the aggregate by about $400,000,000, seems to have removed the debt limit obstruction, which for a time interfered with raising funds for the East River bridge now under construction.

AN ARC AT THE EQUATOR is to be measured as a result of the Stuttgart conference of the International Geodetic Association, in October. Mr. E. D. Preston, of the U. S. Coast and Geodetic Survey, represented this government at the conference and he will soon make his official report. This arc at the equator, when measured, will be compared with one near the pole, now being measured by the Swedes and Russians; and the comparison will make it possible to determine the difference in length between the polar and equatorial diameters of the earth. Continuous latitude observations, at six stations encircling the earth near the 39th parallel, north latitude, are to be made by six separate nations. The purpose of this observation is to investigate the small periodic changes in the latitude of all places first reported about ten years ago, and to determine the secular motion of the pole. The International Bureau of Weights and Measures, at Paris, reported that a bar made of 36% nickel and 64% steel, was expanded by heat only 1-50th of what would be expected from the separate metals. This is of great importance in the manufacture of astronomical clocks, as it practically eliminates the temperature question.

THE TOTAL IMPORTS OF GOLD INTO THE UNITED States, in the ten months ending Oct. 31, 1898, says the U. S. Bureau of Statistics, was $143,658,095; this is more than 50% in excess of any previous importation in the same period. The exports of gold in this ten months were but $14,061,849, or less than for any similar previous period. This unprecedented flow of gold to the United States is explained by the enormous balance of trade in our favor; the total imports of merchandise, in these ten months, being valued at $527,757,754; while the total export was worth $987,964,356. Out of $1,866,757,783 in circulation in the United States, on Nov. 1, 1898, the sum of $649,846,727 was gold; on Nov. 1, 1895, the gold in circulation amounted to $475,181,593, out of $1,598,859,316 as a total.

EXPORTS OF MANUFACTURED GOODS from the United States, and their phenomenal growth in the past ten years, as compared with the two preceding decades, are well shown by a table just issued by the Bureau of Statistics of the Treasury Department, which we reproduce as follows:

	Total value of exports for fiscal year ending June 30. (1 = 1,000)			
Manufactures.	1868.	1878.	1888.	1898.
Iron and steel.......	$8,352	$16,052	$17,763	$70,367
Refined mineral oils..	20,020	43,564	41,260	51,782
Copper and mfrs. of.	479	2,329	3,812	32,180
Leather	1,414	8,080	9,583	21,113
Cotton manufactures.	2,971	11,438	13,013	17,024
Chemicals	2,757	3,414	5,633	9,441
Wood manufactures..	2,088	3,963	4,733	9,098
Cycles	.....	.....	.....	6,866
Agricultural implmts.	673	2,575	2,645	7,609
Paraffin	47	155	2,168	6,030
Paper and mfrs. of..	524	1,086	1,078	5,494
Tobacco manufact'rs.	3,100	3,681	3,776	4,818
Fertilizers	35	1,208	1,255	4,359
Scientific instrum'ts..	.....	27	714	2,770
Books, maps, etc.....	349	586	1,734	2,434
Flax, etc., mfrs......	592	1,202	1,391	2,557
Sugar and molasses..	348	4,920	3,255	2,111
Carriages & horse crs	404	979	1,381	1,946
Spirits.	1,416	1,149	871	1,850
Oils, vegetable	186	323	381	1,843
India rubber mfrs....	170	305	866	1,723
Clocks and watches...	536	936	1,529	1,727
Zinc manufactures ..	68	216	18	1,339
Marble & stone mfrs..	.....	597	644	1,792
Gunpowder, etc.	546	3,459	648	1,395
Stationery	.....	.....	425	1,005
Musical instruments..	173	756	908	1,383
Glass, etc.	609	869	881	1,211
Brass manufactures..	16	589	308	1,320
Starch	205	605	202	1,371
Soap	626	658	815	1,390
Railway cars	.....	532	826	1,478
Paints, etc.	131	239	492	1,079
Wool manufactures...	206	449	471	1,089

It should be especially noted that the growth in volume of exports is really much larger than the above table shows, for prices have gone steadily downward during the past thirty years. This is especially true of the decade from 1888 to 1898, in which the greatest growth in the value of exports is shown. Besides this, it must be remembered that the value of the exports of 1868 was measured in the paper currency of that date, the value of which was only 71.5% of the value of gold. Hence the growth in volume of exports from 1868 to 1878 was at least 30% more than the above table shows.

THE REPORT OF SECRETARY OF THE INTERIOR Bliss deals with public lands, Indians, pensions, territorial and educational affairs, etc. Mr. Bliss says that of 301,000,000 acres of desert land requiring irrigation, the available water supply is only sufficient for 71,500,000 acres; the remainder is only valuable for grazing purposes. The 30 forest reservations contain an estimated area of 40,719,474 acres. During the year the U. S. Geological Survey made a topographical survey of 30,057 sq. miles; the aggregate now surveyed being equal to about one-fourth of the entire territory of the country, exclusive of Alaska.

THE PROGRESS IN ELECTRICAL SCIENCE was the subject of the late address of William Henry Preece, C. B., F. R. S., on assuming the Presidency of the Institution of Civil Engineers. Mr. Preece was a pupil of Faraday, and for nearly 50 years has been actively engaged in electrical work, and especially in telegraphy. He said that the original line of Cook and Wheatstone, constructed in 1837, and connecting Camden Town and Euston Grove Station, and 1⅓ miles long, had grown to 1,111,366 miles of wire under British control alone. This aggregate covered 435,000 miles for the General Post office; 105,000 miles for railway companies; 387,966 for India and the Colonies, and 183,400 miles of submarine cables. In the United Kingdom alone there are now in use 152,019 telephones, 133,498 of these belong to the National Telephone Co. Mr. Preece recommends the control of the telephone business by the state as in the case of the postal and telegraph service in England. He combats the popular idea that the purchase of the telegraph business in 1869 was a bad bargain for the state. He says the sum paid for it was $24,945,240; the number of messages then sent was about 5,000,000 per year, and the gross annual income was about $2,500,000. This income is now $15,358,615, and over 83,000,000 messages are sent per year; the capital account, closed in 1891, and including Post Office extensions, was $50,656,645; and he says a syndicate now wanting to buy the plant would have to raise a capital of over $150,000,000. In referring to electric lighting, Mr. Preece said that the electrical energy used in a first-class battleship was expended as follows:

	E. HP.
Internal lighting	60
Searchlights	65
Ventilation	30
Capstans, hoists, etc.	60
Reserve	45
Total	260

This quantity supplied 1,000 glow-lamps, 6 searchlights, 16 ventilating fans, and required from 2 to 8 motors. Searchlights were first introduced on warships in 1875, by Mr. Henry Wilde; the first ship fitted with internal electric lighting was the "Inflexible," in 1882. In 1884 the British Admiralty ordered it to be applied to all warships. Electric power was first used on the "Barfleur" for working guns and ammunition hoists. Its use has been partially extended to working gun-turrets, capstans, ventilating fans, boat hoists, etc., but hydraulic power, for these purposes, is still preferred in the British Navy.

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A PUBLIC MEMORIAL MEETING, in commemoration of the late Col. George E. Waring was held at the Cooper Union, New York city, on Nov. 23. The City Club, Authors' Club, Century Association and Chamber of Commerce united in arranging for the meeting. Letters were read from prominent citizens and speeches were made by President Low, of Columbia University; Bishop Potter, Reuben Simons, Carl Schurz and Jacob A. Riis. Resolutions were adopted setting forth the services of Colonel Waring as a soldier, citizen and sanitary engineer. The Chamber of Commerce has appointed a committee to raise a fund of $100,000, the income from which is to be paid semi-annually to the widow and daughter of Colonel Waring; and after their death the principal is to go to Columbia University and is to be known as "The Waring Municipal Fund." Thus far about $37,000 has been subscribed.

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AN ELEVATOR TRUST, to be called the Otis Elevator Co., says the "New York Commercial," has been formed by consolidating into one company about 90% of the elevator business of the country. The capital of the company will be $10,000,000; $4,000,000 in non-cumulative preferred stock, and $6,000,000 in common stock. Mr. Wm. H. Baldwin, of the Otis Elevator Co., is the chief mover in the enterprise, and will probably be the president of the new company.

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BOOK REVIEWS.

BUILDING, CONSTRUCTION AND SUPERINTENDENCE. Part II., Carpenter's Work.—By F. E. Kidder, C. E., Ph. D., Fellow American Institute of Architects, New York, 1898: William T. Comstock, 23 Warren St. Cloth; 6¾ × 9¾ ins.; pp. 544; 524 illustrations. $4.

The first volume of this work appeared in 1896 (Eng. News, Nov. 26, 1896), and was devoted to the treatment of those details of building construction generally coming within the province of the mason. Part II., which is now before us, is of the same size and general make-up, but it has 100 more pages and nearly twice as many illustrations. As indicated in the title, it treats of the carpentry work of building construction, and it is essentially a book for the carpenter and builder rather than for the engineer.

Taking up the contents in somewhat more detail; Chapter I. describes the appearance, quality, ease of working, etc., of the different building and finishing woods of the United States. Among the particular features of this chapter which one notes with most interest are the illustrations and remarks showing the manner in which wood shrinks, and giving the methods of preventing shrinkage. Chapter I. is followed by chapters on wood framing; windows and outside frames; outside wood finish, such as cornices, gutters, gables, porches, etc., shingle roofs and the accompanying metal work; interior woodwork, including furring, interior finish, cabinet work, stairs, flooring, etc. Chapter VI. contains nearly 100 pages on the subject of builders' hardware, covering the construction of locks, hinges, butts, etc., etc. In Chapter VII. the subject of heavy framing in wood is discussed, and we note that the author gives the results of the most recent investigations upon the framing of compound beams which have been made by Prof. Kidwell (Eng. News, March 11, 1897, Feb. 3, March 17, 1898), and others. Chapter VIII. gives forms of specifications for carpenters' work, hardware, trimmings, slate and gravel roofing, tin work, etc.

The book is very profusely illustrated, many of the illustrations being detail drawings of parts of which drawings are not easily obtained. Taken as a whole we do not know of any book on the subject which contains the same amount of up-to-date information, and any young architect or ambitious carpenter would do well to place a copy in his library. The book has a very good index which enables references to be made easily to the different subjects treated.

RAILWAY CONSTRUCTION.—By William Hemingway Mills, M. Inst. C. E., Engineer in Chief of the Great Northern Ry. of Ireland, London, 1898: Longmans, Green & Co. Cloth, 6 × 10 ins.; pp. 364; illustrated; $5.

The American book which this volume most resembles in its character and scope is Mr. Geo. L. Vose's well-known "Manual for Railroad Engineers." It is a far less comprehensive treatise of the subject, however, than the American publication. The detailed information relating to the strength of materials and structures and the typical specifications and standard mathematical formulas given by Mr. Vose are almost entirely omitted by Mr. Mills. The book also describes English practice almost exclusively; the author's references to American practice being few in number and not always very accurate. For these reasons the chief value of the volume to the American engineer will be in the knowledge which it gives him in a broad general way of English practice in railway construction, leaving him to go elsewhere for such information as will qualify him actually to do the work. Keeping these limitations in mind, however, and considering the book as a series of notes upon English practice in railway construction rather than as a treatise upon railway construction in general, as its title indicates, it has considerable usefulness for the American engineer. Doubtless it would fill a much more useful field for the English engineer.

The chapters in detail are: (1) Location of a Line of Railway—Government Regulations—Questions for Consideration in Connection with Gage, Gradients and Curves: (2) Works of Construction; Earthworks, Culverts, Bridges, Foundations, Screw Piles, Cylinders, Caissons, Retaining Walls, and Tunnels; (3) Permanent Way, Rails, Sleepers, Fastenings, and Permanent Way Laying; (4) Station Buildings, Roofs, Lines and Sidings; (5) Sorting Sidings, Turntables, Traversers, Water Tanks and Water Columns; (6) Comparative Weights of Some Types of Modern Locomotives; (7) Signals, Interlocking, Block Telegraph and Electric Train Staff Instruments; (8) Railways of Different Ranks, Progressive Improvements, Growing Tendency for Increased Speeds, with Corresponding Increase in Weight of Permanent Way and Rolling Stock—Electricity as a Motive Power.

UP-TO-DATE AIR-BRAKE CATECHISM.—A complete study of the air-brake equipment, including the latest devices and inventions used. All troubles and peculiarities of the air brake and a practical way to find and remedy them are explained. By Robert H. Blackall, Air-Brake Instructor and Inspector, Delaware & Hudson Canal Co.'s R. R. New York: Norman W. Henly & Co. 12mo, cloth; pp. 230; 40 illustrations. $1.50.

This little book is designed especially for railway trainmen whose duties require a knowledge of the air brake and its methods of operation. The aim has been to make it so elementary and simple that the "green hand" can learn all he needs to know about air-brake work without other aid than this book gives. It is also a valuable textbook for use in the air-brake instruction schools which are carried on by most railway companies. Besides the air brake, the book also gives instructions on the use and care of the air signal. This is the first book for engineers' instruction we have seen which specifically cautions against reversing the engine at the same time the brakes are applied in making an emergency stop.

COMPRESSED AIR PRODUCTION, or the Theory and Practice of Air Compression. By W. L. Saunders. Published by "Compressed Air," 26 Cortlandt St., New York. 8vo, cloth; pp. 58; 27 illustrations.

This book consists chiefly of matter which was published serially in the little monthly journal called "Compressed Air." Mr. Saunders is well known as one of the leading authorities on the subject. His present book is of an elementary nature, entirely free from mathematics; but it presents the fundamental principles governing the production and use of compressed air in a way which can be readily understood, and will prove a useful handbook to those who undertake the installation or management of compressed air plants.

A HANDBOOK OF ENGINEERING LABORATORY PRACTICE. By Richard Addison Smart, M. E., Associate Professor of Experimental Engineering, Purdue University. New York: John Wiley & Sons. London: Chapman & Hall, Limited. Cloth, 12mo; pp. 290. $2.50.

The scope of this book is shown in the following extracts from the preface:

> This volume is intended primarily as a maual for the use of students in the routine of experimental work in Steam-engineering, Strength of Materials, and Hydraulics. It may also serve in a limited way as a guide to those engineers in active service whose familiarity with the ordinary methods of testing is limited. The chief object in view has been to provide in convenient form such directions for the conduct of the various tests and experiments comprising the course as the student will need to enable him to take charge of and conduct the particular work assigned to him in an intelligent manner and with little delay. The methods of testing described under the various general heads are not intended to cover the subject in an exhaustive way. Only such tests have been described as may be carried on in connection with the complement of apparatus to be found in the better equipped laboratories of experimental engineering, and the methods explained are those which the author has found to be most easily employed in every-day practice. Both the manner of arranging apparatus and the method of conducting the tests are capable of great variation to suit the needs of special invesigations.

The author has condensed a great deal of useful information into small space. His style is clear and simple, and his treatment is entirely of a practical nature, avoiding theory almost entirely. The book should prove a useful one to students of mechanical engineering.

THE STORY OF THE RAILROADS.—By Cy. Warman, author of the "Tales of An Engineer," "The Express Messenger," "Snow on the Headlight," etc. New York: D. Appleton & Co. Cloth, 7¾ × 5 ins.; pp. 280; illustrated. $1.50.

This is not an engineering treatise, but a story of engineers, and a very interesting general history of the beginning and completion of the various trans-continental railways. The history of the Union Pacific road commences with the efforts of Asa Whitney, in 1835; but progress really begins with the surveys of the present Gen. Granville M. Dodge, made when in the employ of the Mississippi & Missouri Railway Co., in 1853. The story of the Union Pacific is carried to the completion of that road; and the Atchison, Topeka & Santa Fe, the Denver & Rio Grande, the Northern Pacific, and the Canadian Pacific are then taken up in sequence. Interspersed with the story are many incidents connected with the life and trials of the engineers and workmen engaged in building these roads, and character sketches of the rough social element that drifted West with the iron rails. The book is interesting reading for engineers and valuable for the historical matter which it contains.

PRACTICE AND THEORY OF THE INJECTOR. By Strickland Kneass, C. E., M. Am. Soc. M. E., etc. Second edition, revised and enlarged. New York: John Wiley & Sons; London: Chapman & Hall, Ltd. Cloth, 8vo; pp. 161. $1.50.

Mr. Kneass's book on the injector has been well known, since the issue of the first edition a few years ago, as the standard work on the subject. The new edition contains some new matter, and many changes have been made in the text of the original edition.

THEORY OF ELECTRICAL MEASUREMENTS.—Lecture Notes Prepared for the Third Year Classes of the Cooper Union Night School of Science. By William A. Anthony, Professor of Physics. First edition. New York: John Wiley & Sons. 5 × 7½ ins; cloth; pp. 90. $1.

This little book was prepared by the author for the use of the third year classes of the Cooper Union, New York, Night School of Science, in which he is Professor of Physics. It makes no pretension, of course, to be an elaborate and exhaustive treatise, but it presents the fundamental principles of electrical measurements to the student in a brief but clear manner.

Not the least valuable feature of the book is the series of problems given at the end of each chapter, the correct solution of which is proof that the student correctly understands the preceding text.

A TEXT-BOOK OF GEODETIC ASTRONOMY.—By John F. Hayford, C. E., Assoc. M. Am. Soc. C. E., Expert Computer and Geodesist U. S. Coast and Geodetic Survey. New York: John Wiley & Sons. Cloth; 9 × 5¾ ins.; uu. 351; illustrated.

This work is limited to the treatment of astronomy as applied to surveying, or to geodetic astronomy only. It is primarily a text-book for students, and is made sufficiently short and easy to be mastered by the student of civil engineering in the limited time usually devoted to this branch of study. The simpler and special means of deriving working formulas have been chosen, and considerable space is devoted to the discussion of the various sources of error in each kind of observation, and to the practical handling and adjustments of instruments used. In fact, the five principal chapters in the work separately treat of the sextant, astronomical transit, zenith telescopes and determination of latitude, the azimuth instrument and methods of observing longitude. The aim of the author has been to select formulas which have been found in practice to lead to the most rapid and accurate computations; and to this end he freely uses the larger and standard works of Chauvenet, Doolittle and Loomis, the various reports of the U. S. Coast and Geodetic, Lake, Boundary and other surveys and the practice of those making these reports. It is to be regretted that the illustrative figures used are bunched instead of being distributed through the text, where they belong.

EXPLOSIVE MATERIALS.—The Phenomena and Theories of Explosion, and Classification, Constitution and Preparation of Explosives. By Lieut. John P. Wisser, 1st Artillery, U. S. A. Instructor Department of Military Science, U. S. Artillery School, Editor "Journal U. S. Artillery." Van Nostrand Science Series, No. 70. New York: D. Van Nostrand Co. Boards; 6 × 3¾ ins.; pp. 145. 50 cents.

About fifteen years ago a first edition of this treatise appeared; but the development in this art has been so great in the interval, that the present edition has been entirely rewritten. The result is an entirely up-to-date study of the materials of explosives, the phenomena of explosion, chemical composition, the origin and rapidity of reactions and their propagation, and the products and force of explosion. The various types of explosives are then taken separately and minutely described. The composition and manufacture of smokeless powders is gone into at very considerable length, and forms an unusually interesting portion of the work.

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THE CHESAPEAKE & OHIO CANAL sale is to take place on Feb. 7, 1899, when sealed bids will be opened by the Board of Public Works of Maryland for the entire interest of the state in the canal. This interest consists of a $2,000,000 mortgage made in 1834, and the accrued interest thereon for 64 years, common stock to the amount of $788,724, and preferred stock amounting to $4,375,000. There are some prior liens on the property, amounting to about $2,000,000, which are held by interests friendly to the Baltimore & Ohio R. R. It is generally conceded that the only bidders for the property will be some railway company desiring to use the canal towpath as a roadbed, or the Baltimore & Ohio, which may purchase it to prevent the establishment of a competing line. It is stated that except during the years from 1867 to 1878 the canal has never been a financial success.

THE NEW YORK CANAL INVESTIGATION is again brought to public attention by the report of Hon. Edwin Countryman, who was assigned by Gov. Black last August to make a special study of the testimony taken by the Canal Investigation Commission and to report whether civil or criminal proceedings should be instituted against any persons or public officers by reasons of acts in connection with the canal works. Judge Countryman's report is a voluminous one. He finds in the first place that there is no evidence that any of the contractors were guilty of collusion or fraud in obtaining or carrying out their contracts, and concludes that with two or three possible exceptions there is no chance for a successful suit by the state against the contractors. As regards the State Engineer and the Superintendent of Public Works, however, Judge Countryman holds that, although corrupt collusion with the contractors is not shown on their part, they were guilty of various infractions of law; and he advises that the evidence against both these officials be submitted to the Grand Jury. He holds the State Engineer culpable for not making use of the quantities and information contained in the preliminary surveys in preparing his estimates, and he thinks the reason was that it was desired to conceal from the public the fact that the $9,000,000 appropriation was inadequate to complete the work. The reclassification of earth as rock on various contracts is severely commented upon, together with the means which were adopted to induce subordinate engineers to fix quantities and classify materials in accordance with the instructions of those over them and against their own opinions and measurements.

Concerning the Superintendent of Public Works, Judge Countryman holds that his power and authority were sufficient to have enabled him to have detected and prevented the various illegal acts charged to the State Engineer's department, that he exceeded his powers in the making of special contracts for extra work, and that the application of part of the $9,000,000 appropriation to other work on the canals than the deepening ordered by the legislature was a violation of law.

Concerning the subordinate employees of the departments, Judge Countryman says that while many of them have been shown to be willing assistants in the various illegal practices complained of, he has deemed it best that the public prosecutor should be left at liberty to exercise his discretion in using any of them as witnesses in the prosecution of the principal offenders.

As soon as Judge Countryman's report was made public, Gov. Black instructed the Attorney-General to institute criminal proceedings against the two officials. Superintendent of Public Works Aldridge presented his resignation on Dec. 1.

THE PROBABLE EFFECT OF THE CHICAGO DRAINage Canal upon the water flowing by the communities below its outlet, and especially upon the city of St. Louis, is still causing much discussion in Chicago and St. Louis. A committee of prominent public men has been appointed at St. Louis to investigate the subject, while at Chicago Arthur R. Reynolds, M. D., Commissioner of Health, has addressed a communication to the Trustees of the Sanitary District of Chicago urging that a series of bacterial and chemical examinations be instituted of samples of water collected at various points between Chicago and St. Louis. These examinations would be continued for some years, in order to show the changes wrought by putting the canal in operation.

RIVER POLLUTION BY THE SEWAGE OF MIDDLEborough, Mass., has been pronounced by the State Board of Health of Massachusetts as possibly one of the "causes of the large amount of sickness in the portion of the town which is nearest the river." The board recommends that plans be prepared and carried out for the establishment of a sewage purification plant.

RIVER POLLUTION AT WATERBURY, CONN., has been before the courts more or less of the time since April, 1891, and a new suit, entered upon some two years ago, has just come up for trial after a number of delays. The suit is brought by Platt Bros. & Co. and the Platt Mills Co. against the city of Waterbury. An injunction is sought against the discharge of sewage into the Naugatuck River, and damages are claimed on the ground that the river has been rendered unfit for all uses except power, to which it was formerly put by the plaintiffs.

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Dec. 2 on the Fitchburg R. R., near Athol, Mass., in which two freight trains collided. The wreck caught fire and a brakeman, who was pinned in the wreck, was burned to death before he could be released.

THE BURSTING OF THE MAIN STEAM PIPE of the Mallory Line steamship "Alamo," on Dec. 3, caused the death of six men and the injury of one other, all belonging to the engineering force. The "Alamo" had been used as a United States troop transport during the recent war and was just starting on her first regular trip South after being thoroughly overhauled and equipped with new boilers and steam pipes. Both had been tested by U. S. government inspectors, and at the time of the accident the boiler pressure was about 80 lbs., while 100 lbs. was the safe allowable pressure. The accident is attributed to the straining of the copper steam pipe at the time it was tested by the government inspectors.

THE EXPLOSION of a part of the refrigerating machinery of the government hospital ship "Bay State," at a dock in Brooklyn, N. Y., on Dec. 6, resulted in the death of the engineer in charge and the injury of a number of hospital attendants. According to reports one of the pipes leading from the ice machine burst, blowing away the bulkhead separating the ice room from the engine room and otherwise damaging the interior of the vessel.

THE EXPLOSION OF ABOUT 10,000 lbs. of powder at Lamotte, Mo., on Nov. 23, killed 6 men and injured several others. According to accounts the explosion occurred in the packing house of the powder mill at that place, and was so severe that its effect was felt fully 25 miles away.

A HARBOR MINE EXPLODED at Fort Independence, Boston, Mass., on Dec. 6, while being hauled from the water's edge to the magazine. Four men were killed, three of them being blown to fragments.

AN ELEVATOR ACCIDENT occurred in a 11-story building at 55 William St., New York city, on Dec. 6, in which one man was killed and three others were seriously injured. It appears that when the car reached the bottom of the shaft the counterweights became displaced and fell from the shaft upon the car.

TWO BASCULE BRIDGES over the Chicago River will be built by the Drainage Board, as they will be cheaper than the construction of by-passes around the old bridges, in order to increase the capacity of flow. One of these will be at Taylor St., and the other will be for the Chicago & Northern Pacific R. R., between Taylor and 12th Sts. The present structures are swing bridges, and both of the new structures will be of the Scherzer rolling-lift type, already in use at three points on the Chicago River. The cost is estimated at $314,000, or $95,000 less than that of the by-pass, while the new bridges will give better facilities for navigation than those at present existing.

TRACKWAYS OR WAGON TRACKS are proposed for use on State St. and Clark St., Chicago, between 16th and 22d Sts., in order to relieve the street railway tracks from the wear and delay to traffic, due to the very heavy wagon traffic at these points. The Chicago City Ry. Co. has to repair the pavements between the streets named, and Mr. M. K. Bowen, President of the company, proposes to use flat rails, 6 ins. wide, slightly concave on top, forming wagon tracks, between the street railway tracks and the sidewalks.

A COMMISSION TO PREPARE A BUILDING CODE for the city of New York has been authorized by the Municipal Council, and the matter is now in Mayor Van Wyck's hands. The ordinance provides for a representative of the Corporation Counsel, the three Commissioners of Buildings, and five experts who shall have had at least five years' actual experience. It is understood that the five experts will be appointed by President Guggenheimer of the Council, and President Woods of the Board of Aldermen.

THE HOLLAND SUBMARINE TORPEDO BOAT has been favorably reported upon by the Board of Inspection and Survey of the Navy Department. The report says that the board found all the claims of the builders verified, but it recommends a further test under "war conditions." This test is to be conducted in about one month over a mile course. In the center of this course an old vessel will be anchored; and the "Holland" must rise to the surface, discharge a torpedo effectively at the hull and then disappear. On the successful accomplishment of this work will depend the acceptance of the boat by the government.

PROPOSALS FOR MACHINERY for rolling armor plate, to be delivered at St. Petersburg, will be received until Dec. 12 at the office of the Naval Attaché of the Russian Embassy, D. T. Mertvago, 818 18th St. N. W., Washington, D. C. A reversing engine is wanted, capable of rolling the ingots to plates at one heat. The rolls are to be 4,000-mm. in length, the maximum weight of ingot 60 tons, and the maximum thickness of the plate is 900 mm. Roller tables lifting appliances, two sets of regenerative furnaces, with movable bottoms, and other appurtenances, are also called for.

A NEW FACTORY FOR MAKING LARGE GUNS is likely to be built at Newport News, in the vicinity of the shipyard at that place. Negotiations are in progress between Mr. C. P. Huntington and Vickers' Sons & Maxim, the English shipbuilding and gun-making firm, for the taking by the firm of a large part of Mr. Huntington's interest in the Newport News company, and for the addition of gun-making to its business. The work on the great dry-dock at the shipyard is advancing rapidly. About 10,000 piles have been driven, and a large part of the excavation has been made.

THE NEW U. S. COALING STATION at Pago Pago, Island of Lutuilla, Samoa, the contract for which was let some time ago to Healy, Tibbitts & Co., of San Francisco, Cal., is being rapidly rushed. The contract for the steel work, amounting to 2,800,000 lbs., has been awarded to the Carnegie Steel Co., and the mills are now at work getting out the material. Contracts are yet to be let for 350,000 lbs. of iron castings, 200 tons of cement and 200,000 ft., B. M., of timber. The coal shed will be 150 × 100 ft., with a framework of steel covered with corrugated galvanized iron. The contractors will take about 40 skilled workmen from America, but will depend upon native laborers for the other help.

THE TROPENAS STEEL PROCESS is about to be adopted by the Union Iron Works of San Francisco. A large foundry is being built, in which will be placed two 2-ton Tropenas converters. Mr. Irving M. Scott, vice-president and general manager of the company, recently made a thorough investigation of the process in operation in Europe. Messrs. Powell & Colné, 11 Broadway, New York city, are the agents for the process in the United States.

A WOODEN SUBMARINE CABLE CONDUIT to carry electric light cables across Fort Point channel, Boston, Mass., was described in "The Electrical Engineer" for Nov. 24. This was constructed by the Boston Electric Light Co. of 6 × 14-in. pine timber grooved on a planer so that when bolted together there were formed 24 circular ducts. The ends are made of oak and are curved up on a 20-ft. radius. The curves were built up of 4-ft. lengths while 20-ft, lengths were used in the straight section. In placing, a trench was dredged across the channel bottom, the conduit was built in two sections and launched; afterwards being joined and weighted until it sank into the trench, and duplicate cables were then drawn in and terminated in separate manholes.

PROGRESS ON THE NEW WATER-WORKS FOR CINCINNATI, O.

(With two-page plate.)

The most comprehensive scheme of water-works improvement now being carried out by a single city in this country is the one at Cincinnati, O. Here work is well under way on a new supply, which will include a river intake pier and tunnel, a primary pumping station, large settling reservoirs, filter plant, clear water basin, long gravity main, second pumping station and a force main to the present distributing reservoir, for all of which $6,500,000 of bonds have been authorized by the legislature.

The need of a new water supply at Cincinnati has long been recognized. The present intake is located on the river front in the heart of the city, below a large number of sewers. The water of the Ohio River at its best is so laden with sediment that few Eastern men or women would tolerate it for a moment, while at its worst it is shunned even by Cincinnatians. The people of Cincinnati, and the West in general, feel very kindly towards the Ohio and Mississippi water, especially when the mud has been removed from it, and speak scornfully of the "vegetable tea" served up by water-works officials in the East. There is some reason for this, for these Western waters, minus their loads of mud, are very palatable. Besides the sewage and mud in the present supply, the old Front St. pumping station at Cincinnati has a far from modern equipment, being sometimes referred to as a museum of pumping machinery.

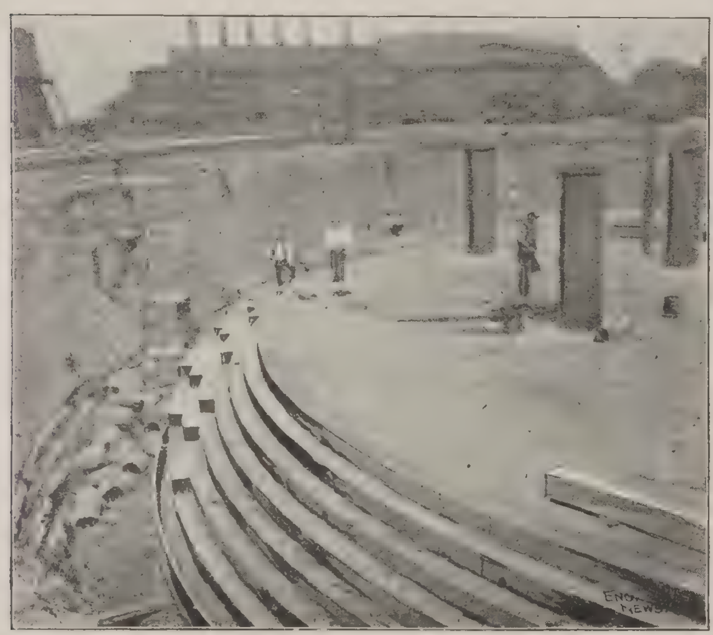

Fig. 9.—Curved Timbers of Triangular Section in Place.

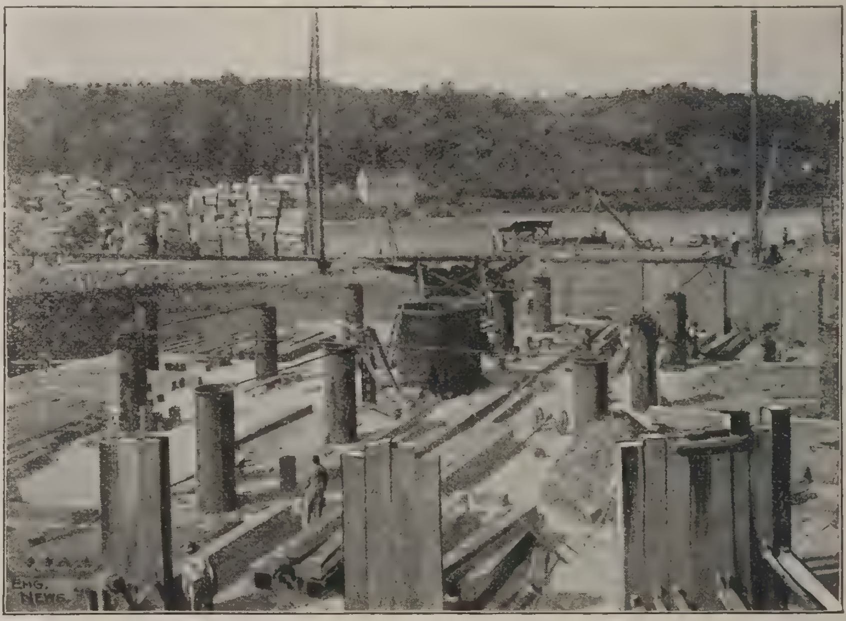

Fig. 10.—Part of Outer Staves and Lining of Central Shaft in Place.

VIEWS OF CAISSON UNDER CONSTRUCTION; THE NEW WATER-WORKS FOR CINCINNATI, OHIO.

In our issue of April 2, 1896, we reviewed briefly a report on a new water supply for Cincinnati, made by Messrs. John W. Hill, Samuel Whinery and Geo. H. Benzenberg, Mems. Am. Soc. C. E., a commission appointed by the Board of Administration of Cincinnati. In its broad general outlines the plan recommended by the commission was similar to that now being carried out, but in its particulars there was much difference. After the appointment of a body officially styled "Board of Trustees, 'Commissioners of Water-Works'," to build new works, the original plans were referred to a new commission for its opinion. The members of this commission were Messrs. Charles Hermany, M. L. Holman, Clemens Herschel, Henry Flad and Samuel M. Felton, Mems. Am. Soc. C. E., and a note giving the main recommendations of its report was published in our issue of May 6, 1897. One of the most significant of the recommendations was that before making designs for a slow sand filtration plant "further investigations be made as to the most advisable method of rendering the water of the Ohio River beyond criticism as to appearance or suspicion as to potability." Mechanical filtration was mentioned as worthy of consideration.

A few days after receiving the report just named the trustees appointed Mr. Gustave Bouscaren, M. Am. Soc. C. E., of Cincinnati, as its chief engineer, and later it selected Mr. Geo. H. Benzenberg, M. Am. Soc. C. E., of Milwaukee, and Mr. Charles Hermany, M. Am. Soc. C. E., of Louisville, as Consulting and Advisory Engineers.

A member of the editorial staff of this journal visited Cincinnati early in October, 1898, saw the work then in progress, and through the courtesy of Mr. Bouscaren, secured the information and material for illustrations from which the remainder of this article has been prepared. It was found that contracts had already been let, as follows: For the intake pier, tunnel and pump pit, to F. H. Kirchner & Co., Cincinnati, who had sublet the pneumatic work to John Monks & Son, of New York city; for grading levee, filter grounds, railway spur and Miami River protection work, to the David Folz Asphalt Paving Co., of Cincinnati; for three 30,000,000-gallon vertical triple expansion pumping engines, boilers and an electric traveling crane at the primary pumping station, to the Lane & Bodley Co., of Cincinnati. Work was already well under way in October on the caisson to be used in sinking the pump pit and on the grading contract. Detailed plans for the pumps had not yet been submitted by the contractors. Experiments, described further on, were in progress to determine the design of the purification works, more especially of the filter plant. The present article will be confined almost wholly to the caisson and the purification experiments.

Description of the Caisson and General Notes on the New Works.

The map, Fig. 1, shows the location of the new intake works in relation to the city and its Kentucky suburbs, while Fig. 2 shows the general plan of the intake, pumping station and purification works. Alternative areas for the filter plant are shown, one for slow sand, the other for mechanical filtration. The river channel here is near the Kentucky shore, necessitating an intake pier in the river and a tunnel with a clear diameter of 7 ft., and a length of about 1,400 ft., as is shown in the plan and profile, Fig. 3. The difference between high and low water in the Ohio River is about 70 ft., which accounts for some of the features of the design of the pumping station, and for the rather unusual appearance of the Covington pumping station, which may be seen on the opposite shore in some of the views. The water will be pumped to two subsiding reservoirs having a combined available capacity of about 345,000,000 gallons, from which it will flow by gravity to the filter plant, and thence to the clear water reservoir and the city pumping station, where it will be repumped to the Eden Park distributing reservoir. The works are being designed for an average daily consumption of 60,000,000 gallons, at the outset, with provisions for a future increase to 80,000,000 or 90,000,000 gallons. Some of the principal elevations of the works will be as follows: Low water at the California, or primary, pumping station, 3.5 ft.; subsiding basins, range, 141 to 110 ft.; clear water basin, range, about 96 to 76 ft.; bottom of well at Pendleton, or second pumping station, about 34 ft.; Eden Park Reservoir, high water, 240.78 ft. The capacity of the Eden Park Reservoir is 100,000,000 gallons.

A cross-section through the California pumping station and pit, showing the caisson at the bottom, is shown by Fig. 4, and the details of the caisson shoe by Fig. 5. The five views, Figs. 6 to 10, show the caisson in its early stages of construction, but before it was completed ready to begin sinking it. The caisson, except for the working cells and air locks, is a solid oak structure, 127 ft. in diameter and 20 ft. high, resting on a steel shoe. It contains about 2,250,000 ft. of oak timber, 12 × 12, 12 × 16, and 12 × 18, every stick of which is planed, and much of which is sawed to special shapes, there being some 15 miles of band saw work on 12-in. oak. Drift bolts, mostly 30 ins. long, 1 to 2 ft. apart, are used vertically and horizontally to such an extent that their combined length would be about 40 miles.

The girders shown in the section, Fig. 4, and in the views, Figs. 6 and 7, divide the lower portion of the caisson into 21 working cells, each 22 ft. square and 8 ft. high, above the level of the cutting edge of the shoe. The cross walls are 3½ ft. thick, including the 3 × 12-in. planking. The inside walls are calked both before and after applying the planking, and the outside walls and the top are calked once. The joints of each horizontal course of timber are grouted with Portland cement and lime, 4 to 1 by weight, after being cleaned with an air blast.

As shown by the views, Figs. 6, 7 and 8, the cross walls, or girders, were first constructed, the first course of roof timbers put on, and then the inclined staves set. After this, the lower, outer part of the caisson was brought to a cylindrical form by adding horizontal timbers, sawed to the proper curves. The inner timbers had their inside faces sawed to fit a conical surface and their outer faces sawed to the radii of the proper circles. These timbers were 12 ins. high, 1½ ins. wide at the bottom, and 13½ ins. at the top. Compressed air was used to bore the holes for the drift bolts and to drive the vertical drift bolts. The pneumatic work and the building of the caisson is in charge of Mr. Daniel E. Moran, M. Am. Soc.

C. E., of and for the sub-contractors, John Monks & Son.

There will be one central shaft, 10 ft. in diameter, which will be the suction shaft, and twelve smaller ones, each 3 ft. in diameter, as shown in some of the views. The latter are the standard shafts for Moran air locks.

All shafts are lined with steel, the plates of the large shaft being ¾-in., and of the small shafts about ¼-in. thick. The caisson is to be sunk to a depth of about 87 ft. below the surface of the ground. The working cells will be refilled with the best sand found in making the excavation, and the air lock shafts will be filled with concrete. The central shaft will then be carried on down to rock, about 18 ft., and continued in the rock to the level of the intake tunnel, the height from the bottom of the shoe to the center line of the tunnel being about 46 ft. The central shaft and the pump house walls will also be extended upwards from the top of the caisson, as shown in Fig. 4. A special feature of the outer masonry wall will be a ¼-in. steel cylinder built into it to make it water-tight. Mr. Alfred Petry, M. Am. Soc. C. E., is resident engineer on the work now in progress at California.

The intake tunnel is designed for a self-cleansing velocity of 3 ft. per sec. It is to be lined with two rings of brick, backed with concrete.

The subsiding reservoirs will be operated on the fill and draw plan. Each basin will be alternately pumped into and drawn from for from 72 to 48 hours at a time, giving an average subsidence of 72 hours for a daily output of 57,500,000 gallons; 60 hours for 69,000,000 gallons; and 48 hours for 86,250,000 gallons. Grounds have been provided for the construction, when needed, of a third settling basin, at the same elevation as the others, with a capacity of about 120,000,000 gallons.

The reservoirs will be formed by damming ravines, thus giving them the irregular shapes shown on the plan, Fig. 2. This irregularity makes the continuous settling plan impracticable, owing to uncertainties regarding the circulation of the water. The embankments will be built by what Mr. Bouscaren terms the dry process, that is, in 4-in. layers rolled dry with heavy steam rollers. In wet weather work on the embankments will stop. Four years is allowed for building these reservoirs. A similar plan of construction was employed by Mr. Bouscaren on the subsiding reservoirs for Covington, Ky., which are right across the river from the new works for Cincinnati. The Covington intake is close by the location chosen for Cincinnati, so the water for the two cities, as drawn from the river, will be identical in character. This fact has interest because some thirty days of sedimentation in the Covington reservoirs effects a large removal of bacteria and sediment, but even this long period of quiescence does not produce an ideal water. Thirty days sedimentation for Cincinnati, with the proposed ultimate capacity of 90,000,000 gallons, would mean duplicate settling basins of 2,700,000,000 gallons each.

The clear water basin will be 20 ft. deep, 400 ft. sq., and have a capacity of 20,000,000 gallons. As it will contain only about an eight hours' supply it is not thought necessary to cover it.

The final location and character of the conduit to the city pumping station had not been decided up to Nov. 20. Its length will be about 23,000 ft.

A toll road passed through the land bought for the new purification works. To divert the traffic, and to save paying tolls, the trustees have bought about a mile of this turnpike, and are constructing a piece of new road. They have also made a contract with a railway for changing its track from narrow to standard gage. A spur about 5,000 ft long will be built by the city from the railway to the pumping station. This will be available for the use of the contractors. It will include a viaduct 630 ft. long, on an 8½° curve, composed of plate girders of alternate 30 and 60-ft. spans.

The five trustees of the new works are: Aug. Herrmann, President; Maurice J. Freiberg, Chas. M. Holloway, Leopold Markbreit and Wm. B. Melish.

The Cincinnati Experiments on Water Purification.

In November, 1897, the chief and advisory engineers submitted a recommendation that water purification experiments be instituted, they being

> confronted with the fact that there is not sufficient reliable information or experience at hand regarding the best and most economical methods to be adopted for filtering th Ohio River water.

The engineers did not doubt the success of slow sand filtration abroad, but they said that the water there differed materially from that of the Ohio for at least six months of the year. They also desired information to enable them to decide between slow sand and mechanical filtration, and more light on sedimentation. They considered that it would be wise to spend in experimental work 3% of the estimated cost of a purification plant and advised

> the construction of settling tanks and filters of sufficient capacity to purify Ohio River water at the rate of 250,000 gallons per 24 hours for a period of eight months.

Mr. Bouscaren estimated that the desired experimental work could be carried out at a cost of $23,000 for construction, and $9,000 for operation for eight months. Mr. Geo. W. Fuller, who had just finished his experimental work on water purification at Louisville, was engaged as chief chemist and bacteriologist to take direct charge of the Cincinnati tests. On March 28, 1898 the experimental plant at Cincinnati was put in operation, and it, as a whole, has not shut down since, running days, nights and Sundays. It is expected that the experiments will be continued until at least Jan. 1. The following information regarding the scope of the experiments, and the factors involved, were obtained from Mr. Fuller.

The drainage area of the Ohio River above the new intake is about 71,000 sq. miles. The turbidity of the water ranges from 5 to 2,500 parts per 1,000,000 of total matter in suspension, by weight. The minimum amount of suspended matter is practically all clay, while of the maximum a large percentage is silt and coarse clay, suspended matters in the water being divided conventionally into sand, silt and clay, according to their hydraulic subsiding value. Between the limits named there are all sorts of variations and combinations in the amount and character of the suspended matter. This will be better appreciated on noting that the drainage area of the Ohio includes many variations in surface geology, and that the rainfall and runoff causing increases in turbidity may cover the whole drainage area, or any of its several sections having different geological formations. The maximum turbidity may occur several times in a year. As compared with the Merrimac River at Lawrence, water from which has been used for the Massachusetts experiments on slow sand filtration, the turbidity of the Ohio River is enormous, for, while at rare intervals, say, perhaps, four or five times in a century, the Merrimac River in freshet may carry 1,100 parts of suspended matter (silt), there is generally so little that chemists do not take the trouble to determine it. The bacteria in the Ohio River water range from 1,000 to 100,000 per cu. cm., with an average of about 10,000. The suspended organic matter ranges proportionately with the total suspended matter, but of the fairly constant dissolved organic matter it is hard to distinguish between that of sewage origin and that washed from the surface of the earth.

The experiment station at Cincinnati is located immediately below the retaining wall of the Eden Park Reservoir, so water may be taken from the force main leading from the main pumping station and pass through the purification plant by gravity. This secures water as nearly as possible like that of the river, at the intake of the present pumping station. The unit basis of the plant being a daily capacity of 100,000 gallons, four settling tanks, each of that available capacity, were provided and are used in rotation. These are of steel, 25 ft. in diameter, and 34 ft. high. They are designed for quiescent subsidence, being filled from the bottom and emptied through valves placed at different levels, the upper valves in succession being opened first. The average total subsidence is designed to be three days, figured from the time the tank is full until it is half empty. It takes about four hours to fill each settling tank.

The water passes by gravity from the settling tanks to an equalizing tank, in which it is held automatically at an approximately constant level. From this box the water flows through valves kept wide open, for constant flow, to the top of the filter beds, which are all at the same level.

There are 15 wooden tanks used for filter beds, in three sets, of five each. The diameter of each tank is 11.78 ft., or 1-400 acre. In each set of five tanks one is 10 ft. deep, three 8 ft. and one 6 ft., the shallower tanks being blocked up to bring the tops all to the same level. Each of the 15 tanks has gravel layers at the bottom for supporting the filtering sand, similar to those at the Lawrence Experiment Station. The 10-ft. tanks contain 5 ft. of filterng sand; the 8-ft., 3 ft.; the 6-ft., 1 ft. The available water space above the sand in each tank is 4 ft., before the depth of the sand is decreased by scraping. To prevent the water from rushing down the sides of the tanks in channels there is a series of horizontal grooves about 1¼ in. wide and ⅝-in. deep, 6 ins. c. to c. They seem to be successful. Each set of five filter tanks is filled with coarse, medium and fine sand, with effective sizes of 0.34, 0.27 and 0.20 mm., respectively. The sand was taken from the bed of the river, in the vicinity of the site for the new works. The inlets to the filter tanks enter at the sides, about 2 ins. above the original sand surface. The filtered water is drawn from the bottom of the tanks, near the sides. The outlet pipes extend to a meter room beneath the filter platform, there being a meter for each filter. On each outlet pipe there are two valves, one close to the tank, which is kept wide open, and one in the meter room, which is used to regulate the rate of filtration.

All the filters operate on the continuous plan. The rates of operation, for each set of five, are, three at 2,600,000 gallons acres per day, these having, respectively, 5, 3 and 1 ft. of filtering sand; one at 4,000,000, and one at 1,500,000 gallons, each having 3 ft. of sand.

The laboratory is a temporary one-story building, of wood, about 30 x 65 ft. It contains a full chemical and bacteriological equipment. Besides Mr. Fuller, who is Chief Chemist and Bacteriologist, there are six trained assistants, three of whom, ranking as first assistants in their respective departments, were with Mr. Fuller on the Louisville work, as follows: Chas. L. Parmelee, Engineer; Jos. W. Ellms, Chemist; Geo. A. Johnson, Bacteriologist.

As to the results of the experiments it is not fitting to speak, in view of their present uncompleted state, further than to say that on the whole satisfactory progress is being made, and that the bacteria are more easily removed than the turbidity. This last is not surprising, in view of the fact that at times the particles of clay in suspension are much smaller than the bacteria. When the Cincinnati report is published we shall have for the first time, so far as we know, detailed information regarding the possibilities of combined sedimentation and slow sand filtration for the removal of bacteria and turbidity from a water liable to be frequently high in both.

A COOLING TOWER AND CONDENSER INSTALLATION.*

By J. H. Vail.†

The conditions existing prior to the installation of the plant referred to in the following paper were as follows: The electric light station was equipped with 27 boilers, 48 ins. in diameter, 20 ft. long, with 22 5-in. tubes. The engine capacity and the load on the station already taxed all the boilers to the limit of their steaming capacity.

Plans had been prepared and estimates made for enlarging the building and increasing the boiler capacity.

After an investigation of the existing conditions, the writer recommended that by the putting in of a cooling tower and a condensing system, the engine capacity of the station could be increased, leaving the boiler capacity the same, thus saving the cost of adding more boilers and enlarging the building, and at the same time obtain better economy, as well as a greater capacity for production.

To determine the steaming capacity of the boilers, two tests were made with one pair of boilers, which showed that under regular working conditions, with Shenandoah pea coal, each 48-in. by 20-ft. boiler would evaporate into steam 4,281 lbs. of water per hour, giving a capacity of 115,587 lbs. steam per hour with every boiler in operation. Coincident with the boiler test, one 18½ x 30-in. Buckeye engine was using the steam from the boilers under test. The result from the engine test and average of all cards showed a steam consumption of 46.8 lbs. steam per I. HP. per hour. [This high figure is no doubt largely due to extremely variable loads.—Ed.]

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*Condensed from a paper presented at the New York meeting of the American Society of Mechanical Engineers.

†Chief Engineer Pennsylvania Heat, Light & Power Co., Philadelphia, Pa.

The writer recommended that the Buckeye engine should be converted from the 18½ × 30-in. hugh pressure engine into a 14¼ and 25 × 30 tandem compound condensing engine. Also that an additional 750-HP. tandem compound condensing engine should be erected in the station, together with a cooling tower and the necessary condenser equipment, and that the only change in boilers should be to raise the working pressure. No increase of boiler capacity has been made.

After investigation, the Barnard type of cooling tower was selected as desirable to best meet the conditions existing at this plant, which were, minimum floor space, and minimum weight, and a considerable elevation above floor level of engine room.

Details of Cooling Tower.

The cooling tower is of the twin type, having two chambers, with a pair of fans supplying a strong draft of air to each chamber. The interior dimensions are 12 ft. 3 ins. by 18 ft. by 29 ft. 6 ins. high. The shell of the tower is of steel, 3-16 and ¼-in. plates, reinforced with angle and channel irons.

The hot water from the condenser discharge is delivered through a 10-in. wrought-iron pipe, extending the whole length of each chamber, slotted on top, and perforated at the bottom, giving equal distribution to a series of 96 distributing pipes, extending across the tower, each pipe being slotted and perforated, thus insuring a very uniform distribution of water.

Means are provided for cleaning these pipes, which is found necessary in cold weather, when the cylinder oil from the exhaust steam is liable to clog the pipes and interfere with uniform and free distribution of the water.

The hot water falls from the distributing pipes over 42 galvanized wire mats, made of No. 19 steel wire, woven to No. 5 mesh. Each mat is 12 ft. by 15 ft. 6 ins., affording a total of 8,064 sq. ft. of cooling surface. Each mat is suspended by galvanized iron hooks, and is easily removed for cleaning or repairs. In actual service it is found that the water is uniformly distributed.

The circulation of air is furnished by two pairs of 8-ft. diameter fans, each pair of fans being mounted right and left on a 2 15-16-in. shaft, and the four fans being capable of delivering 360,000 cu. ft. of air per minute when driven at a speed of 150 revolutions per minute. The air entering the tower chambers at the lower section is deflected vertically from each fan, thus avoiding cross currents, and affording a uniform blast through and between the mats.

The rated capacity of each section of this cooling tower is to cool the circulating water needed to condense 12,500 lbs. of exhaust steam, from an initial temperature of 132° F. to 80° F. when the atmospheric temperature does not exceed 75° F., nor the humidity 85%.

The circulating water is handled by a Blake vertical twin air pump and jet condenser.

In an equipment of this kind it is important to have facilities for driving the fans at variable speeds; this requisite flexibility has been obtained by using a small vertical engine without a governor direct connected to the shaft of each pair of fans.

The accompanying table, extracted from the log records for many months, shows details as to temperatures, speed of fans, reduction of temperature of condenser discharge, etc.

As previously noted, the 18½ by 30 Buckeye engine was changed to a 14½ and 25 by 30 tandem compound condensing engine by bolting new tandem cylinders on the existing frame and making necessary alterations in valve rods, etc.

Specimen cards, taken from this engine as in daily service, give the following data:

Revolutions, 137; steam pressure, 113 lbs.; mean effective pressure, 50.16 lbs.; vacuum per gage, 26 ins.; I. HP. developed in high pressure cylinder, 163.42; I. HP. in low pressure cylinder, 168.48—total, 331.9 HP., and of this 90.52 HP. is below atmospheric line. The work is divided almost equally between the high-pressure and low-pressure cylinders; all cards show similar results.

In addition to the tandem Buckeye engine a tandem compound condensing engine, 20 and 36 by 42 ins., 120 revolutions per minute, Corliss type, built by Pennsylvania Iron Works, was installed to drive a direct-connected Stanley 500-K-W. two-phase A. C. generator. This engine works 15 to 17 hours per day.

The usual work required from the cooling tower and condenser varies from 7 to 17 hours per day. A notable record was made on Aug. 2, 1898, when the run was from 7 a. m. till 12 midnight, and from the daily records, the following data are extracted:

	Maximum.	Minimum.
Temperature, atmosphere	103°	83°
Temperature, condenser discharge to tower	128°	106°
Temperature, condenser suction	98°	91°
Degrees of heat extracted, through tower	32°	21°
Speed of fans, revolutions per minute	160	140
Vacuum at condenser	26	20
Strokes of condenser pump	50	38
Pounds boiler pressure	121	100
Temperature, boiler feed	212°	200°
Engine, HP. developed	900	400

A continuous heavy load was carried during the entire 17 hours' run. This was not a test record, but simply daily service.

Indicator diagrams, Nov. 5, 1898, from the 20 and 36 × 42 tandem compound condensing Corliss engine, gave the following:

Engine revolutions	120 per min.
Steam pressure	112 lbs.
Vacuum at condenser	25 ins.
Work done in high-pressure cylinder	311.8 HP.
And in low-pressure cylinder	31.5 HP.
	643.3 HP.
Work done in low-pressure cylinder below atmospheric line	185.1 HP.

Simultaneously with the engine, the pump and fan engines were indicated. The cards showed:

Work done by the pump	13.75 HP.
Work done by the fan engines	13.5 HP.
Total external work	27.25 HP.

which if deducted from the work done below atmospheric line in low-pressure cylinder 185.1 HP. leaves a net gain of 157.85 HP. from the use of the condenser and cooling tower.

It will be noticed from the previous data that the feed water shows a temperature above 200° F. There are two feed-water heaters in connection with the condensing plant. First, an intermediate tubular heater in the line of exhaust between low-pressure cylinders and condenser. Second, an auxiliary feed-water heater was also attached, receiving the exhaust from the condenser and boiler feed pumps, and any other auxiliaries.

The feed water is first heated in a tank that receives the exhaust from the general line of high-pressure engines. The feed water then passes through the intermediate heater, and thence through the auxiliary heater, and reaches the boiler at a temperature of upwards 200° F.

The condensing plant has increased the station capacity about 1,000 HP. with the aid of a condensing system, using the same water in continuous circulation, while the boiler plant, previously stated to be fully loaded, supplies steam for this additional work with boilers to spare.

	1898.					
	Jan. 31.	Feb.	June 20.	July.	Aug. 26.	Nov. 4.
Time	9 p. m.	8 p. m.	8 p. m.	8 p. m.	8 p. m,	5.35
Temperature atmosphere	30°	36°	78°	96°	85°	59°
Temperature condenser discharge to cooling tower	110°	110°	120°	130°	118°	129°
Temperature condenser suction returned from tower to tank.	65°	84°	84°	93°	88°	92°
Degrees of heat extracted through tower	45°	26°	36°	37°	30°	37°
Speed of fans at tower, R. P. M	36	0	145	162	150	148
Vacuum at condenser	25½	26	25	24½	25½	25
Strokes of condenser pump	30	30	37	44	43	28
Lbs. boiler pressure	110	110	120	120	120	112
Temperature boiler feed	212°	212°	210°	211°	213°	213°

* * *

SWITCHES AND FROGS FOR TRACK OF 100-LB. RAILS; DULUTH AND IRON RANGE R. R.

The use of 100-lb. rails is not yet so extensive but that switches and frogs built up of such rails have a sufficiently striking appearance to attract attention from and be of interest to the users and makers of track equipment, and it is interesting to note that equipment of this kind is now being introduced on the Duluth & Iron Range R. R. The present track of this road is laid with 80-lb. rails, but we learn from Mr. R. Angst, Chief Engineer, that his road is now laying about 4,000 tons of 100-lb. rails (of the section recommended by the rail committee of the American Society of Civil Engineers), and has adopted standard plans for the switches and frogs, as shown in the accompanying drawings.

The switch, Fig. 1, has switch rails 20 ft. long, the throw at the toe being 5 ins., and the width over gage lines at heel, 6½ ins. These rails are connected by five tie rods ¾ × 2½ ins., the ends of which are fitted into sockets in large heads bolted to the rails. The front rod is 9 ins. from the toe, and the rods are spaced 38 ins. c. to c. Near the ends, the switch rails are stiffened by reinforcing bars ⅝ × 3 × 81 ins., each bar being secured to the outside of the web of the rail by ⅝-in. rivets. The ties are spaced 19¼ ins. c. to c., except that those at the heel and toe are 17 ins. and 18½ ins. apart, respectively. On every tie are tie plates or slide plates for the switch rails, and rail braces outside the stock rails. The plates vary in size from 6 × 19½ ins. to 5 × 9 ins., the former being ⅜-in. thick, with slide seats raised 7-16-in., while the smaller plates range from ⅜-in. to 3-16-in. in thickness.

The frogs are of the spring rail type, as shown in Fig. 2, which represents a No. 10 frog. The frog is riveted to a ¾-in. plate, 7 ft. long, and 19 ins. and 27 ins. wide at the ends, on which are the springs, guides and anti-creeping attachment. The main rail is carried to the point, its end being beveled, and 5 ins. from the theoretical point, having a thickness of 7-16-in. The heel block, or raising block, is either a steel casting or an inverted piece of the rail planed to shape. Wooden footguards are fitted to the throat, and at the ends of the spring and wing rails. The frog is 15 ft. 11 ins. long over all, and has a spread of 7⅞ ins. at the mouth and 5½ ins. at the heel, while the width of throat and flangeway is 2 ins. The connections to the lead rails are made with six-bolt splice bars. The movable rail is held by double coiled springs, placed at the throat, 12 ins. from the point. The frog rests on ten ties, 19 ins. c. to c., the toe being over the sixth tie from the heel.

Perhaps the most interesting feature of all, however, and one which is certainly novel, is the use of a heavy angle iron instead of the usual piece of track rail for the frog-guard rail, as shown in Fig. 3. This guard rail is made from a piece of commercial angle iron ¾ × 6 × 6 ins., 20 ft. long. It gives a flangeway 1¾ ins. wide for 8 ft., and then flares out to an entrance width of 4½ ins. The guard rail is fastened to the ties by spikes in ¾-in. square holes, and is secured to the track rail by seven ⅞-in. bolts with cast spacing pieces or fillers. This arrangement reduces the field work on the metal to the drilling of a few holes in the main rails, makes a neat job, and ensures uniformity.

The switch rails, frog and frog guard rails for each turnout are ordered in one lot.

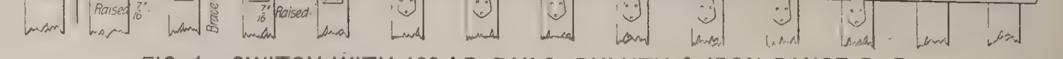


FIG. 1.—SWITCH WITH 100-LB. RAILS; DULUTH & IRON RANGE R. R.
R. Angst, Chief Engineer.

* * *

IS IT SAFER TO RUN FAST OR SLOW OVER A WEAK BRIDGE?

The precaution most commonly adopted to avoid accident in the case of a weak railway bridge is to reduce the speed of crossing trains. The wisdom of this practice can hardly be questioned when we consider all the conditions in the majority of cases, but occasionally the question arises whether in a particular case it would not have been safer to reverse the ordinary practice and cross the weak structure at high speed. A query of this character has recently been brought to our attention by a well-known engineer who gives it his own answer, and states the reasons upon which that answer is based in the following interesting communication. We shall be glad to give space to the narration of similar incidents of trains jumping weakened bridges by any of our readers who may have observed the circumstances. Our correspondent writes as follows:

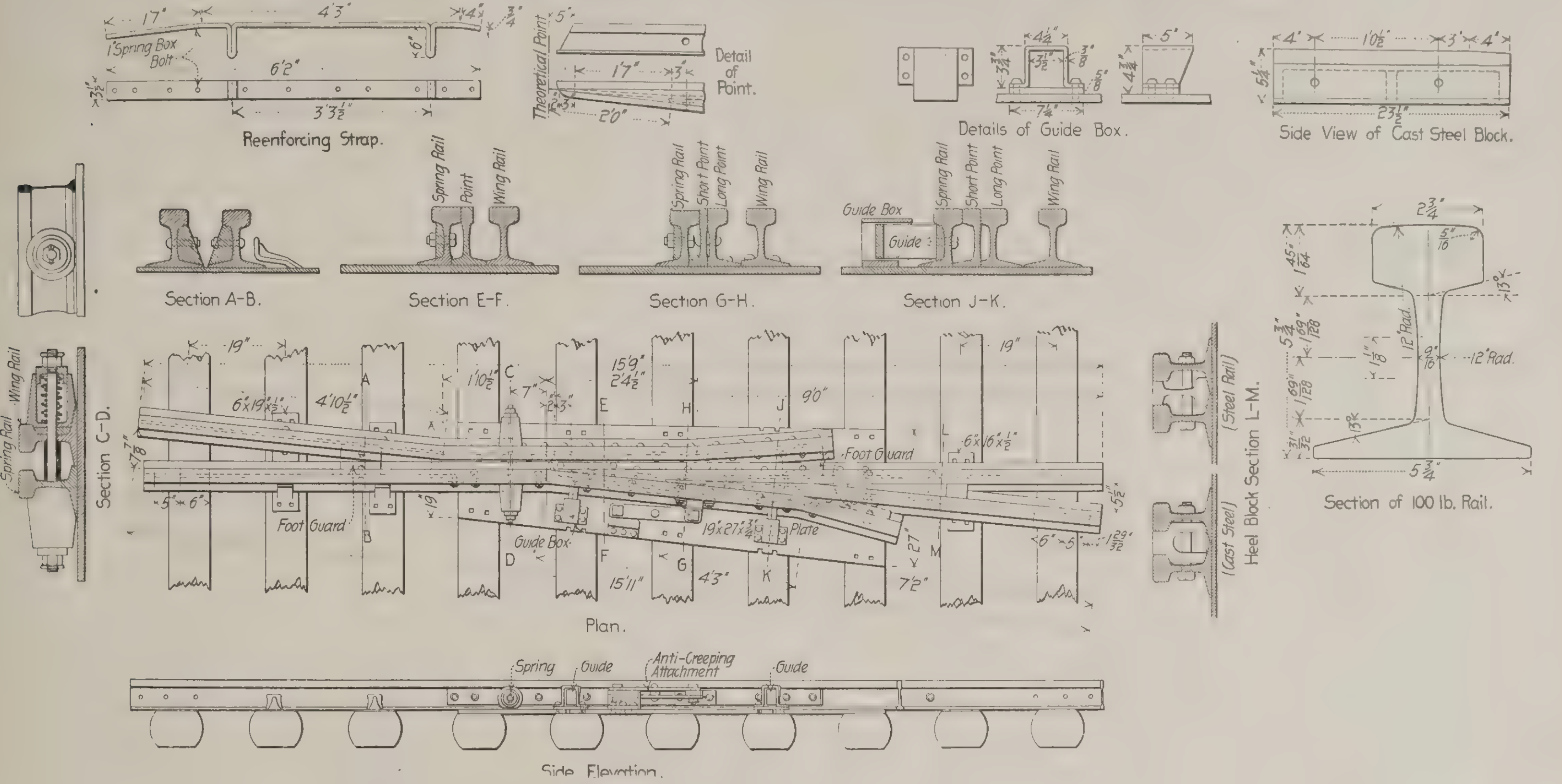


FIG. 2.—NO. 10 SPRING-RAIL FROG WITH 100-LB. RAILS; D. & I. R. R. R.

I believe it possible, if not probable, for a passenger engine running 50 or more miles per hour, actually to leap a clear opening of say not over one-third its stiff-frame length. I would not care to be on the engine, but still I believe such an occurrence is possible. The "leaps" on which I base my opinion were not over clear openings, but over structures that had none or little supports other than the track rails, strength of bolster bolts and stiffness of bolsters (or corbels), stringers and undermined masonry. Though the following trains in each case were wrecked, yet, had their engines been running light at the time, the engines would not have even left the rails but have passed on in safety. These are all authentic occurrences as the newspapers of the dates, the trials in the courts, and the records of the several roads will verify, and I was the Chief Engineer of the roads at the time.

The Blue River accident was at Salem, Ind, and my memory is that the bridge consisted of four spans of 18 ft. (total length, 72 ft.), made up of two new oak stringers, 12 × 16 ins., under each rail, long bolsters of the same size crossing each pier, having 1-in. bolts. All the piers, three in number, were entirely washed out and gone. The engine crossed and stopped (off the rails) safely, and I think, uninjured, on the top of the embankment at the south end of the span.

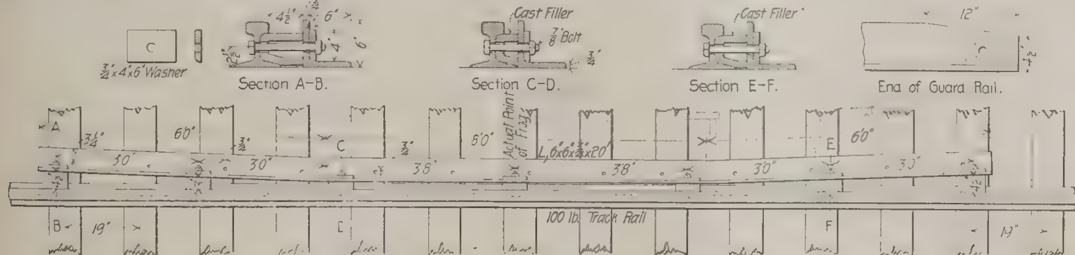


FIG. 3.—ANGLE IRON GUARD RAIL FOR FROGS WITH 100-LB. RAILS; D. & I. R. R. R.

The White River bridge at Broad Ripple, near Indianapolis, had two spans of Howe truss, about 100 ft. long each. We were putting in new stronger end rods in the south end of the north span and moving the old rods towards the center, throwing away the old center rods. The foreman (a smart Alec), against orders, permitted an accommodation train, going south, to run onto this span while only the four temporary 2½-in. diameter construction rods were in, instead of the six new 2-in. rods, which he was just preparing to put in. One of these 2½-in. rods broke. The span broke in two at the north end of the first south panel. The locomotive went over safely, stopped, just off the rails, on the north end of the south span, and was not injured. Both these accidents occurred between 1881 and 1885, and Engineering News, I am sure, gave an account of them.

The Ten-Mile bridge accident, on the Louisville, Cincinnati & Lexington R. R. (Cincinnati Branch), occurred so long ago (between 1875 and 1881) that I have forgotten whether it was two 100-ft. spans of Fink trusses or only one. I think it was two. However, the center pier or one of the abutments was undermined and fell while a train was on the bridge. The engine in this case also went over safely and stopped on the embankment near the bridge.

A few miles north of Crawfordsville, Ind., a light engine I was on, was flagged by the carpenter foreman just as we rounded a curve. The engineer reversed and when we stopped the center of the engine was exactly over a 10-ft. opening. The engine was going north and the north end of the stringers were entirely unsupported by anything, the embankment bent having fallen out.

At the Wea trestle, a few miles south of Lafayette, Ind. (spans c. to c. of bents 15 ft., stringers 15 ft. long, two under each rail, I think, 10 × 16 ins., with bolsters of the same size and about 8 ft. long, bolted with 1-in. bolts through the bolsters and stringers at each end of the bolsters, the stringers being 15 ft. long and cut off over each bent), a freshet at night washed entirely away the second bent at the north end. The Superintendent of Bridges was sent by me to see what damage the freshet had done, if any, as the last engineer over the trestle reported something wrong. The superintendent and all his men with him, after repairing the rocks misplaced at the embankment end, reported the trestle safe—did not miss the missing bent. The engine drivers for a week reported "track not good at Wea trestle," but said it was only a "little rough." The section foreman, who crossed every day and who had repaired the surface at the north end, also reported everything safe. A week after the freshet I went to Lafayette, took a "hog," and with the roadmaster, went to the trestle, went below, to one side where I could see the whole trestle, took a look; asked the roadmaster if he thought the trestle safe, who answered, "Yes." I told him I did not think so as one bent was gone, and pointed to the space. The "hog," waiting for us to get through looking at the trestle, was standing with its tender on the embankment and the pilot over the lost bent space. I motioned the engineer to back up slowly, and he moved his engine onto solid ground. Politics (?) retained the bridge superintendent and roadmaster, but I could and did fire the section foreman who lived near by and saw the trestle twice a day. I wanted to fire the other two but could not. Every train on this division of the road passed over this 30-ft. opening supported by the rails, and eight 1-in. bolster bolts only, for a week, and the only report from the engine-men was that "track was rough on Wea trestle."

The White River bridge, consisting of three spans of Howe trusses, over 100 ft. each (I think 110 or 120 ft.) between Mitchell and Bedford, Ind., had been inspected(?) once a year for 20 years regularly, and probably once a month irregularly, during these years, and always reported sound and safe. I inspected it myself and after removing the weatherboards—snow protection—on the inside of the east truss at the north end of the north span, I found under the end of the end braces and posts that the bottom chord was entirely eaten away by ants. This truss of this span, for no one knows how many of the 20 years, had sustained itself and the live loads by "force of habit" for there appeared nothing else to do it.

All these bridges (and trestles) were located where trains ran fast. In four of the cases engines went over safely, and in the others trains did so.

The question then which comes directly to my mind is, is it not a fact that gravity can to a very considerable extent be overcome by the momentum of swiftly moving trains, and in short spans, say 30 ft. and under, is there not an excess of factor of safety generally used by engineers in designing such spans? I fully approve of using the excess, but I think that a similar excess should be used as well, in long spans, though this adds to cost, on the theory that it is money well spent when spent on the side of safety. But this does not change the question in my mind as to how much impact, weight, gravity, or whatever it may be called, does a rapidly moving rolling object put upon a structure or track. This subject has all come about by my being called upon as a witness in a case of a trestle falling where everything went into the "hole" but the engine, which went over safely. Under oath I was asked: "Which would you consider safest, to pass over a structure (like the one in question whose spans were only 12½ ft., the stringers 25 ft. long, packed to break joint over bents, and composed of two piers of 9 × 16-in. yellow pine) where one of the bents is badly decayed, at a fast rate of speed, or at a slow rate of speed?" I answered I would rather risk my life on the fast train. The reason? I have already stated it. In conclusion, I would very much like to hear of the experience of others on this subject. We learn by experience of others, but some are afraid to tell their experience. I am not, for if I am wrong on any of my theories I want to be corrected as soon as possible before I make a mistake that will ruin the company or kill its patrons. Experiences, as well as appearances, sometimes are deceiving.

THE NEW COVERED FILTER BED FOR THE WATER-WORKS OF SOMERSWORTH, N. H.

The second slow sand filtration plant built in this country and covered with a masonry roof is located at Somersworth, N. H. This filter was put in operation about April, 1898. Like the filter beds at Ashland, Wis., described in our issue of Nov. 25, 1897, the Somersworth plant was designed and constructed by Mr. Wm. Wheeler, M. Am. Soc. C. E., of 89 State St., Boston, and, like the earlier plant, this one also has an area of one-half acre.

The population of Somersworth was 6,207 in 1890, and is about 7,000 at present. From 1864 to 1896 the water supply was furnished by the Great Falls Manufacturing Co. In 1896 the city bought the distributing system, except the portion supplying the property of the company. This portion, together with the old pumping plant, reservoir and stand-pipe, the company retained for the supply if its mills.

The water delivered by the company was taken from the Salmon Falls River, at a point below one of its mills and also below a part of the town. This water was sometimes objectionable to sight and taste, and quite a strong feeling against it developed. In the discussion leading up to the establishment of municipal works the general desire seemed to be to substitute spring or well water for the river supply, but attempts to find such in suitable quantities failed. Of the available surface supplies, chemical analyses and physical examinations indicated that the Salmon Falls River, at a point above the city, would be the best source. A description of this source, accompanying a sample sent by Mr. Wheeler to Dr. Edw. S. Wood, of the Harvard Medical School, for analysis, gives the following information:

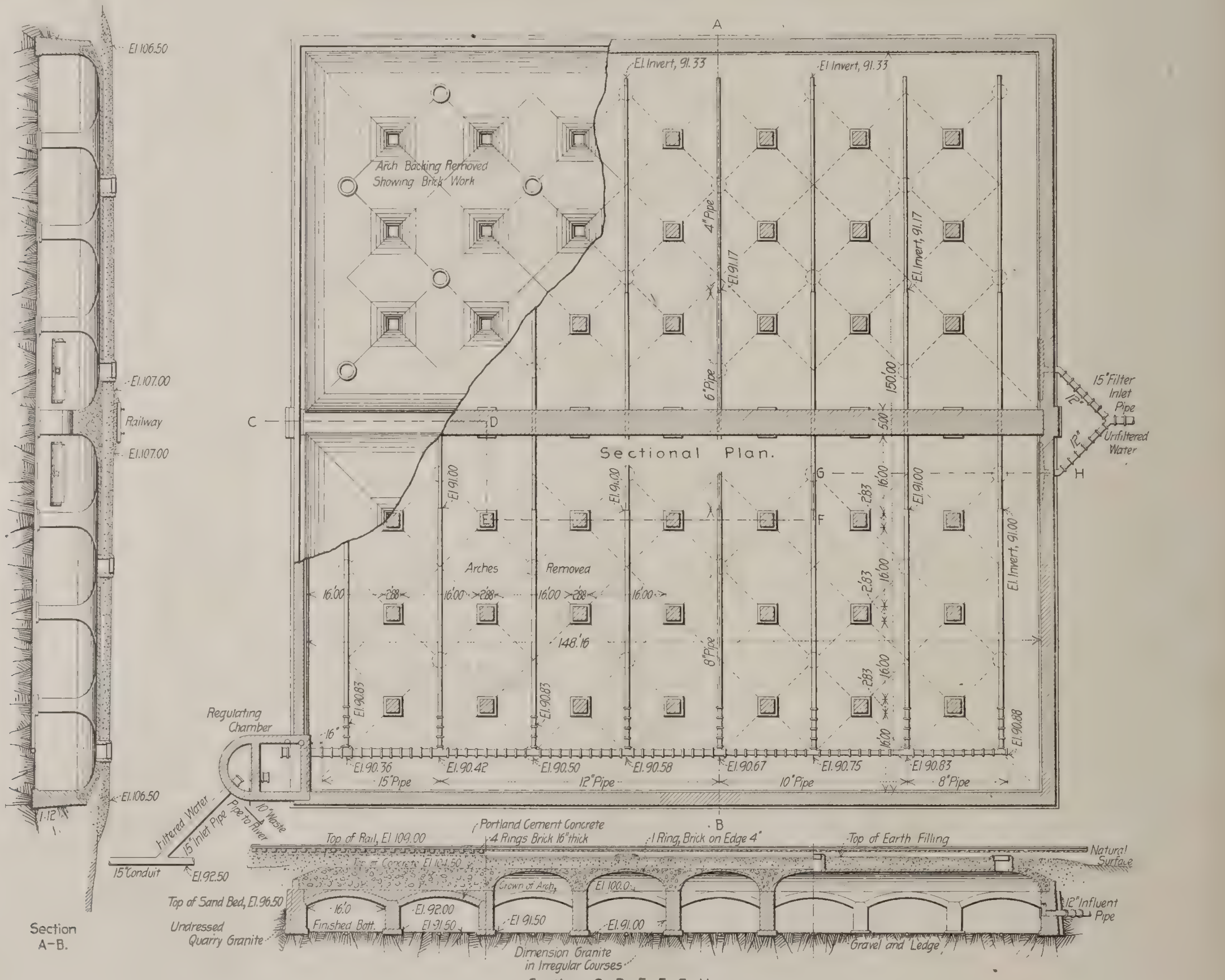
> Salmon Falls River has its source in Great East Pond in Acton and Wakefield, 18 miles distant. Only two places on river above here, Milton (14 miles distant), about 1,000 inhabitants, and East Rochester, about 1,500 inhabitants, 7 miles distant. After leaving Milton, river flows over rapids for several miles; also after leaving East Rochester. No buildings or houses along the river banks except at these points.

The chemical determinations of the Salmon Falls water, in parts per 100,000, were as follows: Transparency, clear; color, 0.3; odor, slightly earthy; chlorine, 0.06; albuminoid ammonia, 0.0174; free ammonia, 0.0072; nitrates, 0.014; total residue, 8.40, of which 1.60 was fixed and 6.80 volatile, there being considerable blackening on ignition. This sample was pronounced by Dr. Wood as the best of samples submitted from three sources, so far as he could judge "without knowing anything about their surroundings or history," which information he requested. On receiving this Dr. Wood wrote as follows:

> The objection to the Salmon Falls River is the existence of the towns above. If, however, the thickly settled parts of the towns are not on the banks of the river, there is probably little danger from their drainage at present.
>
> That is, however, a question for you to decide rather than for me. Certainly, the Salmon Falls River water as it flows in the stream is the best of the three, and if the danger of sewage pollution from the towns above is practically absent, I should recommend its water rather than Nos. 1 and 2.

Mr. Wheeler believed that the limited size of the two communities named, their remoteness from Somersworth and the understanding that they had no sewerage system practically precluded immediate danger from sewage pollution. In case such danger should arise in the future he stated that appeals could be made to the legislature or the courts for protection, or the water might be filtered. The city at once requested information regarding filtration, and eventually it was decided to put in slow sand filters. Bids for such a plant were received on Sept. 22, 1896, the prices, based on the estimated quantities, ranging from $22,037 to $36,303. The contract was awarded to the lowest bidder, Ames & O'Shea, of Somersworth, at the price named. The contractors threw up the contract when about one-third of the work, in value, had been completed. The contract for completing the plant was awarded to the Great Falls Granite Co. (Spence & Coombs). The original contract price of $22,037 did not include certain accessories necessary to the operation of the plant. The engineers' estimate for the beds and all these accessories was $29,892, and the work actually cost $32,720, minus an amount to be recovered upon the bond of the first contractors, Ames & O'Shea. This amount is made up of sums paid the second contractor that were chargeable to the first.

The filter bed is located between the river and the pumping station, only a short distance from each. Its design is shown by the accompanying plan and sections. Water flows from the river to



Section C–D–E–F–G–H.

PLAN AND SECTIONS OF COVERED FILTER BED AT SOMERSWORTH, N. H.
Wm. Wheeler, M. Am. Soc. C. E., Engineer.

the filter bed, and from it to the pump well, by gravity. There is a screen chamber at the river and a regulating chamber at the other end of the bed. The filter is in one compartment, as shown by the plan, but water is admitted to it over two 12-ft. weirs, which, with the regulating chamber, are described by Mr. Wheeler in his report to the Committee on Water Supply, as follows:

> The raw water enters the filter through a conduit leading from the screen well to a point opposite the middle of the northeasterly side. It is of 15-in. vitrified pipe and is divided at the point just indicated into two lines, each of 12-in. pipe, which enter through openings in the wall of the filter at grade 95.50 (center of bore), each 10.50 ft. from, and upon opposite sides of, the central line of the lintel piers above described. At each influent point a horizontal pocket or chamber is formed in the face of the wall, 12 ft. long, 25 ins. high, and 12 ins. deep. Covering the lower part of each of these influent pockets or chambers is a removable flashboard or sand-stop, resting in angle iron fastenings, its upper edge being at or slightly above the level of the top of the sand bed, over which the water enters the filter in two streams, each having a width of 12 ft., thus obviating any objectionable disturbance of the surface of the sand bed.
>
> The regulating chamber is about 13 ft. long and 10 ft. wide. It is divided by a brick partition into two compartments, one receiving the clear water from the filter through the main collecting pipe, and containing the apparatus for regulating the rate of filtration so as to maintain uniformity therein, the other an effluent compartment connecting directly with the main conduit leading from screen well to pump well. The enclosing walls and partitions are of brick, laid in Portland cement mortar upon foundations of Portland cement concrete, which form also the floors of the two compartments, that of the first being at grade 89.50 and that of the effluent compartment at grade 92.00.
>
> The connections between the filter and first compartment, between the two compartments, and between the effluent compartment and the conduit to pump well, are made in each case through 16-in. flanged pipe castings, built into the walls and fitted with Eddy gate-valves, the stems of which extend up through the floor of the room above, to be operated by hand wheels suitably mounted on gate stands.

The ordinary level of the river at the intake is about grade 100.

The filter bed has a total depth of 5 ft., there being 1 ft. of selected gravel at the bottom, overlaid by 4 ft. of sand fairly uniform in size, and with 10% of its total, by weight, composed of grains of from 0.30 to 0.45 mm. (0.012 to 0.015 ins.) in diameter. The dimensions of the underdrains are shown on the plan. They are laid with their bottoms at such a grade as will bring the tops of the pipes of different sizes all to the same level, and thus give the same depth of filtering material above them. The net area of the filtering material is 21,780 sq. ft., or practically one-half acre. The combined area of the 49 piers is 444 sq. ft. The middle row of piers is larger than the others, since it has to support a railway siding. This siding is available for handling filtering material when the bed is being cleaned or renewed. Besides supporting the railway siding the heavy piers were designed to withstand the thrust from the covering of one-half the beds. The contract required at least one-half the centers for the covering arches, or all those on one side of the center line, to be placed complete and not removed or struck until the roof on that side was finished.

The material at the bottom of the excavation for the filter bed was of gravel and ledge, at an elevation about 8½ ft. below the ordinary level of the river. The filtering material rests on this surface. The outer walls of the filter bed are laid in American Rosendale cement, but Portland cement was used for all the rest of the stone and brick masonry, and for the concrete.

When it is desired to clean the filter bed the water can be drawn down to about the level of its upper surface by the regular pumps, then completely drawn out by a centrifugal pump, built by the Lawrence Machine Co., located in the house which covers the regulating chamber. After the filter had been in operation about three months, the water was pumped out. It was found that the top of the sand, only, was discolored, and that but slightly. No cleaning was done then, nor had any been done up to Sept. 16, when a member of the editorial staff of this journal visited the plant. No analyses of the filtered water have been made.

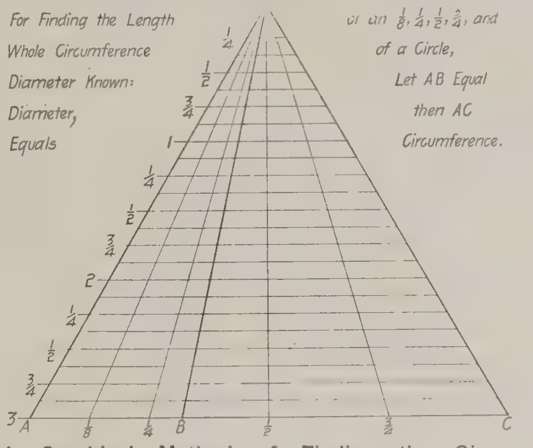
Two 1,500,000-gallon pumps lift the water to a stand-pipe about 40 × 95 ft. The storage afforded by this structure is thought to be sufficient to allow the shutting down of the filter bed for cleaning.

We are indebted to Mr. Wheeler for the drawings and some of the other matter used in the preparation of this article, and to the local officials in charge of the water-works for information given when our representative visited the plant.

A UNIVERSAL CIRCULAR SCALE.

In our issue of March 30, 1893, was published a universal scale for dividing a line of unknown length into any number of equal parts, or for dividing a line of known or unknown length proportionally to another line of known or unknown length. The scale here illustrated is based upon a similar principle, and has for its purpose the finding of the length of the circumference of any circle, or the length of an arc equal to an eighth, quarter, half or three-quarters of the total arc, when the diameter is known.

This scale takes the form of an equilateral triangle, of which the base, A C, is equal to the circumference of a circle whose diameter is the distance A B. The other radial lines shown cut the base, A C, at points equal to ⅛, ¼, ½ or any desired division of the length of the total arc, or circumference. The lines drawn parallel to the base serve two purposes: those with figures attached give a graphic table of circumferences for circles whose diameters are 1, 1¼, 1½-in., etc. In the second place, these lines serve as a guide to the eye in using the scale.



A Graphical Method of Finding the Circumference of a Circle or Any Fraction Thereof, the Diameter being Known.

In using this scale mark off on the edge of a strip of paper the length of the diameter as taken from the object or drawing. Fit this distance between the radial lines, A and B, always keeping the edge of the strip parallel to one of the horizontal lines; then mark on the strip the point where the radial line, C, strikes it, and the distance between the marks, A and C, measured by the same scale as the diameter, will be the length of the circumference. Points taken on the other radial lines will, in a similar manner, give the length of arc for the ⅛, ¼, ½ and ¾ of the total circumference, or for any other division of the circumference as originally laid out on the base, A C.

The designer of this universal scale and the one previously referred to, is Mr. J. Ernest G. Yalden, Superintendent of the Baron de Hirsch Trade Schools, of New York, and he regards it as the most accurate and least complicated of the many geometrical constructions proposed for determining the length of the circumference, or divisions of this arc. It can be made of any size, and with any fractional part desired; and will prove useful to draftsmen, and especially to sheet-metal workers. For general trade purposes it is to be preferred to calculation where dimensions are given in inches, as it is difficult to use the fractional parts of an inch.

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TESTS OF FORMALDEHYDE AS A DISINFECTANT AT NEWTON, MASS.

The report of the Massachusetts State Board of Health for 1897 contains an interesting review of some formaldehyde tests at Newton, Mass. The review was contributed by the Board of Health of Newton, and is as follows:

> During July and August, through the kindness of Prof. S. Burrage, of Purdue University, Lafayette, Ind., the board was enabled to make some interesting and valuable experiments at the Newton Hospital as to the value of formaldehyde as a germicide. The tests extended over a period of about six weeks, and the results have been made the subject of a paper by Professor Burrage, which is too long to be included in this report, but a short resume of the subject will be of interest.
>
> The original intention was to determine what form of formaldehyde generator was the most efficient and best adapted for use by the average unskilled operator. Four different styles of generators were used in the tests, two producing the gas from the 40% solution, and two testing it directly from wood alcohol.
>
> The results taken as a whole showed that formaldehyde is not as fatal to disease germs as is generally claimed, at least when the exposure is for so short a period as six hours.
>
> There was no great difference in the efficiency of the different forms of generator, the results being practically the same with each. A number of tests were made with each generator, in order to have as large an amount of information as possible upon which to base conclusions.
>
> No record was kept of the amount of gas evolved by each generator, although the same amount of solution (about one quart) was used in each of the first form, and about one liter of alcohol was consumed by each of the second form. This would give, approximately, 16 ozs. of formalin and 500 cu. cm. of alcohol to 1,000 cu. ft.
>
> The practical conclusion to be drawn from these tests is that, while formaldehyde remains the most practical gaseous disinfectant which we possess, a number of elements must be taken into account in order to obtain satisfactory results. The length of time of the exposure, the amount of gas used per 1,000 cu. ft., and the care with which crevices are closed to prevent the diffusion of gas, are all of importance and must be taken into consideration.
>
> After the tests with formaldehyde had been finished, dry sulphur fumes were used under the same conditions, with the result that it was shown that they had absolutely no effect upon the test cultures, those which were exposed to its action growing as rapidly and luxuriantly as the controls.
>
> While the city is well equipped for house and room disinfection by the use of formaldehyde, it is still without the proper method of sterilizing the more bulky of household furniture, such as carpets, mattresses, etc., into the substance of which the formaldehyde does not penetrate. For this purpose a steam disinfecting plant is needed, and it is with great satisfaction that the board is able to report that such a plant will be erected in the near future, in connection with the proposed new heating and power plant for the municipal buildings. The sterilizing chamber will be of the most approved construction, and large enough to take the most bulky articles, being 7 × 5 ft.

Reports from other local boards of health in Massachusetts show that at least 14 boards adopted formaldehyde in 1897.

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THE NEW YORK RAPID TRANSIT COMMISSION, at its last meeting considered the situation created by the inability of the enlarged city of Manhattan to borrow the sum required to build the road in the manner planned. The two courses open, says President Orr in his statement on behalf of the Commission, are these: Request legislation making the rapid transit road an exclusive asset of the County of New York, or the boroughs of Manhattan and the Bronx, and charge the debt exclusively to this county; or, request legislation enabling the Board to sell a charter for the road to private capitalists. The statement issued explains how either of these alternative propositions may be provided for in one legislative act, and enters into a discussion of the county charge and gives legal opinions on the proposed action.

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MUNICIPAL OWNERSHIP OF WATER-WORKS at Indianapolis has been under discussion for some time past, but now seems likely to be postponed for a number of years unless the Indianapolis Water Co. will make the city a more favorable offer than the one recently submitted. The city is unable to issue bonds to pay for the works, so the company proposed to transfer its stock to the city for $200,000 cash, and an agreement to pay the company $120,000 a year for 25 years, the stock, however, to be subject to a mortgage indebtedness of $3,350,000, of which $2,850,000 bears 6% and $500,000 bears 5% interest. To cancel the debt, the water company would pay off $75,000 a year for five years, and increase the amount annually thereafter by the amount of reduction in the interest charges. It was calculated that at the end of the 25 years the bonds would all be paid. Mr. John W. Hill, M. Am. Soc. C. E., of Cincinnati, was engaged to report on the physical condition and the value of the water plant. The cost of duplication at present prices Mr. Hill placed at $1,950,000, from which he deducted $270,000 for depreciation, leaving $1,680,000 as the present value of the works, on this basis. This allows nothing for the franchise. He also presented figures regarding the value of the plant as determined by its earning power, which, with the other parts of his report and the company's proposition to sell the plant to the city, have all been printed in pamphlet form and can doubtless be obtained from Mr. Hill by those interested. The city authorities, having declined to accept the proposition, basing their decision largely on Mr. Hill's report, from which they conclude the price to be paid is excessive.

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The invitation of the Quebec Bridge Co. for designs and bids for the construction of a bridge across the St. Lawrence River, near Quebec, was discussed by a correspondent in our last issue, who suggested that before bridge companies expend any considerable sum upon designs and estimates in response to this invitation, they would do well to investigate the financial status of the company and the prospects that it will be able to secure the funds to carry out its enterprise. The subject is again taken up in our present issue by another correspondent, who tells the story of how another Canadian bridge company, which also proposed to bridge the St. Lawrence, offered prizes for the best designs for its structure, and after the prizes were awarded failed to pay them.

As most of our readers know, architects, who meet much more frequently than engineers the calls for the submission of designs in a competition, are generally opposed to competitions, and approve them only when they are conducted under a stringent code of rules laid down by the Architectural Societies. It would be well, it seems to us, if Engineering Societies would follow this example and formulate rules to govern competitions for engineering work. Among the first of such rules, judging by past experience, should be the requirement that the amount of the prizes should be paid over to the expert commission which is to decide upon the relative merit of the plans (this payment to be made at the time when the call for plans is announced), and should be by it paid over to the successful competitors, coincident with the announcement of their names. Such a rule would not only cover the case of the financial inability of the party ordering the competition to pay the prizes after their announcement, but would also prevent such an overruling of the experts' decision as occurred a short time ago in the competition for the Pennsylvania State Capitol.

◆

The average architect or engineer knows little or nothing as to the financial responsibility of any concern asking for competitive plans; and manifestly cannot afford to spend much to find it out. He judges of the competition, in most cases, by the character of the experts who are to pass on the plans. In the case of the Montreal Bridge Company, for instance, we presume that many engineers relied on their use of the name of Mr. Walter Shanly as their consulting engineer, as evidence that a fair award would be made, and that the company had at least a moderate financial standing. But, while Mr. Shanly appears to have had a free hand in the award of the prizes, he had neither the authority nor the power "to draw blood from a turnip," and thus it happens that the prizes remain unpaid to this day.

It may be interesting in this connection to explain something of the financial status of such Canadian engineering enterprises as the two which we have been discussing. By a long-established precedent Canada is committed to the policy of subsidizing public works of various kinds, and this is now so well understood that in the London money market, where nearly all Canadian enterprises are financed, it is well-nigh impossible to secure funds for any such work as these St. Lawrence bridges unless the promoters can show something in the way of a Government grant in aid of the project. On the other hand, if a fair-sized subsidy is once secured, it is easy enough to get funds to cover the remaining cost. The mountain load of public debts which Canada has piled up, however, is getting so serious a matter that the way of the subsidy-seeker has become a hard one. It is, in fact, we believe, only a question of time when public opinion will become so strong that the whole corruption-breeding system of subsidies to public works will be abolished, and the country will get down to the safe and sound basis of letting private capital undertake such enterprises as promise a fair return on the money invested.

Meanwhile, engineers and manufacturing concerns engaged in engineering work will do well to inquire closely into the financial standing of Canadian enterprises before expending any considerable amount of either time or money upon their work.

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The severe snowstorm which swept over the Eastern States on Nov. 26 gave a crucial trial to the conduit electric street railway lines in New York city.

The various lines were tied up from ten to fifteen hours by the storm. The main cause of the blockade was the depth of snow on the tracks. In this respect the conduit system was no more interfered with, of course, than any other surface railway system would have been, except perhaps the cable. The secret in keeping a street railway or a steam railway open during severe snowstorms is first to keep the tracks clear by running snowplows frequently enough to prevent the accumulation of drifts; second, run no more cars than the motive power can haul. The difficulty which a street railway manager finds in putting these rules in practice is that when he cuts down the number of his cars, those that remain are overloaded, and the traveling public bitterly complains because the cars run at longer intervals than usual just when they are most in demand.

Besides the difficulties with the snow obstructing the track, however, the movement of cars on the electric conduit roads was more or less interfered with by some other troubles of a more novel character, resulting from the accumulation of snow in the conduit. Of course, in any driving storm, more or less snow sifts in through the slot, and when a car runs along, a suction is created behind the plow that draws down a shower of snow from the cloud stirred up by the wheels. Past experience with this type of road, both in Washington and New York, has pretty definitely established the fact that water or slush, if allowed to accumulate in the conduit in sufficient amounts, will short-circuit the conductors, throw the station circuit-breakers, and thus interrupt the current supply to the flooded section. That snow would do the same thing would hardly be expected with the comparatively low voltages used, since snow is practically distilled water, and when dry is made up of a mass of ice crystals with air spaces interspersed.

Experience in the recent storm, however, showed that short circuits did occur at several places on the line, and in several instances they were accompanied by a pyrotechnic display of flames shooting from the slot in sufficient volume to cause considerable alarm to passengers and to excite a large amount of speculation as to their cause. From the best information we have been able to obtain, it appears that the chief cause of the short-circuiting was the salting of the tracks for the purpose of melting the snow—a relic of practice in the old horse-car days. The snow alone in the conduit, it is stated, had not enough conductivity to set up an arc; but when the salt slush dripped down upon it, its conductivity was increased enough to start an arc. The salt solution also short circuited the plows and caused arcing, which sometimes ran along the conducting rails for some distance before it was broken.

In some previous storms, the conduit lines have had some trouble with the collection of ice on the conducting rails in the conduit. In the present storm, however, the atmospheric conditions were such that this did not occur.

An amusing incident in connection with the recent storm was an interview with President Vreeland, of the Metropolitan Traction Co., published in one of the daily papers, in which that officer was made to say that the cause of the stoppage of the cars was the formation of ice on the rails, preventing the flow of current from the wheels to the rail. It is, of course, not to be supposed that Mr. Vreeland is ignorant of the fact that in the conduit system, both positive and negative conductors are in the conduit and no current flows from the car wheels to the rail. The error was doubtless due to the reporter's misunderstanding. A discriminating electrical journal of this city, however, picked up this interview, swallowed it whole, and proceeded to preach a sermon to the Metropolitan Street Ry. Co. on the folly of spending so much money on its conduit systems and failing to provide "a complete metallic circuit without regard to the rails."

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COMMERCIAL EDUCATION IN THE UNITED STATES.

The rapid growth in American exports of manufactured goods during the past four years has made plainly evident the need of specially-trained men to conduct our export business in foreign countries, and especially in those regions of Asia, Africa and South America, for whose trade all civilized nations are in keen competition. It is true that we are rapidly increasing our exports of manufactured goods in many lines; but we are doing it largely by virtue of superior facilities for production, which enable us to undersell our rivals. When it is a question of working up new trade, however, or meeting our competitors upon even terms as regards price and quality, it is generally admitted that our salesmen in foreign countries cannot compare with the Germans in point of efficiency. Germany has led all other nations in the establishment of schools designed especially to train those who are to follow commercial life.

In the United States, it was not until 1881 that any of our institutions of learning recognized the need of any such special training. In that year the University of Pennsylvania opened a department known as the Wharton School of Finance and Economy, with a four-year course and a curriculum embracing public law and politics in this and other countries; mercantile law and practice, including accounting; history economics and social science, including banking and currency and the revenue systems of governments, etc. The University of Chicago and the University of California also have separate departments of this sort recently established; while Harvard, Yale, Columbia and a number of other prominent universities offer special courses to students which cover this field.

For a higher education in this direction these schools are doubtless doing good work; but they aim too high for the average young business man,

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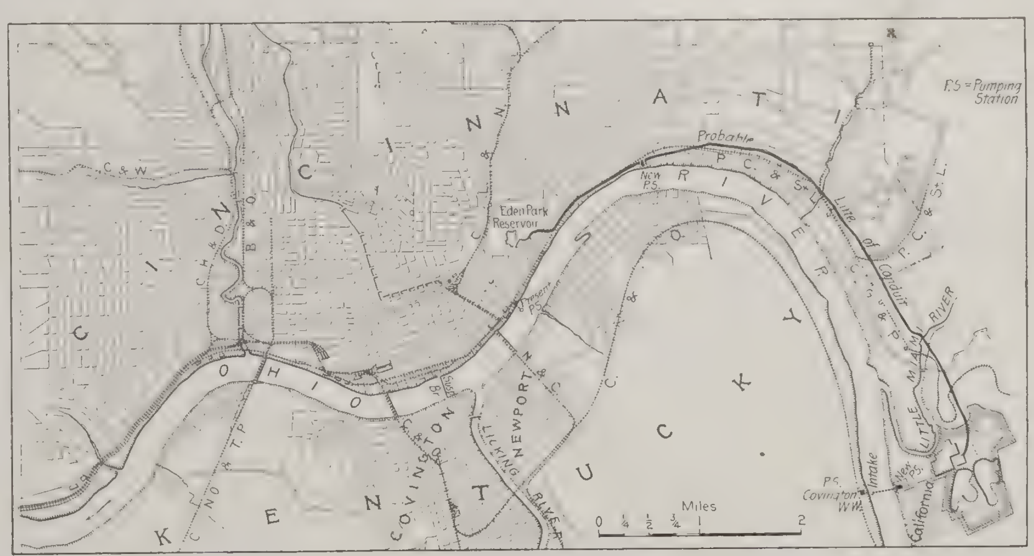


FIG 1. MAP SHOWING LOCATION OF THE NEW WORKS IN RELATION TO THE CITY

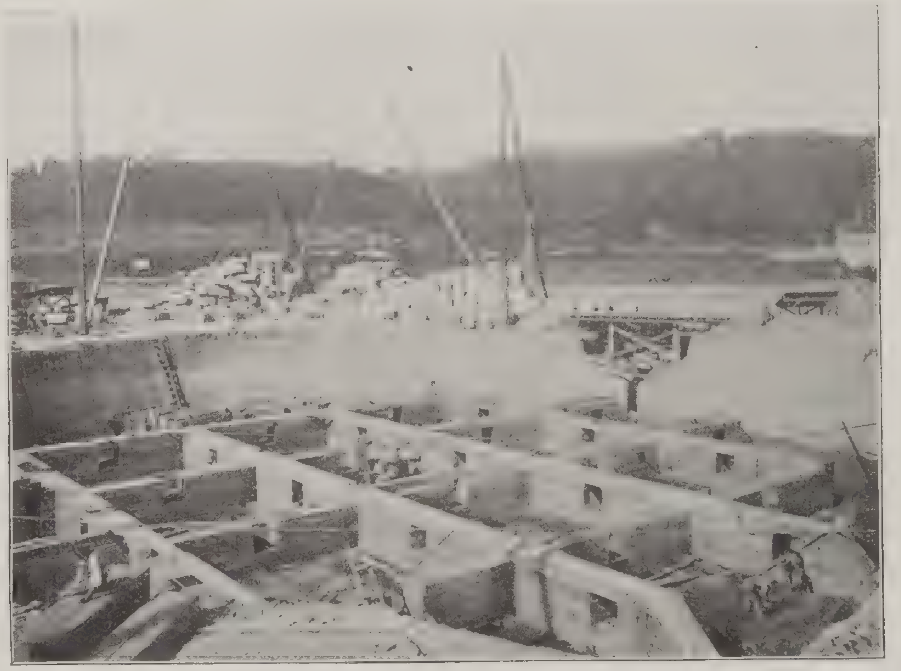


FIG. 6. CAISSON WITH STIFFENING GIRDERS OR CELL WALLS NEARLY COMPLETED.

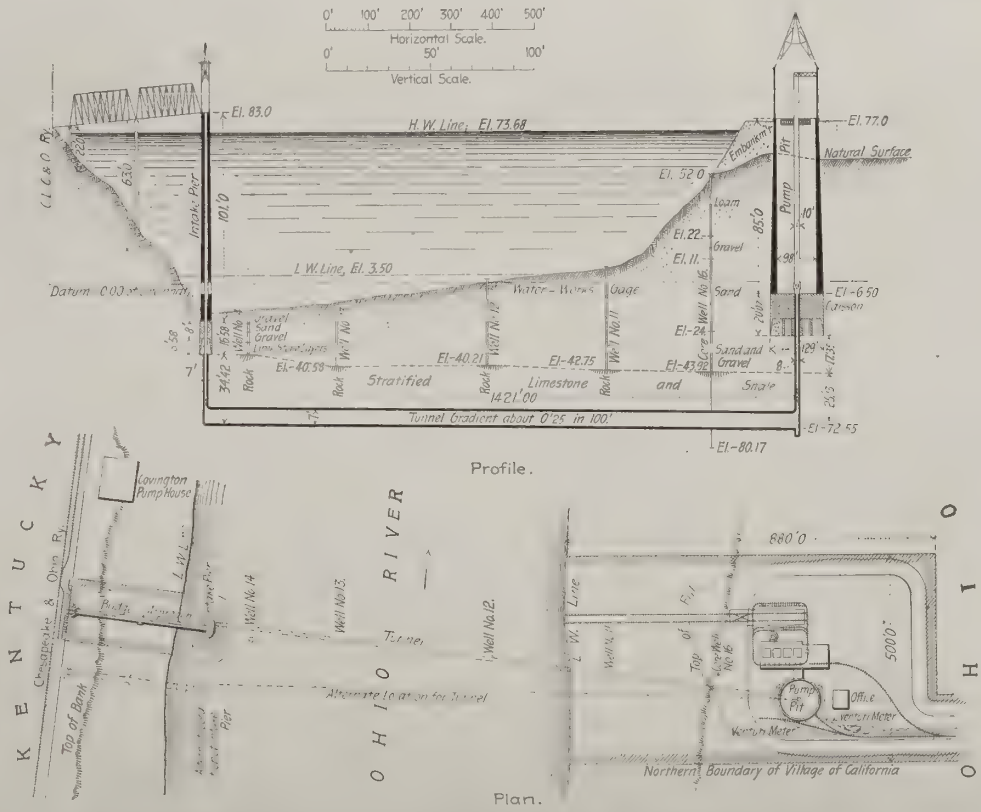
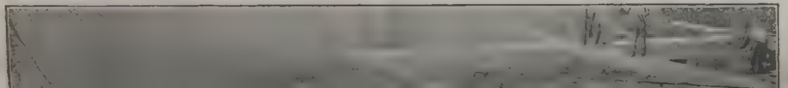
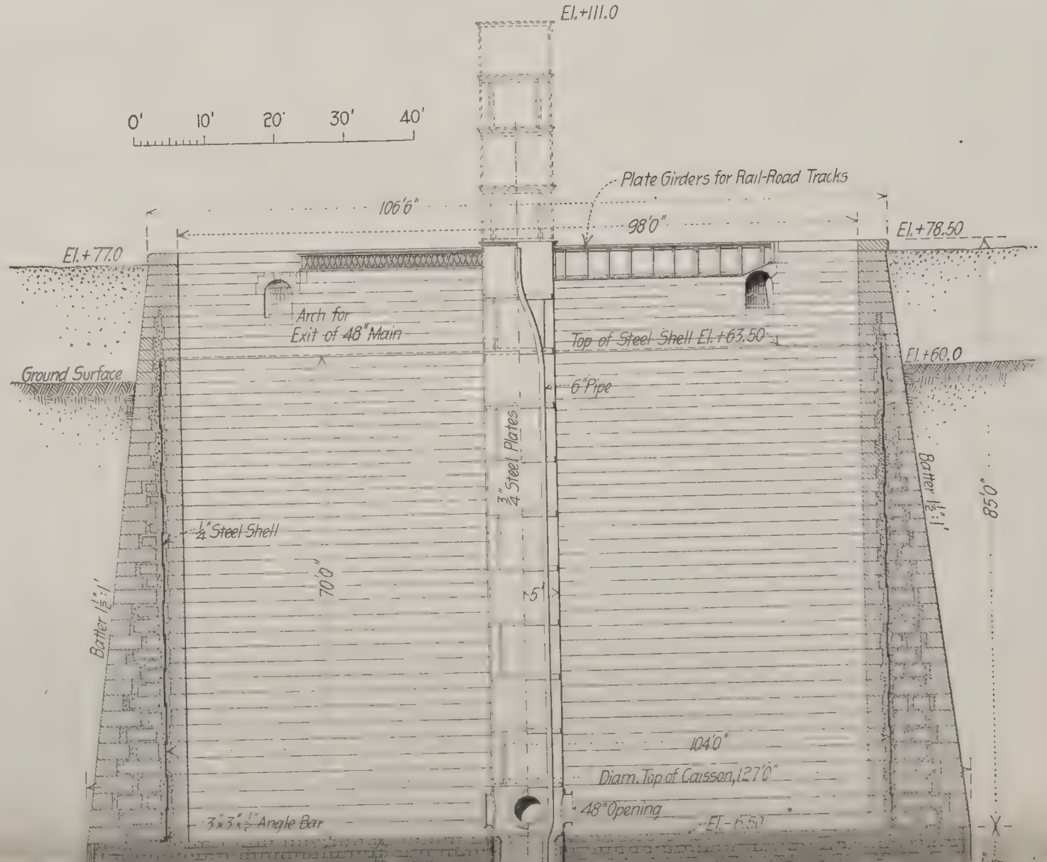


FIG. 3. PLAN AND PROFILE OF INTAKE PIER, TUNNEL AND PUMP PIT.





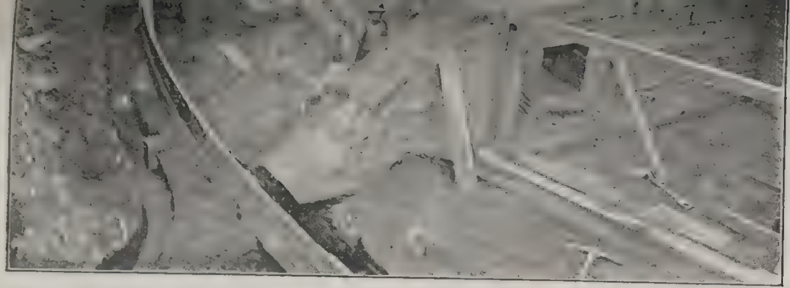


FIG. 7. END OF TWO GIRDERS READY FOR SHEATHING AND INCLINED STAVES; ALSO SHOWS SHOE BEING ASSEMBLED.

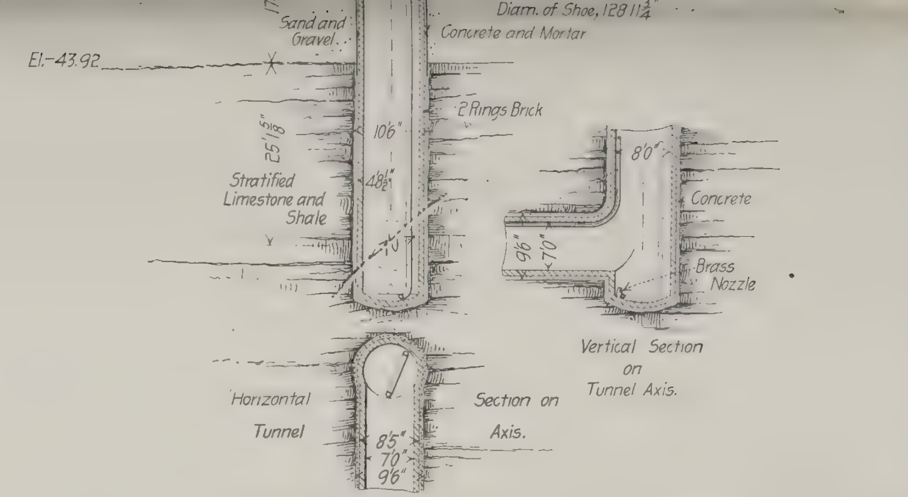


FIG. 4. SECTION THROUGH PUMPING STATION AND PIT SHOWING CAISSON AT BOTTOM.

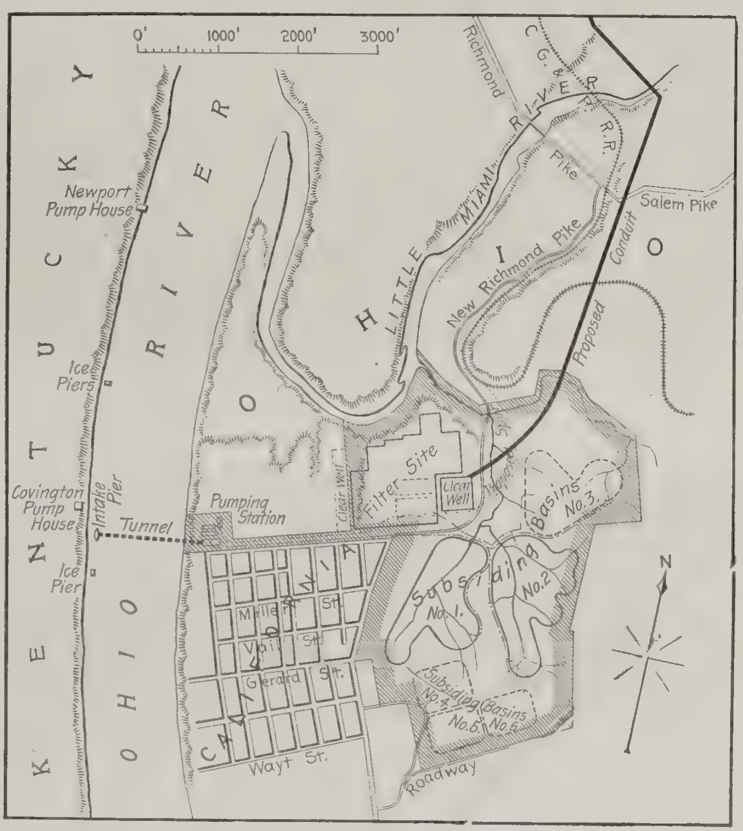


FIG 2. GENERAL MAP OF NEW WORKS AT CALIFORNIA.

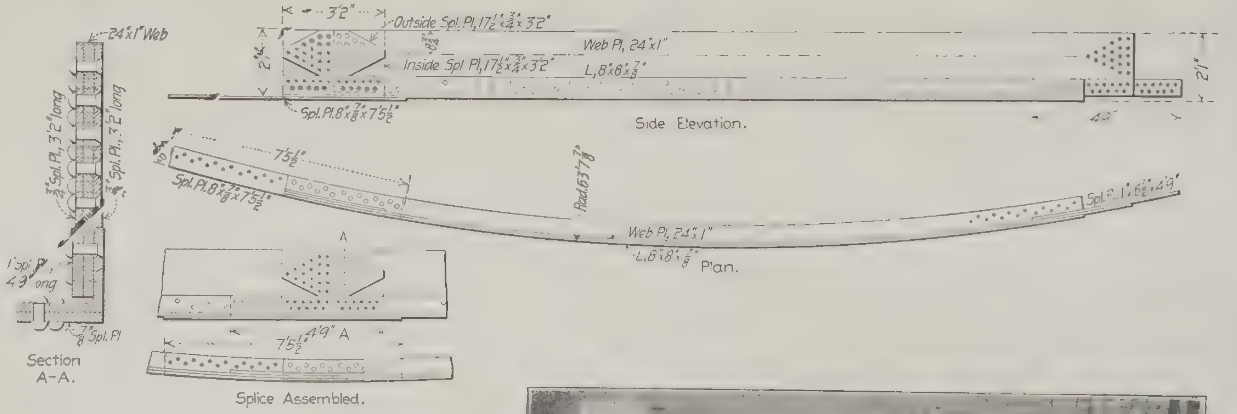


FIG. 5. DETAILS OF SHOE FOR CAISSON.

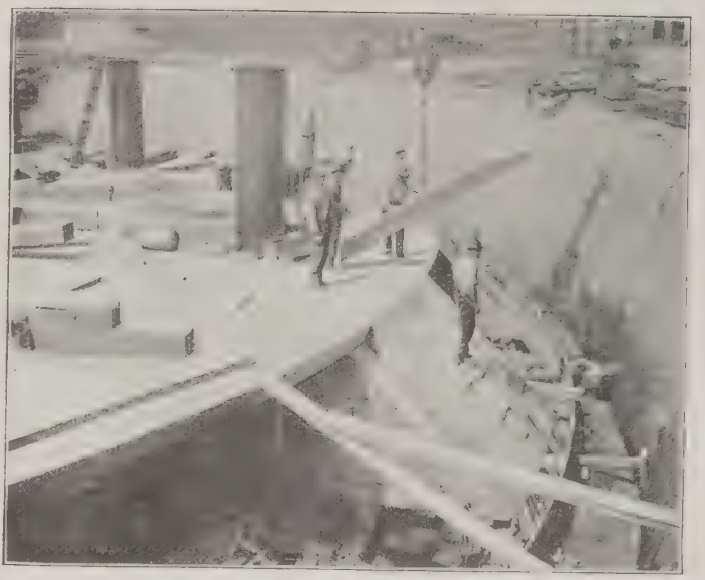


FIG. 8. FIRST COURSE OF ROOF COMPLETED AND SOME STAVES AND AIR LOCKS IN PLACE.

PROGRESS ON THE NEW WATER-WORKS FOR CINCINNATI, OHIO.

G. Bouscaren, M. Am. Soc. C. E., Chief Engineer.

G. H. Benzenberg and Charles Hermany, M's. Am. Soc. C. E., Consulting Engineers.

and do not reach the same number or class of individuals as are served by somewhat similar European institutions. The phenomenal trade expansion of Germany is the direct outcome of her system of technical education. She has sent out men carefully trained to study the resources and wants of other nations; and by thoroughly-equipped technical and commercial schools, she has fitted those who carry on her manufactures and commerce how best to supply these wants. The advantages possessed by a graduate of one of the German commercial schools are very evident when we consider that he is required to conduct an "office correspondence" in German, French and English, and must be able to converse in one other language, either Spanish, Italian or Dutch; he must be familiar with the geography of foreign countries, their history and commercial conditions and customs; and at the school well-filled museums make him familiar with the animal, vegetable and mineral products of other lands. When such a man goes abroad to take a place in the foreign house of a German exporter, he is able to almost at once begin the work of forming acquaintance and business connections, whereas the average graduate of an American high school or college, having at best only a smattering of any other language than his own, and ignorant of the machinery of commerce, finds that he has everything to learn, and that learning under such circumstances is a very difficult task.

That a knowledge of the conditions to be met in foreign markets is of value to those at home as well as those abroad, is shown in the November issue of "Consular Reports." In that issue we find four American consuls criticising American trade methods, due purely to ignorance or to disregard of the directions of foreign importers. The chief complaint is that of bad packing, and the non-observance of foreign customs law. Few of our shippers seem to know that in some countries duties are levied on the gross weight and determined upon the highest-priced article within the package; and a single gold watch packed in a box of cheap cotton prints would result in the computation of the duty as if the case contained only gold watches. The bad condition of American cotton bales, received at Liverpool, occasioned a loss of $500,000 to exporters last season. The Egyptian and East Indian cotton bales are much more compressed, have a stronger and better covering than those coming from the United States, and always arrive in almost perfect condition. A failure to observe the explicit directions of importers, as to dimensions and methods of packing, or to consider the customs and superstitions of possible consumers also stand in our way, and damage the sale of otherwise excellent goods. In China, a fanciful Chinese dragon, as a trademark, will sell goods better than if the housemark were used; in Russia, German makers took away from English firms a considerable trade in handkerchiefs for the head, simply by making them of the peculiar dimensions which the people preferred. Peculiar patterns and colors of calico prints, to suit the fancies of special races, and special forms of tools for farmers or artisans are often necessary to secure the trade of a particular section.

In other words, if we propose to extend our commerce, there is very much to be learned.

Some American manufacturers have already been shrewd enough to appreciate these facts. In Nicaragua, we are told that practically all the machetes used are made by Collins, of Hartford, Conn., who has produced a blade of exactly the shape the natives desire, and as a consequence they will not buy a machete unless "Collins" is stamped on the blade.

It thus appears that if we are to compete for the world's trade in all lines, and not merely those in which our wealth of natural resources gives us a large advantage, there is much to be learned both by our manufacturers at home and by their agents sent abroad. To obtain this knowledge we must make a beginning, at least, in what may be called popular commercial education. The models exist in European institutions of a similar character, though these would doubtless have to be modified to suit our conditions. In this connection, it is an encouraging indication of the appreciation of the need of such training to note that a committee of the New York Chamber of Commerce was recently appointed to prepare and submit a plan for the establishment and development of better commercial education in our secondary and higher schools. England has been forced to similar action, because German and other foreign clerks, on account of their superior commercial training and ability, were rapidly supplanting young Englishmen in positions of trust. The London Chamber of Commerce now grants commercial certificates to candidates who produce evidence of proficiency, according to certain prescribed branches of study, including, at least, two languages, and elementary drawing, chemistry and physics. The Paris Chamber of Commerce manages the Paris Commercial High School; and exemption from military service, for more than one year, is an inducement held out to attend this school. The action of the New York Chamber of Commerce is timely, and it is to be hoped that good results will follow its recommendations.

LETTERS TO THE EDITOR.

Canadian Bridge Schemes and Ethics for Engineers.

Sir: In your issue of Dec. 1, 1898, in answer to the article by "A. P. B.," on "An Opportunity for Bridge Engineers to Practice Engineering Ethics," Mr. Barthe affects a great deal of righteous indignation because "the Quebec Bridge Co. is so sorely arraigned before the tribunal of public opinion" on the general charge of "deliberate attempt to get something for nothing," and because of the "imputation that this company, composed as it is of 200 of the best citizens of Quebec, is unable to pay a few thousand dollars for the technical information it requires," etc.

A. P. B.'s stand is well taken, though one course that he mentions—that of offering prizes for the best plan—has its disadvantages.

In this connection, attention is called to another Canadian case of "gall unparalleled" in which the attempt to get something for nothing was successful.

In the spring of 1895 the Montreal Bridge Co. called for competitive plans for a proposed bridge across the St. Lawrence, and offered prizes for the first and second best plans, of $1,000 and $500, respectively. A large number of plans were submitted and the awards were made; but neither of these prizes has ever been paid.

In view of this fact, engineers are justified in questioning the methods and intentions of the Quebec Bridge Co.—even if it is composed of "200 of the best citizens of Quebec." Yours very truly,

A. L. Bowman.

71 Broadway, New York city, Dec. 3, 1898.

(We have commented on this letter in our editorial columns.—Ed.)

A Battle of Quotations.

Sir: Some time ago those of the trunk line railways which have long been allowed to charge a differential fare to Western points under the agreement were surprised to learn that the "standard" lines had put into effect lower rates from Buffalo to the Pacific Coast, and had requested Western connections to so arrange their rates as to make them the same as the rates enjoyed by the differential lines. The steps were taken somewhat secretly, and the differential lines did not learn of the change until some time after the circulars had been sent out. A meeting was held in New York last week by the differential lines to discuss the matter. David B. Martin, Manager Passenger Traffic of the Baltimore & Ohio R. R., was chosen chairman, and Charles S. Lee, of the Lehigh Valley, acted as secretary. After some discussion, the following telegram was sent to Geo. H. Daniels, of the New York Central; A. J. Smith, of the Lake Shore; O. W. Ruggles, of the Michigan Central; J. R. Wood, of the Pennsylvania; E. A. Ford, of the Pan Handle, and E. O. McCormick, of the Big Four:

> We learn with regret that at this most inopportune time, without conference or advice, you have arbitrarily reduced regularly established fares from common points in our territory to Pacific Coast points, and by request upon initial lines at the Pacific Coast, succeeded in obtaining similar reductions in authorized fares eastbound. We deprecate such arbitrary action as tending to demoralization, and calculated to provoke retaliatory measures and unnecessarily reduce the revenues of all lines. We therefore, respectfully enter this, our protest, against such unwarranted action on your part, suggesting that in our opinion, when changes in authorized fares are contemplated, due notice should be given to all interested lines, in accordance with the established usage, and would request immediate restoration of rates to those in effect Nov. 1, 1898, and ask your prompt reply, to be addressed to D. B. Martin, Baltimore, Md.

One of the first replies was received from George H. Daniels, of the New York Central, and read as follows:

> D. B. Martin, Baltimore, Md.:
>
> I think it would be an opportune time for you to read the 41st verse of the 6th chapter of the Gospel according to St. Luke.

Mr. Martin, after some difficulty, found the verse, which reads as follows:

> And why beholdest thou the mote that is in thy brother's eye, but perceivest not the beam that is in thine own eye.

Mr. Martin undertook a little Biblical research on his own hook, and wired Mr. Daniels as follows:

> Answering yours of Dec. 2, we have been guided through life by the teachings of St. Luke, and fully concur that his sixth chapter is very appropriate to the case in point, and for your personal application would advise reading last half of verse immediately following.—D. B. Martin.

The last half of the following verse reads as follows:

> Thou hypocrite, cast out first the beam out of thine own eye, and then shalt thou see clearly to pull out the mote that is in thy brother's eye.

Yours truly, J. F. M.

Baltimore, Md., Dec. 5, 1898.

(We can add to our correspondent's story that Mr. Daniels has now taken up the study of Shakespeare, and was about to refer his adversary to a certain passage in "The Merchant of Venice," Act I., Scene 3.† The reflection that it might be used as a two-edged sword, however, caused him to refrain.—Ed.)

The "Board of Awards" at Baltimore and Other Features of the New City Charter.

Sir: In your issue of Nov. 24 you comment on that part of the new charter of Baltimore which provides for the letting of contracts for work done and material furnished the city, by a Board of Awards, certain city officials, ex-officio, composing the board. You call attention to the defect in the provision which requires the award to be made to the "lowest responsible bidder," in that the lowest bid may be too high, etc., and which, in the absence of this requirement, would warrant the board in rejecting all bids. This requirement that the lowest responsible bidder shall always be awarded the contract has been defended by saying that it prevents crookedness between the board or some of its members and an irresponsible or dishonest bidder.

An answer to this would be that in a board of city officials whose standing in integrity is that of a Mayor, Comptroller, City Register, City Solicitor and the President of one branch of the city council, the chances of collusion with a dishonest contractor, while possible, are rather remote.

Another defect (though not a serious one) is the requirement that the successful bidder shall give bond in double the amount of the contract price. This is excessive and entirely unnecessary in protecting the city's interests. Contractors in making up their estimates for work or material advertised for will not fail to add the premium on this bond to their proposal, and for this the city will have to pay. Take for example the paving of a street estimated at a cost of $50,000. This, of course, means a $100,000 bond. Moreover, if the contractor were sued on his bond, for failure to comply with specifications or complete the contract, the court would very likely award the city only damages equal in amount to the loss sustained, which in hardly any case could exceed the amount of the contract, and in many cases would be but nominal. Previous to the adoption of the new charter it had been the custom in the City Commissioners Department to fix the bond at about one-third the amount of the contract. This proportion was increased in special cases, such as the erection of a bridge or in emergency work.

Shortly after the new charter went into effect the City Commissioners Department solicited, among other material for constructing a sewer, bids for about 200 barrels af natural cement. The specifications contained the usual provisions for tensile tests (for 1, 7 and 28 days). Two of the brands of cement (offered by different bidders) differed in price by about 4 cts. per bbl. Both kinds satisfied the specifications, but the higher priced was much the better and considerably exceeded the requirements of the specifications, as shown by tests made in the Department. The board had no discretion in the matter but to award the contract to the party offering the lower priced material. The difference in the cost on the estimated amount was about $8, whereas the better quality of the higher priced cement, as shown by the tests, would probably have allowed a lower proportion in the mortar and thereby made it the cheaper in the end.

It is simply one of those cases where it is difficult to draw the line guarding the interest of the taxpayer without encroaching on ordinary business principles. A most excellent provision in the new charter is that all appropriations for public improvements exceeding $2,000 shall, before being passed by the City Council, be referred to the Board of Public Improvements and to the Board of Estimates, in case it has not already been included in the Board of Estimates' budget for that year. The first-named board passes on the value of the measure as a public improvement, and the Board of Estimates passes on the probable cost and availability of the funds to pay for it.

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†"The Devil can cite Scripture for his purpose."

The council will hereafter be unable to appropriate money not provided for and included in the Board of Estimates' annual report for the year. By this means the "floating debt" will be avoided, which has heretofore been the "bete noir" of the party in power and has been the subject of some extravagant oratory and literature in political campaigns.

James A. Paige.

Baltimore, Nov. 28, 1898.

◆

The New Printing Plant of the W. B. Conkey Co.

Sir: In Engineering News, of Nov. 17, we notice the article and the editorial regarding our new establishment.

Regarding the editorial, the gentleman who wrote it evidently did not grasp the plan of our building. I have asked our architect, Mr. Geo. C. Nimmons, to take up the matter and write you concerning it, as the great feature of our plant is its fireproof construction, the absolute impossibility of burning and the ease of exit for employees in case of fire, there being large windows only 2½ ft. from the ground. The entire structure is fireproof, including the roof, which is of heavy galvanized iron, the supports being iron columns, and every partition of fireproof tile 4 to 6 ins. thick. The floor is laid upon cinders solidly packed against the wood, which is 2-in. Norway pine, and 1-in. tongued and grooved maple floor on top. There are also 2-in. fire hose connections to every 100 ft. of floor space, with 50 ft. of hose attached, throughout the building, and our rate of insurance is only 0.5%. In Chicago we carried an insurance of $450,000 on stock and machinery, and in Hammond we carry only $25,000 on machinery and $100,000 on stock.

We recently had a call from the President of the Society of Engineers of London, England, together with such gentlemen as the business manager of the Curtis Publishing Co., New York city; Mr. Talheimer, general manager of the American Book Co.; Mr. A. G. Spaulding, and many representatives of large manufacturing concerns, who have been more than astonished and pleased with the wonderful results that have been attained by this new construction scheme for manufacturing plants.

I mention the three gentlemen above, because they are immediately going to construct new plants, and will adopt our plan, which is thought quite the most perfect scheme for a manufacturing plant that has ever been conceived. There is no question but that the erection of our plant has demonstrated a new condition which will mark a new era in manufacturing plants. Believe me,

Very truly yours,
W. B. Conkey Co.,
W. B. Conkey, Pres.

Hammond, Ind., Nov. 23, 1898.

Sir: I am much pleased to note from the article in your issue of Nov. 17 that you have been interested in the new methods of construction adopted for the plant of the W. B. Conkey Co., at Hammond, Ind., of which I was the architect. As, in your editorial discussion of the subject, you have raised the point as to its fireproof qualities, etc., and as a number of other large manufacturers are about to adopt this style of building, a further description of this plant will, I trust, be of interest to you and also to the readers of your valued publication.

The plant consists of a main factory building one story high, covering about four acres of ground, and is nearly square in plan. It has no interior light courts or areas, as the light all comes from the roof, and the floor and roof are therefore continuous over the entire space of four acres. The office building, with its various apartments, and the employees' entrances, dining rooms, bicycle rooms, toilet rooms, hospital, etc, for the employees, adjoin the main factory and extend clear across the east side, which is the front, and which faces on a park of five acres, landscaped especially for the recreation and enjoyment of the factory hands, having a lake, walks, drives, flower gardens, etc.

Adjoining the north side of the main factory building is the building for the generating plant, which was described in your previous issue.

The roof of the main factory building is perhaps the most striking feature of the construction. The idea for this was borrowed from Europe, principally from the National Fire Arms Works, of Belgium, and an immense bicycle factory in Paris. Both of these works are built on this scheme of obtaining north light only, through a series of windows arranged in parallel rows over the entire roof, thereby admitting only the north white light and no sunlight, but in such quantities as to flood the building with pure white light, over every square foot of floor surface.

The first objection that is likely to occur in reference to this kind of roof, is the possibility of snow collecting in the valleys between the skylights. This is guarded against in a manner similar to that employed for hot-houses, by keeping the bottom of the gutter and the glass heated so as to melt the snow as it falls. This condition produces another difficulty, greater than all to care for, and that is the condensation on the under side of the glass, etc. In order to care for this, a complete system of condensation gutters has been made which collects all the condensation and conducts it to the outside of the building.

The heating and ventilating of the building is accomplished by a blast system, with the heating ducts under the floor, which supply registers throughout the plant, arranged on the side walls of each department. The placing of the heating ducts under the floor does away with the objectionable large galvanized iron ducts usually placed on the ceiling. The heating system can be made to produce a mild heat for the seasons of spring and fall, and can also be turned into a cooling system for summer; by running cold water through the steam pipes at the fans and changing the air every 15 minutes with cool air in hot weather.

The fireproof qualities of the building were among the principal features considered, and it was constructed in accordance with the advice and suggestions of the fire underwriters, who have placed a very low rate of insurance on the building. The building is practically fireproof from the nature of its construction. Fire cannot get under the floor nor through the walls dividing the different departments, as the walls are made of heavy tile; the iron columns in the wall are fireproof, and the openings are closed with iron fire doors. The office department has a thick brick fire wall dividing it off entirely. The floor is built of heavy plank and finished maple laid on sleepers which are bedded in cinders rolled with a six-ton roller, which leaves no space under the floor for fire or vermin, and incidentally permits the floor to be loaded almost indefinitely. Under these conditions, fire cannot get under the building, nor through the partitions, nor spread any further than the department in which it starts. As an additional safeguard, hose pipes with reels have been placed so as to cover every part of the building with water in case of a fire. It is also true that panics among the employees in the time of fire would not be likely to occur.

The advantages to be gained by this kind of a building in a general way over the ordinary ones of two or more stories, or of a plant that consists of a number of one-story isolated buildings, are, first of all, that it brings the different departments into closest contact and saves much time and expense in handling the product and in superintending the men and work, as it is all under one roof and on one floor, with no elevators or stairs, and all concentrated within the smallest possible area. A building, therefore, arranged with all its departments as nearly a square as possible, with the raw material traveling in the smallest possible circle, is the most economical arrangement, both as to handling goods and as to cost of buildings. A building, square in plan, with say 32,000 sq. ft. of floor area, costs just half as much to enclose with a brick wall as two buildings of the same area each 40 ft. wide by 400 ft. long, a width not uncommon in factory plants.

The roof of the square building would cost more than the others, on account of the extra glass, but the saving in the outside wall would more than make up for this extra expense. In a two or more storied plant the saving of the heavy floor supports by the one-story square building is also great enough to make up for the greater cost of a glass roof. It is also true that a building of the type used for the Conkey plant, with the perfect north light, is cheaper to build than either the one-story building with the old lantern-shaped roof, or the mill constructed building of two or more stories.

Factory buildings of this country, as a rule, have received comparatively little study by architects, and are very often defective as to their arrangement and light. As competition at home and with foreign countries becomes closer among manufacturers, it is evident that the problem of planning factory buildings grows in importance, as a great deal can be done by the architect in planning the buildings so as to reduce the cost of producing goods.

George C. Nimmons,
Architect.

94 La Salle St., Chicago, Nov. 28, 1898.

(We give space with pleasure to the above communications; but are obliged to confess ourselves still unconvinced as to the wisdom, from the standpoint of fire protection, of putting such a great area of buildings under what is practically a single roof. We freely admit that the division of the building by solid fireproof partitions is calculated to lessen materially the risk, but we do not see that it is equivalent to the distribution of the risk into separate buildings, far enough apart to permit the firemen to work between.

It must always be remembered, of course, in the study of questions of fire protection, that although a building itself may be incombustible, its contents generally afford material enough to feed a brisk fire, especially in any manufacturing plant where the floors gradually become more or less saturated with oil. Admitting, then, that fire is always liable to occur, the question is how its spread may be checked. The weak point in the Conkey establishment, it seems to us, is that all the work in fighting fire must be done on the inside. The fire resisting partitions, if the openings in them are closed by good fire doors, may do their work, but if one department gets ablaze, will not the flames burst through the glass of the roof, and in case of high wind, be carried into other departments through the breaking of other skylights by the heat? As we write this, the eight upper floors of one of New York's finest office buildings are in ruins through flames which were spread through the glass windows, from a fire in an adjacent building. The trifling resistance that glass offers to fire is now well known; and the question concerning the Conkey plant is whether a fire-fighting force in one of the rooms of the building could keep flame from entering from an adjacent department through the roof skylights. Probably it could do this, under favorable circumstances, but in other cases it seems likely that the smoke and heat might be carried in such volume through the broken skylights as to compel the defenders to retreat.—Ed.)

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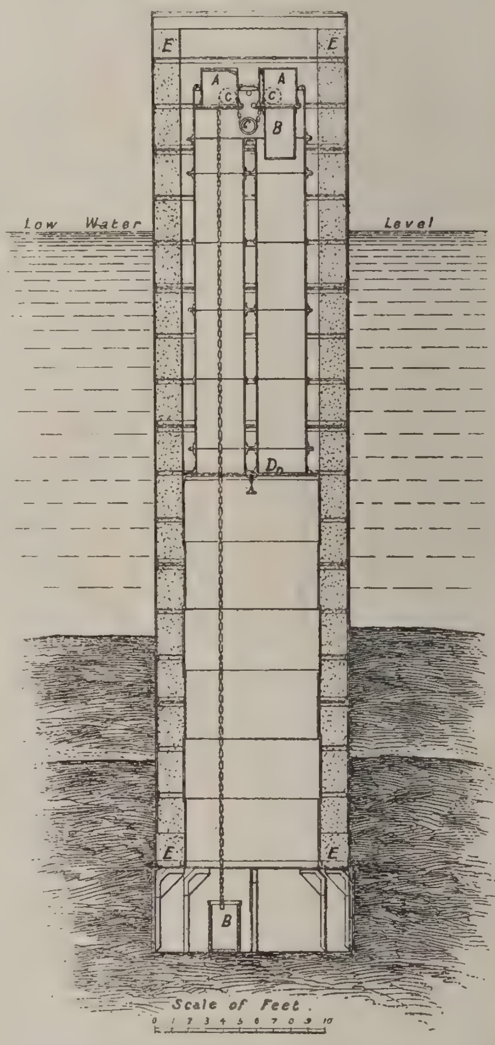
THE HUGHES AIR LOCK; VALPARAISO HARBOR.

The late Mr. John Hughes, M. Inst. C. E., of England, was the engineer for the wrought iron pier built in 1873-83, in the harbor of Valparaiso, Chili, by the Chilian Government. This pier was made by sinking wrought-iron cylinders, 11 ft. 4 ins. outside diameter, through water 48 ft. deep, to a solid foundation, sometimes as much as 107 ft. below the water surface. These cylinders were filled with concrete and braced, and supported the pier platform. They were sunk by the use of the pneumatic process, and the novel air-lock employed is illustrated and described in "The Engineer," of Sept. 9, 1898, from which the following brief account is taken:



Section of Cylinder for Steamship Pier, Valparaiso Harbor, Chili, Showing Operation of Hughes Air Lock.

The main cylinders were made in 8-ft. sections, with angle-iron connections, and they were sunk from a temporary staging supporting a traveling crane. There were, in fact, two cylinders; an inner one, 8 ft.

in diameter, and made of ½-in. plate, and another one made of ⅜-in. plate; the annular space between the two was filled with Portland cement concrete after the bottom was reached, and this weight was sufficient to ballast the cylinder and counteract the buoyancy of the compressed air inside.

After the main cylinder was in the water and floating by reason of the unfilled annular space, a wrought-iron cover was bolted onto the inside cylinder, and on this cover two lengths of 3-ft. shaft cylinder were bolted, and additional lengths of these and the outer cylinders were added until the cutting-edge was on the bottom, with the top of the cylinder rising above the temporary staging. As the cylinder sank, the annular space between the two cylinders was filled with concrete.

The pneumatic apparatus was then put in place, and this was designed with the purpose of requiring no men to be under pressure except those actually engaged in excavation at the bottom. As shown in the figure, the two D-shaped cases, A, were provided with covers opening downward and opened or closed by an outside hand lever fixed on the bar forming the hinge, and passing out through a small stuffing-box; the joint between the case and the lid was made tight by an india-rubber ring attached to the lid. A similar ring was fastened underneath the bottom of the case, A, which was open, intended to form an air-tight joint with the bottom portion of the air-lock, or skip-case, B. This latter was suspended by two chains of gaged links, one on each side, passing around the chain-sheaves, C, so that when both chambers, A, are closed at top and compressed air is admitted to them, one skip-case, B, can be raised and the other lowered simultaneously, by means of a winch on the outside, with the main shaft passing through the sides of the lock in stuffing-boxes. As the top of the skip-case, B, comes in contact with the bottom of the chamber, A, the compressed air may be let out of A and B, and the skip removed; the pressure of the air within the main cylinder forces B against A and makes the joint tight in this case. The cocks for the inlet and outlet of compressed air are 1½-in. diameter, and are linked together so as to be worked by one lever from the outside; smaller cocks, of ½-in. diameter, are provided on the inside for the use of workmen passing in or out. The original article gives no dimensions for the lock chambers; but the cases, A, were apparently about 2½ ft. diameter and 3 ft. high, while B was somewhat less in diameter and about 4 ft. high.

The buckets or skips for hoisting the material from the bottom, were made to closely fit the inside of the skip-case, B; and to assist in dumping them, when hoisted from the skip-case by a steam crane, a pipe was run through each bucket near the bottom, from side to side. Through this pipe a bar of iron was thrust, as the skip was raised out of the air-lock, and to the projecting ends of this bar the tripping, or dumping chain was attached.

This air-lock plant was equipped with a signal gong, pressure-gage, safety-valve, and air-connections, fitted with a check-valve and stop-cock, to be used in the event of a rupture of the 3-in. hose-pipe leading to the air compressing plant. There was also a 3-in. valve and connections in the 8-ft. cylinder for ejecting water from the cylinder, otherwise than by forcing it out under the bottom edge. A small flexible pipe was provided for drawing off compressed air to work a pump for supplying water for the concrete, and a wire rope-ladder, hung beside the air lock shafts, enabled the workmen to pass to the bottom. The air-compressing plant was placed on the shore, and the compressed air was led in an iron pipe to the 3-in. flexible hose referred to.

When the cylinder had been sunk to the required depth, sometimes 107 ft. below the water surface, 8 or 10 ft. of concrete was carefully deposited in the bottom under air-pressure. This concrete was lowered in the skip-cases, B, and these were tipped like ordinary buckets. During the hardening of this concrete the safety valve came into play, in maintaining an even requisite pressure and obviating the possibility of the compressed air blowing out at the bottom and causing unsound work. Two men only were employed at a time under pressure in each cylinder, working in 4-hour shifts. While the usual results of working in compressed air were noted, there was only one death. This one fatal case resulted from the workman failing to give the signal that it was a man, and not material, that was coming up; the consequence was that the pressure was released suddenly and the man was paralyzed from the waist downward. He at once went under pressure again and was released gradually; but the mischief was done, and he died in the hospital, about three months later, from the indirect effects of the paralysis.

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A NEW AIR LOCK AND CYLINDRICAL WOODEN PNEUMATIC CAISSON FOR FOUNDATIONS.

An entirely new system of pneumatic caisson foundations is being employed in constructing the new residence of Mrs. Elliott F. Shepard, on 62d St., near Madison Ave., in New York city. In passing it may be noted that so far as we are aware, this is the first use of pneumatic caissons for dwelling house foundations, although they have been frequently employed heretofore in the foundations of mercantile and office buildings. In New York city particularly the value of this style of foundations has been fully proved, especially where deep foundations have to be sunk in close proximity to older buildings having foundations of shallower depth without injuring or disturbing the existing structures. The success in this direction is also exemplified in the present work. The chief interest of the work, to engineers, however, lies more especially in the cylindrical wooden stave caisson employed, the special form of caisson shaft, and the patented air lock designed by the engineer and contractor, Mr. John F. O'Rourke, M. Am. Soc. C. E., of New York city. The accompanying cuts illustrate these and such other features of the foundation construction as are of most interest.

General Description of Foundations.—The area occupied by the building is about 45 × 100 ft., and is rectangular in form. Eight pneumatic caissons filled with concrete and capped with brick masonry above the cellar floor carry the iron work for the building, which is five stories high. The caissons are placed in two rows of four caissons each along the two longer sides of the rectangle, the distance of the two rows apart transversely being about 25 ft. c. to c. of caissons for the front caissons and 29½ ft. for the others. Each caisson is 6 ft. 7½ ins. outside diameter, and they are sunk from 40 ft. to 52 ft. below the curb to solid rock. The material penetrated is rock filling, mud and clay, and hardpan and boulders, in the order named, and in the case of the front caissons an additional layer of clean, sharp sand just above the hardpan and boulders. The plant used in sinking the caissons and the progress and success of the work will be mentioned further on.

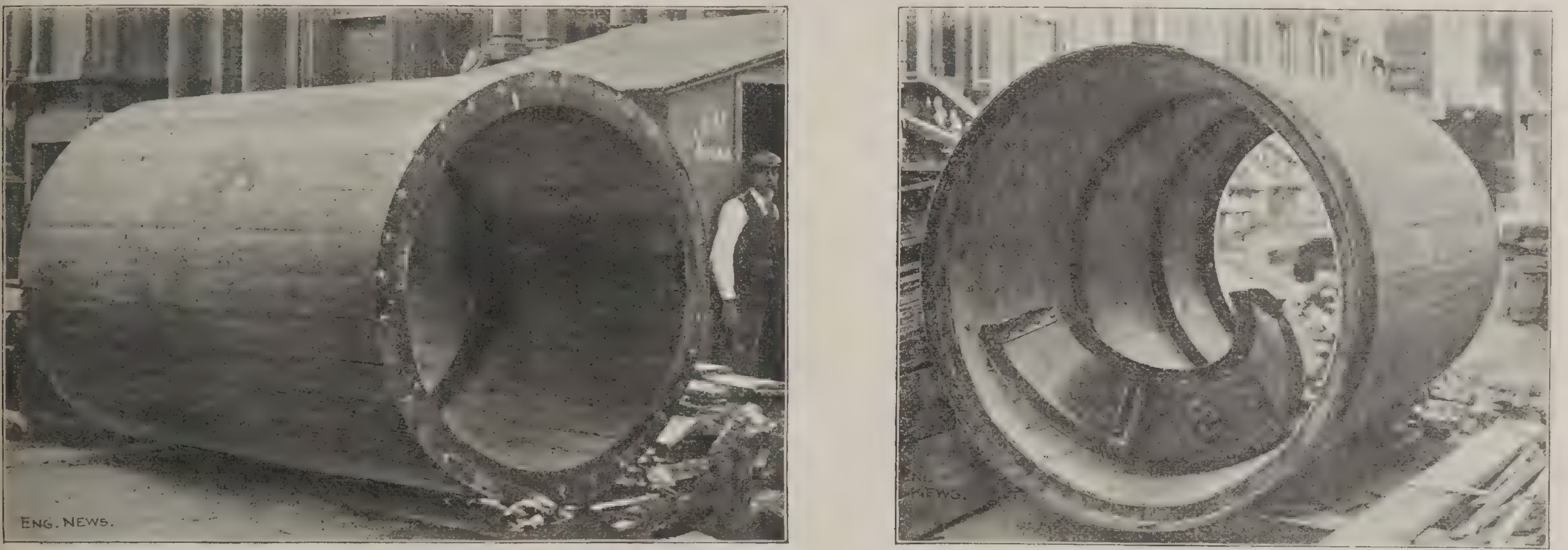


Fig. 1.—View Showing Slip-Tongue Connection of Staves.

Fig. 2.—View of Cutting Edge Showing Detached Section of Roof.

FIGS. 1 AND 2.—WOOD-STAVE CYLINDRICAL PNEUMATIC CAISSONS FOR THE FOUNDATIONS OF A PRIVATE RESIDENCE AT 11-13 EAST 62D STREET, NEW YORK CITY.

John F. O'Rourke, M. Am. Soc. C. E., New York City, Designer.

Cylindrical Caissons.—Figs. 1 and 2 show quite clearly the construction of the wooden caissons. Each is a cylinder 6 ft. 7½ ins. in outside diameter composed of staves cut with radial sides, and having inside angle hoops bolted to the staves. The staves are made of 4 × 6-in. plank dressed to 5½ × 3½ ins., and have 1-in. square slip tongue joints. At first these tongues were covered with whitelead, but it was found that this prevented the tongue from swelling and finally the painting was abandoned.

As will be seen from Fig. 2 and the general drawing, Fig. 3, showing the caisson, caisson shaft and air lock assembled in position ready for work, the wooden cylinder is provided with a metal cutting edge consisting of an angle and plate. Fig. 3 also indicates the construction of the double angle joint connecting two lengths or sections of wooden cylinder. The roof of the working chamber is formed by a ring-shaped diaphragm of steel attached at its outer edges to a special angle ring which was very strongly connected to the staves by a countersunk rivet in each stave, and to its inside edges was attached the bottom of the caisson working shaft. Fig. 2 shows a section of the steel roof ring lying inside the caisson cylinder. It will be noticed that it is detachable and can be used over and over again, like the caisson shaft and air lock.

Caisson Shaft.—The construction of the caisson shaft is shown by Figs. 3 and 4. Briefly stated, the objects sought in designing this shaft were to provide a shaft having no interior projections to catch and otherwise obstruct the hoisting of the bucket, and permitting of its use as a "man shaft" when fitted with a suitably designed lock for that purpose, and also one which would afford a ready means of escape by providing holds by which the men could climb up the inside of the shaft. It was necessary also that all of this should be accomplished without danger of the air escaping and without weakening or greatly increasing the cost of the shaft.

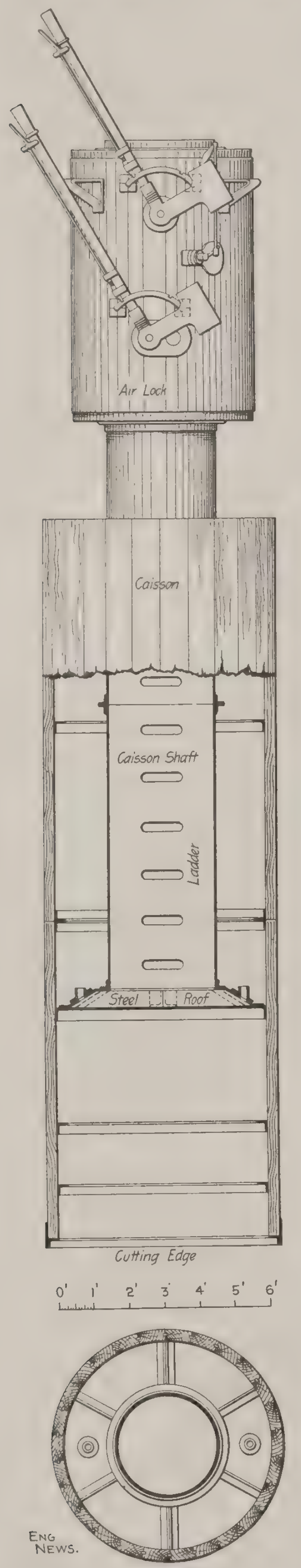


Fig. 3.—Sectional Elevation of Wooden Cylinder Caisson, Caisson Shaft and Air Lock Combined.

Referring to Fig. 4, it will be seen that the shaft is simply a steel cylinder, in one side of which is cut a series of horizontal oblong holes, one above the other, at convenient distances apart to enable a man to step from one to the other. These slots, it will be seen, form a ladder, no part of which projects into the interior of the shaft. To prevent the air escaping through the slots, they are provided with a cover of the same material as the shaft, which bulges outward enough to permit the insertion of the hand or foot into the slot. This cover extends the full length of the shaft, and is riveted to it at the edges, as clearly shown. To prevent the shaft from bulging under the air pressure or the cover plate from being forced inward by any ordinary accident, it is stayed by bolts, which extend through the cover into the shell of the shaft. The shaft, of course, may be provided with any number of these ladders which space will permit and which may be thought necessary.

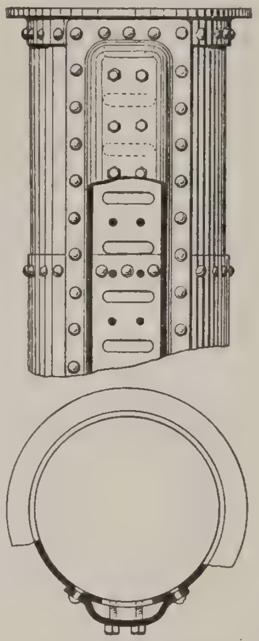


Fig. 4.—Sketch Showing Ladder Construction in Caisson Shaft.

Air Lock.—The several sections and elevations in Fig. 5 show the construction and operation of the air lock. The lock has an essentially cylindrical body, A, which has a top opening, B, and a bottom opening, C, of the requisite size to permit the passage of a bucket or cage through it. Around the top opening is a circular ring, D, on the inside. This opening is closed by the oppositely-arranged convex swinging gates, E, the meeting edges of which are packed so as to make an air-tight closure. The opposite edges are provided with flanges, F, adapted to close against the ring, D, these flanges having flap-gaskets which protrude into the air lock so that the air pressure striking them will make an air-tight seal by pressing them against the ring, D. While ordinarily all the pressure on the doors, E, is taken by the shafts, G, and the actual closure is made by the flap-gaskets, yet the ring, D, may be made to act as an emergency bearing to take the pressure.

The gates, E, are cut away at the center of the meeting edges, as shown at H, to receive and fit snugly upon the stuffing-box, J, banded with rubber, and having a hole through the center for the passage of the hoisting rope. The gates are hung by the arms, K, to the common shafts, G, one (M) being fixed to the shaft, and the other (N) running loose. This arrangement, by means of the bevel gears and idler m, n and o, allows the two doors to be moved in unison and in opposite directions. This hanging of the opposite gates on a single center obviates the necessity of piercing the shell in more than two places, and, therefore, reduces leakage and simplifies the construction. The manner of rotating the shafts, G, by the levers, O, is obvious from the drawing. It will be noticed that the levers have counterweights which balance the doors and thus enable one man to operate the lock.

The air lock has its lower end closed by similar oppositely-arranged swinging gates, P, which near their outer edges have the seats, Q, which fit against the ring, R, with gaskets to secure a tight fit. The castings forming the ring, Q, it will be noticed, have flanges, q, r and s, forming rungs continuing the shaft ladder previously described, and being continued itself by the ladder-like structure, S. Unlike the upper gates, E, the lower gates, P, are swung by the arms, T, from separate centers or shafts, U and V. The gate arms are rigidly fixed to the shafts, and turn with them. To secure opposite motion to the shafts one is operated by a spur wheel from the other, as shown at t and v, the actuating force being obtained through the lever, O. The admission and discharge of air to and from the lock is controlled by the three-way cock, X, operated by a lever and bevel gear and connected with suitable piping to the air shaft, there being no independent connections with the compressors, as is usually the case.

To operate the lock, therefore, the bucket being at the bottom, and the bottom gates, P, necessarily open, the bucket is raised up into the air lock and the gates, P, closed behind it. The air is then discharged by the valve, X, from the lock and the top gates, E, are opened. This allows the bucket to be hoisted out and dumped, or loaded, as may be desired. In the return process the bucket is hoisted into the lock and the top gates closed, care being taken to place the rope stuffing-box, J, approximately in place; air pressure being then admitted, the bottom gates are opened and the mitted, the bottom gates are opened and the bucket is allowed to descend into the working chamber. This operation usually takes about ten seconds, and is accomplished by one man without difficulty. While the drawings show the gates operated by hand levers, other methods may be employed. One of these is a system of oscillating cylinders, and such a system was described and illustrated in the original patent specifications, No. 591,633. After trying both systems the levers were found simpler and cheaper.

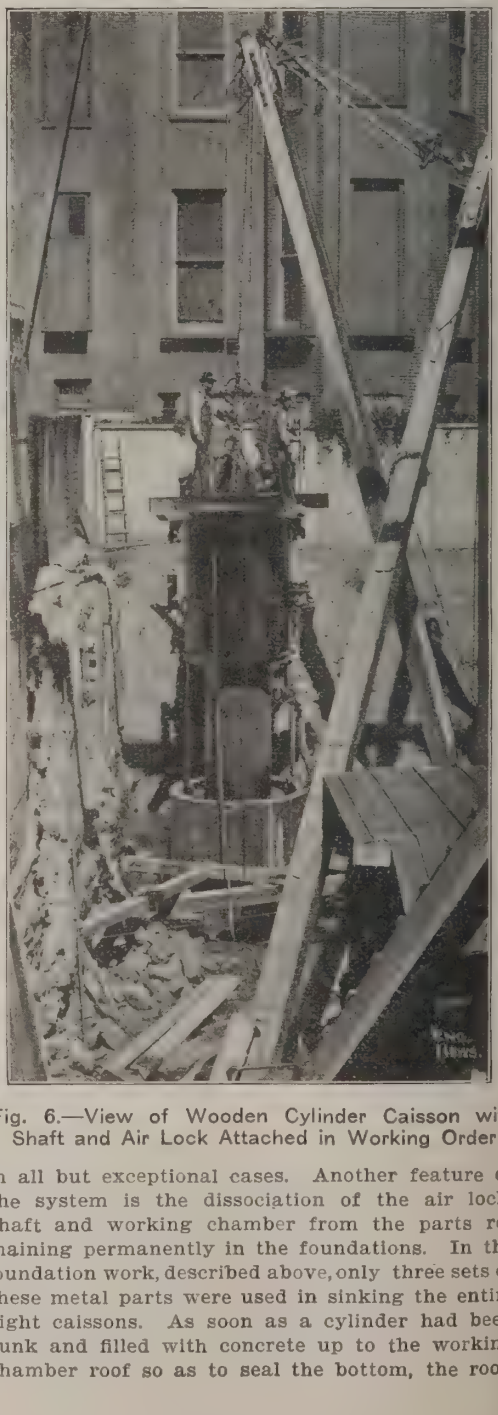
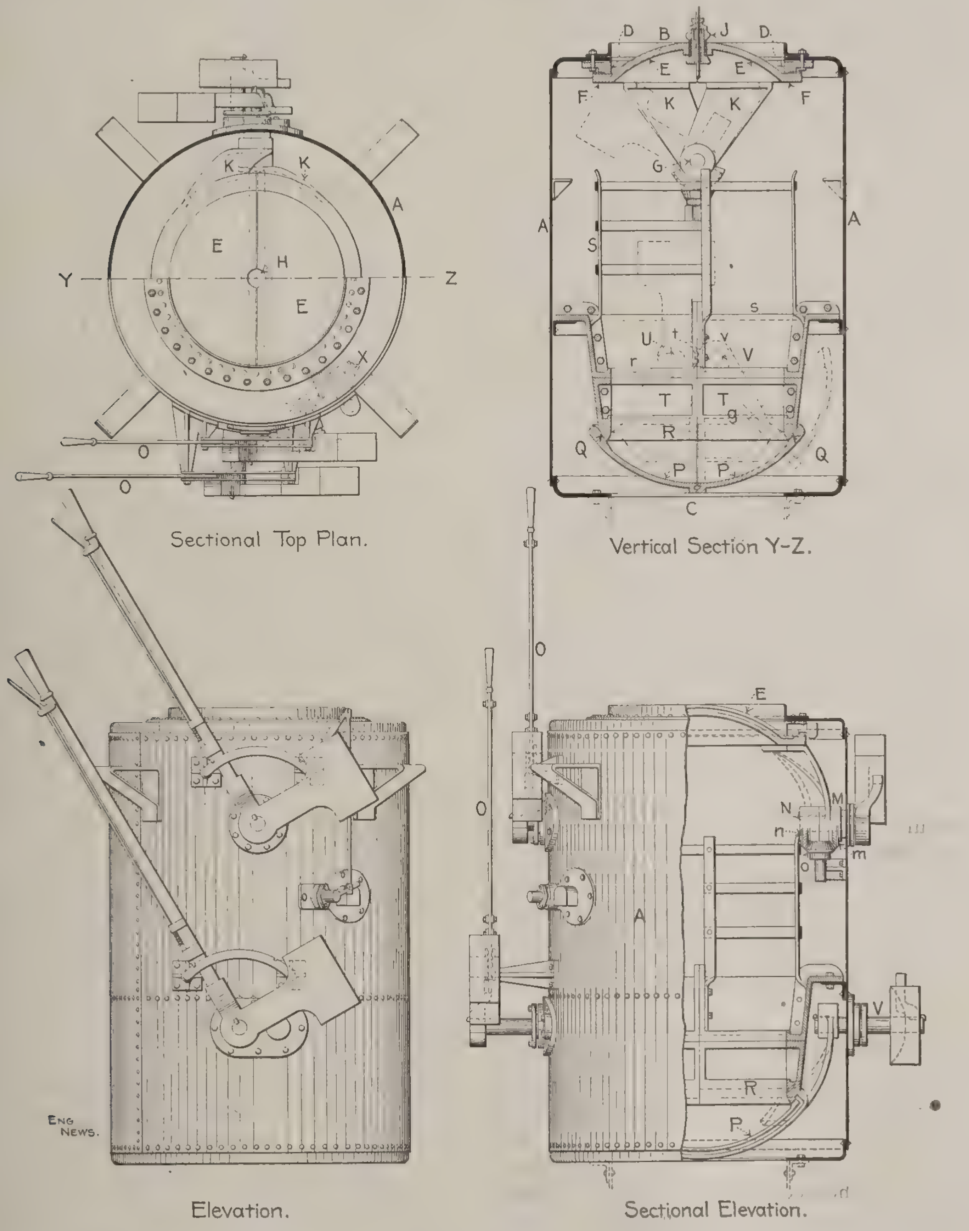


Fig. 6.—View of Wooden Cylinder Caisson with Shaft and Air Lock Attached in Working Order

It will be seen by examining Fig. 3 that when the bucket is at the bottom of the working chamber everything is open clear to the very top of the air lock, and with the ladders provided in the shaft and lock the men can, in the case of a sudden inrush of water, scramble to the top above danger in all but exceptional cases. Another feature of the system is the dissociation of the air lock, shaft and working chamber from the parts remaining permanently in the foundations. In the foundation work, described above, only three sets of these metal parts were used in sinking the entire eight caissons. As soon as a cylinder had been sunk and filled with concrete up to the working chamber roof so as to seal the bottom, the roof, shaft and lock were raised out and the remainder of the filling was done in the open air. A watertight layer of tar and tar paper was embedded in the concrete near the bottom of the chamber to ensure a perfect seal.

As indicating the rugged construction of the wooden stave cylinders as designed, it is stated that in sinking one of them 40 blasts were fired inside the working chamber, using a half a stick of dynamite each, and beyond some of the staves being scarred by flying stone no damage was done. The calking was not affected enough to cause any leaks, and the roof plates and connections were not broken, although the concussion was sufficient to jounce the load of pig iron resting on the roof an appreciable distance into the air.



Sectional Top Plan.

Vertical Section Y-Z.

Elevation.

Sectional Elevation.

FIG. 5.—PLAN, SECTIONS AND ELEVATIONS SHOWING CONSTRUCTION AND OPERATION OF AIR LOCK.

Fig. 6 shows quite clearly the appearance of one of the caissons with the shaft and air lock complete; the fall block attached to the air lock being operated from the boom of a derrick not shown in the engraving. At the time the photograph was taken the air lock had just been hoisted to place. After this was done the falls were unreaved and the excavating bucket was attached to a "single whip." Two derricks were employed, placed near the ends of the lot and covering the entire area with the combined swing of their booms. Between the derricks were situated the two hoisting engines, and their boilers and the duplicate air compressors with their receiver. With this plant the cylinders were sunk to the depth before stated, in periods ranging from 30 hours to eight working days. The largest amount of time was consumed in penetrating the rock fill. Three men were worked in the caisson chamber, one operated the air lock, and another regulated the admission of the air. Absolutely no disturbance of the neighboring foundations was caused. The contractor was Mr. John F. O'Rourke, M. Am. Soc. C. E., the inventor and patentee of the caisson plant used. We are indebted to Mr. O'Rourke for the information from which this article has been prepared. The architects for the building were Haydel & Shepard, of 156 Fifth Ave., New York city.

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BETWEEN THE MINE AND THE SMELTER.

Let us suppose that, as in nine cases out of ten is the fact, you have decided to locate a smelter at a point where fluxes and fuel are more available than at the mine, or to ship your ore to some custom works, at a point so distant in either event that it necessitates railway transportation. The first problem which will usually concern you will be that of freight contracts. There are some railways, like the Great Northern, for instance, that were built through an almost uninhabited country with the express purpose of building up that country and reaping profits in future, and such roads make very liberal rates to miners and smelters along their lines, as well as to other settlers. But there are other roads primarily built perhaps to secure land grants, or, which run from one populous district to another, almost regardless of grades, and, to some extent, of distance; the longer the distance the more land to be obtained from the government. The policy governing such roads has, generally speaking, been unfavorable to industrial development, unless indeed at points where some of the gentlemen interested in the railway were interested in the local development.

When my firm began receiving shipments from Montana, in 1880, the freight rates were from $40 to $60 a ton. They probably do not exceed $18 at this time. One of the most conspicuous instances of the separation for economic reasons of works and mines is that of the Boston-Montana Co. in the state of Montana. Their mines are at Butte, and their works at Great Falls, a distance of 175 miles apart, with one of the main ranges of the Rocky Mountains between. At Great Falls was unlimited water power and cheap fuel; at Butte was not enough water for concentration, and expensive fuel. Before the works at Great Falls were started a freight contract was entered into, the rates of which are popularly supposed to be not much over $1 per ton of ore for this 175 miles of haul over an elevation of 6,000 ft. By way of contrast, I examined a mine in Nevada, only 100 miles from fuel and water by rail, but $3.50 per ton was the lowest freight named for a 7% copper ore.

Recently, competition between railroads and falling prices for metals, have introduced into the question of transportation a new factor, that of the application to ores of the "milling in transit" applied to wheat. You know that a railroad will take a contract to carry wheat from Dakota to New York at a certain price, consenting that the wheat shall be stopped at Minneapolis, turned into flour, packed in barrels, and the flour go forward under the original contract. There are likewise shipments of ores in which the freight contract is based on the number of pounds of copper and lead which they contain, as determined by assay, the contract covering the transportation of the ore from the mine to the smelter in the Middle West, and the bullion from the smelter to the Eastern market; all considered under one contract, not completed until the bullion is delivered. You can readily see the necessity for carefully considering the question of transportation before deciding where to locate works, from this brief outline.

There is still another question of transportation which has been often overlooked by producers of precious metals by smelting, whose product is in the form of rich lead or copper bullion; and when I have suggested that it was worthy of consideration, I have been met sometimes with incredulity until the interested parties began to figure: that is, the difference between freight and express rates on precious metals from the Rocky Mountains to, say, New York.

Take, for illustration, the Anaconda Copper Mining Co. The freight on its product in the form of converter bars or anodes, probably does not exceed $15 per ton to the Atlantic seaboard, and, of course, the gold and silver contained in the copper pay the same freight by the ton. During the fiscal year ending June 30, 1896, the Anaçonda company shipped about 108,000,000 lbs. of copper, containing about 6,000,000 ozs. of silver and 16,000 ozs. of gold. The freight on these 206 tons of gold and silver at, say, $15 a ton, amounted to not much over $3,000; but had this material been refined entirely in the West, and the fine gold and silver all been sent forward by express, the expressage and insurance at 2 cts. per oz. would have amounted to $120,000, difference enough to erect an electrolytic refinery in the East from the saving of two years. In the East, labor is cheaper, sulphuric acid is cheap, and there is a market for the incidental sulphate of copper produced. Then again, the distance from market of the finished product has great influence with the location of works, especially for ultimate refining, as freights are higher as a rule on finished products.

As a result of these conditions, slowly realized, sentiment at present is strongly in favor of the erection of copper refining works on the Atlantic coast, or at least in the East, and it is doubtful whether any of the large copper producers would have put up their electrolytic plants in the West had they realized that the conditions of to-day would prevail, unless it be those fortunate enough to be located on the Great Northern, with the water power of the whole Missouri at Great Falls to draw upon.

Of the 15 electrolytic refineries in the United States, all are east of Chicago, except 3. One-half of the output of the Anaconda is refined in Baltimore, and for the next two or three years all of the United Verde Copper Co.'s output, of Arizona, will also be refined near the port of New York. The entire product of the Canadian Copper Co.'s copper-nickel mines at Sudbury, Ont., is also refined near New York, and all the copper producers west of the Mississippi treat their material, ultimately, in the East, except three. Of course, what has been said does not apply to gold milling, nor in so great a degree to lead smelting, although much Western lead is refined in the East.

While the mining engineer and metallurgist—unless, indeed, the electrical engineer can be called a metallurgist—will find their greatest opportunity in the West, the analytical chemist, assayer and sampler, will find, in all probability, his largest opportunity in the East, or at least as far east as the great manufacturing and refining centers of Omaha and Chicago. He must remember, in choosing his location, that not alone is he to be called upon to handle material going to buyers' works, or those of refiners on toll, but also material destined for export to Europe, and, moreover, a commercial laboratory should seek all branches of analysis.

In 1880, when my laboratory was opened in New York, there was very little assaying of ores or metals at this port, excepting iron ores. The chief support of an analytical laboratory was from manufacturers of chemicals, fertilizers, etc. In those days chemists received from $5 to $7 for a nitrogen determination, and $4 for determina-

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*Extract from a lecture delivered before the graduating class of the School of Mines, Columbia University, and published in the "School of Mines Quarterly," July, 1898.

tion of phosphoric acid. To-day, some are glad to receive $1 for nitrogén determination, and from $2 to $2.50 for phosphoric acid. Not only has the price fallen, but the demand for rapid work has become more exacting. One of the first things the chemist discovers on graduation is that he must invent short-cut methods if he would keep his business. I was "brought up" on Fresenius and taught, for instance, that phosphoric acid could only be safely determined after fusion, separation of silica, solution in nitric acid, precipitation as phospho-molybdate; this after 12 hours' standing dissolved in ammonia, precipitated as ammonia-magnesia phosphate—after standing 12 hours filtered, ignited, etc., etc.

This means at least 48 hours; but I was startled upon opening my laboratory to have the first man who brought in a sample of phosphate say he must have the results before 3 o'clock the same day. All business changes. The assayer of the last two decades has seen the testing of chemicals, drugs, etc., almost disappear from his laboratory, if unwilling to accept nominal prices, and sometimes because trade customs have eliminated analysis. For instance, all the bleaching powder and all the alkalis imported used to be sold on American test. Now the European test is accepted on these in spite of the fact that the trade chemists of England still use an admittedly erroneous atomic weight in calculating the analyses of potash compounds. The analyist, moreover, finds keen competition in his business arising from old established firms, nevertheless alive to modern methods, or from other chemists who can, and will, perhaps, work more cheaply than he. There are foreigners in this business here, who in some cases, live over their laboratories, or in them, whose highest ambition is, apparently, an income of $100 per month, and who have brought the price of sugar testing, for instance, from $2 per sample down to 25 cts., within my memory. Then, there are trade newspapers, who, by way of advertisement, have laboratory annexes, and at reduced rates issue certificates of test for dye-stuffs, groceries, drugs and chemicals; and then in some centers there is the additional competition of men employed by manufacturing or other institutions, with assured salaries, but with the privilege of doing outside work, who do not depend upon their laboratories alone for a living, and who can cut prices proportionately. There is nothing whatever in this competition that is unprofessional or unfair, but it must be reckoned with, and a specialty should be chosen, if possible.

While the analytical business has suffered, the assaying of ores and metals has increased in the East, and in the '80's there seemed to me to be an opening for an ore sampling plants at this port. Here again the transportation problem had to be considered. It is vitally important for such works to be on a line or at a point where railway pools cannot bottle you up, as it is doubtful if your prestige and reputation would be sufficient to bring business to your works, in the face of switching charges or higher freight rates than those obtained over other roads and at other points.

In locating our sampling works, having ascertained the amount of business likely to be brought to the road upon which we located, we interviewed the general managers of several trunk lines terminating at this city. Their reception was characteristic of the roads. The manager of one line did not exactly quote the language of its "Commodore" when he expressed contempt for the general public, but he evidently had no use for ore samplers. Another line offered a piece of ground on the meadows several miles from water transportation, but would make no guarantee against competitive freights. A third road not only gave the land at a nominal rental, but contributed a considerable proportion of the labor and material necessary to erect the works, entered into a contract that it would protect the sampling works against cut rates offered by other roads; and in addition, agreed that ore or other products coming to this port could be stopped not only for sampling but for storage, and upon completion of the sampling or storage, the road would take them over again and complete the haul and lighterage under the original bill of lading. This is storage in transit. It may be said that this road construed this contract with extraordinary liberality. For instance: When, in 1889, Mr. Sécrétan, of Paris, cornered the world's output of copper, buying the entire visible supply, and the entire product of nearly all the mines, sampling was pretty lively at the works mentioned. As the syndicate approached its disastrous end, copper matte began to halt at the sampling works until nearly 8,000 tons had accumulated. Then the syndicate went to pieces, and its creditors fell foul of one another in dividing up the assets. The copper matte was the subject of protracted litigation. It remained in the sampling works—most of it—seven years, at the end of which time the original bags had rotted and carloads were inextricably mixed. Upon the settlement of the dispute at law the matte was ordered out. The musty bills of lading and liter notices were produced, and the railroad sent its empty cars, transported and lightered to ocean steamers some 7,000 tons, seven years after it had started from its Western point of production. These sampling works in turn brought to the Erie Ry. for several years a business of 50,000 tons annually. Choose your location with care.

We have found as another bit of experience that not simply must one be sure of the road's ability to meet its obligations, if we are obliged to tie ourselves up to one line, but must forecast as far as possible conditions of routing and export. Some two years ago roads running southeast from Kansas discriminated against the port of New York, and not only did they quote a lower freight to Gulf ports, but via Gulf ports to Europe. The result was, much of our sampling had to be done on the docks at Galveston, New Orleans, etc. This has temporarily been put a stop to by the Cuban war, and New York is again securing the bulk of lead and copper freights, even when the material is produced in Arizona.

Of late years there has grown up in this, as in other lines of business, the endeavor to get rid of the middle man—in this case the public sampler and assayer—and buyers and sellers have entered into contracts in which the sampling is to be done at buyer's or seller's works by representatives of both parties. There have been such contracts recently entered into, and questions are already arising which cause one or both of the parties most interested financially to regret them. Buyers and sellers are necessarily suspicious of one another on general principles, especially in dealing with material of great value, and some are beginning to realize that it is unwise to place themselves under suspicion, however unjust. In one works, owned by the same people who own the mines, such serious differences arose recently between the respective superintendents that it ended in an agreement, not only that they should revert to independent sampling, but that the material should be sampled on neutral ground. It is perhaps justly said that it is too much to expect of average human nature that impartial sampling shall exist at the works or the mine of an interested party. The office sees so much lead, copper, gold and silver charged on the books and holds the works responsible for this amount either in inventory or shipments. The smelter, therefore, must "protect itself against the office," and if mistakes are made they are apt to be on the safe side where sampling is at either seller's or buyer's establishment.

Neither sampling nor assaying is an exact branch of science especially when dealing with materials containing the precious metals. Your practice in assaying has shown you what variation you can get in any samples, as you vary fluxes, temperature and time of fusion or cupellation. Let me strongly advise you to make every effort, whether you are a seller, buyer or sampler of ore or furnace products, to have the sales contract specify how the assay shall be made.

Now as to sampling methods: In the early '80's our chief export of furnace material was in the form of copper ores. We sampled hundreds of cars of ore from Montana, running 50 to 60% of copper. The lead ores then, as now, stopped in the West, only the bullion coming to the seaboard for export or refining. Then came a period of enormous exports of copper matte; next began the era of bessemerizing, applied to copper, and converter bars became the chief support of the sampler. These mattes contained less than 30 ozs. of silver to the ton on the average, and no silver was paid for unless there was over 30 ozs.

Then the electrolytic refinery came in, and as silver and gold were more easily extracted, the mines sought out gold and silver-bearing ores and run up the values present. To-day, the exports and treatment of furnace products near New York consist of quite two-thirds converter copper bars, as compared with one-third mattes.

THE EXPOSURE FIRE IN THE HOME LIFE INSURANCE BUILDING, NEW YORK CITY.

One of the most severe attacks of fire which a modern tall, steel skeleton, fireproof building, has ever undergone was sustained by the 16-story office building of the Home Life Insurance Co., at 256 Broadway, New York city, on the night of Dec. 4. This building was erected in 1893, and was flanked on one side by the 14-story office building of the Postal Telegraph Co., and on the other side by the 5-story clothing store occupied by Rogers, Peet & Co. The relative location of the three buildings is shown by Fig. 1, from which it will be seen that the 5-story clothing store abutted close against an air and light shaft which recessed the north side of the Home Life Insurance Co.'s building. It was this 5-story building which first caught fire, and which was the torch that communicated the flame to the other structures. The conditions were, indeed, almost typical of what may be seen repeated a score of times in every large city; viz., a tall, steel skeleton, fireproof office building standing by the side of a low, combustible structure whose destruction is nearly certain if fire once catches it, and which is, therefore, a constant menace to its costly neighbor.

The Home Life Insurance Co.'s Building is of the steel skeleton type, all the exterior walls except the front wall, which is self-supporting, being carried by the steel frame. The building has a frontage on Broadway of about 56 ft., and a depth of 107 ft. 6 ins. Two air and light shafts, faced with white enameled brick, with terra cotta trimmings, recess the north and south sides. The exterior walls are brick, except the front wall, which is of white marble elaborately carved. The floor girders run transversely across the building, there being one row of interior columns, and are knee-braced to the columns to resist the wind pressure. The floor beams are supported at each end by angle brackets attached to the girders, and are spaced about 4 ft. 6 ins. apart c. to c. The columns are H-section, made up of plates and angles.

All the steel work is protected by a fireproofing of clay tile. The floor arches are of hard-burned tile, and are 10 ins. thick and of side construction, each arch having two skewback blocks turning underneath to protect the lower beam flanges, four haunch blocks, and a key block. Each block has two horizontal and one vertical interior ribs or diaphragms. The partitions were of 4-in. porous terra cotta tile, the upper 4 ft. in the hall partitions being taken up by windows. The column tile were porous terra cotta tile, ribbed inside to give two air spaces. The main girders, which projected down below the ceilings, were filled in above the flanges with tile blocks, and had their lower flanges wrapped with expanded metal lath. The whole was haunched around by a thick coat of plaster. A plaster finish, of course, covered the column and partition tile.

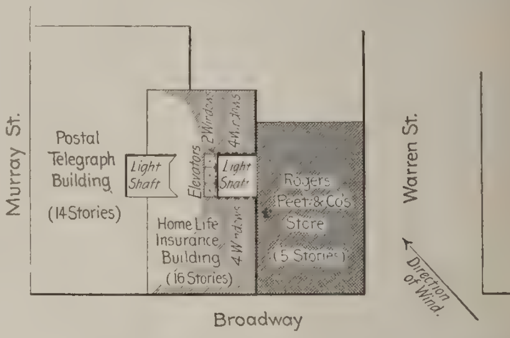
Murray St.
Postal Telegraph Building (14 Stories)
Light Shaft
Elevators
2 Windows
4 Windows
Light Shaft
Home Life Insurance Building (16 Stories)
4 Windows
Rogers Peet & Co's Store (5 Stories)
Warren St.
Direction of Wind.
Broadway

Fig. 1.—Sketch Map Showing Location of Burned Buildings in the Fire of Dec. 4 at Broadway and Warren St., New York City.

The foregoing gives a fairly complete idea of the fireproof construction. Another structural failure of the building which it is important to mention, however, is the light shaft adjacent to the Rogers, Peet & Co. store. To the level of the sixth floor this shaft was inclosed by the wall of the store, but above this point it was open. The two side walls of the shaft had four windows each at each floor, occupying practically the entire area. The other side of the shaft had two smaller windows at each story. None of these window openings were protected by shutters, and it was through them that the flames penetrated the offices of the Home Life Insurance Co.'s Building.

As already stated, the store occupied by Rogers, Peet & Co., and filled with haberdashery, clothing and the extensive shelving and counters of a store of this character was the torch. According to all accounts, it furnished a very fierce fire, the flames of which were driven into the light shaft as a flue by a very severe northeast wind. These flames soon penetrated the unprotected window openings and set fire to the office furniture, fittings and woodwork; thus extending gradually to the farther sides of the building. An excellent description of how the fire made its progress is contained in the following excerpt from the New York "Sun":

> The clothing store was all in a blaze in a quarter of an hour. Then it burned as a whole until the floors fell, one after another. At 11 o'clock there was nothing left to burn. Meantime, the big insurance building, against which this white hot mass of fuel had been sending up steady sheets of flame for a full hour, had just begun to catch fire, this notwithstanding the fact that the windows had no iron shutters on them.
>
> In the middle of the north side of the Home Life Building, the deep light shaft that ran from the bottom to the top was entirely open on the side toward Warren St. When the clothing store became like the inside of a stove the airshaft, far up to the height of the clothing store, was a most effective chimney. The flames swept up that shaft in a solid column, spreading out in clouds of sparks when they reached the top. When the flames above the roof of the clothing store began to die down a little it was seen that every window along the shaft was crackling and blazing. The woodwork around the windows seemed to be all on fire at once.
>
> On every floor the firemen were fighting to keep these flames on the light shaft windows confined to the windows,

Hose had been carried up the elevators, which were in the middle of the building. But the heat was so great that it was impossible for the men to work in the rooms along the shaft. It was half past 10 o'clock when the flames broke into the twelfth floor of the building and began to work away from the shaft and into the building. The fire reached the elevator shaft, in the center of the building, at a quarter of 11.

There are fire mains in the building with connections on the street that the engines can pump water into, and outlets to which hose and nozzles can be attached on each floor. With the constant aid and reinforcement of the furnace in the airshaft, these inside mains were powerless against the flames that were eating from the airshaft toward the front and the back of the building. When the fire once had a firm grip on the twelfth floor there was nothing to do but let it burn. From the buildings on the other side of Warren St. no stream could be sent that would half way reach it.

Here came the exhibition of the difference between the modern construction of the Home Life Building and the old-fashioned plan of the clothing store. This one floor was so thoroughly on fire that spouts of flame were shooting from every window, but the windows of the floor below and the floor above, except on the airshaft, were dark. The fireproof floor kept the fire on each story separate from the others. But the firemen could not keep up the fight above the twelfth floor. Window by window, from office to office, the fire worked its way forward through the 14th floor, skipping the 13th. It worked along the offices on the north side of the building until it reached Broadway, and then south to the Postal building, the windows of each office popping out by pairs. The 14th floor was as thoroughly afire as the 12th at 11:25 o'clock. Ten minutes later the 13th floor windows began to light up. But the floors were standing the test well. The fire was working not from above or below but from the airshaft inward. This was true of every floor that burned. First the heat drove the firemen out, and then the flames followed them.

Substantially the same account of the progress of the fire is given by other observers; that is, that the fire caught and progressed on each floor independently, and did not communicate to any extent from one floor to another. An examination of the burned floors the day after the fire also indicated that the elevator shaft and stairway had not acted to any extent as passages for the flames from story to story. The floors proved to be almost perfect barriers. Only two floor arches altogether had broken through, one on the 15th floor and the other on the 10th floor. On the 10th floor the failure of the arch was due to the fall of a safe. From all the evidence which is available, therefore, it seems fair to assume that there was almost no communication of the fire from floor to floor inside the building. In this respect the fireproof construction served its intended purpose almost perfectly.

The greatest damage was done from the 11th floor up, and in that part of each floor comprised in the wings on each side of the light shaft. It was evident from the ruins that the flames entered the windows on the sides of the shaft, and worked inward and around the front and rear walls to meet in the rooms opening onto the light shaft adjacent to the Postal Telegraph Co.'s Building. The damage was greatest in the rooms near where the fire entered and it gradually decreased as the center of the opposite side was approached. It was also more severe, taking the building as a whole, in the rooms fronting on Broadway. The windows opening onto the elevator wells did not communicate the flames to any very great extent, owing largely to the fact that the elevator enclosure and the adjacent hallway and staircase finishing was incombustible, being either stone or metal.

From the 11th to the 15th floor, inclusive, the damage was about the same on each floor. The condition of the floor arches has already been stated. The partitions were broken down in places and the doors and windows and their casings in the partitions were burned away. Much of the partition damage was evidently done by the firemen, who knocked them down to get at the flames, but water and fire were also responsible to a great extent. The column protection was knocked off in patches, but not very generally. The lower flanges of the floor beams still retained their fireproofing almost perfect as a rule. The main floor girders, which projected below the ceiling, however, had suffered more; the tile filling blocks and the expanded metal and plaster flange wrapping in the places where the fire was hottest being quite frequently either torn off entirely or else hanging loose, leaving the metal bare. The appearance of the metal indicated, however, that the protection had stood long enough to preserve the beams from injury.

The examination, in fact, showed practically no damage done to the steel work, with the exception of two girders on the 15th floor, which had been left unprotected. It may be possible, of course, that a more minute inspection when the debris is removed will show somewhat more damage to the steel framework than now appears; but it hardly seems likely that it can be serious enough to require any great amount of new material. The brick exterior walls may possibly have to be taken down in a few of the top stories, but this will not be known certainly until a closer examination can be made. The marble front, however, in the stories where the fire was hottest is so badly cracked and spalled away that it will certainly have to be rebuilt.

From the 11th floor down the damage gradually decreases, until on the 7th floor it is due mostly to smoke and water. This was probably owing to two things. First, the blast of the flames against the light shaft windows was greater above than below the 7th and 8th floors, but second, and more important, the firemen were able successfully to use their hose up to the 8th story. Above this point the pressure and volume of water obtainable with the ordinary fire apparatus were not efficient against so hot a fire. This was recognized by the fire department at the start, and the 8th floor was established as the level below which the flames must not be allowed. Above that level, after they were once established, they were allowed to burn unhindered.

From what has been said it will be generally admitted by those competent to judge, we think, that the value of its fireproof construction was proven by the Home Life Insurance Co.'s Building. Its weak feature was the unprotected window openings in the light shaft. To this single instance of neglect, we believe, the damage of the building by fire was entirely due. Indeed, we have no hesitation in saying that had the light shaft windows been protected by good fireproof shutters, and been set in metal frames and sash, the flames would never have entered the building with the firemen behind with hose to keep the shutters cool. The building was well fireproofed in every respect except to withstand an exposure fire, and with the tinder-like clothing store by its side an exposure fire was the one which the builders had most reason to expect. As it was, the building kept the fire confined so that its spread was easily prevented under conditions of high wind and bad facilities for fighting flames so far above the ground. Had the whole block been made up of buildings like the clothing store, it is safe to say that it would have been swept clean by the conflagration.

The total damage done by the fire is now estimated at about $600,000. No one was killed, and only two or three of the firemen received slight injuries. For information respecting the constructon of the Home Life Insurance Co.'s Building we are indebted to Napoleon Le Brun & Sons, 1 Madison Ave., New York, the architects. A personal examination of the burned building was also made the second day after the fire by a member of the editorial staff of this journal.

NEW BATTLE REGULATIONS FOR WARSHIPS have been framed by the Navy Department, as a result of experience in the late war. The new instructions leave little to the discretion of officers. Above all else woodwork must be sacrificed in an emergency to guard against danger of fire. All furniture will be reduced to a minimum in war times; camp-stools will take the place of chairs, and swinging tables will replace the substantial mahogany-tables of peace times. All articles on deck not needed in action must be stowed below or cast overboard; proper fire apparatus must be installed and hose led to all parts of the ship with a full head of water constantly maintained; all glass, lights and illuminators above the engine-room are to be taken away; and even boats are to be disposed of, because they would be riddled and useless anyhow in close action. Guns are to be loaded as soon as the ship leaves port, and projectiles are to be kept conveniently near; chains are to be unshackled at the first shackle, so that if the anchor is cut away the whole chain will not go with it. Ships are to be painted a dull gray, with a yellowish shade, as approximating most closely the color of rock, and of an obscuring horizon.

ANOTHER ELECTRICAL EXHIBITION will be held in New York city in 1899. This was decided at the annual meeting of the stockholders, held Nov. 22, at which the following officers were elected: Pres., C. O. Baker, Jr.; Vice-Pres., F. W. Roebling; Secy. and Treas., Geo. E. Porter; General Manager, Marcus Nathan.

A MOTOR CARRIAGE CONTEST was held in Boston, Mass., on Nov. 9, under the auspices of the Massachusetts Charitable Mechanics' Association. There were four types of contests—speed, brake efficiency, manageability, and hill-climbing. The De Dion gasoline tricycle covered two miles in 5 mins. 1⅗ secs.; the Riker electric carriage stopped in 6 ft. 1 in. The De Dion tricycle, 3 ft. 4½ ins. wide, won the manageability contest, which consisted in passing between six sets of posts and turning around and coming back to the line. The Riker carriage, with a width of 4 ft. 8 ins., also made an excellent showing. In the hill-climbing contest, the lighter carriages made the best showing. Prizes to the amount of $1,100 were awarded.

A TELEPHONE CIRCUIT OF 1,900 MILES was talked over on Nov. 28 by Mr. Charles J. Glidden, President of the Southwestern Telegraph and Telephone Co. Mr. Glidden, from his office in Little Rock, Ark., held a distinct conversation with the office in Boston, Mass. Satisfactory tests were also made from the Little Rock office with Memphis, Chicago, Minneapolis, Dallas and Galveston.

500,000 TONS OF STEEL RAILS were ordered in three days, Nov. 25, 26 and 28. Of this amount 275,000 tons were booked by the Carnegie Co., and 225,000 tons by the Illinois Steel Co., which is now a part of the Federal Steel Co. The prices mentioned are $19 per ton at Chicago, and $18 at Pittsburg.

FREIGHT RATES from Duluth to New York by all-rail routes are said to have been recently quoted as low as 10 cts. per 100 lbs., or $2 per ton. Calling the distance 1,500 miles, this is equivalent to only 1⅓ mills per ton-mile. The "New York Journal of Commerce" also says:

> It is reported that early last week one of the lines made a contract with a large exporting firm to carry wheat from Chicago to New York for 8 cts. per 100 lbs. From this rate is to be deducted 3 cts. per 100 lbs. for lighterage in New York, making a net rate for the railroad of only 5 cts. A rate of 9 cts. per 100 lbs. on wheat from Chicago to Baltimore was made recently by another line, but no lighterage charge was to be deducted from that figure.

SMOKE PREVENTION IN PITTSBURG, PA., is to be considered by a commission, which Director E. M. Bigelow, of the Department of Public Works, has asked the city council to appoint.

A CUSHION TIE-PLATE for deadening sound is being used abroad on street railway lines. This mat, according to "Iron Age," is made of wool thoroughly impregnated with oils and the whole covered with a mixture composed of glue, sodium bichromate and formaldehyde. The mat is then compressed to form a plate, the thickness depending upon the conditions of service. The material is also recommended for use under engine and machinery foundations.

BOOK REVIEWS.

DISTRIBUTION DE L'ENERGIE PAR COURANTS POLYPHASES.—By J. Rodet, M. E. Paris: Gauthier-Villars. 5½ × 8¾ ins.; paper; pp. 338; illustrated. 8 francs.

This book presents the subject of distribution of energy by electricity by means of alternating currents, of two, three or more phases. The present state of the art is briefly treated, the effort being to give a clear insight into definite practice rather than to present a theoretical discussion of non-essential matters. By this we do not mean that equations and mathematics are entirely missing, for this would be a harsh criticism, as it is impossible to enter into the realm of alternating currents without employing a certain amount of mathematics. The equations included are essential and are given in a brief but clear manner. Important relations and principles are given in italics, while the general text is simple, straight forward language. Time has not permitted more than a casual examination of the book, but such items as have been examined indicate that the material contained is reliable.

There are seven chapters in all, covering the history and general principles governing the two-phase and three-phase currents, the generation, transmission, transformation use for motors, instruments, and last a description of several installments using polyphase apparatus.

THE DESIGNING OF CONE PULLEYS.—A Non-Approximate, Graphical Solution for the Problem of Proportioning Cone Pulleys, with Concise, Practical Rules. By Walter K. Palmer, M. E., School of Engineering, University of Kansas, Lawrence, Kan. Pamph.; 6 × 9½ ins.; pp. 35. Price, 50 cts.

The mathematical analysis of the solution of the cone pulley problem is complex, and all practical approximate solutions hitherto proposed are either inconvenient to use or otherwise unsatisfactory. Mr. Palmer takes the analysis given in Reuleaux's "Constructor," modifies it at one stage so as to make a more simple graphical construction, and then develops a new diagram from which the problem can be completely and easily solved, for all practical conditions. The author seems to have made a most valuable contribution to the subject.

THE NEW YORK MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

We gave last week an account of the sessions of the meeting held on Tuesday and Wednesday, Nov. 29 and 30. The session on Thursday morning was devoted to the presentation and discussion of professional papers. The first paper was by Prof. C. V. Kerr, of Chicago, entitled "Theory of the Moment of Inertia." The paper is long, abstruse and mathematical, bristling with diagrams and calculus. The author has a theory that the moment of inertia is something different from what it is said to be in the text-books. Those who took part in the discussion held that the books were right and that the paper was all wrong.

The next paper was entitled "Improvements in Steam Boilers," by W. Barnet Le Van, of Philadelphia. It described a horizontal return tubular boiler, with the tubes placed higher in the shell than usual, so as to raise the water level nearly to the top of the shell, thus lessening both the area of disengaging surface and the steam room. It was provided with a long horizontal steam drum, connected to the boiler by a single neck. The paper was roughly handled in the discussion. The boiler was condemned as being no improvement over the plain horizontal tubular boiler, and it was shown that the author had described the same boiler in the Journal of another society as much as 13 years ago.

The next paper was by R. Van A. Norris, of Wilkesbarre, Pa., entitled:

"The Generation and Utilization of Steam by the Lykens Valley Coal Co. and Summit Branch Coal Co., Dauphin Co., Pa."

The paper describes the results of investigations made to discover, and, if possible, to remedy a large discrepancy in the amount of coal used for firing boilers at the two collieries. The work done by the engines at the two collieries was about the same, but at the Lykens Valley mines the boiler horse-power was 3,323 and the coal used per month of 26 working days 4,381 tons, while at the Summit Branch mines the boiler horse-power was 5,313 and the coal used 7,306 tons. The paper includes records of tests of boilers, and engines, indicator cards, investigations of leaky pipes, loss by friction, etc. All sorts of losses of steam and of coal were found; cylinder boilers with stacks red hot, engines so greatly underloaded as to cut off at less than 5% of the stroke, other engines without lap on the valves, carrying steam full stroke, leaky pipes and valves, blowing off of steam with drips from pipes, on account of the absence of traps, etc. A great waste was due to the use of steam jet blowers for forcing the fires under the boilers, some of them taking about 8% of the whole amount of steam made by the boiler.

The discussion of the paper brought out the fact that some of the pumps were over 25 years old. An experiment on fans and steam jet blowers was referred to, in which the steam jet required over 38 HP. of steam and the fan not over 5 HP.

Mr. John A. F. Swenson, of Chicago, then read a paper entitled:

"The Valve Gear of the Willans Engine."

The Willans engine has been well known for many years in England, but is much less known in this country, although it has been made in Chicago for some years. The paper describes the action of the hollow piston rod, which performs the function of a seat for all the valves. The engine may have applied to it an automatic cut-off, the arrangement for effecting the variable cut-off being a rotary sleeve surrounding that portion of the hollow piston rod which travels in the steam chest, the rotation being effected by a shaft governor.

A summary of the advantages claimed for this valve gear is as follows:

> Minimum number of parts and simplicity of form and construction; a free inlet and release, and a cut-off so sharp as to rival even a Corliss; a balanced valve of the piston type, with very small clearance spaces, and which by virtue of its position is easily kept steam tight; great facilities for varying the cut-off; perfect adaptability to the difficulties of high rotative speed.

One shortcoming is that the limit of its general adoption is reached in an engine having single-acting cylinders only. Another is the difficulty of arranging it to run reversing.

Mr. J. H. Vail's paper on "A Cooling Tower and Condenser Installation" was next considered. We give an abstract of this paper elsewhere in this issue. A long discussion followed. Mr. F. Meriam Wheeler exhibited some drawings showing recent arrangements of cooling towers, condensers and air pumps, including one of a duplex pump, in which one of the pump cylinders handled the water from the jet condenser while the other one pumped the air and vapor.

The next paper was by Prof. D. S. Jacobus, of Hoboken, N. J., entitled "Methods of Testing Indicators." It describes the method used at the Stevens Institute of Technology, which the author considers superior to the mercury column method. No discussion followed the paper.

"The Variation of Belt Tensions with Power Transmitted," by Prof. W. S. Aldrich, was the next paper. The object of the paper is stated to be to open up a discussion of the questions: In what way are the belt tensions altered as the load is applied? What effect has the change of the load on the sum of the tensions? Is there any relation between the belt tensions which does not involve the coefficient of friction? The author condemns the old logarithmic formula for the ratio of the tensions on the tight and slack sides, and derives an empirical formula from the results of the experiments of Mr. Wilfred Lewis, as follows:

$$\frac{T_1}{T_1 - T_2} =$$

e raised to a power whose exponent is the fraction

$$2\,T_2 \div (2\,T_1 - T_2),$$

in which T_1 is the greater and T_2 the lesser tension, and e the base of the Naperian logarithms, or 2.7183. Written discussions were presented by Mr. Lewis, who disputed some of Prof. Aldrich's conclusions, and by Mr. Carl G. Barth, who gave a new logarithmic formula, based on theoretical considerations, which is more formidable in appearance than either the old established one or the one proposed by Prof. Aldrich. Mr. Barth's discussion, when printed in the Transactions, will be interesting to those who enjoy studying the mathematical theory of belt tensions

On Thursday afternoon a visit was made to the General Post Office, on invitation of Postmaster Van Cott, to inspect the Batcheller system of pneumatic transmission. The system is working to perfection, and the machinery is a marvelous example of inventive and mechanical skill in solving a most difficult problem.

No programme was prepared for Thursday evening, and the members were left free to their own devices. At the session on Friday morning the first paper was one by R. S. Hale and Henry J. Williams, on

"The Calorific Power of Weathered Coals,"

This paper gives the proximate and ultimate analyses of eight different coals, both before and after weathering. Crushed samples of each coal were exposed out of doors for eleven months. The heating values were calculated from the ultimate analyses by Dulong's formula, and from the proximate analyses by interpolating them on a curve derived by Mr. William Kent from the calorimetric results obtained by Mahler on European coals. Direct determinations of the heating power of three of the coals were also made by Mr. Williams' bomb calorimeter. The conclusions of the authors are that the average heating power of the eight coals was decreased about 2%, according to calculations from Dulong's formula, and that of the three coals about 0.5%, according to the calorimeter. The results obtained from the curve indicated an average increase of 1%. A summary of the results is given below:

	B. T. U.		
	Heating value per lb. combustible, unweathered.	Decreased by weathering	
Name of coal.		Calculated.	By calorimeter.
George's Creek, Md........	15,989	427	90
New River, W. Va.........	15,913	208	..
Portland, O. (C)...........	15,403	611	160
Portland, O. (B)...........	14,406	341	..
McDonald, Pa. (K)........	14,622	Inc. 63	..
McDonald, Pa. (O).........	15,231	220	40
Pittsburg, Pa.	15,003	95	..
Pittsburg, Pa.	15,353	93	..
Average	15,240	241	97

The heating values of the coals given above are calculated by the Dulong formula from the ultimate analyses. The heating values of three of the coals were determined by a bomb calorimeter, with results as follows: George's Creek, 16,048; Portland, O. (C), 15,461; McDonald, Pa. (O), 15,240. These figures show a remarkably close agreement to the figures calculated from the analyses. In the case of the weathered coals, however, the calorimetric results were occasionally quite different from and always higher than the calculated figures, as is indicated by the figures in the last column. The Portland coal (C) after weathering had a heating value, according to the analysis, of 14,792 B. T. U.; while the calorimeter gave 15,301, a difference of 509 B. T. U., or over 3%.

The next paper was by Mr. William H. Bryan, of St. Louis, entitled

"The Mechanical Plant of a Modern Building."

It was a very elaborate description of the method pursued by Mr. Bryan in planning the installation of boilers, engines, dynamos, elevators, heating, lighting and ventilating apparatus, etc., of a large retail store building in St. Louis, with a description of the apparatus finally installed, the reasons for its adoption, its cost, etc. We shall give an abstract of this very valuable paper in an early issue. A long discussion followed the presentation of the paper, which was participated in by Messrs. George Hill, R. P. Bolton and others who have done work of the same character as that described in the paper. Some of the details of Mr. Bryan's specifications were objected to, and doubt was expressed as to the sufficiency of the heating system in the coldest weather. The plan of asking contractors to bid on two or three alternate kinds of apparatus was criticised, and it was said that the architect and consulting engineer should make up their minds exactly what kind and size of apparatus they want before asking for bids. The discussion showed that a wide difference of opinion exists among engineers who make plans and specifications for the mechanical appliances in large buildings, and the paper, with the discussion, when printed, will be full of interest to such engineers.

The next paper was by Prof. R. C. Carpenter, of Cornell University, entitled "Experiments on the Flow of Steam Through Pipes." The object of the experiments was to determine the coefficient of friction of steam flowing at different velocities through pipes and fittings. The author accepts the formula of Unwin, showing that the coefficient f varies with the diameter and that for a velocity of 100 ft. per second it may be expressed by the formula

$$f = K\left[1 + \frac{3}{10}\,d\right],$$

in which d is the diameter of the pipe in feet and K is a coefficient to be found by experiment. Prof. Carpenter's experiments were made on a pipe 90 ft. long and 2 ins. diameter, and he obtained values of K varying from 0.00093 to 0.00360, which would indicate either that K is not a constant, or that there were large errors of observation, but he takes an average value of 0.0027, and constructs from it a series of tables giving the flow of steam in different diameters and lengths of pipes. The paper was severely criticised in discussion, on account of its drawing conclusions from too few data. Prof. Jacobus gave an account of experiments on flow of steam in pipes of different diameters and lengths, made by Prof. Ledoux, in France, some years ago, and published in the "Annales des Mines," and promised to contribute it to the discussion to be printed in the Transactions.

The last paper of the meeting was read by Mr. Chas. L. Newcomb, on "Experiments on the Flow of Streams from Fire Hydrants." This paper had not been printed in advance, and was read from manuscript. It describes an extensive series of experiments, and gives the curves plotted from the results. It will no doubt prove to be an important contribution to the subject, when printed. The paper was discussed by Mr. John R. Freeman, who is well known as an authority on the subject.

This was the last of the regular papers. Several "queries" that had been printed in the programme of the meeting were then brought up for discussion, as follows:

(1) Does it pay to pickle ordinary castings? The replies were to the effect that it depends on the kind of castings. It rarely pays to pickle a heavy casting, but small pieces, such as hardware castings, may be pickled to advantage. The use of hydrofluoric acid as a very effective pickle was mentioned, and the sand blast was commended as far superior to pickling.

(2) Has any improvement in foundry practice been observed from the recent investigations into the physics of cast iron? No one had any reply to make to this question.

(3) What is the strength of pipe fittings made by a casting process? It was explained that this query arose from trouble experienced by, exporters of pipe and pipe fittings to foreign markets. The fittings in this country are usually of cast iron, and they are objected to by foreign purchasers, since the foreign practice is to make them of wrought iron. No definite answer was given to the query, but it was stated that cast-iron fittings are strong enough for all purposes except that of withstanding water ram in large pipes, and that no fitting will resist.

(5) What constitutes a seamless tube? This question arose from some makers of a tube which is not seamless giving their product the name "seamless." A seamless tube was defined as one which had no line of union, and which never had two portions or edges brought together which were at any time separated since the metal was an ingot. A tube made by cupping and drawing from a sheet, or drawn from an ingot which had a hole cast or bored in it was properly called seamless.

(6) On how small a tool does it pay to put an individual electric motor? The question being taken to relate to machine shop tools, it was replied that it generally does not pay to have any electric motor in the shop of less than 5 HP. Smaller units are apt to give trouble, as they are too delicate an instrument for an ordinary shop. The best plan for small tools is to drive the line shafts by motors, and belts from these shafts to the tools.

(7) Have you any new notions on machine shop floors? Several members discussed this question, not claiming to have "new notions," but relating their experience with floors of various kinds. Spruce floors 3 ins. thick, overlaid with 1¼ ins. of hard rock maple, were commended as being about the most durable floor that can be made.

(8) Is it of real advantage to submerge the smoke-box of an upright boiler, to prevent expansion of the tubes? No answer was made to this question.

These queries were the concluding business of the session. The retiring president, Mr. Hunt, after a few remarks, handed the gavel to the newly elected president, Chief Engineer Melville, who made a brief address, and the meeting was then adjourned. The members and guests registered as in attendance at this meeting numbered 493, over a hundred less than were present at the last annual meeting, but the decrease in attendance was easily accounted for by the severe snowstorms which had prevailed throughout New England and New York state, blockading the railways and making travel unpleasant. The next meeting, in May, 1899, will be held in Washington, D. C.

ENGINEERING NEWS
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Portable Forges with Detachable Parts—A Remarkable Belgian Bridge Design (illustrated)—Estimated and Actual Cost of the Chicago Drainage Canal.

THREE PARSONS STEAM TURBINES of 500 HP. each are about to be built by the Westinghouse Machine Co., East Pittsburg, Pa., for the Westinghouse Air Brake Co., Wilmerding, Pa., to replace ordinary steam engines. Each turbine will drive a 300 K-W. generator, furnishing current for electric lighting and for driving the Tesla motors used in the Air Brake Co.'s shops. The Machine Co. is also building a 2,500 HP. turbine for the United Electric Light & Power Co., of New York city, the first of an order of five of the same size. These will be the largest steam turbines ever constructed. They are to be installed in the new station at 28th St. and East River. Each turbine will be used to drive a 1,500 K-W. multiphase generator. The five engines and generators, aggregating 12,500 HP. can be placed in about half the space now occupied by eight vertical Westinghouse engines of 1,200 HP. each, each with Westinghouse generators, now in the 28th St. station. The Parsons turbine has been used in England for several years, giving excellent results as to economy. One of the advantages it offers is that the water of condensation may be safely returned to the boiler, as no oil is used in the engine.

◆

A COMBINATION TO CONTROL ELECTRICAL plants in the city of New York is reported as formed, with Wm. C. Whitney, R. P. Flower, P. O. B. Widener, W. L. Elkins and A. N. Brady as members. This trust is in reality the New York Gas and Electric Light, Heat and Power Co., incorporated at Albany early in October with $25,000,000 capital. Mr. John D. Crimmins is the authority for saying that this company has already secured the Mount Morris Electric Co., with independent subways and a franchise for lighting the entire island of Manhattan; the Manhattan and the Edison Electric Illuminating Cos. The only important company outside is the Westinghouse Electric Co., with its franchise for furnishing heat, light and power. The Empire Subway Co., principally owned by the Bell Telephone Co., has also been secured, But the real extent of the operations of Mr. Whitney and his associates, and their ultimate purpose, are as yet practically unknown, as Mr. Crimmins is no longer associated with the deal, and Mr. Whitney insists that the details are exaggerated, and the Metropolitan Traction Co. simply seeks to sell its surplus power. The purchase of the Manhattan and Edison companies is not confirmed.

◆

THE EXTENSION OF STREET RAILWAY FRANchises in Chicago for a period of 50 years is asked for by the Chicago street railway companies, and an ordinance extending all their franchises for that period has been presented to the City Council by representatives of the leading companies. It provides for payment to the city of a certain percentage of the gross receipts, to be based upon the earnings per mile, as follows: 0.5% for lines earning $7,500 to $10,000 per mile; 1% up to $12,500, 1½% to $15,000, 2% to $20,000, and 3% for all above $20,000 per mile. It also provides means for ascertaining the amounts of the earnings, sets the time for payment, and establishes a 5 ct. fare during the first 20 years of the extended franchise. The mayor is opposed to the ordinance, considering 50 years too long a term, and that the franchises should only be extended for 20 years. He also favors higher rates of compensation, and requirements for improved service on the part of the companies. A mass-meeting was held on Dec. 11 to protest against the extension of the franchises, and the municipal ownership of the street railway lines was favored. On the following day it is reported that the council "indefinitely sidetracked" the ordinances by a vote of 38 to 25.

◆

A CONTRACT FOR A NEW WATER SUPPLY for Jersey City has been awarded by the Street and Water Commissioners to Mr. Patrick H. Flynn, of 189 Montague St., Brooklyn. It is expected that the Board of Finance and the Mayor will approve the award. Mr. Flynn is to build works for the delivery of water by gravity to the present distribution system, the city to buy water by the million gallons, unless it decides to purchase the works. The latter plan it cannot adopt for the present, owing to its financial condition. The supply will be from the Rockaway River. The price per million gallons will be as follows: For the first 25,000,000 gallons a day, $36; for the next two 5,000,000 gallons, $34 and $32, respectively; for the next 10,000,000 gallons, $24; for all above 45,000,000 gallons per day, up to the limit of the possible capacity of the works, or 70,000,000 gallons, $20. This is on an average of $31.40 per 1,000,000 gallons for 50,000,000 gallons a day, and of $28 for 70,000,000 gallons a day. In case the city elects to buy the works, the price for a plant developed to a capacity of 50,000,000 gallons a day, but with a drainage area able to supply 70,000,000 gallons, would be $7,595,000, if the works were bought at completion, and $7,995,000 if bought at the end of 5, 10 or 15 years after completion. Works developed to supply 70,000,000 gallons a day would cost the city $8,745,000, or $9,245,000, respectively, in accordance with the dates of purchase mentioned above. It is reported that Mr. Flynn has made arrangements with the East Jersey Water Co., and those associated with it, for the necessary water rights in the Rockaway drainage area.

◆

A COMBINATION ARCH AND GRAVITY MASONRY dam is being built near Johannesburg, South Africa, with Mr. Wm. Ham. Hall, M. Am. Soc. C. E., of San Francisco, as consulting engineer. The extreme height of the structure, from the foundation to the crest, is about 120 ft., and the maximum depth of water will be about 90 ft. The arched portion of the dam will be 340 ft. long, with a radius of 275 at the crest. The thickness of the arched portion will be 36¼ ft. at the top of the foundation, with an offset of 3½ ft. 20 ft. above, and a batter to 7 ft. at a point just below the coping. The valley at the dam site is some 600 ft. across. The foundation will be of concrete and old rails, and the superstructure of uncoursed rubble. A Lidgerwood cableway is used for constructing the dam. The water impounded by the dam will be used for mining purposes. The work is being carried out by the Vierfontein Water Syndicate, which is controlled by the Consolidated Gold Fields, Messrs. H. Eckstein and others.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Dec. 7 on the Clarion River R. R., near Portland Mills, Pa., resulting in the death of three persons and in the injury of three others. A freight train was cut in two to descend a steep grade, and while the first section was descending the rear section started down the grade and ran into the first section, killing a brakeman. An engine and crew of five men was ordered out to clear the track. On the return trip it jumped the track, rolled down an embankment, and so seriously injured two men that they died within a few minutes.

◆

THE FALL OF A THEATRE ROOF in Detroit, Mich., on Nov. 5, mentioned in Engineering News of Nov. 10, resulting in the death of 12 persons, was due, according to the verdict of the Coroner's jury

> to the collapse of the trusses of roof of said building, caused by said trusses and steel roof construction not being of sufficient strength for the weight they were carrying. We find that the responsibility for said collapse rests upon the firm of John Scott & Co., architects of said building.

◆

THE FALL OF A SECTION OF STEAM PIPE in the United States Electric Lighting Co.'s power station in Washington, D. C., on the night of Dec. 8, caused the extinguishment of every light operated by the station. According to press reports, one of the steam pipes burst and a large section of the pipe fell striking a corner of the switchboard in such a way that all of the station lights were extinguished. To properly repair the damage it was necessary to cut off all the circuits.

◆

THE U. S. BATTLESHIP "MASSACHUSETTS," on leaving the Brooklyn Navy Yard on Dec. 11, struck on a sunken obstruction near Diamond Reef, and sprung a leak in several of her forward compartments. The leaks were quickly stopped by cement, and she will be put into the dock at the yard for permanent repairs. The divers report later that the keel is twisted and buckled at 17 places over a length of 240 ft.

A LARGE GAS HOLDER WAS WRECKED at Baltimore, in a high wind on Dec. 4. The tank, which is one of a row, was partially overthrown against the stone coping containing its water bed. The weight crushed the supporting columns on the leeward side of the tank breaking each into several pieces. The contact with the edge of the coping tore several rents in the shell of the tank, and it is supposed that sparks caused by the friction of the metal against the stone ignited the gas, which escaped through these holes. The contents, amounting to about 300,000 cu. ft., caught fire a few seconds after the gas began to escape, and the portion already in the air exploded, bending the top and sides of the tank. The heat of the flames warped and blistered the metal on the outside for a distance of about 75 ft. The reservoir was 97 ft. in diameter, 47 ft. high, and supported by eight columns of ¾-in. cast iron internally fastened by flanges, reinforced by columns of lattice work. The tank had been in use for 28 years.

◆

THE FAILURE OF A LARGE GAS TANK belonging to the Consolidated Gas Co., of New York, N. Y., and located on the block bounded by 1st Ave., Ave. A, 20th St. and 21st St., in that city, occurred on the evening of Dec. 13, killing and injuring a number of people and destroying considerable surrounding property. According to the best available information the tank, which had just been completed, was being tested when the failure occurred. The holder was 174 ft. in diameter, made up of four sections which telescoped into each other, and which, when fully extended, brought the top of the holder 160 ft. above the bottom of the retaining tank. The retaining tank was 178 ft. in diameter and was a steel cylinder extending 17 ft. below the surface of the ground and 25 ft. above the surface. The retaining tank altogether was thus 42 ft. deep, and it was built of steel plates decreasing in thickness from 1½ ins. at the bottom to 1 in. at the top. To stiffen the tank there were a row of metal buttresses around its outer circumference and a circular lattice girder at the top. There were the usual lattice column girders, pulleys, counterweights, etc., for raising and lowering the holder. The tank and holder were complete, except for minor details, and, as stated above, were being tested preparatory to putting them into use. In order to make the test it was necessary first to fill the containing tank with water and then pump air into the holder until it rose section by section to its full height. According to the best reports of the failure which are available the containing tank was just filled with water when the accident happened. An examination of the ruins shows the shell of the retaining tank torn open vertically in several places, but on the north side the rupture was complete and the ruins of the holder had been thrown or carried through the break and were piled high across 21st St. The failure resulted in the gas being shut off from all consumers supplied by the plant of which the destroyed tank was to have formed a part. Among those who suffered most inconvenience from the shutting off of the gas were the number of daily papers and printing offices which used the gas to heat the type metal used in their linotype machines. The office in which type for Engineering News is set was among the sufferers, which accounts for the delay which some of its subscribers may experience in receiving their copies of this issue. A more complete description of the accident will be given in these columns next week.

◆

BREAKS IN WATER MAINS at Philadelphia and at St. Louis are reported as having occurred within the past few days. The mains in each case were 36 ins. in diameter.

◆

A BREAK IN A 48-IN. WATER MAIN occurred early Sunday morning, Dec. 11, in the eastern part of Brooklyn. A hole some 50 to 75 ft. square and 15 ft. deep was washed out by the escaping water; several buildings were undermined, numerous cellars were flooded, sidewalks and streets were damaged, and sand was deposited here, there and everywhere. A section of a small egg-shaped sewer, and of a pipe sewer, as well as gas mains and small water mains, were washed out, and the double track of the electric railway in the street was left without visible means of support for a hundred feet. The broken pipe was one length of a 48-in. supplementary force main laid from the Ridgewood pumping station about seven years ago. It is said that it was under from 30 to 40 lbs. pressure. The break is attributed to a defective casting.

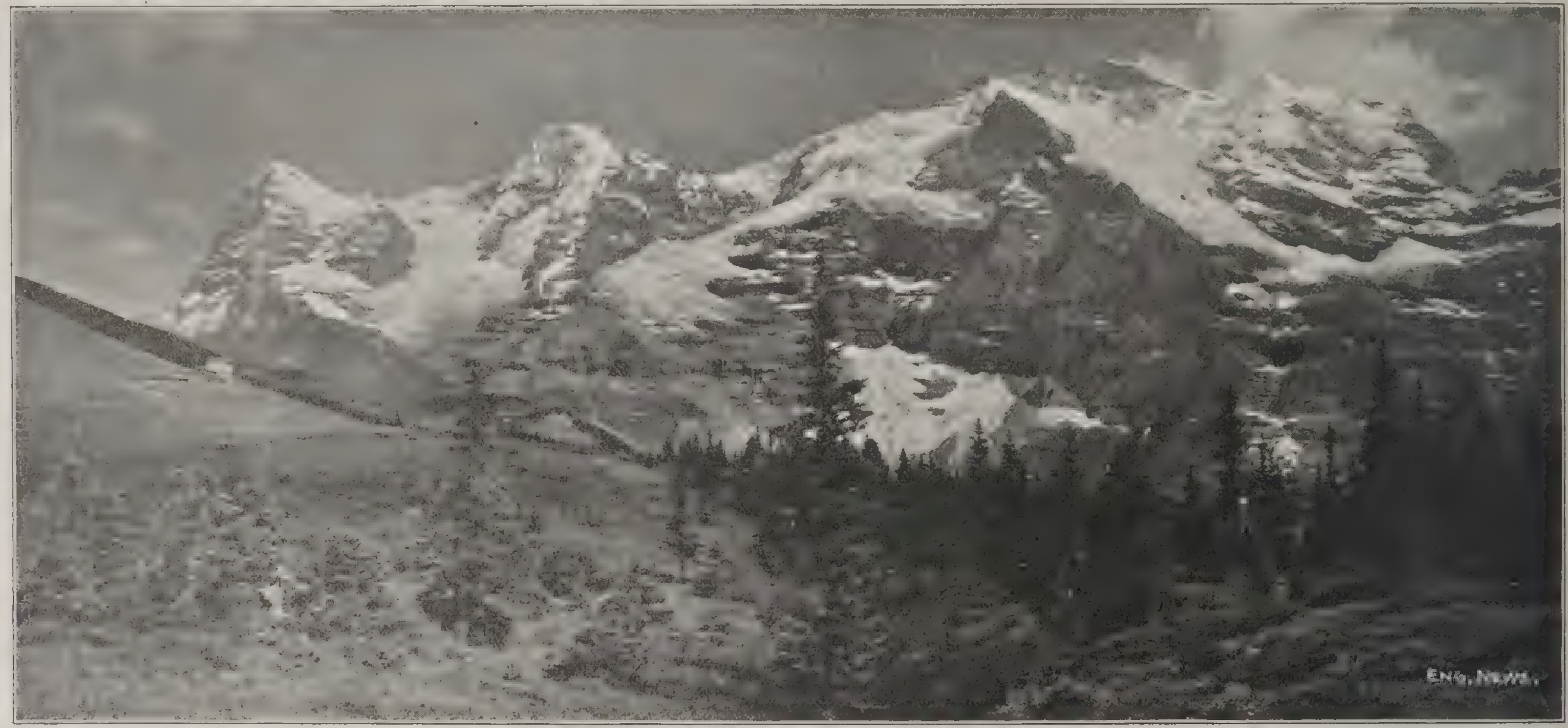
◆

A 6,000,000-GALLON MECHANICAL FILTER PLANT, at Norfolk, Va., is to be built by the New York Filter Mfg. Co., of New York city. The contract was recently awarded the company at $55,000. Mr. J. Thomas Peele is registrar of the Norfolk water-works. At Holyoke, Mass., Mr. James L. Tighe, Engineer of the water-works, has been instructed by the water commissioners to prepare plans for slow sand filtration of the water from the Whiting St. reservoir, which furnishes about one-third of the supply of the city. The estimated cost of the filter beds is $25,000. Mr. Tighe thinks work will be started next April. At West Superior, Wis., the water company is investigating filtration, and has consulted with Mr. Allen Hazen, M. Am. Soc. C. E., of New York city. Mr. W. H. Winslow is secretary of the company.

THE JUNGFRAU ELECTRIC RAILWAY.*

Swiss mountain railways are in a general way so well known that the suggestion of a description of another is apt to arouse little interest. However, the mountain road now being constructed into the very heart of the "Jungfrau" of Switzerland cannot fail to interest, owing to the novelty and boldness of the scheme.

The Jungfrau is one of the highest of the Swiss Alps, and is the highest of the group of three neighboring peaks, Eiger, Moench and Jungfrau. Its snow-capped summit, standing 13,670 ft. above the sea level, affords a magnificent view of the impressive mountain scenery, and has ever been a favorite climb among those sturdy enough to scale its rugged sides. The illustration, Fig. 1 affords an excellent idea of the grandeur and sublime beauty of this mountain mass.



Eiger. Moench. Jungfrau.

FIG. 1.—VIEW OF THE JUNGFRAU GROUP, FROM A PHOTOGRAPH TAKEN NEAR LITTLE SCHEIDEGG STATION.

To make accessible to all visitors the magnificent panorama of snow-capped mountains and glistening glaciers which has heretofore been only possible to hardy mountain climbers, is the project which is now being carried into effect through the untiring energy of Herr Guyer Zeller, president of the Jungfrau Railway Commission It is, of course, out of the question to build a railway on the surface of the mountain, which is one succession of high precipices and deep ravines, and where avalanches occur almost daily at certain seasons of the year. The idea, from the inception of the scheme, has been to tunnel the mountain not far below its surface, and finally reach a point at the base of the highest peak, from which point a vertical shaft would run straight up to the summit, which is about 7,000 ft. above Little Scheidegg, at the base of the mountain, where the mountain railway will begin. This station, nestling at the foot of the great Eiger peak, is on the Wengern Alps Ry., a rack railway, which, by means of a powerful steam locomotive, climbs up from Lauterbrunnen, 4½ miles distant, to the crest of the lower ridge, which is capped by Little Scheidegg (A, Fig. 2), with an elevation of 6,670 ft. above sea level, and then descends on the other side to Grindelwald. The new road, as already mentioned, starts from this station, and, after climbing along the base of the Eiger for a distance of 1.2 miles on a 10% grade, rapidly increasing to 20%, until it reaches the Eiger Glacier station (B), 840 ft. above the starting point. It then plunges into the hard rock of the mountain, through which it burrows for 0.9 mile on a 25% grade to the second station, Eiger Wand (C), 9,200 ft. above sea level. Here the tunnels runs close enough to the face of a precipice to permit windows to be cut through. Continuing the road climbs up still on a 25% grade, and in tunnel until it emerges into the open air at Eismeer Station (D), 1.5 miles further on and 10,360 ft. above sea level. The next section is on a 6¼% gradient, and up this the tunnel continues the climb for 2.6 miles to Jungfraujoch, (E) the fourth station, 850 ft. above the last, and 11,210 ft. above the sea. From this station, for a distance of 1.7 miles, there is a steady ascent on a 25% gradient to the foot of the elevator shaft (F), 240 ft. below the highest point of the Jungfrau. At the top of the elevator shaft will be erected a suitable sheltered observatory provided with everything necessary for the comfort of visitors. Table I. gives in a compact form the distances and elevations of stations and the various grades.

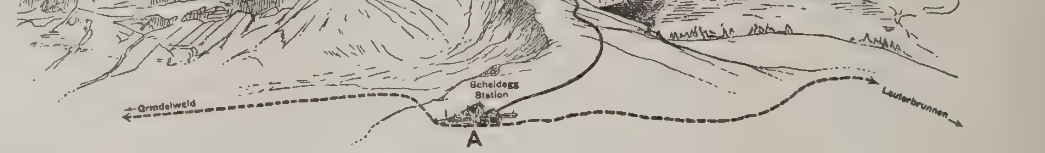


FIG. 2.—SKETCH OF THE JUNGFRAU GROUP, SHOWING ROUTE OF TUNNEL AND LOCATION OF STATIONS.

TABLE I.—Distance Between Stations, Elevations, and Gradients of the Jungfrau Railway.

No.	Station.	Height, ft. Station to station.	Height, ft. Above sea level.	Distance, miles Statn to station.	Distance, miles From start.	Maximum gradient, %.
A	Little Scheidegg...	0	6,770	0	0	0
B	Eiger Glacier	840	7,610	1.2	1.2	25
C	Eiger Wand	1,610	9,220	0.9	2.1	25
D	Eismeer	1,140	10,360	1.5	3.6	25
E	Jungfraujoch	850	11,210	2.6	6.2	6¼
F	Elevator	2,220	13,430	1.7	7 9	25
	Summit Jungfrau...	240	13,670	...	7.9	vert.

With the exception of the Jungfraujoch, the stations will be enlargements of the tunnel in the solid rock, affording visitors an opportunity to look out over the mountain scenery only from windows and balconies cut through the rock faces. It is expected that Jungfraujoch will be a point of departure for sledging or pedestrian parties. The subterranean stations will be equipped with hotel conveniences so that passengers desiring to, may stop off for a short rest or all night if desired. About three-quarters of the total distance, some 6.7 miles, must be cut through a firm limestone, which, if dependence can be placed upon the smooth, firm exposed slopes, which show no disintegration, will need no lining. The remainder will be in alternate layers of gneiss and limestone, requiring a masonry lining. It is the intention of the engineers to line this section with the rock blasted in tunneling, laid in Portland cement. This cement they expect to work at temperatures as low as — 6° C (+ 21.2°F.). The water for mixing will be carried into the tunnel in the form of ice, which will be melted when needed by electric heaters, and kept in a liquid form by the addition of a small quantity of salt. The tunnel is 14 sq. meters (150.6 sq. ft.) in section, and in its construction a new explosive compound, "Lithotrit," is employed, because it is free from noxious gases and is not affected by cold. Dynamite is, however, used in open work, and for such work is thawed out by electric heaters and wrapped in non-conducting materials previous to inserting in the drill holes.

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*Abstracted from the "Electrician" (London), for Sept. 23, 1898, with additional information from "Centralblatt der Bauverwaltung," for Oct. 30, 1897.

At the present time about 1,500 ft. out of the total of some 45,000 ft. have been excavated, and tunneling is progressing steadily, the intention being to continue summer and winter until completion, the time for which is set at 1904. The workmen, mostly Italian laborers, are housed in barracks built on the mountain side. All the drilling, lighting and hauling is done by electricity and a considerable plant is required to furnish the necessary current. Two types of electric drills are being used, a rotary, manufactured by the Oerlikon Co., which is operated by a 3 HP. motor and feeds 0.08 ins. per revolution of the cutter, and the usual percussion form, built by the Union Elektricitats Gesellshaft, making 400 4¾-in. strokes per minute.

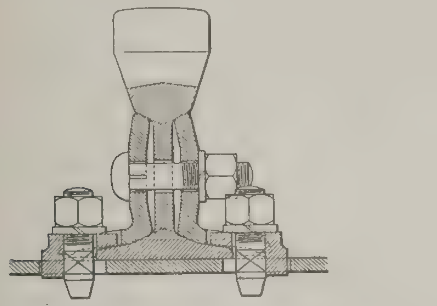
Fig. 3.—Section of the Rack Rail, Showing Method of Splicing and Securing Rack to Ties.

The temporary power plant furnishing current for construction work is located at Lauterbrunnen, where ample water power to drive a 1,000 HP. generator is obtained from the White Lutschine River. This generator, manufactured by the Oerlikon Co., furnishes three-phase current at 7,000 volts with a periodicity of 38 for transmission up the valley to Little Scheidegg and the Eiger Glacier, where the voltage is dropped by means of static transformers to the working pressure of 500 volts. The transmission line is 4½ miles long, in which distance it ascends 4,250 ft. It is composed of 3 bare hard-drawn copper conductors 7.5 mm. in diameter, supported upon large earthenware triple-petticoat insulators 4½ ins. in diameter and about 7 ins. high. Heavy wooden poles 33 ft. long are frequently placed and upon these are mounted galvanized iron brackets. As a precaution, wherever the lines cross footpaths a circular guard net is suspended, almost surrounding the transmission wires. A telephone circuit is also mounted upon the same poles and the conductors of this circuit have to be crossed frequently to counteract the great inductive effect of the high tension current on the transmission circuit.

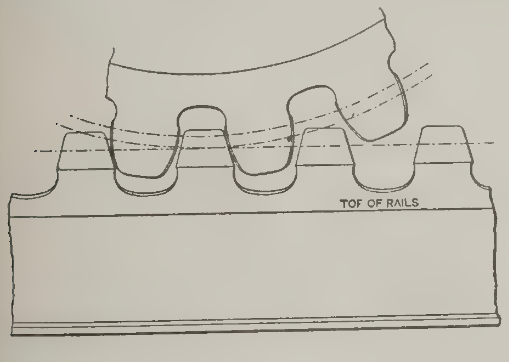

Fig. 4.—Form of Teeth of Rack Rail and Driving Gears.

The substations are substantial stone structures intended to withstand the extremely severe weather of that region, and each contains two 200 K-W. Oerlikon static step down transformers, dropping the current from 7,000 volts to 500, at which voltage it is supplied to the secondary or working feeders. These are 9 mm. hard drawn copper conductors, supported in the same manner as the transmission lines. During construction a rotary converter is employed to supply direct current for rock drills and other machinery. The intention is to install in suitably protected rooms, spaced about every 3,280 ft., static transformers, which will furnish power for mining as the work progresses, and will eventually feed the line wires from which the locomotives will take current. A separate set of transformers will furnish the current for the elevator running up the vertical shaft.

The permanent power plant at Lauterbrunnen, when completed, will be operated by turbines taking water, as in the present plant, from the White Lutschine River. About 1,320 gallons per minute will be required, under a head of 115 ft., which is brought to the power house from just below the Staubbach Water Falls by a steel pipe line 5 ft. 11 ins. in diameter and 4,500 ft. long. For about half this distance the slope of the pipe is only about 0.3%, and this portion has a thickness of 0.197 ins., each section being 19 ft. 8 ins. long. The remainder of the line has a decided grade and varies in thickness from 0.236 ins. to 0.276 ins. At the junction of the two sections, just mentioned, is inserted an air cushion column, its duty being to relieve water hammer on the pipe.

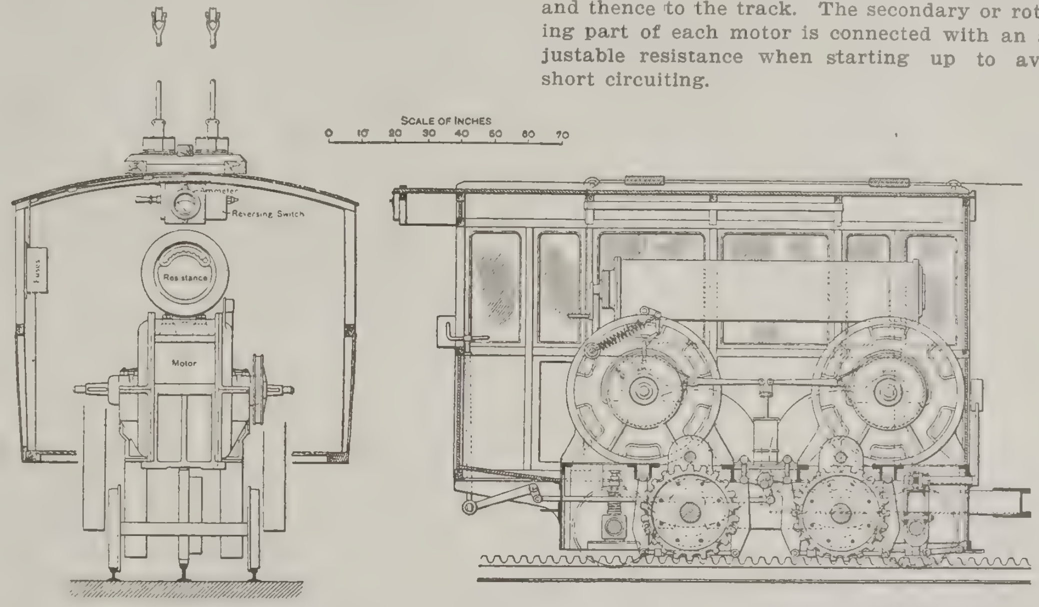

FIG. 5.—ELEVATION AND SECTION OF JUNGFRAU ELECTRIC LOCOMOTIVE, SHOWING TRUCK FRAMING, MOTORS, GEARS AND THE DOUBLE TROLLEY.

The turbines are of the twin Girard type, made by J. J. Rieter & Co. The speed is regulated by Rieter automatic governors belted directly to the turbine shaft. The three-phase generators are manufactured by the Oerlikon Co., and are directly connected to the turbines.

The track and roadbed of the railway will be constructed in the most substantial manner. The rails are laid to a 3 ft. 3⅜-in. gage. They are of the usual Vignoles section and weigh 40 lbs. per yd. Steel channel ties, spaced 3 ft. 3 in. c. to c. are used, and to these are bolted the rack rail, Figs. 3 and 4, which is rolled solid, like the ordinary rail, in lengths of 11½ ft. The teeth are afterwards cut cold. This rail weighs 68½ lbs. per yd. Fig. 3 shows the method of securing the rack to the cross ties and how the sections are spliced. On the road from Eismeer to Jungfraujoch, where the grade is only 6¼%, no rack will be used. On all other sections, however, the rack will be necessary. As the rails are used to carry current, forming one branch of the three-wire system, the tracks are carefully bonded, two "Chicago" copper bonds of 7 mm. section being used for each rail joint, and every 165 ft. the rails are cross bonded with a 8 mm. copper wire.

The trolley wires, two in number, are supported side by side by hanging insulators and span wires strung between wooden poles, on open portions of the line, and by well insulated ceiling hangers inside the tunnel.

The electric locomotives, as will be seen in Fig. 5, consist of a heavy frame built up of channels and I-beams, mounted upon two pairs of wheels, and upon this truck are placed two large three-phase induction motors, which through separate sets of double reduction gears operate the heavy gears meshing into the rack rail. In addition, the whole is covered by a suitable car body to support the four trolley poles, as well as to protect the motors, controller and instruments. These motors range from 125 to 150 brake HP. and run at 760 revolutions per minute on the 500 volt circuit. They weigh 5,200 lbs. each, while the complete locomotive weighs 13 tons.

Fig. 5 shows the arrangement of motors, controller, gearing and braking apparatus of the first locomotive constructed, while Fig. 6 indicates clearly the method of wiring up from trolley to track. For purposes of explanation we may assume that the line current enters the double trolley 1, 2 and 1a, 2a and passes down through a reversing switch and a set of multiple fuses to the stationary part or primary winding of the motors, and thence to the track. The secondary or rotating part of each motor is connected with an adjustable resistance when starting up to avoid short circuiting.

The matter of braking and control of speed is one of considerable importance about which the "Electrician" says:

> One of the great advantages of the three-phase system, aside from cheapness of transmission, lies in the simple automatic breaking action of the induction motor. When the locomotive is going down hill the stator or primary of the motor cannot greatly exceed the speed of synchronism. From Fig. 6 it will be seen that the motors are merely controlled by a reversing switch (through which the stator is connected to the line), and the usual rheostat in the rotor or armature circuit to avoid starting the armature on a short circuit. The locomotive is fitted with three absolutely independent brakes. The first is an automatic one, electrically controlled by means of a centrifugal governor, which, when the speed exceeds a certain maximum, switches the current off the motors, at the same time applying a band brake. A dash-pot prevents slight momentary increases in speed from putting the brake in action. This brake can also be applied by the guard in the passenger car, where a suitable switch is provided. The second brake is a hand one, which applies bronze shoes to a wheel on the driving axle, and the third is an emergency brake, arranged to grip the rack rail. It can be applied by either the engineman or the guard in the passenger car.
>
> The car is pushed ahead of the locomotive and has a capacity for 40 passengers. At times of heavy traffic two cars

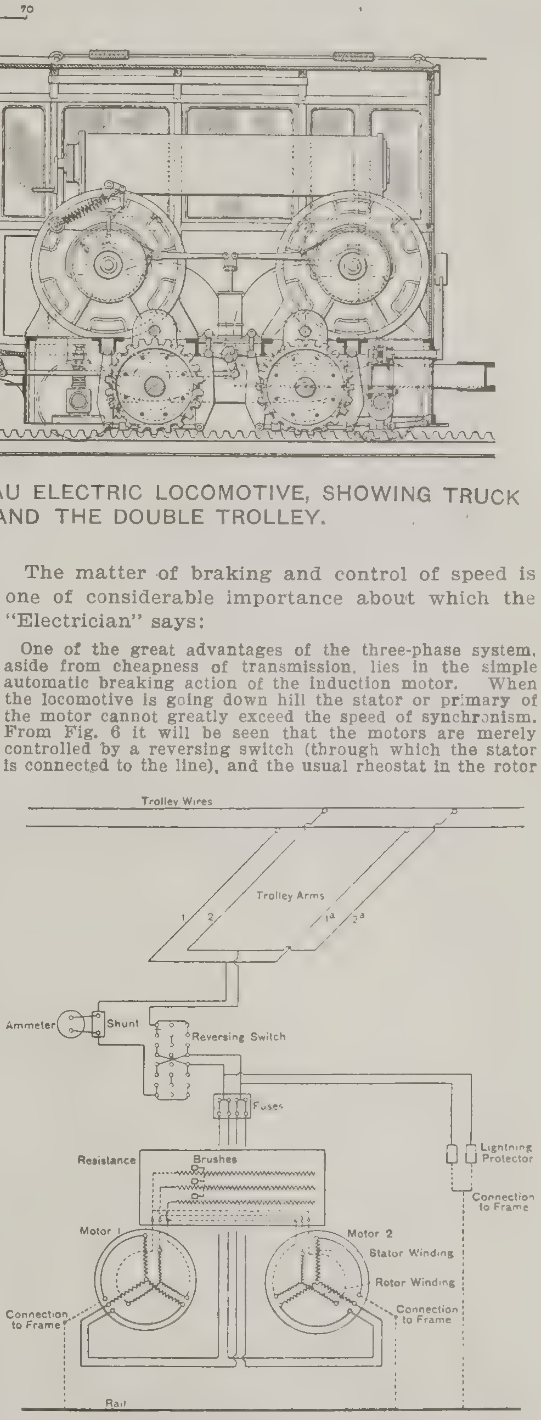

Fig. 6.—Wiring Diagram of the Electric Locomotive, From Trolley to Track.

will be used per train. The train is lighted by 6 incandescent lamps on the locomotive, two in series on each phase, and 15 on each car, arranged five in series on each phase.

The estimates upon which the project was financed allowed a traffic of only 10,000 passengers per year to the top of the Jungfrau, although fully 160,000 persons visited Interlaken in the season of 1895, and the rate of increase of visitors to Interlaken is about 30% every 5 years.

At the time the franchise for the road was given the maximum round trip rate was limited to $8.68; but it is understood that the company contemplates a much lower rate ($6.75), with a schedule for the intermediate stations based upon this.

Using this basis and including the income from all sources, the total annual receipts are placed at about $139,350. The estimated operating expenses, reserve fund and interest on $1,200,000 at 4%, amount to about $86,850. The surplus amount, it will be seen, is equivalent to nearly 7% on $800,000 capital. The entire cost of the road, including construction and equipment, is estimated at $1,930,000.

IMPROVEMENTS OF THE WATER-WORKS OF COUNCIL GROVE, KAN.

By L. L. Tribus,* M. Am. Soc. C. E.

During 1897-8 certain improvements to the waterworks of Council Grove, Kan., have been under the writer's direction. Those not familiar with the action and condition of rivers in alluvial regions, can scarcely appreciate the peculiar difficulties attending their use for public water supply systems. The larger cities of the West have scarcely solved the problem; certainly the smaller ones cannot be expected to have done so.

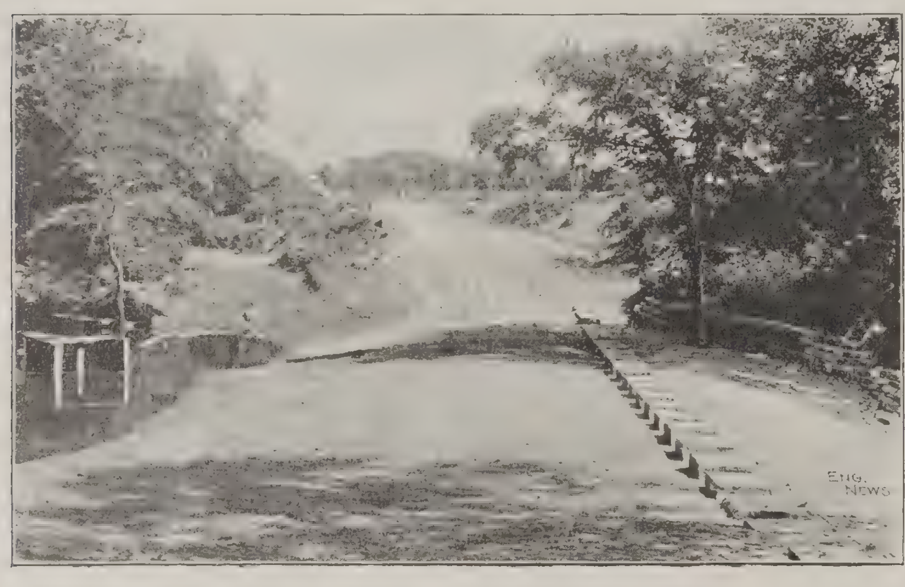

FIG. 1.—HIGHWAY DAM ACROSS THE NEOSHO RIVER FOR THE WATER-WORKS OF COUNCIL GROVE, KAN.
L. L. Tribus, M. Am. Soc. C. E., Consulting Engineer.

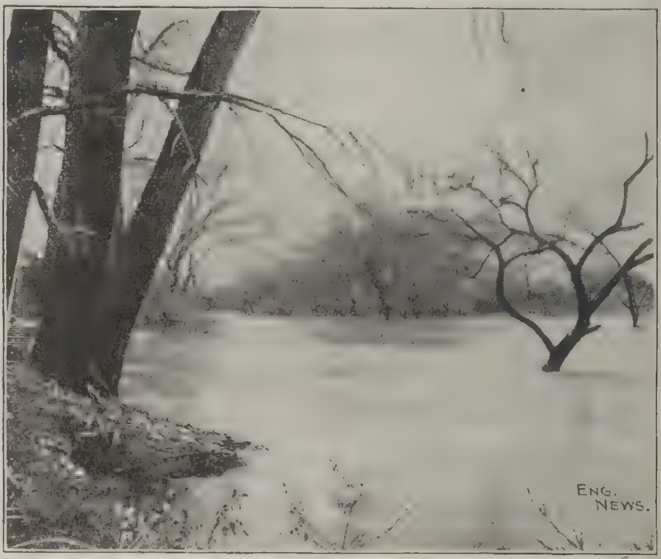

FIG. 2.—COUNCIL GROVE HIGHWAY DAM SUBMERGED BY FLOOD.

The little city of Council Grove, in Central Kansas (under 3,000 population), possesses eminently all the disadvantages of such a source of supply, and is without means to experiment on adequate scale for improvements. The surrounding country consists of rolling prairie land, with a range of elevation of about 100 ft., scantily timbered in spots. The country is intersected at frequent intervals by steep-banked gullies, filled in rainy times by flashy streams, that run from 10 to 30 ft. in depth of water, and a soil of fine blackish loam on limestone or other rock substratum.

The hot winds of summer parch the land; sudden rainstorms, often coming with great violence, wash the powdered soil into the streams, turning them into literally mud rivers; the lack of timber districts to hold back the water and the shallowness of the soil ensures the storm waters reaching the streams in very short order, causing floods of a violence almost unknown in Eastern streams, a rise of 5 to 25 ft. in ten hours being of not infrequent occurrence. Passing between banks of alluvial soil, these floods exercise their own taste in cutting and changing the course of the rivers with little warning or chance for resistance. Deflection cribs are used somewhat, but are of rather problematic value. At the same time these floods are the life of the land; by overflowing the bottoms they deposit much fertilizing material and enable the raising of heavy crops of corn and grain; their abatement being almost as rapid as the rise, relieves the land from "drowning." These general conditions are typical of thousands of square miles of Western lands; eminently so of Council Grove and vicinity.

An engineer would not select the Neosho River, such a one as the above, as the source of supply of a municipal water system unless obliged so to do. The soil is largely clay and loam, and shallow at that. The underlying rock of limestone, not freely water bearing, makes driven or bored wells very scanty in yield of water, usually of very hard quality, unsuited for domestic and manufacturing purposes. No lakes or other sources are available, hence the best had to be made of undesirable conditions.

The city of Council Grove has the same early history of most such prairie towns, built without special reason or necessity, but it is there, and has passed through the throes of municipal development to a stage of permanence and moderate prosperity. Some ten years or so ago, a contract was made on the franchise plan with a private company, for the construction and maintenance of a public water system, directing the company to adopt the Neosho River, as the source of supply. A large brick intake well in the river bank was built, with influent pipe from a deep pool in the river's bed. From this well, the pumps, placed in a neat little brick station, situated some 100 ft. back on higher ground, lifted the water and delivered it at a wrought-iron stand-pipe 20 ft. in diameter by 75 ft. in height, on an eminence nearby, from whence by gravity the city was supplied.

For the period until July, 1897, such water as was used consisted of fairly soft river water, mixed with varying proportions of silt, ranging from a light semi-transparent brown to a deep chocolate color. No special effort was made by the company to improve the condition of the water nor was objection raised by the citizens to its use. Street flushing and sprinkling, boiler use and fire service, naturally made up most of the consumption; rain water tanks and cisterns inadequately serving for domestic needs. In the above month of July, 1897, it began to be realized that modern methods properly adapted could give at least an improvement in supply, and the company, though far from prosperous, undertook to reconstruct the plant, recently completing the changes planned by the writer, its consulting engineer.

A peculiarity of the Neosho River, and one to be remembered, is, that during most of the year it is simply a succession of pools from one-fourth mile to one mile in length, and from 3 to 10 or 12 ft. in depth. The riffles, or low natural dams separating the pools, are composed of a sort of cemented gravel, quite water-tight. When the pool nearest the pumping station becomes too low, a narrow trench is dug through the next riffle above, and its waters are drawn down for use.

Last autumn (1897) this supply, even, came perilously near to being exhausted, but usually storms have been of sufficient frequency to scour out and fill up the pools with fresh water. At best, however, the water was more or less filled with matter in suspension; some of the time becoming offensive. The consumption was about 100,000 gallons per day on the average, the Missouri Pacific Railroad using about one-half the total for its locomotive boilers.

The plans for improving the water plant as carried out, consisted, first, in raising the riffle below the pumping station about 5 ft., making of it a good highway crossing, though submerged at flood times; both of these conditions are shown by the views, Figs. 1 and 2, respectively. This gives additional storage of some 5,000,000 or 6,000,000 gallons, giving opportunity for greater sedimentation, thus improving the quality, or rather decreasing the chance of spoiling, by the increased depth of the reservoir.

A solid masonry dam would have been too expensive, but as rock-bottom was attainable for foundation, a rubble masonry core wall, 5 ft. thick at the base and 3 ft. at the top, was constructed, finished off with a heavy coping, alternate blocks being depressed some 8 ins. to make waterways for the dry weather flow, and the higher stones affording footing for pedestrians. Upstream from this wall was deposited a heavy clay and gravel fill bank, 22 ft. wide on top, with an upstream slope of about 5 to 1. Sixteen feet of the top was paved with stone, edged on the upstream side with a deep-set curve, the downstream side abutting against the core wall. The downstream slope, below the heart wall, was paved with heavy stone blocks, on the same clay and gravel fill of which the rest of the dam was built.

The general idea and hope, based on a study of the river's action, was that floods would pass over in a "roll" without scouring action, the flat slopes and broad crest deflecting rather than checking the current. Events have thus far justified the belief, for a number of floods have already passed over the dam without causing any special damage, and even depositing some additional gravel on the crest.

A 24-in. cast-iron pipe sluice serves for a low water drain when needed. The pool enlarged by this dam extends about 1½ miles upstream to near the foot of an old timber crib dam (also controlled by the Water Co.), which forms a second storage reservoir. At present this is in a very dilapidated condition, but it is the intention to later put it in substantial shape again.

The second main change of system was the installation of a filtration plant. The filter erected by the New York Filter Manufacturing Co. consists of a wrought-iron closed tank, 10 ft. in diameter, filled with sand. gravel, coke and broken stone, housed in a neat brick addition to the pumping station. Water from the pumps is forced through this closed tank into the main to the stand-pipe; a small volume of water under the same pressure passing through a by-pass and small tank filled with lumps of sulphate of alumina, and in turn joining the main volume of water before reaching the filter. Enough of the alum is taken up to form a flocculent precipitate, which assists the upper layers of the sand in entangling and retaining matters that are in suspension.

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*Consulting Engineer, 84 Warren St., New York.

For ordinary stages of the river, this process yields clear water. For specially muddy stages there is admitted to the suction well some lime water, and just before entering the pumps, a strong alum solution. This, it is hoped will, with a slower rate of filtration, answer for all conditions, though as yet the experiments have not been of sufficient duration to demonstrate to a certainty. The reversal of current in the filter once in one or two hours, for a few minutes at a time, suffices to cleanse the filter, and keep it in good operating condition, without a very large waste of filtered water (used for the washing).

The building added to the pump-house is arranged for two mechanical filters of 250,000 gallons capacity per 24 hours each, though but one is as yet installed. In the pumping station are also situated the city electric lighting engines, operated by the same steam plant that supplies the pumping engines; so the combined operations can be carried on with reasonable economy—pumping by day and running the dynamo at night. With filtered water the economy in operating the boilers is considerably increased, over the former use of rolly water, all that was then available.

It is not claimed by the water company that the results secured make the plant ideal in any way, but that making the best of poor advantages, the improvements can be called successful, and a very unfortunate supply of water made available for fairly satisfactory use.

METHODS OF WORK ON THE ST. LAWRENCE POWER CO.'S WATER POWER CANAL NEAR MASSENA, N.Y.

(With full-page plate.)

One of the most notable pieces of canal work now in progress in this country is that for the new water-power electric plant which is being built at Massena, N. Y. This canal will be 187½ ft. wide on the bottom, which, with a depth of water of 25 ft., and side slopes of 1 on 1½, will make the width at water level 262½ ft. As will be noticed, this section is greater than that of any other existing canal, and will be exceeded only by that of the Chicago Drainage Canal when this is excavated to its final dimensions of 202 ft. wide on the bottom, with a depth of water of 22 ft. and side slopes of 1 on 1½. Fig. 1 shows a cross-section of the St. Lawrence Power Co.'s canal as it is planned, although it seems probable now that some of the material will actually require flatter slopes in order to stand, and, therefore, that some of the figures which have been adopted will be changed for certain sections of the work at least. The drawing shows only the normal section, which is to be widened out at one end to form an entrance bay, and at the other end into a fore bay. The dimensions of these enlargements are not yet finally determined. Altogether the work will entail the excavation of about 8,000,000 cu. yds. of earth consisting mostly of quite soft clay and clayey loam, although in the two deep cuts and at other isolated points a sort of hardpan or very hard indurated clay filled with boulders of all sizes is encountered. In the power house foundation work there is also considerable rock excavation.

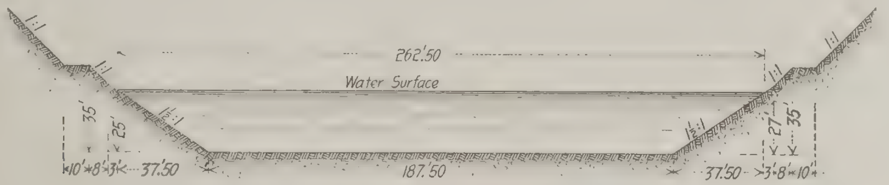

FIG. 1.—CROSS SECTION OF THE ST. LAWRENCE POWER CO.'S WATER POWER CANAL, NEAR MASSENA, N. Y.

The engravings on our full-page plate and in the text show the methods being employed to excavate these materials. These photographs and drawings and the bulk of the information from which this description has been prepared were collected during a visit made to the work on Nov. 17 and 18 by a member of the editorial staff of Engineering News. For aid in collecting this material we are indebted to Mr. Robert Swan and Mr. J. B. Walker, respectively Vice-President and Assistant Engineer of The T. A. Gillespie Co., of New York, the contractors for the work, and to Mr. Wm. H. Cushman, Resident Engineer, St. Lawrence Construction Co., Massena, N. Y. The entire work is being carried on by The T. A. Gillespie Co., and all the plant described is owned and operated by it.

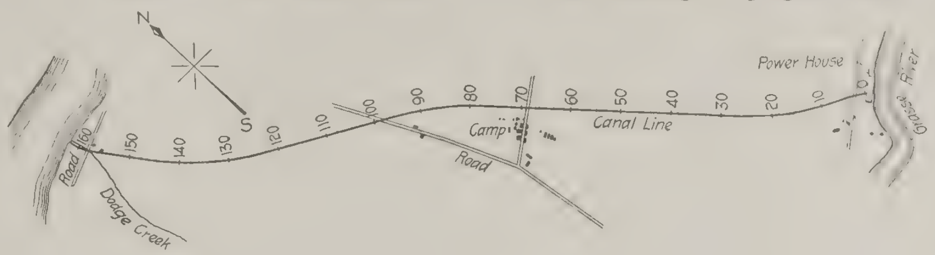

FIG. 2.—MAP SHOWING ROUTE OF ST. LAWRENCE POWER CO.'S WATER POWER CANAL.

Historical and General Description.

The Massena water-power electric plant is being built by the St. Lawrence Power Co., of London, England, and English capital is being very largely employed. The actual work of construction, however, is being done by the St. Lawrence Construction Co., of New York, N Y., which is generally understood to bear the same relation to the St. Lawrence Power Co., as the Cataract Construction Co. did to the Niagara Falls Power Co. Mr. John Bogart, M. Am. Soc. C. E., of New York, is Chief Engineer of the construction company. The St. Lawrence Construction Co. sublet the work first to the Lehigh Construction Co., which began operations in the summer of 1897, and installed considerable plant, a large camp, shops, stables, boarding barracks, etc. No great amount of actual excavation, however, had been done by the company when it assigned on Feb. 15, 1898. Matters which had naturally become somewhat mixed were readjusted, and a new contract was let to The T. A. Gillespie Co., of New York city, on June 15, 1898. This company began work 15 days later, on July 1, and has pushed the excavation rapidly since that time.

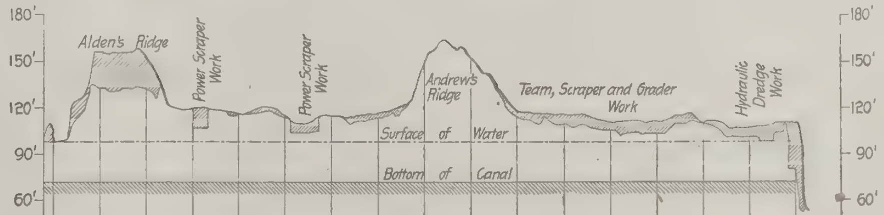

FIG. 3.—PROFILE OF ST. LAWRENCE POWER CO.'S WATER POWER CANAL.
(Shaded area shows progress of excavation on Nov. 1, 1898.)

The plan contemplated is to divert a portion of the waters of the St. Lawrence River and carry it by a surface canal across a comparatively level plateau to the gorge of the Grasse River, where a fall of 42 ft. can be secured. As shown by Fig. 2, the line of the canal is almost straight southeast.

The Grasse River acts as the tail race discharging the water into the St. Lawrence River again, but further downstream. It is just on the bank of the Grasse River that the power house will be situated, which will be almost a duplicate of the power house of the Hudson River Power Co., at Mechanicsville, N. Y. (Eng. News, Sept. 1, 1898), in everything except size, the Massena plant being about three times larger. Fig. 1, as before stated, is a cross section of the canal prism; Fig. 2 is a sketch map of the line, and Fig. 3 is a profile of the canal showing the progress made in excavation up to Nov. 1, 1898. As will be seen, the canal is about 16,200 ft., or slightly over three miles long.

Methods of Excavation.

The general method of excavation adopted is to take out the surface lift and the deep cuts to a depth of about 5 ft. above the water surface by some system of dry excavation. According to the preliminary borings this will remove all of the harder material. The remainder of the prism between 5 ft. above the water surface and the bottom of the canal it is proposed to take out in the wet by dredging. Two dredges will work inland from the St. Lawrence River and another is now working west from the low point A on the plateau just above the power house. The two dredges which will start at the St. Lawrence River end are orange-peel hydraulic dredges of the vacuum pump type. These machines will be described fully in a separate article in a future issue and will not be mentioned further here except to state that at the time of the visit made by our representative they had not begun work.

Hydraulic Dredge.—The hydraulic dredge proper in operation near the power house end of the canal is shown at work in Fig. 4. Those of our readers familiar with the hydraulic dredges operated on the Pacific coast (Eng. News, Aug. 4 and 11, 1892), on the Chicago Drainage Canal (Sept. 6, 1894, July 4, Aug. 15, 1895), and in other places will recognize the essential features of the machine illustrated, which was built by the Morris Machine Works, of Baldwinsville, N. Y., for The J. A. Gillespie Co. Briefly described, the dredge hull is 65 ft. long, 30 ft. wide, and 6 ft. deep. At the front is an A-frame carrying the ladder supporting the cutter and suction pipe, and at the rear are the two spuds on which the dredge swings when at work. Between the spuds and A-frame comes the housing for the machinery.

The dredging pump is one of the Morris Machine Works regular 12-in. high lift centrifugal pumps, directly connected to a 125-HP. compound condensing engine. This pump is designed to operate against a lift of 60 ft., and is very powerful. At a moderate speed of from 150 to 175 revolutions it is stated that a vacuum of from 20 ins. to 25 ins. can be easily maintained on the suction. The pressure on the discharge pipe is usually 18 lbs. running up to 25 lbs. The suction pipe is 12 ins. in diameter and extends to and inside the rotating cutter carried by the ladder. Both the cutter shaft and pipe are coupled so as to allow free movement to the ladder up and down in a vertical plane. The ladder is 45 ft. long. The cutter is basket-shaped, made of flat iron bars, and resembles quite closely that used on the Vivian dredge employed on the Chicago Drainage Canal (Eng. News, Aug. 15, 1895). A 6¼ × 10-in. six-drum hoisting engine is also arranged on the forward end of the dredge, one end being used for raising and lowering the suction ladder, two for swinging the dredge, by means of the guy lines to the opposite banks of the cut, and two for operating the two stern spuds. This engine also generates the cutter. Progress ahead is made by alternately raising and swinging on these spuds, thus "walking" the dredge forward. Steam is supplied by a locomotive boiler of 125-HP. at 125 lbs. pressure. Control over all of this machinery is had by the operator from the operator's house at the front end of the dredge.

At the time of the visit of our representative the dredge was working in blue clay, and water was being pumped from the Grasse River, 1,700 ft. away, to supply the necessary water for floating and operating it. This material runs about 15% solid from the discharge pipe, and the average output of the dredge has been about 1,000 cu. yds. in two ten-hour shifts. Although ordinarily well diluted with water, it has sometimes happened that the material was fed into the pump so rapidly that the 1,000 ft. of discharge pipe leading to the shore has started to clog up, when simply by increasing the speed of the main pumping engine the clay would be forced out through the end of the pipe in a nearly solid mass which would break off in lengths of 15 ins. to 18 ins. and drop down. This phenomenon is, of course, always of short duration. Perhaps the most peculiar feature of the work, however, is the pumping of the water in which the dredge operates from a source 1,700 ft. away. A 12-in. Worthington pump is employed to do this pumping, and so far a 6-in. discharge pipe has supplied all the water wanted, but a 12-in. pipe is provided for use if needed.

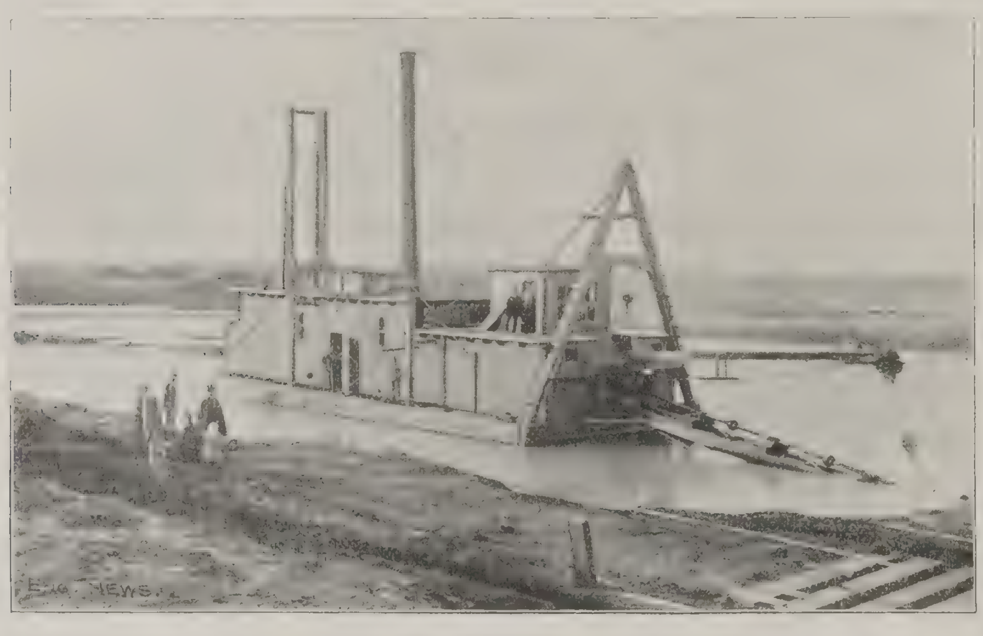

FIG. 4.—HYDRAULIC SUCTION DREDGE WORKING NEAR SOUTH END OF CANAL.

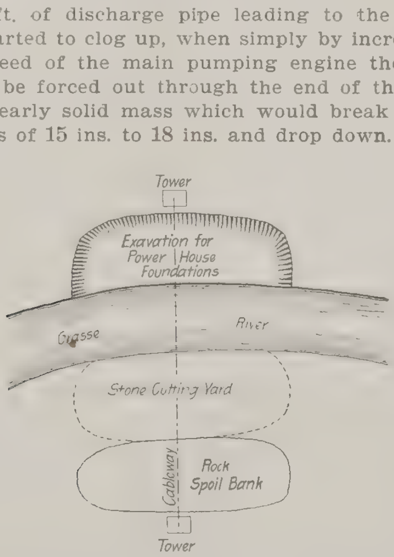

Fig. 7.—Sketch Plan Showing Method of Rock Excavation, Power House Foundations.

The fact that it is regarded justifiable to employ a hydraulic dredge when the water needed for its operation has to be artificially supplied is due in this case to the character of the material. This is a blue clay which is very soft when wet, and which is so located that seepage would be likely always to keep it wet if dry excavation were resorted to. These conditions, unfavorable to dry excavation, are decidedly favorable to successful hydraulic dredge work, which also has here the favoring condition that a neighboring depression affords a convenient discharge basin for the spoil, while allowing the water to drain back to the dredge cut after depositing its load. As stated above, the dredge now handles 50 cu. yds. per hour, and was designed to average 200 cu. yds. per hour. The working crew required consists of the captain, one operator, one engineer, one fireman, and from four to six men to keep the pipe line in order.

Power House Foundations.—The excavation for the power house foundations consists of breaking down the face of the gorge to a level of about 17 ft. below the water level of the Grasse River over an area of about 147 × 633 ft. Figs. 5 and 6 are views of the work, and Fig. 7 is a sketch plan explaining the method of operations. The material is clay down nearly to the water level, and solid rock below, amounting to about 39,000 cu. yds altogether. A steam shovel and a land dredge are the principal machines employed in taking out the soft material, the dredge being worked on the top of the bank, Fig. 5, and the shovel in the cut. Both excavators load into dump cars hauled by locomotives to the spoil banks.

The land dredge, or "orange-peel" excavator, as it is called, is taking out a cut 35 ft. deep in a very homogeneous, cheese-like material. With a 1 cu. yd. bucket the output per ten-hour day averages 600 cu. yds. The total labor cost of operating the machine is stated to be under $20 per day, making it a very cheap and efficient device for handling the material in which it is working.

For the rock excavation a cableway built by the Lidgerwood Mfg. Co., of New York city, is the principal conveying device. As shown by Fig. 7, this cableway spans the excavation, the Grasse River, and a stone yard and spoil bank on the opposite side of the river. Much of the rock being excavated comes out in good enough shape to be used in the foundation masonry, and this is taken across the river by the cableway to the stone cutting yard, where it is cut and stored for future use. The stone in the spoil bank will also be utilized in making concrete, some 30,000 cu. yds. of which will be used in the power house masonry. The view, Fig. 6, shows clearly the condition of work on the power house excavation on Oct. 3, 1898. The Grasse River is shown at the right, or looking down stream, and the line of the cableway may also be seen. This cableway has a span of 1,130 ft.

Team, Scraper and Grader Work.—From the hydraulic dredge work north to Andrews Ridge the top 5 ft. to 8 ft. of loam and clay has been removed by wheel scrapers, power graders and teams. Both the New Era and Western graders have been employed, and their output per ten-hour day has averaged from 600 to 800 cu. yds. Figs. 8 and 9 are views of the scraper and grader work, and they show quite well the nature of the material being handled. Similar methods of excavation were employed north of Andrews Ridge.

Power-Scraper Work.—One of the most notable excavators used on the work is the power scraper designed by Mr. Charles Vivian, and first employed by him on Section 6 of the Chicago Drainage Canal (Eng. News, Aug. 15, 1895). This device showed evidence of its value on the Drainage Canal work, although by the time it had been perfected most of the material in which it was capable of working had been taken out. Its output averaged from 24 to 24½ cu. yds. per hour. Much better work than this has been done by the scrapers on the Massena canal work, they having averaged about 800 cu. yds. per ten-hour day, according to a statement made by the contractors. Figs. 10, 11 and 12 explain pretty clearly the operation and work of the scrapers.

Fig. 10 is a diagram explaining the operation of the scraper. As will be seen, it has three cables attached to it; cable A is used to tip the scraper on end; cable B draws it backward into the pit, and cable C hauls it out of the pit when filled. The method of working then is as follows: When the scraper has been drawn into the pit and is in the position shown by Fig. 10, cable A is hauled in sufficiently to stand the scraper on its end, as shown by Fig. 10a. Cable C is then hauled in and the scraper fills as it resumes its original position, and is then hauled out of the pit onto the spoil bank. When here cable A turns the scraper over and drags it a few feet to empty it, after which cable B turns it right side up and drags it back into the pit.

The material in which the scrapers are working is a clayey loam turning into clay toward the bottom of the cut. Fig. 11 shows its nature quite clearly, and also shows the sequence of cuts made as the scraper advances. The ridge of earth left between cuts serves two purposes. First and most important, it permits the scraper to form a path or groove which aids to keep the scraper in line and facilitates its loading; second, when there is much water, as shown in the illustration, it acts as a natural dam to keep the water of one cut from flowing quickly into the succeeding cut. Ultimately, of course, these ridges are broken down and taken out. The scraper, while requiring soft material for its most perfect operation, has its efficiency greatly reduced by the presence of water, which is the reason for keeping the cut as dry as practicable.

Fig. 12 shows the scraper proper with its load; this load of top soil having been taken out in the course of ordinary operation, but being, of course, considerably larger than the general run. The scraper proper, as the illustration shows, is made of steel plate. Its capacity is 3 cu. yds. water measure, and it has a 7-ft. cutting edge. It is planned to lengthen the scraper and raise its back enough to increase the capacity to about double what it is now. A 12¼ × 15-in. engine is used to operate the scraper. The span between towers is 720 ft. Two of the scraper outfits are employed, their work being located as shown by Fig. 3.

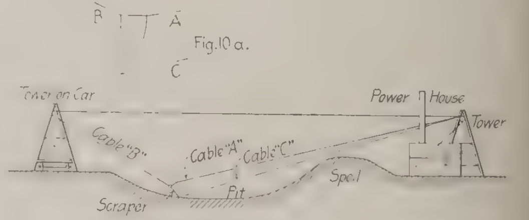

Fig. 10.—Diagram Showing Operation of Power Scraper.

Aldens Ridge Cut.—The deepest cutting which the canal will necessitate is where it passes through Andrews Ridge. Here the depth of excavation to canal bottom will be 92 ft., and the width of the cut at the surface is over 500 ft. The cut at Aldens Ridge is, however, only about 5 ft.

shallower, and, being somewhat longer, it contains more material. As will be seen from the profile, Fig. 3, a pretty good start had been made on the Aldens Ridge cut by Nov. 1. The material is very hard, being an indurated clay filled with boulders, and is peculiar in overlying a softer material, in fact, a soft blue clay, according to the borings made. To take out the hard material six steam shovels were at work at the time of our representative's visit. These shovels were loading into 5 cu. yd. dump cars hauled by locomotives to the spoil banks. Seven and eight cars are used to the train.

Fig. 13 is a view of the work on the top lift of the cut, and shows quite clearly the style of locomotive and cars employed. The shovel shown is one of the Vulcan Iron Works Co.'s special 75-ton shovels designed for handling ore. In the indurated clay and boulders the output of these shovels averages about 1,000 cu. yds. per ten-hour day. A 2½-cu. yd. dipper is used. As stated elsewhere, the steam shovel excavation will be carried down only to within about 5 ft. of water level in the canal, the remainder of the excavation being reserved for the vacuum pump dredge. These, as already stated, will be described fully in a separate article at a future date.

THE PROGRESS OF THE CHICAGO MAIN DRAINAGE CHANNEL.

Aside from difficulties of construction, the prosecution of the Chicago Drainage Canal has been beset with more difficulties during the past year probably than during any other year since work was actually begun. At the very beginning of the year's work legal troubles were encountered, and the litigation, once started, seemed to increase with every new piece of work undertaken. In his report of the canal work for the fiscal year ending Dec. 6, Mr. William Boldenweck, President Board of Trustees, Sanitary District of Chicago, outlines the nature of this litigation, its final decision and the delay produced by it on the work of construction. The following is a brief abstract of President Boldenweck's report:

> The last year has not been as prolific of good results as we anticipated. In fact, it was the year of lawsuits for this board and was the banner year in that line since the organization of the district. We had mapped out a great deal of work for the year—work that would have enabled us to complete the great drainage canal during the coming year and thus would have enabled the people of Chicago to have pure and wholesome water to drink in every home. It was only reasonable to expect that we would not meet serious obstacles that would retard this most important work.
>
> We met our first opposition in Joliet. Here the owners of the land we tried to purchase bitterly fought us at every hand. They placed the price of their land so outrageously high that it was impossible even seriously to consider their terms. We finally acquired the land by condemnation at about the prices we had originally offered for them. With the officials of Joliet the fight was quite as bitter. The matter was finally settled only after the board of trustees of the sanitary district has decided to abandon the plan of a large dam, which was to have been constructed diagonally across the river, and which would have left the streets at present grade. Thus was lost what would eventually have proved a great source of revenue to the district and a great benefit to the city of Joliet—the 9,000 HP. water power.
>
> The negotiations with the Illinois & Michigan Canal commissioners had been pending nearly a year. These were taken up again by the trustees of the sanitary district and the commissioners, with the result that a contract was entered into between the two boards which would protect both the interests of the state and those of the sanitary district. Plans in strict compliance with this contract were prepared and the money for the land acquired from the canal board was turned over to its treasurer, who gave his receipt therefor. Almost as soon as this money was paid over an injunction was prayed for against our board by the canal commissioners, which was granted by Judge Hilscher. Our attorneys at once filed affidavits looking to a dissolution of the injunction, which was not granted. However, the case was set for an early hearing, and after a month of preparation and trial the case was practically decided against the sanitary district. This was one of the most tedious and expensive lawsuits in which this district was ever a party.
>
> Under this decision the sanitary district will be compelled to spend several hundred thousand dollars more than was originally contemplated. Further than that, it received no additional benefit, it is delayed in the completion of the great canal and loses a large amount of money by reason of the outlay of more than $27,000,000 by the taxpayers up to this time which is for so much longer a period rendered useless. The matter has been taken up on appeal to the supreme court, where our attorneys will endeavor to get a speedy hearing.
>
> Another great disappointment to the trustees of the sanitary district was the eight-track bridge at Campbell avenue. Our engineering department, after months of hard labor, had designed the plans for a great swing bridge in this locality, upon which from time to time as the work progressed, the railroad engineers made suggestions. When our plans were finished bids were advertised for on this and also upon other designs that would prove acceptable to the railroads interested. When the bids were opened it was found that those upon our plans were the lowest. When the railroad officials looked into the plans and designs, that made by our engineering department was not acceptable to them. Then came the negotiations with the Strobel company and the Scherzer Rolling Life Bridge Co. for the purchase of their designs in order that all the builders of bridges in the country might compete for the construction.
>
> Bids on the two designs, as well as upon others, were received and opened, and a contract finally was awarded to the Scherzer Rolling Lift Bridge Co. The contract was awarded to the Scherzer company not because its bid was the lowest from the standpoint of dollars and cents, but because a majority of our trustees believed it the best bridge, and because the Strobel design had never been tried, and the Scherzer bridge was easier to operate and would cost less to maintain. A contract was entered into and approved, when the C. L. Strobel Co. obtained an injunction from Judge Payne, from which an appeal has been taken to the appellate court.
>
> The conclusion reached in the difficulties which presented themselves at Adams, Van Buren and Taylor Sts., I think, has been eminently wise and for the best interests of the sanitary district. If the land had been condemned, it would have involved, in my opinion, an immense cost, as the land is very valuable, and, furthermore, there would have been large claims for incidental damages by the railroad companies. In the first settlement you, as a board of trustees, entered into an arrangement with the Pennsylvania R. R. Co., at an annual rental for land used under its right of way for a by-pass at $3,000 a year. To the Chicago & Alton R. R. Co., we agreed to pay $116.68 a year for as long a term as the by-passes would be put to the uses of the sanitary district.
>
> A more perplexing problem was the widening of the river at the Northern Pacific bridge at Taylor St. This was because the land that was sought by the sanitary district was of such a character that if condemned and acquired it would destroy a large portion of the railroad company's business, and if a by-pass were built it would still leave the river in no condition to benefit navigation. There had been different committees appointed to confer with the railroad and city officials with the object of enlisting their co-operation in having a bridge constructed at this point that would have no center piers, in the interests of navigation.
>
> Nothing so far as financial aid was concerned was suggested, except by the Northern Pacific R. R. officials, who consented to stand one-fifth of the expense of maintaining the old bridge, while a new one was being built. This company also offered to pay one-fifth of the cost of creating the interlocking system of switches and the changes of the tracks. You finally accepted this offer, and the right to use the Scherzer rolling lift bridge was purchased, in order that as wide a scope of competition might be obtained as was possible. This was made necessary by the decision of Judge Payne, who claimed it was not in accordance with law to advertise for proposals on more than one design or pattern for a bridge.
>
> It is exceedingly gratifying to note the confidence in which the sanitary district securities are held by the public and investors everywhere. This is nowhere made more apparent and manifest than in the sale of our bonds and warrants. The former have been issued bearing 3½% interest, and bringing a premium of 103. .6%. Our warrants issued at 4% are eagerly sought by investors. For the information of the board of trustees, I give the results of the sale of bonds, rates of interest and premiums received from the commencement of the canal work up to the present time:

Date of issue.	Amount.	%	Price.	Sold to
Nov. 1, 1992.	$2,000,000	5	101.51	Blair & Co.
Jan. 1, 1894.	3,000,000	5	101.793	N. W. Harris & Co.
Aug. 1, 1894.	3,000,000	5	100.5707	N. W. Harris & Co.
Feb. 1, 1895.	4,000,000	4½	100.5	N. Y. Life Ins. Co.
Feb. 1, 1896.	800,000	4½	100.6345	First Nat. Bank.
Jan. 15, 1897.	800,000	4½	102.146	Mer. Loan & Tr. Co.
July 1, 1898.	200,000	3½	103.66	Home Sav. Bank.

> Our warrants drawn against the tax levy have also decreased in the rate of interest in like proportion as the bonds, and to-day are eagerly sought by investors at the rate of 4% per annum.
>
> Our arrangements with the city of Chicago regarding the construction of conduits and intercepting sewers have been very satisfactory. When these systems are once completed there will be no more pollution of our drinking water. This agreement has not yet been put into the form of a contract, but it is virtually binding by reason of an ordinance passed by the sanitary district trustees and accepted by Chicago city officials.
>
> Under this agreement Chicago is to build all the conduits, intercepting sewers, buildings for pumping stations and properly to equip them with the latest improved machinery, which the sanitary district will operate and maintain forever. This will not work a hardship upon our citizens, as the money is derived from the same source in either case. But the city's resources being necessarily limited in comparison with the amount it actually needs, the sanitary district is enabled to assist in this matter, and does so gladly in the interest of the people of the city of Chicago, especially when it is considered that through the aid of the conduit on 39th St. it receives an increase of at least 375,000 gallons of water per minute.
>
> The construction account shows that the expenses, according to an approximate estimate, have been $22,616,781.36 to date. Of this amount $20,048,525.14 has been audited. Fifty cases against the sanitary district are pending in court. The estimated balance required for the completion of the work July 1, 1900, is $5,225,649.27. The resources of the district to the same date are $6,226,472.92. The net receipts from the day of the organization of the district to Dec. 1 have been $28,077,012.54, and there is a balance of $121,231.88 on hand. (Additional figures of the cost of the canal work will be found in a communication from Chief Engineer Isham Randolph published in our correspondence column this week.—Ed.)
>
> During the coming year the committee on engineering will undoubtedly devote itself to the construction of bridges. Plans and specifications are yet to be considered for the following in Joliet and Chicago: Cass St., Jefferson St., extension of Rock Island bridge in Joliet, extension of Van Buren and Canal St. bridges and Throop St. bridge in Chicago. In the case of the Throop St. bridge, it may not be necessary to build a new structure, but we may be able to utilize the bridge now at Taylor St., where a new bridge is to be constructed of the Scherzer rolling lift bridge type. There will also come up the question of the removal of the Henry and Copperas Creek dams. The law makes it part of the duty of the sanitary district to remove these dams, as well as any other obstructions to the flow of water in either the Illinois or the Des Plaines rivers.
>
> The improvement of the great Calumet region is a matter that should not be lost sight of, as well as the improvement of the north branch of the Chicago River.
>
> There are fifty-four cases pending, in which the sanitary district is a party. It is incumbent upon the committee on judiciary to put forward every effort to bring these cases to speedy trial or settlement before the term of the present board expires.
>
> It was for me a gratification when an opportunity offered itself to open negotiations looking to a settlement of all difficulties between the board of Illinois & Michigan Canal commissioners and the sanitary district. Aside from the contractors clamoring for an opportunity to proceed with their work, the great cost of litigation and the loss of over $3,000 a day for interest on the investment, the gravest feature is the delay in the opening of the channel. It is, therefore, not good policy to be penny wise and pound foolish. We have tested our grievances in the court and have the verdict. It is true we were not beaten in the court of last resort, but who of us wants to stand idly by and wait for uncertainties when a compromise can be made for a smaller sum than the decree of the lower court demands from us? The canal commissioners have on this occasion reduced their demands to such an extent that the trustees of this district can take the matter in hand and conscientiously vote for a final settlement of these perplexing and stubbornly contested questions.
>
> The delay so far can, in my opinion, be made up to a great extent by requesting the contractors to work extra shifts, and it may be possible that the weather will be favorable to prosecute the work on the two delayed sections during the winter months. The committee on engineering should take this matter in hand as soon as the agreements between the canal commissioners and the sanitary district are executed and arranged with the contractors to make up for time lost.

Since the above statement of the litigation with the Commissioners of the Illinois & Michigan Canal was made, a compromise has been agreed upon between them and the trustees of the sanitary district. The details of this agreement are not yet made public, but it is stated that by it the drainage canal work can be resumed at once.

TWO NEW EAST RIVER BRIDGES connecting New York and Brooklyn are urged by Mayor Van Wyck, of Greater New York, and at his request the Municipal Assembly has appropriated the sum of $100,000 with which to pay the expenses of preliminary surveys, plans, estimates, etc. The Commissioner of Bridges has already begun work to secure this information. The location advocated for the first of these bridges, as was noted in Engineering News of Dec. 1, is at Blackwell's Island, the eastern terminus being in Long Island City. The second bridge, Mayor Van Wyck thinks, should be located somewhere between the present Brooklyn Bridge and the New East River bridge under construction, two miles north. The plans will be drawn for a bridge to accommodate general surface and elevated railway cars and street traffic.

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The report of Chief Engineer C. C. Martin, M. A. M., Soc. C. E., respecting the ability of the Brooklyn Bridge to carry safely its present loads, is a plain statement of facts which was much needed to disprove the silly stories of danger and disaster which have been recently published by some of the New York "yellow" journals. Among those best informed, it is almost needless to say, there has never been any doubt of the ability of the bridge to carry its additional load of elevated railway and surface electric cars with absolute safety. It has been equally recognized, however, that if this load was not uniformly distributed, that is if the cars were to be frequently bunched together over one portion of the suspended structure while other portions were clear the strains in certain parts of the structure might assume an undesirable and perhaps an unsafe character. Both of these facts have received ample recognition in Chief Engineer Martin's report. The accident of July 29 was directly due to the disobedience of the rules established by the expert engineers to regulate the trolley car traffic, and, as we stated at the time, the damage done, while immaterial in itself and certainly of no permanent injury to the supporting power of the bridge as a whole, was sufficient warning that the proper precautions in loading the bridge should not be lightly neglected. With the present careful regulation of traffic, a repetition of the accident, as Mr. Martin points out in his report, is little to be feared. That there is any danger of the cables breaking or the anchorage pulling up, as has been so alarmingly asserted by sensational daily papers, cannot be seriously assumed for a moment, with far greater loads even than those to which the bridge is now subjected. But even if the bridge were now loaded far nearer its limit of strength than it is, it would be very unwise to take the backward step of ordering the surface street cars and elevated trains from it and return to the old shuttle train system as has been proposed by some. It would be far better to expend money in strengthening the bridge to withstand the extra load. Some interesting statements respecting such a partial renewal of the bridge have recently been made by Mr. Wm. H. Hildenbrand, M. Am. Soc. C. E., in a letter to the "Railroad Gazette." Basing his estimates upon the cost of strengthening the Covington & Cincinnati suspension bridge, of which work he is the engineer, Mr. Hildenbrand calculates that the strength of the Brooklyn Bridge can be doubled at an expense of about $2,500,000. This work could be done without restricting traffic and would practically amount to the construction of another bridge in the additional facilities furnished for East River transit.

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The appropriation of $100,000 with which to pay the expenses of preliminary surveys for two new bridges between New York and Brooklyn is briefly noted elsewhere in this issue. In his message requesting this appropriation, Mayor Van Wyck, it will be noticed, instructs the Commissioner of Bridges to locate one of the new structures somewhere over Blackwell's Island, and the other between the present Brooklyn Bridge and the New East River Bridge, which is being constructed about two miles further north. The character of bridge which is approved for both places, also, is a structure for general purposes and not an "all railway" bridge. Admitting that these two new bridges across the East River are needed, engineers may, we think, justly question whether the location and character of bridges advocated is entirely wise. In the nature of things the Blackwell's Island Bridge cannot have any large amount of local traffic for many years. A brief study of the map makes the reason for this clear. The population of the territory north of Newtown Creek, where the bridge centers, is small, while the more thickly settled district south of Newtown Creek has a much more direct route to Manhattan Island by the new East River Bridge. A field of usefulness in which a bridge at Blackwell's Island promises much, however, is in providing steam railway connection between Manhattan and the suburban towns of Long Island. A vast growth of population and traffic in this direction is possible as soon as direct railway connection can be had across the East River, and by combining with the Long Island R. R. to build a steam railway bridge over Blackwell's Island the city will bring about a really beneficial public improvement. It is not clear at present, however, that the local traffic for many years to come would justify the expenditure of from four to seven millions of dollars in a bridge designed only for general street traffic and street railways.

Further downstream, on the contrary, a bridge designed for general traffic is essentially demanded. It is very doubtful, however, whether the location which Mayor Van Wyck advises is the wisest one. For all the territory north of the New East River Bridge that structure is the natural route to New York, and for all the territory south of the present Brooklyn Bridge that structure gives the most direct connections. As a matter of fact a new bridge located between these two would afford a quicker and more direct route than they to only a very small territory. It needs only a very brief study of the map to convince one of this beyond any reasonable doubt. A part of Brooklyn, however, whose growth in business and population justifies the attention of the city authorities in their work of supplying a better East River transit, is South Brooklyn. Were the natural difficulties to bridge construction no greater here than they are further upstream there could be no question as to the superior advantages of this southern location for one of the proposed bridges. It is to be hoped, therefore, that while Mayor Van Wyck and Bridge Commissioner Shea have the question of additional East River bridges in hand they will give the matter of a bridge to South Brooklyn due study.

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Elsewhere in this issue is given a description of the electric rack railway now being constructed to the top of the Jungfrau, in Switzerland. This road is exciting considerable interest among engineers owing to the fact that the dangers and difficulties of surmounting an Alpine peak nearly 14,000 ft. high are to be avoided by tunneling the entire distance from the point near the foot where the maintenance of a railway in the open becomes difficult and dangerous to a point directly underneath the highest point of the mountain, which will be reached by elevators in a 250-ft. vertical shaft. The plan contemplates about 6½ miles of single track tunnel through the solid rock, a track constructed in the most substantial manner, two electric power stations, suitable for high voltage, transmission lines, and transforming stations where the current will be stepped down to lower pressure and delivered to conductors along the track, the whole involving an expenditure of nearly $2,000,000. This estimate for the cost of construction certainly appears small, but it is probable that those backing the scheme have satisfied themselves on this point.

The estimated number of passengers per year is placed at 10,000, which would seem a very conservative figure, considering that in the season of 1895 fully 160,000 persons visited Interlaken, only a few miles distant from Little Scheidegg, the starting point of this road.

It is of interest to note that the actual altitude reached by the Jungfrau railway is about the same as that reached by the Pike's Peak railway in Colorado. The reason for the great difficulty and danger in climbing Alpine peaks as compared with those of similar altitude in the Rockies, is to be found in the moister and cooler climate of the Alps, which keeps all their upper portions clad in perpetual snow and ice, and produces glaciers and avalanches.

◆

The Division of Hydrography of the U. S. Geological Survey is engaged in the exceedingly useful work of bringing together for publication all available data concerning the water resources of the United States. This Division was organized in 1888, and the reports made are printed as separate volumes of the annual reports of the Geological Survey, and they already make an exceedingly valuable contribution to knowledge on this most important subject. In order to round out the general information now in hand it is desirable that the Division be placed in communication with all parties interested in this subject, and this list would include civil, hydraulic and sanitary engineers, instructors in these subjects, members of boards of health, and biologists and chemists interested in water supply. From the notes made by these men in the course of professional work it is hoped that the Division of Hydrography may be furnished, by correspondence, with any data relating to the following heads: Quantity of stream flow, if even the result of a single observation upon any stream in the United States; quality ot water; natural lakes and ponds, with any information as to origin, size, depth, fluctuation in volumes or changes of temperature; irrigation canals and ditches; water power; storing and pumping water; pollution of stream, with the increase of population and development of industries; and of deep or artesian wells. Engineers and all interested in the development of the water resources of this country can further a work of the utmost importance to themselves and to the country at large, by either forwarding any such data that they may possess to Mr. F. H. Newell, Hydrographer, U. S. Geological Survey, Washington, D. C., or by sending in to Mr. Newell the names and addresses of those likely to possess such information. The work of this Division is one of the most generally useful and commendable falling within the province of the Geological Survey; and it is to be earnestly hoped that all available data on water supply will be placed at its disposal. Much information on this head is now hidden away in private note-books which if collated with similar data and made public would be of great value to the profession.

◆

The letters published in our issues of Dec. 1 and Dec. 8 respecting the financial status and methods of operation of the Quebec Bridge Co. and the Montreal Bridge Co, have brought us several letters from Canadian engineers, warning bridge building firms and engineers in the United States to investigate very carefully the financial status of the Quebec Bridge Co. before expending money upon plans and estimates in response to its call for proposals. We judge, however, that what has already been printed in these columns will be sufficient to ensure this being done without our tak-

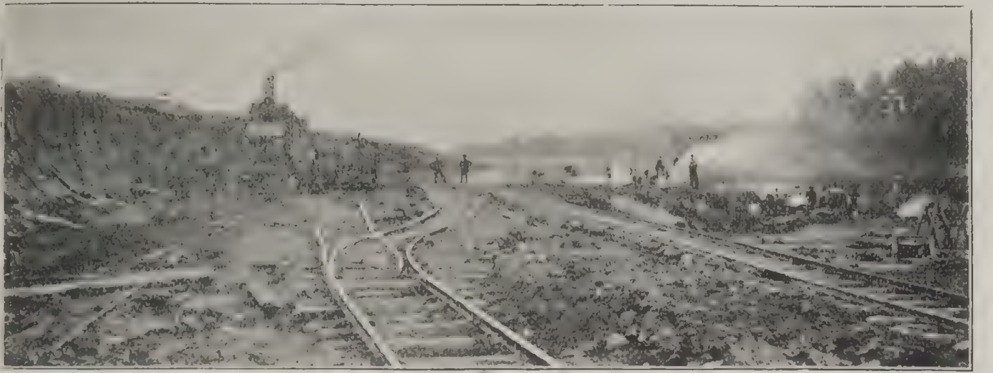


FIG. 6. POWER HOUSE FOUNDATIONS EXCAVATION.

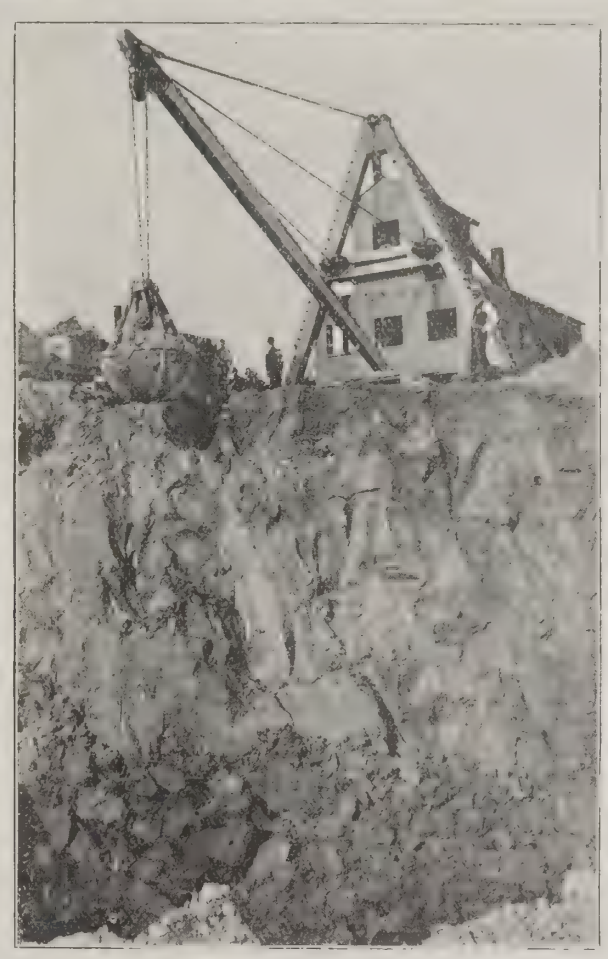


FIG. 5. "ORANGE-PEEL" EXCAVATOR WORKING IN CLAY AT POWER HOUSE FOUNDATIONS.

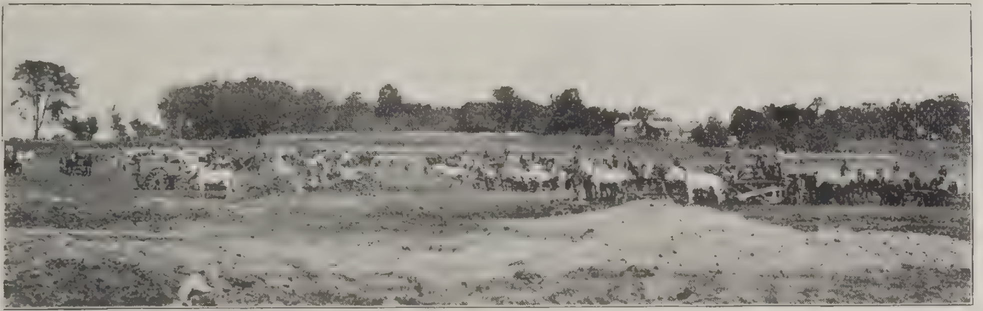


FIG. 9. WHEELED SCRAPER AND GRADER WORK ON TOP SOIL EXCAVATION.

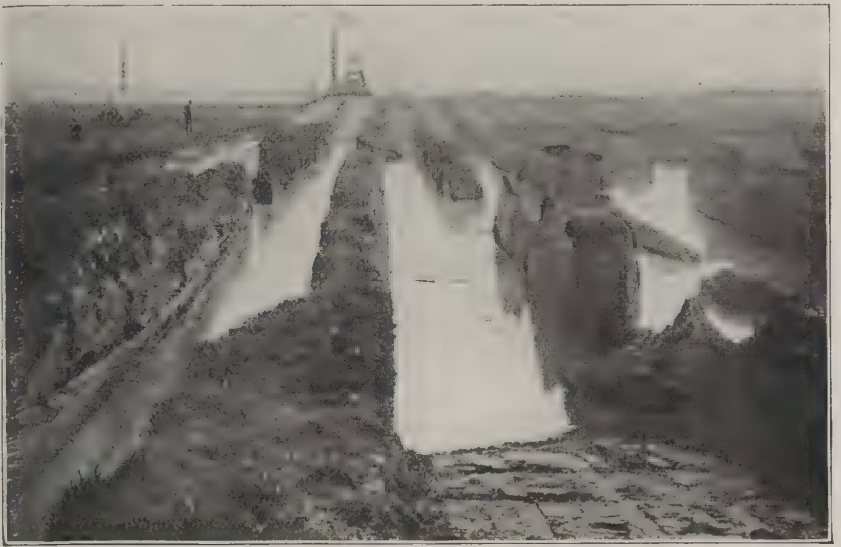


FIG. 11. VIEW SHOWING CUTS MADE BY POWER SCRAPER.

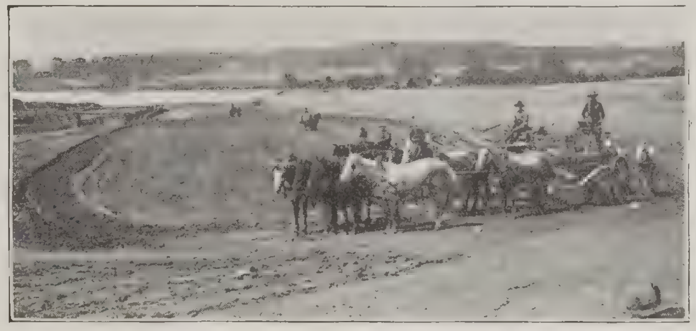


FIG. 8. GRADER WORK ON TOP SOIL EXCAVATION.

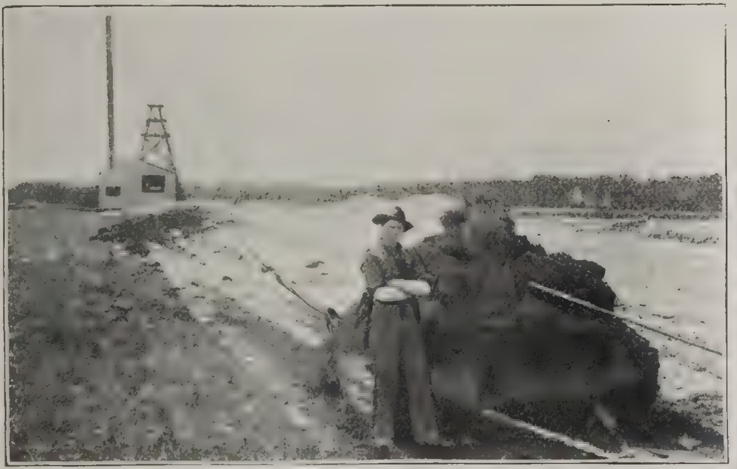


FIG. 12. A SCRAPER LOAD; POWER SCRAPER WORK.

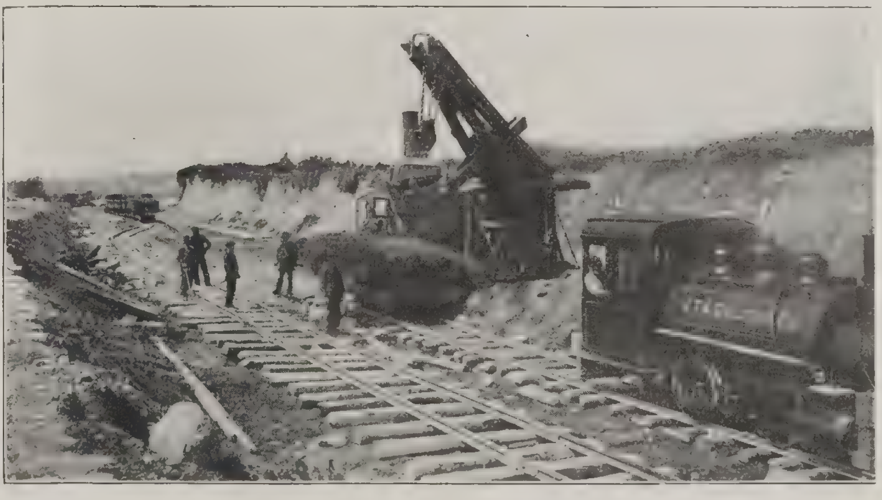


FIG. 13. STEAM SHOVEL WORK IN ALDENS RIDGE CUTTING.

METHODS OF WORK ON THE ST. LAWRENCE POWER CO.'S CANAL.

St. Lawrence Construction Co., New York, N. Y., General Contractors.
The T. A. Gillespie Co., New York, N. Y., Contractors for Work.

ing space to print these letters and the rejoinder which, under our rules, we should be obliged to give the company criticised an opportunity to make. If the company can prove that its financial status and prospects are such as to warrant bridge builders in preparing plans for its work, those from whom it is soliciting such plans will doubtless not hesitate to demand the proof and to give it careful scrutiny.

PLAIN WORDS ABOUT THE MORGAN BILL FOR PURCHASING THE NICARAGUA CANAL CONCESSION.

There can be no doubt, in the mind of any one who keeps in touch with public opinion, that the events of the past year have made the American people practically a unit in favor of the construction of the Nicaragua Canal. Public sentiment at the present time would probably heartily approve the undertaking of the canal as a Government work. The idea has taken strong hold of the popular mind that the canal is essential to our national defence; and a large section of the country, including especially the Pacific coast and the states bordering on the Gulf of Mexico, is well persuaded that the construction is needed as a means of securing its commercial prosperity.

But the problem, as it is now before Congress, is not the simple one of deciding whether the nation shall take the funds from its treasury and build the canal as a national enterprise. The scheme as it is now presented to the Senate is for the United States to revivify the old Maritime Canal Co. of Nicaragua, and to build the canal under that name, incidentally paying to the holders of the stocks, bonds and other obligations of that bankrupt concern, some five million dollars, more or less. Now while public sentiment, as we have said, strongly favors the costruction of the canal, it is inclined to scrutinize very closely such roundabout methods of procedure as are proposed in the Morgan bill, now before Congress. Past experience has taught the public that partnership arrangements between a state or a city or the national government and a private corporation are to be looked upon with much suspicion.

To explain fully the present situation we shall have to review briefly the recent history of the Nicaragua enterprise. When the Maritime Canal Co. obtained its concessions from Nicaragua in 1888-9, it expected to raise capital in the financial markets of the world sufficient to complete the canal as a private enterprise. In fact, the concession from Nicaragua distinctly forbid the transfer of the concession or of the control of the company to any nation or government. Any such transfer was to work the forfeiture of the concession.

After securing its franchise and making its surveys, the canal company's promoters set about the task of securing funds; but in this it was unsuccessful. The investing public of the world refused to be convinced that the success of Suez could be repeated in Nicaragua, and while the company did raise the considerable amounts that were necessary to pay for its surveys and such preparatory work as it undertook, it did this by disposing of its securities at a great sacrifice. It became evident that the canal was too risky a scheme to attract private capital; if built at all, it must be as a Government work; and the managers of the canal company, as the only hope of securing a return for the money they had put in, began their endeavors to dispose of their concession to the Government. At nearly or quite every session of Congress for the past seven years, bills for this purpose have been before Congress; and their advocates have pushed them in a manner which gave good ground for their belief that they were more concerned in the rescue of the canal company's stock and bondholders from loss than they were in the protection of the Government's interests, and securing the construction of the canal.

The general scheme in the various bills before Congress has invariably been to have the Government guarantee the bonds of the canal company to the amount of about $100,000,000, and receive in return $70,000,000 of the company's stock. As it became more and more evident that Uncle Sam could not be induced to pull chestnuts out of the fire to any such extent, the Maritime Canal Co. have reduced their demands. In the bill as presented by Senator Morgan last June, according to the best information at hand, it was proposed to give the canal company stock and bondholders and creditors $4,500,000 in bonds and about $7,000,000 stock in exchange for their present holdings. In the bill as reported by Senator Morgan on Dec. 7, this has been changed, and it is now proposed to give the company the sum of $5,000,000 in bonds for all it has and owns, and to wipe out all obligations of every kind. The old company is, in fact, to disappear, and the new company under the same name is to be practically a department of the United States Government, all its directors being appointed by the President.

There are two questions which ought to be definitely settled before Congress passes the bill for which Senator Morgan has so zealously labored. The first is what the United States is to receive for the $5,000,000 which it is asked to pay, and second, whether it is desirable that the Government shall masquerade as a private corporation in carrying out the work of building this canal.

The actual visible assets of the Maritime Canal Co., and its Construction Company offshoot, are admitted to be trifling in amount. There is about 11 miles of railway embankment running west from Greytown, across the swamp section, on which, according to all accounts, the ties have disappeared and the rails are fast approaching the traditional two streaks of rust. The Greytown harbor works have been wiped out by the sea-worms and the silt carried by the tidal currents. There are a few buildings at Greytown and a small amount of machinery, dredges, etc., all of which has experienced the deterioration due to half a dozen years of tropical exposure. Finally, there is, or was, a couple of miles or so of ditch dredged through the swamp. It seems to us that the fair basis for estimating the value of this plant is to see what it would be fairly worth, or what amount of expenditure its use would save if the Government should now undertake to utilize it in the construction of the canal. From all the information available, it seems probable that the sum of $200,000 would be ample to cover the value of the existing plant and works on the basis above outlined.

The second asset which the Maritime Co. has to dispose of is its surveys, and the maps, plans, designs, etc., which were made by its corps of engineers. Just what value may be fairly placed on this asset, it is difficult to say; but there are good reasons for declaring that the estimate should not be a high one. Much of the work done by the company's engineers was in working up the details of its high-level navigation scheme from the Ochoa dam to the great divide cut. The defects and dangers of this plan are now well known, and it is probable that the canal, if built, will pursue a different route from the great divide cut to the San Juan. Similarly on the western division, it is not at all certain that the canal company's location will be the one adopted. Under these circumstances, the canal company, it seems to us, can hardly claim payment for its work in fixing a location which is afterward discarded.

On the other hand, it is certainly true that a considerable amount of the topography taken and borings made by the company will be of use to the United States; and if this is so a fair valuation should be placed on this work. We cannot pretend, of course, to name anything more than approximate limits to the estimate of such work, but it seems to us that the sum of $300,000 should be ample to cover it, or a total of $500,000 for the entire works, surveys and records belonging to the company.

The remaining asset of the company is its franchise from the states of Nicaragua and Costa Rica, and it is this which Senator Morgan and the canal promoters have chiefly urged as worth the price which they have asked the Government to pay. Recent events, however, have not been calculated to improve the position of those who value this franchise so highly. As our readers already know, Nicaragua has taken formal action declaring that the franchise will be forfeited next October, and has granted a new franchise to a new set of financiers which will go into effect when the Maritime Canal Company's franchise expires.

The ground on which the franchise is declared forfeited is the following clause in the Maritime company's charter:

> Article 43. A term of ten years is also granted to the association for the construction, completion and opening of traffic and the canal for maritime navigation. However, should events of main force arise, duly justified and sufficient to impede the regular progress of the works during the period of the said ten years, an extension shall be granted equal in duration to the time that may have been lost by such delays. If at the expiration of the ten years aforesaid the works should not be completed so as to have the maritime connection between the two oceans opened, in consideration of the great capital the company may have invested in the enterprise and the good will and ability it may have shown and the difficulties encountered, the republic binds itself to grant a new extension."

The phrase "events of main force" is indefinite, it is true, but the idea apparently is to give the company the benefit of an extension to compensate for delays due to strikes, wars, pestilence, earthquakes or other great public calamities. It can hardly be seriously contended that the clause had reference to mere inability to finance the enterprise.

The second clause of the article evidently refers to the situation which would have existed had the company proceeded with actual construction and been unable to complete the canal within the specified time. Had it done this, it might without doubt claim of Nicaragua an extension of the franchise period. As the case actually stands, however, the company can hardly claim to have invested "great capital" in the enterprise; the "ability" has certainly not been manifested in the actual work of construction, and "the difficulties encountered" are not such that an extension of the contract period would be of any benefit to the company, unless it can turn over its franchise to the Government, which the terms of the franchise distinctly forbid.

This, then, is the situation. The United States is asked to pay $5,000,000, more or less, for a franchise, which will in the first place be invalidated on its face by transfer to the Government, and which, in the second place, has been declared by the state that granted it to be forfeited by its own limitation at a date only nine months distant. The present holders of the franchise claim, indeed, that for various technical reasons, which we cannot take space to enumerate, they have a right to an extension of the time allowed for construction; but they have not obtained such an extension.

Suppose Congress passes the Morgan bill, and the United States purchases this concession. Shall this great and powerful nation then compel Nicaragua by force or by the threat of force to reverse its formal action terminating the Maritime Canal Company's concession? Of course we can do this, if we choose; but it would be an act for which every self-respecting American would blush with shame. Nicaragua is an independent state, insignificant, it is true, but nevertheless entitled to the same just treatment at our hands as any other friendly power. It is not long ago that we rapped England over the knuckles to remind her that might did not make right. We then established the principle that a stronger power may not dictate to a weaker, when the latter offers to submit its case to arbitration by disinterested parties. Shall we use compulsion in Nicaragua, when we compelled England to refrain from compulsion in Venezuela?

We believe that there can be but one answer to this question in the mind of any intelligent American. If we purchase the franchise which Nicaragua has declared forfeited, we owe it to ourselves to treat her claims with the same respect that we would if they were made by France, or Germany or Russia. If Nicaragua appeals to arbitration to decide whether her annulment of the Maritime Canal Company's franchise was warranted, to arbitration it must go. In other words, this Government must take up the dispute of the Maritime Canal Co., before some international tribunal, and must go into all the petty details of the various negotiations between Nicaragua and the canal company extending over a period of a dozen years. The result of such an arbitration must at best be doubtful, for, as we have seen above, Nicaragua had, it is extremely probable, a legal right to terminate the Maritime company's charter. The time such an arbitration would occupy can be estimated by recalling the fact that the arbitration between Great Britain and Venezuela has not yet reached an end. Surely, then, the passage of the Morgan bill is not the way to hasten actual construction of the canal. On the contrary, the purchase of the Maritime Canal Company's charter can only land us in a maze of complications, of which no man can discern the outcome. The excuse which has been given for pushing the Morgan bill before Congress in advance even of the report of the engineering commission, is that haste is demanded in the work of actual construction. The flimsy nature of this excuse is now apparent

Let us next consider the question whether if the United States is to construct the canal, it should do so under the guise of a private corporation. The stock reason for this course has always been that it was a way of getting around the Clayton-Bulwer treaty, under which we agreed to join hands with England in the construction and control of the canal. No more peurile argument was ever conceived. If the United States can own the franchise, furnish the money and hold practically all the securities of a company organized to build the canal, it can equally well undertake it as a piece of public work as it would any river and harbor improvement, so far as its obligations under the Clayton-Bulwer treaty are concerned. It has been claimed for American diplomacy that it is straightforward and frank; and that we scorned subterfuges and technical evasions, holding to the spirit rather than the letter of our obligations. What becomes of this claim if we try to get around a treaty with England, our best friend among the great powers of the world, by such a transparent evasion?

There are other reasons why the United States should not pose as a fictitious corporation to build this canal. The checks and safeguards which long experience has developed to protect the Government from fraud in the execution of, its works would all be eliminated if it were to do this work under the guise of a private corporation. The eleven directors appointed by the President would have free and unchecked control over expenditures amounting to over a hundred million dollars. What a chance for corruption and plunder! Is it some foresight of this and of the harvest that will await those who may expect to have the spending of this enormous sum that causes the unseemly haste to rush the Morgan bill through Congress at the beginning of the present session?

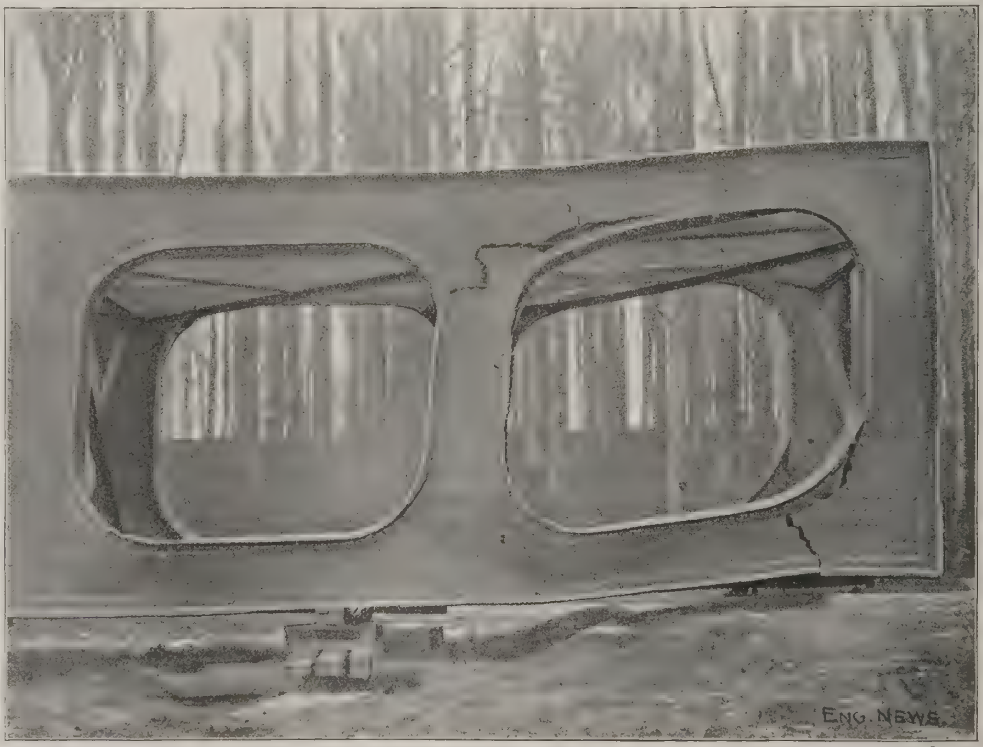
Let us turn now to another aspect of this question. Those who are endeavoring to push the Morgan bill through Congress are privately urging upon the Senators and Representatives that it is really as a measure of justice to those who have invested their money in the canal enterprise that the Morgan bill is desired. They acknowledge that the existing plant and the records and surveys of the company are only worth a small sum, and that the company's franchise is practically void; but they urge that those who put their money into the canal enterprise should not be compelled to suffer total loss. They claim that motives of patriotism, as well as the hope of profit, influenced many of those who invested their money in the company's stock and bonds, and that it will be unjust and unfair for the United States to now take up and complete the enterprise and leave in the lurch those who carried it through its initial stages.

We are far from denying that there is some reason in this presentation of the case. It is quite possible that the nation ought to pay to those who in good faith spent money upon this enterprise, something more than the present value of the plant and surveys. But what we would urge is that if this is to be done, let it be done openly and squarely. Let it be plainly understood that the Morgan bill is a bill to repay to Maritime Canal stock and bondholders their expenditures upon the enterprise. If this is not done, and the bill is passed in its present form, the certain result will be a scandal and an investigation, which will very probably put the action of many members of Congress in a worse light than they deserve It may be just and equitable to pay $5,000,000 to Nicaragua stock and bondholders; but the people will not be convinced that there has not been wholesale fraud if this payment is made in the guise of purchase money for something worth only a tenth part of that sum.

Still another serious question to which Congress should give heed is the question what is to become of the $5,000,000 which it is proposed by the Morgan bill to turn over in a lump to the Maritime Canal Co.? How much would the genuine investors in the company receive, and how much would be diverted on one pretext or another into the pockets of those who have already made profits by their manipulations of the company's stock? How much of the five millions would be allotted to those who paid for their stock only in "influence?" Are some of the newspaper proprietors whose journals have been most vociferous in urging the speedy passage of the Morgan bill to have a goodly share? Is the anxiety to further the interests of the Maritime Canal Co. which certain high public officials have displayed, explainable on any other grounds than pure unadulterated patriotism?

These are some of the questions which the public would like to have answered before Congress turns over five million dollars of the public money to the Maritime Canal Co. If the bona-fide investors and creditors of that company are deserving of relief at the hands of the Government it is surely not too much to ask that the company shall open all its books to public inspection, and that some pains at least shall be taken to see that the money goes to those who have a reasonable claim upon it, and is neither gobbled up by those who are on the "inside," or frittered away in litigation.

We have given in detail the reasons why the passage of the Morgan bill is not the road to speedy construction of a Nicaragua canal. Just what course Congress should take to this end, lack of space forbids us now to discuss. This much, however, is clear: that the acquisition of the Maritime Co.'s concession will give the United States nothing, either as respects the Clayton-Bulwer treaty, or its relations to Nicaragua, that it cannot better and more quickly attain by direct diplomatic negotiation through its own accredited agents. The quicker Congress makes clear that it is not in the business of bargaining with concession-mongers, no matter what their political or financial backing, the more certainly will the public confidence in the Government's ability to handle the many grave problems now pressing upon its attention be confirmed.



END PANELS OF A VIERENDEEL GIRDER OF 103 FT. SPAN, AFTER SUBJECTION TO A BREAKING LOAD.

LETTERS TO THE EDITOR.

Portable Forges with Detachable Parts

Sir: In the Dec. 1 number of your valuable journal you illustrate and describe a forge put up by the Buffalo Forge Co. It is, at least, intimated in the article that the forge is new.

Please look over the enclosed illustrations of our forges. A comparison of the two forges may be interesting. You may never have seen our machines. Some of your advertisers use them. Our forges built the good ship "Oregon."

Yours truly,
David Cumming.

278 N. Hoyne Ave., Chicago, Ill., Dec. 9, 1898.

(The forges illustrated in the circulars enclosed with the above letter show many points of similarity to the one illustrated in our issue of Dec. 1st.—Ed.)

A Remarkable Belgian Bridge Design.

Sir: We send you herewith the latest, if not the most brilliant, development of Continental bridge engineering, entitled "The Bridge System of Vierendeel." This monograph was sent to us by a friend of ours now in Europe, whose desire to give us valuable information exceeds his engineering discrimination. We believe that the bridge engineers of this country will find it amusing, if not convincing, and that they will agree with the writer that the true inwardness of the design is an attempt to patent a hole in a web plate, and the bigger the hole the greater the invention.

It is difficult to imagine what diagonal web members have ever done to this inventor that he should leave them out in the cold. He seems to know of their existence, as witness the sway bracing, and if filletted holes are good enough for the main trusses, why should he not use them for sway bracing? It is needless to point out that the liberal width of his vertical members and the liberal size of his corner fillets enables the structure to show some resistance under load, but what shall we think of an engineering community which would give grave consideration such a monstrosity?

Yours truly,
H. S. Wood, C. E.,
Engineer San Francisco Bridge Co.

World Building, New York, Dec. 6, 1898.

(The pamphlet to which our correspondent refers was briefly noted some months ago in our column of "New Publications." It is quite as remarkable a curiosity as the above letter would indicate. The design will be apparent from the accompanying illustration, which shows the two end panels of a bridge of this type which was broken under a test load at Tervueren, at the time of the Berlin International Exposition of 1897. The bridge had a span of 103.3 ft., and a depth of 10 ft., and was designed for a railway bridge to carry a load of about 3,150 lbs. per lin. ft. The inventor claims an economy in material "which increases with the span," and attempts to defend himself against the charge of costly construction. The "Notes for the Jury," as the work is entitled, enters into an elaborate description of the principle advocated, and into the calculation of values to be obtained. In the actual test, the weight was applied in the form of pig-iron; and though the claim was made that the structure would carry 600 metric tons distributed load before breaking, it actually failed, in the web system, as shown in the cut, under a load of 410 to 420 tons. The inventor explains this by saying that it was "impossible to apply the load fast enough"; and the fact that it was loaded with 370 tons over night "accounts for the mischief." To an American engineer the manner of failure is decidedly interesting, as it shows that the structure failed exactly where theory would indicate probable failure. The inventor's bridge is made up of rectangular instead of triangular elements, and while its weakness is somewhat concealed by the riveted construction and the bracing at the corners of the rectangles, it is, of course, an engineering absurdity.—Ed.)

Estimated and Actual Cost of the Chicago Drainage Canal.

Sir: It is not my purpose to mix up with the entanglements of the Erie Canal, but I cannot let statements made, in ignorance of the facts, by Mr. George W. Aldridge, Supt. of Public Works, under date of Oct. 30, and quoted in your issue of Nov. 3, 1898, go uncorrected so far as they relate to the Sanitary District of Chicago and its work. You quote him as saying that he "challenges the commission or the public in general to point to any work of similar magnitude where greater diligence has been shown or where the estimates have come as near to accomplishing the work required to be done as has been accomplished in this instance." Then follows an alleged table of "comparison" between the original estimates and the actual cost of various notable public works:

	Estimated.	Actual.
Erie Canal	$4,926,738	$7,143,789
Enlargement	23,402,863	32,008,851
Oswego Canal	227,000	565,437
Enlargement	1,926,339	2,511,992
Champlain Canal	871,000	1,746,062
Black River Canal	1,068,437	3,157,298
Hoosac Tunnel	1,948,557	20,241,842
Manchester Ship Canal	26,000,000	67,351,105
Chicago Drainage Canal	12,000,000	*37,671,652
Hudson River Improvement	2,000,000	2,600,000
State Capitol, Albany	4,000,000	24,000,000

*This includes $27,303,216, and an estimate of $10,538,436, to complete the work.

In his table of comparison of estimated and actual cost, he gives for the Chicago Drainage Canal, estimated, $12,000,000; actual, $37,671,652. Where does he get these figures? For five years and six months I have been Chief Engineer of this work, and no such figures have ever come under my observation. Turning to the Records of the Board of Trustees, we find, on page 118, under date of Jan. 10, 1891, a report from W. E. Worthen, Chief Engineer, and John Newton, Consulting Engineer, from which I quote:

> We estimate the total cost of entire line of eighteen (18) feet water depth by way of Ogden Ditch at $25,700,000.

On pages 148-50 of the proceedings for March 7, 1891, will be found an address to the citizens of the Sanitary District of Chicago, signed by Richard Prendergast (then President), Arnold P. Gilmore, Christoph Holtz, Henry J. Willing, Trustees. In this address the estimate of Jan. 10, above quoted, is given with the addenda, "In this carefully prepared estimate the following items are not provided for: Right of way, dumping ground and transportation of waste material to place of deposit; further charges for straightening the South Branch of the Chicago River; changing bridges, etc., to produce a larger flow, to be done by the city."

The canal is now so nearly completed that the margin of possible error in approximating the cost of the unfinished work is very small, and we have a channel whose minimum depth of flow is not "fourteen feet," nor "eighteen feet," but twenty-two feet, and the work embraces not alone the main channel contemplated in the reports above referred to, extending from Robey St. to Lockport, but also covers the diversion of the Desplaines River; the deepening, widening and bridging of the Chicago River, and the deepening widening and bridging of the Desplaines River from Lockport to the mouth of Hickory Creek south of the city limits of Joliet. Nor is this all. The character of the work has been changed in many particulars from that contemplated in the original estimates, notably in the item of masonry; massive walls laid in cement mortar have been substituted for dry rubble. The bridges are being built in conformity to the heaviest modern specifications, and no proper expenditure necessary to make the work first class in every particular has been omitted. The resulting cost to the Sanitary District is shown in the following statement:

Cost of Main Channel and Auxiliary Work, Sanitary District of Chicago, Under Contract and Estimated to Date of Proposed Completion, July 1, 1900.

Construction.		
Diversion of Desplaines River	$1,000,156.38	
Main channel, Roby St. to Lockport	18,416,024.46	
Controlling works	245,536.65	
Railroad and highway bridges	1,318,236.71	
		$20,979,954.20
Chicago River improvement	$678,614.39	678,614.39
Desplaines River improvement from Contrlg Wks. to Joliet	690,823.77	690,823.77
		$22,349,392.36
Right of way and lands		3,141,807.62
Total for construction and lands		$25,491,199.98
Administration Account.		
Engineering, legal, clerical and police		2,080,789.62
Maintenance account		92,426.19
General account		480,115.21
		$28,144,531.00
Amount to be paid as capitalization for maintaining railroad bridges, etc.		267,389.00
		$28,411,920.00

The interest charges up to July 1, 1900, will amount to $3,469,804.85. Bonds to be retired, $830,000. To cover contingencies, an allowance of 10%, or $250,000 for unfinished work would be proper.

This exhibit is an ample vindication of the methods which have been obtained on this work and the results stand as a monument to the character and ability of the men to whom Chicago has intrusted the expenditure of its millions.

Yours truly,
Isham Randolph, Chief Engineer.

Chicago, Ill., Dec. 6, 1898.

* * *

THE ELEVATOR ACCIDENT IN THE MANICE BUILDING, NEW YORK CITY.

On the afternoon of Dec. 6 an accident occurred to the passenger elevator in the Manice Building, an 11-story office building, at the corner of Pine and William Sts., New York city, which caused the death of one man and the serious injury of two others, all of them passengers in the car at the time.

The accident was of an unusual character, consisting in the fall of several of the cast-iron weights forming one of the counterweights from the top of the shaft. According to the best information available, the accident appears to have occurred about as follows:

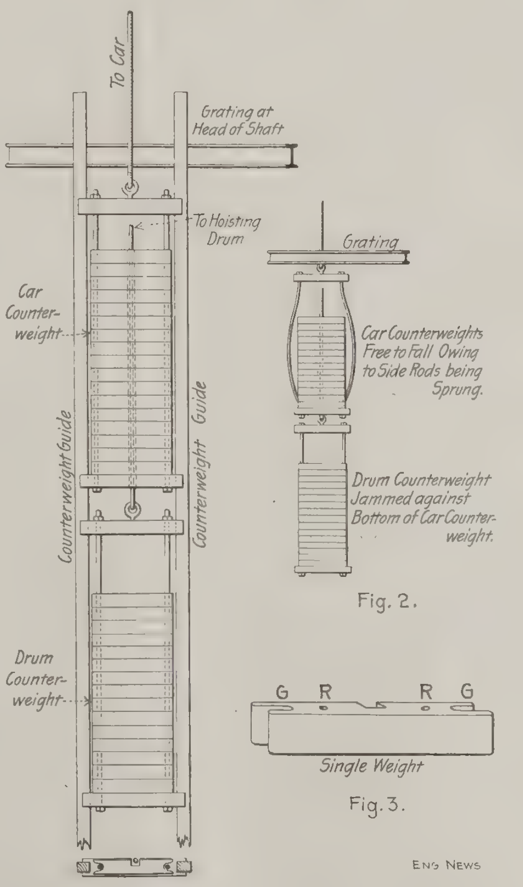


Fig. 1.

Sketches Showing Normal Position of Elevator Counterweights and Position at the Time of the Accident, Manice Building, New York city.

The elevator was descending from the 8th floor, where it had stopped to take on several passengers. At the 6th floor the elevator was stopped suddenly in response to a call from that floor, but as the car was crowded no more passengers were taken on and the down trip was continued, the motion being noticeably jerky and irregular. The final stop was made below the ground floor, the car striking the buffers with considerable force, and an instant later several of the cast-iron counterweights crashed through the frail car roof, after a fall of 11 stories, with the fatal results already mentioned.

The equipment was the standard Otis electric elevator, model of 1895, provided with limit stops, car safeties and the usual car control. Running up one side of the shaft were two counterweight guides for the two counterweights used. These were suspended, as shown in the sketch, Fig. 1, the upper one being the car counterweight, which is hoisted by the downward pull of the car, and the lower one the drum counterweight, which is hoisted by a cable wound on the hoisting drum in the opposite direction to the car lifting cable. Just under the sheaves at the head of the elevator shaft was the usual grating required by the city Building Department to guard against any part of the overhead machinery falling upon the elevator car.

The cause of the accident seems to be that the car on the down trip descended far enough below the lower floor level to jam the car counterweight against the overhead grating, and the closely-following drum counterweight striking the bottom of the upper weight lifted it and spread the suspending rods, as shown in the sketch, Fig. 2, sufficiently to free several of the weights, which toppled over and fell down the shaft. Referring to the accident and its cause, Mr. F. Frankenberg, City Elevator Inspector, is quoted as saying:

> The cause of the accident was that while the car was on the down trip the operator failed to judge the ground floor properly. The car struck the bumpers at the bottom of the shaft, causing the back drum weights to raise the car weights, thus tipping the car weights into the shaft. Had the automatic stop on the motor been set properly for the down stop, and the car properly stopped at the ground floor, the accident would not have happened.

In making repairs the old cast-iron car counterweights were replaced by lead weights, thus shortening up the counterweight and giving more clearance between the overhead work and the traveling weights. The single weights shown in Fig. 3 are the same in form as those so generally used for elevator counterbalances, but to avoid any possible future accident both counterweights will be provided with bolts running through holes drilled in the weights, at the points R, R, Fig. 3.

The accident will doubtless serve to call attention to the need of greater care in the designing of counterbalance weights and their attachments. The common method of assembling counterweights with nothing but gravity to hold the bunch of weights in position is objectionable; and it seems clear that the several weights should be firmly bolted together. Of course it goes without saying that the construction of the automatic limit stops should be such that by no possibility of careless handling can the car or counterweight bring up with a shock at either the top or bottom of the shaft. If the designer is unable to effect this with absolute certainty, then elastic buffers should be provided to receive the counterweights at either end of their travel and prevent their bringing up with such a shock as to cause undue strain in the ropes or other parts of the machinery.

* * *

SHIP-CANAL STATISTICS or the growth of commerce on the great canals of the world are treated by the U. S. Bureau of Statistics, as follows: The Suez Canal in 1869, when first opened, showed a net tonnage of 6,576 tons; in 1870 this was 436,609 tons; in 1891 the figures reached 8,698,777 tons, since which time there has been comparatively little change, the figures for 1897 being slightly below those for 1896. The Kaiser Wilhelm canal, in operation but three years, shows an increase of 50% in that period; or, 1,505,983 tons for the first year, and 2,469,795 tons for the fiscal year ending March 1, 1898. The St. Mary's Falls canal, connecting Lake Superior with the lower lakes, shows a more rapid rate of gain than Suez. In 1881 the freight tonnage through this canal was 1,567,741 tons; in 1885 it was more than three million tons; in 1887, over five million tons; in 1890 over nine million; in 1894 over 13 million, and in 1897 over 18 million tons. The freight tonnage passing through the Detroit River has also increased from 9,000,000 tons in 1873 to 23,000,000 tons in 1896. The Welland Canal shows a slight gain of from 819,934 tons in 1880 to 1,279,987 tons in 1896. On the other hand the New York State canals show a steady decrease in tonnage since 1880. In 1880 the freight carried to tidewater amounted to 4,067,402 tons; in 1890 this was 3,024,765 tons, and in 1897, 1,878,218 tons. In 1877 the average rates per bushel for wheat, from Chicago to New York, by lake and canals, was 11.24 cts.; in 1887 it was 8.5 cts.; in 1897, 4.25 cts. In the combination of lake and rail freights, the rates fell from 15.8 cts. per bushel, in 1877, to 12 cts. in 1887, and 7.37 cts. in 1897. All-rail freights fell from 20.3 cts. per bushel in 1877, to 15.74 cts. in 1887, and 12.32 cts. in 1897.

METHODS OF TESTING INDICATORS.*

By D. S. Jacobus, M. Am. Soc. M. E.†

Indicators should be tested both before and after they are used on an engine, or other trial. One object of testing the indicators before the trial is to make certain that there is no excess of friction, which, if present, will form double lines on the test diagrams. If double lines are found it is generally due to some irregular action of the spring, in either throwing the piston of the indicator out of line, or in forcing it against the side of the cylinder.

A mercury column will often give incorrect results when used in testing an indicator with steam pressure unless it is allowed to stand a long time at each pressure before taking a reading, on account of the fact that a considerable pressure is required to overcome the inertia of the mercury in the column if the latter is in motion, and there may be pulsations which will affect the result.

The apparatus used for testing indicators at ordinary pressures above the atmosphere is shown in Fig. 1. The indicator is placed at A on top of the cylinder B. The cylinder B is made of a piece of 6-in. standard pipe about 2 ft. long. The pressure is measured by means of a plug and weight device C, which is spun around so as to eliminate the effect of friction. The bottom of the plug is at the same level as the pipe D. The U-shaped pipe E is filled with oil. Before starting to calibrate the indicator the pet-cock F is opened slightly, in order to allow any air in the pipe G and the siphon H to escape. The siphon H is surrounded by water contained in the vessel I, which condenses the steam which enters it through the pipe D, so that when all the air present is allowed to escape through the pet-cock F, the pipe G and the siphon H will be filled with water. J is a pet-cock for removing any water that may collect at the bottom of the siphon E, after the apparatus has been in use for a long time. The pressure is adjusted by regulating the amount of opening of the valve K in the supply pipe L, which furnishes steam, water, or compressed air to the apparatus, and also by adjusting the valve M in the escape pipe N. O is a valve for removing any water which may collect in the bottom of the cylinder B when steam is used, and for draining out the water after calibrating an indicator under hydrostatic pressure. The plan of the plug and weight device C is limited in its movement by means of a fork, which comes in contact with it only when the pan is in the extreme positions; the two prongs of this fork are shown in section at P and Q. R is a gage for showing the approximate pressure. The readings of the gage R are not used in testing the indicator, but as general guide in the use of the apparatus. The diameter of the plug in the plug and weight device C is 0.5-in., and the hole in the bushing, 0.5005-in. Both the plug and bushing are ground true. The average area of the plug and of the hole in the bushing is used in calculating the weight required for a given pressure.

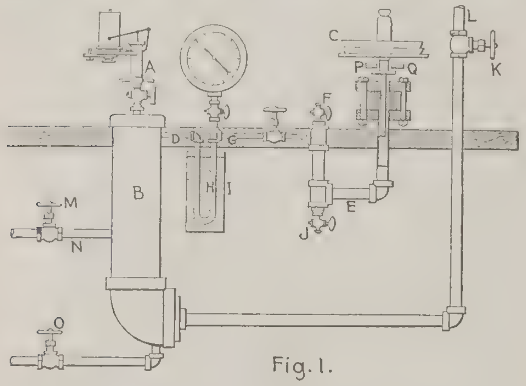


Fig. 1.

Fig. 1.—Apparatus for Testing Between Atmospheric and Boiler Pressure.

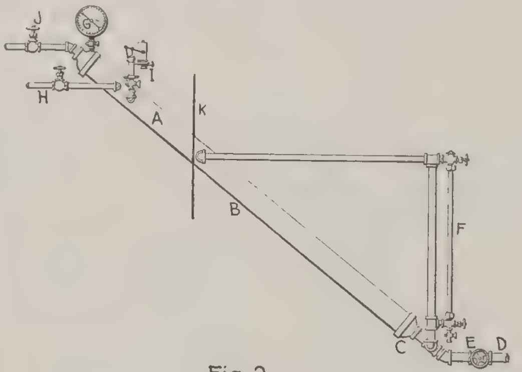


Fig. 2.

Fig. 2.—Apparatus for Testing at Pressures Above Boiler Pressure.

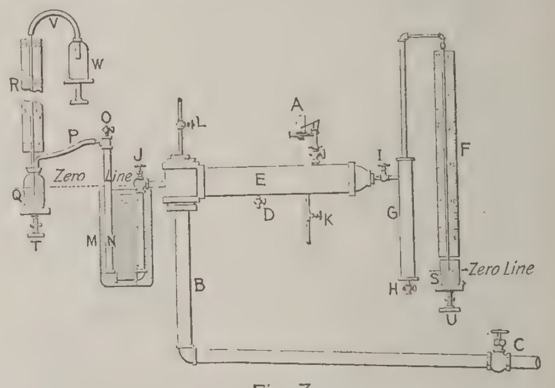


Fig. 3.

Fig. 3.—Apparatus for Use at Pressures Between 15 lbs. Above Atmosphere and Vacuum.

APPARATUS USED IN TESTING INDICATORS AT THE STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, N. J.

In the apparatus, arranged as just described, one person adjusts the pressure and traces the lines on the indicator diagram. If so desired, one person may adjust the pressure, and a second trace the lines on the diagram. To arrange the apparatus for this purpose, the blow-off pipe from the valve M is led to a point near the valve K, and a second valve, for adjusting the rate of flow through the blow-off pipe, is placed near the valve K, where it can be operated conveniently by the party who adjusts the pressure. The apparatus which we use is arranged in this way.

In testing indicators with steam pressure, the steam is brought to the maximum pressure to which the indicator is to be subjected; the indicator cock is then opened and closed quickly a number of times, in order to heat the indicator. The steam is then released from the cylinder B, and the atmospheric line is taken after turning the indicator cock to the proper position. In taking the atmospheric line, as well as the lines for any other pressure, the pointer of the indicator is first pressed upward, and then released and a line taken, then pressed downward and released and the line taken, the indicator being rapped sharply with a small wooden stick before taking each line, as has already been explained. After obtaining the atmospheric line, steam is admitted through the valve K, until the pan and weight device is balanced while being rotated. This requires a very fine adjustment, and the line is not taken until there is no tendency for the plug and weight device to either rise or fall.

An apparatus for testing at pressures higher than can be carried on the boilers is represented in Fig. 2. It consists of a pipe A, 4 ins. in diameter and about 8 ft. long, placed in a slanting position, and arranged so that the lower end, from B to C, can be heated by means of Bunsen burners. The pipe D is connected to both a water and steam supply. Water is first admitted through the valve E, until it nearly fills the gage glass F, after which steam is admitted, and the water in the pipe A is heated, and the pressure, as indicated by the gage G, is brought to that of the entering steam. The valve E is then closed, and the pipe A is heated by means of the Bunsen burners until the desired pressure is obtained. The pipe H leads to a plug and weight device, similar to the one shown in Fig. 1. The indicator is placed at I. In the calibration the pressure is brought to slightly above the maximum, and is then adjusted by opening the valve J. The first line taken is for the highest pressure, and the pressure is diminished for taking the other lines of the diagram by adjusting the height of the flames of the Bunsen burners, and the amount of opening of the valve J. Two lines are taken for each pressure, in the same way as described for the aparatus shown in Fig. 1. K is a screen for confining the heat to the lower end of the pipe A. The upper end of the pipe A is encased with a non-conducting covering, to diminish the radiation. An asbestos shield is placed on top of the lower end of the pipe to partly confine the flames of the Bunsen burners and thus render them more effective.

The apparatus employed in testing springs used under a vacuum is shown in Fig. 3. The indicator is attached at A to the top of the horizontal cylinder E. The pipe B leads to a vacuum chamber and pump, and slopes downward, so that no water can collect in it. The amount of vacuum is regulated by adjusting the valve C, leading to the air pump, and by admitting a small amount of air through the pet-cock D. The vacuum gage at F is graduated in inches of mercury and in pounds per square inch. G is a chamber for condensing any steam which may pass through the valve I, and thus prevent it from condensing on top of the mercury in the gage F. The water which collects in G is drawn off through the pet-cock H. The height of the mercury cup S is adjusted by means of the screw U, so that the surface of the mercury is on the same level as the zero point of the scale. There is a straight edge in front of the mercury cup S, at the same level as the zero of the scale, which makes it easy to adjust the level of the mercury to the proper height.

The apparatus may also be used for testing springs at pressures up to 15 lbs. above the atmosphere, the mercury column R being used for this purpose. Where a spring is used for both a slight pressure and a vacuum, the entire calibration can, therfore, be made with the apparatus shown in Fig. 3.

In measuring a pressure above the atmosphere, the valve I is closed and the valve J opened. The pressure of the steam acts then on the water contained in the U-shaped pipe N, and is transmitted through the hose connection P to the water in the upper part of the closed bottle Q. The lower part of the bottle Q is filled with mercury, and when the pressure increases this mercury is forced upward in the column R. The height of the bottle Q is adjusted by means of the screw T, so that the mercury is brought opposite the zero line of the scale, a straight edge being used in the front of the bottle, at the same level as the zero line of the scale, as in the case of the vacuum gage F. In adjusting the bottle Q up and down, the glass tube forming the column moves up and down with the bottle; this tube bears directly against the scale on which the pressures are read. Should the pressure be accidentally raised to such an extent that the mercury will be blown out of the column, the mercury will pass through the rubber hose V into the bottle W.

In testing the indicator, it is first heated by means of steam, admitted through the valve K, until it attains what is considered to be about the average temperature to which it will be subjected in the test. Two lines are taken at each pressure, and all other details in making the tests are the same as have already been described.

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*Condensed from a paper presented at the New York meeting of the American Society of Mechanical Engineers.

†Professor of Experimental Mechanics, Stevens Institute, Hoboken, N. J.

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THE SAFETY OF THE BROOKLYN BRIDGE.

The dangerous overloading of the New York & Brooklyn Bridge, and even the possibility of its early destruction by the loads at present carried by it, have recently been so strongly asserted in the daily press that the emphatic statement of the perfect safety of the great structure by its Chief Engineer and Superintendent, Mr. C. C. Martin, M. Am. Soc. C. E., which we present here, will be of interest to engineers. Mr. Martin's report was called forth by the public clamor following the accident of July 29, 1898 (Eng. News, Aug. 18, 1898), when a blockade of vehicles and trolley cars on the south roadway, combined with the very great expansion of the cables by the excessive heat, caused a slight buckling of the lower chord members of three of the six stiffening trusses. The accident, while trivial in itself, and certainly of no injury to the supporting power of the bridge as a whole, naturally excited the attention of the bridge officials, and caused considerable alarm to many of the more timid passengers over the structure. It was for the purpose of allaying this alarm, and also to provide the revised statement of loads and strains made necessary by the admission of the surface street cars and elevated railway trains of the bridge, that Chief Engineer Martin's report, which we publish here, was made. The report, practically in full, was as follows:

The loads on the bridge at present are made up as follows:

Bridge cars—the trains are made up of four cars; a motor car, which when fully loaded weighs 44 tons; three passenger coaches, fully loaded, weighing 28 tons each, 84 tons. Total weight of train, 128 tons. This equals 256,000 lbs. The trains run at 11.3 miles per hour, and if they run on 45 secs. headway they will be 748 ft. apart from front to front. Hence, the above load will be distributed over 748 ft., giving a load per lineal foot, for both tracks, of 690 lbs.

The trolley cars loaded weigh each 14 tons, or 28,000 lbs., and are spaced 102 ft. apart; hence this load per lineal foot, is, for both roadways, 550 tons.

The load on the carriageways is taken to be two continuous lines of trucks (one on each roadway), each truck occupying 20 ft. and weighing 2.75 tons, 5½ tons on both roadways, or 11,000 lbs.; hence the load from this source is, per lineal foot, 550 tons; total 1,790.

The load on the promenade is taken at 50 lbs. per sq. ft. (although Mr. John A. Roebling says in his original report of 1870, that 30 lbs. per sq. ft. is a maximum load of a moving mass of people). Since the promenade is 15 ft. wide, the load due to this source is, per lineal foot, 750 lbs. Total moving load, per lineal foot, 2,540 lbs.

The length of the main span of the bridge, in the clear, between towers, is 1,545 ft.; hence, total moving load is 3,924,000 lbs, or 1,962 tons.

In 1892, the actual weight of the bridge superstructure was computed for the use of the Board of Experts, which was appointed to advise upon the introduction of the trolley cars upon the bridge, and it was found to be, including cables and suspenders, 5,828 tons. The additional dead load that has been added from time to time is as follows: Additional new track for bridge railway, additional hauling cables and supporting sheaves, electric feed wires and cables, trolley arms, telegraph and telephone wires and cables, trolley tracks and mail tubes, 430 tons. Total dead weight and moving load, 8,220 tons.

To obtain the strain in the cable produced by this load, this weight must be multiplied by 1.7; the strain is thus found to be 13,974 tons. The ultimate strength of each cable is 12,300 tons; or the ultimate strength of the four cables is 49,200 tons. Divide this amount by the strain in the cable, and the factor of safety is found to be 3.52. That is to say, that the whole strain which is now 13,974 tons, must be increased by 35,226 tons to produce the strain of 49,200 tons, which is required to break the cables. Now, since the weight of the structure cannot be materially increased, the whole increase, if it comes at all, must come from the moving load; and since that is 1,962 tons, it follows that the moving load must be increased the number of times found by dividing 35,226 by 1,962 × 1.7, which is 10½, before the limit of the strength of the cables is reached.

The elastic limit of the cables is two-thirds of the breaking strain, or 49,200 × ⅔, which is 32,800 tons.

The total moving load is 1,962 tons, and this would require to be increased 5.6 times in order to strain the cables even to their elastic limit, to which point the metal of the cables may be strained without injury.

With regard to the safety of the anchorages, it is only necessary to say that during the first few years of the use of the bridge both anchorages moved forward at the top about ⅝ in., but there was no movement at the bottom. This movement was due, without doubt, to the compression or settling together of the timbers under the toe of the masonry of the anchorages. During the last eight years, this movement has been about ⅛ in. at each anchorage, so that any strains that have been brought upon them up to this time have produced no injurious effect whatever, and it is not proposed materially to increase the load on the bridge.

With regard to the eight saddles, careful measurements have been made from time to time and the results show that within a year from the time the bridge was opened to public use, they had all moved toward the river about 4 ins. In the 14 years—from 1884 to 1898—they had moved from 1 to 1¼ ins. additional. There is nothing in this movement but what is normal and proper.

In July last, when the outrageously unbalanced loading occurred, the saddles moved toward the river from ½-in. on some to 2½ ins. on others. Those which moved forward at that time are all returning to their normal positions.

With regard to the movement of elevated railroad trains on the bridge, I would say, that the original schedule upon which they were run was approved by this department, and no change has since been made without proper sanction, and every direction from this office has been cheerfully carried out.

With regard to the trolley cars, soon after they entered upon the bridge a tendency was developed to run the cars nearer together than the 102 ft. limit that had been fixed as the distance apart they should run. Without delay the attention of the executive head of the Associated Trolley Companies was called to the matter, and he at once increased the number of inspectors to five on each roadway, and that number were on duty when the buckling took place on July 29. How they came to allow the cars to run so close together as to form a continuous solid line from the point where the obstruction occurred near the Brooklyn tower, over the entire structure to the New York station, I cannot tell, unless their instructions were that they should not run closer to each other than 102 ft., and that they assumed that they might stand in solid line. Be that as it may, the bunching of the cars and the consequent buckling of the lower chord of some of the bridge trusses occurred. This did not in the slightest degree affect the strength or safety of the bridge.

In order absolutely to prevent the recurrence of such a condition of loading on the bridge, instructions were at once given to the inspectors that the cars were not to be allowed to approach each other nearer than 102 ft. In addition, upon your request, the policemen were instructed by the Police Department to aid in enforcing the rule for the trolley cars, and also to prevent bunching of teams on the bridge in case of blockades. I have not the slightest fear that any serious unbalancing of the loads on the bridge will hereafter occur.

In conclusion I beg to say that in my judgment, the bridge is as safe to-day as it ever was, and that is equivalent to saying that it is absolutely safe; that no one need entertain for a moment any fears of its stability. The most careful inspection and supervision by this department of everything pertaining to the bridge has never been relaxed and will not be.

COST OF ASPHALT STREET PAVING IN LOUISVILLE, KY

At the request of the Louisville Board of Trade, Mr. J. H. Pearson, formerly City Engineer of Louisville, recently read before the Board a paper on street paving in that city, in which he pointed out the difference between the lake and the rock asphalt included in bids lately presented for paving. He argued that the two types of asphalt require different treatment to obtain the best results in each case; that climatic conditions must be carefully studied, and that it is folly for a city to apply the same specifications to both classes of asphalt paving. Incidentally he remarks that Louisville has received the lowest bids for asphalt paving of any city in the country; or $15 for a "square" of 100 sq. ft. with a five-year guarantee, and $17.76 with a ten-year guarantee. For original construction, where contractors have to collect from property owners, the bids are higher; or $16.50 and $19.50 per unit square. The portion of the report relating to the detailed cost of asphalt paving contains some useful information, and we reprint in full, as follows:

I base these figures upon the requirements of our present specifications, and take the lake asphalt streets as the example, because I, as yet, have had no means of knowing the cost of the other kind. I should judge, however, that the labor part of the construction of rock asphalt streets, as here constructed, has certainly been more expensive than the corresponding work in lake asphalt streets, judging from the number of laborers employed on each kind.

Our specifications call for an asphaltic cement for lake asphalt streets composed of standard asphalt, 100 parts by weight, and petroleum residue (average) 17 parts by weight. This asphaltic cement must be mixed with sand and limestone powder in the following proportion:

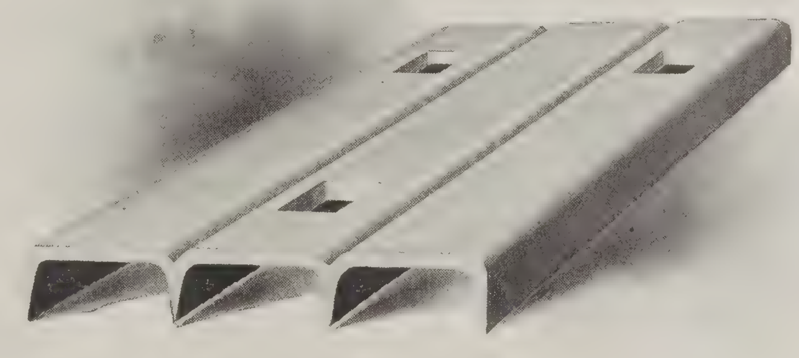
Asphaltic cement (minimum)	14	parts.
Sand (minimum)	81	"
Limestone powder (minimum)	5	"

Figuring this it means:

Refined asphaltum	12	per cent.
Petroleum residue	2	" "
Sand	81	" "
Limestone dust	5	" "

In these proportions a cubic yard of the paving materials contain:

Refined asphaltum	3.24	cu. ft.
Petroleum residue	.54	"
Sand	21.87	"
Limestone	1.35	"
Total	27	cu. ft.
	Or 1	cu. yd.



THE Q. & W. TIE PLATE.
Railroad Supply Co. and Q. & C. CO., Manufacturers.

The wearing surface is required to be 2½ ins. thick. Therefore this cubic yard will cover 129.6 sq. ft. of surface, equal to 1.296 squares of surface as we measure, using 100 sq. ft. as one square. Make a note, that for this over one and a quarter squares of surface only 3.24 cu. ft. of refined asphalt is required, while the other 23.76 cu. ft. are all home products. One square of asphalt street work with us means also one square of concrete base 6 ins. thick. To cover 1.296 squares of surface with concrete base 6 ins. thick requires 2.4 cu. yds. of concrete. Also one square of surface requires one square of binder 1½ ins. thick, requiring 15 cu. ft.

Assuming the contract price of one square of street to be $18, then 1.296 squares would cost $23.33 by contract. Eighteen dollars per square has been, in round numbers, about the bid for reconstruction of streets.

Concrete made with Louisville cement can be laid at a fair profit for $3 per cu. yd. Thus the 2.4 yds. required would cost $7.20, leaving $16.13 out of the $23.33 for the cost of binder and wearing surface. The 15 cu. ft. of binder, assuming broken stone to cost $1.25 per yard (the contractor usually gets this stone off the old street at a cost of only about 50 cts. per cubic yard for breaking and hauling) the cost of 15 cu. ft. of stone would be 60 cts., and the asphaltic cement at 13½ cts. ($30 per ton) per gallon, or cost for the nine gallons required, making a total cost of $1.86 for the binder. Subtracting this from the $16.13 leaves $14.27 for the cost of the wearing surface alone.

Assuming refined asphalt at $30 per ton (the price you or I would have to pay for it, but much more, I think, than the contractor pays for it for street work), is equal to 22.9 cu. ft. per ton, or $1.31 per cu. ft. It requires 34 lbs. of petroleum residue for the 1.296 squares of street worth 5¼ cts. per gallon of 8 lbs. (as the Standard Oil Company say), or 4¼ gallons, costing 22⅓ cts. This is equivalent to 40 cts. per cubic foot.

Sand at $1.08 per cubic yard equals 4 cts. per cubic foot, and limedust at 60 cts. per barrel of about 6 cu. ft. costs 10 cts. per cubic foot. The wearing surface mixture then for this 1.296 squares costs total as follows:

Asphalt, 3.24 cu. ft., at $1.31	$4.24
Petroleum residue, .54 feet, at 40c	.21½
Sand, 21.87 feet, at 4c	.87½
Limestone powder, 1.35 feet, at 10c	.13½
	$5.46½

Deducting this from the $14.27 remaining out of the $23.33, after allowing for cost of concrete and binder, we have $8.80 for cost of labor and profit.

Labor is supposed to cost as follows:

Mixing	4 cts. per sq. yd.
Hauling (estimated)	2 cts. per sq. yd.
Laying	6 cts. per sq. yd.
	12 cts. per sq. yd.
	Or 1⅓ cts. per sq. ft.

The 129.6 sq. ft., therefore, costs for labor $1.73, which deducted from the $8.80 leaves $7.07 for the profit to the contractor to construct 1.296 squares of streets, which is equivalent to a profit of $5.45 per square out of the $18 per square assumed as bid or about 30%. (In these hard times a very fair profit such as few of you in your business are able to make.)

These figures show that the actual cost of lake asphalt streets is about $12.55 per square of 100 sq. ft. (there are reasons why this cost is really less, but it is very difficult to get reliable data from the companies who use it, and they are the only source for such data), and therefore, streets of this class it would seem to us taxpayers might be built cheaper than about $18 per square and still allow reasonable profit of say 15%. My own opinion, based on what I have read and learned, is that such streets can be laid without loss (perhaps no profit) at $10 or $11 per square.

As to the cost of rock asphalt streets, I think, $15 per square with a good guarantee, is about as low as we can reasonably expect good streets to be built, and I do not believe the profit is more than 10%, or possibly 15% at this price. I believe good rock asphalt streets are superior to lake asphalt streets, but not enough so to warrant discarding the latter, and they have the advantage of costing less for repairs than the lake asphalt besides having other small advantages not necessary to mention.

A GROOVED TIE-PLATE.

A new form of tie-plate for railway track is now being introduced which combines the grooved face of the Wolhaupter plate with the outside longitudinal flanges of the Servis plate, thus effecting a combination of the strength and lightness of the former with the secure attachment to the tie of the latter. During the past two years about 40,000,000 tie-plates of these two types have been sold, each having its special advantages, and in the new plate the aim has been to include these advantages. The plates are of the form shown in the accompanying cut, and are made in two sizes, 4¼ and 5 ins. wide.

As the special features are covered by patents owned by two companies, a new company has been organized, under the name of the Q. & W. Co., of which Mr. Willis S. Jones is General Manager, with office in the Owings Building, Chicago, Ill. The sole licensees authorized to manufacture and sell the Wolhaupter, Servis and Q. & W. tie-plates, are the Railroad Supply Co. and the Q. & C. Co., both of Chicago.

WORK OF THE FIRST REGIMENT OF U. S. VOLUNTEER ENGINEERS IN PORTO RICO.

On the evening of Dec. 8 the officers of the First Regiment U. S. Volunteer Engineers gave a complimentary dinner to Colonel Eugene Griffin, the commander of the regiment, at Sherry's, New York city, and presented him with a silver loving cup.

In his speech of acknowledgment Col. Griffin described the inception and formation of the Brigade of Engineers, and particularly the First Regiment.

Col. Griffin is a graduate of West Point, in the class of '75. He entered the Corps of Engineers and afterwards resigned. At the outbreak of the war he felt that he was again called into actual service. In his position as Vice-President of the General Electric Co., in which capacity he was in close contact with the engineering profession of the country, he naturally turned towards the engineering side of the coming struggle. Mainly through his efforts, Congress authorized the formation of a Brigade of Engineers, and Col. Griffin was given command of the First Regiment. It was principally to the character and work of the men composing this regiment that his remarks referred.

In the course of his address, Col. Griffin outlined the actual engineering work performed in Porto Rico, as follows:

> A detailed topographical survey of the main highway from the sea, through Ponce to Aibonito; a survey of the Aibonito Pass, showing the locations of the Spanish batteries and intrenchments; a detailed hydrographical survey of the harbors of Ponce and Guanica; the rebuilding of the fine masonry bridges destroyed by the Spaniards on the military road which crosses the island; the building of a dock and commissary storehouses; the setting up of an ice plant and refrigerating plant for the General Hospital at Ponce, and the construction of buildings for this purpose; the building of a concreted high level reservoir for the hospital, and the completion of the water supply system, including setting up the pumps, laying the pipes, etc.; the partial construction of Fort Capron on the heights overlooking the entrance to Guanica harbor, and the building of a road up the side of the mountain leading to the fort; the laying out of the first National Cemetery in Porto Rico, and many other minor works.

From the time the first detachment of recruits arrived at Peekskill, N. Y., on June 23, until the regiment returned to New York, on Nov. 24, was 154 days. The start was made with 1,097 men and 48 officers, while 857 men and 47 officers returned, 13 men and one officer died, 61 men were left in the hospitals at Ponce and Guanica, the remainder having been discharged or sent home on sick furlough at different times.

In referring to the personnel of the regiment, Col. Griffin said:

> It is my deliberate judgment that engineers, including tradesmen, will make better soldiers than any other class of men, and by soldiers I mean all that the word implies, men trained in drill and marksmanship, able to care for themselves in the field, and to make long marches and to meet the enemy under all conditions, either offensively or defensively. The very nature of the training and daily lives of carpenters, blacksmiths, plumbers, lumbermen, railroad men, steam engineers, electricians, masons, etc., is a preparation for the life of the soldier.

THE CALORIFIC POWER OF COALS IN RELATION TO THEIR PROXIMATE ANALYSES.

In the discussion of the paper of Messrs. R. S. Hale and H. J. Williams, on "The Calorific Power of Weathered Coal," at the New York meeting of the American Society of Mechanical Engineers, Mr. William Kent presented a written discussion, from which we abstract the following:

The authors have compared their results with the curve which I plotted from the results of Mahler's calorimetric work, and published in Vol. I. of "Mineral Industry," in 1890, and also in 1897 in Vol. XXIV. of the Transactions of the American Institute of Mining Engineers, in connection with the discussion of Profs. Lord and Haas on American coals. This curve has frequently been referred to by recent writers, and has now fairly established its validity within the limits claimed for it. I present the curve herewith, with a slight modification which later studies have made advisable.

A table derived from the curve is as follows:

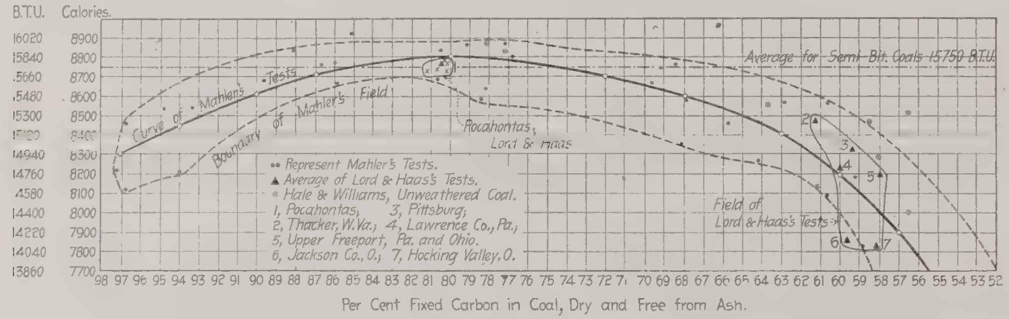
Approximate Heating Value of Coals.

Fixed carbon in coal.*	Heating value.		Fixed carbon in coal.*	Heating value.	
	Calories.	B.T.U.		Calories.	B.T.U.
97%	8,300	15,940	63%	8,400	15,120
94%	8,450	15,210	60%	8,200	14,760
90%	8,600	15,480	57%	7,900	14,220
87%	8,700	15,660	55%	7,700	13,860
80%	8,800	15,840	53%	7,400	13,320
72%	8,700	15,660	51%	6,900	12,420
68%	8,600	15,480			

*Dry and free from ash.

The original claim made for the curve was as follows: "Knowing the percentage of fixed carbon in the dry coal free from ash, we may, in the case of all coals containing over 58% of fixed carbon, predict their heating value within a limit of error of about 3%."

In 1897 a study of Lord and Haas's work led to the following statement: "Excluding coals which have below 58% of fixed carbon in the combustible, the variation of any one of Lord and Haas's coals from the Mahler line does not exceed 320 calories (576 B. T. U.), or about 4%. Taking the average figure for each class of coals [There were seven classes, 39 coals in all, viz.: Pocahontas, 5; Hocking Valley (O), 5; Pittsburg, 7; Middle Kittanning (Pa.), 7; Upper Freeport (Pa. and O.), 11; Mahoning (O.), 1.] it falls in all cases within the limit of 3%. Taking into consideration the fact that the reported percentage of fixed carbon is very apt to be 2% or 3% in error, I am disposed to hold my original conclusion, at least until a larger series of tests may show that it should be modified. It is to be observed, however, that the Mahler line falls rapidly with percentages below 62% of fixed carbon; and it is therefore to be expected that below this point there will be a greater range of variation in the heating value than above it. When the volatile matter exceeds 38% an increasing proportion of it is exygen; and the relative proportion of oxygen in the highly volatile coals varies in the coals of different districts, as is shown by Lord and Haas's analyses. Thus the Upper Freeport coal averages only 9.58% of oxygen (in coal dry and free from ash), while the Hocking Valley coal averages 16.10%, although both coals have the same percentage of fixed carbon, namely 58%. Full credence, therefore, is to be given to the conclusions drawn from Lord and Haas's tests that, when the fixed carbon is less than 62% of the combustible, each class of coal has a law of its own, and coals of any one class may differ in heating value from coals of another class containing the same percentage of fixed carbon to an extent as great as 5%, as in the case of the Hocking Valley and Upper Freeport coals."



RELATION OF THE CALORIFIC VALUE OF COALS TO THE PER CENT. OF FIXED CARBON IN THE COMBUSTIBLE.

A study of the results now presented by Messrs. Hale and Williams shows:

(1) That all the calculated or calorimetric results of coals containing more than 59% of fixed carbon in the combustible, weathered or unweathered, are within the stated limit of the curve of 3%, with the single exception of the result calculated from the analysis of the weathered coal "D." This exception is evidently due to an error in the analysis. The aproximate analysis shows an increase of fixed carbon by weathering of 3.68%, referred to combustible; while the ultimate analysis shows a decrease in total carbon of 0.99%. The figures are incompatible.

(2) The coals containing less than 59% of fixed carbon show in most cases a wide divergence from the curve, tending to confirm the conclusion drawn from the work of Lord and Haas that among the highly volatile coals each class of coals has a law of its own.

SPECIAL WIRE ROPES FOR HOISTING PURPOSES.

In the ordinary construction of wire ropes a the strands are built up of wires of circular cross section, and the outer wire of each strand takes the wear in coiling and uncoiling, so that small wires are liable to be soon worn through, while heavier wires have a tendency to fracture when the wear by abrasion has reached a certain limit. In the two styles of wire rope shown herewith, each strand has a core or central wire of special form.

The strands of the "flattened strand" rope, Fig. 1, are built up of circular wires around a flattened central wire, so that the strand is approximately oval in section, and several of the outer wires take the wear and transmit the pressure to the flattened wire. In fact, the rope is said to have 150% more wearing surface than ordinary rope, thus tending to increase its life, while its greater smoothness of surface reduces the wear upon the pulleys and sheaves. It is also said to be exceedingly flexible, with freedom from any tendency to spin or kink.

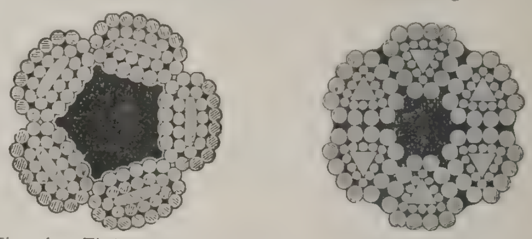


Fig. 1.—Flattened Strand Rope. Fig. 2.—Triangular Strand Rope.

Wire Ropes for Hoisting.
A. Leschen & Sons' Rope Co., Makers.

This style of rope is being extensively used for passenger and freight elevators in office buildings, warehouses, stores, etc. The ropes in the passenger elevators of the Decker Building, New York, have been in constant use since April, 1896, and are still in good condition, though the owner of the building states that they have already lasted twice as long as the ropes formerly used. All the elevator ropes are made of special Swedish iron wire. The ropes used for this purpose are principally ⅝-in. and ¾-in. diameter, weighing about 67 and 96 lbs. per 100 ft., and having a breaking strain of 6 and 9 tons, respectively. The same style of rope is also used for haulage and power transmission.

The "triangular strand" rope, Fig. 2, has the central wire of each strand made of triangular section, with several wires bearing upon the outer face of this wire. This rope is said to have the same advantages in smoothness and flexibility as the "flattened strand" rope. It is being extensively used for heavy hoisting in mines, on derricks and on inclines, etc., for which purposes it is made of Hercules brand wire or of crucible steel wire.

Both these ropes are manufactured by the A. Leschen & Sons Rope Co., 920 North Main St., St. Louis, Mo., and we are indebted to the makers for the above particulars.

AN ILLUSTRATION OF THE INFLUENCE OF IRRIGATION ON SOIL TEMPERATURE.*

By L. G. Carpenter and R. E. Trimble.†

The control which irrigation gives of soil conditions is well known by students of irrigation and is more or less realized by farmers in the arid regions. The extent of this influence is, however, not often recognized, and it is rarely that an illustration as clear as was shown by the soil temperature observations during August, 1897, is to be obtained. In this case our soil thermometers being placed in the grass plat were so situated that the irrigation of the lawn flooded, to a depth of some inches, the ground where the instruments were placed, and the irrigation was continued long enough to saturate the ground underneath. The temperature at a depth of 6 ft. had been nearly uniform at 62° F. for a number of weeks before the date of irrigation on Aug. 12.

With the application of the water it is noticed that the temperature immediately rises, reaching a temperature of 71° almost immediately after. The temperature fell almost immedately after the irrigation, so that during the next three days it had fallen to 64½°. On Aug. 16 the irrigation was repeated, and this time the effect of this added to the effect of the first was to increase the temperature to 75½°. The temperature dropped rapidly to 69°, and then dropped gradually, not again reaching 62° until October. The effect of irrigation on the plat of ground and its vicinity was felt for more than a month.

The effect on the temperature at 2 ft. and at 3 ft. in depth was much the same. At the first irrigation the temperature at 2 ft. was increased over that at the lower depths. At the second irrigation the effect on the deep thermometer was almost as great as upon the 2-ft. thermometer. For the depths less than 2 ft., the diurnal fluctuation is marked, and as the corresponding curves confuse the diagram, they are omitted. The shallower thermometers also show the cooling effect from evaporation so much that their temperatures fell below the deeper ones. In view of the influence which temperature has upon the growth of plants, the importance of the fact shown in the diagram is apparent. Evidently the irrigator can increase the temperature of the soil by application of water of proper temperature. It is also evident from corresponding observations at the shallower depths, that the cooling effect on the sail from evaporation may be considerable.

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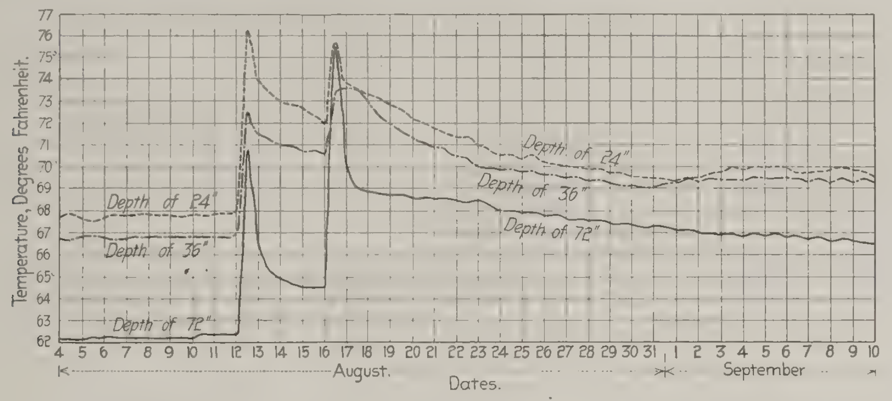
*Extract from Bulletin No. 49, "Meteorology of 1897," of the Agricultural Experiment Station, Ft. Collins, Cal.

†Meteorologists and Irrigation Engineers to the Station.

But as the application of water warmer than the soil will carry heat down into the soil and raise the temperature in spite of the cooling effect of evaporation, so an application of colder water has the opposite effect and chills the soil, both by the direct abstraction of heat and from evaporation.



THE EFFECT OF IRRIGATION ON SOIL TEMPERATURES.

The diagram is here given because of its suggestiveness, and to call attention to the influence of the temperature of the water used. It also suggests a reason why most farmers find it undesirable to irrigate early in the spring and why fall irrigation is sometimes so advantageous irrespective of the need of moisture.

The importance of considerations of this kind, illustrated by the diagram, will be considered more extensively when the observations on irrigation and on soil temperature are published.

◆

MUNICIPAL OWNERSHIP OF WATER-WORKS at Winnipeg, Man., seems likely to be effected soon, it being reported that the London bondholders have accepted the offer made by the city to pay $237,500 for the plant of the Winnipeg Water-Works Co.

◆

THE EXPIRATION OF THE TELEPHONE FRANchise of the Duluth & Superior Telephone Co., Duluth, Mich., occurs on March 9, 1898, and the city of Duluth has decided to advertise for bids for furnishing telephone service for a term of years. A percentage of gross receipts wil be demanded and a rate lower than that heretofore given, together with a certain number of free instruments and a differential in favor of residence telephones. The present company is one of the Bell corporations, and this week has reduced house rates from $50 to $36 a year.

◆

THE LOWEST BID for garbage collection and disposal at Philadelphia for the ensuing year was from the American Product Co., $358,000. The contract price for 1897 aggregated $327,100, the above company now having the contract for three districts, and treating the garbage by the Arnold process, while the Phildelphia Incinerating Co. now has the contract for the two remaining districts, and burns the garbage in Smith-Siemens furnaces. The latter company did not bid this year and there was scarcely any competition. That there was little competition is not surprising in view of the fact that the contract is for but one year, and has been divided between much the same interests for several years back.

◆

THE NEW YORK CONTRACT FOR SNOW REMOVAL was awarded, on Dec. 9, to Bart Dunn, at 30 cts. per cu. yd., or the lowest price since the contract system was inaugurated. The bond required is $100,000. The other four bids ranged from 30⅓ to 38 cts. per cu. yd.

◆

THE WARING FUND has now reached $77,555, the later contributions ranging from $100 down. The contributions for Dec. 9 aggregated $7,553, and the Chamber of Commerce Committee is now assured of the speedy receipt of the entire $100,000 asked for.

◆

CREOSOTED WOOD PAVING BLOCKS 4 ins. deep, on 6 ins. of concrete, have just been recommended to the Kensington Vestry of London, by Mr. Wm. Weaver, Surveyor, according to the London "Contract Journal." It seems that some of the ratepayers were anxious to extend the use of wood paving in place of the present macadam. Under existing rules this can be done, Mr. Weaver states, only when the maintenance of the macadam road costs 20 cts. per sq. yd. per year, "without scavenging and watering." This condition prevails only under "very severe traffic." To reduce the standard of conversion without an increase in the expenditure, 4 instead of 5-in. blocks are recommended. Mr. Weaver states that the reduction of the depth of the blocks from 6 to 9 ins. to 5 ins. in 1883 has saved the Vestry about $60,000. In 1889 two streets were paved with 4-in. creosoted deal blocks, regarding which Mr. Weaver says:

> After nine years wears, the road surface is in nearly perfect condition, and only a very small amount has been spent on repairs during the nine years; one-fifth of a penny per superficial yard for last year, and a half-penny per yard for the preceding year.
>
> The road is wearing thin and the wood will have to be renewed in 1900. The traffic on these streets is very heavy, having increased on one of the streets from 1,429 vehicles, or 42 per ft. width in 1888, to 2,950, or 87 per ft. width in 1898. The wood paving cost about $2.25 per sq. yd. in 1888 and the renewal is estimated to cost about $1.70. Mr. Weaver concludes that wood paving consisting of creosoted deal blocks, 4 ins. deep, laid on 6 ins. of Portland cement concrete, might advantageously be substituted for macadam where the maintenance charges on the macadam are 12 cts. per sq. yd. The cost, including capital charges, would be slightly increased, but this would be offset by the superior character of the paving.

◆

CRUDE OIL ON COUNTRY ROADS has been given a trial at Keokuk, Ia., with very gratifying success, according to a report presented by Major M. Meigs before the Missouri Good Roads Association on Dec. 3. The plan followed is to sprinkle ordinary dirt roads when dry, especially in low places where mud is usually formed. The oil forms a water-proof crust, keeps out the water and prevents the formation of dust and mud. It is claimed that a barrel of crude oil costing about 90 cts. is sufficient to cover a strip of road 100 × 12 ft.

◆

A SURFACE CONTACT STREET RAILWAY of American design and construction has been recently installed at Monaco, France, by the French representative of the General Electric Co., of Schenectady, N. Y. According to the English "Railway World," this road extended from the city to the Casino at Monte Carlo, a distance of about three miles. The track, 3 ft. 3-in.-gage, is of 73-lb. girder rails, using rod cross braces and wooden sleepers. The principal grade is 1,320 ft. long, with a rise of about 1 ft. in 12. Between the tracks are two rows of studs, or contact buttons, alternating in position, which connect with automatic switches grouped together in manholes placed along the line, thus putting all operating parts where they can be inspected. On the car are storage batteries, and contact shoes that slide across the studs, operate the automatic switches and thus connect the car motors with the main feeders. The cars used are 27½ ft. over all, with a 19-ft. body. They are divided into first and second-class compartments, are equipped with G. E. 53 motors, Brill trucks, electric brakes, and other American devices.

◆

THE GENERAL ELECTRIC CO. has obtained the contract to build eight electric locomotives and other equipment for the tunnel division of the Paris-Orleans Railway, in Paris. The contract was won against strong English and European competition. The General Electric Co., some months ago, received the contract to supply 28 similar locomotives to the new Central London Underground Railway Co.

◆

ELECTRIC LIGHTS FOR LIGHT-HOUSES at various points on the Great Lakes will be tried by the U. S. government. It is understood that the first experiments will be conducted at Marquette, Mich., where a breakwater extends out into the lake about 3,000 ft. During storms waves frequently sweep over this making the trip to light the ordinary oil lamp extremely dangerous. The plan to be adopted includes the placing of a submarine cable along the top of the masonry, and the use of a 50-c. p. stereopticon incandescent lamp, which will be controlled from the shore.

◆

A UNIFORM SMALL-ARM CALIBER and cartridge is the question to be considered by a board appointed by the Secretary of War, and now in session in New York. This uniform caliber should be adopted for all small arms and machine guns used by the Army, the Navy and the Marine Corps. The report will not be made public.

◆

TWO LARGE TRANSPORTS for the use of the Navy are asked for by Secretary of the Navy Long, in a letter to Congress requesting the insertion of this item in the Naval Appropriation bill. The vessels called for would be twin-screw, steel ships, of about 7,000 tons displacement, with a maximum speed of 18 knots and to cost not more than $1,250,000 each. Such a transport would carry 1,200 men and their officers, with all regimental supplies, wagon trains, ammunition, hospital stores, etc. Distilling and refrigerating apparatus would be supplied. The argument for the building of special transports is that existing merchant ships can not be properly adapted to this purpose. All horses would be transported on separate ships of the usual type. As the Army is strongly opposed to giving up the transport of troops, it is expected that this request will cause considerable controversy in Congress. Inspector-General Breckinridge, in his annual report, favors, however, the naval control of the transport service, and this is in accordance with foreign practice.

◆

A SPECIAL FLAG for the Coast and Geodetic Survey vessels was first adopted in launching the survey vessel "Pathfinder" at Elizabethport, N. J., on Dec. 7. This flag has a blue field carrying a white circle in the center with a red triangle in this circle.

◆

THE TENNESSEE RIVER IMPROVEMENT ASSOCIAtion held its annual convention in Chattanooga, Tenn., recently, Gen. Joe Wheeler presiding. A memorial to Congress was presented asking that a complete survey be made of the whole Tennessee River system, and especially for the 100 miles between Bridgeport and Decatur, and the section between Florence and Decatur. The most prominent work now in progress is the Colbert Shoals Canal. The memorial concludes by asking Congress to grant the $2,065,000 recommended by the officers of the Engineer Corps.

◆

EXPRESS COMPANIES doing business in the state of New York will be placed under the supervision of the State Railroad Commission if a bill prepared by the Merchants' Association of New York is successful. A table published by the association giving comparative freight and express charges from New York city to the principal towns in the state shows that the express charges per 100 lbs. are from 2½ to 4 times the amount of the corresponding freight charges. The association fails to state that the more prompt transmission of goods by express and their free collection and delivery justifies a considerably higher charge for express than for freight. It is doubtless true, however, that express charges, especially on small weight packages over long distances, are much higher than necessary to give the companies a fair return. It is also to be remembered that the capital of express companies represents a trifling actual investment, as compared with railway companies.

◆

"CARBOLITE," AN ALLEGED NEW CARBIDE is discussed editorially in the "Engineering and Mining Journal" of Dec. 10. It is described in the patent of Herman L. Hartenstein, as calcium-aluminum-silicon-carbide, with the formula Al_4, C_3, SiC, CaC_2. The inventor describes a process of making it by taking blast furnace slag directly from the blast furnace into a converter, impregnating it with pulverized coke by means of a gas blast, and sending a powerful current of electricity through the mass, thus producing the carbide. "The Engineering and Mining Journal" describes the chemical reactions, showing that the product would be a very poor substitute for calcium carbide in the manufacture of acetylene, and states that it is doubtful if it can be made without infringing on existing patents. It says: "The Hartenstein patents are of a kind that ought to be shunned by investors, although we understand that considerable money has already been laid out for their exploitation."

BOOK REVIEWS.

CANALISATIONS ELECTRIQUES.—Aerial Power Lines. By R V. Picon, Engineer of Arts and Manufactures, Paris; Gauthier-Villars, Quai des Grands-Augustins 55, Paris, France. Paper; 4½ × 7⅜ ins.; pp. 172; 86 illustrations; 18 tables.

This is another volume of the "Encyclopedie Scientifique des Aide Memorie," a series of publications upon scientific subjects published under the direction of M. Leaute. It is the third of a series by the same author, all on the distribution of electricity, the first two volumes pertaining to isolated installations and central stations. This volume, as stated in the title, treats of what may best be described as line construction, and, as would be expected, considers conductors, wires and cables; insulators for low and high potentials; insulator pins, brackets, cross-arms; poles, anchorages, metal poles and the other line materials.

The book is divided into four parts, Line Materials, Erecting the Line, and Tables and Calculations, which headings suggest in a general way the contents. No attempt is made to exhaustively treat the subject, but enough is given to make the book interesting and instructive reading.

DIFFERENTIAL AND INTEGRAL CALCULUS FOR TECHNICAL SCHOOLS AND COLLEGES.—By P. A. Lambert, M. A., Assistant Professor of Mathematics, Lehigh University. The Macmillan Co., New York and London. Cloth; 12mo.; $1.50.

Of the making of books on calculus there is no end. The present work may be useful to a teacher of mathematics to have in his desk as a reference book along with a dozen other works on the same subject, but we think few teachers would care to substitute it as a class book for the one they have been using. The author uses the method of limits instead of the infinitesimal method, and his discussion of limits is far from being as clear as that of some other writers. His style is in general too concise for clearness. The book contains a great number of problems, but there seems to be no good reason why the answers to these problems should not be given.

DAS WASSERWESEN DER NIEDERLANDISCHEN PROVINZ ZEELAND.—Von Friedrich Müller, Königlisher Regierungs-Baumeister. Mit 10 Tafeln in Steindruck, enthaltend 133 abbildungen, sowie 121 abbildungen im text. Berlin, 1898, Wilhelm Ernst & Sohn. Boards; 10½ × 7 ins.; pp. 612, and atlas of ten plans, 11⅝ × 10¼ ins. 36 marks.

This is an exhaustive study of the proposed and actual reclamation of the Province of Zeeland, in the Netherlands, including the region covered by the mouth of the River Schelde. The author begins with the geological formation and traces the processes which have resulted in the peculiar configuration of this part of Holland; he traces the elevation of the "polders" reclaimed from the sea by dykes, and by reproductions of old maps, dating back to the 6th century, he shows the successive encroachments of the sea and the efforts made to beat it back, as nearly as the somewhat uncertain mapping of these centuries will permit. Views of old towns and cities, taken at different periods, show their gradual destruction by the sea, or their apparent removal from the sea coast by sand accumulation. Modern reclamation work is then taken up in detail showing mattrass protection, fascines, dyke-building with piles and stone, tools used, etc. The sand-dunes and the beach are separately treated, and the means described for stopping the advance of the one and arresting the destruction of the other The cost of work of this character is given at very considerable length, and the several systems adopted are compared. Pier and breakwater building follow, and individual examples are fully illustrated and described. A chapter is devoted to the organization, personnel and regulations of the Waterstaat, or department of the government having this work in charge; the duties of the engineer and other officials are defined, and the adopted program is laid down for the several sections of Zeeland and the methods indicated by which the work is to be carried on. The construction of ship canals and the maintenance of communication with the sea, for the important towns, conclude the volume. Mr. Müller's work is both a treatise on the natural conditions existing in Zeeland, and a hand-book of methods adapted for dealing with them.

SEWERAGE; THE DESIGNING, CONSTRUCTION AND MAINTENANCE OF SEWERAGE SYSTEMS.—By A. Prescott Folwell, M. Am. Soc. C. E. New York: John Wiley & Sons. London: Chapman & Hall, Limited. Cloth; 6 × 9 ins.; pp. 372; 24 tables and 48 illustrations. Price, $3.

A book on both the separate and combined systems of sewerage, based on recent American practice, and noting the most instructive features of foreign work, has long been demanded in this country. This volume goes far towards filling the conditions named, as far, probably, as could be expected within the limits of 350 pages. More extended treatment at some points would be welcome to many, but most of the information the author might have added can be obtained elsewhere. Thus, only an outline of the principles involved and the methods available are given under sewage disposal by other methods than dilution, the author stating in effect that a full presentation of the subject would double the size of the volume, besides going over ground already "most ably treated by others." This is an extreme example, however, as most of the other phases of sewerage engineering are presented with sufficient fullness to enable an engineer not familiar with sewerage design and construction to solve all the ordinary and many of the special problems that arise in practice. For the most part, the author could have gone into the subject more fully only by giving more of the data on which his conclusions are based and more examples of actual practice in the design of sewerage systems. Sewage pumping machinery might have been given more space than five pages with great advantage. It is true that pumping is not often necessary, and that reference may be had to several books on pumping engines, but pumps must be used much more frequently in the future than in the past, and if the student is to be referred to other books on this subject, so he might be for some of the facts regarding the hydraulics of sewers, though with less propriety, we admit. Certainly it seems a pity that the reader cannot learn from the book what sort of a device a Shone ejector is, except by inference from its name and the statement that compressed air is used to operate it. One reading about the device for the first time would like to know how it works.

Under sewer assessments, reference, at least by title, might well have been made to the Brockton report on this subject and to the symposium recently published in the "Journal of the Association of Engineering Societies," two valuable sources of information.

The volume is divided into three parts: (1) "Designing"; (2) "Construction"; (3) "Maintenance." The last two divisions are intended to be practical, as they should be, and they are very satisfactory in this respect. They give the impression of having been written by a person recently connected with actual works, who has at the same time noted the experience of others. The accompanying sketches aid greatly in giving a clear idea of the methods described.

Regarding the book as a whole, it may be said that it is a comprehensive presentation of the subject, well up to date, written in a clear, logical and attractive style. Two praiseworthy features noted at various points are good judgment in weighing evidence and an absence of crotchets and hobbies. We are glad to see that the book has an index, and one that is well above the average.

TRAITE PRATIQUE DE LA CONSTRUCTION DES EGOUTS. Jules Hervieu. Paris, 1897: Baudry et Cie.

The title of this book is misleading, for it is essentially with the sewers of Paris that the author deals. But concerning these, he goes into considerable detail, stating briefly the underlying principles of their design, but avoiding long mathematical discussions or, indeed, any great elaboration of the principles involved in the general design of sewerage systems. From the title one would look for something more comprehensive in scope. Nevertheless, the volume is well worth the perusal of American engineers, for it contains the results of the accumulated experience of a corps of highly trained municipal engineers for some half a century. The book is divided into two parts, the first treating of the general design of sewers and accessory works, and the second describing their construction and giving estimates of cost. There are, moreover, sixteen appendices, which contain, among other things, samples of specifications, time books, etc., standard sections of the Paris sewers, details of the calculation of quantities, and a discussion of run-off.

The American reader will note the care with which provision is made for what many are apt to consider unimportant features of such work—matter which our city officials are accustomed to leave to the caprice (or, perhaps, the good sense) of the party in control. The following are a few of the many particulars in which the practice in Paris is seen to differ from that in this country: First, as to design, dead ends are generally avoided and where two sewers cross at different levels steps connect the two for the convenience of the workmen. The use of pipe sewers is limited to a comparatively small number of unimportant laterals, most sewers being built of stone of the well known sections with cunette and banquette. They are sufficiently large to carry water and compressed air pipes, electric conduits, etc., as well as to permit cleaning by manual labor without inconvenience. Vassy cement appears to be quite generally used except for a coating of Portland cement plaster, from 1 to 3 cm. in thickness, applied to the interior surfaces. The extrados of the arch receives a coat of Vassy cement mortar, 2 cm. in thickness. This, being "particularly exposed to injury by street urchins who frequent the works after the workmen leave, it is well to stop work some hours before the end of the day, so that the mortar may then, having acquired sufficient consistence, be covered by a protecting layer of earth at least 0.4 to 0.5-m. in thickness" At least fifteen days before beginning the work, notice is served, the Prefect of Police making known its nature and location, and indicating the proper route to be taken by street traffic during construction. "After obtaining authority to close the street, individual letters are addressed by the engineer of the municipal service to each abutting property-holder, advising him of the dates of the beginning and termination of the work; this notice is to allow those interested, especially manufacturers and tradesmen, to make every necessary provision in time to avoid the sudden interruption of traffic."

Attention is being directed more and more to the loose way in which many American cities have virtually abandoned the control of their most valuable streets by the award of franchises to electric light and other corporatins; and it is therefore of particular interest to note that in Paris subways and other structures, the use of which is permitted to concessionaires, are not allowed in any way to hamper the city in the construction of its sewers.

During the process of excavation compressed air or other pipes, controlled by concessionaires, which interfere with the work, are removed and subsequently replaced by the latter without charge to the city, on the grounds of public necessity. It is provided, also, that when articles of value, coin, medals, etc., are found on the work, they shall become the property of the administration, but that the finder shall receive as a reward one-half the value thereof. What proportion of such articles of value fail to reach the coffers of the administration is not stated. It is customary in some American cities, in order to avoid unbalanced bids, to fix unit prices for certain classes of work or material, the amount of which is a matter of particular uncertainty. In Paris, probably for the same reason, the city assumes the cost of pumping required to drain the trench. "As long as the depth of water at the bottom of the excavation does not exceed 10 cm. the contractor shall, without further allowance, drain the water to the pumps, the cost of pumping remaining solely as a charge against the administration; the works required to ensure drainage when the depth exceeds 10 cm., rests, on the contrary, entirely at the expense of the administration." In the construction of arches of small diameter, two half centers abutting at the crown are used. They are supported by props, and in this way "put" holes in the masonry are avoided. In exceptional cases, gas pipes are permitted to cross through the sewer arch, but cast-iron sleeves are then provided, which completely encase the portion of gas pipes so included.

Particular care is given both in the design and execution of the work to afford every convenience and safeguard to the laborer. "When the excavated earth is infected or polluted by excrementitious matter or infiltrations which are liable to endanger the public health, or even to alarm the inhabitants of the neighborhood, the contractor shall proceed, at his own expense, to sprinkle and disinfect such earth and the sides of the trench with antiseptic agents. Among the latter most commonly employed are a saturated solution of the sulphate of iron and milk of lime freshly prepared according to the formulæ indicated in the prophylactic instructions in use for contagious diseases." After further instructions regarding the disposal of infected material, particular directions are given to ensure the safety of workmen engaged in disinterring and removing bodies from cemeteries—these, probably, being more frequently encountered in Paris than here. Besides the use of special antiseptics, ventilating apparatus, etc., "it is well each day in the morning to serve all persons engaged permanently upon the work an allowance of coffee and rum, as customary in Paris in the municipal service of disinfection. During the day the workmen should use exclusively as a beverage drinking water to which has been added a small proportion of coffee and a few drops of rum; it is not necessary to conceal the fact that this hygienic prescription will always be found difficult of application." (The author does not state whether or not the difficulty lies in securing the prescribed proportions of ingredients.) Indeed, the merits of rum appear to be well recognized in the municipal pharmacopœia, for it is further recommended that, to persons exhibiting symptoms of gastric trouble, or those afflicted with colic or diarrhœa, a small glass of rum, with essence of mint, laudanum and water be immediately administered.

Nor is the workman employed on maintenance neglected. Instead of groping his way down a contracted manhole containing a few straggling pieces of iron called steps, he enters an ample manhole on the sidewalk, the side furnished with steps which are vertical, instead of having an inconvenient "negative batter." A few steps bring him to a gallery which leads by a gentle slope to the sewer. The latter has a footway provided on one or both sides of the channel, and, where a gradient of over 3% obtains, not only are there steps to prevent slipping, but a handrail at the side and a gate (barre-de-surete) or chain at the upper end are provided to prevent accident by a misstep. In the meantime a simple contrivance holds the manhole cover propped up, if desired. There are, moreover, other manholes built directly over the sewer and without steps, solely for the purpose of dumping snow into the sewer in winter. This, of course, saves considerable expense in haulage. Flushing tanks, or reservoirs, have been largely introduced of late years. From 1881 to 1894, 2 274 of them were installed. They are frequently built in two compartments, one containing an automatic syphon and the other a valve for hand-flushing.

In measuring up the work, distances are always computed on the slope and, wherever possible, measured inside the sewer itself, instead of on the surface. The price paid per meter assumes a fill above the extrados of the arch of one-half a meter and a proper allowance or deduction per cm. excess or deficit, as the case may be, is made. A similar rule holds good where the work is laid on a foundation of masonry, the unit price assuming a uniform thickness of the latter of one-half of a meter.

From the above random notes, it will be seen that the methods of sewer design and construction are reduced in Paris to a very precise system—cut and dried, it would seem, to meet all ordinary contingencies. Formulæ, elements of design, wages, and, in fact, all possible details are, so far as practicable, permanently established; and in this way considerable subsequent litigation is no doubt avoided. And while there is much that would not bear transplanting to this country—as, for instance, the excessive number of fixed regulations concerning trivial matters whch might safely be left to an intelligent resident engineer—yet, there remains much for us to profit by in the observation of methods which have been thought out and applied with so much care abroad. The chapter containing an account of shield tunneling is especially well written, and particularly interesting as a process employed with such marked success under adverse circumstances on the Clichy Collector and from its recent adoption for the 39th St. intercepting sewer in Chicago. The book is generally clear and concise in style and contains many illustrations; moreover being printed in good open type on good paper, it makes an attractive volume. Two errors may be noted: On page 55 line 15 from top, in place of C insert D; and in Fig. 199, the surface of the subterranean sheet of water should be convexed upwards near the wells as midway between them.

ENGINEERING NEWS AND AMERICAN RAILWAY JOURNAL.

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A WATER FILTRATION ORDINANCE for Philadelphia will probably be submitted soon to the Council's Water Committee by the Director of Public Works, Mr. Thos. M. Thompson. Meanwhile, Mr. Thompson will be relieved from consideration of the numerous bills looking to the filtration of the city water supply by private companies which have been referred to him during the past few weeks. This action is the result of a conference between the committee and the director, during which the latter plainly stated that he was tired of making reports which received little or no attention from the councils. He also urged the necessity of a thorough expert study of the filtration question, for which an appropriation would be necessary, in order to pay for outside advice and the other expenses of the investigation. An event which may have an important bearing upon the water question at Philadelphia is the ignoring by the Grand Jury of the bills of indictment for bribery in the Schuylkill Valley Water Co. matter. It may be remembered that an ordinance providing for a filtration contract with this company was being rushed through the councils last summer, when assertions on the floor that money had been paid for votes caused the indefinite postponement of the ordinance. The matter went into the courts, and the press and public seemed convinced that the charges were true. Greatly to the surprise of the citizens, the bills of indictment found by the judges have been ignored by the Grand Jury, so the cases must be dropped. It is said that the Schuylkill Valley Water Co. will bring in a new proposition early next year. This seems probable enough, for in the face of all the excitement and apparent defeat attendant upon the alleged exposures last summer, the company, it is said, moved into large and commodious new offices. Possibly the withdrawal of other private schemes from the consideration of the director of public works is intended to clear the way for the Schuylkill Valley Water Co. This company is said to be composed largely of Providence and New York capitalists, and to have organized two subsidiary companies; one a land and storage company, probably for the acquisition of real estate, and the other, known as the Providence Construction Co. Mr. Nelson G. Green, 309 Broadway, New York city, is special agent for the Schuylkill Valley Water Co.

◆

EXPERIMENTS ON THE USE OF OZONE for water purification are described at some length in London "Engineering" for Nov. 11 and 18. A briefer and more judicial account of the same experiments is given in the report of the Maine State Board of Health for 1896 and 1897, under "Notes on Disinfectants and Disinfection." The experiments have been made in Germany and Holland during the last six or seven years. Ozone is produced from air by means of high tension electric currents, ranging from 50,000 to 100,000 volts. Thus far the results obtained seem to be of no practical importance, so far as public water supplies are concerned. If the water to be treated with ozone is high in organic matter it is filtered first, at a rate, in some of the experiments, of about 4,000,000 gallons an acre. The ozone seems to be used principally to render the water absolutely sterile, which it apparently does. The expense of the process is not stated.

◆

THE EXTENSION OF STREET RAILWAY FRANchises in Chicago for a period of 50 years, referred to in our last issue, continued to agitate the people of that city through another week. On Dec. 19, the council voted to withdraw the ordinance, 40 to 23. A motion to refer the ordinance to a committee friendly to Mayor Harrison, and against the extension, was carried by a bare majority of one, the vote being 32 to 31. Five members of the council were absent when these votes were taken. The opponents to the extension demand that no ordinance be passed until the Allen law is repealed. This law was passed by the last legislature, under very suspicious circumstances, and gives authority for the proposed extensions.

◆

A COMBINATION OF STREET LIGHTING COMpanies, East of the Mississippi River, is announced from Philadelphia as going into effect on Jan. 1. An alleged infringement of gaslight patents by rivals of the Pennsylvania Globe Gas Light Co. is said to be the cause of the new consolidation. The deal provides for a capitalization of $12,000,000, and the companies involved are the following: Pennsylvania Globe Gas Light Co., Welsbach Street Lighting Co. of Chicago, New York and New Jersey Gas Light Co., of New York; the Chicago Globe Gas Light Co., the Canton Globe Gas Light Co., of Canton, O.; the Kitson Incandescent Gas Light Co., and two other companies not named. The deal carries with it four large factories, and 60,000 lights in different cities, soon to be increased by 50,000 lights contracted for by the Kitson Co. The Welsbach Co. is operating its system in 50 different towns. Except the Kitson, all these companies are controlled by the Pennsylvania Globe Gas Light Co., of which the stock is owned and controlled by the United Gas Improvement Co., of Philadelphia, or the Widener-Elkins-Dolan syndicate. The Kitson Co., for its $3,000,000 stock, gets $3,000,000 common stock of the new company, out of the $6,000,000 common stock authorized. Of the $6,000,000 preferred stock, $5,000,000 goes to the United Gas Improvement Co., along with the other half of the common stock; $400,000 preferred will cover cash in the treasuries of the two companies, and the remaining $600,000 preferred will be left in the treasury.

◆

ANOTHER CABLE-ROAD WILL BE TRANSFORMED to a conduit electric system. The Columbia Railway of Washington, D. C., notwithstanding the fact that it has a modern cable plant in perfect running order, will follow the example of the Capital Traction Co., of that city, and adopt the conduit electric system.

◆

COMPRESSED AIR now seems to absorb the attention of Mr. Joseph Leiter, who came into prominence last fall as a wheat manipulator, and it is reported that he has secured the controlling interest in the International Air Power Co., of New York, capitalized at $7,000,000 with the intension of extensively introducing it as a motive power for street railways, motor vehicles, etc.

◆

A $5,000,000 CONTRACT FOR STEAM AND ELECTRICAL machinery has been awarded to the Westinghouse Electric & Machine Co., of Pittsburg, Pa., by the Third Avenue R. R. Co., New York city. The plans of the railway company, in so far as they have been announced, include the erection of an immense power-house with a capacity of about 64,000 HP. on the company's property at 216th St., New York city. The conduit electric system will be installed on all of its lines. It is also understood that the company contemplates the sale of surplus power after the plan proposed by the Metropolitan Traction Co.

◆

THE NEW YORK RAPID TRANSIT COMMISSION, at its meeting on Dec. 15, decided to apply to the legislature to be relieved of the impediment of the municipal debt limit, and to be empowered to carry out its enterprise, either by the aid of private capital, or by issuing bonds upon the county of New York alone. The bill is being prepared for presentation.

◆

THE ANNOUNCEMENT that $40,000,000 is to be expended for public works in Greater New York, and that improvements are to be energetically pushed next year, comes as a surprise to those who lately heard so much of the debt limit being exceeded, etc. About $10,000,000 of this sum has already been authorized, and the power to raise the remaining $30,000,000 is to be provided for by an increase of $400,000,000 in the assessed valuation of property in the city.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Dec. 15, on the Florida Central & Peninsular R. R., near Madison, Fla., as the result of a passenger train running into some cattle that were on the track. Six persons were killed.

A SERIOUS ACCIDENT occurred, Dec. 13, on the New York Central & Hudson River R. R., near Grimesville, N. Y., in which 8 men were killed and several injured. A gang of from 60 to 70 men were shoveling snow from the tracks and moved out of the way of a west-bound freight, when their attention was attracted by an east-bound passenger train. In getting out of the way of this second train several of them walked in front of the Atlantic Express, which had run down upon them unheard.

◆

THE FAILURE OF THE IRELAND BUILDING, in New York city, which took place on Aug. 8, 1895, and was discussed at length in our issues of Aug. 15, 22, and 29, 1895, is recalled to mind by a verdict for $10,000 damages against Mr. John B. Ireland, the owner of the building, by the widow of John Burke, one of about 15 men who were killed by the accident. A year ago a similar verdict was obtained in the same case, but it was set aside on account of defective proof. In that suit the jury exonerated the contractors, holding that the construction was under the personal supervision of the architect, the direct agent of Mr. Ireland. The Coroner's jury, which made a long investigation after the accident, held responsible the architect, his assistant, the contractor, his superintendent, the mason foreman, and an ex-inspector of the Department of Buildings, and the Grand Jury afterwards found indictments for manslaughter against all of these men, but we believe their cases were never brought to trial. Other damage suits against Mr. Ireland are likely to follow the verdict now given.

◆

A SAFETY GATE FOR DRAWBRIDGES, which is now in use at the Randolph St. bridge over the Chicago River, in Chicago, is similar in design to the gates extensively used at railway grade crossings, having vertically moving arms which extend across the roadway and sidewalk when the bridge is open. The apparatus and operation are very simple. Across the bridge run two transverse shafts, carrying four sprocket wheels, while four other sprocket wheels are mounted on vertical spindles at the corners of the bridge. Short lengths of sprocket chains pass round the wheels and are connected by light wire ropes. On the four spindles are four spur wheels, which have teeth 1¼ ins. long, in order to allow for the contraction and expansion of the bridge. These wheels engage with sprocket wheels on the abutments. Chains from these operate wheels under the gate posts, which in turn operate the gate arms by vertical chains enclosed in the cast-iron boxes or posts of the gate. The shafts on the bridge are operated by sprocket gearing by means of crank handles, the chains being enclosed in a small box or housing. When the bridge is to be opened, electric gongs on the approaches are rung by means of a push button on the housing of the operating gear. The bridge tender then operates one crank, thereby closing the diagonally opposite gates against the traffic, while leaving the other gates open to permit teams and persons already on the bridge to pass off. When the bridge is clear he operates the other crank and closes these latter gates. The bridge is then swung open in the usual way, leaving the gates locked. Each gate arm is made of two bars, which are brought together at the outer ends and spread apart so as to embrace the gate posts, the bars being connected by bracing. The gate is the invention of Mr. H. A. Paquette, of Chicago, and is being introduced by the Chicago Bridge Gate Co., 7114 Cottage Grove Ave., Chicago, Ill.

◆

A FIRE DESTROYED the frame building used by Mr. Allen Hazen, Assoc. M. Am. Soc. C. E., as a branch office during the construction of the filtration plant at Albany, N. Y., and located at 57 Lumber District, of that city. Many valuable records, photographs and plans, relating to the work were burned. Mr. W. B. Fuller, M. Am. Soc. C. E., Resident Engineer, had a very extensive library of engineering literature and private memoranda and several valuable surveying and calculating instruments which were all destroyed. Mr. John H. Gregory, First Assistant, also lost a large number of engineering books. There was no insurance. The unfortunate experience of these engineers would serve as a warning to engineers generally as to the wisdom of keeping books, drawing instruments, etc., insured, even when they are housed in temporary quarters on construction works.

◆

THE PARIS EXPOSITION OF 1900 is the title of a circular letter recently issued by Mr. Francis E. Drake, Director of Machinery and Electricity of the United States Commission, in which the location of the buildings is briefly given and the general conditions of installation and exploitation of steam boilers, general conditions of installation of the engine dynamo group and the conditions for the construction and operation of a number of inclined electric elevators are given in detail.

◆

THE PARIS EXPOSITION AUTHORITIES have awarded to the United States a total of 250,000 sq. ft. of space; but the demands from this country already call for 700,000 sq. ft., says U. S. Commisisoner Benjamin W. Woodward.

THE RECENT PARIS MOTOR-CAB COMPETITIONS.

In February, 1897, the Automobile Club of France decided to hold in Paris an international competitive trial of motor vehicles adapted to regular service as cabs in the streets of Paris. As a basis of comparison with the present cab service, it was decided, upon investigation, that the average daily run of a cab in Paris was about 40 miles; of which 28 miles were devoted to useful work, while the remaining 12 miles were consumed in passing between the stables and cab stands and in driving about the streets in search of passengers. The time thus covered was 16 hours per day.

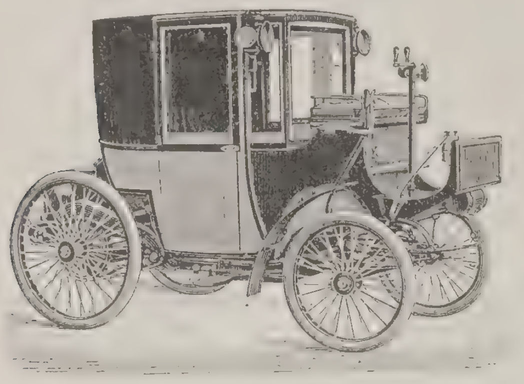

Fig. 1.—Peugeot Coupe; petroleum motor.

Based upon this estimate, the conditions of the competition required the mechanically propelled cabs to make a run of 40 miles in 16 hours over routes specified, with but two halts; one of half an hour and one of one hour for breakfast. This run was to be made for 12 consecutive days over 12 different routes, selected with reference to gradients. Within the City of Paris the speed was not to exceed 20 kilometers, or 12.4 miles per hour; the speed on grades was to be recorded mechanically; and each vehicle was required to make the 12 trips with the complement of passengers and baggage called for in its design, or to carry corresponding weights of 154 lbs. for a passenger and 66 lbs. for baggage. The detailed official report upon this trial is contained in "Le Genie Civil" for Sept. 3, 10 and 17, with illustrations of the motor-cabs used. A brief description of the vehicles and some of the conclusions arrived at follows:

In all 26 motor vehicles entered the race of last June, of which 14 were equipped with electric motors and 12 were operated by petroleum distillate engines. To feed the former a temporary but fully equipped electric generating plant was installed near the place of storage for the vehicles. As a basis for comparison of cost, the daily expense of running an ordinary Paris cab pulled by a horse was fixed at 19.26 francs, or $3.85. This sum included expenses of administration, rent of stables, repairs, horse-feed and attention, pay of driver, taxes and material, and it included the average use of 3½ horses per cab employed.

The first class of vehicles entered covered those with a single motor, where the power is transmitted to motor wheels through an intermediary; with gearing permitting a mechanical variation in speed. Under this head came the Peugeot coupe as a type (Fig. 1), propelled by a gas-engine and intended to carry three passengers, without baggage, or a useful load of 462 lbs. This vehicle was made up of a closed body, with two seats capable of carrying four passengers, and it did frequently carry this number during the trial. The driver or operator has his seat in front, and controls the apparatus for directing and changing speed and operates a brake-pedal. Attached to this front part is the naptha reservoir. The motor is placed in the rear of the carriage-body. The naptha reservoir, holding 35 litres, is in the driver's seat, and the water reservoir, holding 38 litres, is under the vehicle. The total weight is 2,838 lbs., with 1,509 lbs. on the front wheels and 1,329 lbs. on the back wheels. The out-to-out width of the vehicle was 5.25 ft., and the total length was 9.18 ft.

The motor used, with petroleum distillates, was built on the Peugeot system, the charge being exploded by incandescent tubes. It developed 6 HP. and weighed 231 lbs., with its fly-wheel and bedplate. The two cylinders are horizontal; 96 mm. diameter; 32 mm. stroke, and the normal revolutions were 680 per minute. These cylinders are cooled by the circulation of water, pumped from the water-tank around the cylinders and back to the tank. The motor-shaft is horizontal and parallel to the axle-tree, and it is connected with the shaft carrying the speed-differential by a friction-gear, which permits four changes of speed—3.7, 6.2, 9.3 and 12.4 miles per hour, and a backward speed of 9.3 miles. For braking purposes there is a ribbon-brake, lined with camel-skin, and working upon the box of the differential by means of the pedal.

The full detail of the test of this Peugeot motor is too long for insertion here, but some of the more important results are as follows: The average speed made was 14 miles per hour, with 3.7 miles per hour on an 8.2% grade. The jury figured that the daily cost of running this vehicle was $5.55; of which sum $2.17 was for oil, etc. consumed, and $3.28 was for other expenses.

Under the head of electrical motors the Jenatzy coupe (Fig. 2) is taken as a type. This cab was intended to carry two passengers, or a useful load of 308 lbs. It was made up of the ordinary cab-body with a bracket-seat, though this third seat was not used for a passenger during the trial. The driver sat in front and there handled a directing-bar, speed-variant and brake combined, and under foot was a pedal operating a friction-brake. The total weight was 3,964 lbs.; with 1,854 lbs. on the front wheels. The wheels were made of wood with metal hub, fitted with Michelin pneumatic tires. The extreme width of the vehicle was 5.9 ft., and the extreme length 9.2 ft.

The motor, speed-gearing and differential are enclosed in the body of the vehicle. The motor, excited in series, has a normal power of 4 to 5 HP.; but it may easily develop, according to the claim of the builder, 10 to 12 effective HP. Two normal speeds are arranged for—3.7 and 7.4 miles per hour; for the first speed the two batteries are connected in parallel, and for the second speed, in series. Special gearing is provided for passing from 3.7 to 5.6 miles speed, and from 7.4 to 12.4 miles speed, and intermediate speeds can be obtained by introducing momentary resistance coils. The accumulators are of the Fulmen type, B 21, forming two batteries of 22 elements each; each enclosed in a box; one under the driver's seat and one behind the carriage. These two boxes are easily opened for taking out and replacing the batteries.

The general speed results were as follows: On the level the batteries in parallel gave an average speed of 5.27 miles per hour; in series they gave a speed of 10.4 instead of the promised 11.2 miles per hour. On a grade of 8.2% the batteries in series gave a speed of 4.9 miles per hour. The jury figured that the daily cost of operating the Jenatzy coupe was $4.05, of which 80 cts. was for the repairs to the accumulators and 34.4 cts. was for the electricity; the rest went for general expenses.

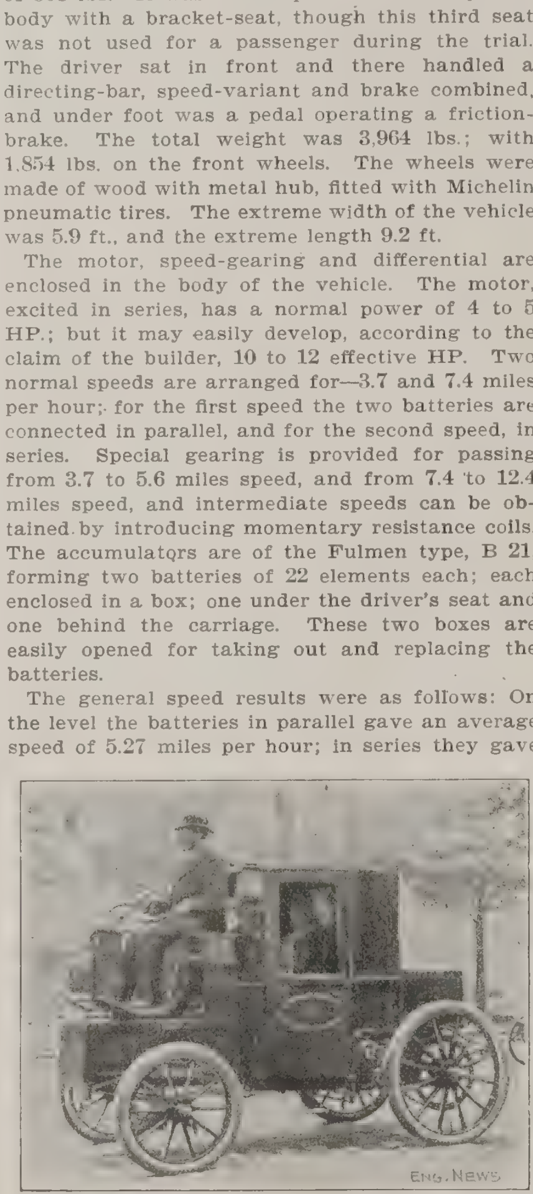

Fig. 2.—Jenatzy Coupe; accumulator system.

The second class in the test included vehicles with a single motor, where power is transmitted by motor-wheels by means of invariable gearing, with a differential and chains; and where the variation in speed is secured by a corresponding variation in the speed of the motor. Under this head the electrically propelled Jeantaud cab (Fig. 3) is taken as a type. This cab is intended to carry two passengers, or a useful load of 308 lbs. It can be made to be sold for $2,800. It is a four-wheeled cab, with the forward wheels carrying a box enclosing the accumulators; the driver is behind, and there controls all movements. The motor and differential gear are under the cab. The total weight of the cab is 3,102 lbs., with 1,419 lbs. over the front wheels. The wheels are wood with metallic hub and Michelin pneumatic tire; the extreme width of the vehicle is 5.08 ft., and the extreme length is 9.7 ft.

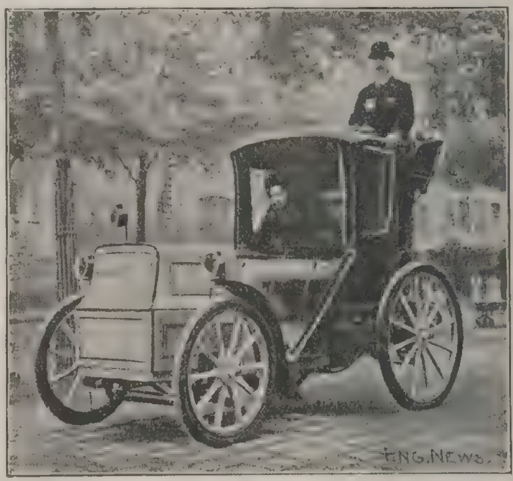

Fig. 3.—Jeantaud Cab; accumulator system.

The motor and shaft of the differential are placed in a closed box, with the ends of the differential shaft projecting and carrying pinions for the sprocket chains; this motor, with its transmission gear, weighs 330 lbs., and has a normal power of 3½ to 4 HP. Different variations of excitation and the coupling of the batteries permit speeds ranging as follows: 4.34, 7.44, 9.3 and 11.2 miles per hour. Intermediate speeds are obtained by momentary resistances introduced through the pedal of the electric brake. The accumulators are of the Fulmen type, B 15; they contain 44 elements and weigh in all 880 lbs. Transmission is by a sprocket-wheel and chain connecting the ends of the differential-shaft and the corresponding motor-wheel.

The mean maximum speed made in the trial was 10.5 miles per hour; the daily cost of running this cab was fixed by the jury at $3.96.

A Jeantaud landaulet, Fig. 4, was also submitted to test, which carried two passengers and cost $2,800. It weighed 3,652 lbs. Fulmen accumulators, B 17, weighing in all 1,005 lbs., were used, and the general plan of transmission, etc., was similar to the cab first described. The daily cost of operation was fixed at $4.04.

The third class of vehicles included those with two motors, one for each motor-wheel; geared directly to it with no provision for change of speed, except by changing the speed of the motor.

To this type belonged the Krieger carriage, Fig. 5, arranged so that the body of the carriage could be changed without interfering with the motor mechanism. The coupe and victoria types would carry three or four passengers without baggage; the useful load is 462 lbs., though in the trial they often carried 616 lbs. Either of these carriages could be sold for $2,400 each.

In these carriages the accumulators are stored in two boxes; one under the seat of the driver, and one behind the body of the carriage. There are two motors, one for each front wheel, and these are both motor and directing wheels, the motors being placed directly over the vertical pivots. The coupe weighs 3,608 lbs.; the victoria 3,498 lbs., and the coupe, with a compartment for baggage, weighs 3,894 lbs.

The two electric motors are of the Krieger type, made by Postel-Vinay. Each has a nominal power of 3 HP., and weighs about 143 lbs. Varying speeds of from 3 to 12 miles per hour are obtained by means of a series-parallel controller. In the trial, speeds of 5.5, 12.3 and 15.9 miles per hour were made on the level with batteries in series; on a grade of 8.2% the speed was 3.7 miles per hour in series. The total daily expenses of running the three types of Krieger carriages were fixed by the jury at $4.05 to $4.06.

In its general conclusions the jury says that one of the most striking features of this trial was the preponderating influence of the cost of repairs to the accumulators and the pneumatic tires, upon the daily expenses of running electric motor-vehicles. The small quantity of electrical energy consumed on this total course of 347 miles, on some of the most crowded streets of Paris, and the small cost of supplying this energy, was one of the suprises to the jury. In the daily expenses for the Jenatzy, Krieger and Jeantaud motor-carriages the specific energy supplied only cost, on the average, 35.4 cts., 34.8 cts. and 20 cts. respectively. This extremely low cost, says the jury, seems to render it almost practically useless to seek for better methods of utilizing the electric motor in propelling vehicles. But while the consumption of energy has so slight an influence upon the daily cost of operation, the enormous general expenses which swell this cost must not be lost sight of. The electric motor must be designed to reduce to a minimum the consumption of energy on streets with steep gradients, and so regulated and controlled that an inexpert driver can not communicate to the motor currents disastrous to the accumulators.

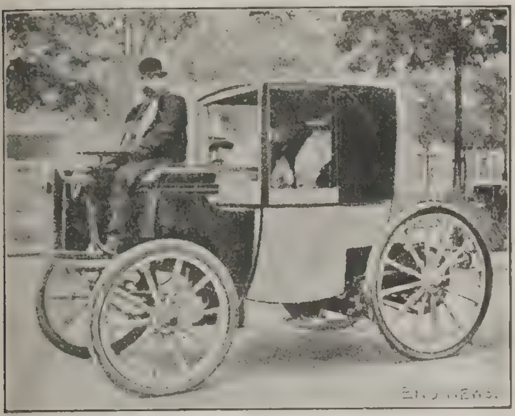

Fig. 4.—Jeantaud Landaulet; accumulator system.

As to speed, while this was generally satisfactory, the jury hopes that in another year makers will submit motor-cabs which will better meet actual cab practice in Paris, and with as small a consumption of energy as possible, meet the following speed conditions:

4 miles per hour in seeking passengers.

5 miles per hour mounting 5% grades.

7.5 miles per hour on grades from 2.5 to 5%.

9.3 miles per hour as an average in ordinary streets.

12.4 miles per hour in open and uncrowded streets.

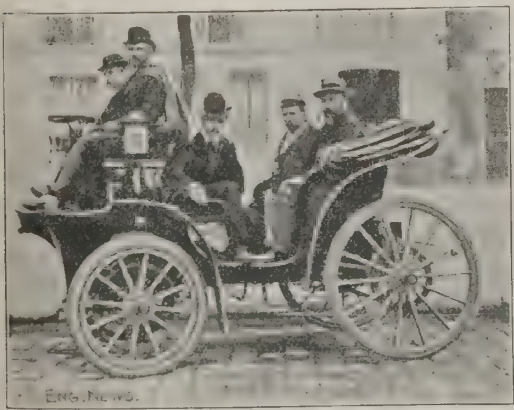

Fig. 5.—Krieger Victoria; accumulator system.

At the present time the police regulations of Paris only permit a maximum speed of 7.5 miles per hour in the city streets, and 12.4 miles per hour outside the city walls. The jury contends that the law should be changed so as to authorize a speed of 12.4 miles per hour within the city; if this were done the authorities could be assured that ordinary conditions would prevent a speed much exceeding 7.5 miles per hour in crowded streets. During the motor trial of last June, covering nine days in time and 3,720 miles in distance, the average speed maintained was about 9.3 miles per hour.

The jury says that one of the most difficult things to contend with, in attempting any great speed with motor-carriages on the streets of Paris, is the tendency of the wheels to slip on muddy streets, causing the carriage sometimes to swing clear around. This trouble is aggravated by having the directing wheels in front; and it thinks that some means should be adapted for braking the hind-wheels in case of breakage or damage to the brakes on the front wheels.

THE RELATIVE IMPORTANCE OF FLIES AND WATER SUPPLY IN SPREADING DISEASE.*

The diseases that may be borne in water under some circumstances and by flies under others are typhoid fever, yellow fever, certain forms of dysentery, Asiatic cholera, and perhaps malarial fever, and malarial poisoning in general.

It will be observed that there are two classes of these diseases, the intestinal and the malarial. In the former the infection is a bacillus of some sort, whose presence in any locality can always be traced to some preceding contamination by excretions from a diseased bowel. In the latter the source of infection is a plasmodium, as it is termed, which lives primarily in marshy soil, or stagnant water, and whose presence in that location is independent of contamination from human sources. These distinctions are to be kept in mind constantly in attempting to trace out the manner in which these diseases spread, and in adopting measures for their prevention.

All are most emphatically camp diseases, and hence the propriety of their discussion at a meeting devoted to the subject of "Camp Hygiene." There is the greater need of such discussion because the relative importance of flies and water supply in spreading disease has been greatly misunderstood, especially in the very case of camps where the danger is greatest.

Contrary to ideas that have existed heretofore, in camps and under similar conditions elsewhere, intestinal diseases are spread almost exclusively by flies, and malarial diseases by water. The exceptions to this, which are relatively unimportant, will be noted in the course of the discussion.

In the Cuban campaign last summer it was sought to prevent the spread of diseases of the intestinal class by the use of water from the purest sources, or purified by boiling. It was a failure. Not until late in the summer was the agency of flies taken into the account in any practical way. Even now reports from Honolulu and Manila state that typhoid is still epidemic among the soldiers in those localities, showing that adequate measures of prevention have not yet been perfected. Likewise during the recent British campaign in Fashoda, which was most carefully planned, and which took place in a climate that is exceptionally dry and hygienic, there was no abatement of typhoid fever, it continuing to be the chief scourge of the army.

Nevertheless, diseases of the typhoid type can be prevented with almost absolute certainty, and malarial diseases greatly abated, in both instances by very simple measures. It is only necessary that those most concerned should think it worth while to understand the matter and act accordingly.

It is not possible to enter very much into detail in a brief summary of results such as the present. Suffice it to say that in the performance of his duties as Health Officer and practicing physician, the writer has been able to put an end to epidemics of typhoid fever and dysentery of the exact type that prevail in the army in such manner as to warrant the belief that the problem of their prevention has been solved completely.

For example, the outbreak of malignant dysentery mentioned in my paper at the recent meeting of the American Public Health Association was encountered when at its height, there having been forty cases and ten deaths and the disease spreading rapidly from house to house in a single neighborhood. As soon as measures were adopted such as would make conveyance of the infection by flies impossible, there was not another new case, although there had been fresh ones every day for some time previously. In like manner the past summer a lively epidemic of typhoid fever was ended in a day by measures directed against conveyance by flies. So, too, on the malarial side of the question there has been prevention, without the aid of quinine, by measures directed against conveyance by water.

It is true that under certain circumstances the poison of intestinal diseases may find its way into water and be thus conveyed, and that the poison of malaria may be taken up and carried by mosquitoes or flies, as the case may be. Hence, it is necessary to discriminate carefully in reference to the peculiarities attending these different methods of conveyance of infection.

When flies are responsible there are little neighborhood epidemics extending in short leaps from house to house, without reference to water supply or anything else in common. But when water is at fault the disease follows its use wherever it may go, the only limitation being the resisting power of the individual using it, and such househould measures of boiling and the like, as tend to destroy disease germs. Epidemics spread by flies tend to follow the direction of prevailing warm winds, as though the fly, wandering out doors after contact with some source of infection, had drifted with the wind; but nothing of the sort is perceptible in the case of water-borne disease. In villages and camps where shallow open closets are in use, giving access of flies to the chief sources of infection, they are the chief medium of its conveyance. In cities where underground sewers carry such material beyond the ordinary reach of flies, whose migrations are not extensive, such diseases can only become very prevalent through infection of the source of public water supply. Hence in villages and camps they are usually fly-borne and in cities water-borne. When a source of public water supply has been infected in this manner, cases of the disease will occur more or less throughout the year, provided that the germ remains active at all temperatures. When the conveyance is by flies the prevalence of the disease will be confined to a particular season exclusively. Thus in cities typhoid fever prevails at all seasons, in villages it is an autumnal disease. When the weather is dry and sultry flies have their best opportunity to carry the disease, or, in other words, under the very conditions best adapted to prevent its spread if water-borne.

With this understanding of some of the more prominent general relations of the subject, it becomes possible to enter into the study of details that are of the utmost practical importance. For example, in investigating a series of epidemics confined to a single neighborhood recurring year after year, the writer, following the lines that have been indicated, was able to secure very positive evidence, both clinical and microscopical, that burying typhoid material in the ground is no protection against flies. Such a procedure simply establishes a culture bed in which the bacilli, like plants, grow toward the surface, attracted by the warmth and other effects of the sun's rays in that location. If any prevention whatever is secured by such burial of typhoid material without disinfection, it is very transient, especially when the weather is sultry. The application of this to the care of the sinks in the army is evident. Indeed, it is the key to the situation, so far as army conditions are concerned, the danger being greatly intensified by the utter heedlessness of many of the men. Discipline as well as accurate knowledge is required, in order to make preventive measures a success in this case. Indeed, unless carefully looked after, there will be neither burial nor disinfection of such material, far too often.

Furthermore the burial of typhoid material not only fails to prevent the immediate spread of the disease, it on the contrary actually perpetuates it in the locality from year to year. This was clearly shown in the series of epidemics referred to in the preceding paragraph, which came to an end at once when this mode of disposal of material was abandoned, and proper disinfectants were used.

The subject of disinfection in general demands revision from the point of view of the present discussion. The material employed must be suitable. If of a volatile nature like carbolic acid it must be remembered that on evaporation it will leave nothing behind to protect against reinfection, and consequently must be used in large quantities and often, so that not a single particle of material containing living bacilli may escape to re-infect the entire mass. Sulphate of copper in solution, on the other hand, on evaporation, is left behind, diffused through the material, thus prolonging its effect, and even making it permanent, if a sufficient quantity has been employed. Earth containing sulphate of copper thus diffused becomes a good disinfectant, and may be used with confidence to cover typhoid or other infected material.

The time at which disinfection is to be performed is likewise of the utmost importance. If a case of intestinal disease is in progress, the material from the diseased bowel should not be exposed to access of flies without disinfection for a single moment. It is taking serious chances to allow even a single fly to crawl over such material, and then visit articles of food and drink. No matter how cleanly the premises, or what other precautions may be taken, if instant disinfection be neglected, the danger becomes impossible to compute. On the other hand, a very little care at the right time yields a result that is an absolute certainty and that even a child can understand.

Among large bodies of men there will always be some who are negligent, and even among those who are thoughtful, the very beginnings of an attack of sickness may pass unnoticed. Thus there is constant danger that bacilli from the diseased bowel will be planted in the sink and there find opportunity to grow and propagate. Consequently there can be no security unless all excretions are disinfected instantly, if possible. Just here the point that has been made in regard to sulphate of copper in solution as a disinfectant may prove to be the key to the situation. The writer has had large experience with its use for this purpose, and has been surprised many times at the way in which even so small a quantity as a pound or two diffused through several barrels of water checked putrefaction and all signs of bacterial growth in foul drains and the like. The fact that soil can be converted into a good disinfectant by its aid is likewise important. It is portable and its color is such that there is no liability of mistake, and it likewise has the advantage of showing visibly exactly how far it has penetrated. It would seem to be the ideal disinfectant for army use, if its efficiency is as great as the writer has been led to suppose. In the absence of water it can also be used dry with good effect, but a larger quantity is required.

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*Abstract of a paper read by Dr. M. A. Veeder, of Lyons, N. Y., at a meeting of the Buffalo Sanitary Club, Dec. 14, 1898.

If, however, during the exigencies of a campaign no special means whatever of disinfection are at hand, it is nevertheless possible to do much. For instance, it is a good plan to follow the example of the Indians, who change the location of their camps often. Although burying infected material is at best a very uncertain precaution as against conveyance by flies, still it may lessen the chances somewhat for a period of some hours, more or less, according to the quantity or character of the earth employed. Hence it may be resorted to as a temporary expedient, in default of a better, when a camp is to be abandoned very soon, for example, or in the interim between the hours at which disinfectants are to be applied.

If so cumbersome an arrangement as the tank, fourteen feet long and two or three feet square, containing a strong solution of crude carbolic acid, to receive the excretions, as recommended by the commission appointed to investigate the spread of disease in the army, can be had, and its use insisted upon, there is no doubt but that a vast amount of sickness will be prevented. The idea of its use is certainly based upon a correct understanding of the dangers involved, and is something new in army sanitation. Perhaps inventive genius may evolve something even better, and more readily available under all of the exigencies of warfare, now that it is known precisely what it is necessary to accomplish.

Pretty much everything that has been said thus far has had reference to the prevention of conveyance by flies, this being the greatest danger in camps. Still there may be times when the use of water that is liable to contain the bacilli of intestinal diseases cannot be avoided. It may be necessary also to use water from soil in which the plasmodium of malaria is indigenous. In either case boiling is a precaution that has the merit of absolute certainty. If it is possible to make a fire and make a little coffee or tea to drink on the spot, or fill the canteens for subsequent use, it relieves the difficulty completely and at once.

With reference to this mode of escaping malarial disease by not touching water that has not been boiled, the writer has reason to believe that the security it affords is well-nigh absolute. It is possible that there may be some small conveyance by mosquitoes, which are known to harbor the malarial parasites. There is a likelihood also that flies that have come in contact with freshly upturned marshy soil may carry the infection to some extent. But the chances in both these regards are so small that they are nothing compared with drinking the soakage from swamps fairly reeking with the poison. The deepening of wells in marshy soil may be of some assistance, especially if they are of the artesian variety, not admitting water except at the very bottom of an iron pipe. This also avoids contamination with surface filth, and if such water could always be had there would be no need of other precautions. Under army conditions, however, it is better to cultivate the habit of boiling the water as a protection against diseases of the malarial type especially. There are many persons known to the writer who find it cheaper and pleasanter to do this than to dose themselves with quinine while undergoing slow processes of acclimatization, so-called, on any change of residence, for it is a peculiarity of malarial infection that immunity against it in one locality does not always protect in another. Hence there is the greatest need of preventive measures on the part of soldiers, who are liable to be constantly changing their location.

It is evident that much was expected in a sanitary way during the recent campaign against Spain, although it was organized in such haste. The American people do not appear to be willing to tolerate the idea that their boys at the front should be sick at all. At any rate, if there has been suffering and death, they want to know the reason why. It is a healthy symptom. But sanitation under the guns of the enemy is a hard matter, implying thorough knowledge and discipline. If anywhere this should be found, it is on the part of the American soldier who exhibited such magnificent initiative at Santiago. With the tremendous efflorescence of patriotic feeling taking the form of sanitary inquiry in the manner that it has, the Spanish-American war of 1898 may come to be known as the war that saved more lives than it destroyed many thousandfold.

BITUMINOUS ROCK PAVING IN SAN FRANCISCO, CALIFORNIA.

At the present time Market St., the chief thoroughfare of San Francisco, Cal., is being paved with the so-called bituminous rock. We are indebted to Mr. James M. Owens, B. S.,* of that city, for the following information concerning this material and its use in California.

Bituminous rock, as found in California, differs from that obtained from Seyssel and Val de Travers in one important particular; it is a bituminous sandstone while the others are bituminous limestones. Stratified deposits of this bituminous sandstone rock are found in a number of localities in California, and also in Kentucky and Utah, though California produces more than 80% of the total yearly output of this material. Probably the best known and most productive mines in California are in Santa Cruz Co.; and the most noted mine in this county is about eight or nine miles from the town of Santa Cruz, N. 76° W., and about 90 miles from San Francisco. It crowns the top of a hill, and is only three miles from the ocean. This mine was first opened in 1864-5, and the material was then distilled to extract the oil. The first shipment of this oil to San Francisco was destroyed by fire when in storage, the project was abandoned and the mine remained unworked until early in the 80's. Most of the work in developing the mine has been done since 1885.

Plant for the Reduction of Bituminous Rock by the Hot Air Process, for Street Paving in San Francisco.

This rock is a dark chocolate brown in color, almost black, almost odorless; and in the harder varieties the fracture is irregular, fine-grained and without cleavage planes. At low temperatures it breaks up into fragments like ordinary stone. The rock from the Santa Cruz mine is classified as hard, soft and medium rock; the hard rock, upon analysis, shows a very fine quartz, about as fine as beach sand. The soft rock contains pebbles sometimes ⅛-in. diameter. The Santa Cruz rock carries from 10 to 21% of bitumen and 0.8 to 0.3% of moisture. The specific gravity varies from 1.4 to 1.9. The deposits dip slightly towards the sea, and are from 10 to 30 ft. in thickness, and in most cases are underlaid by a moderately coarse-grained, clean, soft sandstone. The top rock is a very fine-grained, white, clayey sandstone. Numerous fossil remains of marine animals are found imbedded in the rock. The accompanying table contains the results of analyses made from samples of the Santa Cruz rock:

Analyses of Santa Cruz Bituminous Rock.
(Analysis by Thomas Price & Son, San Francisco, Cal., April 28, 1890.)

	Samples	
	No. 1. Soft rock.**	No. 2. Hard rock.†
Asphaltic material	11.50%	16.60%
Silica	86.22%	76.72%
Oxide of iron	1.28%	3.30%
Carbonate of lime	.22%	.36%
Carbonate of magnesia	.18%	2.42%
Water and loss	.60%	.60%
	100.00%	100.00%

**From Walrath Mine Santa Cruz. †Consolidated Bituminous Rock Co.

(Analysis by H. G. Hanks, San Francisco, Sept. 27, 1889.)

	Thurber Hard Rock Mine; Sample No. 3.	
	Chemical.	Mechanical.
Bitumen	20.04%	20.04%
Water	.76%	.76%
Silica	57.81%	sand, 79.20%
Carbonate of lime	4.75%	...
Oxide of iron	7.92%	...
Alumina	8.72%	...
Magnesia.	Trace.	...

Determination of Asphaltene and Petrolene in Santa Cruz Bituminous Rock.—By Jas. M. Owens, May, 1897.

Chemical Analysis.*

	Samples			
	No. 3.—Medium.		No. 4.—Soft.	
Moisture & loss at 86°C.	0.3766⅔%		0.2155%	
Tot'l bitum'n	14.6416⅔%	Pet. 11.773⅓ Asp. 2.868⅓	16.075%	Pet. 13.185 Asp. 2.890
Non.-bit. orgn. matter..	.88%		2.42%	
Mineral matter or ash..	84.1016⅔%		81.2895%	
Specific gravity.......	1.89		1.45	
	100.00%		100.00%	

*Samples obtained April 26, 1897, from Thurber Hard Rock Mine and the Walrath Mine.

Residue from No. 3: Sand, consisting mainly of milky-colored quartz; general shade, gray; coarse grained.

Residue from No. 4: Coarser grained sand, contains quartz and golden-colored mica.

Solvents used: Chloroform to extract asphaltene, and acetene to extract petrolene.

High percentage of petrolene noticeable: Over 80% of total bitumen in each case.

Mechanical Analysis.

		Per cent.			
No. of sample.	Kind of rock.	Moisture or loss, 86°C.	Total bit. incldg organic matter.	Mineral matter or ash.	Total.
1.	Medium....	0.3983⅓	14.80	84.8011⅔	100.00
2.	Soft........	.29	16.2464	83.4644	100.00
3.	Hard.......	.76166⅔	20.463⅓	78,775	100.00

N. B.—Under the microscope the hard rock shows fine granular structure, and the presence of considerable bitumen. In portions of the soft rock large sized pebbles are quite visible.

Of the several patented processes now employed in San Francisco for reducing this material one of the oldest, and probably the most widely used, makes superheated steam the reducing agent. Disintegration by means of hot air, with petroleum as fuel, is the chief characteristic of the second process; the first method is intermittent and the second continuous. The accompanying cut shows a plant at work by the hot-air process. In the steam process the rock is broken into fragments of about egg-size; is wheeled up an incline and dumped into the kettle through an opening in the top. When filled the lid of the kettle is clamped down and the cooking process is commenced by the use of superheated steam. As the rock is melted it falls into a lower chamber and is removed when disintegration is complete. It is then ready to be taken to the work. Each of these kettles holds about ten tons; and with average rock about 40 minutes are required for complete reduction.

In the hot-air process, the kettle is filled automatically by an endless chain of buckets which deliver their contents into a hopper at the top and rear of the oblong kettle. From the hopper the broken rock finds its way into a revolving cylindrical crib, about 3 ft. diameter and the full length of the kettle; the openings in this crib are about ¼-in. apart, and through these the disintegrated material passes to a chamber below. This chamber has a double jacket of boiler-plate through which hot-air circulates, and this jacket extends up the sides so as to partly envelope the crib. In the bottom of the chamber, and running its full length are two longitudinal screw conveyors, about 12 ins. diameter. These deliver through openings in the end of the kettle. It requires a 7½-HP. engine to operate the mechanism attached to the kettle; and with a fair grade of rock this kettle can turn out enough material to lay about 9,000 sq. ft. of finished roadway, 2½ ins. thick, in one working day. With the so-called hard-rock, this amount is reduced as low as 5,000 sq. ft.

The method usually adapted in laying this pavement is as follows: Bituminous rock disintegrated and hot as it comes from the kettles, is spread over the concrete foundation by means of hot iron rakes. Heated hand-rollers, weighing about 20 lbs. per inch of tread, are then passed over it until a smooth surface is obtained; and while still warm the surface is dusted with infusorial earth which is a powerful absorbent, with the object of preventing adhesion between the wheels of the roller and the pavement. Finally, a steam-roller, weighing about 300 lbs. per inch of tread, is passed over the pavement, until the wheels of this roller cease to show any indentation. The pavement is then considered fit for traffic.

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*643 Haight St., San Francisco.

Since bituminous rock pavement was introduced into San Francisco, about 13 years ago, over 72 miles of pavement have been laid and it is growing in popularity. During the fiscal year ending June 30, 1898, more bituminous rock pavement was laid than in any preceding year, or 74,533 lin. ft.; and this amount exceeds that of any other type of pavement laid in one year since 1893. Macadam is now used in outlying districts only, and cobble pavements are in limited use on steep gradients where smoother pavement would be out of question. The advantages claimed for bituminous pavement are: ease of traction; it is impervious; it is adapted to all kinds of traffic; produces neither dust nor mud, and is easily cleaned; is comparatively noiseless and has considerable elacticity; it is easily laid and repaired and is durable; and on account of its highly granular texture, due to the presence of a large excess of sand, it is not so slippery as asphalt. It is also comparatively cheap; for, in San Francisco, this class of pavement costs from 18 to 28 cts. per sq. ft., or $1.62 to $2.52 per sq. yd., according to difficulties encountered in laying it.

But notwithstanding its many good qualities, bituminous rock pavement has its faults. It is not adapted to grades steeper than 4%; in foggy or damp weather, a thin coating of mud is likely to form on the top of the pavement, if it has not been properly cleaned, and under these conditions the surface becomes slippery for smoothly shod horses. When the pavement has become thoroughly wet, however, this slipperiness is reduced to a minimum. Unless ordinances are enforced regulating the width of tires and the travel upon streets having car-tracks, it is not suitable for constant and heavy traffic, and will wear in ruts. In San Francisco a recently enacted ordinance forbids the driving of any vehicle over a street paved with bituminous rock, and upon which car-tracks are laid, in such a way, that two of the wheels run in the groove of the outer-rail while the other two are running on the pavement proper.

The specifications for the repaving of Market St., San Francisco, with bituminous rock generally provide as follows: The roadway is to be excavated to a depth of 11½ ins. below the finished surface and brought to a true arc with a rise of 1 in. in 3 ft. from the curb to the center of the roadway. After the roadway is properly graded it is thoroughly compacted by a 5-ton steam roller, and all soft places must be dug out and refilled with suitable material, well-puddled with water and re-rolled. On this road-bed will be laid a concrete foundation of 9 ins., made of 1 part Portland cement, 2 parts clean sand and 7 parts clean hard rock, the latter either blue or gray sandstone. Before laying the bituminous rock, the surface of the concrete must be allowed to become thoroughly dry and it must be then broomed and cleaned.

On this foundation the disintegrated bituminous rock is to be spread in equal parts of soft and pulverized hard rock thoroughly mixed. The mixture must contain 12 to 15% of natural bitumen; must be of even texture; free from quartz, sulphates, clay, gravel or other impurities. This mixture shall then be heated in a suitable closed kettle, adjacent to the work, to about 215° F., by a process whereby neither wet nor dry steam, nor flames of eny description, nor the direct heat from flames, shall be allowed to come into direct contact with the mixture. The heated rock is applied in a layer 2½ ins. thick, as before described.

A SECTIONAL DUMP CAR.

In most of the large dump cars now used for ballasting, filling, and other railway and construction work, provision is made for regulating the operation of dumping, so as to deposit the material in any desired quantity, at any particular point. This is usually effected by means of the doors through which the material is discharged, but in the Page car, which we illustrate this week, it is effected by mounting a series of dumping boxes on the car frame.

The Page car is made in two styles: The side-sill car has six boxes (three on each side) which discharge the load on opposite sides of the track; the center-sill car has three boxes (each the full width of the car), which can discharge their load on either side. In the side-sill car, the boxes are pivoted nearly over the sills, while in the center-sill car they are pivoted over the center sill. The builders consider that the center-sill type is in general preferable, since it enables the entire load to be dumped on either side of the car.

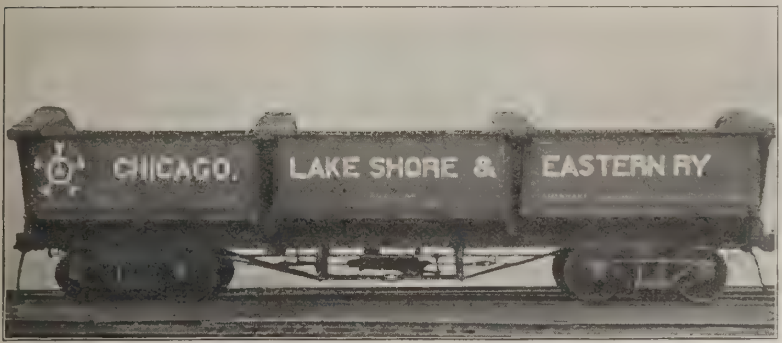


Fig. 1.—Page Sectional Dump Car in Running Position.

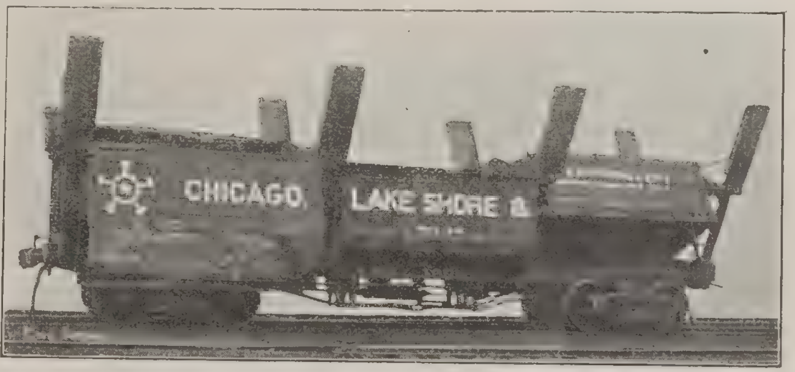


Fig. 2.—Page Car, With Two Boxes Dumped and the Third Ready for Dumping.

THE PAGE SECTIONAL DUMP CAR AS USED ON THE CHICAGO, LAKE SHORE & EASTERN RY.

The Sheffield Car Co., Three Rivers, Mich.

The accompanying cuts represent a car of this latter type. The underframe consists of five longitudinal sills, two end sills, and two intermediate cross sills, with transverse tie-rods, the whole frame being stiffened by four truss rods. On the end and cross sills are erected frames which support the dumping mechanism, latches, etc. The three dumping boxes are all the same size, and are pivoted on a steel T-bar over the center sill, the bar extending the full length of each box and being bolted to the bottom of the box. The boxes rest and rock upon flat iron straps on the upper face of the center sill. A malleable iron extension of the T-bar enters a cast socket which is secured to the end and cross sills, to hold the boxes in position over the sill. To avoid heavy framing in the ends of the boxes they are not built with a view to sustaining the pressure of the load unaided, but are reinforced by the vertical frames, which are provided with anti-friction rollers, engaging with bearing points on the boxes.

The sides of the boxes are closed by doors which hook on to lugs on the ends near their upper edges, and are secured at the bottom by straps entering keepers on the side sills of the boxes. Their action is automatic. As the boxes tip, projections on the doors first drop into seats on the caps of the frames, to prevent further downward movement. They are then released from the box and hang swinging. Latches pivoted to the vertical frames engage lugs at the four upper corners of the boxes. When returned to position the boxes are automatically locked.

Sheet steel shields, hinged to the outer ends of the vertical frames, cover the latches and the frames, and serve to prevent material from falling between the boxes and dropping on the ends of the latches. They also prevent the raising and releasing of the boxes. The hinges of these shields are provided with safety hooks, which engage the boxes, so that each box is thus secured with four latches. Buttons are placed on the middle frames, where the ends of the shields meet, and these may be turned so as to prevent the raising of the shields. A spring on the bottom shaft maintains a pressure so as to prevent the button from being turned by anything but a special wrench. This wrench is intended to be kept only at the unloading point, insuring against the boxes being dumped anywhere else, since none of the boxes can be dumped unless the shields are raised.

On construction work where many men are employed, the boxes may be tipped by a direct lift, and sometimes by means of cant hook levers. If, in loading the car, care is taken to trim the load, it is only necessary to raise the latches, whereupon the boxes dump automatically. Under favorable conditions one crew of men has unloaded and restored the boxes of a car for loading in one minute. Where a large number of men are not at hand, a dumping device may be employed, by which two men, standing on top of the vertical frames, one at each end of the box, can tip the boxes to either side of the car. The dumping device consists of a malleable iron casting, so constructed as to admit of attaching it to the box end at its highest point. The casting projects over a rack on the vertical frame, and is provided with pawls which drop into the rack. An opening in the casting admits of the insertion of a lever, which is used in moving the casting over the rack. The rack is used as a fulcrum of the lever, the pawls dropping into the indents of the rack and holding whatever is gained by each lift of the lever. With one of these devices at each end of the box it may be tilted to any angle desired and kept from tipping back.

The door opening of these boxes is large enough to allow a 3-ft. cube to pass out. When occasion demands, the doors can be removed and the car used as a flat car. The floors being horizontal the car is available for a great variety of freight service, whether it is desired to dump the load or not. It is claimed that the car can be used for hauling such materials as earth, sand, ore, coal, ballast, building stone, pig-iron, cinders, etc., which can be discharged by dumping or shoveling, or by means of a derrick. One of the special advantages claimed is that a sticky or frozen load will be discharged more readily from a tipping box than from a car having a stationary inclined floor.

A number of these cars are in use on the Chicago, Lake Shore & Eastern Ry. They are 36 ft. long, with a carrying capacity of 60,000 lbs. and a bulk capacity of 42 cu. yds., and are mounted on ordinary diamond frame freight car trucks. The floor, which is covered with 3-16-in. steel, is 4 ft. 8 ins. above the rails, and the top of the side is 8 ft. 2 ins. above the rails. The cars are fitted with air brakes and automatic couplers.

Some of them were built by the Pullman Car Co., of Chicago, and others by the United States Car Co., of Hegewisch, Ill. Mr. W. G. Brimson, President of the railway company, informs us that the cars were built for the purpose of ballasting and filling trestles. Since that work has been finished they have been used successfully for about two years in the coal and ore traffic, with practically no cost for maintenance. These cars are of the center-sill type.

Fig. 1 shows one of the cars in its normal running position, and Fig. 2 shows the same car with one box dumped to the right, another dumped to the left and the third ready for dumping.

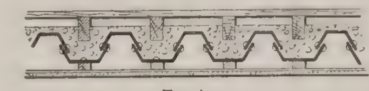


Fig. 1.

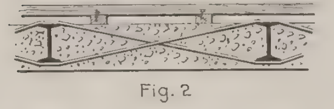
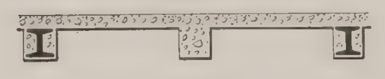


Fig. 2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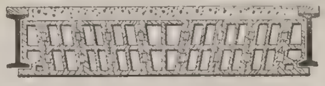
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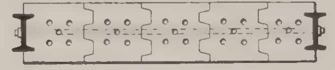
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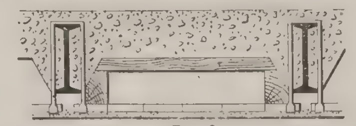
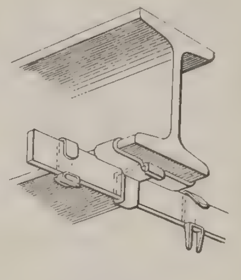


Fig. 6.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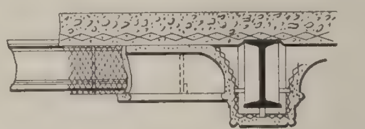
Fig. 9.

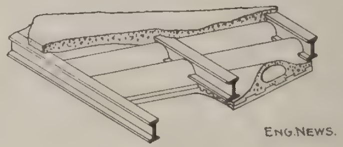

Fig. 10.

These cars were invented and patented by Mr. C. D. Page, of Greeley, Colo., who is now in Seattle, Wash., building some cars of this type for the White Pass & Yukon Ry., of Alaska. The new cars are 36 ins. gage, 3 ft. 6 ins. long. Each car carries two boxes, the inside length of which is 13 ft. 3½ ins. They are to be used on construction for hauling ballast, railway ties and other building material. Later on they will be put into coal service.

For information respecting these cars we are indebted to the Sheffield Car Co., Three Rivers, Mich., which is interested with Mr. Page in the patents.

FIREPROOF FLOOR SYSTEMS USED IN LONDON.[*]

By Frederic R. Farrow.[†]

In the earliest forms of fireproof floors used in London, the aim of the inventors seems to have been simply to provide a floor of non-combustible material, and for a very long time the importance of preventing damage to the incombustible components of fire-resisting floors was wholly neglected; but, at the present day, it is almost needless to point out that it is quite as important that the construction of a fireproof floor should be such as to obviate the possibility, or at least the probability, of damage occurring to the building by failure of the floor in several other directions besides that of combustibility. A fireproof floor to be of any reliable value must not permit of any part of its construction being melted, distorted, or broken by the action of the heat of the fire, or by the water used in quenching the fire, nor must there be any possibility of damage by expansion or contraction of the various constituents of the construction under the greatest extremes of heat and cold to which it may be exposed.

The importance of avoiding damage by expansion and contraction militates against the employment of some otherwise admirable materials. It also renders it imperative that all metal work shall be preserved, not only from the direct action of fire, but also from the convection of any considerable amount of heat by such protective sheathing as may be incorporated in the construction of the floor.

Perhaps the earliest attempt at the construction of fireproof floors was the employment of a series of iron girders supporting brick arches which rested upon the upper surface of the flanges. In some of the very earliest examples, the girders were of cast-iron, but the system was continued subsequently with rolled iron joists. Those who used this form of floor evidently felt that there might be some possibility of trouble arising from the thrust of the arches, and therefore in some cases wrought-iron tie-rods were inserted below the level of the brick arches. The result could hardly be otherwise than disastrous; the girders and tie-rods were exposed to the full action of both fire and water, and the failure of one girder meant, of course, that of the arches supported by it, which necessarily would be speedily followed by the collapse of the whole floor from the thrust of the remaining arches. Such an unsatisfactory method of construction may now, we hope, be relegated to the limbo of forgotten ineffectiveness. The use of unprotected iron girders for supporting incombustible construction of various kinds remained, however, the common practice for a very long time; and although suggestions were made for adequate protection of the iron many years ago, it is but quite recently that this has been generally regarded as a sine quâ non in the design of a satisfactory fireproof floor.

The varied forms of fireproof floors which have been devised may be classified into those which do not attempt complete protection of the ironwork, those which do attempt complete protection of the ironwork, and those in which endeavors are made to dispense with ironwork, or, at least, iron joists altogether. In each of these classes we have a subdivision into those forms of construction which require temporary centering, and those which provide their own centering, or have a permanent centering.

There are but few examples now in use of fireproof floors which do not attempt some protection of the ironwork, although in several instances the protection consists only of a suspended ceiling. Fireproof floors, in which a permanent centering is used are constructed with curved sheets of corrugated galvanized iron resting upon the upper surfaces of the lower flanges of the iron joists with concrete filling-in above this centering.

Messrs. William Lindsay & Co.'s floor, shown in Fig. 1, of steel decking with concrete filling-in above, is a floor designed with the view of weight-bearing capability. The under surface of the steel decking and the lower flanges of the joists are unprotected. The concrete used is pumice concrete, that is, it is composed of coke breeze, sand and Portland cement. Where protection to the iron is desired a suspended ceiling can be applied as shown.

Passing on to the consideration of those floors which attempt complete protection of the ironwork, and taking first of all those which require temporary centering, we have a group in which the ironwork is wholly embedded in solid concrete. Of these, Lindsay's system with interlaced tension rods passing over and under the iron or steel joists is illustrated in Fig. 2. The concrete is in this case pumice concrete.

Messrs. B. Ward & Co. have constructed floors under their patent for a steel webbed solid concrete floor, in which the steel webbing passes over the top of the iron joists, and so is embedded in the lower half of the thickness of the concrete. This was one of the earliest forms of floor in which the idea of increasing the tensile strength of concrete by means of embedded metal was adopted. Messrs. W. B. Wilkinson & Co. have also made floors of solid concrete with the joists embedded and the tension iron rods passing over the top of the joist.

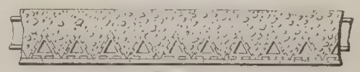
Fig. 13.

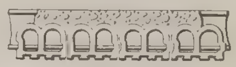
Fig. 11.

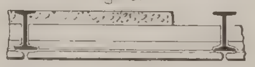
Fig. 12

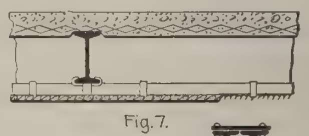
Fig. 7.

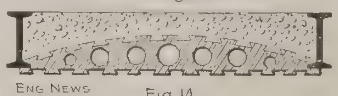

Fig. 14.

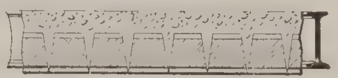
Fig. 15

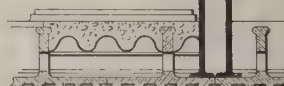
Fig. 16.

The Stuart Granolithic Stone Co. make thin floors in granolithic concrete, with the steel joists embedded in concrete blocks, and using central beams also of granolithic concrete, as shown in Fig. 3. Floors in granolithic concrete have also been constructed in arched form with thin crowns and thickened haunches.

Another group of floors is that in which flat arches between the joists are used, provision being made for the protection of the under side of the joists on which the arches rest. Of constructions of this kind we have examples in the Doulton-Peto floor, illustrated in Fig. 4, in which the arches are built of fire-clay blocks with dovetailed sinkings on the sides to form a key for the cement. Another example is Messrs. Blanchard's floor, in which perforated blocks are used, tied together with iron rods passing through the joists, as shown in Fig. 5. Similar in principle to these are Burnett's floor, Hornblower's, and Northcroft's; whilst Whichcord's system, with solid fire-clay blocks enclosing the lower part of the joists and forming the skewbacks of the arches, may be taken as the parent of these systems of construction.

The United Terra Cotta Co. use arched forms in flat arches similar in principle to those already described in the Doulton-Peto, and cognate systems. The essential feature is that the material of which the hollow blocks are composed is a very light and porous earthenware, obtained by mixing the clay with sawdust before burning.

The more modern examples in this section are to be found in a group of which Banks' floor and the floors made by the Expanded Metal Co. are the best illustrations. In Banks' fireproof floor the steel joists are wholly embedded in the concrete, excepting the under side of the lower flanges, and these are protected by the suspended ceiling hung from the top of the steel joists. This floor is shown in Fig. 6, with the wood centering in position, for the removal of which the hangers to the ceiling are hinged.

The Expanded Metal Co. use their patented material as the basis of several varying forms of fireproof floors. The expanded metal lathing is generally embedded in the lower part of a concrete slab to which it therefore imparts, as do other arrangements of embedded metal, the tensile strength in which simple concrete is deficient. In most of the methods adopted by this company, the concrete slab with the embedded metal lathing is above the joists (as shown in Fig. 7), which are protected by being embedded in concrete, cased around with metal lathing and plastered or shielded by a suspended ceiling. In other instances the joists are themselves embedded in the concrete slab, the metal lathing being placed either below or between the joists. Additional strength for the concrete slab is in some cases provided by arched ribs of channel iron and concrete, either with or without a suspended ceiling.

The hanging arrangement for the suspended ceiling is shown in Fig. 8, the wire lathing being attached to the thin bars by the clips shown. An example of a floor with the joist cased is shown in Fig. 9.

Of floors in which a permanent centering is provided or of which the construction of the floor is independent of any temporary centering, there are a large number of examples that attempt complete protection of the iron or steel joists. In the majority of these floors the lintel principle is adopted in construction rather than the arcuate.

Of these the Fawcett floor is a typical example, the special feature being that the hollow tubular earthenware lintels are arranged diagonally, their own diagonals being at right angles to the line of the joists. The advantage sought by this method is to enable the lintel to cover more completely the under-side of the lower flange of the joist. These tubular lintels form the centering for the concrete which is filled in above as shown in Fig. 10.

Messrs. C. G. Picking & Co.'s interlocking floor is similar in some respects to the Fawcett, but each lintel has two tubes, and projections are arranged at the side to afford the means of interlocking. This is shown in Figs. 11 and 12.

The Shepwood patent floor is an arrangement of flat terra cotta slabs grooved at the edges and fitted to the flanges of small T-iron bearers, which span the distance between the joists. Special blocks are made to cover the lower flanges of the joists and thus a complete permanent centering for the conctrete is formed.

In the most modern type of Messrs Homan & Rodger's floor, triangular lintels are used, passing from joist to joist and resting on the lower flange, the under surface of which they cover. This form is illustrated in Fig. 13, whilst an older type is shown in Figs. 14 and 15.

Messrs. Aston & Son construct a floor, which as will be seen from the illustrations, Figs. 16 and 17, is a combination of flat lintels of T-section and corrugated iron permanent centering. This floor was formerly carried out by

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[*] Abstract of paper presented to the British Fire Prevention Committee.

[†] 7 New Court, Lincoln's Inn, London.

Willis & Astley, the preceding holders of the patent. Messrs. Aston & Son also construct floors of solid concrete with terra cotta casings to flanges, as shown in Fig. 18. This latter form of floor, of course, requires temporary centering.

Messrs. Potter & Co.'s floor, as illustrated in Fig. 19, is a combination of several ideas. The lower flanges of the joists are protected by clay shields which support corrugated iron permanent centering for the concrete, and in addition there is a suspended ceiling of wire lathing and plaster.

Another example of the lintel system is the Adamant Cement Co.'s floor, in which the lintels are formed of concrete blocks composed of Adamant cement with breeze or other aggregate, and sometimes strengthened by the insertion of steel laths. On these lintels is laid a concrete filling. The lintels are slightly varied in form, one shape being shown in Fig. 20, and another in Figs. 21 and 23.

Approximating somewhat to the lintel form are the floors known as the Mulciber and the Carlisle. The former of these, as will be seen from Fig. 23, consists of loose fireclay blocks, enclosing the flanges of the joists and forming corbels, on which rest the hollow fireclay lintels, serving as the permanent centering for a slight finish of concrete. The Carlisle consists of two hollow tubes between each pair of joists, and the filling in of concrete, of which there is a very small amount, forms the key between the tubes. This is illustrated in Fig. 24. A somewhat similar floor to the Carlisle has been made by Messrs. Picking & Co., as shown in Fig. 25.

In Messrs. B. Ward & Co.'s system of cellular tubes between the joists, as illustrated in Figs. 26, 27 and 28, the especial feature is that the cellular slabs or lintels are formed of gypsum, this being in small pieces.

For domestic buildings and where no great weight is to be carried by the floors, or where the floors are of small spans, various forms of fireproof floors are in use which are specially intended to fulfil these particular conditions. As examples of these we have concrete slabs with expanded metal or other lathing, Edwards' floor of concrete slab with iron rods, and several other similar constructions. There is also the method of using wood beams set diagonally so as to form skewbacks for the reception of concrete arches or slabs.

A method of considerable antiquity, but now very little used, is that in which a floor sometimes flat but more often arched in section, is constructed of plain roofing tiles, and in three or four courses laid in cement and breaking joint, with or without a finish of fine concrete on top. This method has been largely used for corridors and other situations where the floors are of no very great span.

Fireproof floors formed of wood have been introduced, such as Evans & Swain's, which consists of ordinary wooden joists nailed together side by side, thus forming a practically solid floor of wood.

A newly patented floor is Hinton & Day's, in which the space between ordinary floor joists is blocked in solid with wood at the lower part of the depth of the joists. A layer of concrete is sometimes added.

Another class of floors intended to provide a moderate amount of protection or "fire-resistance," includes those in which the ordinary construction of wood-joisted floor is supplemented by pugging on fibrous plaster slabs as carried out by Messrs. Wilkinson, or pugging laid on metal lathing without rough boarding and nailed to the under side of the wood joists. A modified form of Messrs. Ward's cellular gypsum slabs, already referred to above, has been used for affording protection to the under side of an ordinary wooden joisted floor. The protection of ordinary wooden joisted floors is carried out also by various combinations of special fire-resisting plasters, and various forms of special lathing.

Amongst these special plasters may be mentioned Asbestic, Fibrous, Silicate Cotton plaster; Adamant cement, and Robinson's cement. Amongst the special Lathings may be mentioned the Expanded Metal already referred to, and Banks' Helical Lathing, in which flat ribbons are interlaced in lattice fashion but twisted between their interlacings. Jhilmil is a metal lathing in which flat sheets of metal are cut and bent up and down to form projecting strips, thus forming a metal lathing with space for keying. There is also a fire-resisting lathing recently introduced by the Mural & Decoration Syndicate, made of woven iron wire studded at its intersections with terra cotta.

Mention must be made of concretes of special composition for the purpose of resisting fire more thoroughly than ordinary concrete. One of the first introductions of this nature was the gypsum concrete of Messrs. Dennett and Ingle. A more recent introduction is the Boyd-Wilson patent concrete, in which "Kieselguhr" is used on account of its low conductivity.

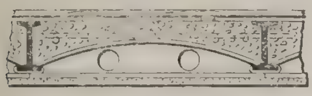

Fig.17.

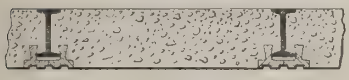

Fig. 18.

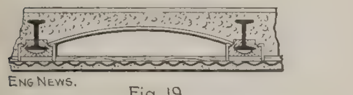

Fig. 19

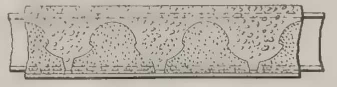

Fig.20.

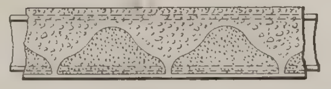

Fig. 21.

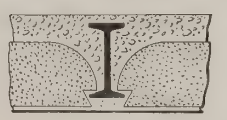

Fig.22

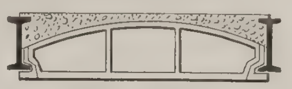

Fig.23.

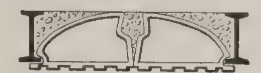

Fig.24.

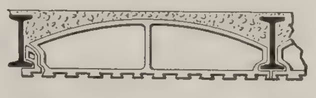

Fig.25.

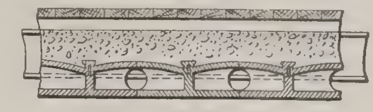

Fig.26.

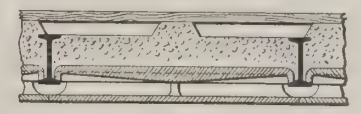

Fig.27.

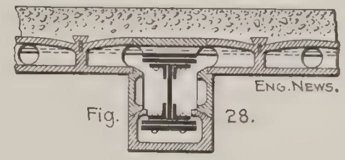

Fig. 28.

* * *

RIBBED GLASS AND THE DIFFUSION OF LIGHT THROUGH WINDOWS.

Previous to 1883, Mr. Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Co., began to study the best means of diffusing light through windows and skylights in mills, factory buildings, etc.; and in the year named he submitted a report to the Cotton Manufacturers' Association, together with a suggestion for fixed light and transom windows which has since been widely adopted in mill practice. The windows recommended had no sliding sash and were glazed with thick, rough plate glass. This glass cost more than common glass; but it was less liable to breakage; the sash cost less; the thick glass retained the heat in winter, and the light, though a little less, was much better diffused and no shades were required to keep out the glare of the sun.

About the same time he experimented with various forms of glass for this purpose, including prismatic, corrugated, rough, waved and ribbed glass. He had photographic images taken from each kind, and also from plain glass; and he found that the greatest and most uniform diffusion of light was not derived from prismatic or from angular forms, but from simple ribbed glass in true curves, inverse and obverse, 21 ribs to the inch. This form of glass was fortunately in commercial use for certain purposes, and was also the cheapest type of glass suitable for glazing windows, except the common clear glass. There are no patents on the ribbed glass itself, and it was introduced into mills with very satisfactory results. It soon became evident, however, that more complete research was necessary, and the investigation was placed in charge of Mr. C. L. Norton, of the Institute of Technology. The conclusions reached by Mr. Norton were published about three years ago in Circular 67 of the company; but as many new facts have developed since then, Mr. Norton was commissioned to make a second and still more complete investigation, and this report is now made public in Circular 72 of the Boston Manufacturers' Mutual Fire Insurance Co., which is given briefly as follows:

Mr. Norton started out by decidedly doubting the assertion made, that more light was admitted into a room when glazed with corrugated glass than when glazed with plain glass. But experience has clearly shown that at the rear wall of a room 25 ft. deep the intensity of the light was increased three times by substituting ribbed glass for plain. A similar increase is found on the side walls and ceilings, but on the floor there is a distinct loss near the window. Mr. Norton explains this effect as follows:

> The light entering a room through a window comes, for the most part, from the sky, and has, therefore, a general downward direction, varying with the time and position. Hence the position of the room which receives the most light, ordinarily, is the floor near the windows. But, of we interpose in this downward beam of light a dispersive glass, the light no longer falls to the floor, but is spread out in a broad, divergent beam, falling with nearly equal intensity on walls, ceiling, and floor. We must bear in mind that we gain nothing in the total amount of light entering the room, but we have simply redistributed the light, taking up from the floor that which fell there and was comparatively useless, and sending it in directions where it is of more service. The result of the examination of the various glasses was to show that a finely ribbed or corrugated glass was better than the others, as it gives the widest and most unform distribution. There is no apparent gain in corrugating both sides. Ground glass is barred out, because of its actual loss of transparency, caused by slight amounts of moisture or dust. The ribbed glass about 3-16-in. thick, with 21 ribs to the inch, known now as "factory ribbed glass," is, says Mr. Norton, the best dispersive glass upon the market. When a glass of slightly better appearance is desired, that which is known to the trade as "maze" glass is the best. It is similar to the fine ribbed glass, except that the ribs are not straight, but are bent into irregular figures.

Photometric measurements were made by taking two rooms, one above the other, alike in exposure, shape and size, and comparing the intensity of light falling on similar portions of the two, when one was glazed with plain glass and the other with the glass under examination. Broadly speaking, it was found that the center of the room was as bright when lighted by a window of 1 sq. ft. of ribbed glass as with a window of 3 sq. ft. of plain glass. This was true in all lights; from a bright sunshine to a heavy thunderstorm, and with the windows facing in any direction.

The circular reproduces a number of photographs of the same rooms or objects taken when lighted by plain and by ribbed glass. In each case the greater intensity of light derived from the window glazed with ribbed glass is very apparent. One of the most striking of these exhibits is a pair made by exposing a photographic plate in the bottom of a box, in the cover of which was a round hole, provided with a shutter. One opening was filled with plain, and the other with ribbed glass. When exposed a second or two and developed, the plate back of the plain glass showed a perfectly round, bright spot, proving that the light came straight through the hole; on the plate exposed to the ribbed glass the light was diffused over a large surface without clearly defined margins. As the plate was only 6 ins. from the hole the angle of dispersion in the latter case was found to be nearly 90°.

Mr. Norton says that this ribbed glass is especially useful in the factory, where the question of position of machinery, etc., is usually decided by convenience in setting it up, and the possibility of getting the greatest number of operatives into the smallest possible space. If the man near the window needs a shade he cuts off light from the entire room; but the substitution of ribbed for plain glass does away with the necessity for the shade and benefits, instead of harming, those remote from the window. In the school-room, this soft, even light, leaves no desk or book untouched, and is a great protection to the eyes; its use in laboratories, in libraries, and in art galleries, is also commended.

Factory ribbed glass is best set with the ribs running vertically; as otherwise, when the sunlight strikes it, it is too dazzling for comfort. But it may be used with horizontal ribs in basement and cellar windows, where the brightness of the glass does not matter. In these latter places the full measure of the gain in the use of ribbed glass is best appreciated. The fact that operatives in a mill cannot attend to affairs in the street is an advantage; though it is seriously objected to by the operatives themselves, and Mr. Atkinson suggests that it might be well to have some plain glass in each window on this account. But the real gain to the operatives is the better diffusion of light and the protection from the glare of objects outside; shadows are also less sharp. The ribbed glass also diffuses heat; and while the temperature of the whole room is not changed, the heat from the sun is spread evenly over the whole room, instead of being uncomfortably concentrated on a spot near the window.

The ribbed glass should have its ribs on the inside, for ease in keeping it clean; and where double glass is used the ribs should be crossed and set facing each other. Ribbed glass is made with a wire netting imbedded in it, and it has the same optical characteristics as the ordinary ribbed glass.

Mr. Atkinson, in commenting on this report, says that he finds that the use of ribbed glass on the south side of a mill, subject to full exposure to the sun, does not abate the need of shades in many places. He hopes that a glass may yet be found which will shut out part of the light and diffuse that admitted. Another caution is that in mills, print works, or other places devoted to color work, only the pure white glass should be selected. Many kinds of glass that appear pure white show a distinct greenish tinge, if examined on the edges; and the slightest tint of green destroys all possibility of discrimination in many colors. Mr. Atkinson considers that where windows of the ordinary kind have been bricked up, or guarded with shutters, on account of fire hazard, wire-glass of the "maze" pattern would help to stop the spread of fire and at the same time greatly improve the light. Glass of this latter kind is made by the Mississippi Glass Co., with an agency at 20 Canal St., Boston, Mass.

THE NEW BREAKER AT CRANBERRY COAL MINE, HAZLETON, PA.*

By W. S. Ayres, M. Am. Inst. M. E., Hazleton, Pa.

(With two-page plate.)

The construction of a new breaker at the Cranberry Colliery, Hazleton, Pa., was forced upon the operators, A. Pardee & Co., by a fire which destroyed the entire plant early in January, 1896. The loss included, in addition to the breaker, three boiler-houses and three engine-houses. The breaker-engine and all the machinery in the breaker, including the rolls, screens, jigs, etc., were a total wreck.

Among the things aimed at, in the design of the new breaker which was made and carried out by the writer, were:

1. An arrangement and style of machinery that would be very simple, and enable the coal, as it comes from the mine and is hoisted to the top of the breaker, to descend by gravity through the various rolls, screens and jigs to the storage-pockets without the use of any elevator or device for rehandling. Also, such designs of crushing-rolls as would produce a larger percentage of the larger sizes of coal, and a correspondingly smaller percentage of the smaller sizes, than had been obtained in the old breaker. The special relative arrangement of the dump, rolls, screens and jigs, as adopted, is the conception of Mr. F. Pardee, the Superintendent.

2. The introduction of easy grades and turns in all the chutes that convey the coal from one machine to another and to the pockets, so as to avoid chipping and waste.

3. A design of frame for the breaker that would be very rigid, and at the same time use the smallest amount of material for the strength and rigidity required, and that would also embody the possibility of taking out any piece and replacing it, as, for instance, in repairs.

The detailed description of the breaker now to be given will follow, not the above order, which is the logical order controlling the design, but the successive steps of construction, namely: (1) Foundations; (2) frame of structure; (3) machinery; (4) chutes and connections; to which will be added (5) a statement of results.

Foundations.

The foundations were built of stone laid in cement, one foundation for each post, having a broad base and tapering to a capstone about 2 ft. square. There are, in all, 131 of these pyramidal foundations. The size of the base was determined in each case by the nature of the soil and the load that would come upon the post. A careful calculation was made of the load that would come upon each, comprising the weight of the structure, machinery, coal going through and stored in it, the water in jigs, and the effect of vibrations, wind and snow. Fig. 1 is a plan of the foundations.

Fortunately, the majority of the foundations under the breaker proper, including all those carrying the greater weights and subject to the greater vibrations, were upon rock. Where they came upon clay and hard-pan, one to two tons pressure per square foot was allowed, and the size of the base for each was figured from the weight to be carried by that post.

These foundations were not less than 4 ft. deep, so as to ensure them against frost. Yet at this shallow depth, the pressure per square foot assumed for each was far less than the greatest intensity consistent with the stability of the earth. To allow fully for the vibrations that would be caused by the machinery, when in motion, an intensity of pressure was assumed, representing about half that allowable for the same depth were the structure to remain in absolute repose.

The cement used was the Hudson River Rosendale, mixed one of cement to two of sand. The stone used was a very hard conglomerate, having a probable safe working resistance to crushing of at least 50 tons per sq. ft., this being one-tenth of its probable ultimate strength. To avoid any settling, a bed of about 2 ins. of sand was first put into each pit, and the first course of stone was well rammed into it. Large flat stones were selected for this course. In each successive course great care was taken that each stone should be well bedded upon the one below. Only the hammer was used, however, in dressing, so that stone touched stone with only enough cement between to fill up the irregularities of the bedding-faces and abutting joints. This precaution was necessary, as the cement has a safe working strength of only 3 to 5 tons per sq. ft., while the stone, even though it touches the one under it on only a few small surfaces, has a capacity to resist 500 tons per sq. ft. before crushing. That is to say, in all foundations carrying as much as 125 tons, the small surfaces of contact together must equal an area not less than ¼ sq. ft.

This area is quite easily secured in ordinary hammer-dressing, and, when reinforced by the resistance of the cement, the foundation can be relied upon.

The cap-stones were from 20 to 24 ins. square by 12 to 15 ins. thick, rough-chiseled to a level surface on top, after bedding. The above method was adopted in the construction of the foundations, as giving the least risk of settling, the least mason-work, the least cement, and the least labor.

Frame of Structure.

The old breaker, which was consumed by fire, had been constructed entirely of timber, and according to the old plan for wooden structures, which has been in general use in the anthracite region since the mines were first opened, fifty years ago. It consisted of solid members, braced with the usual short braces, framed together in the usual way with mortises and tenons, and pinned with 1¼-in. wooden pins. All upright pieces were set upon, and mortised into sills, which rested upon long stone-wall foundations. The old structure contained about 1,300,000 ft., B. M., of lumber.

The defects developed in the old structure were:

1. The foundations would settle directly under the posts for want of a base of sufficient size at these points, while between posts the foundations were unaffected and useless.

2. The sill-timbers would crush and rot, and the posts would also rot, causing a very great settling, which, added to the settling of the foundations, would throw the machinery all out of line. This was a very serious matter.

3. The mortises and tenons, particularly those of the braces, formed pockets for water to lodge in. When the pin or tenon was rotted off, only the boxing prevented the timber from falling out.

4. It was impossible, except at relatively great expense, to replace any timber or brace framed with mortise and tenon.

5. In the solid members, such as posts, ties, inter-ties, etc., the centre or heart of the stick was found in many cases to be entirely rotten, even to within an inch or less of the sides.

There was a want of rigidity in the structure, due to the short corner-braces, and to the tendency of those pieces acting as struts to shove apart the joints between ties and posts.

7. The strength of any post depended entirely upon what was left of its cross-section after cutting the mortise.

To meet the evils above enumerated, to avoid the use of large and long timbers, which are becoming more scarce and expensive every year, and to use the timber in its most efficient directions, was the problem; and it was solved in the following manner:

The first of the above evils was met by building an individual foundation for each post, with a base sufficiently large to resist the pressure without settling, as described above under the head of "Foundations."

The second was avoided by not using sills under any part of the structure; and the considerations which suggested remedies for this and for the third, fourth, fifth, sixth and seventh defects, were based upon well-known facts concerning the strength of timber, namely:

(a) The ultimate resistance to crushing of white pine, for example, across the grain, is only about 550 lbs. per sq. in.

(b) The ultimate resistance to crushing in the direction of the grain, or end-wise, is about 5,500 lbs. per sq. in.

(c) The ultimate tensile strength in the direction of the grain, or end-wise, is about 11,000 lbs. per sq. in.

(d) A hollow column is stronger than a solid one of the same cross-sectional area of material; the strength increasing as the hollow space increases.

Other kinds of timber, such as oak, yellow pine, hemlock, etc., have ultimate strengths differing from those of white pine, but they follow the same general law.

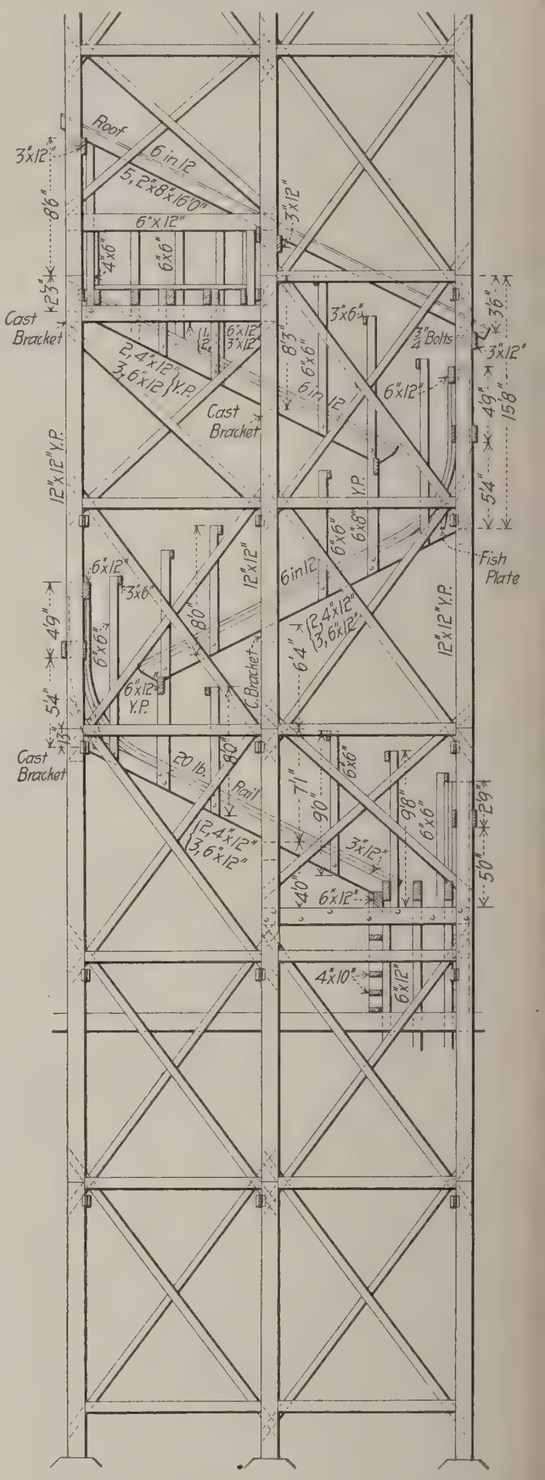

Fig. 6.—Detail of Rock Chute Between Bents 17 and 18.

In view of these facts and deductions, it was decided:

1. Not to place any timber in such a position that it would be acted upon by the load across the grain either in compression or tension, except when this was absolutely necessary, as in the case of bearers under tracks and machinery.

2. To make all braces, as far as possible, act in tension.

3. To build up the posts from ordinary commercial sizes and lengths of lumber, such as can be found in almost any lumber-yard, and to make them hollow.

These points decided, the next step was to design and arrange the machinery in such relative positions, without any reference to the frame, as would accomplish in the best manner the preparation and handling of the coal. Two thousand tons per day of 10 hours was the capacity aimed at.

This done, an outline-design of the structure, having a total height of 200 ft., was sketched about the machinery. Then a very careful calculation, which covered about 100 pages, was made to determine the strain in each piece of the entire structure. This calculation embraced the weight of each machine, the coal running through it, the water in the jigs, all connections, platforms and enclosures, the weight of the roof and snow, the strains due to the wind, and the weight of each piece of timber that entered into the structure. The calculations of the wind-strains in this high structure were complicated, and in some members showed a possible strain of 27.5 tons to be provided against, assuming a wind-velocity of 80 miles per hour.

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*Condensed from a paper read at the Atlantic City meeting of the American Institute of Mining Engineers. We are indebted to the courtesy of the Institute for the privilege of reproducing direct several of the cuts accompanying the paper.

After the general outlines of the frame and its bracing were sketched around the machinery so as to accommodate every convenience of operation, strain-sheets were constructed from the calculations, and the timbers were assigned to resist the various forces, according to the well-known principles above stated. The result of this by no means trifling labor is shown in the elevation and section of the breaker, Figs. 2 and 3.

The size of each post and strut was determined by Gordon's formula, using a factor of safety of 10, and that of each tie and brace by using one-tenth of the ultimate tensile strength as the safe working-load. To the net sectional area so determined was added whatever would be cut away by the bolt-holes, bolts being used throughout to connect all joints. The number and size of bolts required for each joint was determined by dividing the total strain on the member in consideration by the load one bolt would carry, this load being found by multiplying together the thickness of the timber, the diameter of the bolt and the safe working-pressure per square inch for the timber used. Those timbers which would receive severe shocks (as in the dump, under the rolls, etc.), were increased in size to at least twice the strength required for a quiescent load.

From the elevation shown in Fig. 2, it will be observed that the structure is in two principal divisions; bents 1 to 17 inclusive forming the plane, while bents 18 to 22 inclusive form the breaker proper.

The plane has three tracks with room for the fourth. Each bent is framed as shown in the section through bent No. 8, shown on the left of Fig. 2. The questions of rigidity and of stability against wind-pressure were the most important in designing the plane. To make the structure with sufficient width of base to resist the wind-pressure would require a base so wide that it would occupy valuable ground desired for other purposes. At the same time, the tops of the high bents would have an unavoidable sway, which increases, as shown by experience, the longer the structure is in use. The simple narrow-base parallel bent, shown in Fig. 2, with guy-lines to meet both the sway and the wind-strains, was decided upon. The higher bents were provided with two sets of guy-lines one set attached about 70 ft. from the ground and the other at the top. The wind-strains on these guy-lines, with the wind at 80 miles per hour, is estimated to be 10 tons on each. These guy-lines were grouped in twos and fours at the anchors, which consisted of old railroad-rails, bent like the letter A, with a hook turned on the lower end of each leg, into which was laid a piece of old shafting, and, across the shafting, pieces of old mine-rails. On top of the rails flat stones and pieces of slate from the mines were laid to a depth of 1 foot; and then the earth from the pit was thrown in. Each pit was made large enough so that the weight of earth on top of the anchor would exceed the combined pulls of the guy-lines attached to that anchor. A screw-device for adjustment was attached to each guy-line, and formed the connection with the anchor. These guy-lines are of 1½-in. and 1¼-in. galvanized steel, and were finally adjusted so that the deflection taken out of them by a wind having a velocity of 80 miles per hour, would not allow the structure, when struck by such a hurricane, to sway more than ¼-in. at the height of 165 ft. A hurricane having a 60-mile gait did strike it, July 27, 1896, but without producing any appreciable sway.

The posts of the plane are made of two pieces separated 6 ins., and are butt-jointed every 14 ft. These two pieces are 3 × 10 ins. for bents 1 to 9 inclusive; 4 × 10 ins. for bents 10 and 11, and 4 × 12 ins. for bents 12 to 17 inclusive.

The cross-diagonal braces are 3 × 6 ins. in size, and are entered between the post-pieces, as shown in the elevation of bent No. 8 on Fig. 2. The longitudinal diagonal braces are 2 × 6 ins. in size. Owing to the slender proportions of these braces they will practically act only in tension, a condition which, coupled with the arrangements of the braces at the joint, will pull the joints together, and never tend to separate them. This completely removes the objectional features of the short brace, and at the same time makes each panel a rigid frame, which the short brace cannot accomplish.

The cross-ties and inter-ties are made of two 2 × 8-in. pieces, separated by fillers and joint-pieces. In the cross-ties they are separated 6 ins. throughout, while in the inter-ties they are separated 4 ins. at the center and only 2 ins. at each end.

The mode of framing employed by the contractor was to lay each bent upon skids, placing the various posts, cross-ties and cross-diagonal braces in their exact positions, sawing the post and cross-tie-pieces to a given length, sizing the post-pieces, where the cross-ties came against them, to a uniform distance from the center line of the post, and then laying the whole on the skids, and boring through for the bolts. Next, all bolts were put in, except those, the omission of which would permit the bent to be taken apart in sections for erection.

The plane just described practically continues beyond bent 17, and on top of the breaker proper, from bents 18 to 21 inclusive. The highest part, between bents 20 and 21, carries the three main sheaves for the hoisting ropes. The strain coming upon these three sheaves, amounting to more than 30 tons, is carried directly to the foundations by two struts fastened to the outside of the posts, as shown in Fig. 2. In like manner the main counter-shaft is provided with a vertical strut to resist the jar of the bevel-gears, and with one running diagonally to the engine-foundation, to resist the weight of the shaft, its equipment, and the pull on the driving-ropes, together amounting to 8 tons; also with three horizontal struts, forming the bearers for the counter-shaft, and abutting against the three rows of steel columns in the breaker, to resist the pull on the driving-ropes running from the counter-shaft to the rolls. The object of these devices was to carry the ever-varying and intense strains produced at these working-points directly to the foundations; and the wisdom of it has been shown by the fact that the structure is entirely free from any racking strains or vibrations.

All pieces are of easy access for repairs. For example, to replace any section of a post, the entire weight coming on that post can be taken off by simply slacking the guy-line on that side and tightening the one on the opposite side; and then, by removing a few bolts, the piece is easily removed.

The breaker proper was framed in the same general style as the plane, although some modifications of the cross-ties, inter-ties and bracing were found necessary about the machinery. The majority of the posts are made of two 6 × 12-in. pieces of yellow pine, separated 4 ins. The cross-ties and inter-ties are made of two 4 × 12-in. pieces, separated 4 ins. The fish-pieces, in the cross-ties which come directly opposite each other, run between the post-pieces, and, as one piece, hold the ends of the opposite cross-ties against the post. In cross-ties not opposite, the fish-piece stops at the opposite edge of the post. The inter-ties, all of which come against the side of the 6 × 12-in. post pieces, are cut square and between the posts, and are carried by a cast bracket which forms the connection with the post.

On posts 18, 19, 20 and 21, C. D. and E, the load to be carried is so great that a compact post 2 ft. square would be required for each. A compact or solid post 2 ft. square was out of the question. Therefore, for these twelve posts, steel columns of the Carnegie 12-in. Z-bar type were substituted. These twelve columns carry the greater part of the machinery, and are braced with diagonal braces. They extend from the foundations to the crusher-rolls, and vary in length from 118 to 126 ft. While they cost erected about 1⅞ times the cost of the equivalent wooden posts, yet they have the advantage of greater rigidity and greater durability, in addition to occupying much less valuable space.

The framing of the coal-pockets, eleven in number, for receiving the seven different sizes of prepared coal, each having a capacity of 100 tons, is such that they rest on posts entirely independent of the posts of the breaker. This was done chiefly to avoid adding these 1,100 tons to the already great load of the breaker, and secondly, because it was far easier to provide for their support by using independent posts, giving at the same time far greater advantage for repairs.

A view of the breaker in process of erection is shown in Fig. 4, and a view as completed in Fig. 5.

Machinery.

All coal is hoisted to the top of the breaker direct from the bottom of the mine in 2-ton mine-cars, and is there dumped into a dump holding 25 car-loads. This storage capacity is to insure a regular supply of coal for the breaker against any irregularity in the hoisting. From this dump the coal passes over bars, to sift out the fine coal, and the larger pieces are fed into the crusher-rolls by a regulating feed, or, if lump-coal is to be made, another set of bars is put in over the rolls, and the suitable lumps of clear coal are pulled aside and passed to the lump-coal chute, all other pieces being passed into the crusher-rolls. Just below these rolls the crushed coal and that coming from the bars are mixed, and the mixed product is divided into two equal streams, one going to the prepared-rolls of the east side of the breaker and one to those of the west side; or the whole product can be turned to either set, as desired.

From this point down, the breaker is divided into two distinct parts, exactly alike, each a complete breaker within itself. This is to enable work to continue in one-half of the breaker if a break-down should occur in the other half, or, in running on half-time, to run half of the breaker all of the time.

The product from each set of prepared-rolls is again divided immediately under the rolls, half going to a complete set of screens on the north side and half to a complete set on the south side. At this point, therefore, when both sides are running, the total product is divided into four equal parts, two parts from each set of prepared rolls. Each of these four parts passes directly into a screen, the "over"-product of which is steamboat and broken sizes. The steamboat-size passes to a picking-space and then to the egg-rolls. The broken size passes to a jig, then to a picking-space, and then to either the pocket for that size, or, if not wanted in the market, to the egg-rolls, where, together with the steamboat-size, it is broken down to egg and smaller sizes, which are separated by a special screen, the "over"-products of which are egg, stove, chestnut and pea, all of which pass directly to the pockets without jigging. The "through"-product from this screen passes to a buckwheat- and No. 2 buckwheat-screen, which sizes pass directly to the pockets or to the boiler-house.

At the picking-spaces of the steamboat- and broken-coal the "bony" coal, consisting of pieces that are part slate and part coal, is picked out and passed to a set of bone-rolls. There is one set of bone-rolls and one set of egg-rolls for each side of the breaker. The product from these bone-rolls is divided and passes into the chestnut-screens.

Returning now to the "through"-product of the steamboat and broken-screen, it will be followed to the pockets. It is at once passed to a second screen, the "over"-products of which are egg and stove, which pass to jigs, then to picking-spaces, and then to the pockets. The "through"-product of this egg- and stove-screen passes to a third screen, the "over"-products of which are chestnut and pea, which pass to jigs and then directly to the pockets. The "through"-product of the chestnut- and pea-screen passes to a fourth screen, the "over"-products of which are buckwheat and No. 2 buckwheat, which pass directly to the pockets or to the boiler-house. The "through"-product of the buckwheat- and No. 2 buckwheat-screen passes to the settling-tanks, with the "wash-water."

From the pockets the prepared coal is drawn into cars for shipment. The pockets, eleven in all, have a storage-capacity of 100 tons each, to insure the running of the breaker against any shortage in cars.

The coal, from the time it is dumped from the mine-cars at the top of the breaker until it reaches the cars for shipment, is made to pass from one process to the next by gravity only, no elevators being used. To accomplish this it was necessary to build the structure to the unprecedented and apparently dangerous height of 200 ft.—apparently dangerous because of the wind-pressure and the constant vibrations from the heavy machinery placed so high above the ground.

The capacity of this machinery is 2,000 or more tons of merchantable coal per day of ten hours.

A brief summary of all the machines is as follows, viz.:

Rolls.—1 pair crusher-rolls, 36 × 72-in. shell, fitted with 286 steel teeth in each roll; 2 pairs prepared-rolls, 24 × 48-in. shell, fitted with 280 steel teeth in each roll; 2 pairs egg-rolls, 24 × 36-in. shell, fitted with 520 steel teeth in each roll; 2 pairs bone-rolls, 24 × 36-in. shell, fitted with 2,700 steel teeth in each roll.

Screens.—All screens are of the revolving type.

Four steamboat- and broken-screens, 12 ft. long, with two rings of segments, one 5 ft. in diameter and the other 7 ft.; 4 egg- and stove-screens, of the same dimensions; 4 chestnut- and pea-screens, of the same dimensions; 6 buckwheat- and No. 2 buckwheat-screens, of the same dimensions; 2 egg-, stove-, chestnut- and pea-screens, 18 ft. long, with three rings of segments, 5, 7, and 9 ft. in diameter.

Jigs.—Four broken-coal, 4 egg-coal, 4 stove-coal, 4 chestnut-coal, and 2 pea-coal jigs.

Before passing to the description of the individual machines, a glance at the dump at the top of the breaker, shown in elevation on Fig. 2, may be of interest. In order to hoist to the dump, in 2-ton mine-cars, coal to the amount of 2,000 tons per day, it is necessary to hoist three cars at a time. The cars are hitched together with extra long chains, and the three tracks over the dump are arranged so that the cars, when in position to dump, stand as shown on Fig. 2, thus making room for the coal dumped from a car above to drop into the dump without striking the car below or lodging on its bumpers. In hoisting three cars at a time, it will be plainly seen that there is three times the pull on the hitching-staple at the upper end of the upper car that would occur in hoisting only one car. This triple strain is increased as the cars are pulled over the corrugated track of the dump, and it

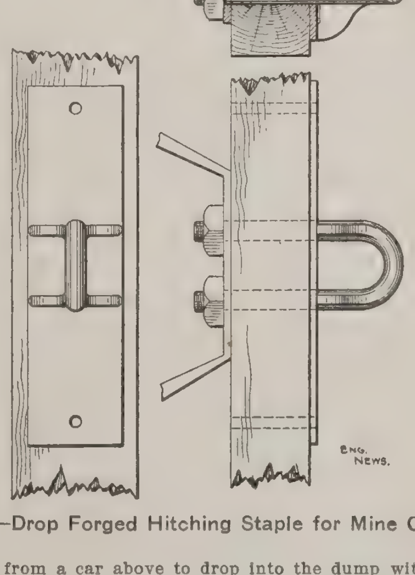

Fig. 7.—Drop Forged Hitching Staple for Mine Cars.

acts in an oblique direction on this staple, alternately up and down, causing a bending-action that would be sure to break the ordinary staple, and cause serious run-aways. Those between the cars are acted upon obliquely also, but with less strain. This danger was anticipated and forestalled by replacing the old staples with new drop-forged steel staples, designed by the writer, having brace-wings, as shown in Fig. 7.

Of the machines, the rolls and jigs play the most important part. The rolls were increased both in diameter and length over those ordinarily in use, and the teeth were made with the points hooked forward in the direction of the motion. The section of the tooth is like the area included between the segments of two overlapping circles. This forms a tooth with rounded sides and cutting edges. The tooth also tapers to a point which looks forward. The rolls of the larger diameter produce a smaller percentage of the small sizes of coal. This is due to the piece of coal being acted upon by the teeth in a way that approximately splits it into pieces. In the old small-diameter rolls, the piece of coal rides on the teeth and is abraded by them before it is pierced and carried through.

The screens are of the revolving type, having a greatly increased screening surface. Eighteen of these are double, having an inner circle of segments 5 ft. in diameter and an outer one of 7 ft.; and all are 12 ft. long. The remaining two have a third circle of segments added, 9 ft. in diameter, and the 5-ft. circle is extended 6 ft., making a total length of 18 ft. for the 5-ft. circle and 12 ft. for the other two.

The jigs are of a special design, patented by Mr. F. Pardee. They are driven by small engines, one for each jig. There are 18 of these jigs in the entire breaker, and, when running full, 2,000 tons of coal per day of ten hours can be prepared with them.

The entire machinery of the breaker is driven by a 30 × 48-in. non-condensing engine.

The transmission of power from the engine to the counter-shaft, and from the counter-shaft to the various rolls, is by a manila rope-drive. From the engine to the counter-shaft ten 1½-in. ropes are used; from the counter-shaft to the crusher-rolls, four 1½-in. ropes; from the counter-shaft to the prepared-rolls, two 1½-in. ropes, and from the counter-shaft to the bone-rolls, two 1½-in. ropes. The egg-rolls are driven by gears from the bone-roll shaft. This arangement of the rope-drive is shown in elevation by Fig. 2.

The entire counter-shaft, and, in fact, the entire rope-drive, except the main driving-sheave at the engine and the sheaves at the rolls, is out of doors, and without any protection from the weather. The weather seems to have some effect upon the ropes to tighten them in wet weather and to make them more slack in dry weather, but the range of this change is not sufficient to give any trouble, provided the ropes are adjusted to the right tension when dry. The first set of ropes was put on in September, 1896, including only five ropes on the main drive from the engine to the counter-shaft, and also only those from the counter to the east-side machinery of the breaker. On July 1, 1897, the west-side was put in operation, and the remaining ropes were put on. All of these ropes are still in operation without renewal.

Many interesting problems were discussed in connection with the selection of a means of transmission of the power of the engine. The counter-shaft is about 85 ft. above the engine-shaft, and so nearly directly over it that it was impossible to count upon any grip on the pulley or sheaves being furnished by the weight of the slack-side of either a belt, a wire rope, or a hemp rope. Therefore, it was necessary to adopt some convenient way to take up all slack and insure a perfect grip.

A leather belt was discarded, because it would be very difficult to keep it at the proper tension without a tightening-pulley, which is a very objectionable device, and also because it would require housing, besides costing about five times as much as a manila rope-drive. A wire rope was found to be uncertain in its grip on the sheaves, and its life could not be warranted. To secure the required grip, a continuous-rope wound system would be required, with a take-up for wear and stretch, which in turn would require some system of differentiation in the grooves of the drum, like the Walker differential drum, to prevent one round of the rope from running away from the others and doing all the work or breaking, a result which may follow a very slight difference in the diameter of the grooves or of the rope. A wire rope-drive was, therefore, out of the question, because of its complications, uncertainty and cost. In like manner the manila continuous-rope wound system was considered and discarded, in view of the objection that if the rope should part for any reason the whole system would be unwound and serious delays would occur in rewinding it.

In the manila individual rope-system were found the advantages of a very low first cost, non-requirement of housing, and ability, if one rope should part, to continue work at once with the remaining ropes. The question of differentiation in the grooves in the manila rope-drive, although the necessity of it exists, is not as serious a problem as in the wire rope-drive, owing to the greater elasticity of the manila rope and to the V-shape of the grooves used. Yet the question arose, how would a new rope work with an old one that is much reduced in diameter by wear? Would the V-shaped groove accommodate this great difference in the diameter of the ropes? It was feared not. The difficulty was solved, however, by the adoption of a shackle and coupling-link like that used by the Philadelphia & Reading Coal & Iron Co., at its storage-docks at Schuylkill Haven, Pa. This shackle is of the ordinary U-shape, is made very short, and has the legs flattened into very thin plates, so as not to increase the diameter of the rope very much. A shackle is riveted on each end of the rope, and the two are hooked together by an open link. This slightly increased diameter at the shackle lifts the rope out of the groove a little as it passes over each sheave, enabling the rope to yield a little toward the side that is drawn too tight. This solved the difficulty of differentiation entirely.

The ropes are shortened, as wear and stretch make it necessary, in two ways. One is to unhook the coupling-link and put more twist in the rope, and the other is to cut off a piece of the rope at one end, and replace the shackle. This is done in the noon-hour, or after-time, but is not a matter of very frequent occurrence after a new rope has received its permanent set. The number of ropes necessary to drive the rolls was doubled, to provide against any delays from the parting of a rope. On the main drive several were added for the same reason.

The diameter of the sheave on the engine-shaft is 20 ft., with 10 grooves in its 22-in. face. On the counter-shaft the main sheave is 10 ft. in diameter, while all others are 6 ft. The speed of the engine ranges from 50 to 60 revolutions per minute, as desired. The speeds of the ropes on the main sheave, corresponding to these speeds of engine, are 3,100 to 3,800 ft. per minute. The screen counter-shaft is driven from the main counter-shaft by bevel-gears, and in turn drives the eighteen 12-ft. screens by means of link-belts. These link-belts have a speed varying with that of the engine from 470 to 565 ft. per minute, and work exceptionally well as a drive in a dusty, dirty place.

Chutes and Connections.

Owing to the great height of the breaker, it was necessary to resort to some special and unusual device for delivering the slate and rock, and some of the coal, from points high up in the breaker to the loading tracks below. Among these will be mentioned only the device in the rock-chute between bents 17 and 18, the spiral chutes from the jigs to the pockets and the spiral lump-coal chute.

The usual way of delivering the waste and the coal to the loading-tracks has been by long, straight chutes, down which the slate or coal runs, at times with a cannon-ball velocity. Turns have frequently been introduced, so as to avoid certain spaces or to gain more distance in which to accomplish the descent. This system requires a great deal of lumber, and occupies a great deal of valuable space, besides having the objection as to the coal-chutes, of chipping the coal badly at every turn, and also where it drops into the pocket. These chippings are small in size and worthless, but their constant production, even in small quantities, reduces in a year, by many tons, the output of the larger sizes of coal, which are most valuable. In the slate- and rock-chutes, however, no such considerations arise, and they usually take the shortest route. One necessity, however, does arise, namely, to provide against the impact of the large pieces at the turns or at the draw. This is usually done by making the timbers at the turns very heavy.

On Fig. 2, in the rock dump, where it turns at the top of bent 12, is shown the device used to avoid the full impact of the large pieces, or of a car-load of mixed sizes, dumped suddenly and moving as one mass. Each car of rock dumped into this chute weighs approximately from 3 to 3½ tons. This device consists of a vertical return, in which the material dumped on the upper section is delivered at an oblique angle against the curved end of the lower section. The force of the impact in this device is only about two-thirds of that produced when the piece is brought against the turn at a right angle. On account of this condition, less timber was used to provide against impact.

This rock-chute down to bent 17 is perfectly straight, but between bents 17 and 18 it makes two horizontal and two vertical turns. These are shown on Fig. 6. The bottom of the chute at each turn is completely covered with 20-lb. rails, laid with the heads up, as in a track, and as close together as the bottom flanges will permit. They are slotted in the flanges, and fastened down with bolts. Such a bottom presents a series of rail-heads to receive the wear, and they are separated about 1¼ to 1½ ins.

When a piece of rock slides down the long, straight part of the chute and enters the horizontal turn it strikes the heads of these rails a glancing blow across their length, and the greater part of its force is expended in passing from rail to rail. Thus the full force of impact is avoided in the horizontal turns. At the lower part of the chute, where the rock and slate are drawn into the dump-cars, there is another horizontal turn, constructed in the same manner. Between these two horizontal turns will be seen, on Fig. 6, two vertical turns which operate in the same manner as the one in the dump at the top of bent 12, above described. Thus a drop of 82 ft. is made in a horizontal distance of 72 ft., and without any destructive shocks.

From the jigs to the pockets, the vertical drop ranges from 70 ft. from the broken-coal jigs to 34 ft. from the pea-coal jig. To convey the coal from the jigs by the usual inclined troughs, or "telegraphs" (a good name for this trough, for the coal often goes through it at almost lightning-speed), would require many thousand feet of lumber, besides which the building would need to be increased by about one-half of its present floor-space to accommodate them. About a mile of these "telegraphs" would have been required. After discussing this method, together with several modifications of it, the possibilities of a spiral chute, or, more correctly speaking, a helicoidal chute, were brought forward and carefully gone over, with the result that, after some hesitation, they were adopted. To determine the correct pitch, so that the coal would neither stop nor run too fast in the chute, was a problem concerning which there were no practical data to be found. From the experience with quarter-turns, both in the old breaker, and also in other breakers in this region, it was decided to adopt a pitch of 3¼ ins. per ft. for the outside circle.

A chute was then constructed as follows:

The outside diameter is 36 ins. and the inside diameter 16 ins. The cross-section is uniform for all sizes of coal from broken to No. 2 buckwheat, the width being 10 ins., and the heights of the sides or flanges 4 ins. for the outside and 2½ ins. for the inside. The chute is made of cast-iron, with four segments to the circle. They are also made rights and lefts. Each segment is provided with four holes in its outer flanges, two at each end, and all are countersunk on the inner side, and are large enough to take an ordinary ⅜-in. chute-nail. These segments, or spiral chute-plates, are nailed between four upright posts of yellow pine, each 4 × 6 ins., and each plate joins the next one at the center of a post. No support is used for the inside edge of the plates. The surface of each plate is made to match that of the one below by a beveled joint, so made that the plate above rests on the one below.

The floor-space occupied by these chutes is very small, being only about 3 ft. square for each chute, and no difficulty occurred in finding space for them.

In the practical operation of this chute it was found that the pitch was not great enough for the smaller sizes of coal, and that the chutes would choke. This was remedied by taking the plates out, and nailing them in again in a tilted position, which gave them more pitch. Since this change, no difficulty has been experienced.

When the machinery was put into the west side of the breaker, from April to June, 1897, a new set of chutes was made, having a different pitch for each size of coal, as determined by the experience on the east side. Only the pitch was changed; all other dimensions were retained.

Between a jig and the place selected for its spiral to go down, a connecting-chute is made of these spiral plates by using alternately a right and left segment. They are nailed to a 12-in. plank that has been stiffened by a backing-piece, 6 ins. wide, set edgewise and spiked to its under side. These right and left plates form a zigzag chute, through which the coal passes without any acceleration. When the coal enters the spiral it at once crowds against the outside flange, and the pieces tend to arrange themselves in a tandem order, forming, particularly in the larger sizes, a continuous stream of single pieces of coal. When the speed increases above a certain amount, each piece leaves the bottom of the plate and runs against the outside flange, where it assumes a uniform speed which is regulated by the centrifugal force pressing it against the side and causing greater or less friction, according to the tendency of the piece to accelerate or retard.

In the pockets the spirals run to the lowest points desired, so that all the coal will be delivered into them without any drop or impact. They are made without any inside flange, and the action of the coal is to slide off the inside edge of the spiral at the immediate surface of the conical mass that is accumulating in the pocket, and to slide down and over its surface. No impact of any consequence occurs from the time the coal leaves the jig until it is at rest in the pocket, and the amount of chippings, therefore, is very small. It is fascinating to see the coal en route to the pockets. First it goes like a snake and then it takes a spin.

The lump coal chute, which begins at the bars over the crusher-rolls, makes a drop of 110 ft. in 78 ft. horizontal. This chute has two sections which are also constructed as spirals. It is shown, in elevation and detail, on Fig. 3, at the right or east side. The same want of data as to pitch, confronted us in the construction of this chute, as in the construction of those just described. It should be clearly understood that the pitch of a spiral does not follow the same law as that of a straight chute. Under these circumstances, and in the anxiety to avoid, particularly in this chute, the usual cannon-ball velocity, the same error was made as to the pitch, that was made in the others. The pitch proved to be not quite great enough. It has not yet been changed to a greater pitch, because lump-coal is not in demand, and, therefore, is not now made. There is no doubt, however, that it will work.

Results.

Foundations.—The foundations are carrying their respective loads without any settling. This is due to the fact that the intensities of pressure assumed to be safely carried by their various parts, are, in practice, within the limits consistent with the stability of the earth upon which they rest, and of the safe working-pressures for the stone and cement used.

Frame of Structure.—In the plane, the advantages gained by the use of the open-member, narrow-base construction, stayed with guy-lines, are briefly as follows:

1. The narrow-base avoids occupying valuable room wanted for other purposes, that would be fully occupied by any self-sustaining broad-base construction.

2. The guy-lines hold the top of the structure perfectly rigid, while in any self-sustaining structure the sway will increase with use.

3. The open members have all the advantages over the solid members, which have already been mentioned in the description of the frame. Prominent among them are:

(a) Greater rigidity of the frame.

(b) The commercial sizes of timber used are cheaper and always obtainable in emergency.

(c) They are more easily inspected.

(d) They will season better and dry out quicker after being wet, and therefore are less liable to rot.

(e) Each piece is easily removed and replaced in repairing.

(f) The open-work in the columns, ties, and cross-ties, and the use of braces acting in tension only, consumes generally about two-thirds of the lumber, for the same strength, that is required by the solid-member construction.

In the plane as constructed, about 127,000 ft. of lumber were used, 24,329 lbs. of bolts and washers, and 5,972 ft. of 1⅛, 1 3-16, and 1¼-in. guy lines.

The saving in lumber as compared with a broad-base self-sustaining structure, built after the same open-member system, is about 100,000 ft.; and, as compared with a broad-base solid member system, is about 200,000 ft. The value of this timber at $25 per thousand, erected, is $5,000. Against this must be charged the guy-lines and their connections (about $800), and the bolts and washers (about $550), or $1,350 in all, leaving as a net saving to the credit of the method used, $3,650, in the plane alone.

In the breaker a similar saving of about 250,000 ft. was effected, which, added to that saved in the plane, makes a total saved in the entire structure of 450,000 ft. of timber. The value of this 250,000 ft. at $30 per thousand, erected, is $7,500, against which must be charged 45,951 lbs. of bolts and washers (about $1,100), leaving, as a net saving, in the breaker, $6,400. This, added to the saving in the plane, gives as the total net saving in the entire structure, to the credit of the method used, $10,050.

The old breaker, which was a smaller structure, contained over 1,300,000 ft. B. M., and the new one just described contains about 900,000 ft., including the equivalent of the steel columns and exclusive of the trestles to the slate-banks.

The contract was awarded to S. D. Kingsley, of Olyphant, Pa., and the entire erection was performed without an accident of any kind. The number of skilled carpenters required was comparatively small. Instead of an army of skilled carpenters at work making mortises and tenons, only a few skilled men were required to direct the assembling of the pieces, to lay off their proper distances, and to mark the positions of the bolt-holes. All of the contractors bidding on the framing and erection were very wary, and even fearful that the structure would not stand up. In fact, some were very pronounced in their disapproval of it. But such views are not now entertained.

Machinery, Chutes and Connections.—All that will be necessary to give here as to the efficiency of the machinery, chutes and connections will be the approximate gain effected by making a greater percentage of the larger sizes of coal and a correspondingly smaller percentage of the smaller sizes. Compared with the old breaker, it is estimated that from 10,000 to 20,000 tons, on a yearly out-put of 300,000 tons, is transferred from pea, buckwheat and No 2 buckwheat to egg, stove and chestnut.

In this comparison it is also necessary to bear in mind that egg, stove and chestnut are the sizes that command the highest prices in the market, while pea, buckwheat and No. 2 buckwheat command the lowest, and lump, steamboat and broken the medium prices. The above gain is accomplished by the style of the rolls, the simplicity of the machinery, the absence of all elevators, and the avoidance, by the use of the spiral chutes, of any impact. The item of saving in labor in the cost of preparation should here be mentioned, as it also stands to the credit of the construction of the breaker, and of the efficiency of the machinery. In the old breaker, to prepare 1,150 tons per day, 194 men and boys, on an average, were required. In the new breaker, to prepare 2,000 or more tons per day, only 84 on an average are required. Mr. Pardee has recently made some important changes in his jig that will in all probability reduce the number of slate-pickers from 55 to not more than 25, and they will be employed only on coal that is not jigged. This will further reduce the total number of men required from 84 to 54.

As to the capacity of the breaker, it has been intimated, under the head of "Machinery," that more than 2,000 tons of merchantable coal could be prepared in a day of ten hours. All calculations and expectations in this direction have been more than realized, and it is now assured that 3,000 tons can be prepared instead of 2,000.

The tendency in the preparation of anthracite coal has been, in recent years, to complicate rather than simplify the process, particularly since the late Eckley B. Coxe read before the Institute his famous paper on the "Iron Breaker at Drifton," in which he described so many ingenious refinements in coal-preparing machinery. In the construction of the Cranberry breaker the greatest simplicity was aimed at, so as to avoid the frequent handling and consequent undue chipping of the coal, the costly repairs on complicated and expensive machinery, and, not least of all, to do the work of preparation with a far smaller number of men.

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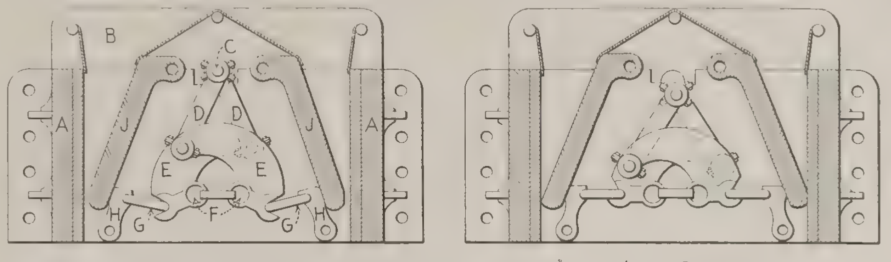
A DOUBLE-ACTING STONE CRUSHER.

In most crushing machines of the jaw or reciprocating type, the crushing is done by a single jaw, but the Preston crusher, which we illustrate herewith, is a double-acting machine, having two sets of jaws at opposite ends of the frame. A general view of the machine is given in Fig. 1, while Fig. 2 shows a sectional view with the jaws open.



Jaws Open. Jaws Closed.

FIG. 2.—LONGITUDINAL SECTION OF PRESTON DOUBLE-ACTING CRUSHER, WITH JAWS OPEN.

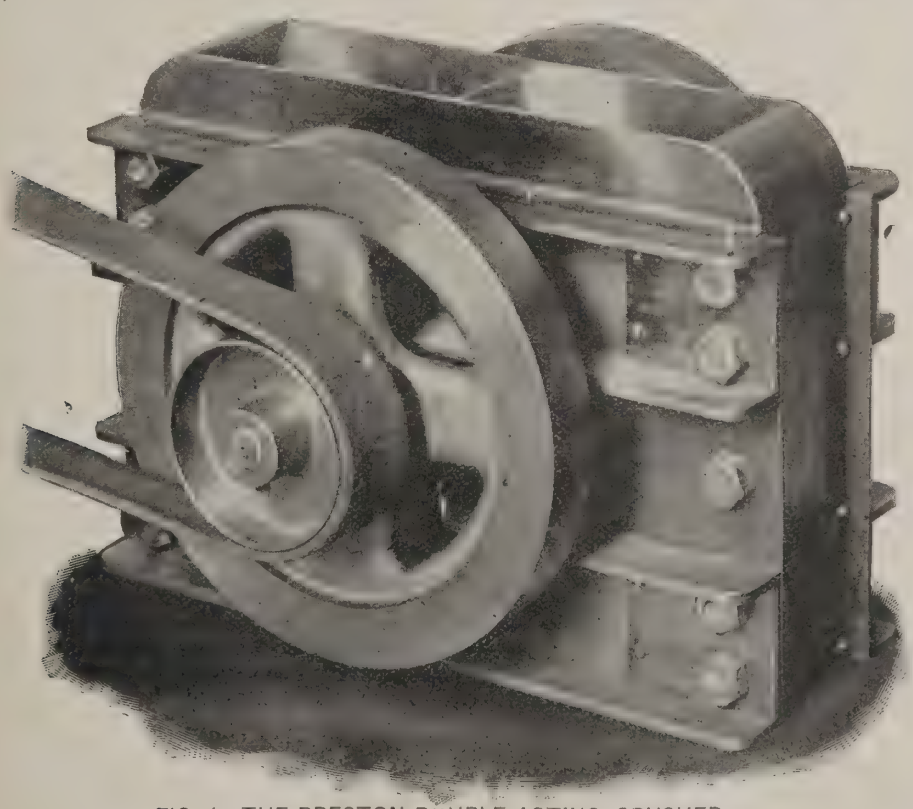


FIG. 1—THE PRESTON DOUBLE-ACTING CRUSHER.
J. C. McEvoy & Co., Beloit, Wis., Builders.

The cast-steel frames, A, are surmounted by a hopper, B, and the crankshaft, C, runs across the tops of the frames. This shaft carries two arms, D, D, to which are attched the levers, E, E, turning in fulcrums, F, F, which are journaled in the frames. In the ends of the levers are inserted the toggles, G, G, which, by means of the pivoted push-plates, H, H, operate the steel crushing jaws, J, J. Great crushing power is claimed for this combination of toggle, lever and crank, and the cranks are so arranged that one jaw is always one-sixth of a stroke ahead of the other.

Lightness and strength are obtained by the use of cast and forged steel for all parts except the two fly-wheels and the belt pulley. In order to fit the machine for transportation in difficult country, for mining and other purposes, it is built up in sections, no part weighing more than 400 lbs., and in case of wear or breakage new parts can easily be applied.

The machine is intended for work in mining districts and for crushing stone for ballasting, macadamizing and other purposes. It is also said to be equally effective for cement and emery works. It may be mounted on wrought-iron trucks if desired, so as to be readily portable. In a test made at the builders' works, a machine having two 12-in. jaws and driven by a 5-HP. motor, readily crushed what are termed "hard-heads" or "iron stone," 7 to 9 ins. diameter, to a 1-in. size, both jaws crushing at the same time.

This crusher was invented by Mr. F. L. Preston, of Beloit, Wis., and is being manufactured by J. C. McEvoy & Co., of Beloit, Wis., to whom we are indebted for blue prints and other information.

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A NEW APPLICATION OF THE POETSCH PROCESS, for shaft-sinking by freezing, is proposed for a deep shaft at Harchies, Belgium. The strata overlying the coal measures are 745 ft. deep. The first 170 ft. is made up of dry strata, of blue marl, etc., and the remaining 570 ft. is sand heavily charged with water; the trial borings giving rise to an artesian well discharging nearly 23,000 gallons per hour, and rising 16 ft. above the surface. The engineer proposes to form an ice-wall by freezing from the outside; but as the freezing tubes might be crushed flat and circulation prevented by the enormous pressure developed in the lower strata, he proposes to keep the central boring open down to the coal. The top would be closed and provided with a stand-pipe rising to a height equal to the hydrostatic head at the surface; then, any excess pressure due to increase of volume by freezing would be relieved by the surplus water flowing out at the surface. To prevent the freezing of the pipes in the upper dry strata, he would lead steam or hot water through a ½-in. pipe placed in the central boring and going down to the bottom of the marl deposit. In this method the amount of water flowing from the relief-pipe would be a good indicator of the progress of the freezing process.

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We give considerable space in this issue to a description of a coal breaker recently erected at Hazleton, Pa., which embodies some novel features in construction and in its arrangement of the machinery for handling the coal. The most notable is the use of guy lines for securing the structure against wind-strains instead of giving its posts a batter, according to the usual practice.

The use of guy lines as a permanent part of an engineering structure is of course not entirely novel; but in general they have been used only for such structures as tall standpipes, steel chimneys, derrick poles and similar high and slender objects. Their application to hold erect a timber framework, 50 to 150 ft. high, and only 24 ft. wide at the base, is, so far as we recall, unprecedented. We see no reason, however, why their use should not be entirely successful if the strains put upon them under various conditions of loading, tightening, temperature and wind pressure are all correctly determined and provided for. It may be pointed out, however, that such a construction would be much more appropriate with a wooden structure with its large elasticity than it would be with a steel structure, such as a standpipe for example, which is too stiff to accommodate itself to the variation in tension of the guy lines.

A guy rope, like the cable of a suspension bridge, is necessarily a flexible member, and is subject to vibrations, which are especially great when the wind is high. A wooden structure has elasticity enough to accommodate itself to the changes of stress which these vibrations produce. To put the matter in another way, a structure like the Cranberry Mine breaker is held erect against lateral forces, first by the bracing of its frame-work, and, second, by the guy lines. It is necessary that these two systems shall act in harmony, just as in the case of two different systems of bracing in a bridge truss. One reason for the lack of success in the use of guy ropes for stand-pipes may be that the stand-pipe is so stiff that it becomes crippled by wind pressure before the guy line takes its proper proportion of the stress.

The construction of a trunk railway line in Cuba, with branches to the coast, is suggested by Secretary of War Alger on the ground that it would afford employment to thousands who would otherwise be dependent upon charity. Aside from this, however, it is doubtless true that the improvement of the means of internal communication is the first and all-important step in the development of the island. Such an expenditure of public money for charity alone would hardly meet with popular approval; but it is very probable that such a railway would eventually prove a profitable enterprise if it were properly constructed and operated. Cuba now has about 1,100 miles of railway track, connecting Havana with the town of Pinar del Rio, on the west, and Santa Clara, or the port of Caibarien, on the east; but the whole eastern half of the island is without railways, excepting only a north and south line in the Province of Puerto Principe and the mineral roads in the vicinity of Santiago de Cuba. The distance between the latter city and Santa Clara is about 300 miles, and it is to the construction of a main line from Santa Clara eastward and its branches that Secretary Alger doubtless refers.

Cuba is approximately 800 miles long, and from 30 to 160 miles wide, and is thus topographically well adapted for the location of a trunk line which with its branches would provide means of access to the greater part of the island. Its common roads, though abundant upon Spanish maps, can hardly be depended on as feeders to a railway system. As one writer puts it—the art of road-making in Cuba is not a lost art, for the very good reason that it never existed; and the loose character of the soil, combined with a tropical rainfall, convert existing roads into almost impassable quagmires in the wet season, and covers them with thick dust in dry weather. Except in the vicinity of a few large towns there are no roads worthy of the name in Cuba; and this condition has been partly met on large plantations by the construction of light private railways leading to seaports or to stations on railways now in service. As highway construction is expensive in the island, these private railways will doubtless be increased in number for some time to come, as feeders to the main lines from agricultural centers. As a result of the notoriously inadequate transportation facilities under Spanish rule the development of the natural wealth of the country has been very slow, and not more than one-fourth of the island's surface has ever been under cultivation. Although valuable timber is abundant, the export of such timber has never exceeded $220,000 per year, and good timber land at any distance from a railway lately sold for less than one dollar per acre. The characteristics of previous rule in Cuba seem to have been an almost total neglect of local development and an almost prohibitive tax upon such industries as did exist under these conditions. As to the measure of this Spanish taxation, Mr. Wm. J. Clark, in his recent book "Commercial Cuba," tells us that while, in 1894, the total value of the agricultural products of the island was about $85,000,000, the total tax gathered in that year by the "Mother Country" was nearly $23,000,000.

With this tax incubus removed and modern and civilized methods substituted for the obsolete Spanish rule, the future commercial possibilities of Cuba can hardly be estimated. But the better sanitation of large towns and the improvement of ways of internal communication are the all-important first steps, whether undertaken directly by the government, or by private individuals under government control. The latter seems to us the better method; and it would provide equally well for the employment of the destitute. Capital is abundant in the United States and seeks just such investments as Cuba can offer; provided, that the government will insure stable conditions and will hasten, by all practicable means, the restoration of the island to peaceful conditions.

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An interesting legal controversy has arisen at St. Paul over the question whether a railway company is responsible for damages done by its trains to a structure crossing its tracks overhead, which is owned and maintained by the city and which was placed there after the railway tracks were built. The accident which gave rise to the controversy is described in our Correspondence department in this issue, and we think it is worth especial notice by engineers as an instructive lesson in the design of viaducts for crossing railway tracks. Derailments are always a possibility in the movement of cars and trains, especially in large yards where switches and frogs are numerous; and an engineer designing any structure to be placed above railway tracks should endeavor, if possible, to so place or so design its supports that they may be reasonably secure against knocking down by derailed cars. It may not always be possible to do this. At times it may be necessary to place slender pillars so close to tracks that a derailed car will be pretty sure to destroy them and bring down the structure which they support. In these days of cheap concrete construction, however, it is generally possible to provide a monolithic masonry support for the columns of sufficient height and weight to withstand the shock of any ordinary collision, and to do this at no large expense. Here, as everywhere, the matter of safety is really a matter of dollars and cents; and if an engineer can show that at a moderate outlay he can make a structure reasonably secure against the danger of knock-downs by derailed rolling stock, he will generally be instructed to do so.

This matter is of interest not only in connection with the removal of highway grade crossings by the erection of viaducts, but as a matter to be considered in the design of railway stations. There are many old-time "through" railway stations where the brick wall which forms the end of the station is supported on a series of slender brick piers between the tracks. Such a structure may stand unharmed for a century; but whenever a derailed car does come along and strike one of these piers, the whole wall is bound to collapse.

◆

The paper on "The Softening of Water by the Archbutt-Deeley Process," which we publish elsewhere in this issue, contains one of the best expositions we have seen of the chemical theory of removing scale forming ingredients from water. It also describes a new process of water-softening which seems to have a considerable advantage over the old Clark process, and which has met with much success in practice in several installations in England. We believe it would be worth while for large steam users in the country to investigate the merits of this process, with a view to substituting it for the "boiler compounds" they have been in the habit of using.

THE NEED OF IMPROVED METHODS FOR EXTINGUISHING FIRE IN HIGH BUILDINGS.

The need of improved methods and apparatus for fighting fires in tall buildings has received a very timely illustration in the partial burning of the 16-story Home Life Insurance Building, in New York city, on Dec. 4 (Eng. News, Dec. 8, 1898). This structure, taking it as a whole, was a good example of modern tall building construction in all the conditions with which firemen may expect to have to deal in fighting fires in such buildings. The amount of combustible contents was probably as small as it can be expected to be in buildings devoted to business purposes. The amount of inflammable wood-work could certainly have been less, but it was no more than is found in most similar buildings. The interior fireproofing acted almost perfectly in preventing the spread of flames from story to story. Indeed, the only broad feature of the fireproof construction which was essentially faulty was the lack of protection against the entrance of the flames from an exposure fire. Notwithstanding all this, it was found impossible, even with the excellent modern apparatus of the New York Fire Department, to combat the flames successfully above the eighth story, and when the fire had once become established above this level it had to be left to burn itself out.

Reasoning inferentially, this practically amounts to saying that the majority of modern tall buildings must be left to their destruction above the tenth floor when once a fire has obtained headway

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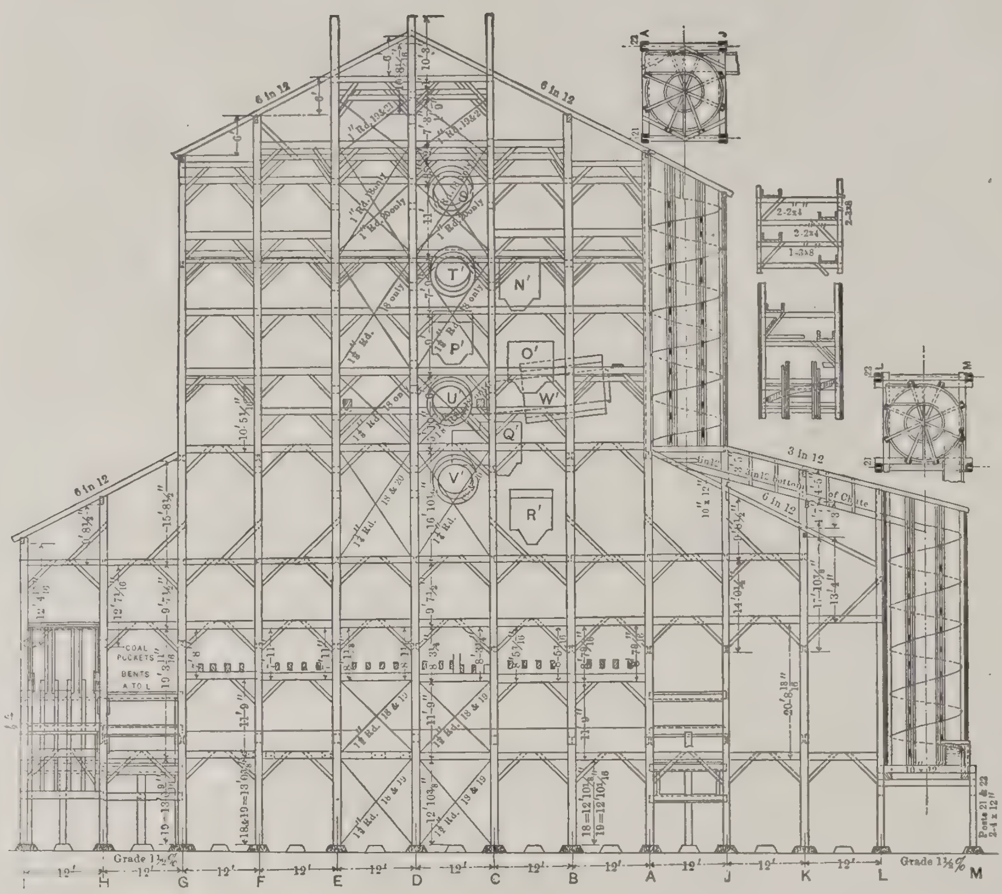
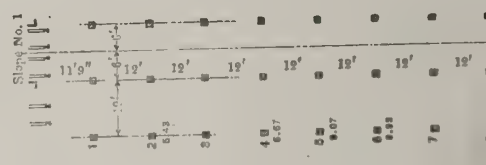


FIG. 3. CROSS-SECTION AT BENT NO. 18.

EXPLANATION

- N', 4-BROKEN COAL JIGS
- O', 4-EGG " "
- P', 4-STOVE " "
- Q', 4-CHEST. " "
- R', 2-PEA " "
- S', 4-STEAMBOAT AND BROKEN SCREENS
- T', 4-EGG AND STOVE SCREENS
- U', 4-CHEST. AND PEA SCREENS
- V', 4-BUCK. AND NO. 2 BUCK. SCREENS
- W', 2-EGG, STOVE, CHEST. AND PEA SCREENS



NOTE:
Figures under posts are the tons borne by each post.
Those marked "P" are the loads from Coal Pockets o

ANTHRACITE COAL BREAKER AT THE CRANBERRY MINE, HAZLETON, PA.

W. S. Ayres, M. Am. Inst., M. E.,
Chief Engineer.

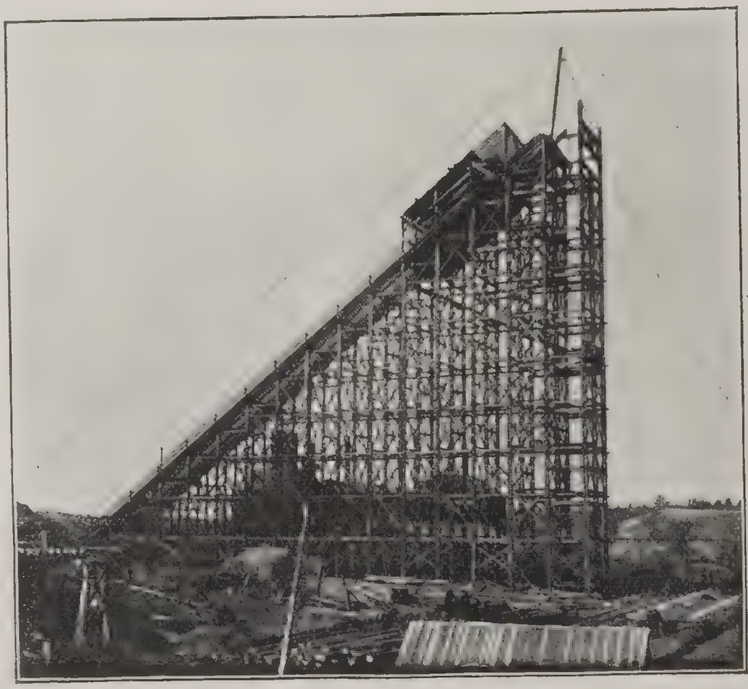
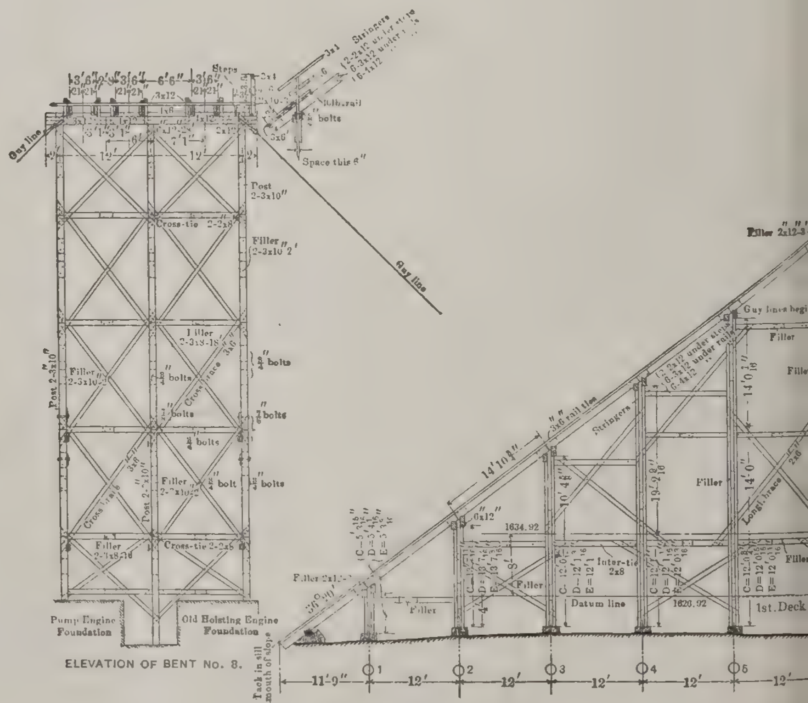
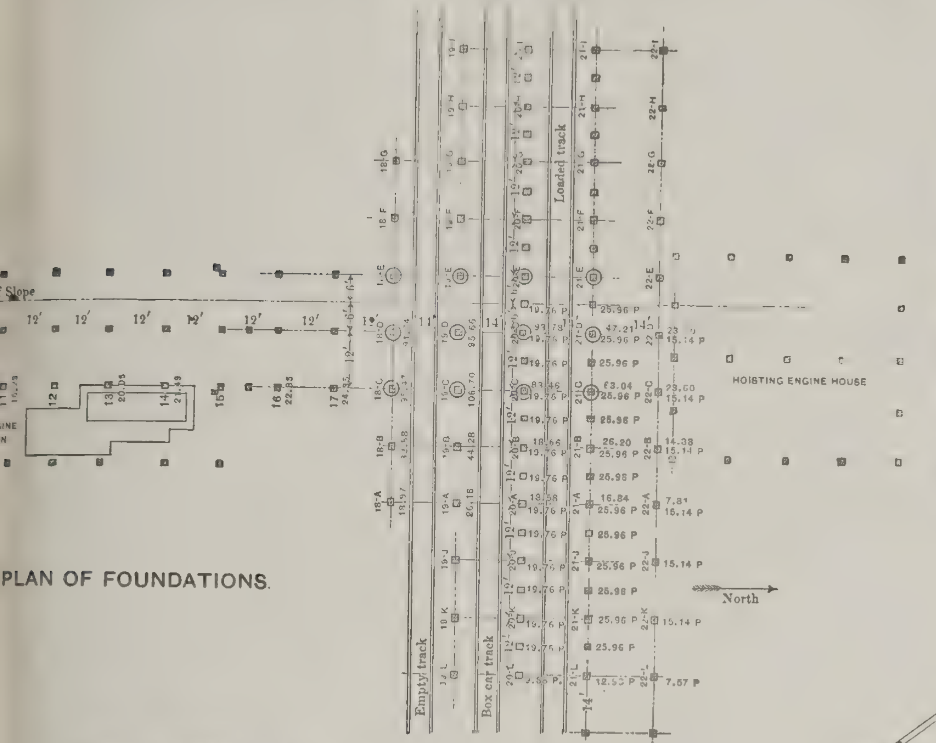


FIG. 4. BREAKER IN PROCESS OF ERECTION.



ELEVATION OF BENT No. 8.



PLAN OF FOUNDATIONS.

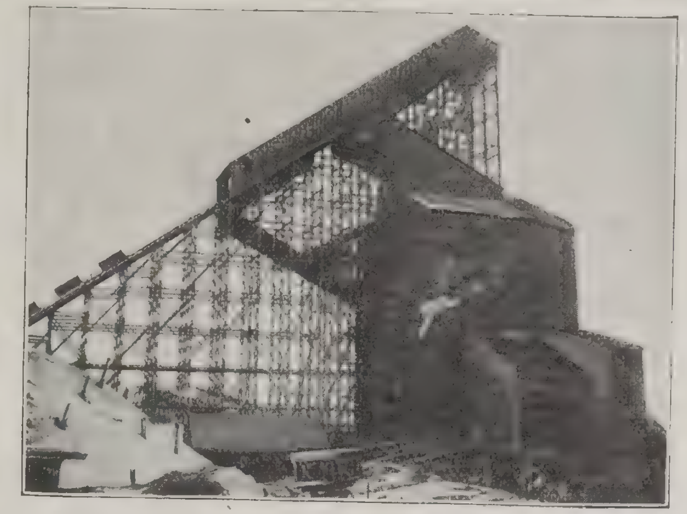


FIG. 5. VIEW OF COMPLETED BREAKER.

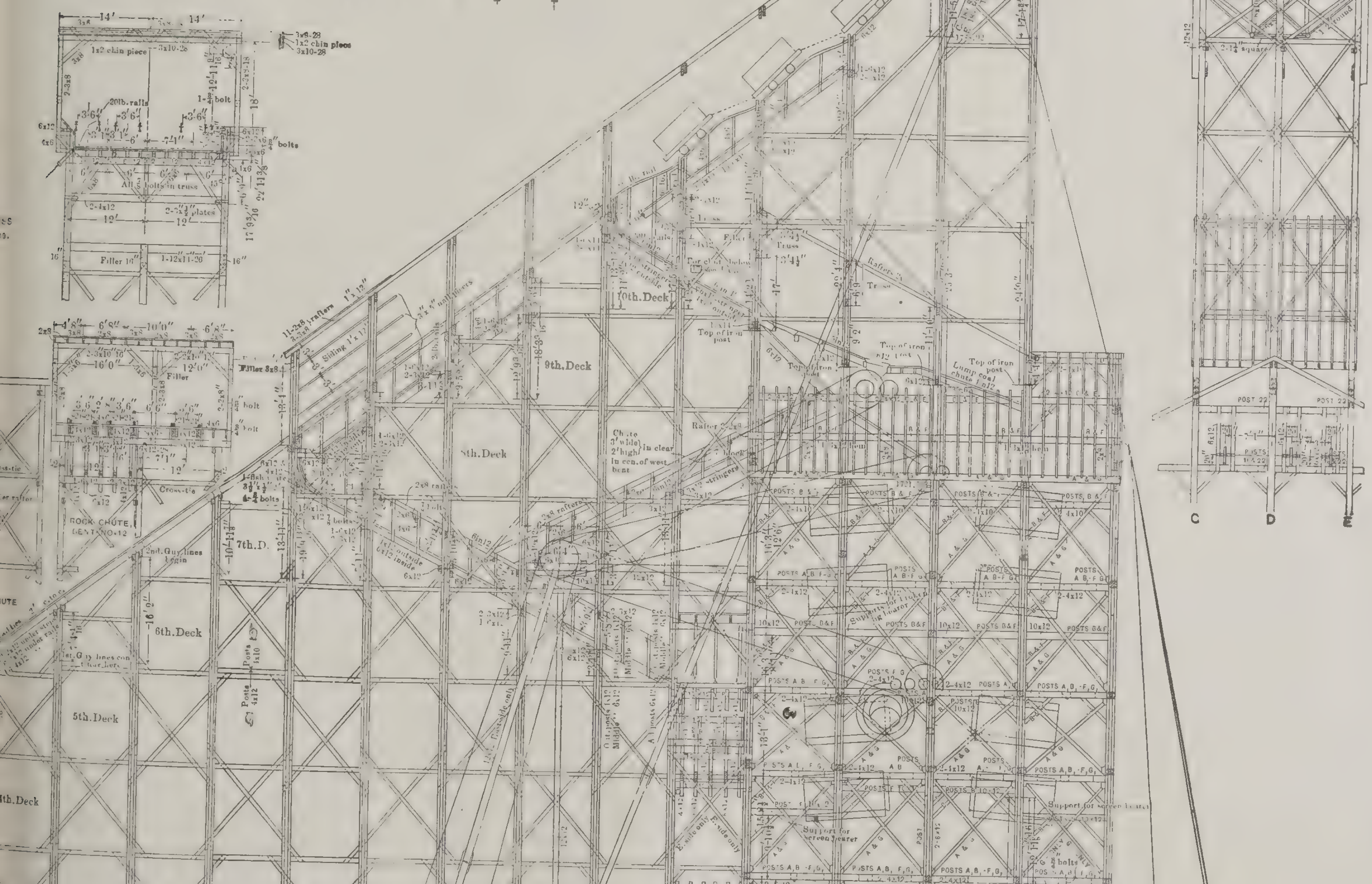


FIG. 2. GENERAL ELEVATION.

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there. That there is good cause on this account to be dissatisfied with fireproof construction for such buildings, however, no one who studies the facts will believe. Indeed, in this building, and wherever fireproof buildings have been subjected to fire, there has been every reason for the owners to congratulate themselves that their buildings were well fireproofed. The thing which is clearly proven by the Home Insurance Building fire is that the tall building has introduced conditions in the fighting of fires which require improved devices to meet them. It is this phase of fire protection particularly which will be considered here.

The difficulty of fighting fire in a tall building is due to the fact that it is tall, and to nothing else. At over 125 ft. above the street modern fire apparatus is not and cannot be made efficient in fighting fire from the street level. For high buildings, therefore, it must be supplemented by devices for getting water and firemen above this level, as high in some cases as 300 ft. above the street. (There are five buildings in New York city, the "Syndicate," "St. Paul," "American Tract," "American Surety," and "Commercial Cable," which are 309 ft., 308 ft., 306 ft., 306 ft., and 304 ft. high, respectively.) Not only is it necessary to get water in ample quantities and with high pressures to the tops of these buildings, but there must also be means provided for getting firemen with their hose and other paraphernalia to the same points.

For transporting the firemen and their apparatus the stairways and elevators must serve as else. At over 125 ft. above the street modern and their goods under ordinary circumstances. They must operate, however, under far different conditions than they do ordinarily, and should be designed with that fact in mind. Consider first the common staircase as the means of access to the upper floors where a fire is raging. A 50-ft. section of ordinary 2½-in. cotton hose weighs from 56 to 60 lbs., and 250 ft. of 1¼-in. rope weighs 65 lbs. The carrying of either of these loads from story to story is a task which attains pretty serious proportions at any time, and which may, under certain conditions of inconveniently arranged stairways, or obstructions from smoke, become practically impossible, even with a fire of no very great proportions.

That this is not a merely theoretical criticism, a review of the role played by the stairways in some of the recent office building fires in New York city will indicate. In the comparatively insignificant blaze which occurred in the Vanderbilt Building on Feb. 11 of the present year (Eng. News, Feb. 17, 1898), the firemen were overcome by smoke and exhaustion several times in getting the hose from the street to the eleventh floor by the way of the staircase. Neither this stairway nor the adjacent elevator shaft were touched by the flames, and the only obstacles which the firemen had to overcome in surmounting the stairs were their crookedness and the presence of smoke. Again, in the case of the burning of the Temple Court and the Manhattan Savings Bank buildings, the slate treads of the stairways yielded to the heat, leaving the staircase with openings the full size of the tread, which made them impassable. Marble and bluestone, which are also continually used for stair treads, have proved equally insecure when attacked by fire and water. So little confidence, indeed, is felt in such stone treads that a well-known authority on fireproof construction has recently expressed the opinion that the staircase construction in 90 per cent. of our great office buildings would prove utterly unreliable for the use of firemen in the event of a fire of serious proportions.

These are serious considerations, especially as there is no good reason for a construction which is so insecure. The fault is due entirely to the prevalent construction, which is simply to let the stone tread into iron rabbit frames, with no support underneath them. To make the construction safe would require only that an iron plate, of openwork or gridiron pattern if desired, be placed underneath the stone tread and firmly fastened to the frame. Then if the stone broke or crumbled away there would still remain the iron plate, which would afford a safe support for the foot. Obviously also the staircase could be made entirely of metal, as is, indeed, sometimes done. By the exercise of a little taste the architectural aspect of the staircase would not suffer much by such a construction, and where the stairs are used so little as they are in high buildings, the greater insecurity of foothold afforded by cast-iron treads would not cut a very important figure. The metal construction would, if anything, be less expensive, and it certainly would be a great deal more reliable than the ordinary iron frame with unsupported stone treads.

But when it comes to providing access to the upper floors of a tall building, a stairway is about as crude a method for firemen and hose as it is for handling the freight and tenants under ordinary conditions. For this reason safety requires that all high buildings should have constantly present, day and night, some competent person understanding the elevator machinery, fire appliances, etc., who can aid the firemen in reaching the upper levels, and there should be sufficient steam in the boilers at all times to run one elevator. It was the lack of such precautions in the Vanderbilt Building which necessitated the hose being carried up the ten flights of stairs to the floor which was burning, with the difficulties and dangers to the firemen which have been previously enumerated. In the Home Insurance Building fire the one elevator which was running was used to great advantage until the progress of the fire in the upper stories rendered it inoperative. These two instances illustrate clearly the advantages of having elevator service available in the event of a fire, and also indicate the weakness of this service. These are so apparent, indeed, that it leads one to question seriously whether it might not be justifiable to provide in tall buildings one elevator completely inclosed in a fireproof shaft with solid doors which would be used only for freight service and in the case of fire. To ask that the regular passenger elevators should be inclosed is, perhaps, requiring too great a sacrifice of appearance and comfort on the part of the owners and occupants of tall buildings, but something might possibly be done even here to improve the present conditions if the matter were gone at in earnest.

The foregoing questions are, however, of secondary importance to the question of providing an ample water supply under efficient fire pressure on the upper stories of tall buildings. In all but a few such structures it is only fair to say that an attempt is made to do this. Generally it falls far short of its possible success, however, because of the failure to comprehend the full magnitude and character of the conditions to be met. The apparatus provided is too small for its purpose, and this is true not only of the roof tank supply and the interior pipe system and fire pumps, but also of the stand-pipes for the fire department. The full importance of these latter devices in fighting fire high above the ground seems to be very often overlooked. In many buildings they are not supplied at all, and in many others they are entirely inadequate for efficient fire service.

As indicating the importance of such stand-pipes, Fire Marshal D. J. Swenie, of Chicago, who has made a special study of fighting fire in high buildings, urges that they should not be less than 6 ins. in diameter; should have Siamese connections at the street for the fire department; should be provided with check valves, so that when the steamers are attached their force will be added to that of the building's pumps, and that there should be hydrants on each floor and on the roof. Finally, he urges that each floor should have hose connections with the stand-pipe, and sufficient hose to reach the most remote point of the floor above.

The providing of sufficient power to supply the stand-pipe with an ample amount of water under fire pressure, which is included in these requirements, is deserving of particular stress. It requires no small pumping capacity to keep up efficient nozzle pressure on a few of the upper floors alone of a 16 to 25-story building, and a special fire-pump for this service alone, which may not be called into use once in a decade, seems to owners a useless burden. The result is that the pump for the water supply is very often made to serve as a fire-pump as well, and is more than likely to be entirely inefficient to meet the demands when the crucial test of fire comes. A very obvious partial remedy, at least, which occurs to one in buildings where there is hydraulic elevator service, is to have the elevator pumps so arranged that they can be thrown onto the fire service in case of emergency. The provision described for bringing into service the aid of the fire engines is too obviously wise to need much urging. In the case of the building pumps becoming inoperative by the flooding of the basement or by some disabling accident, these fire engine connections afford the only means for getting water to the upper floors.

There is much reason also to urge that the control of the stand-pipe service should be placed entirely in the hands of the fire department in the event of fire, and be subject to the inspection and approval of this department at all times. This would enable the fire department to utilize the stand-pipes in extinguishing neighboring fires, as well as to protect the building in which it belongs. So evident are the benefits to be gained by such a system, in rapidity of getting the hose into service, in the directness and accuracy with which the water can be applied, and in the shelter afforded to the firemen, that the fire insurance interests would be warranted in insisting upon the general adoption of this requirement.

So far we have spoken only of increasing the efficiency of devices already in somewhat common use. There are many competent authorities on fire protection, however, who urge that a still longer step in advance is necessary, and that in all important cities the business section at least should have an auxiliary water supply system for fire protection only. In a recent report to his department, Fire Chief Bonner, of New York, angues in favor of such a system as follows:

> We must realize the fact that the capacity of land engines to force water to great heights has been reached. When greater power is required to force water to meet conflagration, and to great heights, it must be obtained from other sources than the steam fire engines now in use, and there is no system that could better be recommended than the one under sonsideration. There are high buildings in New York that are entirely beyond the ability of the machinery of the Fire Department to force water to the upper stories. It must also be considered that the tall buildings of the present day, as well as the mercantile buildings, are of greater height and cover larger areas than ever before, and that fires will entail great loss if not promptly checked. If the department is not able to control the fire and surround the structures with large quantities of water, there is a possibility that such fires will extend and become great conflagrations. This source of danger can be obviated by adding an auxiliary plant for the use of the department in the form of the underground pipe line, connected to a roof line system, as well as an aerial line, which should connect to all of the tall buildings. This should be fed from the underground system, and also from our city mains, with the aid of auxiliary pumps—electric or steam—located at different points in the city. By the use of the auxiliary pump water could then be forced to the topmost story of any building, no matter how high, as well as to the circuit on the roof line, and would render positive protection against any extensive fire in that section of the city.

Experience with auxiliary pipe systems of this character is not lacking, for the cities of Milwaukee, Detroit, Cleveland, Buffalo and Boston have already adopted them on somewhat limited scales with entire success. It is reasonable to believe, indeed, that where a plentiful supply of fresh water is available, as is the case in the Great Lake cities, such a system of pipes, into which water can be forced by powerful fire boats or from special high-power pumping stations, affords an almost ideal water supply for fighting fires. Where salt water has to be used, as would be the case in New York and other seacoast cities, the matter assumes greater difficulty. Here the danger of destruction to the pipes by corrosion, and the rusting tight of connections, valves and fittings by the salt water may constitute a serious objection, and before the adoption of an auxiliary pipe system at a great expense, this objection will need to be thoroughly investigated.

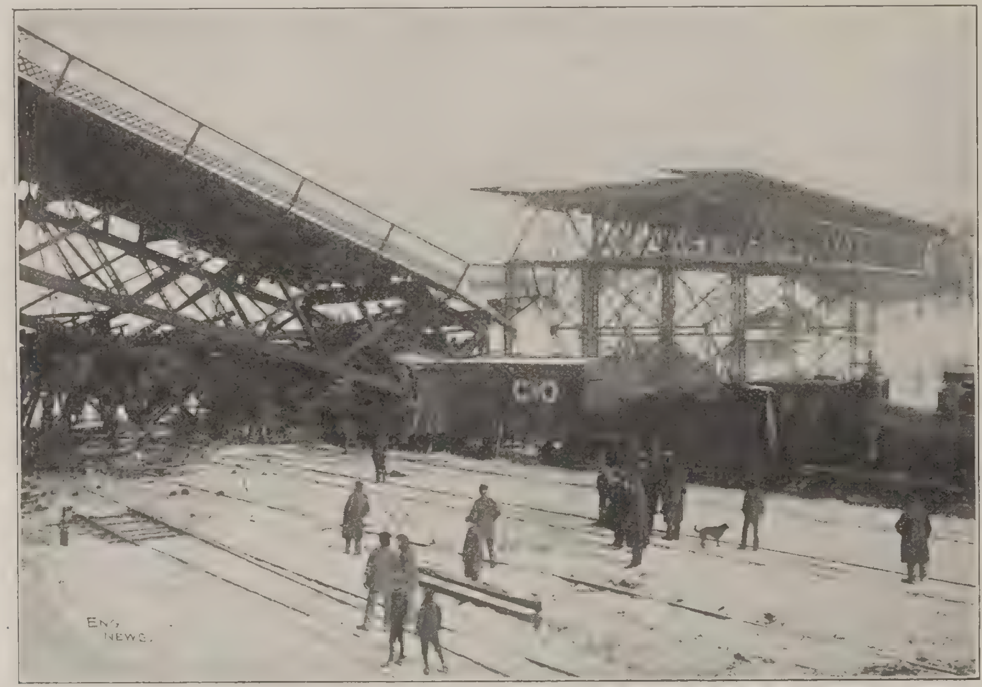
It has been possible in the foregoing to touch briefly upon only a few of the more salient features of the problem of fighting fires in tall buildings. Enough has been said, however, to show that it is a problem which is worthy of careful study by engineers, architects and underwriters. It is also apparent that the erection of a steel framework and covering it with clay tile, concrete, etc., does not create complete protection from damage by fire to the building and its contents, as the non-technical public is too apt to assume.

LETTERS TO THE EDITOR.

Technical Education of Railway Employees.

Sir: I desire to say that I have been requested to prepare a report for the next meeting of the International Railway Congress, to meet in Paris in 1900, on technical education of railway servants, the official wording being as follows:

> Question XXXLV.—Technical Education of Railway Servants; Appointment and Promotion. (A) Attempts made by railway administrations to promote the technical education of their staff. Special schools for the technical staff. Primary schools for the children of railway employees and workmen. (B) Methods of testing the knowledge of railway servants. Appointment and promotion.



WRECK OF THE SIXTH ST. VIADUCT OVER YARDS OF ST. PAUL & DULUTH R. R., ST. PAUL, MINN., DEC. 7, 1898.

(From Photograph taken half-an-hour after the Accident, showing Fallen 100-ft. Span and the Train which Caused the Accident.)

I desire, therefore, to ask any one conversant with the subject to transmit to me as soon as possible full information as to any course of instruction that they may be familiar with, and I shall take great pleasure in acknowledging receipt of the same. As some extended correspondence may be necessary, it is desirable that I have the first information in the immediate future. A reporter on this question has been appointed from each of the European countries, the one from Switzerland being the General Manager of the St. Gothard, and the one from England being Mr. George Gibbs, General Manager of the Northeastern Ry. I presume it would be the desire of all Americans interested in this subject that our report should be as complete as possible.

Very truly yours,

Geo. B. Leighton.

Los Angeles Terminal Ry., 712 Rialto Bldg., St. Louis, Mo., Dec. 13, 1898.

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Relating to Mr. Garrels' Pamphlet on "Experiences with an Internal Combustion Motor."

Sir: My good opinion of the Engineering News, to which I have subscribed for a number of years, has caused me to take the trouble to answer a criticism, to which my attention has been called, concerning myself, that appeared in your Supplement of Dec. 8, p. 182. As I believe you do not intend to treat me unfairly, your sense of justice will no doubt cause you to give my reply as prominent a place in your paper as you gave the criticism. My critic thinks we should have taken the matter into court. Permit me to remind him that before doing this it is desirable to have as much relevant information as one can get, and to point out to him that this was my purpose in gathering information concerning this engine, a proceeding which impressed him as being extraordinary. Permit me to say further that it was upon information carefully gathered that we based our opinion that it would be a useless expenditure of time and money to take the matter into court. The writer is under the impression that these facts are brought out in the pamphlet. The uselessness of sueing is surely clearly shown. In the writer's humble opinion the pamphlet is interesting not merely with respect to internal combustion motors, but because it describes the peculiar business methods of certain firms, and this opinion has been confirmed, not only by the large number of letters received inquiring for copies, but by the statements of some men of recognized ability, some of them engineers financially interested in internal combustion motors. My critic's doubt as to the libelous nature of the pamphlet does not agree with the opinion of my attorney. Does the former expect to raise my opinion of technical papers by such a criticism?

Respectfully,

W. L. Garrels.

Franklin Bank Building, St. Louis, Mo., Dec. 14, 1898.

(If any of our readers are further interested in the subject matter of Mr. Garrels' pamphlet we have no doubt he will send copies on application. —Ed.)

Wreck of a Viaduct Over Railway Tracks at St. Paul, Minn.

Sir: I send you herewith photographs of an accident which occurred in this city on Dec. 7. A freight train coming into the yard of the St. Paul & Duluth R. R., at 10:30 a. m., passed a stub switch. The switch was set for the right-hand track, and the engine, one freight car and the forward trucks of the second car passed safely. The switch then turned back, owing to a break in the crank of the switch rod at the stand, and the rear truck of the second car and the balance of the train, some 17 loaded cars, took the left-hand track. The two tracks continue parallel for some distance, and 700 ft. from the switch there stood between the tracks a steel bent supporting a viaduct which carried a street over the railway yards. The viaduct was 60 ft. wide, and the spans whose ends rested upon this bent, were, respectively, 80 ft. and 100 ft. long. The car with its forward trucks on one track and rear trucks on the parellel track struck this bent and knocked it down, and the two spans fell as shown. Luckily but one man was on the wrecked portion of the bridge, and he is in a fair way to recover. The damage to the train was confined to the first and second cars of the train. The principal damage therefore is to the bridge. To rebuild the two wrecked spans would cost about $12,000.

The railway company at this date has claimed that it is not to be held responsible for the accident. The city condemned the street across its right of way and built the bridge at its own risk. The city claim that the railway company so operated its trains and arranged the tracks that it caused the wreck, and therefore it is bound to replace the bridge. At present, the matter stand in this shape, and it is probable that neither city nor railway company will pay for renewing the structure until the courts have passed upon the matter.

Yours truly,

Geo. L. Wilson, Asst. City Engr.

St. Paul, Minn., Dec. 12, 1898.

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Estimating Cost of Rock Excavation.

Sir: The estimated cost per cubic yard of excavating rock in a cut, tunnel or shaft is a problem continually presenting itself to engineers. In my own experience this cost varies from less than $1 to $18 per cu. yd. The usual method of getting at the cost is to divide the work under the heads of labor, explosives and tools, and to subdivide these items as may be considered desirable. But while this method will do very well for work performed, it does not apply to work yet to be done; and in the latter case the correctness of the result depends largely upon the experience of intuition of the engineer. Under these conditions the following method of estimating cost is suggested:

To drill and blast a boulder containing one cubic yard will cost not far from 60 cts., and I have assumed this cost as one unit in the calculation. But as the rock to be handled is not always in the form of boulders, but occurs as ledge, or cutting to grades and lines, more or less exactly, the cost is increased by another factor. It occurred to me that working to line in a rock cut was somewhat similar to dressing a stone in a quarry; and as the cost of cutting rough beds on stone was about 20 cts. per square foot, I adopted this as the other factor, and thus evolved the following rule:

To the volume of rock to be removed, calculated as common open quarrying at, say, 60 cts. per cu. yd., add the number of square feet of surface in the bottom and sides of the proposed cut, figured at 20 cts. per sq. ft. This sum divided by the number of cubic yards in the mass will give the probable cost per cubic yard. For tunnels multiply the resulting yard price by two; and for shafts, by three.

A few examples will show how this rule works: Ex. 1.—A rock cut 108 ft. wide by 25 ft. deep measures 100 cu. yds. per lin. ft. of cut; and it has 158 sq. ft. of working surface for the same length unit. These two factors multiplied by 60 cts. and 20 cts., respectively, give $91.60, or 91.6 cts. per cu. yd. Ex. 2.—A rock cut 108 ft. wide and 1 ft. deep measures 4 cu. yds. per lin. ft. of cut, and has 110 sq. ft. of working surface. Calculating again at 60 and 20 cts., we have $22.40, or $6.06 per cu.yd. From the second example we will see that if a mistake is made in leaving the grade 6 ins. too high, it will cost $11.50 per cu. yd. to cut it down this 6 ins., as a separate operation.

As tested by experience the factor prices of 60 and 20 cts. come very near the actual cost in many cases. And contrary to the usual assumption, the hardness of the rock does not vary the result very materially; and it would seem that the dimensions of the cut have much more to do with the cost of excavation than the quality of the rock. I simply suggest this rough rule that it may be further tested by engineers.

Very truly,

John F. Ward.

New York, Dec. 19, 1898.

◆

More Light on the Morgan Bill for the Purchase of the Maritime Canal Company's Concession.

Sir: I have read with great interest your admirable editorial on the Morgan bill, and ask space to make a few comments on the bill and on the Maritime Canal Company. The Morgan bill provides for a board of eleven directors, one of whom shall be appointed by Costa Rica, one by Nicaragua and nine by the President of the United States.

Article X. of the Concession from Nicaragua provides as follows:

> Its board of directors shall be composed of persons, one-half at least of whom shall be chosen from the promoters who may yet preserve their quality as such.

Article XI. reads:

> The Government of Nicaragua shall have the perpetual right of naming one director, who shall be an integral part of the board of directors of the company.

Article X. of the Concession from Costa Rica confirms the same right to Costa Rica. Under the terms of these concessions at least six of the eleven members of the board must be selected by the President of the United States from among the original promoters of the scheme, thus putting the organization of the board into the hands of the old Maritime Canal Co. The bill seems to have been drawn all the way through with this in view. It provides that "the canal *may* be constructed under the supervision of the Engineer Department of the United States Army if the President of the United States shall so direct" (italics mine). "Otherwise the board of directors shall appoint all the engineers in the service of the company."

Why not make it mandatory that the work shall be done under the direction of the Corps of Engineers of the U. S. Army? Are the people of this country willing to turn over to the Maritime Canal Co. $100,000,000 to $150,000,000 to be expended as they see fit? Especially when their annual reports show that they have issued stock and bonds to the amount of $23,471,500, and only claim to have expended from $4,000,000 to $5,000,000.

Under the terms of the bill, the company may default in the interest every year until the maturity of the bonds in 1926, and no steps can be taken to enforce the collection. The lien of the United States on the work cannot be enforced until the maturity of the bonds.

The act also provides that if default is made in the payment of the principal, the United States may take possession, and "thereupon the full and complete title to all such property, rights, privileges, easements, or franchises shall vest absolutely in the United States." This is clearly contrary to Article VIII. of the Concession, which prohibits the transfer to any government. This is not an evasion, but a clear violation of the terms of the Concession.

If the new Maritime Canal Company is to be made up from persons connected with the old one, it behooves the government and the people to examine into their business methods in the past.

We find here a company attempting to carry out one of the largest engineering enterprises of modern times, without ever having had an engineer in their employ. Mr. A. G. Menocal was the chief engineer of the Construction Company; his reports are addressed to them, as is also the report of the Bogart board.

In his statement before the Congressional Committee Mr. Menocal states that he never saw the contract which was said to exist between the Maritime Company and the Construction Company, and yet he was carrying out the work under that contract. The Maritime Company are said to have paid the Construction Company from time to time for work done. How did the Maritime Company verify these accounts? They had no representative or engineer at Greytown. Or were they simply a bureau to charge up whatever the Construction Company presented, and then ask the Government of the United States to take these accounts off their hands for a lump sum ranging from $11,000,000 to $5,000,000, the amount depending on the length of time the Concession still has to run?

Before making any such purchase it behooves the government to untie the bag and view the pig.

The Government of Nicaragua have repeatedly stated that they would prefer to negotiate directly with the Government of the United States, and have the canal built directly as a government work. If this were done and the work were put under the control of the Corps of Engineers of the U. S. Army, there is no doubt but the canal would be well built and there would be no scandal connected with it.

Subscriber.

Dec. 19, 1898.

◆

Some Observations on a United States Transport.

Sir: Apropos of the recent criticism of the War Department, and with special reference to transport ships, the writer was, up to a few weeks ago, in a position particularly favorable for close observation of many of these vessels; a statement of some of the facts of special moment might therefore be of interest to the engineering public. Concerning the chartered vessels much might be said, but it is not intended to consider them here, since their position was peculiar and the "Charter Parties" weak.

It is to six vessels purchased from a Transatlantic steamship company that attention is invited, taking one of these ships in particular as a fair representative of all. It is thought perfectly fair to consider that all of these ships were in very nearly the same condition at the time of their acquisition by the War Department, as all were about the same age and had done about the same amount of work in the Transatlantic trade. All apparently had received about the same amount of attention with respect to maintenance. At the beginning of the peace negotiations between the United States and Spain, one of these six ships was taken out of service and sent to a well-known shipyard for repairs and permanent refitting as a transport, and it was while acting as resident inspector of this refitting that the writer became acquainted with the exact condition of this ship by close personal examination.

It is a modern, twin-screw, steel steamship, 445 ft. long by 49 ft. beam and 39 ft. deep; draft on load water line 26½ ft.; six athwartship bulkheads and double bottom throughout. She has two single and two double-end Scotch boilers and two triple expansion engines of the fore-and-aft type—that is, three cylinders, each working on its own crank. The piston rods of the intermediate and low pressure engines extend up through the cylinder head, and these tail-rods were the most noticeable objects to one entering the engine room. They were so badly cut and fluted that it is hard to see how the ship had run at all, so difficult it must have been to keep any packing in the stuffing boxes. On close examination, nearly all the piston rods and valve stems were found in a varying degree in the same condition, and all had to be turned down to permit the stuffing boxes being packed with metallic packing. This turning down was considerable; one rod, for instance, was reduced in diameter from 4 to 3½ ins.

The valves of the high pressure engines are of the piston type, the others being slide valves. These piston valves were found on removal to be rusted on their faces, showing that the steam had blown freely around them for a long time, and the slide valves were very badly cut in grooves and furrows over ⅛-in. in depth. Another noticeable feature which was an index to the apparent character of the previous maintenance of the ship was the condition of the bearings of the valve gear rock shafts on each engine. These bearings contained an upper and a lower brass, which, in the course of time, had worn away until the bearing was "brass bound"; instead of relining these brasses or properly taking up further wear, a wooden stick had been driven in between the shaft and the upper brass of each bearing. To all appearances these bearings had been in this condition for many months.

Among the auxiliaries the condition of things was very bad. The boiler feed pumps were unfit for any use and the water piston of the principal pump was so much smaller than its cylinder that a large pocket-knife blade could be run all around between it and the sides of the cylinder. In the boiler room probably a little more attention had been given to proper maintenance, as the boilers had been kept fairly clean inside; but some of the boiler mountings, such as drain valves, and some of the stop valves, were so badly corroded that they could be neither opened nor closed without destroying them. Connecting the bilges of the various compartments are gates or sluices in the bulkheads at each side of the ship worked by rods running up to the spar deck. Connected to each of these bilges is a hand pump. Neither the sluices nor the pumps were in working condition, and, to all appearances, no attempt had ever been made to keep them in order.

The tanks in the double bottom, with the exception of the engine tank-head, evidently had not been cleaned for a long time, and probably never. The manhole covers had certainly not been removed within a year. Beneath the ceiling the lower holds were foul with decaying grain, the odor of which filled the lower decks and hold of the ship. This is a ship that for five years previous to last July had carried first-class passengers between New York and London, and then made a trip to Porto Rico, thence to Santiago de Cuba, thence to New York and thence for repairs. While on the voyage to the West Indies the former crew remained with the vessel, and it is reasonable to consider that the vessel did not get into such deplorable condition on the last short voyage.

It is not the intention of the writer to find fault with the War Department for purchasing and operating ships in this condition, because these were practically the only ones available that were at all suitable for the purpose for which they were required, and the urgent necessity therefore was a sufficient excuse. But is there any justification for the management of a Transatlantic steamship company, carrying passengers as well as valuable cargoes, cutting its operating expenses to a point where the engineering department of the company is unable to make a better showing than in the case of the ships referred to above? Is it not remarkable that there are not more "Mohegans" lost at sea?

Yours truly,

Eugene Betts.

New York, Dec. 14, 1898.

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A Question in Engineering Ethics.

Sir: I enclose a slip cut from a daily paper published in a neighboring town in this state (Indiana), giving a statement of the business transacted in regular Council meeting. The item speaks for itself, but it may be well enough to call attention to the fact that the company in question publishes a journal ostensibly in the interest of engineers and depends for its support upon the advertisements of this same body of men. Of late several items have been published in the journal upon the ethics of engineering, and some of the experts referred to have been very much exercised over the low standard of ethics in the engineering profession. No further comment is necessary.

Yours,

Oct. 28, 1898. E. A. P.

The clipping enclosed is as follows:

> The Municipal Engineering Co., of Indianapolis, made a proposition to the council through their special representative, Mr. Charles G. Lohman. This proposal embodied the retaining of the company as advisers in all technical questions which will arise in regard to sewerage, street paving, and public improvements of all kinds. The company employs experts in all these lines whose business it is to answer all questions asked by officials of the cities which have retained their services. This saves these cities all the expenses they would otherwise entail by the hiring of experts at such a time. After some discussion the motion was made by Rinehart that the services of this company be retained at the $100 asked by them. The motion was seconded by Kibele, and the roll was called, which resulted in a tie vote. The vote was as follows: Yes, Rinehart, Kibele and Little; nay, Venis, Kreep and Poffenberger.

(In accordance with our usual rule, we submitted a proof of the above communication to the parties criticised, with an invitation to present their side of the case. We append their reply as follows:)

Sir: Both the communication and newspaper clipping, as stated, are erroneous and misleading. Municipal Engineering Co. has not offered or undertaken to furnish engineering service to any municipality. The information service supplied to municipal officials by Municipal Engineering Co. is purely educational, and prepares them for better understanding and appreciation of their need of engineering service, where it may be required. In all cases where there is need of such service, we inform the inquirer that an engineer should be employed, and we advise engineers through our special bulletins to them that there may be opportunity for such employment, but Municipal Engineering Co. does not offer to render this engineering service. Our information service in no way conflicts with the interests of engineers or with professional ethics; it is, on the contrary, helpful in the largest possible measure to engineers, as many of them have realized, and we strictly and faithfully live up to the standard advocated in the articles on engineering ethics in "Municipal Engineering Magazine," referred to by the writer; possibly the writer of the above misleading communication has suffered some from these criticisms. Engineers are among the most zealous advocates of the service referred to, as it in no way unfavorably affects them, but, on the other hand, they profit by it, as information on technical matters, such as we furnish to officials, brings better appreciation of engineering skill.

Municipal Engineering Co.,
William Fortune, Pres.

Indianapolis, Ind., Oct. 31, 1898.

(As we have no desire to give publicity to any "erroneous and misleading" statements, we delayed publication of the above letters and undertook an independent inquiry as to the fact in controversy, viz.: Whether the Municipal Engineering Co. offered to render engineering service to the city in question or not. We addressed inquiries on this point to some of the members of the council of the city referred to in the above newspaper clipping, and have received the following answer:)

Sir: Your inquiry of Dec. 3 received, in regard to the proposition made by Mr. Chas. G. Lohman, representing the Municipal Engineering Co., of Indianapolis, Ind. The company did not offer to render engineering service. Simply that they were at our service as consulting them on any technical question, or would be our advisers for one year if the proposition was accepted. The Municipal Engineering Co. claims to have employed experts on all topics, which would render valuable service in regard to information furnished by them.

Yours very truly,

Cuno Kibele.

Bluffton, Ind., Dec. 5, 1898.

(The question which will doubtless puzzle our readers is: What sort of information or advice did the company propose to render to cities on technical questions that would not be rendered by a competent consulting engineer? We believe we can explain the seeming contradiction which appears in both Mr. Fortune's and Mr. Kibele's letters. A curious idea of engineering exists in certain rural sections. This idea may be expressed by the following definitions: 1. Surveying is making measurements in the field with the aid of a compass. 2. Engineering is making measurements in the field with a transit or a level. Thus the city engineer in many small cities is required merely to make measurements for streets, grades, sewers, drains, etc. That he should be also an adviser concerning the design and construction of pavements, sewers, water supply systems and similar city improvements or should be placed in charge of such work, never appears to be thought of. We may also add that in these same localities the value set on an engineer's services is in close relation to the above idea of his sphere of action.

But, it may be asked, if the term engineering is limited to the purely mechanical work with measuring instruments, what name is given to the real work of the engineer in the design and supervision of construction work—what we may call the "knowing how?" To the best of our knowledge the "knowing how" is not thought to be worth paying for at all in such places. Any alderman is supposed to know how to look after street paving, highway construction, sewers and drains. In case a contract is let for work, the contractor is supposed to furnish the "know how," for nothing.

To return now to our correspondent's original criticism, it is fair to say that in the present unformed state of ethical standards in the engineering profession, we know of no reason why the publishers of a technical journal may not, if they choose, conduct a consulting engineering business; nor why they or any other consulting engineer may not solicit engagements in which the payment will be by the year instead of by the job. The extent to which it would compete with its own patrons is a matter for it to decide for itself. We are somewhat inclined to think that the towns which it may induce to engage its services will be towns which would otherwise be little likely to engage the services of any consulting engineer. In this way it may, as it claims, be doing missionary work for the profession.—Ed.)

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Spacing Stiffeners in Plate Girders.

Sir: I have noted with much interest the discussion regarding the spacing of stiffeners in plate girders in several of the last issues of the Engineering News. In Prof. Turneaure's observations on a plate girder with an extensometer, described in the issue of Sept. 22, it might be of some value to know where the extensometer was applied, i. e., whether on the outstanding leg of stiffener angle or on the leg against the web plate, and also whether any reading was made on the same stiffener from the opposite side of girder. Unless readings by the extensometer were made on both sides of the girder, a possible solution for the case of those stiffeners which apparently showed tension instead of compression, might lie in the fact that while the outer edge of the stiffener might be in tension the opposite side of stiffener, and the stiffener as a whole was acting in compression, analogous to a column eccentrically loaded. This is an occurrence which was observed in the course of some investigations made on a girder a year ago by Mr. C. A. P. Turner, described in "The Transactions of the Engineers' Society of Western Pennsylvania, of September, 1897," in which the writer assisted.

One point noted in these observations by means of the galvanometer, was that readings taken on the stiffeners showed them to be in compression, and readings on the web in the path of the diagonal of a Pratt system showed tension, while readings taken outside of this broad belt of the diagonal upon the neutral axis gave no positive or determinate readings. These results seem antagonistic to Prof. Turneaure's statement that, "there is as much reason to suppose that the web stresses follow down the web and up the stiffeners, as in a Howe Truss, as to suppose that they follow the lines of a Pratt Truss." In the galvanometer readings referred to, the galvanometer responded very freely to the application and removal of load, thus seeming to preclude the possibility of incipient failure. Your very truly,

F. G. Skinner.

Minneapolis, Minn., Sept. 29, 1898.

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Sir: For trespassing further upon the space in your columns in continuance of the discussion of the internal stress in plate girders, the writer will plead the excuse that the letter of Prof. Turneaure, in your issue of Sept. 22, would, without comment, make the experimental results obtained by the writer appear in a false light, and that, having made several hundred measurements on all parts of the experimental girder illustrated in your issue of Sept. 8, and having checked the general results by three or four different experimental methods, perhaps a more concise statement of the results obtained may lead to a more rational and general analysis of the internal web stress than that presented by the average text-book.

Let us first refer to the analysis of the internal stresses in beams in Rankine's "Applied Mechanics," and we find that the case examined by him is that of a beam of constant section along its length. For such a beam he proves clearly that the principal stresses at the neutral axis are tensile and compressive, acting at 45° with this axis and at 90° with each other. The special case of a beam of a given type of cross section increasing or decreasing regularly in sectional area along its length is amenable to similar mathematical analysis, and the general distribution of the internal stress would vary but slightly from the first case considered, as stated in applied mechanics. The general case of a beam varying irregularly along its length, both as regards area and type of section, is quite a different problem, involving too many conditions to be handled in a general way. Even the special cases, when the variations are at regular intervals with a constant section between are by no means simple and easily analyzed.

Since built sections, when well riveted, act under stress approximately as solid sections, we should consider the built girder with stiffeners as coming under the latter class of beams, and the writer would subdivide such girders into general classes as follows:

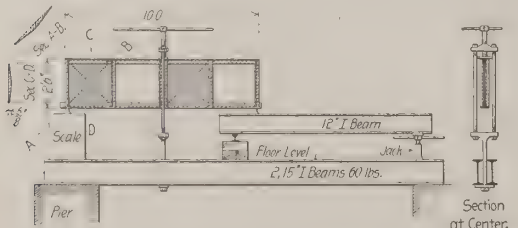


Fig. 1.—Sketch Showing Method of Testing a Plate-Girder to Determine Nature of Web Stresses.

(1) Those girders in which the stiffeners are spaced economically: that is, sufficiently close to prevent buckling of the web and cause it to be capable of fully developing the strength of the flange.

(2) Those girders in which the stiffeners are placed needlessly close together.

Class 1 includes those girders in which the designer has followed Cooper's excellent specifications, in which he requires stiffeners to be placed about the depth of the girder apart, when the shearing stress on the web exceeds that allowed by the formula given. The experimental girder belongs to this class, Fig. 1. The web of this girder was 30 × ⅛-ins. × 10 ft. Top flange, two angles, 3 × 3 × 5-16-ins. Bottom flange, two angles, 3 × 2½ × ¼-ins. Stiffeners at center, four angles, 2⅓ × 2 × 3-16 ins.; all others, two angles, 2 × 2 × 3-16 ins.; fillers ¼-in., rivets ½-in. diameter. Area top flange 3.56 sq. ins.; of bottom flange 2.62 sq. ins. or 2.37 sq. ins. net, practically two-thirds the area of the top flange. Under the usual theory, figuring the experimental girder as though the stiffeners did not affect the internal web stresses, we would have the strain per square inch in the bottom flange about 30% greater than in the top flange, while as a matter of fact it was 6% less. The average deflection noted in a series of readings with the same load repeatedly applied being 25.5 cm. top flange (average both sides); and 24.1 cm. bottom flange (average both sides). This discrepancy can be accounted for only by truss action, as the error of measurement with as expert an instrument man as Mr. Frank McIntyre, who took these readings, would be extremely small.

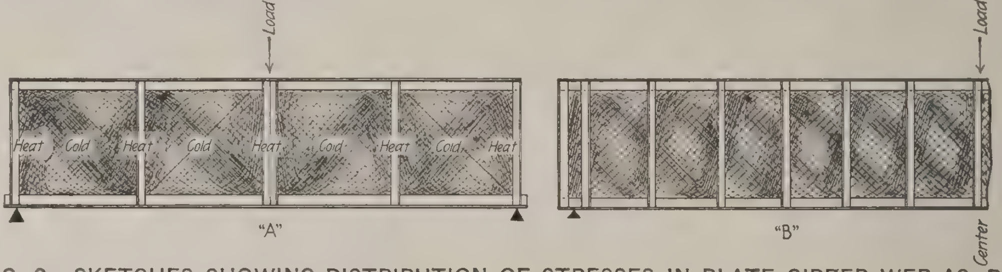


FIG. 2.—SKETCHES SHOWING DISTRIBUTION OF STRESSES IN PLATE-GIRDER WEB AS DETERMINED BY TESTS.

The next proof of truss action, as stated in your issue of Sept. 3, was the springing of the buckled web, which increased gradually with the increase of the load and going back with and apparently proportional to the removal of the load.

The maximum load in this case was insufficient to produce any set whatever, the maximum shear per square inch of sectional area of the web being under 7,500 lbs. and maximum flange stress under 18,000 lbs. per square inch. In this connection also it should be noted that in the panels with the flat web there was no tendency apparent in the plate to wrinkle nor any sign of lateral deflection.

With the thermal junction on the neutral axis of the girder attached to the web plate, either near a stiffener or in the center of a panel, the galvanometer would indicate almost the initial application of the load, the deflection obtained with the junction attached near the stiffener being the reverse in direction of that obtained when the junction was attached in the center of the panel, the wiring remaining the same, thus differing from the I-beam lever on the neutral axis of which we were able to obtain no positive deflection when the load was applied as should be the case under the usual theory. To attempt to account for this result on the ground of incipient failure, when we know the load to have been increased from a few hundred pounds to twenty tons concentrated load on the center of the girder, would indeed be rather grotesque theory.

Finally, the condition of stress, as nearly as the writer is able to determine from several hundred recorded observations, is something like sketch "A," Fig. 2. Here we note:

(1) That the lines of maximum compressive stress in the web are concentrated as it were in the dark area near the stiffeners and that they have changed in direction from 45° being deflected towards that portion of the plate best able to resist compression by virtue of the lateral support of the stiffener angles.

(2) That the path over which the maximum stresses act is but slightly longer than it would be were the tensile and compressive stresses acting at 45° with each other.

It is evident that the intensity of the stresses in the dark area in excess of those in the other portion of the plate are a direct function of the size of the panel, and an inverse function of the thickness of the plate.

Were the stiffeners applied vertically and so close together that the web is practically stiffened all over, it would undoubetedly be in a similar condition of internal stress to the plate of a flitched beam, which the common theory covers exactly. For cases between this extreme condition of excessive stiffening and that of stiffeners spaced economically, as investigated, we should naturally expect intermediate conditions of internal stress. A solution will be offered for one only of these as giving a fair insight to the treatment proposed for other cases.

Referring now to observations (1) and (2) concerning the distribution of stress shown in sketch "A," we may summarize the gist of these deductions in the words of Mr. Buel, that the load seeks the shortest course consistent with the strongest members. Now, under tension, it is true that the strength of a member varies as its sectional area, but under compression, sectional area alone is not the sole factor in determining the degree of strength and rigidity. For example, a 12 × ½-in. plate 10 ft. long would be almost worthless as a strut, while the same sectional area in the form of two 7-in. channels would make a strong and rigid compression member; likewise the stiffener by its form more than by its mere sectional area renders the plate under and near it stronger and more rigid under compression than that portion more removed from it.

Referring now to sketch B, Fig. 2, as in sketch A, we would expect the belts or areas of maximum compression near the stiffener and slightly inclined to it while the belts of maximum tension that act in connection with them in order to fulfill the conditions of following that path which would permit the least vertical deflection of the structure would naturally run to the alternate panel point, this being the shortest path consistent with the condition named that will allow the maximum compressive stresses to follow those portions of the plate which by the lateral support of the stiffeners is best able to resist them.

The point of most interest in this case, with a distribution of stress as outlined, would be that the stiffener would be strained much less than in the first case, sketch A, since the stiffener does not follow the center line of either belt of maximum stress, but lying between them the component of the distortion of the compressive belt along the length of the stiffener being offset in a measure by that of the tensile belt of the maximum stress crossing it at the center.

In sketches A and B, Fig. 2, the writer drew the lines of stress, as they approach the flange, convex towards it in order better to represent graphically his idea of the manner the components of the principal web stresses are transferred to the flange and the condition of strain on the rivets, instead of showing them concave towards the flange, the true position of the lines of principal stress in this portion of the web.

If, with a constant load, we should plot the readings obtained on the web along the neutral axis of the experimental girder, as ordinates with the distances from one end of the girder as abscissas, we would have a sinusoidal curve and the points where this curve passes through the value of $y = o$ would represent the only points where no deflection could be obtained by application of the thermopile when the load was applied. These points lie between the consecutive belts of maximum tension and compression shown in sketch A.

When the thermopile was applied to the plate between the neutral axis and the compression flange heating effect was noted, and the magnitude of this did not appear to increase regularly towards the center of the girder along a line parallel to the neutral axis as it should do were the web stresses uniformly distributed instead of being concentrated in belts, as shown in the sketch. Similarly, cooling effect was noted near the tension flange, indicating the extent to which the web was assisting the flanges in resisting bending.

The action of the stiffener in affecting the distribution of stress in the web plate may be regarded as twofold; first, in rendering the plate in its vicinity better able to resist compressive stress through the lateral support it affords, thus causing an uneven distribution of stress in the web, as shown in the sketch; and, second, under favorable conditions it may relieve the web of a considerable portion of the compressive web stress.

For the former action few rivets are required, but to act efficiently in the latter capacity, where the stiffeners are economically spaced, they should be well riveted as was the case in the experimental girder.

Merely investigating the condition of stress on one side of a few stiffeners in such a girder as selected by Mr. Turneaure would appear on this ground as an insufficient basis upon which to attempt to verify an assumed general analysis of the condition of internal stress of the stiffened plate girder.

As the experiment conducted by the writer is perhaps the first on record in which careful measurements were made of the internal web stresses of a stiffened plate girder, it is natural that some should be inclined to question both the accuracy of the work and the conclusions based thereon. To these, if sufficiently interested, the writer would suggest that as the method used by him is simple and practical, they may readily duplicate the work.

In conclusion, the writer would say that while personally looking after all details of the experiment conducted by him, the work was shared by the following voluntary assistants, all graduates of the engineering schools named, each of whom took his turn reading the galvanometer, taking notes and applying or weighing off loads: Mr. H. A. Kennicott, Massachusetts Institute of Technology; Mr. F. G. Skinner, University of Michigan; Mr. W. P. Rothrock, Pennsylvania State College; Mr. W. S. Huntington, University of Iowa; Mr. J. T. Richards, University of Wisconsin; Mr. Frank McIntyre, Minnesota State University.

All of the above, with the exception of Mr. McIntyre, who is instructor in physics in one of our High Schools, are engaged on structural iron work.

Respectfully yours,

C. A. P. Turner.

Minneapolis, Minn., Oct. 15, 1898.

THE NEW FREIGHT YARD OF THE HARLEM TRANSFER CO., OF NEW YORK.

One of the most unique freight yard arrangements which we have ever seen, has been adopted in constructing the new terminal freight yard of the Harlem Transfer Co., in New York city. This company was formed to establish a railway freight receiving and delivery station for the Harlem River district of the city, and for this purpose it secured the city block at 135th St. and the Harlem River, 330 × 540 ft. in size, the narrower side fronting on the river. This property had been bulkheaded in at various times in the past, and had a slip 100 ft. wide and 200 ft. long. The problem which the engineer was called upon to solve was to develop the property for receiving and delivering freight, either in car loads or in separate packages, the cars to be transferred to and from the various railway terminals in and about the city by the regular car transfer floats.

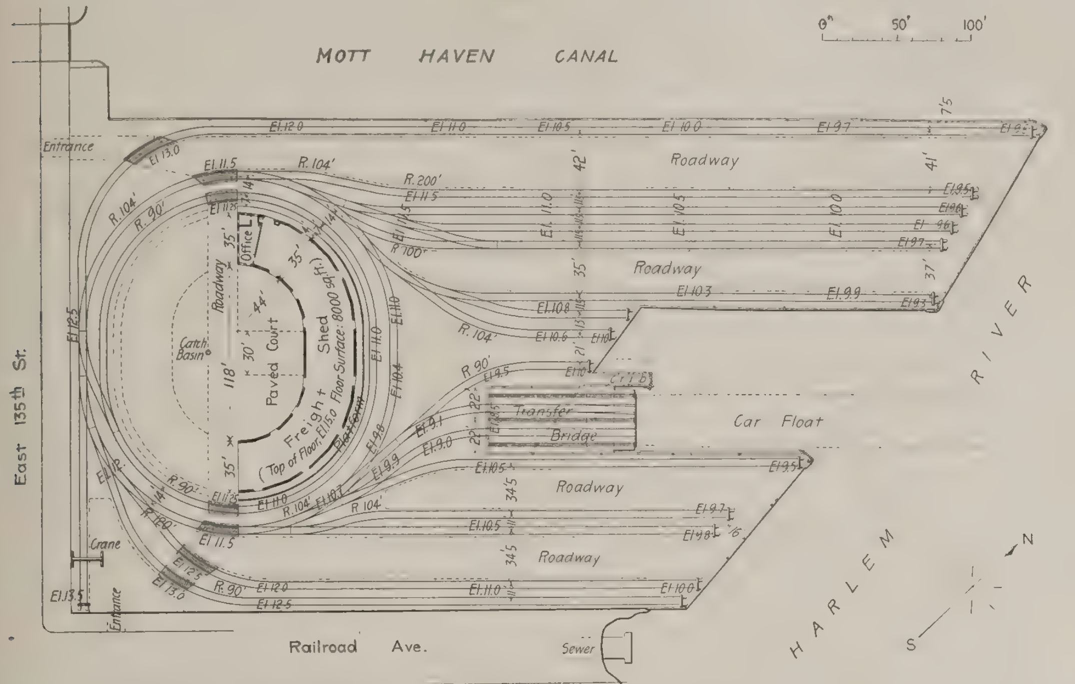


FIG. 1.—TERMINAL YARDS OF THE HARLEM TRANSFER CO., AT 135TH ST. AND THE HARLEM RIVER, NEW YORK CITY.

Walter G. Berg, M. Am. Soc. C. E., Designing Engineer.

The first step was to construct a transfer bridge at the head of the slip. As the standard transfer float adopted by the company was 35 ft. 6 ins. × 240 ft. in size, in order to keep the outer end of the boat when tied up to the bridge within the bulkhead limits, the shore end of the bridge had to be placed within 280 ft. of the line of 135th St., thus limiting the track system to an area of about 280 × 330 ft. The transfer bridge itself is a three-truss wooden bridge, 100 ft. long, the shore end resting on piles and the sea end on a wooden pontoon 40 × 38 × 8 ft.

The leading feature of the design (Fig. 1), however, is the full circle distributing track, from which all side and switching tracks start, and the radial freight house with the inside courtyard for teams. The freight house is an iron frame single story building, 35 ft. wide, on brick piers, and is sheathed with corrugated iron and roofed with tar, felt and gravel. It will be noticed that the loading and unloading track for the freight house is inside and concentric with the circular distributing track, to which it is connected by a switch track. Among the features of this radial or annular form of freight house which the engineer will notice particularly is the great track frontage for a given floor space. Thus the half circle freight house shown in the plan has a car frontage of eight cars with an average actual length of 240 ft., corresponding to six cars. Further, it will be noticed, that by placing the car delivery doors on the outside circle and the wagon delivery doors on the inside circle considerable space is saved. Only one freight shed has been built so far, but it will be seen that the plan allows for the construction of a second exactly similar in all respects, should the traffic demand it.

For switching operations in the yard a special locomotive, built by the Baldwin Locomotive Works of Philadelphia, Pa., is employed. This engine is shown by the accompanying cut, Fig. 2, and its leading dimensions and particulars are as follows:

Switching Engine; Harlem Transfer Co., New York, N. Y.
General Description: Class of traffic............Switching.
Gage of track..4 ft. 8½ ins.; Fuel.............Hard coal.
No. of driving wheels......4; No. of truck wheels,..None.
Simple or compound ....Simple.
Running Gear:
Driving wheels, No........4; Diameter........3 ft. 8 ins.
Wheelbase: Driving ....6 ft. 6 "
Weight in Working Order:
On driving wheels.86,000 lbs.; Engine, total....86,000 lbs.
Cylinders: Number ....Two.
Diameter and stroke..........................17 × 24 ins.
Diameter of barrel, inside smallest ring ....4 ft. 6 "
Thickness, barrel plates ....9-16-in.
Working steam pressure ....180 lbs.
Firebox:
Length, inside, 5 ft. 9⅞ ins.; width, inside ...3 ft. 5⅝ ins.
Depth at front, 4 " ¼ " ; depth at back, ..3 " 9¼ "
Thickness, side plates, ⅜-in.; back plate ....⅜-in.
" crown " ½-in.; tube plate. ....½-in.
Tubes: Number 191
Diameter, outside ....1¾ ins.
Length over tube plates ....8 ft. 3½ ins.
Heating Surface and Grate Area:
Heating surface, tubes (interior area)........718.03 sq. ft.
" " firebox .... 80.11 "
" " total ....798.14 "
Grate area .... 20.2 "

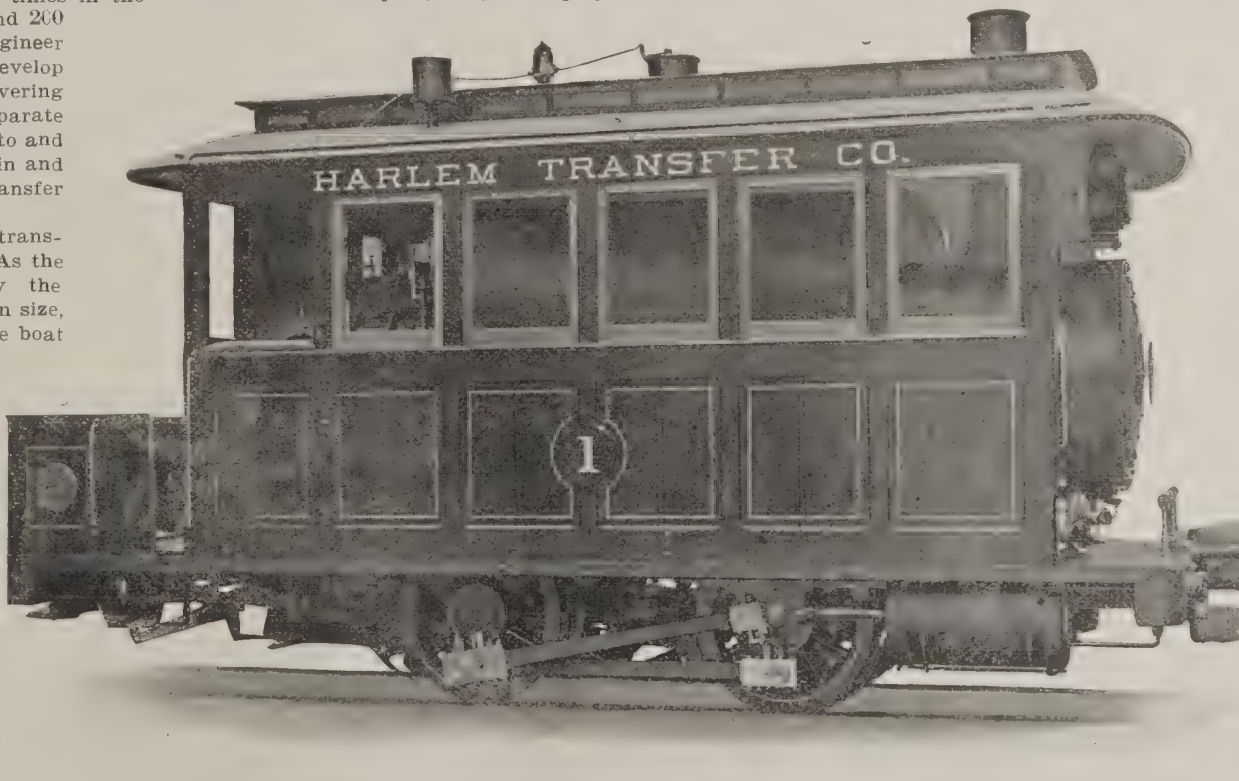


FIG. 2.—FOUR-COUPLED SWITCHING LOCOMOTIVE FOR THE HARLEM TRANSFER CO.

Baldwin Locomotive Works, Philadelphia, Pa., Builders.

For the information from which this article has been prepared we are indebted to Mr. Walter G. Berg, M. Am. Soc. C. E., Assistant Engineer, Lehigh Valley Ry., Jersey City, N. J., who designed the terminal, and to the Baldwin Locomotive Works.

NOTES FROM THE ENGINEERING SCHOOLS.

Cornell University.—The address by President Schurman at the 30th annual commencement, June 16, 1898, entitled "A Generation of Cornell," has been printed in a handsome pamphlet with red line borders and broad margins by G. P. Putnam's Sons, New York city. The address covers the history of Cornell from 1868 to 1898, and a remarkable history it is; that of modest beginning, of struggle for life, of weary years of waiting, and then of rapid progress to the proud position the University now holds, that of being one of the leading universities of the world. The address is worthy of preservation by every Cornellian, and by all who are interested in American educational history.

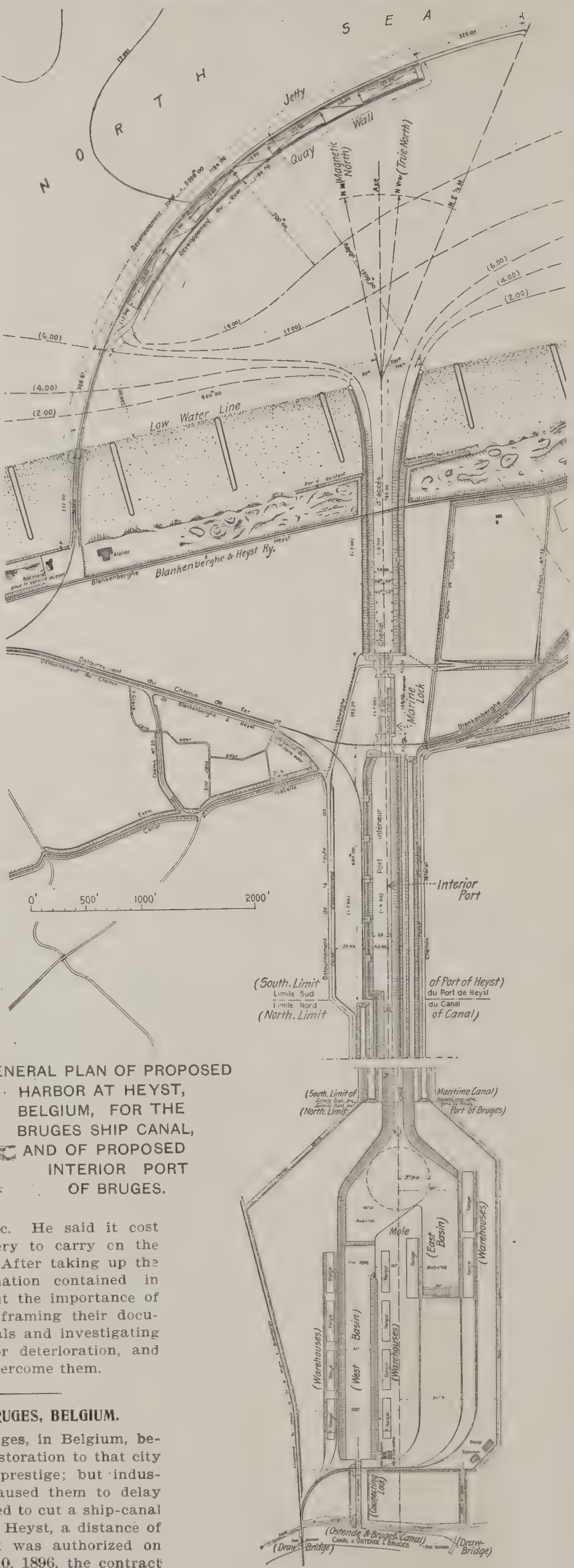
We have also received a pamphlet containing the sixth annual report of President Schurman, 61 pages, with an appendix of 100 pages, giving the reports of the deans of faculties, the register, librarian, etc.

Massachusetts Institute of Technology.—An illustrated descriptive circular, issued by the department of mechanical engineering, gives, among other things, tables showing the present occupation of all graduates of the department since 1868. There are 389 living graduates of the department of mechanical engineering, and but four of these are unaccounted for. Definite occupations are stated for the balance. Over 90 per cent. are employed in work for which they received special training at the Institute, and most of the remainder are engaged in pursuits demanding some scientific training. The Institute has established a special course in architectural engineering, offered as an option in the course in architecture. This course is to meet the demands created by the development of steel construction in the last ten years, and the course is adapted to the solution of the many new and difficult problems thus presented to engineers and architects.

Lehigh University.—An address on "Origins and Destiny," delivered on Founder's Day, Oct. 13, 1898, by Langdon C. Stewardson, Chaplin of the University, has been printed in pamphlet form. It is a highly philosophical and somewhat metaphysical discourse, but is interesting reading, and contains many good thoughts well expressed. It has some thoughts on "science," however, which seem rather to belong to the philosophy of the Keely motor than to the science of ordinary mortals, such as the following:

> It is not Phillip Brooks, but Professor Brinton who says, "The teachings of the severest science tells us that matter is in its last analysis motion, and that motion is naught else than mind; and who dare deny that in their unconscious functions our minds may catch some overtones, as it were, from the harmonies of the Universal Intelligence, thus demonstrated by inductive research, and vibrate in harmony therewith?"

Purdue University.—"The Relation of Chemistry to Railroads" was the subject of the opening lecture in the University course, delivered by Dr. Charles B. Dudley, Chief Chemist of the Pennsylvania R. R. Co. In connection with the amounts of money expended by railways for materials, he said the Pennsylvania Railroad spent from $17,000,000 to $20,000,000 annually on this account. Of this aggregate, about $5,000 was expended for rubber-bands, $7,000 for lead pencils, $1,000 for pins, $5,000 for ink, $2,000 for toilet soap, $1,000,000 for lumber, $60,000 for hose, etc. He said it cost nearly as much for stationery to carry on the business as it did for iron. After taking up the specifications and the information contained in them, Dr. Dudley pointed out the importance of the duty of the chemist in framing their documents and in testing materials and investigating difficult problems of wear or deterioration, and the suggestion of means to overcome them.



GENERAL PLAN OF PROPOSED HARBOR AT HEYST, BELGIUM, FOR THE BRUGES SHIP CANAL, AND OF PROPOSED INTERIOR PORT OF BRUGES.

* * *

THE SHIP CANAL OF BRUGES, BELGIUM.

In 1877 the citizens of Bruges, in Belgium, began to plan means for the restoration to that city of its one-time commercial prestige; but industrial and other conditions caused them to delay until 1890, when it was decided to cut a ship-canal from Bruges to the coast, at Heyst, a distance of about six miles. The work was authorized on Sept. 11, 1895, and on Jan. 10, 1896, the contract for its execution was let to the Campagnie des Installations Maritimes de Bruges. From a pamphlet issued by this company for the International Congress on Navigation, held this year at Brussels, the following description of the canal is abstracted:

The port of call at Heyst is made up of a jetty, alongside of which ships can lay; an anchorage and protected harbor, a canal with a marine lock and an interior basin with docks. The jetty leaves the shore about half way between Heyst and Blankenberghe, and forms a curve with radii of 3,936 and 6,560 ft., and at the end the direction is about parallel with the coast line and 2,788 ft. distant at low tide. This jetty has in it an opening, extending 984 ft. beyond low-tide mark, intended to facilitate the movement of the shore currents and prevent the deposit of silt and sand in the harbor. Over this opening a railway is carried on a steel trestle structure with bents 16.4 ft. apart, and this bridge terminates at an abutment of masonry founded by the aid of compressed air.

The outer part of this jetty is a solid curved structure, protected by a high sea-wall. The base of this portion is made of monoliths of beton weighing from 2,500 to 3,000 tons, deposited in iron caissons, each 82 ft. long and 29.6 ft. wide and of a height varying with the depth of the water. They rest upon a sand bottom previously dredged to a depth of about 13 ft., and the tops of the caisson blocks rise to a height of about 3.28 ft. above low-tide. Upon this base is built a wall of 50-ton concrete blocks; this wall being 16.4 ft. thick and 24 ft. high above low-tide mark; an outer parapet wall, 3.28 ft. high, protects the top of the jetty. The jetty terminates in a pierhead, 50 ft. in diameter, upon which a lighthouse and the fog siren are established. Under the shelter of this jetty, and at a distance 177 ft. between centers, is built a parallel quay wall, having a total length of 3,562 ft., and constructed in a similar manner, of 3,000-ton foundation caissons surmounted by a wall of 50-ton blocks. The space between these walls forms a quay, upon which are railways, warehouses, cranes, etc., for the rapid handling of goods at this port of call. Inside this quay there is a depth of water of 26.24 ft. at low-tide over a space of 984 ft. wide.

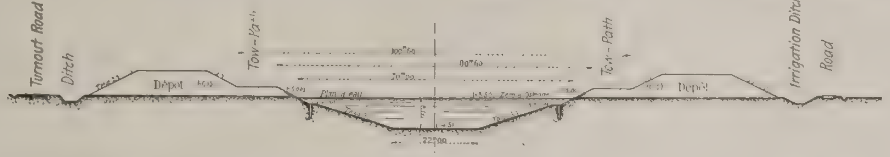
From this harbor a dredged channel 2,460 ft. long, leads to the sea-lock, or entrance to the ship-canal. This channel has an opening 656 ft. wide, a normal width of 164 ft. on the bottom, and a depth of 19.68 ft. at extreme low tide. The lock is 65.6 ft. wide and 518.24 ft. long between gates and 839.7 ft. long over all. The gates roll into opening built at right angles to the axis of the lock proper, and the lock can be closed or opened in 10 minutes. Electricity is used to operate the gates, cranes, etc., and to light the harbor; and a central station, equipped with 500-HP. boilers and engines and two generating dynamos, will provide all the power now necessary. Before completion this port will also be furnished with a repair shop, a floating crane of 55-ton capacity and a large marine dredge.

The so-called interior port of Bruges commences at the inner end of the lock and includes two basins parallel to the canal axis and separated by a mole 393 ft. wide. The West Basin is 1,771 ft. long and 21.3 ft. deep; the East Basin is somewhat shorter, and is 26.24 ft. deep, and both basins have a surface width of 295 ft. At the shore end of the West Basin is a lock uniting the new port with the Ostend canal system. This lock is only 39.4 ft. wide and 564 ft. long over all, and has a depth of 14.7 ft. over the sill. Warehouses will be built upon the central mole, and movable cranes, of 3,000 lbs. capacity, will command the whole length of the dock front.

Progress upon this work, to the present date, is reported upon as follows: The work was ordered on Sept. 11, 1895, and was to be completed in seven years, or on Sept. 11, 1902. The Campagnie des Installations Maritimes de Bruges, which obtained the contract, has a capital of 9,000,000 francs, and is itself interested in the completion of the work, as the following statement of cost and capital contributed shows:

	Francs.
Construction company interest	6,900,000
State of Belgium	26,810,620
Province of West Flanders	2,000,000
City of Bruges	3,258,446
Total	38,969,075

The City of Bruges actually contributes more than appears in the above statement, as it owns one-half, or 4,500,000 francs, of the capital of the construction company. The contractors are themselves interested to the extent of 3,500,000 francs, and the West Flanders railways and some Bruges manufacturers have contributed altogether 1,000,000 francs. At the present time the work is being actively pushed. The ship canal is diked, and is now being dredged out; the interior port is being cleared for the excavators; but the most active work is at the jetty and port, and it is expected that both the jetty and the sea-lock will be finished in 1899. The publication from which this is taken does not enter into details of jetty or lock construction.



TRANSVERSE SECTION OF PROPOSED SHIP CANAL CONNECTING THE HARBORS OF HEYST AND BRUGES, BELGIUM.

THE SOFTENING OF WATER BY THE ARCHBUTT-DEELEY PROCESS.[*]

By Leonard Archbutt.[†]

Hard water owes its peculiarities to the presence of compounds of lime and magnesia, chiefly the carbonates and sulphates, but occasionally also the chlorides and nitrates.

Distilled water, from which every trace of carbonic acid has been expelled by boiling, can hold in solution only about 1.3 grain of carbonate of lime per gallon; but if the water be saturated with carbonic acid it can dissolve as much as 60 to 70 grains, the whole of which, except the above 1.3 grain, is precipitated when the water is boiled and the carbonic acid expelled. All natural water contains carbonic acid, and therefore all such water which has been in contact with chalk contains carbonate of lime in solution.

The use of slaked lime, or hydrate of lime, for softening chalk water[‡] was first proposed by Thomas Henry, F.R.S., about a century ago. The lime removes from the water the dissolved carbonic acid, combining with it to form carbonate of lime, which precipitates, and the carbonate of lime previously held in solution by the carbonic acid precipitates also, leaving the clear water soft. The late Dr. Thomas Clark, of Aberdeen, in his celebrated patent in 1841, described the method of ascertaining the necessary amount of lime by determining the alkalinity of the water; and also the method of controlling the process on the large scale by the simple and delicate test with nitrate of silver, which indicates, by the brown color of the precipitated silver oxide, when the slightest excess of lime has been added. This test fails, however, where, as occasionally happens, the water contains sulphuretted hydrogen. Clark's process in its simplest form is perfectly applicable to but few waters, namely, to those only of which the hardness is due entirely to chalk. It also requires large and expensive settling tanks to carry it out unless filters are employed.

Carbonate of magnesia, though much more soluble in water than carbonate of lime, is usually met with in smaller proportion, seldom exceeding, according to the author's experience, 5 or 6 grains per gallon. Occasionally he has found 10 or 11 grains; and in one instance the exceptional quantity of 28.8 grains per gallon. Carbonate of magnesia can easily be removed from water by treatment with lime; but as it is much more soluble than is usually supposed in water quite free from carbonic acid, merely adding enough lime to remove the carbonic acid will not suffice; it is necessary to add a sufficient excess of lime to decompose the carbonate of magnesia and convert it into hydrate of magnesia which is almost insoluble in water; thus,

$$\mathrm{Mg\ CO_3 + Ca\ (OH)_2 = Mg\ (OH)_2 + \underset{\text{(insoluble precipitate).}}{Ca\ CO_3}}$$

As magnesia reacts like lime with a solution of nitrate of silver, this test does not show when sufficient lime has been added to decompose the whole of the carbonate of magnesia; and it is partly on this account that, when such waters are treated by Clark's process, the removal of the carbonate of magnesia is frequently incomplete. There is also another reason. Magnesia, when set free by lime water, has a tendency to remain in a state of semi-solution, forming an opalescent liquid which may be kept for several days, and even heated, without the magnesia precipitating; and when an attempt is made to filter water in this condition, the magnesia separates out as a gelatinous precipitate in the pores of the cloth, completely choking them. On this account, the softening of water containing both carbonate of lime and carbonate of magnesia is frequently limited to the removal of the carbonate of lime; and the carbonate of magnesia is purposely left in the water. Owing to the practical impossibility of filtering out the magnesia, the hardness of the water can be reduced only from 18.5° to 10° or 12°;[||] but it has been proved by experiment that by doubling the quantity of lime, and precipitating in plain tanks by the special method about to be described, the extra hardness can be further reduced to 6°, and the extra cost for lime is balanced by the saving in the cost of filter cloths, etc.

Sulphate of lime, or calcium of sulphate, which is one of the most objectionable constituents of boiler water on account of the hard crystalline scale it produces, does not owe its solubility to the agency of carbonic acid, but is dissolved by the water itself. It is an exception to the general rule that hot water dissolves more of a substance than cold water. The solubility, it is true, increases from 32° F. up to about 104° F.; but above this temperature it diminishes, at first slowly, then rapidly, and finally more slowly again, as shown by the following Table I., and the diagram Fig. 4:

Table I.—Solubility of Sulphate of Lime in Pure Water.

Observer.	Temperature. deg. F.	Corresponding pressure above atmosphere per square inch. lb.	Sulphate of lime (anhydrous) dissolved by 1 gallon of pure water. grains.
Marignac[*]......	32.0	..	133.0
	68.0	..	144.2
	104.0	..	149.8
	140.0	..	145.6
	176.0	..	136.5
	212.0	0	121.8
Tilden and Shenstone[†]....	284.0	37.8	54.6
	324.5	80.8	39.2
	356.5	132.0	18.9
	473.0	513.5	12.6

It is commonly stated, apparently on the authority of Sullivan,[†] that sulphate of lime is quite insoluble in water at a temperature of 302° F., equivalent to a boiler pressure of 55 lbs. per sq. in.; but Tilden and Shenstone's experiments in Table I. show that even at 473° F., a temperature far beyond the range of any ordinary steam boiler, pure water can retain in solution 12.6 grains of sulphate of lime per gallon. The solubility of sulphate of lime in natural water is influenced by the presence of other substances with which it is associated. Thus it is increased by the presence of common salt; but the amount dissolved by the salt water diminishes as the temperature is raised. At 437° F., however, a solution containing 21 parts of common salt to 100 of water can still retain in solution 0.178 part of sulphate of lime, or 124.6 grains per gallon.[‡] In saturated brine Lewes states that sulphate of lime is insoluble. Sulphate of soda is said to increase the solubility of sulphate of lime. Chloride of calcium, on the other hand, diminishes it, but does not reduce it to nil until the proportion of 50 chloride of calcium to 100 water is reached. Chloride of magnesium increases the solubility at the ordinary temperature, but at higher temperatures appears to behave similarly to calcium chloride.

This point has been dwelt upon, because there is a certain class of apparatus, sold for preventing scale in steam boilers, which depends for its usefulness upon the supposition that the carbonate and sulphate of lime are rendered insoluble by the mere heating of the feed water; but so far as the sulphate is concerned, Tilden's experiments prove that such apparatus cannot be efficient, especially that kind in which the feed water is passed into the boiler through a tube in the steam space, where the water occupies only a few minutes in its passage through the tube. What happens in a steam boiler, working at, say, 140 lbs. pressure, is probably as follows: The water containing, say, 5 to 10 grains per gallon of sulphate of lime, besides carbonate, first loses its carbonic acid and deposits the carbonate of lime, partly as mud and partly as scale; the water then concentrates by evaporation, until the sulphate of lime reaches the saturation point; and then the sulphate of lime gradually crystallizes out, mainly upon the plates, cementing the carbonate of lime into a hard scale, so long as the evaporation continues. To suppose that by merely heating the water under pressure, without concentration, the sulphate of lime is entirely thrown down, is contrary to the results of Tilden's experiments; and it is doubtful whether even the carbonate of lime is more than partially precipitated under these conditions, unless the water is actually boiled sufficiently to expel the carbonic acid.

As the solubility of the sulphate of lime in water does not depend upon the presence of carbonic acid, this salt is not precipitated when the carbonic acid is removed by the lime treatment. Before sulphate of lime can be removed, it must be decomposed, which can be done by adding sodium carbonate, when the following reaction occurs:

$$\mathrm{Ca\ So_4 + Na_2\ CO_3 = Ca\ CO_3 + Na_2\ SO_4;}$$

The sulphate of lime is decomposed, carbonate of lime is precipitated, and sulphate of soda remains in solution. In this case there is not a diminution but a slight increase in the total solids, 136 parts of sulphate of lime being replaced by 142 parts of sulphate of soda.

In removing the "permanent hardness"—that is, the hardness due to the sulphates and other compounds of lime and magnesia, these compounds are not precipitated unchanged, but are replaced by other salts of a less objectionable and more soluble character, and the dissolved solids are slightly increased. Such softened water, therefore, should not, any more than unsoftened water, be allowed to concentrate indefinitely in steam boilers, but should be regularly blown off and replaced by fresh water from time to time; or the boilers should be completely emptied at regular intervals of not too long duration. If this be done, no trouble will be experienced; but if the water be allowed to concentrate too far, priming may occur, and even scale may be formed.

Chloride and nitrate of calcium, which are sometimes met with in hard water, are very soluble salts, which do not enter into the composition of boiler incrustation. They are decomposed by sodium carbonate similarly to calcium sulphate; the calcium is precipitated as carbonate, and sodium chloride and nitrate remain in solution.

Sulphate, chloride and nitrate of magnesium are also easily soluble salts, which are not constituents of ordinary boiler incrustation. Sulphate of magnesia may nevertheless prove a highly objectionable substance, if allowed to concentrate in the boiler. A soft carbonate of lime incrustation, when boiled with a solution of sulphate of magnesia, is gradually transformed into sulphate of lime and basic carbonate of magnesia, which latter, if the temperature be high enough, changes into hydrate of magnesia, and the two together then form a hard scale like porcelain, thus:

$$\mathrm{Ca\ CO_3 + Mg\ SO_4 + H_2O = \underbrace{Ca\ SO_4 + Mg\ (OH)_2}_{\text{hard scale}} + CO_2.}$$

Chloride and nitrate of magnesium are objectionable, owing to their corrosive character. The hardness caused by either of the above compounds of magnesium can be removed by adding to the water caustic soda, or, what comes to the same thing and is cheaper, lime and carbonate of soda in proper proportions, by which these magnesium compounds are decomposed and the magnesia is precipitated as hydrate. When caustic soda is used, the reaction is

$$\mathrm{Mg\ SO_4 + 2\ Na\ OH = Mg\ (OH)_2 + Na_2\ SO_4,}$$

and when lime and carbonate of soda are used

$$\mathrm{Mg\ SO_4 + Na_2\ CO_3 + Ca\ (OH)_2 = Mg\ (OH)_2 + Ca\ CO_3 + Na_2\ SO_4.}$$

Thus, all hard water can be softened by means of either lime alone or lime and sodium carbonate, in proportions which depend upon the character of the water to be treated; but a water may be so hard as to be unsuitable for softening, owing to the cost of the chemicals required and the excessive proportion of soluble salts remaining.

Carbonating Softened Water.—Hard water is, as a rule, an extremely dilute solution of the substances which it is wished to remove from it; and the changes which occur when it is chemically softened require time for their completion. These changes are both more rapid and more complete if the hard water and reagents are heated together, than if they are mixed when cold; and water which has been softened when cold is liable to deposit a further small quantity of precipitate on heating. At Derby several years ago, during the experimental softening of water for use in some of the stationary boilers in the locomotive works[*], it was found that the softened water which formed no scale in the boilers had quite the opposite effect in the injectors, feed pipes, and valves. The valves began to give trouble by sticking, and an examination proved that the whole interior of the feed apparatus was coated with a soft deposit, which was gradually choking everything. Some of the deposit removed from the interior of one of the copper pipes gave the following results on analysis:

Carbonate of lime	42.58
Carbonate of magnesia	3.33
Hydrate of magnesia	24.87
Silica	11.05
Alumina	3.68
Peroxide of iron	2.23
Water and organic matter	10.79
Metallic copper (from the pipe)	1.47
	100.00

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[*] Paper read before the Institution of Mechanical Engineers.

[†] Chemist of the Midland Ry., Derby, England.

[‡] The term "chalk water" is uncommon in the United States. It means water containing carbonate of lime which has been dissolved from what are called the "chalk" formations in England.—Ed. Eng. News.

[||] One degree of hardness is caused by 1 grain of carbonate of lime dissolved in 1 gallon of water.

[*] Annales de Chimie et de Physique (5), I., page 274.

[†] Philosophical Transactions, Part I., 1894.

[†] British Association Reports, 1859, page 292.

[‡] Tilden and Shenstone, "Proceedings of the Royal Society," vol. xxxviii. (1885), pages 331 to 336.

[*] Journal of the Society of Chemical Industry, vol. x. (1891), page 515.

The large amount of magnesia in this deposit, and the fact that carbonate of lime and hydrate of magnesia occur in it in proportions which are chemically equivalent, whilst in the water itself the ratio of magnesia to lime was much less, afforded a clue which was followed up by heating some of the clear softened water in a glass flask to about 200° F. Nothing appeared to separate at first, but on shaking the water around in the flask an exceedingly thin film peeled off the surface of the glass, and broke up into fragments which floated about in the water. These fragments were found to consist of carbonate of lime and magnesia. The cause of the deposit was now apparent. The chemical reaction between the lime and the carbonate of magnesia,

$$MgCO_3 + Ca(OH)_2 = Mg(OH)_2 + CaCO_3,$$

which was not quite complete in the cold, completed itself when the hot water became raised in temperature in the hot pipes, and a slight further precipitation took place. If thrown down in the boilers, this would have amounted to nothing more serious than a little harmless mud; but by its precipitation in the feed pipes the narrow passages were gradually choked up. The experiment was subsequently made of passing a little carbonic acid into some of the clear softened water before heating, and this was found entirely to prevent further precipitation at 200° F. The remedy, therefore, lay in carbonating the softened water; and eventually a coke stove was set up, and the gases from it were led into the softened water in sufficient proportion to convert all the carbonates into bicarbonates, which is easily ascertained by means of phenolphthalein solution. Since then no further troubue has been experienced.

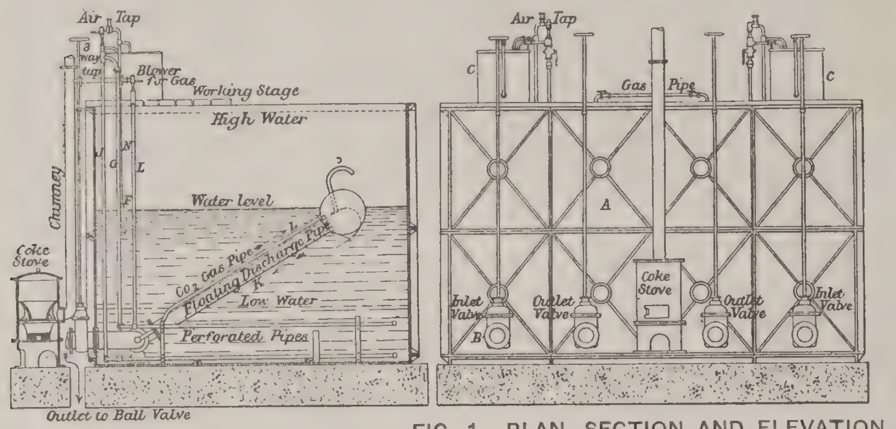
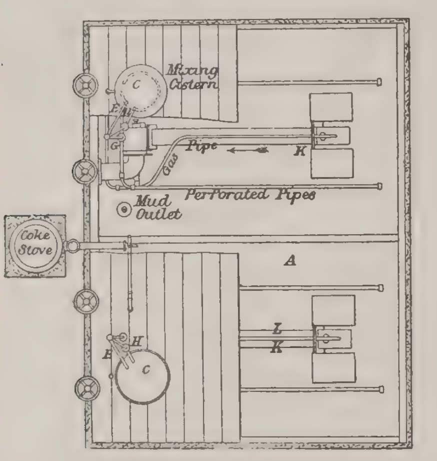


FIG. 1.—PLAN, SECTION AND ELEVATION OF PLANT FOR SOFTENING WATER.



Passing carbonic acid into the clear softened water cannot possibly harden it, as some appear to think. After removal of the carbonate of lime, as much carbonic acid as desired may be put back into the water without hardening it. Carbonating the softened water is, in fact, an advantage, not only when the water is required for feeding boilers, but for some other purposes, such as wool-washing and tanning, because all traces of free caustic alkali and carbonate of soda remaining in the softened water, which would be detrimental, are converted into bicarbonates. By this process softened water is made more palatable for drinking, and the tendency to form a deposit in town mains is lessened, if not entirely obviated.

Softening Apparatus.—The mechanical operations involved in the softening and purification of hard water include the preparation of the reagent, the mixing of it with the hard water, the separation of the precipitate, and the subsequent bicarbonating of the softened water. The apparatus and process employed must be of the simplest possible character compatible with efficiency, and should be applicable to the removal of both temporary and permanent hardness, whether due to lime or to magnesia salts. Nothing could be simpler than the original Clark process of precipitation in plain tanks; but the slow settling of the precipitate necessitated either large and costly tanks or the use of filters; and filtration, besides complicating the process, has been found to be troublesome and expensive when the water contains magnesia, and practically unworkable if any attempt be made to remove the magnesia. In the process about to be described plain tanks are used and filters are dispensed with; for by a special method of manipulation it has been found possible to increase the rate of subsidence of the precipitate to such an extent that about one-eighth of the tank area required in Clark's process is often sufficient. This effect is produced mainly by the simple expedient of stirring up, every time a tankful of water is softened, some of the precipitate which has settled from previous operations. This precipitate by lying at the bottom of the tank becomes aggregated into coarse flakes, which, when stirred up and allowed to settle again, carry down the fine particles of fresh precipitate so rapidly that in from half an hour to an hour, the water clears itself to such an extent that the suspended matter remaining, even at a depth of 6 ft. from the surface, does not exceed about 1 grain per gallon. This very small quantity may for many purposes be neglected; and when perfectly clear water is required the subsequent carbonating redissolves it, hardening the water, it is true, to the extent of one degree or less, according to the amount in suspension, but not sufficiently to be of material importance.

Fig. 1 shows the general arrangement of apparatus suitable for treating on this principle from 5,000 to 10,000 gallons of water per hour. The two exactly similar softening tanks A A, preferably 10½ ft. deep, are intended to be used alternately, one being filled with water which is being softened and clarified, whilst a supply of purified water is being drawn off from the other tank. For 4,000 gallons per hour, or less, one softening tank is sufficient, with a storage tank; for more than 12,000 gallons per hour three tanks are desirable, and for 35,000 gallons and upwards, four tanks. The working capacity of each softening tank is three-fourths of its depth, about 2½ ft. of water and mud being allowed to remain when the water is drawn off, while a margin of 6 ins. at the top is left in filling, which is done by means of the supply pipe B. The quantity of water to be treated being thus exactly known, the proper quantities of quicklime and anhydrous carbonate of soda—58% alkali—are weighed out. The lime is first slacked in hot water in one of the small reagent tanks CC, Figs. 1 and 2, which is filled with water, either from a tap connected with the softened water main, or direct from the softening tank, by means of the tee and pipe between the three-way tap and blower, Fig. 2, by throttling the passage through the three-way tap, turning on steam to the blower, and opening the tap E, Fig. 2; water is then lifted into the tank through the rose F, Fig. 1. The water is boiled by a steam coil, Fig. 2. After the lime has been completely slacked, the alkali is added, and the liquid is boiled for a few minutes and stirred until the alkali is dissolved. The reagent thus prepared is injected into the hard water in the softening tank through the upper row of horizontal perforated pipes, Fig. 1, in the following manner: Steam at not less than 45 lbs.—preferably 90 lbs.—pressure is admitted to the blower, and the three-way tap is turned so that a current of water is established from the softening tank, through the rose F, Fig. 1, the suction pipe N, Figs. 1 and 2, and a three-way tap, down the vertical pipe G, and back into the tank, through the perforations on the upper side of the upper row of horizontal pipes. Into this current of water the reagent solution is slowly admitted by opening the tap H, Fig. 2, and is diffused throughout the volume of hard water in the softening tank. The operation, including the rinsing of the reagent tank, is generally allowed to occupy ten minutes. The suction pipe in the reagent tank extends below the perforated false bottom O, Fig. 2, which prevents any pieces of stone, etc., in the lime from getting into the pipe. The tap H having been shut off, the air-tap over the blower opened, and the three-way tap reversed air is forced down the pipe J, Fig. 1, and through the perforations in the under side of the lower row of pipes, into the mud at the bottom of the tank, stirring up a portion of the mud and diffusing it through the water. After the blower has been in operation for a few minutes—usually ten, but varying with different waters—the steam is shut off, and in about an hour or less the water will be ready to be drawn off. The operations of carbonating and drawing off are effected simultaneously by means of a floating discharge pipe K, Figs. 1 and 3, the body of which is of brazed copper, rectangular in section, having at intervals along the bottom, baffles, which cause the water to flow down in a cascade and splash up into the gases, which are injected from the coke stove into the cast-iron head of the pipe through the gas pipe L. The water and surplus gas escape together, at the lower end, through a ball valve, the carbonated water falling into the cistern from which it is drawn for use, and the gas escaping into the air. The coke stove, Fig. 1, contains a supply of coke in the upper part, which, by falling through the cone, maintains a fire of constant thickness about 12 ins. in depth over the firebars. The top of the chimney, Fig. 1, is closed by a butterfly valve, below which the gas is drawn off through a branch for carbonating. In order to ensure a constant and ample supply of gas, a small blower is fixed in the branch pipe. When the ball valve closes and water ceases to flow down the discharge pipe the gas accumulating in the head of the pipe forces the water below the sill M, and escapes through the pipe N, without disturbing the water in the tank. When the ball valve opens again the floating pipe first empties itself of water, and the gas then escapes through the ball valve, relieving the pressure, and allowing water again to pass over the sill and down the pipe with the gas, so long as the valve remains open.

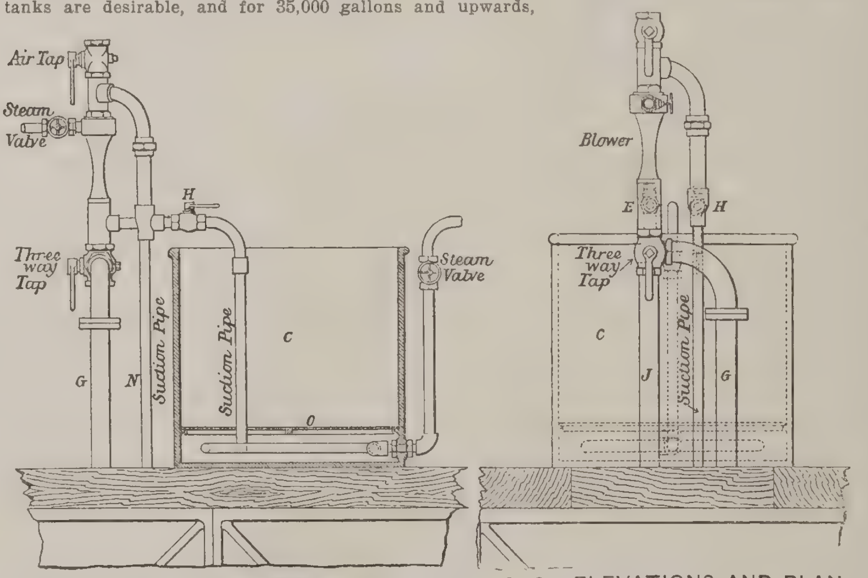
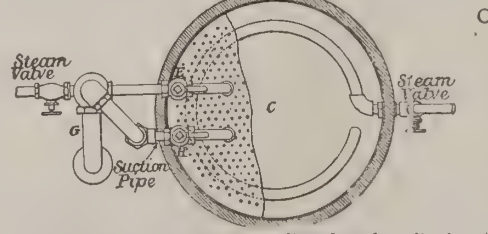


FIG. 2.—ELEVATIONS AND PLAN OF REAGENT TANK, BLOWER AND CONNECTIONS.



The precipitate is prevented from unduly accumulating in the tanks by its partial removal at regular intervals; this is effected in various ways to suit different circumstances. From the nature of the precipitate, and the fact that it is not allowed to consolidate, it is easily dealt with. In a small apparatus a mud pipe leading to a drain is provided near one corner of the tank; and by lifting a plug, and using the blower to stir the mud, a sufficient quantity can be run off. In a larger apparatus it is swept out into a pipe or trough, which conveys it into shallow draining pits, whence it can be carted away; or, it is raised from the tank or trough by a steam lifter, and discharged direct into a cart or wagon lined with waste furnace ashes, through which the excess of water soon drains, leaving the nearly dry mud and ashes ready for tipping.

General Remarks.—The softening of water is an exact process, and in order to obtain satisfactory results proper attention must be given to it. Rough-and-ready methods may succeed in a few instances, but they will not answer in the long run for general adoption. Automatic machines for softening water, which are said to require attention only once or twice a day, and which run continuously, are not to be recommended. In the comparatively rare cases where lime alone is required, and the hard water is practically invariable in character, the continuous method of mixing the hard water with lime water in properly proportioned streams may give good results, provided the machine for preparing the lime water is thoroughly efficient and properly attended to. Lime water is a saturated reagent;

it can be prepared of nearly constant strength by causing water to flow continuously through a mass of it kept in agitation, and the solution being very dilute, does not need extremely fine measurement. But when the same plan is adopted with a solution of caustic soda of much greater strength, finer measurement is necessary; and unless it be carefully looked after, a deficiency or an excess of reagent in the softened water may easily occur. Another objection to the continuous flow system of softening is that, unless frequent tests are made, a large quantity of improperly treated water may pass from the apparatus. Therefore, it is preferable to soften a known volume of water with a known weight of chemicals, and to test each tankful; the excess or deficiency of reagent can then never be serious, even with a variable water. With the tanks fitted as above described, the manipulation of 20,000 or 30,000 gallons of water is as easy as that of one gallon; the appliance for mixing is effective and easily kept in order; every tankful of water may be treated with whatever weight and kind of chemicals are desired, and every drop of water gets its proportion. The labor is light. No expensive buildings are required; all that are necessary are a storehouse for lime and coke, and a covered working stage over the tanks; and the apparatus generally is almost indestructible, necessary repairs being limited to keeping the valves in order, occasionally cleaning out the holes in the perforated pipes, and painting the tanks outside; experience shows that they do not rust inside.

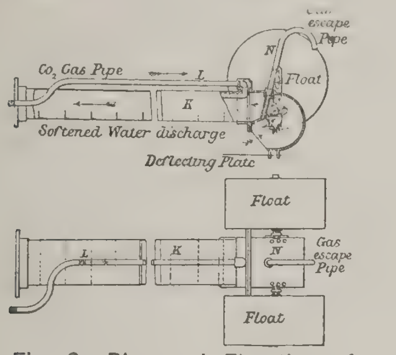


Fig. 3.—Plan and Elevation of Floating Discharge Pipe.

This process has been in operation since January, 1892, in the Midland Railway Works, at Derby, clarifying and softening the sewage-polluted water of the river Derwent; reducing the hardness from about 15° to 4½° to 5°, and effecting considerable organic purification, at an inclusive cost for chemicals, labor and interest on outlay, of about 2 cts. per thousand gallons. The water is of variable character. The following analyses recently made show the composition of the water before and after softening:

	Grains per gallon	
	Unsoftened water.	Softened water.
Carbonate of lime	9.90	2.63
Carbonate of magnesia	0.78	....
Sulphate of lime	3.06	0.17
Sulphate of magnesia	2.89	1.67
Sulphate of soda	0.41	5.10
Common salt	2.56	2.64
Nitrate of soda	0.28	0.28
Silica	0.34	0.34
Water not expelled at 266° F., organic matter, etc.	1.78	1.37
Total	22.00	14.20
Degrees of hardness	15.4	4.14

By using more lime and alkali, the hardness can be reduced to 3°; but as the softened water is used in locomotives, it is found desirable not to reduce it so low.

The organic purification effected is shown by the following figures:

	Water,	
	From pump main as delivered into tanks.	Same after treatment; 30 minutes' subsidence.
Free ammonia (parts per million).	1.15	1.08
Albuminoid ammonia*	0.42	0.28
Oxygen absorbed in 4 hrs. at 80°F.†	0.204	0.106

*Parts per million. †Grains per gallon.

Bacterial Purification.—Of greater importance from a sanitary point of view is the remarkable bacterial purification effected by this process, which the polluted character of the unpurified river Derwent water brings into special prominence. Before treatment the water swarms with a bacteria capable of growing on a gelatine plate; after treatment, few are left in the water. Dr. Percy Frankland showed, several years ago, that the precipitate of carbonate of lime produced in Clark's process carries down about 98% of the organisms contained in the water; the author's own experiments show that the repeated stirring up of the old precipitate does not impair the efficiency of the purification in this respect, even when the mud is swarming with bacteria, as that in the tanks at Derby must be.

Other Applications.—During the last five years this process has been adopted for softening water at upwards of 50 works at home and abroad, including water-works, dye and bleach works, woolen and worsted mills, paper mills, laundries, etc., where the quantities of water treated by it range from 500 to 45,000 gallons per hour. It has been found to be applicable to all kinds of hard water, and gives the best results when magnesia is present, the hydrate of magnesia forming a coarser precipitate which settles more rapidly than pure carbonate of lime.

An interesting example of the application of this process to a public water supply is afforded at the new waterworks of Swadlincote and Ashby. The water, which is pumped from a well, besides being very hard, contains in solution a considerable amount of iron, which precipitates on exposure of the water to light and air. This iron is successfully and completely removed, the hardness of the water is reduced from 22° to 23° to an average of 8½°, and the softened water is bicarbonated, at a total inclusive cost—for chemicals, labor, steam for the blower, coke for carbonating, and interest at 6% on capital and outlay—of 1.6 cts. per 1,000 gallons. Here 2% is allowed for depreciation and 1% for repairs, which is considered ample for such a plant. Lime only is used in softening this water. The presence of the iron, instead of being a trouble, is a positive advantage in the purifying process, as it assists the precipitation, which is remarkably rapid. The tanks are 10½ ft. deep; and 40 minutes after shutting off steam from the blower the water is clear, almost to the bottom of the tank, and ready to be drawn off. The guaranteed output of the plant is 45,000 gallons per hour, or 540,000 gallons per day of 12 hours; this quantity of water is easily softened and purified in four tanks, each having a working capacity of 27,000 gallons. The purified water gives complete satisfaction to the whole of the consumers, and is being largely laid on to works of various manufacturers in the district.

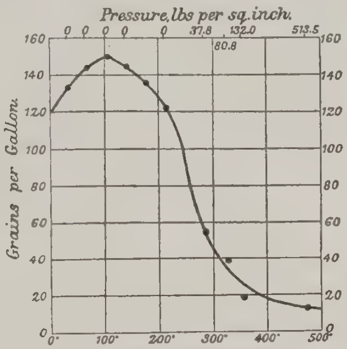


Fig. 4.—Diagram Showing Solubility of Calcium Sulphate in Water at Various Temperatures.

General statements as to the cost of softening water by any particular process must be misleading, because so much depends upon the quantity as well as the character of the water treated. A water of which the hardness is entirely "temporary," that is due to carbonate of lime and carbonate of magnesia, can be softened with lime alone, which costs, per ton, say, £1 or less; but "permanent" hardness, due to sulphate of lime, can be removed only by using alkali, costing at present prices nearly £5 per ton. Less than one pound of lime per thousand gallons of water will remove 10° of temporary hardness; but 1.6 lb. of alkali is required for the removal of 10° of permanent hardness due to sulphate of lime, while sulphate of magnesia is still more expensive to remove. Taking quicklime at £1 per ton, and alkali at £5 per ton, the cost of the chemicals required for softening water is about as follows per thousand gallons:

For every 10° of temporary hardness...........0.22 ct.
" " " permanent " ....1.90 cts.

Thus permanent hardness is approximately nine times as expensive to remove as temporary hardness. These figures for the cost of chemicals are quite independent of the particular mechanical process employed, except that caustic soda, which is used in some water softeners, increases the cost. Clark's process is never used for any other purpose than the removal of temporary hardness, and this is why the cost of softening by that process is low. Assuming the cost of labor, interest on outlay, and other incidental expenses to amount to 1 ct. per 1,000 gallons, the cost of softening water of 20° hardness would vary as follows, according to the nature of hardness:

	Cost per 1,000 gallons, ct.		
Nature of hardness.	Chemicals.	Labor, interest, etc.	Total.
All temporary	0.44	1.0	1.44
Half temporary, half permanent.	2.12	1.0	3.12
All permanent	3.80	1.0	4.80

Advantages of Softening.—The chief advantage of softening hard water for boilers, apart from the saving of fuel, are increased safety of working, longer life of the boilers, and a great saving in the cost of cleaning and repairs. It has also been found that in a battery of boilers the cost of an extra boiler may be saved, owing to the smaller amount of repairs and to the saving of time required for cleaning. There is no doubt that, to avoid incurring the cost of a softening apparatus, much more money is frequently spent in "boiler compositions" than would pay for properly softening the water. Many of these nostrums are useless, and some dangerous, whilst the best are only a partial remedy for the evils complained of.

Pitting and corrosion of boilers cannot be caused by properly softened water, unless it be allowed to concentrate unduly; neither can the use of such water cause leakage. Corrosion of brass cocks and gage fittings most likely arises from the use of alkali in excess, which is simply due to neglect. Pitting of boilers, even where apparently caused by softened water, may really be due to the uncovering of old "pits" by the removal of scale, which always occurs when softened water is first used in a dirty boiler. Pitting when once started is likely to continue, owing to galvanic action between the metal and the crust of oxide of iron contained in the cavity. By thoroughly scraping the pits so as to remove every trace of this oxide, and by then painting the dry metal surface with a thin coating of mineral lubricating oil, Mr. Deeley has found pitting to cease in many instances when the water was kept slightly alkaline. Leakage of the boiler plates sometimes occurs soon after commencing to use softened water in an old boiler, and is sometimes wrongly attributed to the water; it is really due to the loosening of the old scale, which had covered up defective places.

The softening of water is a necessity in all cases where soap has to be used, as in the washing, milling and scouring of textile fabrics. For such work a great saving may be effected by a properly constructed softening apparatus, without which the softening must be expensively done with soap or soda. The advantage may be judged from the fact that 1,000 gallons of water of only 10° hardness will destroy 12 lbs. of the best hard soap, costing, say, 50 cts.; the same quantity of water can be softened by 1 lb. of lime costing about ⅕ ct., or by 1.6 lb. of alkali, costing rather less than 2 cts., and the soap is saved. One firm state that they save 40% of soap and 25% of alkali by using their own well-water softened from 12° to 3°, instead of using town water of 7° hardness. Several firms testify to the saving of soap in wool washing, and to the improved results obtained by the use of softened water for dyeing, especially where the dyes are applied in neutral or slightly alkaline baths. The material is less liable to fleck, the formation of objectionable lime lakes with the alizarine dyes is avoided, and the colors obtained are more brilliant than when hard water is used. It should not be forgotten that, in any laundry where hard water is used, all the water must be softened in the wash-tub before a lather can be obtained; and this is done at the cost of soap and soda wastefully used, and with all the objectionable lime and magnesia soap scum left in the water.

Clarification of Waste Water.—This process is not limited to the softening of hard water, but has proved very effectual in the clarification of manufacturers' waste water. During the last three or four years apparatus has been supplied for this purpose to about 25 works of various kinds, including bleach and dyeworks, calico-printing works, paper mills, cloth mills, etc., and gives great satisfaction. No novelty of chemical treatment is adopted, but it is found that the thorough method of mixing leads to a great economy of chemicals; and owing to the rapidity of precipitation there is also considerable economy in the amount of tank capacity required. Lime and aluminoferric are the chemicals chiefly used. The clarification of the water is perfect, and when desired the alkalinity of the effluent is neutralized by carbonating. The water is also decolorized.

◆

A TIN-PLATE TRUST was incorporated on Dec. 15 at Trenton, N. J., under the name of the American Tin-Plate Co., with an authorized capital of $50,000,000. The stock is divided into $30,000,000 of common and $20,000,000 of preferred, the latter to pay 7% cumulative dividends.

◆

RULES FOR WORKING IN COMPRESSED AIR were presented to the late International Congress on Internal Navigation by three Austrian doctors, Messrs. Heller, Mager and von Schroetter; they are given as follows in "Le Genie Civil:" They recommend that no work of this character be done under pressures exceeding five atmospheres, or say 75 lbs. per sq. in. The workmen employed should be between 20 and 50 years of age, and should only be acepted after a medical examination into the state of their heart, lungs, vascular system and ears. There should also be medical supervision during the performance of the work. The compressed air should be admitted very gradually; for novices the pressure should not be increased faster than one-tenth of an atmosphere per minute; for trained workmen this rate can be increased to 10 minutes for 1½ atmospheres, 15 minutes for 2½ atmospheres, and 40 minutes for 5 atmospheres. If the renewal of air is well assured during lockage, the capacity of the lock may be 720 liters per man, or, say, 3 to 4 cu. m. for four men. As to the time spent in the working chamber, there is no necessity for limiting it, provided that the pressure is not excessive. It is well to lodge the men near the work and to build special rooms for them at the head of the shaft. The workmen should always dress in woolens to avoid chills.

A FILTER FOR REMOVING OIL FROM FEED-WATER.

A very essential part of the equipment of a surface-condensing steam engine plant, especially in marine service, where fresh feed water is not readily available, is some means of removing from the water of condensation, which is to be used over again as feed water, the lubricating oil which has been carried out of the cylinders by the exhaust steam. In surface-condensing the same water is used over and over again, but the oil, being fed to the cylinders continuously, gradually accumulates in the feed water, and enters the boiler, where it may become a source of danger. A thin film of oil on the heating surface preventing the water from adhering to it, may cause a plate or a tube to be overheated, and possibly cracked, and this danger is greater if the oil makes a thick paste with any mud or fine scale that may happen to be present in the boiler.

The apparatus for removing oil from feed water, shown in the accompanying illustrations, was put on the market a few years ago in England by Messrs. Railton & Campbell, and largely introduced by them in ocean-going steamers. It is now being made in this country by the Ross Valve Co., of Troy, N. Y. The filter is placed between the feed pumps and the boiler. It consists essentially of a chamber containing a bag made of the fabric known as "Turkish toweling," so folded as to obtain a large area of filtering surface in a small space. The surface of the bag is formed into a series of deep circular corrugations by being drawn over the bronze skeleton shown at the left of the perspective view, and drawn down between each of the sections by means of strings wound around it. The area of the filtering surface is made from 250 to 1,000 times the area of the feed pipe, according to the service required. The threads of the Turkish toweling retain the oil until they become saturated with it, while they let the water pass through. The filter is so constructed that the water passes from the outer side of the bag through it and the metal skeleton to the interior of the latter, and thence to the outflow pipe, as shown in the sectional view. The oil gradually clogs up the filtering material, increasing the resistance to the passage of the water. This resistance is indicated by the difference in the readings of the two pressure gages, one on the inlet and one on the outlet side of the filter. When the difference in pressure reaches 2 or 3 lbs. per sq. in. the filter may be cleaned by reversing the direction of the current, allowing the wash water to run to waste, or by changing the filter bag, a fresh one always being kept in reserve. The head of the filter chamber may be opened, the filter bags changed, the skeleton and the bag being removed and replaced by means of the long handle seen in the half-tone cut, and the head replaced inside of five minutes. The washing of the filter by reversing the current of water is done by operating the valves shown in the sectional view in the following manner: The inlet valve, A, is first screwed down and closed; B is then closed, and the drain cock opened. Valve A is then opened a little and the current of water thus created washes the outside of the filter. A is then closed and B opened, causing water to pass from the boiler through the filter-bag from the inside. The valve, A, is ingeniously made to perform the double function of a stop-valve and a by-pass valve, as may be seen in the sectional view.

We are informed that these filters are in use on most of the transatlantic steamers of the White Star and North German Lloyd lines, and that many of these vessels make a round trip without changing the filter cloth, merely washing it by reversing the flow, as before explained, as often as it clogs. The manufacturers are also finding considerable demand for these filters for use in steam power stations, and they are even sending them as far away as South Africa.

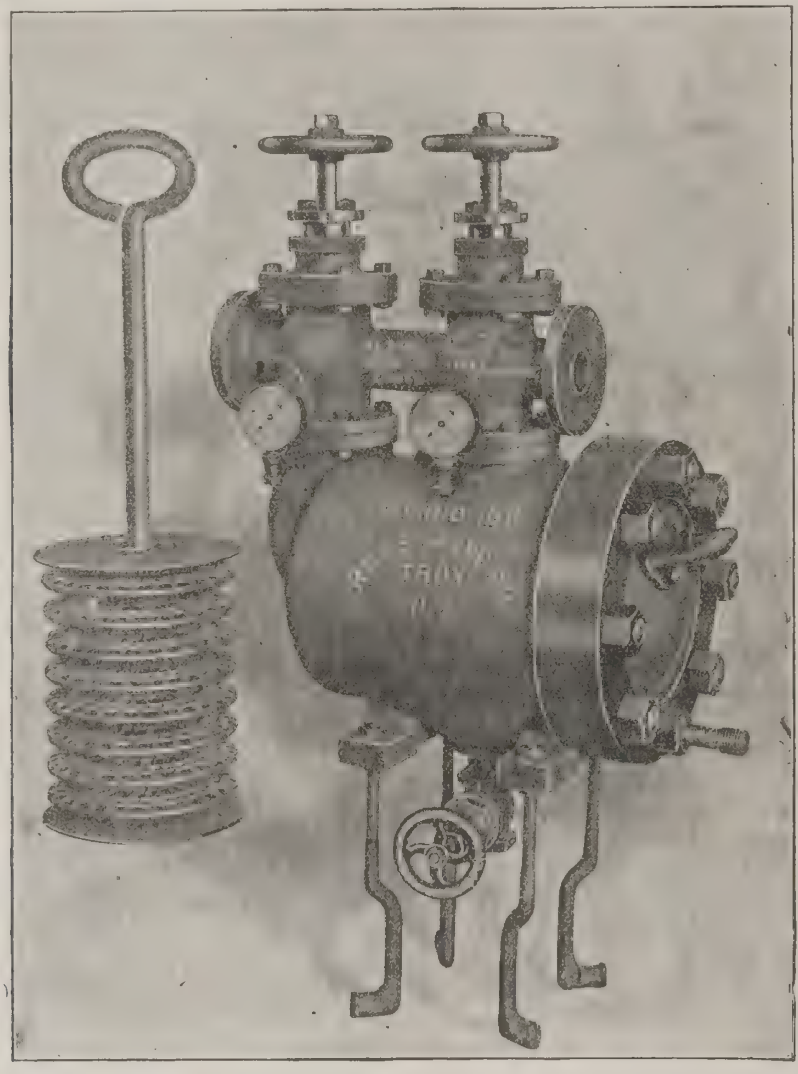


FIG. 1.—PERSPECTIVE VIEW OF ROSS FEED-WATER FILTER, SHOWING FILTER CAGE REMOVED.

The Ross Valve Co., Troy, N. Y., Makers.

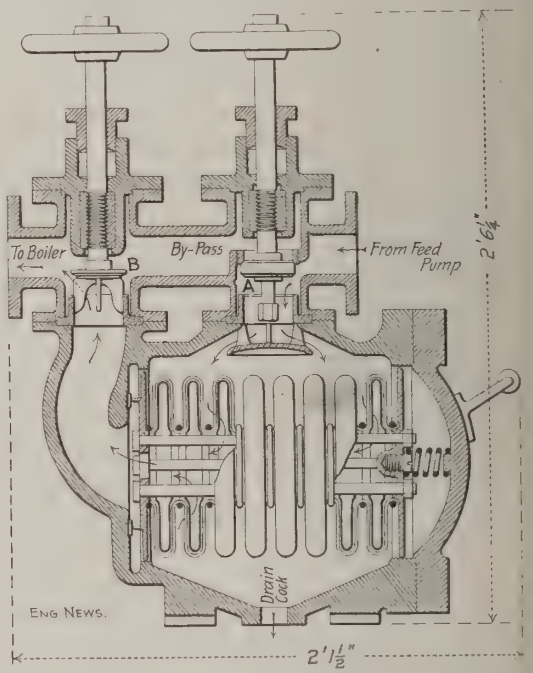


Fig. 2.—Sectional View of Ross Feed-Water Filter.

THE FAILURE OF A LARGE GAS HOLDER IN NEW YORK CITY.

In our last issue was given a brief description of the failure, on Dec. 13, of an immense gas tank, or holder, while undergoing a contractor's test previous to being accepted by the Consolidated Gas Co., for whom it was being constructed by the Logan Iron Works, of Greenpoint, Brooklyn, N. Y.

With this issue we present two views of the wreck, affording a fair idea of the complete destruction of the tank. Fig. 1 is a view of the eastern half of the wreck, and shows the mass of plates, girders and braces so badly tangled and twisted that, although a large force of men was at once put to work to clear away the wreck, very little impression has been made even at this time.

The holder, according to the best obtainable data, was a 4-section telescoping tank, 174 ft. in diameter and 160 ft. high, when fully extended, with a retaining or sealing tank 178 ft. in diameter and 42 ft. deep, 17 ft. of which was above ground, as seen in Figs. 1 and 2, and 25 ft. below. For the benefit of those not conversant with gas holder design, we may explain that the retaining tank is simply a huge reservoir filled with water. The gas-containing tank is like a great inverted tumbler, its lower edge immersed in the water of the tank, and is moved up or down as the gas is pumped in or drawn out. The gas-containing tank is subject, of course, to only a trifling pressure; but the tank which contains the water has to sustain hydrostatic pressure the same as any water reservoir or stand-pipe.

This great retaining tank, holding, when filled with water, some 1,044,621 cu. ft., burst through some cause not as yet determined, and all the water above the ground level instantly rushed out. Its volume was so great that buildings were wrecked by it, and it rushed through the streets with such force and volume that passers-by were carried for blocks in the flood as by a river. The total of deaths and fatal injuries due to this flood now numbers eight. Of course, the failure of the retaining tank brought down the entire overhead structure; and the thin plates of the gas-containing tank were bent and torn in all sorts of shapes by the force of the water and the collapse of the heavy overhead columns and girders.

The retaining tank, whose failure appears to have been the original cause of the disaster, was built up of plates varying in thickness from 7-16 in. at the top to 1¼ ins. at the bottom. The manner in which these plates were torn is admirably shown in our illustrations. It will be seen that the fracture went through the body of the plate and showed no tendency to follow the riveted seams. In Fig. 2 several 4-ft. plates are seen torn nearly straight across, the fracture, however, in some cases taking a curved form similar to that seen in the fracture of a pane of glass. There were several similar tears at various other points on the portion of the tank still standing.

An examination of these fractures shows metal of a rather coarse crystalline structure at the center of the plate, shading off into a very fine grain at the surface, with here and there splinter edges much like broken case-hardened material. In one case two straight cracks appear running directly across the short dimension of a plate, in the unharmed standing portion. Of course, these fractures in these plates are not conclusive evidence that the metal from which they were rolled was too hard, or defective in other particulars. But they are certainly significant enough to call for a searching investigation into the specifications for these plates, their chemical composition, and their behavior under test. Our endeavors to obtain this information for the benefit of our readers have so far been unsuccessful; but it is certainly to be hoped that it may be brought forward in the Coroner's investigation which is to be made.

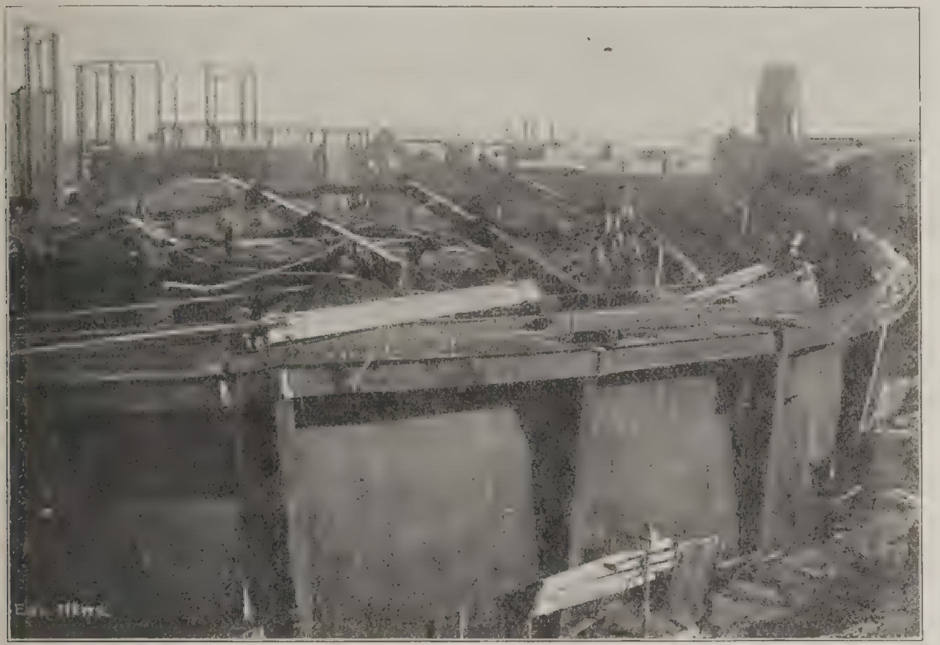


FIG. 1.—WRECK OF A LARGE GAS HOLDER; CONSOLIDATED GAS CO., NEW YORK CITY.

(From a photograph looking in the direction of the point of failure and showing the above-ground portion of the water tank.)

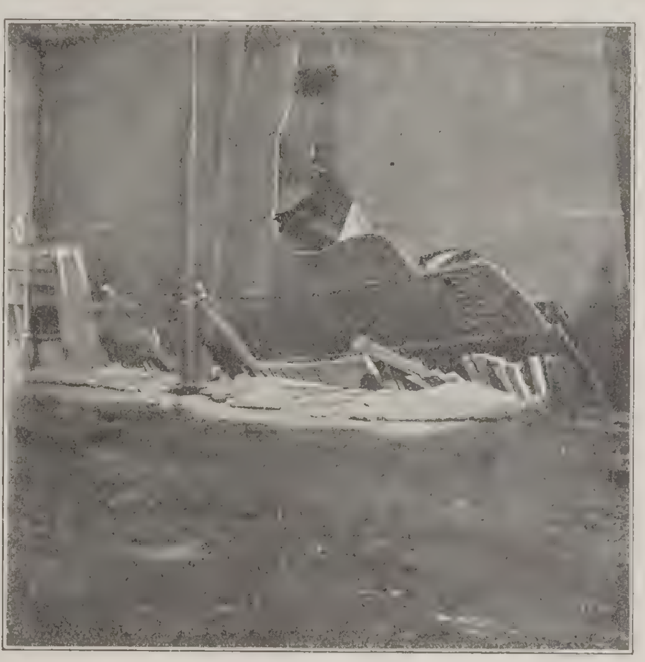


FIG. 2.—ONE OF THE TEARS IN THE STANDING PORTION OF THE WATER TANK.

(The fractured plates vary from ⅝-in. to about ⅞-in. in thickness.)

One feature in the design of the structure is made apparent in our photographs, and we are sure will be examined with interest by our readers. We refer to the support of the entire overhead structure on box-brackets bolted to the upper and thin portion of the retaining tank. These brackets, as may be seen in both figures, extend from the top of the retaining tank down to about the ground level. The question what stresses were set up in the plates of the tank by these brackets and the weight which they supported is one worth consideration. It may be, of course, that this method of support was a usual and proper one; but no reason is apparent why the overhead structure might not have been as well supported by independent piers of masonry, thus avoiding any possibility of distortion of the huge water-tank.

◆

A MASONRY-PIER MOVED BY ICE was successfully put back into place on the St. Lawrence & Adirondack Ry. at the bridge over the Chateauguay River, in Quebec. The method adopted is described in a paper read by Mr. R. W. Leonard before the Canadian Society of Civil Engineers. The water was from 8 to 12 ft. deep, and the piers were built in a box-caisson sunk upon 75 piles, and finally riprapped. The ice-field which broke loose and caused the damage, was about 3 ft. thick, and the pier was shoved out of position at one end about 1 ft. Mr. Leonard then sunk a crib, 20 x 13 ft., alongside the pier; loaded this crib with stone and drove a line of nine piles on the outside of the crib. Four 50-ton. hydraulic jacks were then placed between the crib and the pier, and the latter was successfully pushed bask into place without a crack in the masonry. The pier, with its platform, weighed in all about 500 tons; the total cost of putting the pier back into its proper position was about $800.

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A PAN-AMERICAN EXPOSITION, at Buffalo, N. Y., is planned for 1901, and the Mayor of that city has appointed a provisional committee to take decisive action in the matter. The City of Detroit is discussing a similar exposition.

◆

A GREATER AMERICAN EXPOSITION in Omaha, in 1899, is proposed by the citizens of Omaha, and $105,000 was subscribed at a meeting Dec. 16. This sum is sufficient to secure the grounds and buildings of the recent Trans-Mississippi Exposition. A committee, with Mr. Edward Rosewater as chairman, has been appointed to prepare articles of incorporation for the enterprise.

◆

THE HOUSE BILL FOR AIDING THE PHILADELphia Commercial Museum, by a grant of $350,000 to assist in providing permanent buildings, etc., passed by a vote of 142 to 70, under suspension of the rules. This permanent exposition, on which over half a million has already been expended, is intended wholly to promote the export trade of the United States. Its purpose is to show the products of all parts of the world; to educate manufacturers as to the articles most needed in foreign countries; to instruct merchants in packing and shipping goods, and in every way possible to aid in the development of foreign trade. The Councils of Philadelphia have contributed 56 acres of valuable ground within ten minutes ride of the City Hall; and the government appropriation is not available until Pennsylvania appropriates $300,000 more. The City of Philadelphia has already contributed $200,000 towards the buildings, and the State of Pennsylvania has voted $50,000, so that only $50,000 more must be raised. The plans for the buildings call for four acres of floor space, and numerous applications for this space have been received from manufacturers and merchants and dealers in the United States, Mexico, Central and South America, Africa, Australasia, India, Japan and Europe. Mr. William P. Wilson is the Director of the Museums.

◆

THE EXPORTS OF THE UNITED STATES for 1898, in domestic merchandise, will amount to over $1,200,000,000 in value, as compared with less than $1,140,000,000 for the United Kingdom. Eight years ago, England shipped goods valued at $1,280,758,643—the greatest world's record, while that from the United States for the same year was worth $845,999,603. The November exports from the United States, says the Bureau of Statistics, broke the record with $127,483,467, exceeding that of November, 1897, by over $13,000,000, and by over $42,000,000 that of November, 1895. Including a few exports of foreign products, the total for November, 1898, was nearly $130,000,000, while the imports were only $52,109,560 in value.

◆

TWENTY AMERICAN FREIGHT LOCOMOTIVES have been ordered for the Midland Railway Co., of England. The Schenectady Locomotive Works have the contract for ten of these and the Baldwin Locomotive Works are said to have the other ten. Within the last week the latter firm has closed contracts for 56 locomotives, 16 of which are for the Imperial Railways of China. The Schenectady Works are now shipping 27 locomotives constructed for the Nippoo Railway of Japan; and they are also completing 14 heavy compound consolidated locomotives for the Northern Pacific Ry. The Reading Railway Co. has made a contract with the Baldwin works for 25 freight engines and five heavy switching engines, especially designed for use on the Reading Subway, in Philadelphia, and on parts of the main line. The Baldwin works are also building ten large freight engines for the Chicago & Western Railroad Co. These contracts, coupled with numerous smaller orders, requires day and night work and a force of over 5,000 men in the Baldwin shops. The "Pall Mall Gazette" explains the English order as a consequence of the engineering strike in England. British locomotive builders are said to be only able to handle arrears of work and can take no new orders.

◆

EXTRAORDINARY ACTIVITY IN THE IRON TRADE is reported from all the leading districts. The tonnage of the blast furnaces in operation on Dec. 1, according to the "Iron Age's" statistics was 235,528 gross tons per week, the highest figure ever recorded. Stocks of pig iron at the furnaces are reduced to 544,024 tons, as compared with 805,311 tons on July 1. Sales of pig iron and of steel in various shapes aggregating about 200,000 tons, were reported in one week at Pittsburg and Chicago. Prices of Bessemer pig iron have advanced 25 cents per ton. Fears are expressed that there will be a sudden scarcity of pig iron in the market, and that the conditions of the "boom" of 1879 and its disastrous consequences may be repeated. If a marked advance in prices should take place it will seriously curtail the export trade unless European prices are likewise advanced.

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THE TWO RUSSIAN WARSHIPS now being built by the Cramps of Philadelphia, will have the following dimensions: The protected cruiser "Bear" will be 400 ft. long, 52 ft. beam, 6,500 tons displacement, 20,000 I. HP.; contract speed for 12 continuous hours, 22 knots; coal-bunker capacity, 1,400 tons. She will have a main battery of 12 6-in. rapid-fires, with 12 3-in. rapid-fires, and 6 47-mm. rapid-fires. There will be four torpedo tubes, with two of them under water. All the guns will be guarded by shields. The battleship will be 376 ft. long, 72 ft. beam, maximum draft 26 ft., 12,700 tons displacement, 16,000 I. HP., speed for 12 hours 18 knots, bunker capacity 2,000 tons. The side armor will be 7½ ft. deep and from 2 ins. to 9 ins. thick; above this will be 6-in. armor for the gun deck with 9-in. cross bulkheads. She will be armed with 12-in. guns in 10-in. barbettes and turrets, and with 6-in. and 3-in. rapid-fire guns, and six torpedo tubes. The full descriptions of these two ships are not yet published, but they are evidently to have great speed and an efficient rapid-fire batteries, with a minimum of armor.

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PROPOSALS FOR RAISING THE "MAINE" and "Cristobal Colon" will soon be asked for by the Secretary of the Navy, as a result of the many offers received by the Navy Department from responsible firms, who are willing to undertake the work at their own risk.

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THE HAVANA FLOATING DRY-DOCK, having a lifting capacity of 10,000 tons, is held to be floating and movable property by the American Evacuation Commission, and will be sold for the account of the Spanish government. This dock was built in England at a cost of $600,000; but is said to have been so badly used by the Spanish engineers that it is now not worth half that sum.

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THE INFLUENCE OF COAL IN NAVAL WARFARE is indicated in the late report of the Bureau of Equipment of the U. S. Navy Department. During the fiscal year the sum of $2,122,005 was paid for 452,551 tons of coal, or at the rate of $4.68 per ton, as compared with 138,318 tons, bought for the navy in the previous year of peace. Of the first amount 74,111 tons were purchased abroad at an average rate of $8.12 per ton, as compared with 56,268 tons, at $6.68 per ton, bought abroad in the previous year. At Key West, with an original coal-shed capacity of only 3,000 tons—later raised to 9,000 tons—warships were often present having a bunker capacity of from 10,000 to 12,000 tons. The government first met the demand for colliers by the purchase of five vessels having an aggregate carrying capacity of about 13,000 tons; and by purchasing other foreign ships, the Bureau eventually had in Atlantic waters an efficient, armed collier fleet capable of carrying 50,000 tons of coal. At one time, at Hampton Roads, there were afloat on steam colliers, 40,000 tons of the best American coal, ready to be sent at an hour's notice to any point desired. Another experience of the war demonstrated the absolute necessity of providing either tank ships or distilling ships of large capacity for furnishing fresh water for boiler use. The distilling apparatus on our warships, with the notable exception of the "Oregon," was inadequate to keep up the supply of fresh water needed, and the boilers on blockading ships suffered from the want of fresh water. The Bureau believes that tank ships, such as are used for carrying oil in bulk, will be most useful in transporting water to a fleet. The purchase of fresh water for steaming purposes, under former methods, is now too expensive. For example, at Hampton Roads, 1,000 gallons of fresh water delivered to the ships costs $7.50; the same amount drawn from the mains at the Norfolk Navy Yard into a water-barge and towed to the ship, costs 30 cts. During the war, $2,067.50 was paid for 432,000 gallons of fresh water delivered to the "St Paul," at Tompkinsville, N. Y.; had this water been taken at the Brooklyn Navy Yard and towed in a barge to the ship, the cost would have been $43.25.

◆

A UNIFORM .30 caliber, for small arms and machine guns, is recommended by the board of Army, Navy and Marine officers now in session in New York, with Col. Alfred Mordecai, U. S. A., presiding. The board proposes this caliber for all branches of the service, because the army is already armed with a number of such guns and large quantities are being daily turned out to meet the possible demand of an increased army. The cannelured cartridge-case is considered most suitable for use with these small arms and machine guns; provided, the change can be readily made in the army guns now in use.

◆

THE 8-IN. CAST-STEEL, ONE-PIECE GUN, invented by Dr. R. J. Gatling, was submitted to the first of its series of tests at Sandy Hook on Dec. 15. Five rounds were fired with brown prismatic cocoa powder, in charges of 68, 132, 135, 141 and 142 lbs., and a projectile weighing 300 lbs. The gun successfully withstood these tests, though the highest chamber pressure recorded was about 37,000 lbs. per sq. in. This gun is cast, muzzle down, from a combination of steel and nickel, showing a tensile strength of 50 tons to the sq. in. To insure against blowholes a sinking head of 15 tons of metal is used in pouring. When bored the steel is found to be of fine quality, and homogeneous; but the chief claim of Dr. Gatling lies in his method of reheating the ingot and then cooling from the interior in such manner as to practically provide a series of shrunked bands about the bore. The full test includes 300 rounds, and the cast-steel gun must prove its equal efficiency with built-up and wire-wound guns before it will be recommended by the board having its test in charge. In 8-in. built-up guns an abnormal chamber-pressure of 100,000 lbs. has been recorded; and the Brown 5-in. wire-wound gun has often withstood pressure of 50,000 lbs., and one of 82,850 lbs.

◆

THE LEAGUE OF ASSOCIATED ENGINEERS, with headquarters at the House of the Engineers' Club, in New York city, aims to bring closer together American engineers in civil life and those serving under the government in the engineering profession. It is also intended to foster a more active public interest in the engineering aspect of our national defense and to assist government engineers in their efforts to secure the highest possible efficiency both in material and in personnel. Technical education and training of a high order in these branches of the service are imperatively necessary; and in encouraging the necessary legislative measures the citizen engineer performs a patriotic duty and betters the standing of the profession generally. At the present time the Executive Committee of the League is engaged with H. R. bill No. 10,403, entitled "A bill to reorganize and increase the efficiency of the personnel of the Navy and Marine Corps of the United States." The League intends to press the passage of this bill, and any who have suggestions to make, or who can assist in this work, are asked to communicate with Mr. Stephen W. Baldwin, Chairman, care of The Engineers' Club, No. 374 5th Ave., New York.

◆

THE PROPOSED DEEPENING OF THE CHANNEL at the entrance of New York Harbor is being examined by a special board of engineer officers, made up of Col. Henry M. Roberts, Lt.-Col. C. W. Raymond and Major H. M. Adams. The surveys and plans recommended by Col. Ludlow are being especially considered. These, as the best of three alternative routes, practically cover the deepening of the direct East channel to 35 ft., thus avoiding the long detour by the Gedney and Main channels, and saving several miles in entering the harbor.

◆

A 30-FT. CHANNEL IN THE DELAWARE RIVER, 600 ft. wide, is again agitated by maritime interests in Philadelphia. The length of this channel would be about 56 miles and it would require the removal of 32,375,000 cu. yds. of mud, etc., and about 12,100 cu. yds. of rock. The estimated total cost would be $5,935,000, and the work could be finished in five years. The present channel is 26 ft. deep, but this is inadequate for the demands of commerce.

◆

THE BALTIC-BLACK SEA SHIP CANAL, so often reported as a possible enterprise, will not be built, according to a communication from the Russian government to U. S. Consul-General Halloway, of St. Petersburg.

◆

WATER POWER IN PORTO RICO is abundant and efficient, according to Gen. Roy Stone. The numerous small rivers have an average fall of 2,500 ft. in passing from the central mountainous country to the coast; and on these streams are many high water falls.

◆

THE RAILWAY SYSTEM OF THE BERNESE OBERland, starting from Interlaken, Switzerland, has a total extent of a little over 42 miles, including the 7.8 miles of the Jungfrau railway now under construction, described in our issue of Dec. 15. From Interlaken to Zweilutschinen, 5 miles, ordinary locomotives are used; but beyond this point the system of traction is a mixed one, including both ordinary and rack rail lines. The maximum grade surmounted on the lines to Lauterbrunnen and to the Grindelwald is 12%; but the lines to Schynigeplatte and to the Wengeralp have rack rails for the whole length, and the maximum grade is 25%. The line to Murren is operated by a counterpoised cable, over a length of 4,526 ft., with an incline of 26%. These lines have a gage of 2.62 ft., and the rails usually weigh about 45 lbs. per yd. The cost of building the 14½ miles of the Interlaken-Lauterbrunnen-Grindelwald line, opened in 1890, was about $44,000 per mile; and 86% of the business is from tourists, amounting to annual gross receipts of $80,000. The rack-railways up the Schynigeplatte and Wengeralp, opened in 1893, cost nearly $80,000 per mile, with their 25% maximum grades. Interlaken is 1,863 ft. above sea level; Murren has an elevation of 5,376 ft.; Grindelwald of 3,467 ft., and the summit station of the Jungfrau line will be 13,668 ft. above sea level.

◆

A COMBINED BRAKE COUPLING and angle-cock has been invented in which the cocks are automatically opened by the operation of coupling up the hose, which operation is performed by hand in the usual way. The main object is to prevent accidents caused by tampering with or neglect of these valves. The ordinary hose coupling shell is used, and is provided with an angle-cock valve connected by a link with a turn-plate on the back of the shell. This turn-plate is fitted with two claws, which grip the projecting flange of the mating shell, thus operating the valves, opening them when coupling, and closing them when uncoupling. The coupling gives the full air opening required and will couple and work with any standard coupling now in use, so that it can be introduced gradually. In case of a train parting the valves will remain open, thus releasing the air and causing the application of the brakes. The device has been tested under 100-lbs. pressure in the shops, but has not yet been in use on any cars. It is being introduced by W. & M. Cunningham, P. O. Box 340, Pittsburg, Pa.

◆

THE TERM "SEMI-STEEL," which has recently been applied by some founders to cast-iron which has been improved by remelting with the addition of some steel scrap, is strongly objected to by Dr. Richard Moldenke, of Pittsburg. In a letter to the "Iron Trade Review," he says:

> The addition of steel scrap has simply extended the upper strength limit from 25,000 to 40,000 lbs. per sq. in., and the ductility from 0.3 to about 0.75%, but has not made a new class of material by any means, all the properties being those of cast-iron. . . . The use of the term "semi-steel" conveys to the minds of modern men an impression similar to the name of some patent medicine.

◆

THE WORLD'S PRODUCTION OF GOLD in the last five years, says Mr. George E. Roberts, Director of the Mint, has amounted to $977,622,100. The industries consumed $300,000,000 of this. The stocks of gold in sight in European banks and government treasuries, from December, 1892, to December, 1897, increased about $550,000,000, or over 40%. In these five years the stock of gold in the United States increased $95,457,000; and the increase in Australia, Canada and South America was $15,000,000.

◆

THE MONEY IN CIRCULATION IN THE UNITED States, on Dec. 1, was $1,886,879,504, or nearly $165,800,000 more than on the same date one year ago. Gold coin alone shows a gain of nearly $114,500,000 in this period; standard silver dollars show an increase of $2,700,000, and subsidiary silver coin, $5,100,000. U. S. Treasury experts, on a basis of a population of 75,194,000, estimate the circulation at $25.09 per capita, of $1.70 more than one year ago.

◆

THE U. S. GENERAL LAND OFFICE, according to its report for the fiscal year ending June 30, 1898, recorded 99,806 entries of land, in all classes, covering 12,909,607 acres. The cash receipts from sales amounted to $1,391,393, and from fees and commissions the office received $853,265. The 30,293 agricultural patents covered about 4,846,880 acres, and the 1,259 mineral and mill site patents covered 31,605 acres, and railroad land grants amounted to 1,069,534 acres. The estimated unreserved and unappropriated land amounts to 579,368,274 acres, exclusive of Alaska.

◆

THE WERNWAG WOODEN BRIDGE, over the White River, at Indianapolis, Ind., was built in 1831-33, and is still standing in fair condition, according to a paper read by Mr. Edward Hill before the Indiana Engineering Society and published in the "Proceedings" of that Society for 1898. The bridge is on the old National Road, and was contracted for on July 26, 1831, by Wm. H. Wernwag and Walter Blake for $18,000, and finished in 1833. There are two spans of 170 ft. each, and the timber used was yellow poplar. Each span consists of three arched beams, which carry all the load; and each one is made of three 5½ × 11½-in. sticks placed one over the other, with 1½ ins. between sticks for packing; the arch being thus 3 ft. 1½ ins. deep. The posts are spaced 8 ft. 9 ins. apart, and are set radial to the curve of the arch. The original abutments stand, but the pier has been practically rebuilt. After 64 years continual service this bridge was straightened and repaired by the City of Indianapolis in 1897.

◆

THE ELECTRIC SEASONING OF WOOD is mentioned by the London "Builder." The timber is immersed about half its depth in a tank of water, and an electric current is applied through a metallic conductor, so arranged as to distribute the current through the whole area. In about 4 minutes the sap begins to exude at the lower end of the stick, and in 6 hours it is all extracted. In another tank an antiseptic solution is then forced into the empty pores by an electro-capillary process. The cost of doing all this is not stated.

BOOK REVIEWS.

MODELLVERSUCHE UBER DEN EINFLUSS DER FORM UND GROSSE DES CANALQUERSCHNITTES AUF DEN SCHIFFSWIDERSTAND.—Von H. Engels, Geh. Hofrath, Professor an den Technischen Hochschule in Dresden. Berlin, 1898: Wilhelm Ernst & Sohn. Paper; 14 × 10½ ins; pp. 12; two diagrams. 3 marks.

This treatise relates to experiments, made with models, upon the influence of the form and dimensions of the cross-sections of canals upon the resistance of ships in transit. Seven forms of canals were experimentel upon, with varying widths, at water surface, but constant depths; though other experiments are given in which both dimensions are widely varied in canals with inclined sides. These experiments are all tabulated and the apparatus used is illustrated. Professor Engels seemingly favors a section which is deepest at the middle; with slight upward slopes to the foot of the side-slopes.

TOPOGRAPHICAL SURVEYING. — Van Nostrand's Science Series, No. 72. Including: Topographical Surveying, by Geo. J. Specht, C. E.; New Methods in Topographical Surveying, by Prof. A. S. Hardy; Geometry of Position Applied to Surveying, by John B. McMasters, C. E.; Co-ordinate Surveying, by Henry F. Walling, C. E. Second edition; revised. New York: Van Nostrand Co. Cloth; 6 × 3⅞ ins.; pp. 210. 50 cents.

The earlier edition of this series of essays having been exhausted, the present issue has been revised in text and diagrams to agree with the latest practice. The titles are sufficiently descriptive of the purpose of the handbook. The chapter by Professor Hardy is devoted to the application of photography to surveying, and describes the general practice in the field and in the office.

TECHNICAL EDUCATION (FRANCE).—Copy of "Report on French Technical Education," by Mr. Charles Copeland Perry, recently issued by the Science and Art Department. Eyre & Spottiswoode, Government Printers, London. Pamph.; 8vo.; pp. 59. Price, three pence.

This report is divided into three parts: 1. Recent Legislation on French Primary Technical Education. 2. Schools Visited—Primary and Secondary. 3. Summary. A French law in 1880 provided for the establishment of schools "manuelles d'apprentissage," to "develop in youths intended for manual trades the requisite dexterity and technical knowledge. The law was practically a dead letter until 1888, and it was not until 1892, when a new category of schools "pratiques de commerce on d'industrie" was created, that the present system of French industrial education was seriously begun. The report is a carefully written account of the difficulties that have been encountered in arriving at a correct theory or scheme of industrial or trade education in France, of the mistakes that have been made, the beneficial results already visible, and generally of the present status of these schools.

ENGINEERING NEWS
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THE NORTHWESTERN ELEVATED RAILWAY, of Chicago, upon which work has been suspended for nearly two years, is to be pushed to completion as soon as practicable. According to press reports, negotiations have been completed for a loan of $4,500,000, which will be used to continue the work. This loan was received through Blair & Co., of New York city, and is to be financed by notes of the railway company payable on or before 18 months, with interest at 5%. To secure the loan the railway company will deposit with the Illinois Trust & Savings Bank as trustees, $5,000,000 in 5% first mortgage gold bonds and $5,000,000 in preferred stock, representing the entire issue of both classes of securities. As a guarantee that the railway company will at once proceed with the construction of the road and have it completed by Jan. 1, 1900, it has deposited $100,000 with the Comptroller of the city of Chicago. The Northwestern Elevated Ry. will extend from the business district into the northern section of the city of Chicago, and will be about 6⅔ miles long. The motive power will be electricity. The foundations for a considerable part of the line are completed and much of the steel work is ready for erection. A full description of the proposed road was published in Engineering News, of Sept. 5, 1895.

◆

A PLANT FOR THE MANUFACTURE OF STEEL cars is about to be built by the Carnegie Steel Co., Ltd., It will have a capacity of about 40 cars per day, and will include a large axle forge. The company has purchased a large track of land on the south bank of the Monongahila river, west of Homestead. It is about 1½ miles long by from ⅛ to ¼ mile wide. With this new track the company will own over seven consecutive miles of land on the river. The establishment of a car works by the Carnegie company is a notable example of the tendency of iron and steel manufacturers not only to control their own coal and ore supplies and their own transportation, but also to carry the manufacture of their product to the final shape in which it is to be used, instead of selling it in intermediate forms, such as bars, beams and plates.

◆

PROPOSALS FOR TÚRBINES for the water power electric plant of the Lake Superior Power Co., at Sault Ste. Marie, Mich., will be received until March 1, 1899. A full description of the canal, penstock and power-house construction for this plant was published in Engineering News, of Aug. 4, 1898. The turbines which are required must be capable of developing in penstock units, composed of two or more turbines, with a head of 16 ft. at the penstock entrance and with 391 cu. ft. of water per second, 568 HP. at the end of a shaft, which revolves 180 times per minute. The details of construction, type, size and number of the turbines are left to the bidder. The proposals are to be submitted to the Chief Engineer, Lake Superior Power Co., Sault Ste. Marie, Mich.

◆

A $9,000,000 LOAN AT NEW ORLEANS for water supply, sewerage and drainage will be submitted to popular vote on Feb. 2. If the vote is in the affirmative, the proceeds of the loan will be divided equally between the works named. The city is already part owner of the water-works, and work on the drainage system is under way. A franchise for a sewerage system was granted a number of years ago, a company organized and some pipe laid. The company has been in the hands of a receiver for some time.

◆

THE SANITATION OF SANTIAGO DE CUBA requires strong measures to impress upon the inhabitants the force and meaning of the new regulations. Major Barbour, with his force of 126 men, has dug out and carted away very much of the accumulated filth of centuries, and whitewash, lime and disinfectants have greatly improved the sanitary conditions of the city. But doors of houses have had to be smashed in getting at filthy yards, and natives who insist upon turning the streets into sewers are publicly horsewhipped in the streets. Eminently respectable citizens were at first sentenced to aid in cleaning the streets, when convicted of defiling them; but all classes have completely surrendered now, says Mr. Robert P. Porter, in his report as Special Commissioner, and they begin to appreciate the common good to result from the new regime. Several important streets have been repaved and all the public buildings thoroughly cleaned. The law courts have been reorganized; and the municipal taxes, formerly diverted into other channels by Spanish officials, are now being devoted exclusively to local improvement. Public roads are greatly needed in the Province, as practically none exist worthy of the name. Mr. Porter says there is a nominal revenue of nearly $5,000,000 annually, in Santiago Province, coming from internal, industrial, professional and licensing taxes, and this could well be devoted to local improvement.

◆

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred Dec. 21 on the Pennsylvania R. R., at Colonia station, near Rahway, N. J. Two persons were killed and six seriously injured, all of whom were on an express known as the "Pittsburg Flyer," due at Jersey City at 6:21 a. m. Owing to a dense fog the Southern express, from Tampa, due at Jersey City at 6:43 a. m., ran into the rear of the Pittsburg express, which was being held by the block signal.

◆

TWO WATER MAINS BURST IN CLEVELAND on Dec. 21. One was 30 ins. and the other 8 ins. in diameter, the breaks being close together. A large hole was washed out in the street and some other damage was caused by the water.

◆

HEAVY MARINE LOSSES, for 1898, are reported by marine insurance men. A list of the 26 most important total losses foots up at $4,325,000 for the approximate hull value, and $7,397,500 for the freight cargo. In this list "La Bourgogne" figures at $800,000 for the ship and $500,000 for cargo; and the "Mohegan" at $700,000 and $150,000, respectively. On the American lakes, 56 vessels were lost, with a tonnage of 29,194 tons, valued at $2,600,000.

◆

THE SINKING OF A PIECE OF STATE ROAD in Swampacott, Mass., is reported in the Massachusetts papers. A stretch of road has given some trouble by continued settling, requiring the addition of new material from time to time to keep it to grade. On Dec. 8, as filling was in progress, alarm was caused by heavy settlement. The settlement continued until quite a pit, filled with water, is said to have formed over a length of 100 ft. of what had been roadway. It appears that an embankment was built on a thin crust of solid material; that settling began, and was made worse by each successive filling, until finally the crust gave way under the load. The road was built by, or under the direction of, the Massachusetts State Highway Commission, whose headquarters are at Boston.

◆

THE TRANS-CASPIAN RAILWAY, says the London "Times," has been extended from Merv, 300 miles southeast of Khwa, to Kushk, in the Jamshidi province of Afghanistan and within 95 miles of Herat. The first train passed through on Dec. 16.

◆

THE MOMBASA-UGANDA RAILWAY, in East Central Africa, is completed for 250 miles, from Mombasa, on the Zanzibar coast. The terminus will be on the north shore of Lake Victoria. The line is one meter gage, and for fully 200 miles it traverses a waterless desert. At 131 miles from Mombasa, at Tsavo, it reaches an elevation of 1,900 ft. above sea-level; at Kibwesi, 193 miles, the elevation is 3,000 ft.; and at Kikuyu and Mau the line will be 7,700 ft. and 8,300 ft., respectively, above the sea. The road was constructed under great difficulties; but the portion completed is being operated with first, second and third-class cars, moderate fares and with time-tables arranged on the 24-hour system.

◆

GEOLOGIC FOLIOS, or the parts of the geological map of the United States already surveyed and mapped by the U. S. Geological survey, are on sale at the offices of the Survey, at Washington, D. C. A circular has been prepared, and will be forwarded on application, showing for each folio, the state, the limiting parallels and meridians, the area covered, and the price, which in nearly all cases is 25 cts. The area covered by a folio is usually 1,000 sq. miles; 46 folios are ready for distribution and 15 are nearing completion.

◆

TOPOGRAPHIC MAPS OF NEW ENGLAND are on sale by the U. S. Geological Survey as follows: Massachusetts, Rhode Island and Connecticut are completely surveyed and mapped; of Maine, 24 sheets are published; of New Hampshire, 19 sheets, and of Vermont, 23 sheets. The whole number of published sheets for New England is 133; of which Massachusetts has 55; Rhode Island, 15, and Connecticut, 34. The unit sheet is 16½ × 20 ins., covering 1-16th of a "square degree," embracing an area of about 220 sq. miles, on a scale of 1:62.500, or about one mile to one inch. They are sold for 5 cts. per sheet, or 2 cts. each for 100 or more sheets. On application a circular will be forwarded showing just what parts of the three unfinished states are surveyed; and on this circular, the separate sheets of all work done are so designated that maps for any desired section can be ordered.

◆

SHIP DRAFTSMEN are wanted at various shipyards, and on Feb. 7 the U. S. Civil Service Commissioner will open a competitive examination of applicants. The pay is $5 per day for draftsmen, and $4 for assistant draftsmen. All persons desiring to compete should at once write for application blanks and directions to the U. S. Civil Service Commission, Washington, D. C.

◆

SURVEYS OF PORTO RICO HARBORS are to be made by the U. S. Coast and Geodetic Survey, and the survey steamer "Blake" sailed from Baltimore on Dec. 22 with a party of engineers. The government will extend this work as rapidly as possible to the whole coast of Cuba and Porto Rico, which is either now very poorly mapped or has never been surveyed at all.

◆

THE PROPOSED LAKE ERIE-OHIO RIVER SHIP canal is not believed in by the Pittsburg Chamber of Commerce, according to the "Commercial Gazette," of that city. At a recent meeting of the directors of the Chamber, a resolution was presented favoring the incorporation of the canal company by Congress and urging Congress to pass the bill. This resolution brought out vigorous opposition. Capt. Jno. F. Dravo said that the plans for the canal call for a depth of 15 ft., whereas nearly all lake vessels draw from 18 to 20 ft.; and at the proposed terminus of the canal, at Davis Island, there is only 12 ft. of water. To make the canal available, locks 1 and 2, in the Ohio slack-water navigation, would have to be rebuilt, and the river would have to be dredged from the Island to McKeesport. This dredging would destroy Pittsburg harbor, as the water is now held by the natural bar at Brunot's Island, which bar would have to be cut through. Mr. Dravo criticised the estimated cost as too small, and finally said that the building of the Carnegie railway line to Lake Erie had killed the canal as an enterprise. Other directors spoke in a similar vein, only one favoring the canal. In the interest of the subscribers to the canal fund, the resolution was finally adopted, although a number of the members did not vote.

◆

COAL FOR AMERICAN WARSHIPS, to the amount of about 500,000 tons, is to be systematically distributed along the Atlantic, Gulf and Pacific coasts, at Manila, Honolulu, Pago-Pago, Guam, etc. In addition, at least 50,000 tons more is always available at either Hampton Roads or New York. The government now possesses 17 armed colliers, with an aggregate carrying capacity of 50,000 tons.

◆

THE FIGHTING FORCE OF THE U. S. NAVY, at its maximum on Aug. 15, 1898, according to the report of the Secretary of the Navy, was made up as follows: First class battleships, 4; second class, 1; armored cruisers, 2; coast-defence monitors, 6; armored ram, 1; protected cruisers, 12; unprotected cruisers, 3; gunboats, 18; dynamite cruiser, 1; torpedo boats, 11; vessels of old Navy, including monitors, 14. Auxiliary Navy: Cruisers, 11; converted yachts, 28; revenue cutters, 15; lighthouse tenders, 4; converted tugs, 27; converted colliers, 19; miscellaneous, 19. This is a total of 73 in the regular navy, and 123 in the auxiliary fleet, or 196 vessels in all. This fleet was manned by 24,123 enlisted men. There were 856 volunteer officers of all grades in service during the war; 456 of these ranking with the line, and 205 were engineer officers. There are now under construction: 8 first-class battleships; 4 coast-defence monitors; 1 training vessel; 1 sheathed cruiser; 16 destroyers; 22 torpedo boats; 2 steel tugs; 1 submarine boat; or 55 warships in all.

◆

A 40-FT. CHANNEL TO NEW YORK HARBOR is advocated by New York business and marine interests before the House Committee on Rivers and Harbors. This channel, by way of the East Channel, would cost $5,840,000, and could be finished in ten years. A 35-ft. channel would cost $4,510,000, but in view of the rapid increase of the draft and dimensions of ocean steamers the deeper channel is recommended.

NEW RUSTIC STONE ARCH BRIDGES IN THE NEW YORK STATE RESERVATION AT NIAGARA FALLS.

The Commissioners of the New York State Reservation at Niagara Falls have been replacing several of the older bridges by rustic stone arches. The largest of these, which has just been completed, is one connecting Goat Island with the First Sister Island, and it takes the place of the old suspension bridge familiar to every visitor to Niagara Falls. This older bridge was too narrow for the traffic, and being located some feet above the present stone arch, it obstructed the view of one of the prettiest of the small water falls at Niagara. The new bridge was so built that the fall can be seen, and the channel was deepened above the bridge to increase still further the beauty of the scene.

RUSTIC STONE ARCH BRIDGE CONNECTING GOAT ISLAND AND FIRST SISTER ISLAND, NIAGARA FALLS, N. Y.
Vaux & Emery, New York, N. Y., Architects.
W. A. Shepard & Co., Niagara Falls, N. Y., Contractors.

The span of the arch is about 60 ft. and the outside width is 16 ft., with parapet walls 2 ft. thick. The arch is built of "native" stone, used undressed on the face and laid with ½-in. joints in Giant Portland cement. The rock-face projects about 3 ins. beyond the plane of the joints, and the general character of the masonry is well shown in the photograph. In construction the arch was laid uniformly from both ends, and all backing, wing walls, etc., are made of first-class random rubble-work laid in courses and well bonded. The top of the arch and part of the abutments have a concrete backing plastered over with cement, and on this is laid a three-ply damp-course made of tarred felt and asphaltic cement. Four 3-in. weepholes through the abutments carry away any moisture reaching the damp-course. At each end of the arch are projecting bays, and from these the wing walls extend. The parapet-wall is made of two courses of rock-face stone, and a cement walk completes the bridge. Judging from the photograph alone the chief criticism to be made upon this arch is that it is somewhat too massive in appearance for the span and site.

The architects were Vaux & Emery, of New York, and the work was done by W. A. Shepard & Co., of Niagara Falls, at a cost of about $8,000. We are indebted to Mr. Orrin E. Dunlap, of Niagara Falls, for the photographs and information used.

A WOODEN LINING FOR SHIELD-DRIVEN TUNNELS.

In the construction of the sewerage system of Melbourne, Australia, a large amount of tunnelling was necessary; in all, 37,145 lin. ft. of sewers, from 3 ft. 3 ins. to 9 ft. internal finished diameter, were built with the assistance of shields. Compressed air was employed in 5,250 lin. ft. of this work, and cast-iron, wood, concrete and bluestone blocks were used for lining. The cast-iron, with concrete lining, was first adopted, but the great extent of the work demanded some more economical construction, and concrete and bluestone blocks were next tried. This latter system of lining was not found to be generally suitable, especially in wet grounds and in the larger diameters, and, for a time, iron lining was again employed. In the last shield tunnel work, however, a system of lining with wood, devised by Mr. George Henry Dunlop, M. C. E., of Melbourne, was successfully adopted. This tunnel was finished in concrete, as with the cast-iron lining.

For two lengths of sewer, one amounting to 2,000 lin. ft. of 6 ft. 9 in. tunnel and the other 1,250 lin. ft., 7 ft. 6 ins. in diameter. Mr. Wm. Thwaite, M. Inst. C. E., and Engineer in Chief of the Melbourne Metropolitan Board of Works, had two designs prepared, one using cast-iron lining of the usual type and the other the wood lining proposed by Mr. Dunlop. The two constructions were deemed of equal efficiency for use with shields and alternative bids were received upon the two plans. As a result, the lowest bid for the cast-iron was $164,000, and $121,300 was bid for the wooden lining. The bid for the wood lining was accepted; but it should be said in connection with these prices that a considerable part of each sum was chargeable to shafts and other non-tunnel work common to both.

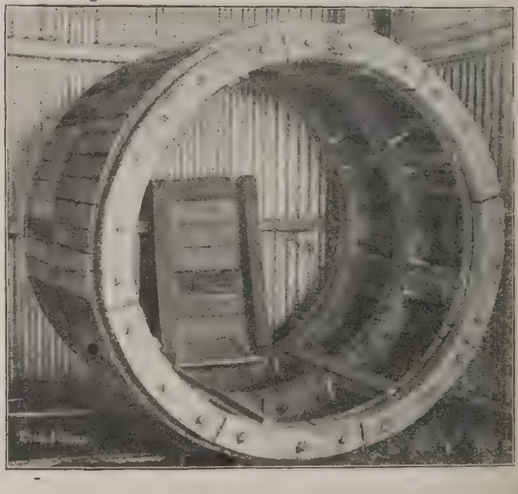
The construction of the wooden lining is shown in the illustration given for a 4 ft. 3 in. sewer. The wooden lining is built up in successive rings, about 2 ft. broad, each ring being made of eight segments fastened together by the lagging nailed to them. In the sewers here shown the ribs were made of 5×3 in. material, cut to the circle and radial lines, and the lagging was 1½ ins. thick. The sections are put together outside of the tunnel, and are laid up like blocks in the tunnel; and as they are put in place the rear-rib is made to break joint with the rib already laid, and the two are firmly bolted together, so as to act as one piece. As a consequence, each complete rib is actually made of two sets of the 5×3 in. timbers. In construction, freshly tarred felt is placed between the abutting ribs. The bolts used are ¾-in. diameter, with square heads and nuts, and washers 2½ ins. square and ¼-in. thick.

To take up the thrust of the rams used in forcing the shield ahead, eight stout struts, or thrust-blocks, are fitted between the ribs with wedges, and in continuous lines extending as far back from the shield as may be necessary. These struts are removed before the concrete is put in place and they may be used over again. In these Melbourne sewers Australian hardwood was employed, and red-gum, ironbark, and box was specified for the ribs. In the 7 ft. 6 in. circular sewers the ribs were made of 6×3 in. red-gum; the lagging was 1½ ins. thick, with 10 pieces to each of the eight segments; the thrust-blocks were 8×6 ins. in section, and ¾-in. bolts were used throughout. Each ring was 2 ft. long, and the final concrete lining was 14½ ins. thick, with a rendering of ¾-in. of neat cement mortar on the inner surface. The ground passed through was largely a sandy clay, with a considerable section containing only sand heavily charged with water. This tunnel was carried under several railways, a small creek, and the brick abutment of a bridge.

In designing this wood lining the purpose is to make the ribs, taken in connection with the lagging, sufficiently strong to resist the outside pressure, for a considerable time at least; and as a matter of fact, at Melbourne, sometimes as much as 2,000 lin. ft. of the wood lining was built ahead of the concreting work. The chief advantage claimed for the wood over the iron lining, aside from economy in cost, is the better subdivision of duties to be performed by the ribs and lagging. Any tunnel lining, when unequally loaded, depends for its rigidity upon its ribs, or flanges. In cast-iron lining the circumferential flanges usually contain from 25 to 33% of the whole metal, and it is difficult if not impossible to separate the duty performed by the flanges and the metal connecting them. In a properly designed wood lining, the ribs would contain from 50 to 66% of the total wood; and this material and the span and thickness of the lagging can be readily and certainly proportioned to sustain any estimated compression. The use of the continuous thrust-blocks prevents the rings from being distorted by ram-action, and for all practical purposes the wooden lining is as rigid as one of cast-iron.

It is true, that there is an unusually large number of joints in the wood lining. But the swelling of the wood in damp ground will tend to prevent leakage; and if it were necessary, the whole outer surface of the ring could be covered with thin metal or other waterproof material—even overlapping the joints of rings. While the timber lining requires a slightly larger shield, this is compensated for by the lighter weights to be handled in wood construction. The lagging, if closely fitted, will swell, and to a considerable extent act as an arch in transmitting pressure to the ribs. In fact, the wooden lining used at Melbourne was found to deflect less under pressure than the cast-iron which it replaced; and it well withstood heavy and unequal ram pressures.

In large tunnels, lined with cast-iron, it is a common practice to omit the concrete, or only to cover the flanges with concrete, on the assumption that the life of the cast-iron used is equal to that of brick or concrete. In construction of this kind to be used in connection with electric power, there is now a suspicion of possible serious trouble from electrolytic action. Based upon the experience in Melbourne, the inventor of the new system believes that an all-brick or concrete tunnel could be thus built at a less cost than for an


General View of the Dunlop Wood Lining for a 4-ft. 3-in. Sewer, Built at Melbourne, Australia.

(This sewer, when finished, had concrete walls 13 ins. thick; the wooden ribs being imbedded; but the longitudinal struts were first taken out.)

unlined cast-iron tunnel, and it would be totally free from danger of the kind mentioned.

The following comparative tables of quantities are given from actual experience with the two systems:

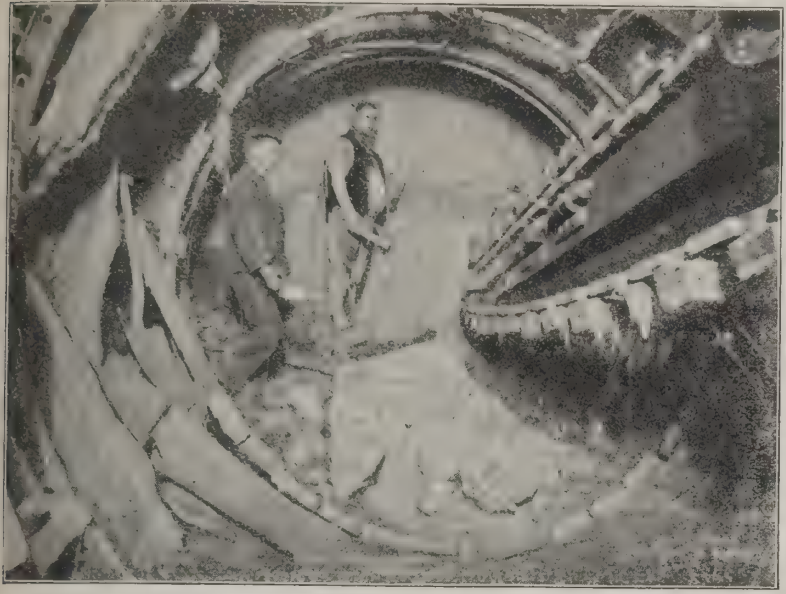


FIG. 1.—TUNNEL EXCAVATION IN THE CENTRAL LONDON RY., LONDON, ENG., SHOWING INTERIOR OF GREATHEAD SHIELD AND THE ELECTRIC CHAIN CUTTER USED.

Quantities Per Lineal Foot for a 7-ft. 6-in. Circular Sewer.

	Cast-iron lining.	Wood lining.
Cast iron, lbs.	1,820	....
Bolts, lbs.	56	34
Concrete, cu. yds.	1.07	1.23
Rendering, sq. yds.	2.70	2.70
Wood ribs, B. M.	....	82
Boarding, B. M.	....	55
Rails, lbs.	....	6

To the above must be added labor and plant.

Quantities Per Lineal Foot for 4-ft. 3-in. Sewer.

	Cast-iron lining.	Wood lining.
Cast iron, lbs	1,012	....
Bolts, lbs.	54	29
Concrete, cu. yds	.40	.50
Rendering, sq. yds	1.53	1.53
Wood ribs, B. M.	....	40
Boarding, B. M.	....	34
Nails, lbs.	....	2.3

Add labor and plant for erection.

Any further details regarding this process may be obtained from Mr. Wm. H. Breithaupt, M. Am. Soc. C. E., 35 Nassau St., New York city, who is the representative of the inventor, Mr. Dunlop, in the United States.

SOME NOTES OF THE CENTRAL LONDON RAILWAY.

By Gilbert Rosenbusch, M. E.*

While conducting tests on the first elevator installed by the Sprague Electric Elevator Co., of New York (Eng. News, Nov. 3, 1898), for the Central London Ry., it was my good fortune to be able to inspect this interesting underground railway, and to procure, through the courtesy of Mr. Cowperthwaite, assistant to Sir Benjamin Baker, the chief engineer, some photographs of the tunnel work. These are here reproduced as being characteristic and of interest to American engineers.

This road, it will be remembered, consists of twin deep level tunnels, constructed with the aid of the well-known "Greathead" shield system. The principal reasons for using twin tunnels with a single track in each, one for up trains and one for down trains, in preference to a double track single tunnel were: First, the lower initial cost; second, ability, by reason of small diameter and change of relative position, to remain under the roadway proper; thus complying with the acts of Parliament which precluded the right of way under private property; third, avoidance of the possibility of collisions as the result of derailment; fourth, maintenance of ventilation due to the draft caused by continued passage of trains in one direction only.

The objections to this method were: First, increased cost of maintenance of way, inspection and signaling; second, increased cost, and complication of inlet and egress passages at stations, with relatively greater discomfort to passengers; third, inability to switch over en route.

In the construction, the need of rapid acceleration and quick braking, without greatly increased power consumption, or wear and tear on the running equipment, was provided for by "peaking" the road bed at each station, the approaching grade being 1 in 30 and the leaving grade 1 in 60. Otherwise, the road bed is practically level; the depth at various stations varies considerably, being from 40 ft. to over 100 ft. The majority of the work being through black London clay, which is extremely hard and dense, air pressure is generally dispensed with, being used only at the Shepherd's Bush end, where gravel was encountered, and again where the work went under the supporting piers of the Holborn Viaduct at Chancery Lane, where a pressure of 20 lbs. per sq. in. was used. At these places air locks were necessary, and Fig. 2 shows the entrance to one of the air lock chambers. These entrances are boiler shells about 7 ft. in diameter, and about 10 ft. long, or sufficiently large to hold two loaded muck wagons. The doors are hinged, and, of course, open only toward air pressure, locks being found unnecessary. This air chamber is held in place by a brick bulkhead, 12 ft. thick, also shown in the figure, which takes the pressure of the air on the remaining area of the tunnel (about 165 tons).

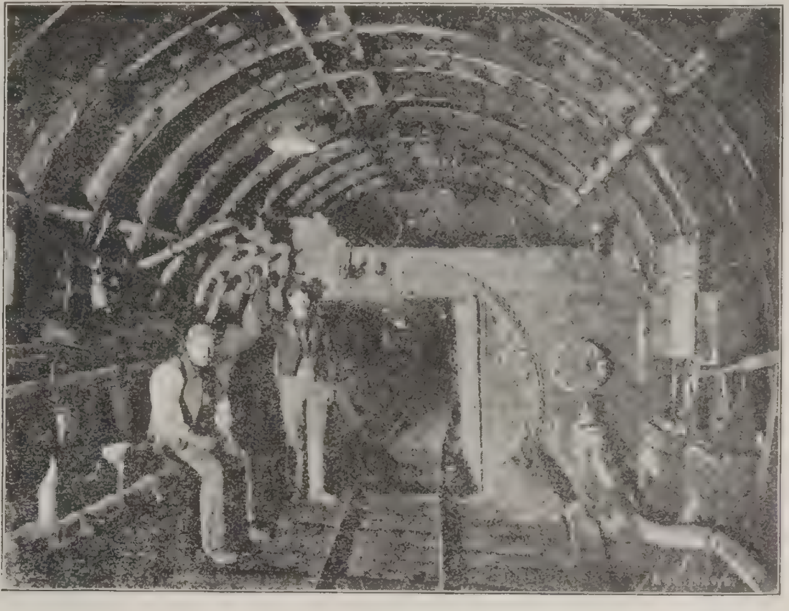


FIG. 2.—ENTRANCE TO AIR LOCK IN 11½-FT. TUNNEL, CENTRAL LONDON RY.

The men employed work on 8-hour shifts, being taken only with a doctor's certificate of soundness. They receive pay for time and a third, and are furnished with hot coffee at the air locks when they desire it.

The air compressors are situated in the open on the street level, the supply pump opening being kept close to the heading, thus insuring a constant supply of fresh air. The air-lock tender has telephonic communication with the compressor room.

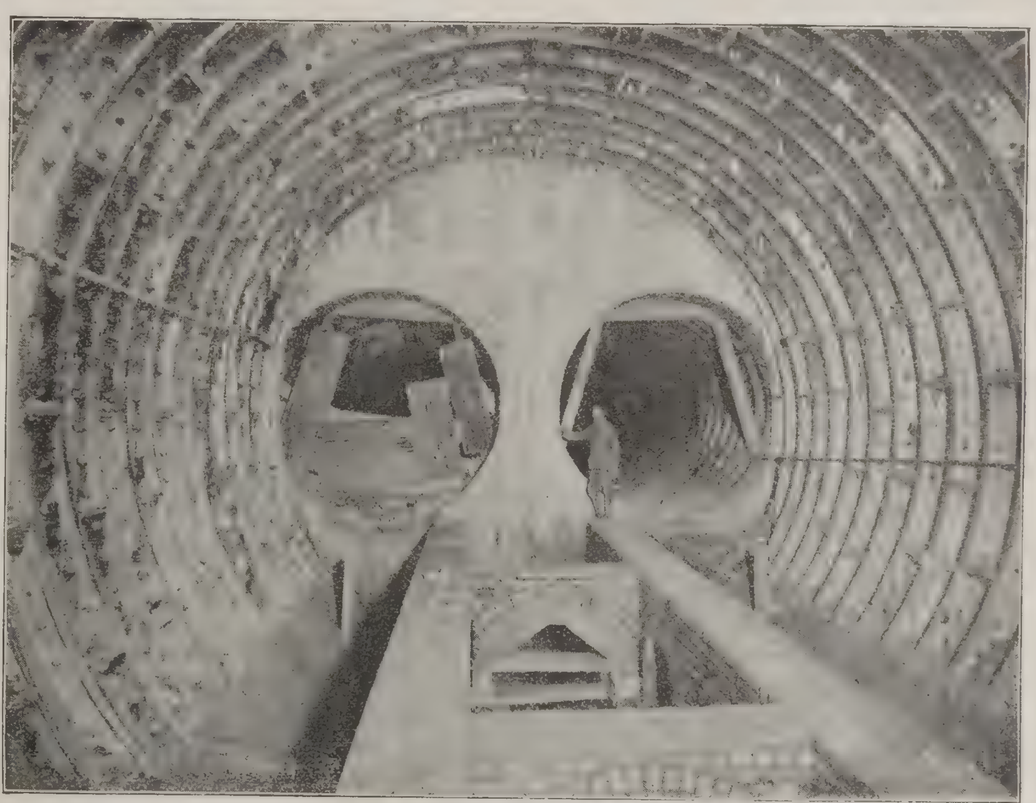


FIG. 3.—VIEW SHOWING LARGE TUNNEL AT STATIONS AND CONNECTION WITH SMALL TUNNELS.

The tunnels are driven by a steel shield worked with six hydraulic jacks operated by a hand pump and cutting out a tunnel 1 in. larger in diameter than the outside of the tunnel lining. This lining is built up of cast-iron rings 18 ins. wide, and consisting of 6 segments and one key, the latter having parallel sides is slipped in from the front after the 6 segments are in place. These segments weigh in the neighborhood of 5 English hundred-weight (560 lbs.), and the contract for furnishing them was sublet to a number of foundries, because of the enormous quantity of cast iron involved. In the small tunnels they are erected by hand and bolted together in place, following as closely behind the advancing shield as working room will permit. The finished inside diameter is about 12 ft., with a working diameter of 11½ ft. The resulting series of circumferential and longitudinal joints are rust calked with sal-ammoniac and metal filings, and then carefully grouted. In places where the soil was of softer character a traveling bucket excavator, shown in Fig. 1 (also Eng. News, May 19, 1898), was used to great advantage, the moving mechanism being mounted on a wooden boom so as to be pointed at any spot desired, like a derrick.

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*Engineer with the Sprague Electric Elevator Co., 44 Broad St., New York city.

As the shield bores 1 in. in diameter larger than necessary, a ½-in. recess is left all round the iron which permits of an outside water-tight lining. This is done by forcing through holes in the segments by air pressure a grout of hydraulic lime which sets in about 15 minutes, thus affording additional proof against the entrance of water to the tunnel.

The road bed proper is built up in the tunnel to the proper level by filling in with concrete, with a top layer of cement, on which are laid longitudinal wood stringers upon which the 100-lb. rails, are bolted. The resulting low head room precluded the use of motor cars unless the car bodies were made like those used by the Waterloo & City road, in which, however, valuable seat room is sacrificed, owing to the large and high motor required. The company, therefore, adopted a locomotive system. (Eng. News, June 9, 1898.)

At stations the tunnel is enlarged for a length of about 500 ft. to 21 ft. in diameter to take a platform. An excellent idea may be gotten of this arrangement from Fig. 3. It will be noticed that where the twin tunnels enter the station tunnel, the latter is, for a short distance, considerably larger in diameter. This enlargement was allowed for the setting up of the shield.

Of course where the tunnels are on different levels, and have different vertical center lines, two enlarged station tunnels are necessary. These station tunnels, which are constructed exactly similarly to the smaller road tunnels, will be lined with a white vitreous material 1 in. in thickness bedded into cement, and having the effect of, and doing the duty of, glazed brick at a much reduced cost.

The station tunnels were also constructed with shields, which were made 22 ft. 10 ins. in diameter and 6 ft. in length. They were built of two cast-iron rings, strengthened and braced by steel stringers, running vertically and horizontically. A central diaphragm of steel plate was bolted between the two cast-iron rings. Each ring was made up of 22 segments, and there was a hydraulic ram for each segment.

LIFE ON A RAILWAY SURVEY IN THE WOODS.

We are indebted to Mr. E. T. Abbott, of Minneapolis, for a photograph, reproduced herewith, of a railway location party equipped for a fifty-mile survey in the forests of Minnesota and Wisconsin, last October. In a breezy letter accompanying the photograph, Mr. Abbott wrote:

> Those who take their luxurious ease in parlor cars, after the road is built, ought to get a taste of the life of the men who first laid out the route over which they ride in such comfort. At this time of year a "bell-ringer" is necessary in surveying in the woods to prevent some city "pot-hunter" taking a shot at you for a deer. Notwithstanding our precautions, twice during the fall some one of my party has been fired at with a Winchester rifle. Thanks to bad marksmanship, however, no harm was done. Wolves are numerous, and we have occasionally had to keep fires all night to keep them away from the camp.
>
> It may be of interest to know the contents of the kit of supplies, which we packed on our backs in our fifty-mile survey, so I append it as follows: One 12×14-ft. 10-oz. duck tent, 14 pairs blankets, 2 axes, 1 tin bake oven, 1 frying-pan, 6 tin cups, 6 tin plates, 6 knives and forks, 6 spoons, 1 bread pan, 1 dripping pan, 1 wash basin, 25 lbs. flour, 25 lbs. ham, 10 lbs. bacon, 6 lbs. corned beef, 3 tin pails, 2 lbs. tea, 10 lbs. coffee, 5 lbs. butter, 10 lbs. mess pork, 10 lbs. sugar, 20 lbs. canned peaches, beans, baking powder, condensed milk, etc.; 25 lbs. extra clothing, rubber sheets, etc., etc. No guns, revolvers, cards or whiskey.
>
> All the above was carried in the packs shown in the photograph.

The bags with shoulder straps, which are shown in Mr. Abbott's photographic view, call to mind another form of "pack," the making and carrying of which are fully illustrated by the sketches on the opposite page. To make this pack a tarpaulin and a "tump-line," or "pack-strap," are needed. The tarpaulin may be from 7 to 8 feet square, and is useful for many other purposes, particularly to lay on the ground under the blankets. The tump-line consists of a head-strap of leather about 3 ins. wide by 2 ft. long, to each end of which are attached leather thongs about 7 ft. long. A pack so made is thoroughly waterproof and may be varied in size and form to suit the nature of its contents.

BLAZING THE WAY FOR THE PALACE CAR; RAILWAY SURVEY PARTY EQUIPPED FOR A FIFTY-MILE TRIP THROUGH THE WOODS.

Mr. Abbott does not state what time was spent on his survey, but his list of provisions shows that he carried 25 lbs. of flour and about 50 lbs. of meat. This proportion is not in accord with the experience of a member of the staff of this journal who has spent some thirty months surveying in six different seasons, on Canadian Government work. His notes show the average consumption of the staples to be 2 lbs. of flour and 1¼ lbs. of preserved meat (salt pork, ham, etc.) per man per day.

MARITIME COMMERCE; PAST, PRESENT AND FUTURE.

At the fiftieth meeting of the American Association for the Advancement of Science, at Boston, Mass., Mr. Elmer L. Corthell, M. Am. Soc. C. E., presented a paper with the above title, of which the following is an abstract:

The purpose of the paper is to note the changes that have taken place in the last half century in the methods of maritime transportation, from sail to steam, and from wood to iron and steel. It deals with the effective carrying power of the commercial navies of the world, the dimensions of ocean vessels and the facilities of harbors and ports. Mr. Corthell, from such data as are available and within the limits of future and unforeseen conditions, attempts to estimate the dimensions of vessels, and the requirements in harbor approaches fifty years hence. He does this so that those having to do with public works of this description may at least form some idea of what may be demanded of them in the future. He plots these results in diagrammatic curves; and he approximately projects these curves forward twenty-five or fifty years. In obtaining this information, he has personally visited some forty ports of Europe; consulted those qualified to give an opinion, and has carefully studied a great list of authorities given in the paper. The chief end of all these studies is to ascertain the depth and dimensions to be given to sea-approaches to harbors, to meet the possible demands of the next half century following increased dimensions in ships themselves.

In 1848, Lloyd's Register of British and Foreign Shipping shows that the commerce of the world was almost altogether carried in sailing vessels built of wood. There were only 121 steamers afloat in that year, and only 36 of these were built of iron; and of the 10,579 sailing vessels described only 79 were built of iron. The development prior to this date had been slow and tentative. The first attempt to propel vessels by steam power was made in Barcelona, Spain, in 1543; then in France in 1707; in England in 1736; in the United States by John Fitch in 1787; then by Robert Fulton in 1807, and on the Clyde in 1812. At the latter date steam navigation may be said to have been fairly under way. The first steamer to cross the Atlantic was built in the United States, at Savannah, Ga., in 1819, by John Stevens. But steam was only an auxiliary to sails. The first British Atlantic steamer was the "Royal William," built in Quebec in 1831, and it crossed in 1838. The first Cunarder crossed in 1840; the first steamer of the Collins Line in 1848; and the first vessel fitted with a screw propeller was the "Francis B. Ogden," built by Capt. Ericsson in 1837. The first screw steamer to cross the Atlantis was the "Great Britain," in 1845, and she was also the first iron steamer to cross the ocean.

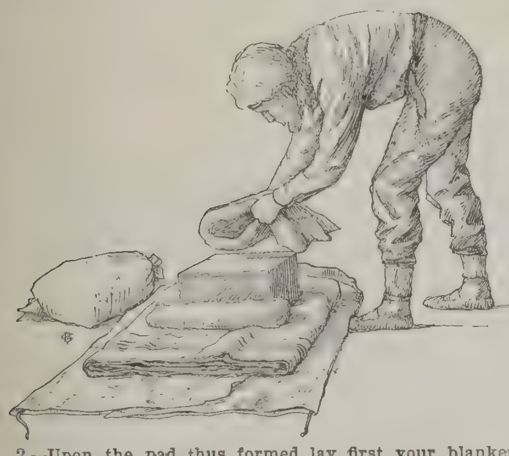
The fastest passage, between Liverpool and New York, up to 1840, was made by the Cunarder "Europa," in 11 d. 3 h.; in 1852 this time was reduced by the Collins Line's "Baltic" to 9 d. 13 h. The "Royal William," above referred to, made the passage from Quebec to London in a little over 40 days. She was 160 ft. long, 44 ft. beam, 17¾ ft. deep and 363 tons' register, or about the size of an ocean tug of the present day.

Mr. Corthell does not note the comparative dimensions of modern ocean steamers, their sailing time, etc., as these are matters of record elsewhere, but he proceeds to generally point out the effects of the continued increase of steam navigation, in all lines, in the last fifty years. The increase in the number, size, speed and economy of steamships has augmented the amount and decreased the relative value of goods transported. This economy makes it now possible to transport goods of low values long distances; it has brought new countries into the commercial field, and the sources of supply are brought nearer to the markets. The beneficial change is not confined to the sea, as canals and railways have in a similar manner covered immense distances on land and provide transportation for districts far removed from the sea-board. And in the case of railways, the gain is in continually increased hauling power and car capacity; the latter having increased from an average of 10 tons to 30 tons, and even 50 tons.

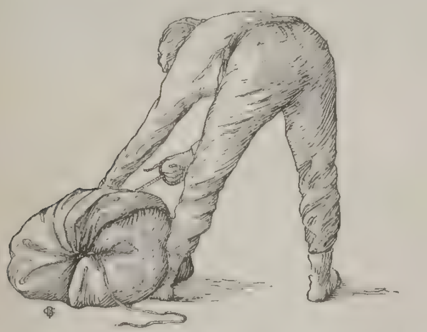
In 1848, coal, grain, timber and metals, all articles of relatively low values, were transported in the ratio of 9,000,000 tons of these to 7,000,000 tons of more valuable merchandise. This ratio is now as 120,000,000 tons is to 65,000,000 tons of the more valuable goods. This decrease in transportation cost has doubtless had very much to do with the notable fall in prices in these fifty years, as the average prices of all articles of consumption were about twice as much in 1848 as in 1898. In this period the effective horse-power of all steam vessels afloat has increased from 2,000,000 to 60,000,000 I. HP.

In referring to the diagram given in the paper, we find these curves of special interest, made by taking the average of 20 of the largest steamships; Average length: 230 ft. in 1848; 541 ft. in 1898; possible 1,000 ft. in 1948. Average beam: 36 ft. in 1848; 61 ft. in 1898; 100 ft. in 1948. Average depth: 23 ft. in 1848; 39 ft. in 1898; 43 ft. in 1948. Average loaded draft: 19 ft. in 1848; 29 ft. in 1898; 33 ft. in 1948. Average speed in knots: 9 knots in 1848; 18 knots in 1898; 24 knots in 1948. Average tonnage: 1,430 tons in 1848; 10,717 tons in 1898; 30,000 tons in 1948. Speed in knots of the fastest steamships: 10 knots in 1848; 22 knots in 1898; 30 knots in 1948. Number of dry-docks, 500 ft. long and more: 23 in 1881; 75 in 1898; 176 in 1948.

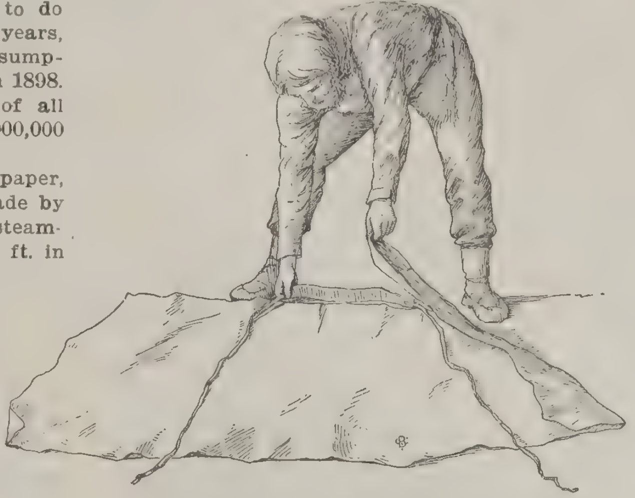
The curves of general features give the following general rate of growth: Total number of sailing vessels, 56,281 in 1873; 29,315 in 1898; 10,800 in 1948. Total tonnage of sailing vessels, 14,185,836 in 1873; 8,894,732 in 1898; 3,241,000 in 1948. Average tonnage of sailing vessels, 252 tons in 1873; 303 tons in 1898; 300 tons in 1948. Total number of steamships, 242 in 1848; 5,148 in 1873; 11,271 in 1898; 16,685 in 1948. Total tonnage of steamships, 74,700 in 1848; 4,328,193 in 1873; 17,889,006 in 1898; 45,000,000 in 1948. Average tonnage of steamships, 310 tons in 1848; 841 tons in 1873; 1,587 tons in 1898; 2,700 tons in 1948. Power of steam and sail, in millions of tons, on the basis of one ton of steam equivalent to three tons of sail, 16½ million tons in 1848; 27 millions in 1873; 62½ millions in 1898; 138 millions in 1948. Weight of seaborne commerce, in millions of tons, 26½ million tons in 1848; 113 million in 1880; 201 million in 1898; 435 million in 1948.



2.—Upon the pad thus formed lay first your blankets; then anything hard you have to pack—say an instrument box; on top of this place all the soft things you can.



3.—Fold the blanket and tarpaulin from top and bottom over all; then take hold of the head-strap and each end of the tie-strap, alternately, haul them tight until you have puckered the ends of the tarpaulin close over the contents. Make a half-hitch of the tie-strap round the head-strap at either end.

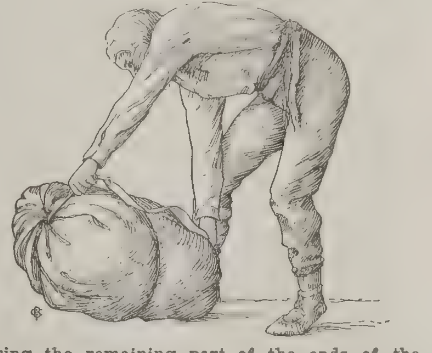


1.—First spread your tarpaulin; lay your tump-line across it, with the tie-straps from two to three feet apart, depending on the size of the pack; then fold the ends of the tarpaulin over the tie-straps.

If the growth of the tonnage in the principal ports of the world be compared with the general increase of commerce, we have additional evidence of the remarkable increase brought about by steam transportation. Selecting twelve characteristic ports, and commencing with 1832, when steam navigation was practically not in existence, we have the following:

1832,	total tonnage of arrivals	4,832,828
1887,	" " "	54,879,222
1895,	" " "	68,965,483

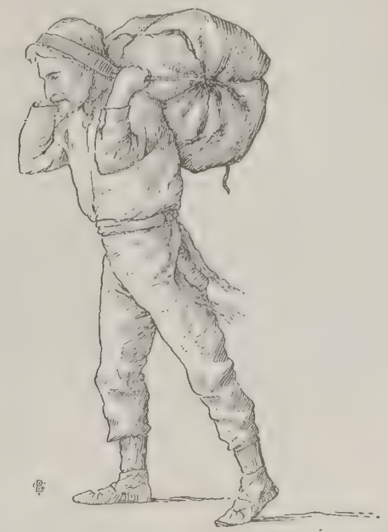
The draft, or depth, of vessels is now restricted by the depth and width of channels in harbor entrances and through outlying bars, or river channels, leading to basins and docks. The author says that if these dimensions are not increased the size of steamships will not much further increase; and in such case the limit of the carrying power and economies of commerce is in sight. Further, and according to Dr. Francis Elgar, the designer of the "Campania" and "Lucania," if the draft of the ship were not restricted, the form of section in the hull could be improved by giving it more rise of bilge and an easier curvature. And as the displacement is increased by increase of draft, the power required to drive a ton of displacement at a given speed is reduced. Hence, increase of draft does not mean a proportionate increase in engine power, even when such increase is obtained merely by extra immersion without any improvement in form, such as would otherwise be possible. The advantages of increased draft would be felt more in a seaway than in smooth water, as the lower part of the hull would be less affected by the wave surface, and better and more constant immersion could be given to the propellers.



4.—Bring the remaining part of the ends of the tie-straps across and around the bundle; then take hold of the head-strap at either end and lift.

The engineer must here assist the naval architect in any further development in maritime transportation. All that the employers of engineers have thus far felt justified in doing or expending the engineer has done or is doing. But it is safe to say that, in the near future, no port in the world will be classed as a first-class port which will not readily admit vessels drawing 30 ft. of water. This means 35 ft. in the entrance channels through sea-bars; 32 ft. in river channels and other entrance approaches, and 31 ft. in harbors and basins, and alongside docks and wharves.

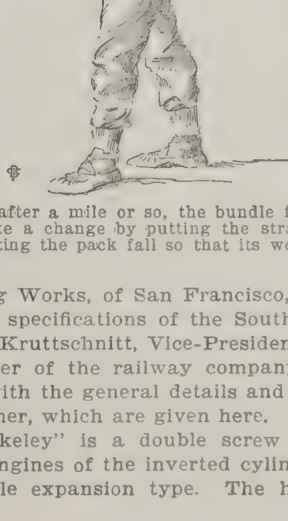
As to what is being done to secure this depth we have the Suez Canal, the key to the harbors of Europe and Asia, built with a depth of 26 ft., deepened to 28½ ft., and planned for 30 ft. The Amsterdam Canal has been deepened from 23 to 30 ft.; the new Kaiser Wilhelm Canal has about 30 ft.; the Liverpool channel has 30 ft. at low tide, or a channel entrance depth of from 27 to 57 ft., according to tide; Southampton has 30 ft., and New York will soon have 35 ft. at low tide; Boston and Philadelphia will have 30 ft. New Orleans is asking for a least depth of 35 ft. over the bar and 32 ft. in the South-West Pass and the River; Galveston, under present plans, will have 30 ft.; Antwerp has a sea-entrance of 30 ft., a river depth of 31 ft. at high water, and a projected port depth of 32½ ft.; Hamburg, in the near future, will have a deep channelway to the sea adequate for the largest vessels.



5.—Throw the pack over the head onto the shoulders; settle the head into the head-strap, easing the backward pull by grasping the strap with the hands; then off you go.

THE NEW DOUBLE SCREW FERRY STEAMER "BERKELEY," OF THE SOUTHERN PACIFIC CO.

One of the largest ferry steamers which we now recall has just been put in service by the Southern Pacific Co. on its San Francisco Bay ferry line between the foot of Market St., San Francisco, Cal., and Oakland Pier. This vessel has been named the "Berkeley," for the city of Berkeley, Cal., located on the eastern side of San Francisco Bay, and the seat of the University of California. It was designed and built by the Union Iron & Shipbuilding Works, of San Francisco, Cal., after the general specifications of the Southern Pacific Co. Mr. J. Kruttschnitt, Vice-President and General Manager of the railway company, has furnished us with the general details and dimensions of the steamer, which are given here.



6.—And if, after a mile or so, the bundle feels irksome, you may make a change by putting the strap across the chest and letting the pack fall so that its weight rests on the ribs.

The "Berkeley" is a double screw steel boat, driven by engines of the inverted cylinder, direct-acting, triple expansion type. The hull is constructed entirely of steel, and has, including the bulkheads at the ends of the screw shaft, seven complete steel bulkheads without openings below the main deck, and two bulkheads with small openings for the transfer of coal from the bunkers to the boiler room. Between these bulkheads are located the crew's quarters, engine room, boiler room, restaurant, wine room, and toilet room. Access to these various compartments is had only from the main deck, making the boats safe against sinking in case of damage to the hull.

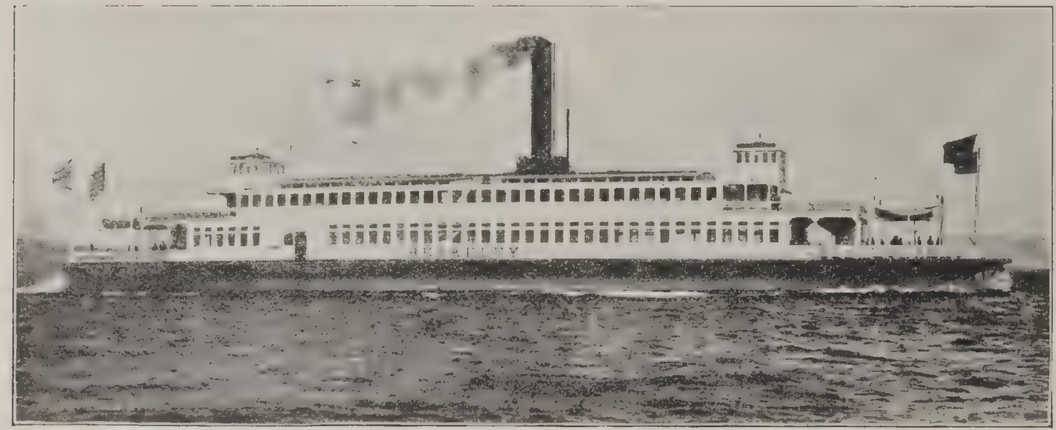


FIG. 1.—THE NEW SCREW FERRY STEAMER "BERKELEY" OF THE SOUTHERN PACIFIC CO.
The Union Iron & Shipbuilding Works, San Francisco, Cal., Builders.

The main deck has a seating capacity of 580 passengers; a toilet room, reached by a stairway from the saloon deck, and two driveways for baggage and for mail and express trucks and wagons. A single stairway at each end of the boat connects the main and saloon decks. The saloon deck has a seating capacity for 997 passengers in the cabin, and for 132 outside, making the total seating capacity of the boat, 1,709 passengers.

The cabin seats are constructed of perforated black walnut on teak wood frames. The floor covering is interlocked rubber tiling. The cabin is painted dead white with gold leaf ornamentation. The clear-story is glazed with art glass. Ventilation and heating is provided for by the plenum process, pipes being provided for the inlet of fresh air and the efflux of vitiated air. The boat is lighted throughout by electricity.

The rudders of the boat are operated by a steam steering gear. A special feature of this boat is its numerous large windows, glazed with plate glass, and set at such a height from the decks that an unobstructed view of the bay of San Francisco can be had from all the seats. Under ordinary running conditions, the trip between San Francisco and Oakland Pier, 4½ miles, is made in 17½ minutes. The principal dimensions and details of the vessel and machinery are as follows:

Length over all	289 ft.
Length inside rudder posts	260 "
Beam, molded	40 "
Beam over wood guard	64 "
Depth molded at guard	16 ft. ' ins.
Depth molded at center	17 " 0 "
Depth of hold	14 " 10 "
Draft, extreme load	8 " 6 "
No. of propellers	Two—one at each end.
Diameter of propellers	8 ft.
Revolutions per minute	125
Registered tonnage, gross	1,945 tons.
Registered tonnage, net	1,245 "
Type of boilers	"Scotch."
Horse-power	1,450
Boiler pressure	165 lbs.
Cylinder diameters	23, 34 and 56 ins.
Stroke	36 ins.

Second story landings are provided and used at both the San Francisco and the Oakland Pier depots, a large proportion of the passengers being thus handled to and from the depots on the saloon deck level. Referring to the illustrations, Fig. 1 is a general view of the vessel; Fig. 2 is a view on the saloon deck, showing the arrangement of the seats and the appearance of the interior finish and decorations; Fig. 3 gives half transverse sections of the steamer through the engine room and boiler room, and Fig. 4 is a plan of the hull.

NOTES FROM RECENT REPORTS OF CITY ENGINEERS AND OTHER MUNICIPAL OFFICERS.

Repairs to macadam streets in Boston, according to the last report of Mr. Benj. Wells, Superintendent of Streets, are successfully and economically made by first picking up the surface with spikes attached to the wheels of steam rollers, then giving the street a light dressing of stone and rolling it.

The Ferry Division of the Street Department has installed electric motors for assisting teams on and off the boats at extreme stages of tide. The running time of the boats has been improved by the installation.

Concrete gutters in place of macadam have been found necessary on the Commonwealth Ave. Boulevard, in Newton, Mass. Such gutters were included in the original estimates, but as the work progressed it was thought that they could be dispensed with. It was found that the combination of frost and moisture was causing the disintegration of the macadam, and that wheel ruts were cutting down to the foundation. Contracts were let in 1897 for putting in 3-ft. gutters on all the steeper grades. Mr. H. D. Woods, M. Am. Soc. C. E., is City Engineer of Newton. Mr. Wood's report for 1897 contains a review of work done during the year in the abolition of grade crossings, illustrated by numerous reproductions of photographs.

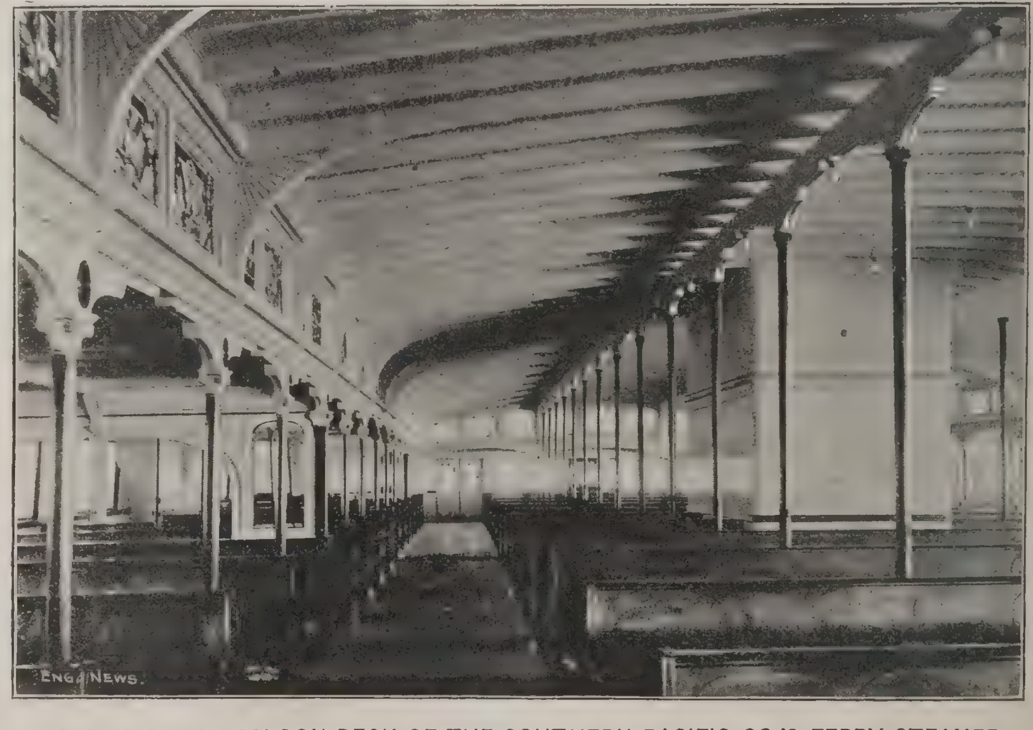


FIG. 2.—VIEW ON SALOON DECK OF THE SOUTHERN PACIFIC CO.'S FERRY STEAMER "BERKELEY."

A special feature of the last report of Mr. E. A. Fisher, M. Am. Soc. C. E., City Engineer of Rochester, N. Y., is a table showing the cost of asphalt paving in a number of cities when reduced to a proper basis of comparison with Rochester, ordinary excavation and a 6-in. concrete foundation. The consecutive columns in the table are as follows: Name of city; year of return; reported price; percentage of correction; corrected price, for 5, 10 and 15-year guarantees; security required; cash reserve and bond; kind of asphalt laid; amount laid, and remarks. Mr. Fisher took his original figures from replies to a circular sent out by himself, from a report by Mr. F. W. Capellen, City Engineer of Minneapolis, and from notes made while on tours of inspection to other cities. These figures should be suggestive to those city officials who are met with wild statements regarding the low comparative cost of paving in other cities, without regard to the relative character of the work and local conditions.

A report on the apportionment of the cost of a proposed joint outlet sewer for a small section of Newark and a number of adjoining or near-by communities, has recently been made by Mr. Alex. Potter, Assoc. M. Am. Soc. C. E., of New York city. Mr. Potter reviews at some length the methods employed heretofore in the distribution of the cost of joint municipal works, and finally recommends a plan summarized by him as follows:

> The apportionment recommended will be based upon the amount of sewage contributed by the possible ultimate population of each district or municipality, determined by a detailed examination of the physical characteristics and environments of the various municipalities, and a study of the water supply of each.
>
> Further, that the absolute right shall be granted each municipality or district to own, control and dispose of so much of the cubical capacity of the outlet sewer as is proportionate to the percentage of the total cost of the joint outlet which is borne by each municipality or district.

Unfortunately, so limited a number of copies of this report were printed as to make their distribution, on application, impossible.

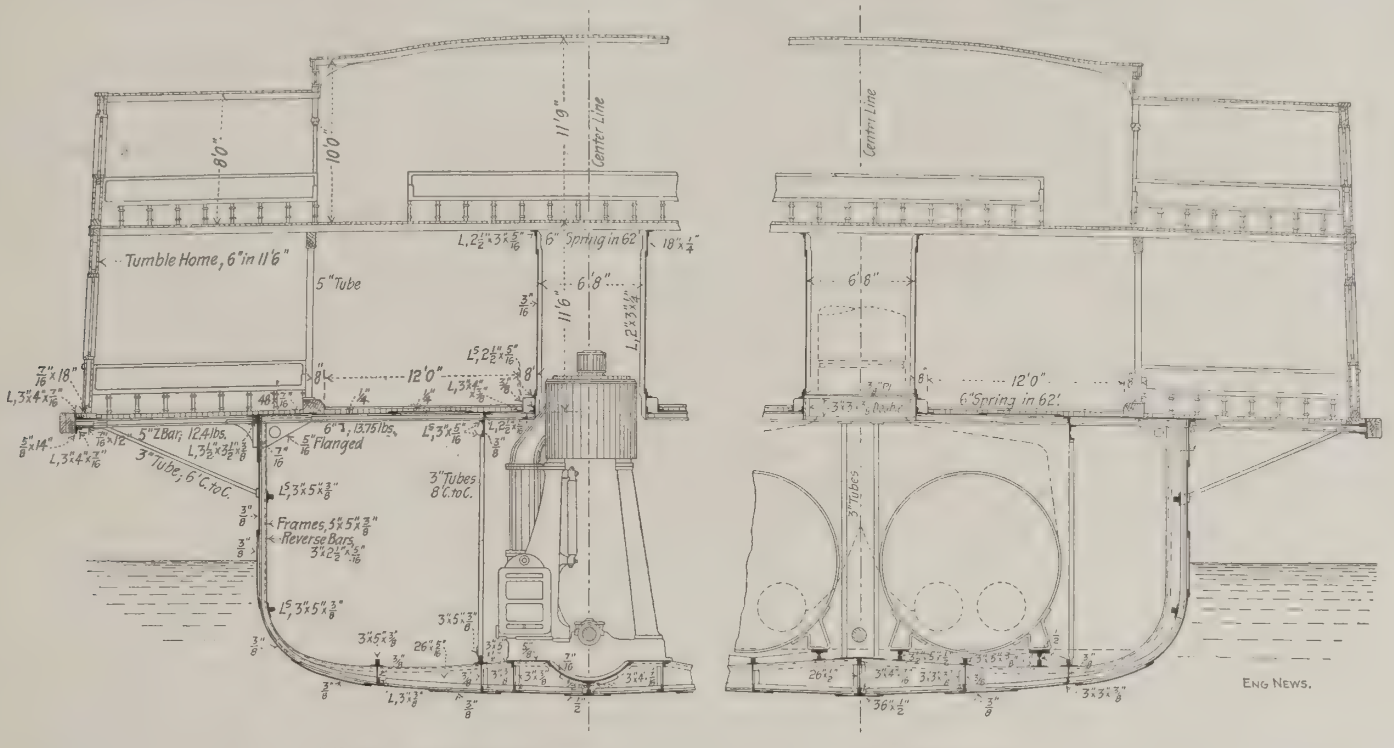
Heavy rainfalls in Philadelphia are cited in the last report of Mr. Geo. S. Webster, M. Am. Soc. C. E., Chief of the Bureau of Surveys, as follows:

> June 8 to 9, in 21 hours, 2¼ ins.; July 19 to 23, 5 ins. On Aug. 19, 1.34 ins. fell in 3½ hours. The greatest intensity of rainfall occurred Oct 12, when for a space of five minutes the precipitation was at the rate of 2¾ ins. per hour. Aug. 23, for 15 minutes the rate was 2½ ins. per hour. At that time the water in the sewer (6 ft. in diameter) on Lombard St. near Third St., rose 4¾ ft.

The effect of the best material and workmanship upon the carrying capacity of pipe sewers is well illustrated by the extract given below, from the last report of Mr. T. Chalkley Hatton, M. Am. Soc. C. E., Engineer in Charge of Sewers, at Wilmington, Del. The sewer in question is for foul liquid wastes, only, and serves an area of 931 acres, and a population of about 46,500 people. The sewer, and tests of it, are described by Mr. Hatton as follows:

> The total length of this sewer is 15,102 ft., and its mean average fall is 5.75 ft. in 1,000 ft. It is composed of 3,-

091 ft. of 18-in. terra cotta pipe, standard thickness, on a grade of 6.5 ft. per 1,000 ft.; 2,106 ft. of 20-in. terra cotta pipe, double strength, on a grade of 6 ft. per 1,000 ft.; 6,952 ft. of 24-in. terra cotta pipe, double strength, on a grade of 8 ft. per 1,000 ft.; and 2,953 ft. of brick and concrete sewer, from 2½ × 3¾ ft. to 5 ft. in diameter, on a grade of 2 ft. per 1,000 ft. Its total cost has been $43,546. This includes the amount paid the contractor, inspectors' salaries, costs for right of way, incidentals and office expenses. Three per cent of this cost was paid for inspection, and when you consider the nature of the work this percentage is very small.



Half Section through Engine Room. Half Section through Boiler Room.

FIG. 3.—TRANSVERSE SECTIONS THROUGH ENGINE AND BOILER ROOMS OF THE FERRY STEAMER "BERKELEY."

Owing to the nature of the fluids which have to be carried through this sewer (they being the thick liquid wastes from a morocco shop principally, of which a large percentage consists of hair, lime, scraps of skins and other heavy matters), and because but a small portion of the capacity of the sewer would be needed for many years, I was particularly concerned for its ability to keep itself clean, and to overcome the liability of stoppage as far as possible, the specifications for the pipe, and the laying thereof, were made particularly stringent; we insisted upon having the best pipe in the market, paying particular attention to having them so laid that the flow line of the pipe should not be interrupted at each joint by one pipe being a little bit higher or lower than its neighbor. We used hemp in the joints for this purpose, and succeeded in getting an uninterrupted flow throughout, although the 18-in. and 20-in. pipes were not as uniform either in diameter or in circular shape as could have been desired, but were the best we could get, and I desire to here call your attention to the effect upon the capacity of this sewer resulting from this very close inspection; as soon as the sewer was finished and examined, I made a test of its carrying capacity, having a chance to turn into its upper end whatever flow of water I desired for this purpose. We procured eight cork floats, varying in size from 3½ ins. in diameter to 3 ins. by 6 ins. long, and 1-in. thick, there being four different sizes and shapes, one of which was loaded sufficiently to guarantee its being constantly submerged, and its mate being light so that it would float upon the top of the water. With the help of three men and a stop watch I found the velocity of the water running in the 18-, 20- and 24-in. pipes. Averaging the velocity of the eight floats, (although I found but little difference between the velocity of any of them, the loaded ones travelling as fast as the light ones), the result was that the velocity in the 18-in. pipe was found to be 5.75 ft. per sec., the coefficient of friction .011, making its capacity 10 cu. ft. per sec., whereas the calculated velocity before it was built, was to be 4 ft. per sec., its coefficient of friction .015, and its capacity 7 cu. ft. per sec. The velocity in the 20-in. pipe was found to be 6.8 ft. per sec., its coefficient of friction .01, and its capacity 14.8 cu. ft. per sec., whereas the calculated velocity was to be 4.14 ft. per sec., the coefficient of friction .015, and its capacity 9 cu. ft. per sec. The velocity in the 24-in. pipe was found to be 12.47 ft. per sec., its coefficient of friction .0075, and its capacity 39 cu. ft. per sec., while its calculated velocity was to be 5.47 ft. per sec., its coefficient of friction .015, and its capacity 17 cu. ft. per sec.

An ideal park system for a large city, according to a statement by Mr. John. C. Olmstead, in a report to the Board of Public Works, of Indianapolis, should include the following: (1) A central tract for public buildings; (2) a series of small parks; (3) a series of local parks of greater extent than (2); (4) one or more large parks in the outskirts, where one may drive for an hour or two without going over the same roads twice; one or more great reservations, thousands of acres in extent; and (6) parkways connecting two or more of the parks. Mr. J. Clyde Power is Engineer and Superintendent of the Park System of Indianapolis, and has issued a pleasing illustrated report for the year 1897.

The last report of the Board of Public Works, of Detroit, Mich., contains the results of tests of 5,296 gas meters, new and repaired. Of 2,780 new meters, eight were condemned for registering too fast, 4.22% on the average, and four for registering too slow, averaging 4.67%, and four were condemned for other reasons. Of 2,439 repaired meters, 63 were condemned for registering too fast, 3.98% average, and 22 for being too slow, 5.27%; 14 were condemned for failing to pass gas, not registering, leaking and other causes. Mr. Robt. Y. Ogg is Secretary of the Board, and Mr. Henry D. Ludden is City Engineer.

A variety of interesting and useful information regarding the streets of St. Louis has been made public by Mr. A. N. Milner, Street Commissioner, in a pamphlet prepared for general distribution. Statistics, extracts from paving specifications, and numerous illustrations are included.

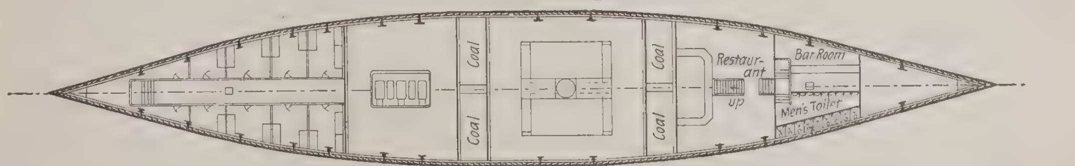


FIG. 4.—PLAN OF HULL OF FERRY STEAMER "BERKELEY," SHOWING BULKHEAD ARRANGEMENT.

The last report of Mr. E. J. Barrow, City Engineer of Hamilton, Ont., contains a brief description of a new sewage disposal plant, the second one built by the city. Chemical precipitation is used at each plant. The plants are located in different parts of the city. A plan and sections of each plant are given in the report. The first plant built was described in Engineering News for Jan. 28, 1897.

PROSPECTS OF THE KLONDIKE MINING REGION.

An interesting story of the "boom" in the Klondike mining region is told in a paper by Mr. Samuel C. Dunham, in the "Bulletin of the Department of Labor," for November, entitled "The Alaskan Gold Fields, and the Opportunities they offer for Capital and Labor." Mr. Dunham is an agent of the Department, who made an investigation on the ground from Jan. 8, to Aug 1, 1898. We advise any one who thinks of going to the Klondike, or of investing in any of its properties, to obtain a copy of the "Bulletin" and study Mr. Dunham's paper before concluding the arrangements. We quote the following summary:

> The Klondike stampede was unique, and it may be interesting to survey the situation briefly with particular reference to its most fascinating feature, the financial result. It is a common assumption among those familiar with the uncertainties of mining for the precious metals, that every dollar's worth of gold extracted from the earth costs somebody at least a dollar in money or labor. Applied to the case under consideration, this assumption is far within the bounds of truth. By actual count, 40,000 men started for and reached the Yukon gold fields during the year beginning with July 15, 1897. It is conservatively estimated that 20,000 more undertook the journey, but were unsuccessful in their efforts to reach the Yukon. It is fair to assume that the average expenditure of these 60,000 men, for outfitting and transportation was $500 each, or a total expenditure of $30,000,000. It is probable that the money invested in ocean and river vessels and the organization of commercial companies for operations on the Yukon would add $5,000,000 to this sum. Without considering the large amounts that have been absorbed in the capitalization of Klondike mining companies, a few legitimate and many wildcat, it may safely be assumed that this great movement during the year following its inception cost the participants $35,000,000, and it is equally safe to assume that in the case of 75% of the individuals involved, their contributions are an absolute loss to them. As against this enormous outlay, we have for the period under consideration, as indicated by the mint returns, a gross product from the Yukon placers of less than $12,000,000.
>
> Although this statement as to the immediate result of the Klondike "boom" cannot be refuted, it would be misleading if allowed to stand without qualification. The condition described is almost entirely due to the exaggerated statements as to the extent of the new discovery so widely published in last year's newspapers and magazines, and should not be permitted to obscure the fact that there is now being developed on the Yukon a mineral zone of wonderful richness, which will eventually contribute hundreds of millions of dollars to the wealth of the world. The lesson to be learned from the present situation is that it will take years of hard work to bring the mines up to their highest point of productiveness, and that the country offers no opportunities for professional men or others who are not equipped by nature for the most exacting manual labor.

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ADVERTISING RATES: 20 *cents per line. Want notices, special rates see page* 18. *Rates for standing advertisements sent on request. Changes in standing advertisements must be received by Monday afternoon; new advertisements, Tuesday afternoon; transient advertisements by Wednesday noon.*

A new plan for the maintenance of railway rates has been brought forward by the Receivers of the Baltimore & Ohio R. R. They have forwarded a letter to the Interstate Commerce Commission, in which they declare at the outset that:

> Within the territory north of the Ohio River and east of the Mississippi, the railroad carriers are transporting the larger part of the interstate traffic at rates less than those shown on the published tariffs, filed with your Commission, which are by statute the only lawful rates.

This being the state of affairs, and the voluntary association of railway companies to discover and check discrimination and secret cutting of rates having been declared illegal by the Supreme Court, the Baltimore & Ohio Co. now proposes to appeal to the Interstate Commerce Commission. Beginning on Jan. 1, it will maintain on all its lines the rates for passenger and freight traffic shown on the published tariffs filed with the Commission, and it announces that if any of its competitors depart from their published tariffs, the aid of the Commission will be invoked to stop them.

The working of this new plan for the maintenance of rates will be watched with much interest. Messrs. Cowen and Murray, the Receivers of the Baltimore & Ohio, express the belief that all or nearly all of the railways will follow the B. & O.'s example and begin to maintain strictly the published tariff rate on Jan. 1. It may be of interest to note that by the terms of the Interstate Commerce Law, the charging of a rate different from the published rate is made a misdemeanor, punishable by a fine not to exceed $1,000.

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The use of steel for large pipe lines is now becoming so common as to attract comparatively little attention, unless some departure is made from the usual type of construction, or the size or length of pipe is something unusual. The contract for the Coolgardie pipe line, the details of which are given elsewhere in this issue, is notable for both the mode of jointing the pipe and the size of the contract. The line will be 30 ins. in diameter and 328 miles long, but will be practically rivetless. Each section of pipe will be 28 ft. in length, made from two plates, each bent to a half circle and joined by two horizontal locking-bars, each plate edge being dovetailed into one side of a bar and secured there, watertight, by hydraulic pressure, as described in our issue of June 9, 1898. The ends of the 28-ft. sections will be fitted together and the joints formed by an overlapping steel ring, or sleeve, calked with lead. It seems probable that some other type of transverse joints may be used in some cases, whether at regular intervals or under special local conditions we cannot say. Nearly all the pipe will be made from ¼-in. steel plates, less than 2 per cent. in length, being from 5-16-in. plates. The pipe line, as contracted for, differs materially from the recommendations of the advisory English engineers, discussed at length in our issues of Feb. 17 and Oct. 13, 1898. This is largely due to the low bids received on the style of pipe adopted. The English engineers advised the use of 26, 27½ and 29-in. pipe, according to the head, or velocity; that pipe with gas-welded longitudinal joints be used for all pipe ¼-in. thick or over, and that the pipe be laid above ground, on account of the probable action of the salts in the soil on buried pipe. The last recommendation made necessary expansion joints, the design of which we described and adversely criticised in our issue of Oct. 13. Bids, therefore, were invited on 82 miles of welded and 246 miles of riveted pipe, with the results stated elsewhere in this issue. One bidder offered to substitute locking-bar pipe for the welded pipe at such low figures that negotiations were entered upon, which resulted in the adoption of this style of pipe throughout, increased to a uniform diameter of 30 ins., and with ¼-in. plates substituted for the large quantity of 3-16 plates. The changes in size and thickness were effected at an advance of only about $100,000 in the total cost of the pipe, thus reducing the pump friction and adding to the permanency of the line. The adoption of transverse joints, that can be calked with lead, and the placing of the pipe underground "in most cases," will effect a considerable saving in cost. Getting the pipe below ground, and doing away with the expansion joints recommended by the English engineers are changes greatly for the better, we believe. In fact, if the locking-bar and ring joints prove satisfactory, we think Mr. O'Connor will deserve the highest praise for the changes he has made from the design recommended by the engineers. He has done away with all rivets and with changes in the diameter of the pipe every 28 ft., which would have been caused by placing the sections alternately inside and outside of each other. This, coupled with the increase in size, ought to decrease the friction materially, and thus reduce the pumping expenses. When it becomes desirable to sacrifice friction for an increase in capacity, through enlarged demands for water, this can be done, thus delaying the necessity for constructing a temporary pipe line. In our issue of Feb. 17 we stated that it would be foolish to employ an untried invention, like this locking-bar joint, on a piece of work of such magnitude. But since then, as we have already stated, it has been used at Adelaide on 8¾ miles of 26-in. steel pipe, and, we are informed, with entire success. The merits of the device are certainly worth consideration by American engineers and contractors interested in steel pipe manufacture and use.

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The condition and prospects of the water-works of Philadelphia are becoming more and more alarming. Urgent improvements are postponed from year to year. Little or nothing is being done to provide for future needs. Portions of the existing works are improperly cared for, some of the costly pumping plant being housed under a temporary board shelter. Nothing is being done to check the rapidly increasing waste of water, although the per capita consumption has reached an enormous figure. The character of the water is notoriously bad, and has been for years, yet practically nothing is done to improve it. The works are being slowly wrecked by the refusal of appropriations for their maintenance and improvement. The executive branch of the city government has pointed out the needs of the water department time and again, and pleaded for appropriations. But it is all of no avail. Just now some of the councilmen are making a great show of virtue and indignation. We believe most emphatically, they assert, in municipal control of the water-works, but if the administrative branch of the city government cannot give us a definite plan for pure water we shall be compelled to contract with some private concern that has the ability to formulate such a plan. This sounds well, but it is very misleading. The department of public works, and the bureau of water, have repeatedly asked for appropriations to make investigations of water purification, but have never received a cent. Had such appropriations been granted, when first asked, several years ago, not only plans, but purification works, might now be ready. The appropriations having been denied, the water department has been helpless during the months and years of agitation, giving ample opportunity for promoters to work out detailed plans meanwhile. To a city councilman who seldom or never drinks water and who cares infinitely more for the success of his party and the length of his purse than for the health or interests of his constituents, it may seem a light task to prepare plans for the purification of 200,000,000 to 300,000,000 gallons of water per day, but to any other mortal the problem becomes a serious one the moment he begins to give it practical consideration. The cities of Providence, Louisville, Pittsburg and Cincinnati have not hesitated to spend months of time and thousands of dollars in studying the problem of purifying much smaller quantities of water, and had Philadelphia taken up the study at the same time, with the same civic and scientific spirit, it might have solved it or been near a solution ere this.

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That Chicago, of all places in the world, should be afflicted with a plague of snails must be set down as one of the most remarkable occurrences of the year 1898. According to a report submitted to City Engineer Ericson by Prof. Frank C. Baker, snails have appeared in large quantities in the Lake View water supply, and their eggs are found in great numbers upon the screens at the opening of the Lake crib. The prospect that the mollusks will accumulate in the tunnels and finally die and contaminate the water is now causing no small anxiety to those responsible for the city's water supply.

Just why the peaceful snail should choose the floating anchor ice around the Chicago intake cribs as a place in which to display its reproductive powers, must be counted as one of the unsolved problems of biology. Its natural habitat would seem to be the water supply of Philadelphia; but in recent years that has become too bad for even snails to endure.

A FEASIBLE PLAN FOR THE NEW YORK RAPID TRANSIT RY,

For more than a dozen years has the project for an underground rapid transit railway up and down Manhattan Island, to be constructed with the aid of the city's credit, been before the public. At various times the construction of the road has seemed practically assured; but some obstacle has always intervened to prevent the actual undertaking of the work. The attitude of this journal toward the enterprise has been uniformly one of friendship. We have held from the outset that hardly a great engineering project of the century offers so sure a financial success as the project to convey passengers up and down the length of Manhattan Island, through the central part of the most densely populated city in the world, with a saving of half or more of the time required for the journey.

But while we have recognized the great merit of the scheme as an engineering and financial proposition, we have also been well aware of the difficulties which have hedged it about. The existing Rapid Transit law is a hodge-podge of contradictions. It prescribes a financial scheme for the construction of the road complicated enough to prevent any responsible contractor from ever undertaking the work, and it surrounds the whole enterprise with restrictions and red tape enough to seal the doom of the most promising project that was ever planned.

We have consistently favored the policy of municipal ownership and control, and in some cases of municipal construction of street railway lines. All this has been done, and done successfully; but such a hybrid alliance between city and a corporation as the New York Rapid Transit act proposes was never known on earth. We believe, therefore, that the first step toward the construction of the New York Rapid Transit railway, is not the amendment, but the repeal in toto of the present Rapid Transit act.

Before outlining what should be put in its place, let us discuss briefly certain engineering aspects of the enterprise. The most important feature of the New York Rapid Transit scheme is the provision of a four-track road with two tracks for express trains, stopping only at stations two or three miles apart, and the other two for local trains, stopping at stations ¼ mile or so apart. It is proposed that the local trains shall collect passengers at express stations, and distribute them from these stations. We believe that for the peculiar local conditions on Manhattan Island (enormously heavy traffic concentrated in a single direction), this scheme promises great benefits to the public in the saving of time. We are aware that it has been criticised, and that some have attempted to show that the time saving would be little or nothing over the time of transit by the present elevated railways in the case of a passenger who has to take first a local train, then an express train, and then a second local train to reach his destination. If it were proposed to operate the Rapid Transit road by steam locomotives with such train intervals as are common on the present elevated railway lines, this criticism would have considerable weight. But nobody proposes, or has proposed for many years, to operate the road in that way. With electric motor cars, on both the local and express tracks, having power enough to make a quick start, and running at as short intervals as safety permits, it would be feasible to make a very great time saving, in the journey from New York's business district to its residence district, even when two transfers have to be made.

The original $50,000,000 plan of the Rapid Transit Commission comprehended a four-track road from the Battery up Broadway to the northern limits of the city, with various four-track and two-track branches, which we need not now describe. In the modified plan of the commission, contemplating an expenditure about two-thirds as great, the four-track scheme was still adhered to.

The matter to which we wish to call especial attention, is that while the four-track scheme was an excellent and proper one when it was planned, the march of events has now rendered it obsolete, and it is no longer the best or wisest plan of furnishing real rapid transit for New York city. When the Rapid Transit scheme was originally planned, the surface street railways of New York were operated by horses, or in a few instances by cable traction. The coming year will see practically all the main north and south surface lines operated by electricity, and in a manner which leaves little to criticise. In other words: The local tracks for the New York Rapid Transit Ry. have been laid and are now in operation on the surface of the streets.

If the local lines of the proposed Rapid Transit railway were now completed and in operation, they would be forsaken by travelers for the electric cars on the street surface. Passengers will not walk even a block or two and descend to an underground station when they can take an electric car on one of the surface roads at the nearest corner. Further, the rate of speed, including stops, attained on the present electric conduit roads is nearly or quite as good as what the proposed local trains of the New York Rapid Transit Ry. could make.

If these facts are fully understood, it will be at once seen that all that is required for the carrying out of the New York Rapid Transit enterprise, with practically the same measure of public benefit as originally proposed, is to build two-track tunnel roads, for express trains only, beneath some of the principal north and south lines of the present electric conduit system.

Such a two-track tunnel could be built without any difficulties from the destruction of vaults, the interference with building foundations, and the closing to traffic of the entire street that arrayed so many interests against the original Rapid Transit enterprise. Its cost, moreover, would be comparatively very moderate, and it could be built and operated in sections and extended as fast as its success was demonstrated and the public demand warranted.

Of course these proposed express tracks would need to be operated in entire harmony with the present surface railways, and this means practically that they must be built and operated by an arrangement between the city authorities and the Metropolitan Street Railway Co. Such an arrangement, if we may trust the evidence of recent outpourings from the oracle that rules our destinies, is already "in the air," and the coming year may very likely see it placed on a firm basis of fact.

It may be objected that such a plan of construction will not afford the same measure of benefit to the city treasury as would have accrued from the original plan under which the road was to be owned by the city and leased for operation to a corporation. This is doubtless true, provided the original plan of construction could have been carried out, and provided also that conditions had remained the same that they were when it was planned; but it is quite within the possibilities that they would not have remained the same. Had the city undertook the construction of the Rapid Transit system eight years ago, as it came so near doing, it is quite possible that the diversion of traffic which would have ensued when the surface roads adopted electricity might have made the enterprise a financial failure.

Past conditions are past, however, and the conditions which at present confronts the city are these: Should it obtain legislation enabling it to build the four-track Rapid Transit system as originally planned, it is extremely doubtful whether the local lines could obtain sufficient traffic to pay for their operation with the frequent trains and short train intervals which are essential to the system's usefulness. It is evident that the four-track Rapid Transit system, as originally proposed, would never prove profitable from its express train traffic alone. The long distance traffic must be handled in connection with the short distance traffic to make it profitable. Again, should the city adopt the plan we have proposed above and construct a system of double-track tunnels for express train service only, it must operate them in connection with the surface electric roads, and probably a system of transfers between the surface and underground lines would be a necessity to secure a paying traffic.

The whole matter, then, resolves itself into this: The city has one chance, and one only, of securing the system of combined local and express transit up and down Manhattan Island which is so urgently needed. That chance is an arrangement with the Metropolitan Street Railway Co. for the construction and operation of a system of double-track express-train tunnels beneath some of its principal north and south lines.

That such an arrangement could be devised which would promise great benefits to the city, and would at the same time offer great attractions to the railway corporation there is every reason to believe. Whether the Rapid Transit Commission, the present city authorities, the powers behind them, the new state government, and the groups of financiers who control the Metropolitan Street Railway Co. can all be brought into agreement upon such an arrangement, is another and far different question which we shall not attempt to answer.

As we have said above, however, in such a co-operation between the city and this corporation lies the only real hope for the Rapid Transit enterprise. Besides the reasons for this that we have already set forth, there are others of equal or greater force. As everyone knows, the proposition to carry out the enterprise on its original lines, with the aid of the city's credit, has enlisted against it both the present city government, and the political leaders whose word will exercise great influence in shaping legislation at Albany. Besides this, the real estate owners of the city look askance upon the proposition that under a separate county organization further bonds in unlimited amount can be saddled upon the real estate comprised in the Boroughs of Manhattan and the Bronx.

All these facts in connection with a real change in public sentiment toward the Rapid Transit enterprise make the proposition to revive it, on its original lines, a scheme that can be called little less than Quixotic.

On the other hand, the need for real Rapid Transit up and down Manhattan Island grows every year with the growth of that section of the city north of Central Park, and that other and much larger section north of the Harlem River. The speed of the Manhattan elevated trans is 12 to 14 miles an hour, including stops. The electric conduit cars, where streets are not too crowded, make 8 to 10 miles per hour, including stops. These speeds are all right for short trips; but for long journeys they are far too time-consuming to satisfy the reasonable demands of modern life. Let us for a moment see what saving of time would be possible through such an express tunnel system as we have outlined, with stations, let us say, at City Hall, 23d St., 59th St., 90th St., 125th St. and the Harlem River. Let us assume a maximum speed of 40 miles per hour for express trains, and also that stops are made on the average in a distance of 700 ft., and in 30 seconds' time; also that a distance of 1,500 ft. and 50 seconds of time are required for the train to attain full speed; also that an average of 25 seconds is spent at each station in receiving and discharging passengers. The time of express trains from the City Hall to the Harlem River, about nine miles, would then be as follows:

	Seconds.
Stops at 4 stations (25 secs. at each)	100
Getting under way 5 times (50 secs. each)	250
Slowing up 5 times (30 secs. each)	150
Deduct distance run in getting under way (7,500 ft.) and in stopping (3,500 ft.), from total distance leaves 7 miles run at full speed; time to run 7 miles at 40 miles per hour	630
	1,130

Total time, City Hall to Harlem River. . 18 mins. 50 secs.

These assumptions of times and distances of acceleration and retardation are made after comparison with the results of actual tests, and it is worth noting that they by no means represent the limit of what is practicable. By arranging the station levels on summits with a sharp descending grade on either side, the time spent in getting up speed and in stopping the train can be considerably reduced, thus permitting either a reduction of the time between terminals or an increase in the number of stations. The stations, however, should not be placed much closer together than is indicated in the above, except, perhaps, toward the terminals at either end of the line. The surface roads should be left to collect at and distribute the passengers from the express stations. Taking average speeds of the electric surface cars at a mile in 8 minutes, and allowing 2 minutes' average wait for an express train, it will be seen that a passenger could ride half a mile to the City Hall express station, take an express train to 125th St., and then take another half-mile ride on an electric car to his destination, all in about 26 minutes.

Of course the above suggestions for the location of stations are merely tentative. We have merely assumed them to make plain that by such a combined local and express service as the new electric conduit railways make practicable, a great saving can be made in the time required for daily travel in this busy city. The benefits of such a time-saving to the city and all its people can hardly be overestimated. It is greatly to be hoped that the Rapid Transit Commission may be able to bring about some arrangement between the Municipality and the Metropolitan Traction Co., by which this improvement may be brought to pass.

LETTERS TO THE EDITOR.

One-Story Buildings with Saw-Tooth Skylights for Weaving Mills.

Sir: I have noticed with some curiosity the recent discussion in your journal about the one-story factory at Hammond, Ind. (Engineering News, Dec. 8, 1898), because it seems to have been considered as a novelty in factory construction. As a matter of fact, there have been no less than six buildings of this type, with large "saw-tooth" skylights, built in the Eastern States from designs made by me within the past three years, one of them covering over two acres in one room. I would not express any opinion as to the merits of this construction for the purposes of the printing company referred to in your articles, as I think a building should always be designed with especial reference to the use to which it is to be put, but for the purposes of weaving, for which all of the buildings designed by me were intended, there is nothing that can equal it. It is an ideal construction for this purpose. I believe I was the first to adopt it to any extent, in the form I have designed, with the very large glass surface, and adapted to New England climatic conditions. The objections you speak of, on the score of fire risk, were fully considered, and, while there is some force in them, they were insignificant in comparison with the great advantage gained, by obtaining a perfect and uniform light, which is the paramount desideratum for weaving.

Yours truly, F. P. Sheldon.

Providence, R. I., Dec. 10, 1898.

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Do They Get Their Engineering Work for Nothing?

Sir: A town in the Middle West, having a population of about 4,500, desires to put in a first-class municipal water-works plant. The mayor invites engineers to submit prices for making plans and specifications for the proposed plant. After receiving bids for performing the engineering services, the town council decides that better and more economical results can be obtained by asking contractors and builders to furnish their own plans and specifications and estimates of cost. It would be interesting to hear from any one knowing the actual experience and results of other towns proceeding in a similar manner.

An Engineer.

Kansas City, Mo., Dec. 21, 1898.

[In asking for bids for a bridge, or a pumping engine, or any piece of machinery whose design can be determined by the manufacturer with comparatively little regard for local conditions, there is much to be said in favor of the plan of permitting the bidder to make his own designs. In constructing a water-works or sewerage plant, on the other hand, it is absolutely necessary that completed surveys be made, before any intelligent design and estimate can be prepared. The town can have one survey made by a competent engineer, and a design made upon that survey; or it can require that every contractor who submits a bid shall go to the expense of making a survey and design on the chance of getting the contract. The latter course will certainly result in crude designs and high bids. Business experience teaches that those who try to get something for nothing generally fail in the attempt. The same rule holds good in the conduct of municipal business.—Ed.]

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Concerning Hydraulic Dredging Patents.

Sir: I have just read in Vol. XL. of the Transactions of the American Society of Civil Engineers the very interesting paper presented by J. A. Ockerson at the Annual Convention in July last, entitled "Dredgers and Dredging on the Mississippi."* I cannot spare time to notice this as I would like, but there is one matter in the discussion of this paper upon which, in justice to my licensees, I feel called upon to make brief comment. This would have been done at an earlier date but for the fact that my absence in Europe prevented it from falling under my notice. In Prof. Haupt's discussion of this paper there occurs the following:

> Under the subdivision of water jets., etc., the writer (Mr. Haupt) is impressed with the failure to refer to the pioneer and basic patent for the system of removing spoils from the bed of a river or bay by means of rotary cutters with inward delivery, centrifugal pumps and flexible distributing pipes as issued to Mr. A. B. Bowers, C. E., of San Francisco, and which has been applied so extensively in various modified forms on rivers and harbors, to the great benefit of commerce. The claims of the patentee have been uniformly sustained by the United States Courts, and the inventor's time is consumed in efforts to protect his interests, the history of which reads like a romance. Active opposition to an invention is, however, the best evidence of its merit. These dredges were used at St. Louis, on the Mississippi; on the Chicago drainage canal; at Seattle, Tacoma, Alameda Bay, and, in modified forms, on the Atlantic and Gulf coasts, with great effect.

Now, Mr. Ockerson's connection with the commission for the improvement of the Mississippi River, especially in connection with the references giving in his closing paragraph, are such as to make his statements authoritative. But, in view of my suit against the United States for infringement of my patents, in the use of this apparatus, it could not be expected of Mr. Ockerson to state that under the numerous decisions of the United States Circuit, and Circuit Court of Appeals, much of the more indispensable portions of these machines are covered by the Bowers' patents. On the contrary, I marvel at his furnishing the facts that prove my contention, and had he let the matter rest here, I should have had abundant reason to be grateful for the service rendered. But, replying to Mr. Haupt, he says:

> In reviewing the discussion it may be well to state that the author did not intend to exhaust the subject in the brief space of a single paper, and purposely omitted descriptions of many channel improvement devices that have come to his notice. It may also be well to state that he aimed to limit himself to devices proposed for, or used, on Mississippi River. With these explanations, Professor Haupt will understand why the author failed to "refer to the pioneer and basic patent," etc., and also omitted the mention of many devices, several of which have been described by Professor Haupt.

Now, in the explanation quoted, Mr. Ockerson has, unintentionally, without doubt, done me an injustice. His language is susceptible of the construction that he does not consider any of the devices described in his paper to be covered by the Bowers' patents. This cannot be true, if he has read the decisions to which I have referred, and he will doubtless thank me for correcting any wrong impression that may have been conveyed, inadvertantly, I am sure, in his explanation.

Yours very truly,
A. B. Bowers.

New York, Dec. 24, 1898.

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Some Results of a Test of a Hydraulic Cement Containing a Large Percentage of Sulphides.

Sir: Herewith I send you a table of tests made with a certain brand of American cement, the name of which is withheld. The cement was bought on specifications, which required a certain tensile strength after one day in air and six days in water; also a certain fineness on a No. 100 sieve. The samples taken passed the tests given and the cement was accepted. The usual test for change of volume showed no defects, as noted under remarks in the table. The sand tests also were good. The percentages of sulphuric acid and magnesia were thought to be low enough, but the high proportion of sulphides caused the cement to be looked on with suspicion. The cement was therefore used in comparatively unimportant work. Part of the cement so used took a fairly good set, but part of it failed to get hard.

Further tests were then made with the cement. It was found to take a good set in water, but if allowed to dry would lose a great part of its strength, as may be seen from the table. For example, 10 briquettes were put in air one day, then left in water for six days, then removed from the water, and kept in a damp atmosphere at a moderate temperature for seven days more before breaking. These briquettes showed a strength (Table I.) of only 158 lbs. per sq. in.

TABLE I.—Results of Experimental Tests of a Defective Hydraulic Cement.

			Days			Tensile strength,		
No.	Date, 1898.	No. briquettes.	In air.	In water	In air.	Max., lbs.	Min., lbs.	Avg., lbs.
1.	July 27.	..	1	6	0	564	352	443[1]
2.	Aug. 18.	..	1	6	0	232	196	213[2]
3.	Aug. 18.	..	1	27	0	382	300	345[2]
4.	Oct. 3.	10	1	6	0	614	412	496
5.	" 3.	10	7	0	0	240	152	203
6.	" 3.	10	1	1	5	254	184	229
7.	" 3.	10	0	7	0	482	368	451[3]
8.	" 26.	10	1	6	1	286	224	258
9.	" 26.	10	1	6	7	182	136	158

Remarks: [1]Pats O. K. [2]Sand test—1 cement 3 sand—pats O. K. [3]Briquettes swollen slightly.

Note.—Fineness = 94.8% on No. 100 sieve; magnesia, (MgO), = 2.25%; sulphuric acid (SO_3), = trace; sulphur as sulphide (S), = 1.21%. All samples were from the same lot of 120 barrels.

The experiments Nos. 4-7, under date of Oct. 3, were made simultaneously with similar tests of Atlas American Portland and German Puzzolan cement. In these tests with the Atlas cement, the highest result obtained was 854 lbs. after one day in air and six days in water; the lowest was 765 lbs. after seven days in air only. With the Puzzolan, the highest was 455 lbs. after one day in air and six days in water, while the lowest was 435 lbs., after seven days in air only. Each result was the average of ten briquettes. Hence, we may say that the Atlas and Puzzolan cements do not show an important falling off in strength when removed from the water.

There seems to be no satisfactory explanation for the loss of strength shown in the table, unless one can be found in the high percentage of sulphides, and that does not seem probable. The moral of the above account is that the usual tests of hydraulic cement do not always serve to exclude an inferior brand. The matter is thought to be worthy of space in your journal, as it may prove a valuable hint to those preparing specifications for important work.

Very truly yours,
S. Bent Russell, M.Am.Soc.C.E.

St. Louis, Mo., Nov. 23, 1898.

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Notes of a Visit to the Keely Workshop.

Sir: The notice of the late John W. Keely, in your issue of Nov. 24, recalls an account which he once gave me of the origin of his so-called "motor," which may prove interesting to you. It was, I believe, in the summer of 1880, and during a visit to the workshop in Philadelphia, in company with some intending New York investors who did not invest. The usual exhibitions were made: of pressures of 10,000 lbs. per sq. in., produced after pouring of half a gill of water into the "generator," and the caterwauling of a bass viol; of lead bullets propelled from a gun with violence; of a rotary motor, which wobbled as if driven by a piston engine, and was easily stopped by a brake, etc., etc. In conversation afterwards, I asked Mr. Keely how he happened to discover his "motor." He said that many years previously he had been, for quite another purpose, trying experiments with various substances; that on one occasion these substances and mixtures were enclosed in a number of copper globes, and had been placed temporarily on a window sill. That he approached to remove them, when one of the globes suddenly exploded, knocking him insensible, and so far injuring his face and hands that he had to be put to bed and his wounds dressed by a surgeon. In that bed he laid a week, nearly blind, and mainly striving to remember accurately just what combination of substances he had put into that particular bomb. At last he recollected them all, he made up his mind as to the cause of the explosion, he jumped out of bed, he experimented, and his "motor" was the result.

All the prodigies exhibited to our party could have been reproduced by chemical means; for there are a number of alkali metals (sodium, potassium, etc.), which have so great an affinity for oxygen that they will absorb it from water or damp air, and release the hydrogen, which may reach a high pressure, if confined. The impression left on my mind, by my interview with Mr. Keely, was that it was possible that he was employing one of the alkali metals, perhaps in combination with other chemicals; that the mixture was previously introduced into the "generator," and came into activity upon the introduction of water. I do not claim that this is the way it was done, for I made no experiments, and took no further thought about the matter, being satisfied at the time that whether produced in this or in some other way, the enormous pressures generated were too erratic, and necessarily too small in volume, to be employed as a motive power.

It was also my impression that Mr. Keely originally had taken up his motor in good faith, and had anticipated a great success. After some years, however, he must have had doubts and then discouragements. This probably was the time when he resorted to the big fiddle (he played it very badly), to hasten by vibration the generation of pressure, or the trickling down of water through a narrow aperture, and invented the many puzzling words with which he interlarded his mystifying explanations. Once engaged upon that course, all his ingenuity would be devoted to guarding the secret which furnished him a living.

I hope you will carry out your expressed intention of giving an account of the investigations of your staff into this curious mystification.

Respectfully,
O. Chanute.

413 E. Huron St., Chicago, Ill., Dec. 13, 1898.

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Notes and Queries.

B. K. C., Beaumont, Tex., asks as to the advisability of laying even or broken joints on a light unballasted railway in Southeast Texas.

Broken joints are preferable, and are the most generally approved, making a better running track with less maintenance work in surfacing and lining, especially if plain splice bars are used instead of angle bars. It is sometimes assumed that even joints are better in light tracks, but this is now generally recognized as being incorrect, in consequence of the additional work of maintenance required.

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THE MAIN ENTRANCE TO THE PARIS EXPOSITION of 1900, from the Place de la Concorde, is ingeniously planned. The ground plan is an equilateral triangle, surmounted by a dome; one side forming the entering façade. Arranged about the other two sides, in a semi-circle, are 108 passages for visitors, each fitted with a registering wicket. The interior apex of the triangles is cut off, and the dome is here supported on two piers with an arched passage between. This arrangement provides a driveway for special occasions, leading directly through the dome triangle into the grounds. It is estimated that this one gate will easily admit 60,000 persons per day to the Exposition. Architecturally the gate is a failure, but it will cost $38,000 to build.

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A DIFFICULT PIECE OF STEEPLE REPAIR is being performed in Boston by John H. Cunningham, of Providence. In the storm of Nov. 26-27, the rod supporting the vane on the steeple of the First Methodist Church was bent over about 50°. A staging was first built inside the top of the steeple, and then a hole, 20 ins. wide by 3 ft. long, was made about 18 ft. below the top. Through this hole a stout stick of timber, 34 ft. long, was pushed up and secured; and on this stick was a tackle and falls by which a boatswain's chair, with Cunningham on it, was hoisted up to the vane. This man first removed the letters on the vane-rod, which were 2 ft. long by 18. ins. deep. The vane itself will be taken down by means of another stick lashed to the first, which will carry a tackle by which it may be lowered to the steeple belfry. None of these adornments will be replaced as they are too heavy for the steeple. The "Lynn" method, here used for work of this character, implies working from the inside of a steeple or chimney, instead of building staging up on the outside, as was once done. In the case of a chimney, 30 ft. timbers are employed, placed diagonally inside and secured, and on top of each is placed another similar stick inclined in the opposite direction, until the top is reached and a secure staging is made. When the work is completed, the lower stick is pulled out and the rest drop to the bottom.

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*Eng. News, Oct. 13, 1898.

THE CORNWALL BRIDGE ACCIDENT.

The uncertainty which prevailed at the time of the accident as to the original cause of the failure of the Cornwall Bridge has been cleared away somewhat by recent developments. This bridge crosses the St. Lawrence River in the vicinity of Cornwall, Ont., where Cornwall Island divides the river into two channels, and consists of a cantilever structure over the Canadian channel and a Pratt truss structure over the American channel. It was to the part over the American channel that the accident occurred (Eng. News, Sept. 15, 1898), and it resulted in the complete destruction of two of the spans and the pier between them. Fig. 1, from a photograph taken only a few hours before the accident, shows quite clearly the condition in which the structure was. The two spans shown in their entirety by the illustration were the ones which fell with the pier. At the time the erection of both spans had been practically completed, and from under one span the falsework had been removed. On the other span the blocking had been removed and the traveler was being taken down, and the men were at work riveting up the floor. This span was, in fact, ready to carry traffic, it being thoroughly bolted up and considerable riveting finished. The design and construction of the piers were fully described in Engineering News of Sept. 15, 1898, and at that time we also expressed the opinion that all the available facts pointed to the pier and not to the spans as the original cause of the accident.

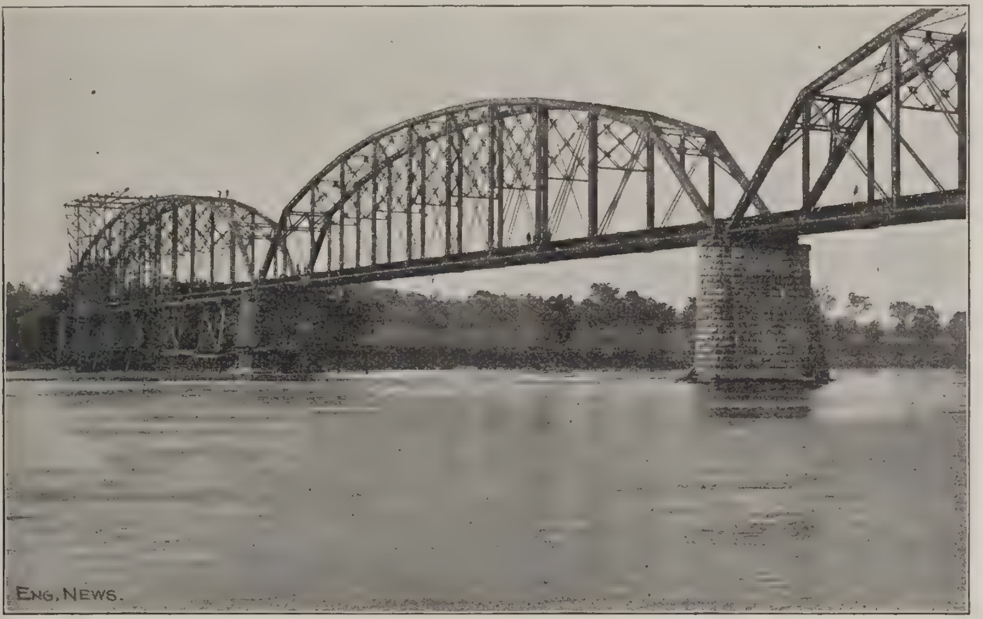


FIG. 1.—THE NEW YORK & OTTAWA R. R. BRIDGE OVER THE AMERICAN CHANNEL OF THE ST. LAWRENCE RIVER, NEAR CORNWALL, ONT.
(From a photograph taken on the morning of Sept. 6. The two spans shown and the center pier fell at noon on that day.)

With the purpose of determining the responsibility more definitely, and also of inspecting the wrecking operations, a member of the editorial staff of Engineering News visited the bridge on Oct. 17 and 18, and studied the ground and interviewed all persons likely to possess authentic information upon the accident. The officers of the New York & Ottawa R. R. Co., the owners of the bridge, refused to give any information. In other directions the success of the inquiry was greater, and a number of persons familiar with the structure and competent to judge of the conditions and circumstances gave valuable information. For various personal reasons we are not at liberty to divulge the names of the gentlemen who aided our representative. A careful comparison of the different statements, however, has been made, and the inconsistencies weeded out as far as possible, so that we believe that the following statements are as nearly accurate as the present knowledge of the accident permits.

So far as could be ascertained, no examination was made to determine the character of the bottom of the river previous to the sinking of the cribs for the piers. The only difficulty in making such an examination arose from the swiftness of the current, which ran about five miles per hour at the bridge site. The bottom was successfully examined with a sounding rod in a stronger current, however, after the pier fell. After the cribs were sunk a diver went down inside them and examined the bottom. In the case of the crib which failed, the diver, it is stated, reported that the bottom was hardpan, and brought up a sample to prove his statement. No borings or soundings were made inside the crib to verify further the diver's report or to determine the depth of the hardpan layer.

The whole region surrounding the bridge is clayey. On the Canadian side of the river this clay is hard, but it becomes softer as the American shore is reached. It is, geologically, a glacial drift deposit of clay interspersed in places with deposits of boulders, and a formation which is frequently encountered is a layer of boulders and indurated clay, known locally as hardpan, overlying a deposit of soft blue clay. Such a formation is found in a number of places on the St. Lawrence Power Co.'s canal (Eng. News, Dec. 15, 1898), only a few miles distant.

In erecting the falseworks for the spans it was observed that the bottom was very uncertain. Fig. 2 shows the falseworks in process of erection. It will be noticed that the trestle bents are made up of Phoenix columns braced together by iron rods and timber struts. At the bottoms of these columns were fastened circular shoes or disks 2 ft., and, in some cases, more in diameter. The purpose of these disks was, of course, to give the iron posts greater bearing surfaces on the river bottom, and with a bottom of hardpan such as the piers were supposed to rest on, the size of the disks used was calculated to be ample to prevent any settlement. This did not prove to be the case, however, for, although an extra length was added to the bent posts to allow for settlement, they sunk more than was assumed in several cases. This extra sinking of the bent posts was noticed on both sides and close to the pier which was destroyed.

The destroyed pier was located slightly diagonal to the direction of the current, and had no protection of rip-rap to prevent scour. The ultimate intention was to rip-rap all the piers thoroughly, but this work had not been done. Any scour, therefore, which might be induced by the diagonal position of the pier and the restriction of the channel by the piers and falseworks had an entirely unprotected bottom to act upon.

So much for the conditions previous to the accident. At the time of the accident gas pipe soundings were being made in the Canadian channel of the river by the engineers of the Canadian Department of Railways and Canals, and shortly afterwards the barge being used there was moved around to the American channel and work begun over the site of the destroyed pier. After penetrating about 18 ins. to 2 ft. of hardpan the sounding rod struck a soft clay, into which it was forced from 12 ft. to 18 ft. without difficulty by a man pushing downward on it. The wooden crib had crushed through the shell of hardpan and tipped onto one edge, and the masonry had disappeared. It is surmised that the soft material under the hardpan was a deep pocket formation. Soundings have shown that no such formation exists in the Canadian channel of the river, but, so far as is known, no other soundings of a similar nature have been made in the American channel. It was, however, just such a formation as is found frequently in the surrounding country.

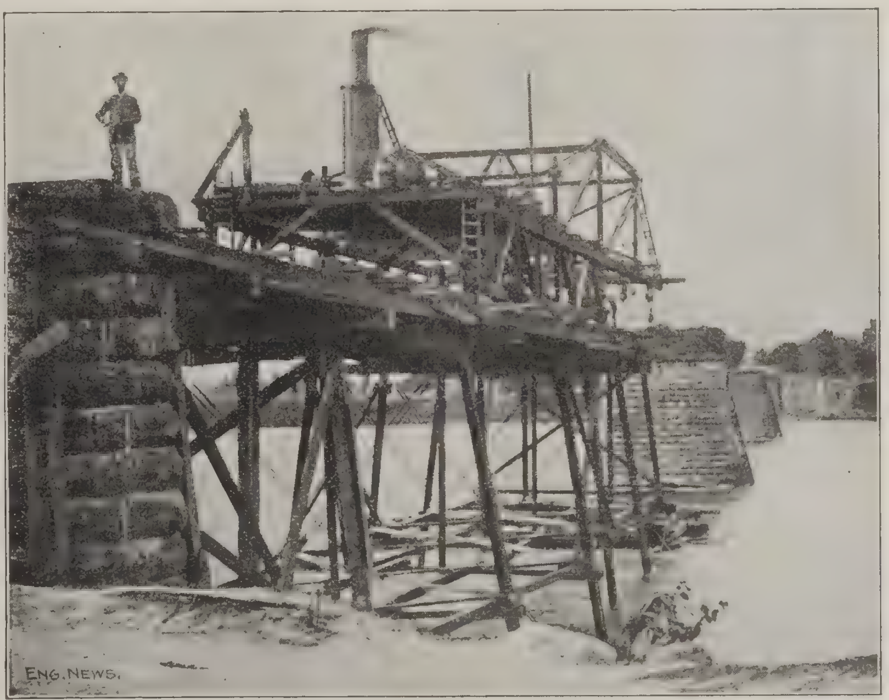


FIG. 2.—VIEW SHOWING CHARACTER OF FALSE WORKS AND TRAVELER USED IN THE ERECTION OF THE CORNWALL BRIDGE.

The evidence pointing to the failure of the pier first is both direct and inferential. The survivors of the accident who were at work on the destroyed pier state that it literally sunk from under them. It is difficult to conceive under the conditions how it would be possible for the failure of a member in either of the spans to pull the pier over and destroy all vestiges of it completely. Moreover, the span from which the falsework was removed fell perfectly intact, except for the end panel, which rested on fallen pier, according to the examination made by the wrecking company's divers. It pretty certainly did not break in two and drag the pier down. The fact that the pier had shown no signs of failure also agrees in every respect with what one would expect should the pier break suddenly through a shell such as the soundings showed to exist.

As stated above, the second span from the American shore fell into the river intact, and now lies on its side with the upper chord downstream. The shore span, however, carrying the falseworks with it, fell in a tangled mass, occupying the space between the piers. Work was in progress removing the wrecked ironwork at the time our representative made his examination. To take out the wreck of the shore span a winch has been fitted upon the shore pier. The tackle from this is fastened to the wrecked members, which are hauled ashore. Dynamite placed at the connections is employed to break up the wreckage into pieces small enough to be handled. About one-fifth of the wrecked steelwork had been removed on Dec. 15.

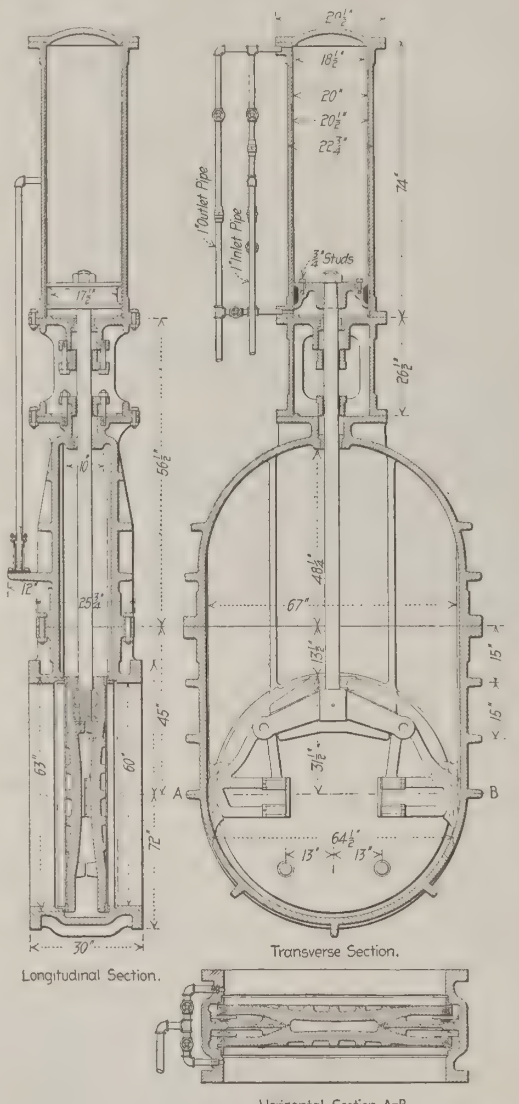
The second span it is proposed to raise as a whole by means of pontoons and thus float it to shallow and quiet water, where it can be broken up. The span is now lying on its side with its top downstream. It is proposed to attach a cigar-shaped pontoon to each of the ten vertical posts. Each pontoon is 8 ft. in diameter and 40 ft. long between its extremities, and has a lifting capacity of 60 tons. Altogether the ten pontoons can thus exert a lift of 600 tons. The fastenings are made by chains between the panel points and the ends of the pontoons, that is, the pontoon lies on top of the span, parallel with the vertical post and the current, with one end chained to the top chord panel point and the other end to the bottom chord panel point. At the time of our representative's visit, work was in progress attaching the pontoons to the wrecked span. Since then the span has been moved downstream about 300 yards and into shallower water, thus forcing the pontoons nearly half their diameter out of water, and consequently destroying their usefulness. The wrecking company has abandoned the work for the winter.

One of the novelties of this work was the working of divers behind shields. With the wreck restricting the channel the current is like a mill race, and it is absolutely impossible for a diver to work in it unprotected. The protection adopted successfully is a steel plate, half-cylinder, 4 ft. in diameter, with a 1 ft. tangent plate at each free edge. Across the open front, between the free edges, are horizontal braces arranged like the rungs of a ladder. This cylinder is hung from the boom of a derrick on a large working barge, and is guyed to ensure its descent vertically into the water. In operation the shield is placed so that its opening covers a panel point, the curved surface being upstream. A diver descending inside the shield is thus thoroughly protected from the force of the current and can attach the chain to the panel point at his convenience. So far as the work had gone at the time of our representative's visit, no accidents had occurred with this shield, and it was doing successfully what it was designed to do. The contractors for the wrecking operations are the Collins Bay Rafting & Towing Co.

A 60-IN. HYDRAULIC VALVE.

In our issue of Aug. 20, 1896, we described a 42-in. valve operated by hydraulic power, a number of which had at that time just been installed on a 42-in. pipe line of the Detroit, Mich., water-works. These valves were designed and built by the Michigan Brass & Iron Works, of Detroit, Mich., and the same firm has recently completed a 60-in. valve of similar design for a water power electric plant at Ft. Ann, N. Y., which we illustrate in the accompanying drawings. These drawings show the nature, arrangement and dimensions of the different parts in detail, and will for that reason be of interest to engineers.

The valve was designed for the flume which conveys the water from the dam to the water wheels in the Ft. Ann, N. Y., electric plant. Here it will be used to shut off the water in case of accident or any other emergency in which prompt shutting off of the water becomes necessary. The pressure employed in testing the valve before shipping it was 75 lbs. per sq. in. Some idea of its size is obtained from the statements that its height is 42 ft., and its total weight is 27,400 lbs. Over 1,500 lbs. of bronze were used in its construction. The several features of construction and operation of the valve are clearly shown by the drawings, and need not be explained further here. For the information from which this description has been prepared we are indebted to Mr. Frank B. Ward, Secretary and General Manager, Michigan Brass & Iron Works, Detroit, Mich.



Longitudinal Section.

Transverse Section.

Horizontal Section A-B.

A 60-in. Hydraulically Operated Gate Valve for Water Power Electric Plant at Ft. Ann, N. Y. Michigan Brass & Iron Works, Detroit, Mich., Builders.

STREAM GAGINGS AND OTHER STUDIES RELATING TO IRRIGATION IN WYOMING.*

By Elwood Mead, M. Am. Soc. C. E.†

During the past two years, C. T. Johnston, Assistant Engineer, has given the greater part of his time during each irrigation season to the gaging of streams and looking after the records of their discharges. This work was done for the hydrographic branch of the U. S. Geological Survey, which paid all the expenses, but gave this office copies of the results. In September of this year, Mr. Johnston was employed by the Department of Agriculture in the study of some interstate water right questions in which Wyoming is conecrned. The facts gained in this investigation have also increased our knowledge of the irrigation problems which must in time receive attention from Congress or the courts.

In addition to these measurements, the office made some special investigations into the water supply of several streams, the results of which seem worthy of a place in this report.

Discussions of stream discharges and laws for acquiring rights therein seem to assume that the volume to be divided can be readily ascertained and that all those in charge of the streams have to do is to measure the flow and then apportion it out among users in accordance with their priorities of right. Those who have charge of this division find this conception does not always agree with the facts. Of all the adjudicated streams in Wyoming, I cannot think of one where gagings at one point, no matter what place is selected, will give the volume which can be utilized by irrigators. On many streams irrigators divert the entire flow. Where this is done we are able to locate the sources of that supply and observe its fluctuations to much better advantage than before such diversions were made. In these studies we have found that subterranean waters are of much more importance than was formerly supposed. On some streams springs furnish the main supply; on others, crevices in the rocks are the cause of large losses. Among the adjudicated streams of this state, very few are like canals—simply a channel to transport what is turned in at the head. On the contrary, they gain and lose in every mile of their channel. The inclination of the underlying strata often has more influence on a creek's flow than the area of its mountain watershed. Some streams have a large volume where their channels cuts across a rock ledge, while in sandy basins above and below the visible supply will wholly or in large part disappear. Because of these fluctuations the location of a right is often of more importance than the number of its priority. In order to conserve the water supply and secure the most effective division of a creek or river, these changes in the available volume have to be taken into account. They cannot be obtained from a gaging record secured at a single station. What is needed is a careful study of physical conditions along the entire stream.

The experience of our water commissioners would furnish as many illustrations of the truth of these statements as there are rivers to divide. Only a few can be given. We will begin with Salt River, which waters about as many acres of land as any stream in the state, and where the enforcing of rights is about as perplexing as can be imagined. Where this river leaves the mountains it has a perennial flow; so it has at the narrows, 25 miles below; midway between these two points it goes dry every summer. The closing down of every ditch on the main stream and all its tributaries above this dry section would not furnish water to appropriators along it. When I crossed it near Fairview several years ago its channel was as dry as the streets of Cheyenne, while 11 mines below the river was larger than North Platte on the same date.

The North Platte is another, but less striking example. For many years a gaging station has been maintained at Orin Junction. It is an excellent location, and the record is of value in view of possible interstate complications, as the station is below all ditches of any size in Wyoming, and the flow measured gives a close approximation of the surplus which remains for irrigators below. The volume taken out in Wyoming below the station is less than is received from Laramie River, so that when there is a 1,000 sec.-ft. in the river, at the station there should be as much or more for Nebraska's irrigators at the state line. The facts are otherwise. Last july, when 900 sec.-ft. was flowing past the gage rod at Orin, a hot and thirsty representative of Nebraska's irrigators protested against the stream being dried up by Wyoming ditches. He was correct about the river being dry. I crossed it on the Burlington Railroad, near Grand Island, and nothing but a succession of pools was left of the torrent which at that minute raged through the canyon 50 miles west of the Wyoming state line. The water was gone, but it did not depart in ditches. It disappeared in the sand through which the stream winds its devious way. In September the discharge at the gaging station was about 500 sec.-ft. Not 100 sec.-ft. of this was taken out between that point and the eastern border of the state, and the volume diverted was offset by what the Laramie supplied, yet, before the border of Nebraska was reached the water had all disappeared. The channel was nearly dry at the state line. In less than 100 miles over 400 sec.-ft. had gone into the air by evaporation or sunk into the sand by percolation. If, instead of one station on the river, there had been three, one at the Colorado-Wyoming boundary where the river enters the state, another at the Nebraska-Wyoming border where it leaves, and the one at Orin where its present diversion now practically ends, the three records would have little resemblance to each other, while their differences would have no relation to the use of water by irrigators. The loss of over 400 sec.-ft. between Orin and the state line really occurs in half that distance. Gagings made at Fairbanks, 50 miles nearer Nebraska, show a greater discharge than at Orin. The causes of the fluctuations are not at all obscure. Less than a mile below Orin the river cuts across a rock ledge which brings the underflow to the surface. This permits nearly, but not all to be measured. At Fairbanks, a vertical marble dike cuts across the valley. Every particle of water which gets past this has to flow through the narrow notch which the river has eroded. Whatever underflow escapes at Orin is in evidence here. At the state line the river has a broad, shallow bed winding in and out among islands and sand bars, where every condition favors its rapid absorption both above and below.

The report of Mr. Gilcrest shows that the streams, on which he surveyed the ditches in 1897, are divided into sections which are, in a large measure, independent of each other, so far as the enforcement of prior rights or the use of available supply is concerned.

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*Extracted by permission from the forthcoming annual report of the author, as State Engineer of Wyoming.

†State Engineer, Cheyenne, Wyo.

The gaging station at the mouth of the La Prele, maintained by this office in 1897, showed how much water escaped, but it gave no indication of how or where it could have been used to the best advantage.

Horse Shoe, Cottonwood, Chugwater, Lodge Pole, Crow and Lone Tree creeks are examples, in Laramie county, of streams which each year become dry, or almost so, in places, and have a perennial flow in other sections. There is little use in trying to enforce priority of right across some of these dry stretches. The water required to saturate these basins of sand will, if used where it rises, save many acres of crops. The loss of over 400 sec.-ft. in 50 miles of the North Platte is evidence of this. The truth is that each stream is in a measure a law to itself, and conditions along one are no guide as to what they will be on another.

The rise of water in some sections of a stream and its disappearance in others creates some perplexing questions. Many of the earlier ditches were located before these facts were known, and before the extent of the water supply was much thought of. As a result, headgates were placed on sand bars where 10 sec.-ft. has to sink beneath the channel in order to keep one in sight. The loss in putting water into such ditches is, therefore, heavy and other appropriators object to the waste, as they term it, which the enforcement of these rights involves. The members of the Board of Control hold different views regarding our duty in such cases. Some are of the opinion that where the protection of a priority involves an excessive loss, the right should be ignored and the water be given to later appropriators, who can use it to better advantage.

I do not believe we have such discretionary authority. The law gives the first user the better right. It left him free to locate his ditch where he pleased, without regard to the abuses which this absence of direction or control might create. The right cannot, therefore, be disregarded without setting aside the whole theory of prior rights and violating the law creating them. I believe that so long as the law is in force these priorities should be recognized, unless it can be shown that there is not water enough in the stream to supply both the waste and the use combined. If doing this involves a loss to others of such proportions as to make the existence of this right a public injury, the law should be changed. Permanent relief will not come from disregarding statutes, but through their modifications. Let a law be passed to condemn such wasteful rights, other appropriators to pay the costs incurred in proportion to the benefits received.

Influence of Subterranean Waters on the Flow of Streams

In the adjudication of water rights, and in most court decisions affecting those rights, the stream disposed of is treated as though it all had come and was to come from one snow bank, or in other words, as if all the rights established were to be supplied from a single and common source.

Because of this premise it has been held that so long as the supply comes from the same source the place of diversion and use is immaterial, and that the holders of water rights should be permitted to shift their appropriations from one ditch to another and move their priorities up stream or down, as interest or inclination may dictate. Those who uphold this doctrine appear to take it for granted that no matter where the original right was acquired the appropriator took from a supply which included all the water in the stream. The soundness of this doctrine depends, in a large measure, on whether it agrees with the facts. If all the water a stream carries enters above an appropriator's ditch, the claim that the place of diversion is not material has much better foundation than it has where the greater part comes into it below. It has never been held that the beneficial use of water from a particular source gives a right to water from a different one. The first appropriator from Crow Creek cannot transfer his priority to Lodge Pole, and take the water away from the second priority there. Using water from the North Platte gives no right to Green River. So far as streams are concerned, rights are restricted to the source from which originally acquired.

I can think of no reason why such limitation should not apply to rights from a single stream. If it does, then the man who builds a ditch at the head of a creek has no license to move his priority down stream in order to get control of an additional supply which his original ditch could not divert. An irrigator on the Laramie Plains, taking water from the Laramie River, has, in my opinion, no right whatever to Sybille Creek, even if it is a tributary, because it rises on the other side of a range of mountains and joins the river 2,000 ft. below his ditch. To permit the shifting of his priority so that he could take the volume designated in the right out of the river below the mouth of Sybille Creek, would be to recognize control over a stream as foreign to the original appropriation as to transfer the priority to an entirely different watershed.

The experience gained in the division of Wyoming streams has shown that the number in which the rights are based on the entire supply is exceedingly limited. On the contrary, most streams are fed from a multitude of sources, some of which are below many early rights, and hence furnish a supply which was never used by the holders of these rights.

The limit of this report prevents the publication of all the investigations which have led to these conclusions. Like the maps of surveys, we can only present one or two typical examples. The results of the Horse Creek measurements, which follow, could be duplicated by as marked gains or losses on scores of other streams where similar measurements have been made.

The Water Supply of Horse Creek.

Horse Creek rises in the Black Hills, on the western border of Laramie county, and empties into the North Platte near the Wyoming-Nebraska boundary. It is over 100 miles long, but with one exception, all of the ditches now in use are found between the base of the foot-hills and Hawk Springs, a distance of 70 miles. The adjudicated rights are largely in excess of the stream's discharge, as they aggregate over 1,200 sec.-ft., yet they are derived from a creek whose greatest measured discharge is 32 sec-ft. Practically all the surface supply comes from the mountains at the head. Only two small creeks join it below, and one of these formerly ran dry during the greater part of the irrigation season. The other is over-appropriated and nothing but seepage water comes from it. The first ten priorities aggregate 35 sec.-ft. Hence, if the stream was not reinforced except by surface tributaries, these priorities would absorb the largest flow ever measured, and leave irrigators with later rights, amounting to over 1,100 sec. ft., with a lot of paper priorities of little or no value. This is not the existing situation. Certain irrigators, whose priorities are far down the list, have always an ample water supply. Others with early rights have an intermittent and scanty supply. This is not due to the improper division, but to the fact that the ditches are so located that earlier rights just above drain the creek, while farther down, seepage and spring waters reinforce it. Measurements, extending over a period of ten years, have proven that the greater part of the water supply in this stream does not come from the foot-hills, but from the seams in the rock ledges it cuts across. Some of these springs are large—one has a flow of 3 sec.-ft.—but the greater number are so small that they have not been located. In order to show more definitely the extent of this increase, two series of measurements were made this year, the first in May and the last in August. The method pursued was to follow down the stream and wherever a ditch was diverting water the volume taken out was measured, as was the discharge of the stream immediately below the headgate. Adding the two gave the volume above the headgate. These gagings began just outside the foot-hills where the three branches of the creek unite. They ended where Hawk Springs enters the stream over 70 miles below.

The rainfall in May was above the average, and its influence on the first measurements was apparent. While there were no surface streams, the ground was wet and the flow of springs much larger than usual. The August measurement was made during one of the dryest periods of which we have any record. In May the discharge above all ditches was 18.3 sec.-ft.; to this was added the surface flow of Sprager Creek, Little Horse Creek and Hawk Springs, amounting in all to 8.62 sec.-ft. Hence, if none were lost by evaporation in the 70 miles, the total surface supply would be 26.9 sec.-ft. There was taken out over 85 sec.-ft., and the last measurement showed 17 sec.-ft. still in the stream, an apparent loss of less than 10 sec.-ft. for evaporation in the creek channel, and in the use of 85.6 sec.-ft. in irrigation.

When the August measurements were made the irrigation of grain and pastures had ended and some of the ditches in use in May were dry. The first four ditches measured in May were in this condition. While there was a decided shrinkage in the amounts of all measurements, except the seepage from Sprager and Little Horse creeks, the relative importance of the subterranean supplies added to the stream was not diminished.

The amount of water above all ditches was less than 6 sec.-ft. That was the limit of the common supply. Whatever was added below could not be diverted or used by the upper ditches; 17.47 sec.-ft. of seepage and spring water was so added and 4.44 sec.-ft. entered from the two tributary creeks. In both measurements about four times as much water was taken out as there was in the stream at the start, and in both cases approximately as much remained at the end as there was at the beginning.

The subterranean increase comes from two sources. The winter snow and spring rains fill the cavities of the rocks and this finds its way slowly into the creek channel where it cuts through these ledges. The increase between the 10 and 40-mile points is largely from this source. For 15 miles of this distance the creek flows through a canyon with no ditches and no seepage from irrigation. That water from irrigated fields formed a considerable part of the August increase was shown by the fact that the volume of seepage water flowing out of the two tributary creeks showed no material diminution. There is also reason to believe that there has been a progressive increase in the amount of irrigation water which returns, as a comparison with similar measurements described in the report for 1889 shows a considerably larger percentage of increase.

This progressive increase in the water which returns from irrigated fields has been clearly shown on Horse Shoe Creek. For ten years after ditch building began no land was irrigated for two or three miles above the mouth of the stream, although the land was fertile and ditch building easy. Ditches above drained the channel; newcomers were afraid to settle below them. They went higher up stream to get nearer the original supply in an effort to make position offset priority. But when the upper part of the creek had become unquestionably over-appropriated springs began to appear near its mouth. While the upper ditches were being closed down to protect early rights water was going to waste at the mouth of the creek. One ditch was built to use it. Later a second ditch was built and the farms under them although last in priority have all the water needed.

On some streams the volume of return or seepage water is small and does not seem to increase. This appears to be due to the underlying strata being inclined away from the channel instead of toward it. Spring Creek, a tributary of the Platte, is an instance.

This office is frequently requested to approve changes in the place of diversion and use of appropriations. The holders of early rights, which experience has shown to have little value, desire to move them to some other point on the stream where, from the influence of seepage or other causes, the supply is more abundant. In some cases the request comes from a speculator who sees in these early paper rights a chance to blackmail later appropriators whose ditches are located where the supply is more abundant. I have refused every such request and have notified every one that until either the legislature or courts make the right to move a priority absolute I shall do all in my power to prevent such transfers and to avoid our repeating the blunder made by some of the other arid states. In my opinion this office can do the irrigators of the state no greater service than to prevent the abuses which in all countries have followed the recognition of such right.

I can seen no more reason for permitting an early appropriator near the head of Horse Creek to move his priority down the stream to get the benefit of the springs which he never used than there would be to sanction the transfer of his priority to the Laramie. In both cases it would enhance the value of the migratory right, but it would rob some other appropriator and unsettle and demoralize our whole irrigation system.

TEST OF AN ALLIS PUMPING ENGINE AT ST. PAUL, MINN.

A new triple-expansion, high-duty pumping engine of 10,000,000 gallons daily capacity, built for the Water Commissioners of St. Paul, Minn., and erected at the McCarron Lake pumping station in that city, has recently been given a 72-hour test, with very satisfactory results.

The test was started at 7 p. m., on Nov. 13, and concluded at 7 p. m., Nov. 16. All the steam used by the engine was condensed and weighed, and the condensation from the jackets was collected and weighed separately. The water delivered was measured by a weir situated at the reservoir, and readings of this weir were taken at frequent intervals. The water pressure was read by means of a mercury gage.

The engine was built by the E. P. Allis Co., of Milwaukee, Wis., and was completed some months before the foundations were ready for its erection. Under the contract, the builders were to receive a bonus of $600 for every million ft.-lbs. of duty secured above 130,000,000 ft.-lbs., up to $6,000, and the tests show that they are entitled to the maximum amount of the bonus. The test was made by Robert W. Hunt & Co., of Chicago, to which firm we are indebted for a copy of the preliminary report, and for the following statement of the dimensions of the engine and the result of the test:

Diameter of h.-p. cylinder	21½ ins.
" i.-p. "	38 "
" l.-p. "	56 "
Diameter of plungers	24¾ "
Stroke of pistons and plungers	42 "
Plunger displacement, per revolution	262.42 U.S. galls.
Average: Steam pressure by gage (corrected)	127.9 lbs.
First receiver pressure by gage	31.8 "
Second receiver pressure by gage	.28 "
Vacuum by gage	12.83 "
Discharge head on pumps	146.638 ft.
Suction	.052 "
Total head on pumps	146.586 "
Total revolutions of engine	116,649
Average revolutions per minute	27
Actual total water pumped during test, weir measurement	254,308,222.97 lbs.
Actual water pumped for 24 hours	10,159,000 galls.
Loss by slip and leakage	0.44%
Total condensed steam	219,601.5 lbs.
" jacket steam	38,443.5 "
" dry steam supplied to engine	258,045 "
Duty per 1,000 lbs. steam	141,463,000 ft.-lbs.

The engine is of the vertical, triple-expansion, crank and fly-wheel type, the arrangement being somewhat similar to the ordinary type of marine engine. There are three steam cylinders (high, intermediate and low pressure), 21½, 38 and 56 ins. diameter, and 42 ins. stroke. Each steam piston rod connects to a steel cross-head, from which four steel-tie rods extend to the head of the pump plungers, making a direct and rigid connection between the steam pistons and water plungers. The main shaft has three cranks set at angles of 120°, giving a steady turning effect, and as the pump plungers move in unison with the cranks, a very steady flow of water is obtained, and the shock on the pumps and pipes is reduced to a minimum.

The steam cylinders are steam-jacketed, thoroughly covered with a non-conducting material, and lagged with sheet steel. The valve gear is of the Reynolds-Corliss type, the high pressure gear being under the control of an adjustable speed regulator, while the intermediate and low pressure cylinders are adjusted by hand. The steam and exhaust valves are located in the cylinder heads, reducing the clearance to a minimum (2% in the high-pressure cylinder, 1.6% in the intermediate, and 1.37% in the low pressure).

The pumps are located below the engine bed plates, and are of the single-acting, outside-packed, plunger type, provided with large valve area, the valves being of rubber and arranged in groups mounted on "cages." The valve chambers support one end of the engine bed plates, this arrangement reducing the amount of foundation required, while at the same time it renders the pumps more accessible. The opposite end of the bed plates is carried on a masonry pier.

A surface condenser is located in the suction pipe. The air and feed pumps are driven direct from the main engine by means of an arm on the low pressure plunger. The throttle valve, injection valve for condenser, cut-off levers, etc., are all so placed that the engine can be stopped, started and controlled from one position on the engine-room floor. The total weight of the engine is 200 tons.

The engine has a capacity of 10,000,000 gallons in 24 hours, when operated at a plunger speed of 189 ft. per minute (27 revolutions). The pump HP. during the test was 262.47; with 279.56 I. HP., the friction being 6.11%. The steam consumption was 12.82 lbs. per I. HP., the steam pressure being 127.9 lbs.

During the test steam was applied by two horizontal tubular boilers, each 5½ ft. diameter and 18 ft. long, but as the duty test was on steam, no effort was made to obtain high boiler efficiency. In fact, the builders state that the conditions were poor for high boiler efficiency, the actual evaporation being only about 7.57 lbs., while under ordinary conditions the boilers readily evaporate 8.5 lbs.

* * *

TESTS OF A DIESEL MOTOR.

We have received from the Diesel Motor Co., of America, 11 Broadway, New York city, a pamphlet containing a report by Prof. James E. Denton, of the Stevens Institute of Technology, of the principal results of a series of economy tests of a Diesel motor, rated at 20 brake HP., using various kinds of oil as fuel. The motor is one of the first made for the market in Germany, and is the first that has been brought to this country. It was erected at the Electrical Exhibition held last spring in New York city, where it drove an electric light plant for five weeks. It was then erected for the purpose of the tests at No. 24 West St., New York city. The results confirm those obtained from similar engines in Germany, and are worthy of record as marking a long step forward in the economy of oil engines. We give a condensation of Prof. Denton's report below:

Description of Motor.

The motor has one main cylinder 10.23 ins. diameter and 16.16-in. stroke. The piston, which is exposed to the atmosphere on its under side drives the main crank by direct connection, and an air-compressing pump, about 3.5 ins. diameter and 8.05-in. stroke, through a lever. Two poppet valves in the main cylinder head control the introduction of air from the atmosphere to the main cylinder and the exit of the contents of the main cylinder during exhaust. A smaller poppet valve introduces fuel, which is fed from an oil tank by a small pump. A fourth poppet valve controls the introduction of air from the air receiver for the purpose of starting the motor. The operation is as follows:

The receiver is charged with air at the desired maximum pressure (about 600 lbs. per sq. in.). To start the engine the piston is placed at the top of its stroke. A hand-starting lever is set so that all the cams upon the valve shaft are inoperative except the one connected to the starting valve, which then holds the latter open. The oil pump is operated a few strokes by hand, whereby the space around the stem of the starting valve is supplied with oil. On opening a cock by hand, the pressure from the receiver acts upon the piston and starts the latter downward. At the end of the down-stroke the rotation of the cam shaft has automatically closed the starting valve, and put the three operating valves into regular action. The momentum acquired in the down-stroke carries the piston through an up-stroke, and compresses the contents of the main cylinder to about 520 lbs. per sq. in., whereby they are heated to a temperature of upwards of 1,000°F. As the piston starts to make another down-stroke by momentum, the fuel valve opens, and the 600 lbs. of air pressure in the receiver acting upon the fuel forces it into the heated contents of the cylinder, thereby causing combustion to occur, and power to be developed throughout the second down-stroke, the fuel valve closing at about one-tenth of the stroke of the piston, so that the heat developed is applied with a high degree of expansion. On the next up-stroke the exhaust valve is opened, permitting the cylinder to exhaust itself against the atmosphere. During the next down-stroke of the piston the inlet valve connecting with the atmosphere, supplies the cylinder with pure air. This is compressed on the return stroke, and oil again introduced, and thence the operation of the engine proceeds regularly.

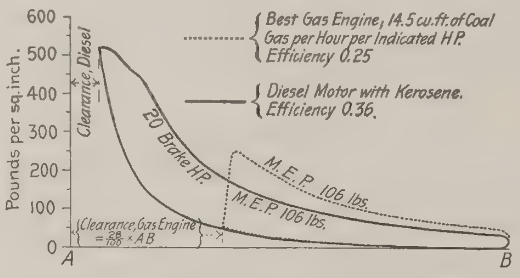
The pistons of the main and air cylinders are lubricated automatically from a reservoir.

The revolutions of the engine are governed by a fly-ball governor, which controls the effective length of the stroke of the oil-feeding pump.

The engine was provided with a fly-wheel, 6½ ft. diameter, weighing about 2,800 lbs. Its total weight, including fly-wheel, was about 600 lbs. per rated brake HP., which is about 70 lbs. greater than that of a Priestman oil engine, of 7 brake HP., running 208 revolutions per minute.

The distinctive thermodynamic features of the engine compared with existing explosive gas and oil engines are:

1. That the cylinder contents during compression consist of air only, so that the compression may cause a pressure at the end of the in-stroke far above that which would cause premature explosion in a gas engine, or explosive oil engine.



Comparison of Indicator Diagrams from a Diesel Motor and from the Best Gas Engine.

2. The greater degree of compression confines the contents of the cylinder when combustion occurs to about 0.07 of the cylinder volume, whereas in explosive gas or oil engines they occupy about 0.28 of that volume. (See cut.) Consequently in the Diesel motor the available rate of expansion of the heated contents of the cylinder is several times as great as that of the gas and oil motors, and, therefore, the theoretical proportion of the heat of combustion utilized in work upon the piston is about 20, 25 and 36%, respectively, for the best explosive oil engine, gas engine, and Diesel motor.

3. The fuel in the Diesel motor burns gradually in the cylinder, during the first one-tenth of the stroke (as does oil which is burned under a steam boiler), without augmenting the pressure above that due to the compression of the contents of the main cylinder by its piston. Consequently the particular proportion of air to fuel necessary to secure explosion is unnecessary. The proportion of air to fuel may be anything, provided there is air in excess of that required for combustion. The proportions of this engine permit the excess to be about 25% at full load, and the presence of this excess of air ensures the steady maintenance of perfect combustion, which, together with the relatively small clearance space as compared to that of explosive engines (see cut), protects the engine against unreliable acting from fouling of the cylinder under continued action.

Results of Experiments.

Tests were made with ordinary domestic kerosene, and with the various grades of petroleum used as fuel under steam boilers, which covered the operation of the engine for upward of 250 hours, to observe the behavior of the oil, and the conditions of the interior of the engine after using each oil. During this time economy tests were made of from 1 to 10 hours' duration, as per the data in Table I. The principal commercial results abstracted from this table are as follows:

TESTS OF THE DIESEL MOTOR.—By. Prof. J. E. Denton, M. Am. Soc. M. E.

Kind of oil used	Ordinary Domestic Kerosene.						Fuel Oil.			California Crude Oil.			Eagle Crude Oil			Lima Crude Oil.			
Approximate brake horse-power	19 HP.	21 HP.	21 HP.	15 HP.	13 HP.	9 HP.	20 HP.	13 HP.	No load.	20 HP.	20 HP.	11 HP.	21 HP.	11 HP.	No load.	21 HP.	15 HP.	11 HP.	No load.
Date of test	Jun.30.	July 1.	July 9.	July 8.	July 8.	July 8.	July 29.	July 29.	July 29.	Aug. 12.	Aug. 12.	Aug. 12.	Aug. 27.	Aug.27.	Aug.27.	Aug. 27.	Aug. 29.	Aug. 27.	Aug.27.
Duration, hours	2.00	4.25	1.966	2.00	0.49	1.50	1.94	2.07	0.81	0.99	0.99	1.00	0.76	1.00	0.49	0.96	10.01	1.01	0.50
Pressure in air tank, lbs. per sq. in.	636.6	631.7	643.7	611.7	621.8	618.9	630.1	617.4	623.0	641.1	647.2	628.9	651.7	643.1	620.4	634.6	653.1	650.2	632.5
Temperature of exhaust gases, °F.	740.+	740.+	740.+	673.	601.	511.5	.....	...	...	...	...	...	740.+	516.	374.7	740.+	628.3	...	...
Inlet cooling water, °F.	73.0	74.0	76.0	77.0	78.0	78.00	74.0	74.6	74.5	76.	76.	76.	74.	74.	74.	75.	75.6	75.7	75.
Outlet cooling water, °F.	109.2	110.6	119.9	108.6	128.0	120.6	113.5	104.6	98.4	118.5	117.5	110.75	127.	123.9	116.5	115.7	126.2	125.	119.
M. E. P. of main cylinder, lbs. per. sq. in.	99.565	103.909	108.462	87.612	81.197	66.763	104.65	78.67	39.70	104.29	100.32	72.17	110.43	76.14	...	111.87	87.55	77.95	44.03
M. E. P. of air cylinder, lbs. per sq. in.	60.00	62.07	61.71	64.89	63.48	63.4	68.96	67.86	66.20	70.62	74.48	78.93	76.135	79.445	75.58	83.31	79.78	83.86	82.75
Max. indicated press., main cyl'dr, lbs. pr. sq. in.	520.63	521.57	521.08	517.45	510.02	505.5	522.1	515.4	511.4	564.7	557.9	542.4	549.2	529.4	522.4	549.0	537.1	533.7	526.9
Revolutions, per minute.	187.6	186.6	186.8	191.5	186.5	188.5	184.2	185.7	187.9	188.4	186.1	186.9	183.65	186.7	188.7	187.1	186.0	186.4	190.1
I. HP. of main cylinder	31.33	32.53	33.99	28.14	25.40	21.11	32.34	24.49	12.51	32.09	31.32	22.63	34.02	23.85	13.23	35.11	27.32	24.37	14.04
Of air cylinder	2.01	2.07	2.06	2.22	2.145	2.17	2.27	2.25	2.22	2.90	3.10	3.09	3.13	3.32	3.19	3.49	3.33	3.50	3.52
Net	29.32	30.46	31.93	25.92	23.255	18.94	30.07	22.24	10.29	29.19	28.22	19.54	30.89	20.53	10.04	31.62	23.99	20.87	10.52
Brake HP.	19.43	20.81	21.51	15.16	13.05	8.78	20.07	12.56	...	19.64	20.07	11.44	20.76	10.58	...	20.73	15.16	10.77	...
Friction HP.	9.89	9.65	10.42	10.76	10.205	10.16	10.00	9.68	10.29	9.55	8.15	8.10	10.14	9.95	10.04	10.89	8.83	10.10	10.52
Mechanical efficiency, %	66.27	68.32	67.37	58.49	56.12	46.36	66.74	56.47	...	67.28	71.12	58.55	67.17	51.54	...	65.56	63.20	51.61	...
Oil consumption: Per hr., per B. HP. Lbs.	0.546	0.534	0.549	0.594	0.586	0.721	0.613	0.681	...	0.688	0.626	0.699	0.555	0.691	...	0.590	0.579	0.672	...
U. S. gal.	0.0835	0.0817	0.0839	0.0908	0.0896	0.1102	0.0862	0.0958	...	0.0975	0.0887	0.0990	0.0784	0.0976	...	0.0826	0.0811	0.0941	...
Per hour per net I. HP. Lbs.	0.36	0.365	0.370	0.347	0.329	0.334	0.409	0.384	0.427	0.463	0.445	0.409	0.373	0.356	0.520	0.387	0.366	0.347	0.487
U. S. gal.	0.0553	0.0558	0.0566	0.0531	0.0503	0.0511	0.0575	0.0540	0.0601	0.0656	0.0630	0.0579	0.0527	0.0503	0.0734	0.0542	0.0513	0.0486	0.0682
Efficiency on brake HP., %	25.20	25.77	25.06	23.17	23.48	19.09	...	...	...	...	...	...	...	...	...	...	...	...	...
Efficiency on net I. HP., %	38.01	37.70	37.19	39.66	41.83	41.20	...	...	...	...	...	...	...	...	...	...	...	...	...
Cooling water, per hr., per brake HP., lbs.	...	...	82.4	126.8	...	117.8	99.1	154.3	...	101.7	90.8	170.4	59.9	89.8	...	86.0	71.6	91.9	...
Heat units abstracted pr hr., pr B.HP., B.T.U.	...	...	3,617	4,007	...	5,018	3,914	4,629	...	4,322	3,768	5,921	3,175	4,481	...	3,500	3,623	4,531	2,161
Quality of oil: Calorific value,† B.T.U., per lb.	20,156						19,980			19,376			19,742			19,648			
Probable calorific value, (Mahler's bomb)§.	18,604						...			...			.....			.....			
Flash test, °F.	120						200			...			249			90			
Fire test, °F.	150						268			...			296			160			
Specific gravity at 60° F.	0.784						0.852			0.846			0.849			0.856			

†Mahler's bomb. §Corrected for condensed vapor, B. T. U., per lb.

1. With ordinary colorless domestic kerosene, of 120°F. flash, 150°F. fire test, and 0.784 gravity, at about 187 revolutions per minute, an average of 20.8 brake HP. was developed, with an oil consumption of 0.534 lbs., or 0.082

U. S. gallon per hour per B. HP.; 13.05 B. HP. with an oil consumption of 0.586 lbs., or 0.0896 U. S. gallon per hour per B. HP., and 8.78 B. HP. with an oil consumption of 0.72 lbs., or 0.110 U. S. gallon per hour per B. HP. This shows an efficiency on B. HP. of 25.8, 23.5 and 19.0% respectively. The corresponding indicated horse-power efficiencies were 37.7, 41.8 and 41.2% respectively. These results practically confirm the tests made on an engine rated at 19 B. HP., at Augsburg, Germany, by Professor Schroeter and other experimenters, which for 17.33 English HP. showed an oil consumption of 0.54-lb., or 0.0819 U. S. gallon of American kerosene per hour per B. HP., and for 9.315 English HP. an oil consumption of 0.63 lb., or 0.0956 U. S. gallon per hour per B. HP., the efficiencies being as follows.

	Per cent. on 17.33 HP.	Per cent. on 9.315 HP.
Thermal efficiency on indicated HP...	34.15	38.18
Thermal efficiency on brake HP.......	25.81	22.12

The same increase in indicated efficiency with reduction of load to one-half, shown by the German tests, is found in the New York tests, The mechanical efficiency, or the per cent. of the indicated power utilized at the brake, of the New York motor was not as great as that of the motor tested in Germany—a result which is possibly attributable to the insufficiency of the foundation of the New York motor, which by permitting excessive vibration, may have caused a waste of power between the cylinder and the brake. The New York motor showed the greater indicated efficiency, however, which is probably due partly to the slight difference of maximum pressure, and partly to the higher temperature of cooling water reducing the jacket waste.

The heat balance for the two cases is as follows:

Heat Balance.

	Brake HP.			
	21.51	8.78	17.33	9.315
	New York.		Augsburg	
Heat*	37.2%	41.2%	34.7%	38.9%
Removed by jacket	35.4%	37.4%	40.3%	45.1%
Remainder	27.4%	21.4%	25.0%	16.0%
Total heat of combustion.	100.0%	100.0%	100.0%	100.0%

Examination of the interior of the engine during the use of the kerosene showed that there was no deposit on the surfaces, other than an infinitesimally thin film of lampblack on the cylinder and piston head, which did not increase with time. The bore of the cylinder was clean and polished.

2. With Pratt's fuel oil, which is a dark, straw-colored, clear petroleum, of 200°F. flash, 268°F. fire test, and 0.852 gravity, considerably used as a steam-boiler fuel, at practically the same revolutions, 20.07 B.HP. were developed with an oil consumption of 0.613-lb., or 0.0862 U. S. gallon per hour per B. HP.; and 12.56 B. HP. with an oil consumption of 0.681-lb., or 0.0958 U. S. gallon, per hour per B. HP. The operation with this oil was attended with the same insignificant lampblack deposit.

3. With a black, clear, Pennsylvania petroleum, known as "Eagle" fuel oil, of 249°F. flash, 296°F. fire test, and 0.849 gravity, at practically the same speed, 20.75 B. HP. were developed with an oil consumption of 0.56-lb., or 0.0784 U. S. gallon, per hour per B. HP. This oil left absolutely no deposit in the cylinder.

4. With Lima fuel oil, a black, clear petroleum of 0.856 gravity, at about the same speed, 20.73 B. HP. were developed with an oil consumption of 0.59-lb., or 0.0826 U. S. gallon, per hour per B. HP.; and 10.77 B. HP. with an oil consumption of 0.672-lb., or 0.0941 U. S. gallon, per hour per B. HP. The operation with this oil was attended with no deposit in the cylinder whatever.

5. With California crude oil, a black, clear petroleum of 0.846 gravity, with practically the same revolutions, 20.07 B. HP. were developed with an oil consumption of 0.626-lb., or 0.0887 U. S. gallon, per hour per B. HP., and 11.44 B. HP. with an oil consumption of 0.699-lb., or 0.099 U. S. gallon, per hour per B. HP. This oil left absolutely no deposit in the cylinder.

With all these oils the engines started instantaneously and operated very steadily. The action of the valve gear is very smooth, and practically noiseless. The combustion occurred with perfect regularity, and was accompanied with no noise other than that due to the pulsation of the floor under the engine. There was also no noise from the exhaust of the engine audible a few feet distant from the chimney into which the exhaust pipe led.

The exhaust gases with all of the oils carried no soot, a piece of white paper being unsoiled by the impingement of the gases against its surface.

No deposit was found in a drum, forming part of the exhaust pipe, after the entire 250 hours of operation of the motor.

The cooling water is shown in Table I. to be 60 lbs. per B. HP., with an outflow temperature of 127°F. The engine operates safely, however, with water leaving the jacket at 140°F., which would reduce the water to about 50 lbs., or 6 gallons per hour per B. HP. The quantity of water used does not, however, constitute an expense item in the use of the motor, as it can be stored in an inexpensive reservoir, or cooling tower, which once charged, will last indefinitely.

The cost of operation will then be practically confined to the cost of oil, and as the motor shows itself to be able to use oil obtainable at about 2 cts. per gallon, the cost of a B. HP. may be 0.2-ct. per hour, which is slightly less than the cost of the same power from the average triple-expansion steam engine, with coal at $3 per gross ton.

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THE CONTRACT FOR THE COOLGARDIE STEEL PIPE LINE, WESTERN AUSTRALIA.

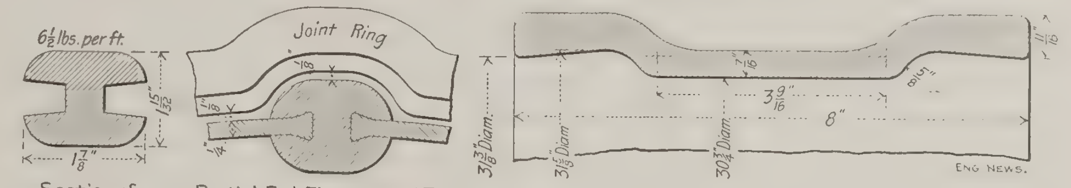
During the current year we have given considerable space to accounts of the immense steel pipe line, 30 ins. in diameter and 328 miles long, to be built by the government of Western Australia to supply water to the Coolgardie mining district.*

Through the courtesy of Mr. C. Y. O'Connor, M. Inst. C. E., of Perth, W. A., Engineer-in-Chief of the Department of Public Works of Western Australia, we are enabled to give further particulars regarding the contract and the pipe to be used in its fulfillment.

As stated in previous issues, the works as a whole include, besides the pipe line, a large storage reservoir, nine pumping stations, and a small intake reservoir at each station. The works are designed to deliver 5,000,000 (British?) gallons a day, with an aggregate lift of 1,313 ft. at the nine stations, the lifts generally being through short sections of the line, with long sections of falling grade between them.

As coal costs some $7 to $8 a ton and the total lift is so great, it is of course desirable to reduce friction to a minimum, even at a large increase in the capital outlay for the pipe line. Mr O'Connor originally planned to use 30-in. spiral riveted pipe for the whole line, but the English engineers recommended 26, 27½ and 29-in. pipe, according to the head, and that pipe of plates ¼-in. or more in thickness be made with two gas-welded longitudinal joints; and that the pipe made of 3-16-in. plates, comprising about 246 of the 330 miles, be riveted longitudinally and transversely, with sections alternately in and out. The contract as finally awarded is for pipe of a diameter of 30 ins. throughout, in 28-ft. sections, with two longitudinal locking bar joints. For the transverse joint, steel rings, or sleeves, calked with lead, will probably be used, to be furnished by the contractors at the option of the government.

Bids for furnishing the pipe f. o. b. in Western Australia, including all duties, insurance and freight, were invited at London, and also at Perth, W. A. The lowest bids received in London were, for the riveted pipe, $3,810,000, from Buchner Blagen, of Portland, Ore.;** for the welded pipe, $2,300,000, from Piggot & Co.; total, $6,100,000. The lowest bids at Perth were, for the riveted pipe, $3,325,000, from G. & C. Hoskins, of Sydney; for locking bar pipe, in lieu of welded, $1,165,000, from Mephan Fergusson, of Perth; total, $4,490,000. The engineer's estimate for 330 miles of 30-in. spiral riveted steel pipe was $5,340,000, so the lowest home bid was not only lower than the foreign bid, but lower than the estimate by $850,000. If, however, the lowest bid for welded pipe, which type was specified, had been accepted, the aggregate of the lowest bids would have been $5,625,000, or $285,000 above the estimate, the smaller size of the welded pipe not making up for its increased cost.



Section of Locking Bar from Mill.

Partial End Elevation and Transverse Section of Joint Ring and Pipe.

Longitudinal Section of Joint Ring.

DETAILS OF LOCKING BAR AND RING JOINTS FOR THE COOLGARDIE STEEL PIPE LINE.

After negotiations with the lowest home bidders, Messrs. Hoskins and Fergusson, it was finally arranged, and a contract executed accordingly, that the contract should be divided equally between them, the size of all the pipe to be increased to a diameter of 30 ins., and the thickness of the 3-16-in. plates, making up a large part of the contract, to be increased to ¼-in. Of the 61,856 lengths of 28-ft. pipe, 1,000 will be made from 5-16-in. plates, and the balance from ¼-in. The contractors, of course, revised their unit prices, and as the quantities were increased the aggregate of the new bids was brought up to $4,990,000, which is still $350,000 below the engineer's estimate. The contract also includes as many steel jointing rings, up to 61,856, as the government may desire, at about $5.50 each. This item was made conditional, owing to doubts as to whether these rings can be used for all joints. The original intention was to lay the pipe on the surface of the ground, but this has been abandoned, rendering unnecessary the expansion joints illustrated in our issue of Oct. 13.

The weight of the steel involved in this pipe contract, without the rings, is 74,442 long tons. The coating will add 3,867 long tons. The contract price for the coated pipe is about $65.30 per long ton, or a little under 3 cts. per lb., f. o. b. at Falkirk, W. A. The contract is dated Oct. 18, 1898. The specifications for the pipe are as follows, being identical for each of the two contracts:

(1) Quantities and Dimensions—
30,428 lengths of 28 ft. each ¼-in. thick and 30 ins. internal diameter.
500 lengths of 28 ft. each, 5-16-in. thick and 30 ins. internal diameter.
Total, 30,928 lengths of 28 ft. each.

(1) General Description of Pipes.—The pipes shall be of the type known as Mephan Ferguson's Patent Rivetless or Locking-bar Pipes, and each 28 ft. length of pipe shall be composed of not more than two plates and two longitudinal locking-bars, as shown in the drawings. Each locking-bar of the ¼-in. pipes shall weigh not less than 6½ lbs. per lin. ft., and each locking-bar of the 5-16-in. pipes shall weigh not less than 7¾ lbs. per. lin. ft., unless it shall have been conclusively proved to the satisfaction of the engineer that such weights can be reduced without any risk of impairing the efficiency of the locking-bar joint, which must in all cases be of the full strength of the plates. If, on the other hand, it be found that the weights specified are too light, or that the sections shown in the drawings are capable of improvement, then the bars shall be increased in weight or be otherwise modified as the engineer may direct.

(3) Joint Rings.—The contractor shall also supply so many welded steel joint rings of the type shown in the drawings as may be ordered, up to a total of 30,928 of such rings at the rate of £1 2s. 6d., delivered at Falkirk.

(4) Anchor Plates.—Three feet from one end of every fourth 28-ft. length, three 12-in. pieces of angle iron, 6 × 4 × ⅜-in., shall be double riveted to the pipe to prevent creep, wherever the engineer may consider that such precaution is desirable.

(5) Special Pipes.—Where required, the contractor shall provide, at the same price per foot as ordinary lengths, special lengths to connect pipes of different thicknesses of metal, so that a good joint may be made without fitting or arranging in laying the pipes, and also such tapered tubes as may be required for purposes of fitting valves of all kinds. The contractor shall also supply without extra cost such tubes as may be required for curves, with ends either not parallel to each other or not rectangular to the pipe, as the engineer may direct.

(6) Coolgardie to Kalgoorlie Pipe Main.—The contractor shall also provide, if required, half the quantity of pipes necessary for a water main from Coolgardie to Kalgoorlie at the same rate per ton as his contract price per ton for the pipes of 30 ins. diameter and ¼-in. thick, herein provided for. The diameter of such main has not yet been determined upon.

(7) Quality of Steel.—The plates and bars shall be made of open hearth acid steel and the plates shall be capable of withstanding a tensile strain of not less than 25 tons [N. B.: All tons are long tons here.—Ed.] nor more than 2 tons per sq. in., with elongation in 10 ins. of not less than 20%, and contraction of area of not less than 45%. The steel must also resist the following drifting test, that is to say: A hole ⅝-in. diameter to be punched within 1¼ in. of any edge of a plate and to be drifted out

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*Heat of combustion accounted for by indicated power.

*See Eng. News, Feb. 10, 1898, for a description of the scheme, and a profile of the pipe line; Feb. 17 and Oct. 13, 1898, for editorial discussions of the pipe line, including the recommendation of the English engineers, who reported on it; and Nov. 17, 1898, for a brief note on the award of the contract.

**But the bid was for basic, instead of acid, steel, and for punched, instead of drilled rivet holes.

cold to a diameter of 1⅛ in. without showing signs of fracture. It must also resist such hot and cold bending tests as the engineer may consider necessary to assure him that the steel is of the best quality and perfectly suitable for the work. The manufacturers of all steel employed on the work must be previously approved in writing by the engineer.

(8) Testing of Steel.—Each plate on leaving the rolls shall be stamped with its cast number or with consecutive numbers which will identify the cast. A mill sheet giving cast numbers and size of each plate shall be supplied every morning to the authorized representative of the engineer, who will then select pieces for tests of tensile strength. Not less than two tensile tests will be made from each cast, and bending and drifting tests will be made from each plate, and the pieces must bend cold round a bar of a diameter of three times the thickness of the plate, without signs of fracture. Pieces must be sheared for the purpose of testing and duly marked with the plate number. Should the test pieces fail to withstand any of the specified tests, the whole cast represented will be liable to rejection.

(9) Testing of Locking-Bar.—Sections of locking-bar and adjacent plates, shall be cut from any such pipes as the engineer may direct and such sections shall be submitted to tensile strain for testing the efficiency of the locking-bar joint, which must be capable of withstanding without injury a strain equivalent to 29 tons per sq. in. of plate, unless the plate itself fail within the limits of 25 and 29 tons per sq. in. specified for such plates, but the joint must be always fully as strong as the plate and shall safely resist all strains within the limits above mentioned.

(10) Method of Manufacture.—The pipes shall be made strictly to the drawings and shall be as nearly circular as possible. The thickness of plates specified are those of the thinnest parts of the plates. Every plate will be measured, and all will be rejected in which the thickness of any part falls in the least degree below that specified. The workmanship throughout shall be the best possible.

(11) Calking.—No calking of the locking-bar joint will be permitted.

(12) Protection of Plates and Bars.—All plates and bars which may be imported into the Colony by the contractor shall be carefully protected against oxidisation, and all plates and bars which have become unduly rusted will be rejected, and shall be forthwith removed from the works.

(13) Dipping of Bars and Edges of Plates.—Before the locking-bar joints are made the locking-bars and the outer portions of the plates shall be completely freed from black oxide, by being dipped in a bath of dilute sulphuric acid and then in a bath of limewater, followed by scrubbing if necessary. This must be done under cover, and the plates and bars must not be exposed to the weather after dipping, but must be at once formed into pipes.

(14) Pressure Test.—The pipes shall then be submitted to hydraulic pressure of 400 lbs. to the sq. in., and also to smart tapping with a hammer while under pressure. All pipes which leak, or show other defects, shall be rejected, or the defects remedied in such manner as may be approved by the engineer.

(15) Dipping of Pipes.—After having been tested and approved by the engineer, the pipes shall be dipped in a bath of dilute sulphuric acid and then in a bath of limewater, and shall, when thoroughly clean, be forthwith coated.

(16) Coating.—The pipes shall be coated with a composition, consisting of Trinidad asphaltum and creosote as soon as they have been freed from black oxide, and otherwise thoroughly cleansed, as specified in Clause 15 above. They must be heated uniformly before being immersed to about 300°F., and the bath of composition must be kept fluid at an uniform temperature. They must be left in the asphaltum bath long enough to acquire the same temperature as the bath, and then suspended until the excess of coating has drained off. Very special care must be taken in coating the pipes, and the whole of the arrangements, as well as the composition of the asphaltum mixture, must be to the entire satisfaction of the engineer.

(17) Place of Delivery.—The pipes, special pipes and joint rings, etc., shall be delivered on land belonging to the Government, at Falkirk, Western Australia, and shall, after having been finally passed by the engineer, be stacked on a piece of land belonging to the Government, and reserved for the purpose, so that they may be kept apart from those which have not yet been passed.

(18) Special Pipes Testing and Treatment.—All special pipes provided for in this specification shall be tested and treated in a similar manner to the 28-ft. lengths of pipes.

(19) Joint Rings Testing and Treatment.—The materials of which the joint rings are to be constructed shall, as far as practicable, be subject to similar tests, and shall be treated in a similar manner to the materials of which the pipes are to be constructed.

The designs for the locking-bar for the longitudinal joints and the steel rings for the transverse joints are shown in the accompanying illustration. The only work on which this locking-bar has been used heretofore, so far as we can learn, was for 8¾ miles of 15 and 26-in. pipe connected with the water supply of Adelaide, S. A., as described in our issue of June 9, 1898. Editorial comment on the contract is made elsewhere in this issue.

WEATHER TABLE FOR NOVEMBER, 1898. (Furnished to Engineering News by the Department of Agriculture.)

	Stations	Temperature. (Degrees Fahrenheit.)				Wind.			Precipitation—Rain or melted snow. (Inches.)		
		Average.	Max.	Min.	Range.	Velocity in miles per hour.		Direction at time of max. velocity.	Total.	Heaviest in 24 hours.	No. of rainy days.
						Average.	Max.				
Northern Cities.	Northfield, Vt.	32.4	61	1	60	9.6	42	SW	1.97	1.03	10
	Portland, Me.	38.6	58	18	40	8.0	42	NE	5.51	1.71	13
	New York City	44.6	63	25	38	17.5	65	NW	5.90	1.60	12
	Pittsburg, Pa.	42.7	70	18	52	6.4	24	NW	2.34	0.88	17
	Chicago, Ill.	37.0	67	2	65	21.2	76	S	2.25	1.20	13
	Omaha, Neb.	35.2	76	−1	77	8.6	34	NW	1.20	1.05	6
	St. Paul, Minn.	29.6	60	−10	70	9.0	36	NW	1.59	0.92	8
	Duluth, Minn.	29.0	58	−4	62	11.5	56	NW	0.94	0.56	7
	Bismarck, N. Dak.	24.0	58	−15	73	9.8	48	NW	0.16	0.06	7
	Average	34.8	63	4	60	11.3	47	—	2.43	1.00	10
Southern Cities.	Washington, D. C.	44.0	69	22	47	7.2	32	NW	3.12	0.95	15
	Louisville, Ky.	44.7	74	14	60	9.1	43	SE	2.55	1.43	11
	St. Louis, Mo.	43.1	74	10	64	11.2	58	SW	2.07	1.09	8
	Savannah, Ga.	57.2	79	31	48	8.8	31	NW	6.28	4.15	11
	Kansas City, Mo.	40.3	73	6	67	9.0	39	SE	2.72	1.54	9
	Jacksonville, Fla	62.6	81	36	45	7.5	30	W	2.34	0.90	15
	Chattanooga, Tenn.	46.7	70	18	52	8.1	36	NW	2.31	0.51	11
	New Orleans, La.	57.3	81	34	47	9.8	34	NW	5.17	1.76	14
	Memphis, Tenn.	49.0	75	20	55	10.4	52	SW	3.22	1.13	7
	Palestine, Tex.	53.2	85	26	59	7.5	28	S	4.19	1.50	11
	Average	49.8	76	22	54	8.9	38	—	3.40	1.50	11
Western Cities.	Helena, Mont	29.1	51	−10	61	7.9	45	SW	0.66	0.29	10
	Port Crescent, Wash.	42.9	55	30	25	4.0	40	SE	5.10	0.56	25
	San Francisco, Cal	55.4	78	43	35	7.4	30	W	0.46	0.24	4
	Salt Lake City, Utah.	37.3	74	10	64	5.1	47	S	1.95	0.66	8
	Santa Fe, N. Mex.	37.0	62	12	50	6.6	41	SW	0.27	0.23	4
	Denver, Colo.	35.2	74	2	72	8.2	50	NW	0.85	0.32	7
	Yuma, Ariz	—	—	—	—	—	—	—	—	—	—
	Average	39.5	66	14	51	6.5	42	—	1.55	0.38	10

BOOK REVIEWS.

U. S. GEOLOGICAL SURVEY.—Bulletin No. 88: The Cretaceous Foraminifera of New Jersey. By Rufus Mather Bagg, Jr.; pp. 71. No. 89: Some Lava Flows of the Western Slope of the Sierra Nevada, California. By F. Leslie Ransome; pp. 74. No. 149: Bibliography and Index of North American Geology, Paleontology, Petrology and Mineralogy for the Year 1896. By Fred. Boughton Weeks; pp. 152. Washington, D. C. Paper; 9 × 6 ins.; the first two illustrated.

REPORT RESPECTING THE YUKON DISTRICT.—By Major G. M. Walsh, Commissioner, Department of the Interior, Ottawa, Canada. Ottawa. Paper; 9¾ × 6½ ins.; pp. 28.

This report covers the food question, royalty to the government, mail service, liquor dealing, law and order, river navigation, mining regulations, output of gold, general prospects, etc., in the gold producing region of Canadian Alaska. Maj. Walsh figures the output of gold for 1898 at about $10,000,000, and thinks that the Klondike will be a rich mining camp for the next 25 years. In the summer of 1898 from 3,000 to 5,000 people went up the Stewart River; but very little intelligent work seems to have been done. The trade of the camp is worth about $8,000,000, and in ten years it should be worth $30,000,000, and he calls the attention of Canadians to this fact.

NOTES ON THE NICARAGUA CANAL.—By Henry I. Sheldon. New and enlarged edition. Chicago: A. C. McClurg & Co. Cloth; 8½ × 5½ ins.; pp. 242; illustrated. $1.25.

As the author explains in his preface, this is a popular, and not a technical or professional discussion of the Nicaragua Canal project, and his avowed purpose is to stimulate popular interest in the enterprise. He believes that the tardy development and depressed agricultural interests of California, Oregon and Washington, are due to their long distance from markets and that a ship-canal through the Isthmus can alone benefit them. His visit to Nicaragua was made in 1895, and the lack of facilities made it impossible for him to visit the actual line of the canal between Greytown and Ochoa; though he did ride over the line between the Lake and the Pacific. All engineering data he obtained from the records of the Maritime Canal Co., in which he evinces entire faith, and from the report of the Ludlow Commission. The real interest of the work therefore lies in Mr. Sheldon's observations upon the people and resources of Nicaragua; the climatic conditions he found; the expenses of traveling and living, etc. These parts are useful to the intending traveler and are interesting to the general reader. Mr. Sheldon considers the conditions in Nicaragua very favorable to canal building. Notes upon other great ship-canals follow, based mostly upon personal inspection in 1897, and he gives an interesting general history of the Suez, Manchester, Chicago Drainage, Panama and North Sea-Baltic ship-canals. The discussion as to probable revenue and cost, method of construction and operation, etc., is very brief, and while the author evidently aims to be judicial, his enthusiasm rather carries him off his feet. For example, he thinks one great reason for building the canal is the trade of the Philippines, although the difference in the distance from New York to Manila by Suez and by Nicaragua, will be only 600 miles in favor of the latter, and the possibility of more frequent coaling on the Suez route would probably overbalance the difference in distance. Again, he says that the Nicaragua Canal will make New York and Liverpool "almost equally distant from Hong Kong," whereas as a matter of fact it will be no shorter voyage from New York to Hong Kong by Nicaragua than the present route via Suez. The book is written, however, in an entertaining style, and will doubtless find many readers.

ELEMENTS OF SANITARY ENGINEERING.—By Mansfield Merriman. Professor of Civil Engineering in Lehigh University. New York: John Wiley & Sons. London: Chapman & Hall, Cloth; 6 × 9 ins.; pp. 216; illustrations. Price, $2.00.

After an introductory chapter on "Sanitary Science," the author takes up in succession "Water and Its Purification;" "Water Supply Systems;" "Sewerage Systems;" and "Disposal of Garbage and Sewage." As an elementary work on sanitary engineering, adapted more especially for college use, the book is an excellent one. It outlines in a satisfactory manner the several branches of sanitary engineering named in the chapter headings, and so emphasizes the most important principles that they are pretty sure to be impressed upon the minds of the reader or student.

An excellent feature of the volume is a list of topics for further investigation at the end of each chapter. These not only point the way to specific sources of information, but, if followed out, cannot fail to broaden the minds of the investigators, by showing the connection between this and other branches of science, and by bringing the reader in contact with some of the best things in general literature. To illustrate the latter point, there is a reference to Charles Reade's "Put Yourself in His Place," for a description of the failure of the Dale dyke reservoir, near Sheffield, England, in 1861, and to Goethe's "Faust," for the reflections of the latter on his work in sanitary engineering.

It may cause surprise to some to know that the heating and ventilation of buildings is not given a chapter. The reason for not doing this, the author states, is that while these subjects are in the domain of sanitary science they do not pertain to the work of the sanitary engineer, which relates to matters affecting the public rather than the individual; also, that the architect, and not the engineer, is responsible for heating and ventilation. We believe there are many who will not agree with this line of reasoning, or who will at least feel that the ventilation of buildings is quite as much a public matter as the plumbing they contain, which receives attention in the book. The statement that the subject of ventilation has been adequately presented in other books, is hardly a reason for not taking it up here, as there is little on any subject in the volume before us that has not been treated much more fully elsewhere. In the section on "Water Supply," the author goes into hydraulics and hydromechanics to a rather surprising extent in a book on sanitary engineering. The subject of garbage disposal, on the other hand, might well have been discussed with greater fullness. The book has no index, a surprising omission to be made by an author with such a large experience, both as a teacher and a writer, and one which should be remedied in the future editions. Despite these minor defects, the book, as we have said above, is calculated to fill a real need as an elementary general textbook in this field.

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PERSONAL.

Capt. F. P. Brevier has been appointed Superintendent of the water-works of Mobile, Ala.

Mr. Gavin Nelson Houston, Jun. Am. Soc. C. E., formerly Assistant Engineer, has been appointed Superintendent of Water-Works of Nyack, N. Y., to take effect July 1.

Mr. William D. Cornish, of St. Paul, Minn., has been elected First Vice-President of the Union Pacific R. R., with headquarters in New York city, to succeed Mr. Oliver W. Mink, resigned.

Mr. A. A. Wirth has been appointed Assistant Engineer of Maintenance of Way of the Pennsylvania Lines West of Pittsburg, with headquarters at Louisville, Ky., to succeed Mr. William B. Blake, promoted.

Mr. Thomas B. Minister has been appointed Superintendent of Buildings of the Borough of Brooklyn, New York city, to succeed Mr. John Guilfoyle, whose appointment as Commissioner of Buildings was noted in our issue of June 9.

Mr. Bushrod W. Taylor, Engineer of Maintenance of Way of the Pennsylvania Lines West of Pittsburg, has been appointed Superintendent of the Louisville Division, with headquarters at Louisville, Ky., to succeed Mr. P. A. Bonebrake, transferred.

Mr. William B. Blake, Assistant Engineer of Maintenance of Way of the Pennsylvania Lines West of Pittsburg, has been appointed Engineer of Maintenance of Way, with headquarters at Louisville, Ky., to succeed Mr. Bushrod W. Taylor, promoted.

Mr. Charles S. Butts, civil engineer, is making a resurvey with a complete set of maps of the Lake Superior & Ishpeming Ry., with headquarters at Marquette, Mich. He was recently engaged on similar work on the Lake Erie & Western R. R., with offices at Indianapolis, Ind.

Mr. P. A. Bonebrake, Superintendent of the Louisville Division of the Pennsylvania Lines West of Pittsburg, with offices at Louisville, Ky., has been appointed Superintendent of the Indianapolis Division, with headquarters at Columbus, O., to succeed Mr. Frank G. Darlington, M. Am. Soc. C. E., resigned.

Mr. Dorsey Ash, who has been employed by the Metropolitan Water Board of Massachusetts on the construction of the Washusett Aqueduct, has resigned to take charge of the construction of a fortification and gun emplacements at Grover's Cliff, Winthrop, Mass., under Lieut.-Col. Mansfield, Engineer Corps, U. S. A.

Mr. Emil Swensson, M. Am. Soc. C. E., Chief Engineer and Superintendent of the Keystone Bridge Works, Carnegie Steel Co., Ltd., Pittsburg, Pa., was tendered a dinner, June 30, by the heads of the company's departments just prior to his sailing for Sweden, of which he is a native, after 18 years spent in the United States.

Mr. Nelson D. Miller has been appointed Chief Engineer of the Great Northern Ry., with headquarters at St. Paul, Minn., to succeed Mr. John F. Stevens, M. Am. Soc. C. E., whose resignation was noted in our last issue. Mr. Miller resigned the above position Jan. 7, 1895, to take charge of the engineering work on the Kaslo & Slocum Ry., then under construction.

Prof. William Dennis Marks, M. Am. Inst. E. E., President of the American Electric Meter Co., Philadelphia, Pa., has been elected President of the General Electric Automobile Co. of the same city. He was Professor of Dynamical Engineering in the University of Pennsylvania for a number of years. In 1887 he became engineer of the Edison Electric Light Co., of Philadelphia, and in 1889 was made Chief Engineer, and later President, of the Edison General Electric Lighting Co.

OBITUARY.

Mr. J. R. Kerr, Resident Engineer of the new waterworks at Augusta, Ga., died June 29.

Mr. Palmer J. Pillans, for many years City Engineer of Mobile, Ala., died June 22, aged 83.

Mr. Edward Gustine, contractor for water and gas works, of Keene, N. H., died July 4, aged 78.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

INTERNATIONAL MINING CONGRESS.
July 6-9. At Salt Lake City. Secy., W. D. Johnson, Salt Lake City, Utah.
MONTANA SOCIETY OF ENGINEERS.
July 9. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 12. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
AMERICAN SOCIETY OF R. R. SUPERINTENDENTS.
July 13-14. Annual meeting, Alexandria Bay, N.Y. Secy., C. A. Hammond, Asbury Park, N. J.
AMERICAN HEATING AND VENTILATING SOCIETY.
July 15. Atlantic City, N. J. Secy., S. A. Jellett, 704 Arch St., Philadelphia, Pa.
ENGINEERS' CLUB OF MINNEAPOLIS.
July 18. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
July 19. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
WESTERN FOUNDRYMEN'S ASSOCIATION.
July 20. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
July 26 to 29. Annual convention at Detroit. Secy., C. W. Hunt, 220 W. 57th St., New York, N. Y.
WESTERN SOCIETY OF ENGINEERS.
Aug. 3. "Establishment of Street Grades," Chas. P. Chase. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
Aug. 18 to 20. Annual meeting at Massachusetts Institute of Technology, Boston, Mass. Secy., Albert Kingsbury, Durham, N. H.

PACIFIC COAST ELECTRICAL TRANSMISSION ASSOCIATION.—At the annual meeting of the Association held June 21 the following officers were elected for the ensuing year: President, W. Frank Pierce; Vice-President, Carrol M. Beal; Secretary, Geo. P. Low, and Treasurer, William Angus.

MONTANA SOCIETY OF ENGINEERS.—At the regular monthly meeting held June 11 Mr. Walter Harvey Weed, U. S. Geologist, delivered a lecture upon the geology of Butte, Mont. The lecture was illustrated by maps showing the various geological formations in and about this important mining center.

ENGINEERING ASSOCIATION OF NEW SOUTH WALES.—At the regular meeting of the Association, held at Sydney, May 12, Mr. F. Ernest Stowe read a paper entitled "Instrumental Calculations as Applied to Modern Engineering." The paper dealt with the application of the slide rule in various forms to the calculation of the horse power of engines and the various other quantities and forces used in engineering work.

INTERNATIONAL MINING CONGRESS.—The annual meeting of this organization is to be held at Salt Lake City, Utah,on July 6 to 9 inclusive. The programme as announced includes besides the routine business and a long list of entertainments and excursions two special committee reports, one regarding the establishment of a national department of mines, and the other regarding the revision and codification of the Federal mining laws,and the following special papers: "Coal and Coke," "Advances in Methods of Concentration.," "Relation of the Geological Survey to the Mining Industry," "Relative Merits of Cyaniding and Chlorination," "Mine Inspection," "History of Reduction of Smelting Costs," "Long Distance Transmission of Electric Power," "Fuel Cost in Pumping," "Recent Advances in Smelting," "A New Treatment of Low Grade Ore," "Copper," "Relations of Investors and Miners."

IRON AND STEEL INSTITUTE OF GREAT BRITAIN.—The following special transportation arrangements have been made for the members leaving England to attend the autumn meeting of the Institute to be held at Stockholm on Aug. 26 and 27:

A special steamer of over 3,000 tons will be sent by Dr. H. S. Lunn and Mr. Woolrich Perowne on an itinerary to suit the exact requirements of the members. This vessel will leave Newcastle-on-Tyne on Aug. 17, and will proceed by way of the Baltic Canal, Kiel and Wisby to Stockholm, where she will lie, and serve as a floating hotel, from Aug. 25 to Aug. 28. The return journey will be by way of Copenhagen, Gothenburg and Christiania. The cruise will occupy 19 days, and the fare will be nineteen guineas for berth in four-berth cabins. Dr. Lunn and Mr. Perowne have also arranged for the steamship "St. Sunniva," a 1,000-ton boat, to leave Leith on Saturday, Aug. 20, proceeding by way of Christiania to Stockholm, where she will lie Aug. 26, 27 and 28, proceeding from Stockholm to St. Petersburg, and returning by way of Copenhagen and the Baltic Canal. This cruise will take 24 days, and the fare will be 20 guineas each passenger in four-berth cabins; 25 guineas each passenger in two-berth cabins; and 35 guineas for the exclusive use of a two-berth cabin by one passenger. The Orient Steam Navigation Co., Ltd., have also rearranged the itinerary of their pleasure cruise No. 3 to the Baltic, so as to bring their steamship "Lusitania" (3,912 tons) to Stockholm on Aug. 25, and to keep her there until Aug. 28. The itinerary includes visits to Copenhagen, Wisby, Stockholm, Kronstadt, St. Petersburg, Kiel, and the Baltic Canal, and occupies 28 days, from Aug. 17 to Sept. 14, the fares being from 35 guineas exclusive of shore excursions, or from 55 guineas inclusive of shore excursions. Particulars of this cruise can be obtained from Messrs. Anderson, Anderson & Co., No. 5, Fenchurch Ave., London, E. C. Particulars of the other cruises can be obtained from Dr. H. S. Lunn, No. 5 Endsleigh Gardens, London, N. W.

NEW PUBLICATIONS.

PROCEDURES RECOMMENDED FOR THE STUDY OF BACTERIA, with Especial Reference to Greater Uniformity in the Description and Differentiation of Species. Being the Report of a Committee of American Bacteriologists to the Committee on the Pollution of Water Supplies of the American Public Health Association. Submitted at the Meeting of the Association in Philadelphia, Pa., September, 1897. Paper; 6 × 9 ins.; pp. 47; illustrations and folding sheets giving forms for reports. Address any member of committee as follows: J. Geo. Adami, Chairman, McGill University, Montreal, Que.; A. C. Abbott, University of Pennsylvania, Philadelphia; T. M. Cheesman, College Physicians and Surgeons, New York city; Geo. W. Fuller, Bacteriologist to Commissioners of Water-Works, Cincinnati, O.; W. T. Sedgwick, Massachusetts Institute of Technology, Boston; Chas. Smart, U. S. Army, Washington, D. C.; Theobald Smith, Harvard University, Cambridge, Mass.; W. H. Welch, Johns Hopkins University, Baltimore, Md.

The general scope of this report is fully given in the title. While we do not pretend to pass judgment upon matters relating almost wholly to bacteriological methods we have no hesitation in saying that the names of the men composing this committee are in themselves a guarantee of the value of the report and that just this sort of co-operative work was needed and gives every promise of being highly beneficial. Recent progress in checking the spread of disease through water and sewage purification, disinfection and other means of prevention is largely indebteded to bacteriology and will so continue. Engineers stand ready to do whatever biologists point out as necessary in the line of public sanitation. Bacteriology is so new an art and so many workers of all classes of ability have taken it up that there is great need of co-operative work to place the methods followed and the results obtained on a truly scientific basis.

The over-zealous, to use the most charitable term available, must be repressed, especially in naming new species and announcing the isolation of typhoid germs from drinking water, and the careless and unmethodical must be urged to do better work.

THE TECHNOGRAPH, 1897-98.—Published annually by the Association of Engineering Societies of the University of Illinois; Champaign, Ill. Paper; 8vo.; pp. 146; illustrated; 50 cts.

The first paper in this number of "The Technograph," while addressed principally to architects, should be of interest to many engineers. It is entitled "Notes on Sketching," and shows the value of the ability to make a sketch, not necessarily artistic, but one which will be of use as an aid to memory if for nothing else. The introduction of amateur photography has tended to kill the art of sketching, but there are many matters of detail, which no photograph can show satisfactorily. Many of the private note books of the older engineers are full of valuable sketches giving information which could be given in no other way.

The other papers include "Standard Methods of Testing Paving Brick," and "The Shearing Strength of Rivet Steel," both by Prof. A. N. Talbot; "The Effects of Temperature on Insulating Materials" and "Electric Car Heaters," both by Prof. W. Esty; "The Buildings of the Electrical and Mechanical Engineering Laboratory," Prof. S. J. Temple; "The Design of Elevating and Conveying Machinery," J. V. E. Schaefer; "The Effect of Freezing Cement Mortar,"A. C. Hobart; "The Central Heating, Lighting and Power Plant of the University of Illinois," Prof. L. P. Breckenridge; "Strength of Concrete of Various Proportions," R. B. Ketchum and F. W. Honens; "Specification Writing," Prof. J. M. White; "The Corrosion of Iron," Prof. S. W. Parr and A. E. Paul; "Survey of a Deep Coal Mine in Illinois,' W. H. Tarrant; "Repairing Plaster of Paris Casts," C. R. Clark; "Repairs of Masonry Arch; Illinois Central R. R.," A. E. Harvey; "A Problem in Metallurgy," W. H. Kavanagh; "Simple Standard for the Precision of Level Circuits," Prof. Wm. D. Pence; "Impact Tests of Beams," D. C. Wray; "A Governor Indicator," A. H. Neurother; and "A Short Method for Railway Crossing Computations," L. K. Vial and R. B. Ketchum.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

SOME LIGHTING PLANTS.—Walker Co., Cleveland, O. Pamph.; 10¼ × 7½ ins.; illustrated.

This pamphlet gives nine full-page half-tone illustrations of isolated plants using Walker apparatus. A brief description accompanies each picture.

VOLTMETERS, AMMETERS AND WATTMETERS.—Whitney Electrical Instrument Co., Penacook, N. H. Pamph.; 6 × 3¾ ins.; pp. 80; illustrated.

This small pamphlet tells about the electrical instruments manufactured by the Whitney Electrical Instrument Co.

STEAM AND OIL SEPARATORS.—The Cochrane Separator, Harrison Safety Boiler Works, Philadelphia, Pa. Pamph.; 5¾ × 7½ ins.; pp. 48.

The well-known Cochrane separator is now made in a great number of sizes and of different shapes. One recently built was 13 ft. high and 5 ft. in diameter. The pamphlet illustrates all the styles.

STREET IMPROVEMENTS AND GENERAL CONTRACTING.—City Street Improvement Co., Mills Building, San Francisco. Paper; 9 × 7 ins.; not paged; illustrated.

Most of this pamphlet is given up to a description of bituminous sand-rock paving materials and the bituminous rock mines of this company located in San Luis Obispo, Monterey and Santa Cruz Cos., Cal. Most of the balance is devoted to a detailed list of the paving, sewer and other contracts executed by the company. An illustrated description of the Humboldt Bay Jetty System at Eureka, Cal., occupies two pages. This work was begun April 15, 1893, and it is expected that it will be completed next year. The above-named company has the contract. The government appropriation for the work was about $1,740,000.

SIGNAL AND INTERLOCKING PLANT. — National Switch & Signal Co., Easton, Pa. Paper; 7 × 10 ins.; pp. 35.

This beautifully printed pamphlet is a compilation of descriptions of certain devices and plants which have been published in the technical papers. It includes the interlocking plant of the State Line crossing, the use of the train-staff system for block working at single-track tunnels on a double-track road, and the electric block and mechanical release, as described in our issues of Jan. 20, Feb. 24 and May 12, respectively. There is also an article showing that under the electric train-staff system back flagging is not required.

WHITE-LEAD, PAINTS AND CHEMICALS.—Harrison Bros. & Co., Philadelphia, New York and Chicago. Boards; 9 × 6 ins.; pp. 96.

The historical review in this catalogue is a very interesting sketch of the growth of a great manufacturing establishment founded in 1793 by Mr. John Harrison, of Philadelphia. Mr. Harrison was the first maker of sulphuric acid in the United States, the first to concentrate the acid in platinum instead of glass retorts, and the first but one to make white-lead in this country. The works of this company have grown from the small establishment of 1793 to one covering 35 acres of ground at Gray's Ferry, in Philadelphia. The catalogue itself describes and prices the products of the present company. These include white-lead for various purposes, zinc white, the "Harrison" oil colors, paste oil colors, coach paints, distemper or fresco colors, stains, varnishes, dry paints, etc. Included with this pamphlet is another on the "Chemistry of Paints," which gives a very good idea of the methods of making paints and chemicals and concludes with a very practical treatise on the application of paints.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
July 7	Drainage work	Cornwall, Ont.	June 16
July 7	Tow-boat service	Cincinnati, O.	June 16
July 7	Jail building	Irwinville, Ga.	June 16
July 7	Iron or steel bridge	Kingfisher, Okla. Ter.	May 19
July 7	Sewers and water mains	Lamberton, Minn.	June 23
July 7	Bridge	Sprague, Wash.	June 23
July 7	Plans for sewer system	Lancaster, N. Y.	June 23
	Advertised, Engineering News, June 23.		
July 7	Heating and ventilation	Charles City, Ia.	June 23
July 7	Channel work	Barnstable, Mass.	June 30
	Advertised, Engineering News, June 30.		
July 7	Telephone franchise	Lexington, Ky.	June 30
July 7	Steel viaduct	Jersey City, N. J.	June 30
July 7	Stone coping	Smith's Landing, N. J.	June 30
July 7	Dynamo, etc.	Bay City, Mich.	June 30
July 7	School building repairs	New York	June 30
July 7	Paving	Buffalo, N. Y.	June 30
July 7	Asphalt paving	Fort Wayne, Ind.	June 30
July 7	Church building	Mifflinburg, Pa.	June 30
July 7	School building repairs	St. Louis, Mo.	June 30
July 7	School building	Wallsville, Utah.	June 30
July 7	Macadam road	Kansas City, Mo.	June 30
July 7	Iron bridge	Ivesdale, Ill.	July 7
July 7	Electric plant	Morris Plains, N. J.	July 7
July 7	Electric lighting	Sea Isle City, N. J.	July 7
July 7	Pipe sewers	Esplen, Pa.	July 7
July 8	Pile bridges (8)	Fargo, N. Dak.	July 7
July 8	Sewer pipe	Charlottetown, P. E. I.	July 7
July 8	Electric plant, etc.	Eaton Rapids, Mich.	July 7
July 8	Concrete paving, etc.	New Haven, Conn.	July 7
July 8	Garbage disposal	St. Louis, Mo.	July 7
July 8	Brick paving	Portage, Wis.	July 7
July 8	Sewer pipe	Detroit, Mich.	July 7
July 8	Bridge bonds	Youngstown, O.	July 7
July 8	Water-works	Cambridge Springs, Pa.	June 23
	Advertised, Eng. News, June 23 and 30.		
July 8	Heating, etc.	Clarksville, Tenn.	June 23
July 8	Bridge	Roseburg, Ore.	June 2
July 8	Bridges (2)	Farman, N. Dak.	June 9
July 8	Steel bridge	Aberdeen, S. Dak.	June 16
July 8	Macadam road	Windsor Locks, Conn.	June 30
July 8	Paving, etc.	Rochester, N. Y.	June 30
July 8	Sewers	Le Sueur, Minn.	June 30
July 8	School building	Bradford, Pa.	June 30
July 8	Macadamizing, etc.	East Hartford, Conn.	June 30
July 8	Macadam road	Easton, Pa.	June 30
	Advertised, Engineering News, June 30.		
July 8	Gravel road (18 miles)	Rockville, Ind.	June 30
July 8	Factory building	St. Joseph, Mo.	June 30
July 9	Water pipe castings, etc.	Huntington, Mass.	June 30
July 9	Street bonds	Cadiz, O.	June 30
July 9	Boiler house	Washington, D. C.	June 30
July 9	Pipe sewers	Des Moines, Ia.	June 30
July 9	Fire station	Montreal, Que.	June 30
July 9	Grading and graveling	Woodstock, Conn.	June 30
July 9	Street improvement supplies	Washington	June 16
	Advertised, Engineering News, June 16.		
July 9	Brick paving, etc.	Cleveland, O.	June 16
July 9	Water-works	Morris, Minn.	June 16
July 9	School buildings	Dayton, O.	June 9
July 9	Substructure, etc.	Cincinnati, O.	June 16
July 9	Asphalt paving	Washington, D. C.	June 16
	Advertised, Engineering News, June 16.		
July 9	Highway work	Wapakoneta, O.	June 16
July 9	Post office, building	Pottsville, Pa.	June 23
July 9	Hospital building	Mendocino, Cal.	June 23
July 9	Street work	Athens, O.	June 23
July 9	Dredging	Waukegan, Ill.	July 7
July 9	Repairing bridges	Weiser, Idaho	July 7
July 9	Pipe sewers	Warren, Pa.	July 7
July 9	Dynamos	Painesville, O.	July 7
July 10	Street bonds	Burlington, Vt.	July 7
July 10	School building	Rush City, Minn.	May 26
July 10	Asphalt paving, etc.	Spokane, Wash.	June 30
July 11	Water conduit, etc.	Parkersburg, W. Va.	June 30
	Advertised, Eng. News, June 30 and July 7.		
July 11	Street improvements	Lafayette, Ind.	June 30
July 11	Brick paving, etc.	Mishawaka, Ind.	June 30
July 11	Garbage disposal, etc.	White Plains, N. Y.	June 30
July 11	Pipe sewers	Parkersburg, W. Va.	June 30
	Advertised, Eng. News, June 30 and July 7.		
July 11	Crib bulkhead	New York, N. Y.	June 30
July 11	Bridge	Breckenridge, Minn.	May 19
July 11	Paving	Salem, O.	June 16
July 11	Paving	Toledo, O.	June 16
July 11	Electric light bonds	Wapakoneta, O.	June 23
July 11	Hospital building	Newark, N. J.	June 23
July 11	Brick paving	Swanton, O	June 23
	Advertised, Engineering News, June 23.		
July 11	Cement sidewalks	South Bend, Ind.	June 23
July 11	Cedar paving	Detroit, Mich.	July 7
July 11	Paving	East Aurora, N. Y.	July 7
July 11	Bridges (2)	Brooke, Ont.	July 7
July 11	Buildings for school	Springfield, Mass.	July 7
July 12	Road work	Columbus, O.	July 7
July 12	Paving	Sioux City, Ia.	July 7
July 12	Bridge	Dayton, O.	July 7
July 12	Brick paving	Troy, N. Y.	July 7
July 12	Macadam road	Ridgefield, N. J.	June 23
	Advertised, Eng. News, June 23 and 30.		
July 12	Road work	Columbus, O.	June 23
July 12	Bridge and material	Moscow, Idaho.	June 16
July 12	Boiler and engine houses	Evansville, Ind.	June 30
July 13	Truss bridge	Gettysburg, Pa.	June 30
July 13	Street work (1 street)	Hoboken, N. J.	June 30
July 13	Steel bridge	Brookings, S. Dak.	June 9
July 13	Hospital building	Agnew, Cal.	June 23
July 13	Bridge	Towson, Md.	July 7
July 13	Gravel road	Freehold, N. J.	July 7
July 13	Improving road	Waterbury, Conn.	July 7
July 13	Asphalt paving	Hartford, Conn.	July 7
July 13	School building	Springfield, Mass.	July 7
July 14	Asphalt paving	Spokane, Wash.	July 7
July 14	Fire engine	Cleveland, O.	July 7
July 14	Water-works, etc.	Batesville, Ark.	July 7
July 14	Electric light plant	Batesville, Ark.	July 7
July 14	Broken stone, etc.	New York	July 7
July 14	Brick paving	Champaign, Ill.	July 7
	Advertised, Engineering News, July 7.		
July 14	Gas lamps (300)	Ironton, O.	June 16
July 14	Electric lighting	Ironton, O.	June 16
July 14	Paving (26,000 sq.yds.)	Champaign, Ill.	June 30
July 14	Court house	Savannah, Mo.	June 30
July 14	Water tower, etc.	Chicago Junction, O.	June 30
July 15	Electric light plant	Wynne, Ark.	June 30
July 15	Church building	Scottdale, Pa.	June 30
July 15	Asylum buildings	Huntington, W. Va.	June 30
July 15	Church building	Wayne, Neb.	June 30
July 15	Water department supplies	St. Louis, Mo.	June 30
July 15	Electric plant	Lamar, Colo.	May 5
July 15	Electric plant	Gaylord, Minn.	June 16
	Advertised, Eng. News, June 16 and 23.		
July 15	Bridge	Cincinnati, O.	June 23
July 15	Harbor work	Goderich, Ont.	June 23
July 15	Post office building	Akron, O	June 23
	Advertised, Eng. News, June 23 and 30.		
July 15	Railway station	Nashville, Tenn.	July 7
July 15	Asphalt paving	Newport, R. I.	July 7
July 15	Wharf, etc.	Halifax, N. S.	July 7
July 15	Paving, etc.	Iowa City, Ia.	July 7
July 15	Apartment building	Chicago, Ill.	July 7
July 15	Brick paving	Binghamton, N. Y.	July 7
July 15	Retorts	Hamilton, O.	July 7
July 15	Drain	Coldwater, Mich.	July 7
July 16	Underground crossing	Kingston, N. Y.	July 7
	Advertised, Eng. News, July 7 and 14.		
July 16	Dredging, quay, etc.	Brooklyn, N. Y.	July 7
July 16	Sewers	Washington, D. C.	July 7
	Advertised, Engineering News, July 7.		
July 16	Bridge	Norwalk, O.	June 23
July 16	Water pipe	Montgomery, Ala.	June 23
	Advertised, Eng. News, June 23 to July 7.		
July 16	Brick sewer, etc.	Muscatine, Ia.	June 16
July 16	County buildings	Beverley, England	June 30
July 18	Iron bridge	Birmingham, Ala.	June 30
July 18	Grading and paving	Scottdale, Pa.	June 30
	Advertised, Eng. News, June 30 and July 7.		
July 18	Removing wreck	Philadelphia, Pa.	June 30
July 18	Weirs road	Laconia, N. H.	June 30
	Advertised, Eng. News, June 30 and July 7.		
July 18	Street work	Union City, Ind.	June 30
July 18	Water pipe, (3,060 ft.)	Whiting, Ind.	June 30
July 18	Electric light plant	Fitzgerald, Ga.	June 30
	Advertised, Engineering News, June 30.		
July 18	Water-works	Fitzgerald, Ga.	June 30
	Advertised, Engineering News, June 30.		
July 18	Hospital building	Toledo, O.	June 30
July 18	Street railway franchise	Salinas, Cal.	June 23
July 18	Steel water tower	San Jose, Cal.	July 7
July 18	Substructure, etc.	Muskegon, Mich.	July 7
	Advertised, Engineering News, July 7.		
July 18	Jail building	Woodstock, O.	July 7
July 19	Water-works	Yale, Mich.	July 7
	Advertised, Engineering News, July 7.		
July 19	School building	Troy, N. Y.	July 7
July 19	Dormitory buildings (15)	Sonyea, N. Y.	July 7
July 19	Reservoir	Delphi, Ind.	July 7
July 19	Bridge construction	Chillicothe, O.	June 23
	Advertised, Engineering News, June 23.		
July 19	Granite paving	Rensselaer, N. Y.	June 30
July 19	Lighting fixtures	Binghamton, N. Y.	June 30
	Advertised, Eng. News, June 30 and July 7.		
July 20	Pipe sewers	Davenport, Ia.	June 30
July 20	Bridges, etc. (11)	Chicago, Ill.	June 2
	Advertised, Engineering News, June 2.		
July 20	Embankment, etc.	Lemont, Ill.	June 2
	Advertised, Engineering News, June 2.		
July 20	Capitol building plans	Phoenix, Ariz.	June 2
July 20	Heat regulating system	Athens, O.	June 9
July 20	Truss bridge	Rumford, Me.	July 7
July 20	Building elevator	Baltimore, Md.	July 7
July 20	Heating, etc.	Clinton, Ia.	July 7
July 20	Water and light bonds	Cass City, Mich.	July 7
July 20	Paving	Tarentum, Pa.	July 7
July 21	School building	Dayton, O.	July 7
July 21	Sewers	Amsterdam, N. Y.	July 7
July 21	Pipe sewers (12 miles)	Goldsboro, N. C.	July 7
	Advertised, Engineering News, July 7.		
July 22	Water-works	Sparta, Minn.	July 7
July 22	Hydraulic dredge	St. Louis, Mo.	June 23
	Advertised, Eng. News, June 23 to July 14.		
July 22	Grading, road work, etc.	California, O.	June 30
July 23	Water-works	Beatrice, Neb.	June 30
July 23	Cement sidewalks	Washington, D. C.	June 23
	Advertised, Engineering News, June 23.		
July 23	Paving	Carbondale, Pa.	July 7
	Advertised, Eng. News, July 7 to 21.		
July 25	Lighting bonds	Lebanon, O.	July 7
July 25	Asphalt paving	South Bend, Ind.	July 7
July 25	County building	Riceville, Va.	July 7
July 25	School buildings	Mansfield, O.	July 7
July 25	Water-works	Winnipeg, Man.	June 2
	Advertised, Eng. News, June 2 to 23.		
July 25	Timber	Willetts Point, N. Y.	June 30
July 26	Electric light plant	Sycamore, O.	June 30
July 26	Water-works	Sycamore, O.	June 30
July 26	Electric light plant	Yale, Mich.	July 7
	Advertised, Engineering News, July 7.		
July 27	Church building	Moro, Ore.	July 7
July 27	Paving	Charleston, Ill.	July 7
July 27	Water supply	Ridgewood, N. J.	June 23
	Advertised, Engineering News, June 23.		
July 27	Bridge	Carthage, O.	June 30
July 28	Masonry work	Louisville, Ky.	June 30
	Advertised, Eng. News, June 30 to July 21.		
July 29	Sluice gates	Cincinnati, O.	July 7
	Advertised, Eng. News, July 7 to 21.		
July 30	Brick paving	Ashland, O.	July 7
	Advertised, Eng. News, July 7 and 14.		
July 30	Iron bridge	Cincinnati, O.	July 7
July 31	Water supply	Tangier, Morocco.	June 23
Aug. 1	Electric light plant	Charleston, S. C.	June 30
	Advertised, Eng. News, June 30 to July 21.		
Aug. 1	Power canal	Ellensburg, Wash.	June 30
Aug. 1	Bonds ($8,000.)	Ellensburg, Wash.	June 30
Aug. 1	Jail building plans	Syracuse, N. Y.	July 7
Aug. 1	Steel bridge	Stockton, Mo.	July 7
Aug. 1	Iron bridges (3)	Wichita, Kan.	July 7
Aug. 2	Bonds	Holly Springs, Miss.	July 7
Aug. 2	Road work	Anaconda, Mont.	July 7
Aug. 2	Arc lighting	Lebanon, Pa.	June 30
Aug. 2	Steel rails	Ottawa, Ont.	June 16
Aug. 3	Levee work	West Memphis, Ark.	June 30
	Advertised, Eng. News, June 30 to July 28.		
Aug. 6	Dike	York River, Va.	July 7
	Advertised, Eng. News, July 7 to 28.		
Aug. 6	Dredging, etc.	Virginia.	July 7
	Advertised, Eng. News, July 7 and 14.		
Aug. 8	Water pipe, etc.	Winnipeg, Man.	June 16
	Advertised, Eng. News, June 16 to 30.		
Aug. 9	Torpedo boats	Washington, D. C.	July 7
Aug. 15	Exhibition bldg. plans	Glasgow, Scotland.	June 2
Aug. 23	Water pipe	Coolgardie, West Australia,	June 2
Aug. 31	Custom house	Guayquil, Ecuador	Apr. 21
Sept. 1	Battleships (3)	Washington, D. C.	June 23
Sept. 1	Drainage system	Savannah, Ga.	June 30
	Advertised, Eng. News, June 23 to Aug. 25.		
Sept. 3	Sewage pumping station	Boston, Mass.	July 7
	Advertised, Eng. News, July 7 and 14.		
Sept. 12	Hospital plans	San Francisco, Cal.	Mar. 24
Oct. 1	Monitors (4)	Washington, D. C.	July 7
Oct. 1	School building (equipment)	St. Thomas, Ont.	July 7
Oct. 24	Markets, etc.	Belem, Brazil	Apr. 28
Oct. 30	School building	Chehalis, Wash.	June 16
Dec. 31	Plans for station, etc.	Stockholm, Sweden.	June 23
No date	Pump (4,000,000 gallons)	Austin, Tex.	June 30

RAILWAYS.

ARKANSAS, LOUISIANA & SOUTHERN.—F. H. Drake, Pres., Minden, La., informs us that track is now being laid on this proposed line and that it is expected to run a through train soon on the road. The route is from Sibley, La., on the Vicksburg, Shreveport & Pacific R. R., to Stamps, Ark., a distance of 65 miles. M. M. Hunt has part of the contract work. L. N. Polk, Ch. Engr., Minden.

BRIDGEPORT & HELENA.—This company has been incorporated in Oregon, with a capital stock of $5,000,000, to construct a railway from Bridgeport, Ore., to Helena, Mont.

BRITISH COLUMBIA.—Press reports state that Mackenzie & Mann, Toronto, Ont., have accepted the subsidy of $4,000 a mile from the province of British Columbia, and have signed a contract by which they agree to commence work at once on the proposed line of railway from Glenora to Lake Teslin. It is said that the country is quite level, and that no engineering difficulties of any magnitude will be found.

CENTRAL R. R. OF WEST VIRGINIA.—This company was incorporated in West Virginia June 29, with headquarters at Morgantown, W. Va., with a capital stock of $100,000, to construct a steam railway to connect Morgantown and Charleston, W. Va., a distance of about 130 miles. The incorporators are Thos. E. Davis and Geo. M. Whitescarver, of Grafton, W. Va.; R. T. Devries, Wheeling, W. Va.; Geo. C. Sturgis, Morgantown, W. Va.; J. W. Mason, Fairmont, W. Va.

CHICAGO GREAT WESTERN.—This company is reported to have awarded the following contracts: For changing four miles of grade at Kenyon, Minn., to William Stoddard, of St. Paul, Minn., at $20,000; for improving station grounds at Hayfield, Minn., and for 1½ miles of siding, to cost $12,000; for filling in three miles of wooden bridges, to cost $300,000; for seven stone culverts, to cost $25,000, to John Nevin & Son, St. Paul. H. Fernstrom, Ch. Engr., St. Paul.

CHICAGO, INDIANA & EASTERN.—The sections of this proposed railway from Swayzee to Converse, Ind., seven miles, and from Matthews to Muncie, Ind., 15 miles, are said to be under construction. H. U. Drew, Gen. Mgr., Fairmount, Ind.

CHICAGO, ROCK ISLAND & PACIFIC.—B. B. Brayton, Davenport, Ia., informs us that the Flick & Johnson Construction Co., of Davenport, has completed about one-half of the construction work on that portion of the line between Davenport and West Liberty. The work includes about 35 miles of grading for double track; the erection of iron girders and pipe culverts; masonry work and concrete piers and abutments, etc. The bridges include two double-track lattice bridges, 126 ft. long; four pairs of 44-ft. deck-plate girders; and three pairs of 33-ft. girders. It is expected to complete the work by September 15. W. G. Purdy, Chicago, Ill., Pres.; W. K. McFarlin, Supt. Maintenance and Construction, Davenport.

CHICAGO, ROCK ISLAND & TEXAS.—H. A. Parker, Vice-Pres. Chicago, Rock Island & Pacific Ry. Co., Chicago, Ill., informs us that nine miles of track were laid on June 28 on this proposed line of railway from Bridgeport to Jacksboro, Tex. It is expected to reach Jacksboro, 29 miles from Bridgeport (on the main line), by August 1. Pres., M. A. Law, Topeka, Kan.; Ch. Engr., W. B. Worrell, Bridgeport, Tex.

COLUMBUS, FULTON & NORTHERN. — Newman Cayce, Pres., Columbus, Miss., informs us that the larger part of this line has been surveyed and much of the right of way been obtained, but that no contracts have yet been offered. The proposed route is from Columbus, Miss., to Lexington, Tenn., via Aberdeen, Amory, Fulton, Burnsville and Savannah, a distance of 175 miles.

DETROIT & LIMA NORTHERN.—Reports state that track has been laid on this new road between St. John's and Bellefontaine, O., about 20 miles. This is a portion of the proposed extension of the Columbus & Northwestern from St. Mary's to Peoria, via St. John's and Bellefontaine, 50 miles. D. J. Casey, Ch. Engr., Bay City, Mich.

DULUTH & NORTHERN MINNESOTA.—Grading is said to have begun on the first six miles of this new logging railway from a point on Lake Superior north to open up the lumber district of St. Louis and Lake counties, controlled by Alger, Smith & Co., lumbermen, of Detroit, Mich. Preliminary surveys have been made for about 30 miles, and it is intended that the work of laying 60-lb. rails, with a standard gage, be done by the company direct. Pres., M. S. Smith, Detroit, Mich.; Gen. Mgr., John Millen, Black River, Mich.

INTEROCEANIC OF MEXICO.—Press reports from Mexico state that E. V. Sedgwick, Supt. of Motive Power, is in the market for ten locomotives and 1,000 freight cars. It is expected that the contracts for all this equipment will be placed some time this month from Mr. Sedgwick's office at the City of Mexico.

KANSAS CITY, ELDORADO & SOUTHERN.—Reports state that this company has executed a first mortgage to the Lincoln Trust Co., of St. Louis, for $450,000, to be used in completing the line. We have been advised that all the grading has been done and that the rails, ties, steel for bridges, etc., necessary to complete the line are upon the road. The contract is held by the Middle States Construction Co., Rialto Bldg., St. Louis, Mo., of which B. A. Aldrich is secretary.

KANSAS, OKLAHOMA CENTRAL & SOUTHWESTERN.—Press reports state that the directors of this company have awarded a contract to Coons & Co. for building the road from Bartlesville to Vernon, Tex. It is proposed to construct a railway from Cherryvale, Kan., to Vernon, Tex., through the central part of Oklahoma, a distance of about 350 miles. The Toledo Construction Co., of Toledo, O., has contracted to build a portion of the line. J. H. Bartles, Pres., Bartlesville, Ind. Ter.; F. B. Dallon, Ch. Engr., Independence, Kan.

LITTLE COAL RIVER.—The Little Coal River R. R. & Mining Co. was incorporated in West Virginia June 29, with a capital stock of $1,400,000, to construct a steam railway from St. Albans to Madison, W. Va., about 25 miles. The incorporators are H. J. Tondy, Huntington, W. Va.; J. P. Laflin, J. O. Lee, H. M. Green and A. R. Sheffer, all of New York.

MANISTIQUE & NORTHWESTERN.—C. E. Kelso, Secy., Manistique, Mich., informs us that rails have been purchased for an extension of this line from Scott's Camp to the Duluth, South Shore & Atlantic Ry.

MANSFIELD SHORT LINE.—Chas. W. French, Pres., Mansfield, O., informs us that the Crouch Construction Co., First National Bank Bldg., Chicago, Ill., which is building this line, has completed about five miles of grading, and that it expects to begin track-laying in August. The proposed route is from Shelby to Lucas, via Mansfield, O., 20 miles. Surveys have been made and the right of way is being secured. R. E. Harwood, Ch. Engr., Mansfield, O.

MISSISSIPPI, HAMBURG & WESTERN.—L. A. Cole, Pres., 100 William St., New York, informs us that ten miles of work have been completed on this new railway between Hamburg and Leland, Ark., on the Mississippi River, a distance of 40 miles. All the right of way has been obtained and the necessary capital secured. C. M. Gibson, Ch. Engr., Portland, Ark.

MONTEREY & MEXICAN GULF.—A. Monnom, Gen. Mgr., Monterey, Mexico, writes us that this company is in the market for six freight engines, three cabooses and 100 box cars of 60,000 lbs. capacity.

NORTHERN PACIFIC.—The contract for grading, bridging and ironwork on the Northern Pacific Ry. extension from Belmont to Hartney is said to have been awarded to J. D. McArthur, of Winnipeg, Man.

PACIFIC & ARCTIC.—John Hislop, Asst. Ch. Engr., Skaguay, Alaska, writes us that the Pacific & Arctic Ry. & Navigation Co. is now building a narrow gage (3 ft.) railway from Skaguay to navigable water on the Yukon. About 6,000 ft. of track is laid and four miles of grading completed and ready for track-laying. The location of the line will soon be completed to the summit of White Pass, and it is expected that trains will be running to Summit Lake or beyond in September. The work is being done by the Pacific Contracting Co., Dexter, Horton & Co., Bank Bldg., Seattle, Wash., and of which E. C. Hawkins is chief engineer and superintendent. The railway company was incorporated in West Virginia, March 27, with a capital stock of $1,000,000, by D. N. Rowan and G. W. Rowan, of Irvington, N. Y.; Webster Gillette, of New York, and others.

PONTOTOC & STARKVILLE.—This company has been incorporated at Mississippi to construct a railway from Pontotoc south to Starkville, 60 miles. It will practically be a continuation of the Gulf & Chicago line running from Middleton, Tenn., to Pontotoc, a distance of 62 miles. The building of this railway will give Memphis a shorter route to West Point, Columbus and other Mississippi towns via the Southern & Kansas City, Memphis & Birmingham lines, the Gulf & Chicago, and the proposed Pontotoc & Starkville Ry., and will open up a rich country in northeastern Mississippi.

ST. LOUIS, SILOAM & SOUTHERN.—It is announced that Hector D. Mackay, of St. Louis, Mo., who is the chief promoter of this proposed railway, has made all financial arrangements to construct the line at once from St. Louis to Fort Smith, Ark., a distance of about 300 miles, with a branch from Little Rock, Ark., to Pomona, Mo. The route has been surveyed and the line located. The International Construction & Improvement Co., of Fort Smith, Ark., which has the contract for building the road, was incorporated in Arkansas, June 24, with a capital stock of $1,000,000, by Jesse French, John L. French, H. D. Mackay, John Dooley and J. S. Drake.

SPRINGFIELD, LITTLE ROCK & GULF.—Reports state that Governor Jones, of Arkansas, has issued a proclamation annulling the Smith railway act passed June 26, 1896, which granted to this road 1,000 acres of state land, a mile for each mile of the main line and its branches that might hereafter be constructed, provided that the railway shall be completed to Fourche, La., Favre River, within twelve months from date of passage of the act. P. L. Dougherty, Ch. Engr., Springfield, Mo.

TALLAHASSE & SOUTHEASTERN.—The Florida Construction Co. is said to have 280 men at work constructing this proposed railway from Tallahassee to Gainesville, Fla. Grading is completed from Tallahassee to about Perry, and it was expected to begin track-laying on July 1, and to push the work as much as possible. R. L. Bennett, Vice-Pres., Tallahassee, Fla.

TEMPLE & SALADO.—Preliminary surveys are about completed for a line of railway between Temple and Salado, Tex., and it is said that a firm of railway contractors have made a bid to construct the 16 miles of road and to equip it with one full passenger train for $70,000.

TIONESTA VALLEY.—Crage & Tench, 61 Terrance, Buffalo, N. Y., have been awarded the contract for constructing the proposed Millstone extension of this line, which is in operation from Sheffield, Pa., south through a large timber territory. Work will begin at once. Pres., J. H. Horton, Sheffield.

MARSHALL, TIMPSON & SABINE PASS.—We are informed that the survey has been completed and all of the right of way obtained, except five miles, for an extension of this railway between Timpson and Carthage, Tex. Most of the necessary capital has been secured, and the contract for construction has been awarded to Garrison, Avery & Co., of Timpson. Seven miles of the line are now in operation, seven miles graded for ties and bridges and the remaining six miles are to be graded within 60 days. John Burkett, Ch. Engr., Kokomo, Ind.

TOLUCA & TENANGO.—E. W. Knapp, Master Mechanic, Box 59, Toluca, Mexico, informs us that the engineers are now in the field locating another extension of 15 kilometers (9.31 miles), from Tenango to Tejaloya, Mexico. The company will do its own work.

UNION, COVE & VALLEY.—This company was incorporated in Oregon June 24, with a capital stock of $25,000, to construct a standard gage railway from the station of the Union, Cornucopia & Eastern Ry. in Union to Cove, Ore., a distance of about 12 miles. It is the intention of the company to begin surveying the route at once. The grading, tieing and ironing of the road will be under the direction of Joseph Johnson, Supt. of Construction. It is expected to have the work completed by October 15. The directors of the new company are, E. P. McDaniel, M. B. Rees, J. F. Phy, J. M. Carroll, P. J. Taylor, L. B. Rinehart and Joseph Johnson.

WISCONSIN.—J. S. Cowan, Almond, Wis., informs us that contracts will probably be let for the construction of this line in the latter part of July. The proposed route is from Plover, on the Green Bay & Western Ry., to Almond, via Keene and Lone Pine, Wis., a distance of 16 miles. No surveys have yet been made, nor has the right of way been obtained nor the capital secured. W. F. Hopkins, Ch. Engr., Green Bay, Wis.

WYOMING & MISSOURI RIVER.—This company has been organized, according to reports, to construct a line to the Hay Creek coal fields at once. W. S. Heckert and Geo. S. Harris, Belle Fourche, S. D., are said to have received the contract for grading and ironing the road.

STREET AND ELECTRIC RAILWAYS.

WHITMAN, MASS.—The selectmen, June 28, granted a franchise to the Whitman & Plymouth Electric Ry. Co. to build a line from this place to the East Bridgewater town line.

BATH-ON-HUDSON, N. Y.—It is reported that the Albany Ry. Co. will extend its tracks into this place.

ONEIDA, N. Y.—Geo. W. Chadwick, of Chadwicks, N.Y., is reported to be interested in the construction of an electric railway from this city to Sylvan Beach, through Durhamville. Irving, Wicks & Co., New York, are attempting to obtain the franchise for this work now owned by J. W. Warner, Oneida.

SIDNEY, N. Y.—Robt. Cartwright, of this place, has bought the Sidney & Franklin Electric R. R., at receiver's sale, for $225, being subject to a judgment for $202 and a $3,000 mortgage, according to reports.

SOLVAY, N. Y.—The Syracuse, Skaneateles & Moravian R. R. Co. has petitioned the village trustees for a franchise for an electric railway through this place.

WALLOOMSAC, N. Y.—The Bennington & Hoosick Valley Electric Ry. was opened July 4, from North Bennington, Vt., to this place.

WHITEHALL, N. Y.—Chas. I. Baker, Troy, is said to be interested in an electric railway from this place to Granville.

DOYLESTOWN, PA.—Surveys for the Doylestown Ry. have been made and a franchise has been requested. The company also proposes to make extensions later to Morrisville, Centreville and Yardley. Pres., Frank N. Booz.

EASTON, PA.—The Easton, Palmer & Bethlehem Electric Ry. Co. has awarded the contract for the construction of its line to the Worcester Construction Co., Worcester, Mass., and work has already begun. The power house and car barns will be erected at Butztown, according to report.

ERIE, PA.—The Erie Electric Motor Co. is planning to build an extension to its electric railway in this city to a point near the end of the public dock at the foot of State St.

FOREST CITY, PA.—The Carbondale Traction Co. has been granted a franchise to build its line in this place. The company is required to accept the franchise in 20 days and to have the road extended to South St. within six months.

NAZARETH, PA.—It is proposed to build an electric railway from Bethlehem to this place, at a cost of about $50,000.

SCHUYLKILL HAVEN, PA.—The town council has granted a franchise to the Schuylkill Haven & Orwigsburg St. Ry. Co. to construct an electric railway in this borough, to connect with the tracks of the Pottsville & Reading Electric Ry.

WEST CHESTER, PA.—A meeting of the stockholders of the Philadelphia & West Chester Traction Co. will be held Aug. 23 to authorize a mortgage indebtedness of $340,000, with which to construct an extension to this place along the West Chester Turnpike, 10 miles.

BALTIMORE, MD.—Baldwin & Pennington are the architects for the new car barn of the Consolidated Ry. Co. This company has purchased the uncompleted electric railway between Baltimore and Ellicott City from the Columbia & Maryland Electric Ry. Co. and after completing it will operate it in connection with its Edmondson Ave. line through to Ellicott City.

WASHINGTON, D. C.—Congress has passed a bill requiring the Brightwood Ry. Co. to remove its overhead wires on Kenyon St., from 7th to 14th, and authorizing it to equip the road with the underground electric system at an estimated cost of $150,000.——Contracts for the construction of the Washington, Westminster & Gettysburg Ry. are reported to have been awarded.

NEWPORT NEWS, VA.—It is reported that before the Newport News & Old Point Ry. & Electric Co. can operate its electric line in this city, it will be necessary for the city to build two bridges across the tracks of the Chesapeake & Ohio Ry. W. J. Payne, Richmond, is one of the chief promoters of the project.

WHEELING, W. VA.—Elias McConnaughy, Bridgeport, has been given the contract, according to reports, for the grading of the extension of the Wheeling St. Ry. to the fair grounds.

FERNANDINA, FLA.—J. E. Starke, of Jacksonville, and others, have applied to the city council, according to report, for a franchise to build a street railway in this city.

BOWLING GREEN, KY.—The Bowling Green St. Ry. Co. has been reorganized by the Fidelity Trust Co. which had a lien of $23,000 upon it when it went into the hands of a receiver several months ago. The property of the railway company is to be sold. T. H. Whayne, Pres., may be addressed.

BIRMINGHAM, ALA.—The Birmingham Ry. & Electric Co. and the Birmingham Traction Co. are said to have reached an agreement by which cars will soon be running on First Ave., which will be relaid with heavier rails.

VICKSBURG, MISS.—The contract for the construction and equipment of the Vicksburg R. R., Power, Light & Mfg. Co. is reported to have been let. The line will probably be in partial operation early in September. Secy., M. J. Mulvihill, of Vicksburg.

BATON ROUGE, LA.—Fire destroyed car barn and six cars of the Baton Rouge St. Car Co. July 24, resulting in a loss of $20,000; almost covered by the insurance. Traffic will be suspended for several months.

XENIA, O.—J. M. Wilson, the promoter of the Dayton, Spring Valley & Wilmington Traction Co., is endeavoring to obtain a franchise to operate a line on Detroit St.

EAST ST. LOUIS, ILL.—The St. Louis & Belleville Electric Ry., of this city, has increased its capital from $50,000 to $500,000, according to report. John Day, Pres.

MILWAUKEE, WIS.—The Murray Hill Land Co. has secured an injunction restraining the Milwaukee Light, Heat & Traction Co. from changing the grade on Wells St.——The Waukesha extension of the Milwaukee Ry. & Light Co. was opened June 25. John I. Beggs, Mgr.

OSHKOSH, WIS.—A. B. Ideson, Vice-Pres., writes us that the Oshkosh, Omro & Berlin Electrical Ry. Construction Co. has been organized to build an electric railway from this city to Berlin, 26 miles, passing through three or four villages. The company will endeavor to secure a private right of way, 15 ft. wide, adjoining the highway and will be ready to finance within 90 days. The officers are: S. W. Hollister, Pres.; A. B. Ideson, Vice-Pres.; W. J. Wagstaff, Secy.; J. Howard Jenkins, Treas., and J. K. Tillottson, Mgr.

MINNEAPOLIS, MINN.—F. W. Cappelen, City Engr., writes us that the Twin City Rapid Transit Co. is pushing work on its line and expects to have it completed and in operation in a short time from this city to St. Paul, by way of Como Park.

KANSAS CITY, MO.—The Metropolitan St. Ry. Co. has decided to operate its Ninth St. cable line from Grand Ave. to the western terminus by electricity, according to report. The company is welding the joints in the rails on East 12th St. and on 15th St., from Highland Ave.; much welding still remains to be done.——The Brooklyn Ave. St. Ry. Co. contemplates building a line on Grand Ave., from 13th St. to 3d St., according to report.——The Kansas City Electrical St. Ry. Co. has been organized to build a line from 11th St. and Grand Ave. to a point near Westport.

WICHITA, KAN.—It is reported that the Commercial Club, of this city, has appointed a committee to confer with the city council in regard to constructing a street railway, the franchise for which has been asked for by an eastern promoter. C. G. Cohn, J. O. Davidson, C. Aylesburg, C. H. Brooks, E. Vail and J. H. Black are the committee.——The franchise granted to W. Q. Church and associates to build a street railway has been annulled by the city council, according to report, owing to the time condition having elapsed.

DEVIL'S LAKE, N. DAK.—Allan Tompkins is reported to be interested in building an electric road to Chautauqua, S. Dak.

PINE BLUFF, ARK.—A site, 180 × 200 ft., has been secured for the power house of the projected electric railway in this city, and work has been commenced.

DENVER, COLO.—The board of aldermen has voted to give a franchise to the Denver City Ry. Co. allowing it to change its motive power from cable to electricity and to extend its line on certain streets. The supervisors have not yet confirmed the vote.——The residents of Montclair, a suburb of this city, have petitioned the city council to grant a 20-year franchise to the Colfax Electric Ry. Co. to permit it to extend its line to their locality.

AUSTIN, TEX.—E. A. Ellis and others are reported to be interested in building a street railway in this city.

OAKLAND, CAL.—The Oakland Transit Co. has applied for a franchise on 12th St. and Oak St., according to report.

PASADENA, CAL.—The council granted a hearing recently to the Terminal Ry. Co. on its application for a franchise to operate an electric railway in this city. T. E. Gibbon, Att'y.

SAN MATEO, CAL.—The San Mateo Electric Ry. is reconstructing its 30th St. branch from Ocean View to Holy Cross Cemetery and is double-tracking its 18th St. line, from Guerrero to Danvers, according to report.

HAMILTON, ONT.—The city is contemplating purchasing and operating the Hamilton St. Ry. and will submit the question to the vote of the rate-payers on July 27.

ELECTRIC LIGHT AND POWER.

HOLYOKE, MASS.—J. J. Kirkpatrick, Cy. Engr., writes us that the committee appointed by the supreme court some time ago to appraise the value of the electric light plant, which it was voted to purchase, has not yet met. The plant has capacity for 250 1,200-c. p. arc lights.

SOMERVILLE, MASS.—Albion A. Perry, Mayor, writes us that at present no action is being taken by this city to secure or establish an electric light plant.

BELFORT, N. Y.—It is stated that Lafayette Wetmore, Martinsburg, N. Y., has purchased the grist mill site and water power at Belfort, 14 miles from Lowville. Mr. Wetmore proposes to build a plant at once to furnish 2,000 HP.

BUFFALO, N. Y.—J. G. White & Co., Baltimore, Md., have been awarded the contract for constructing a subway system in this city for the Buffalo General Electrical Works.

DOLGEVILLE, N. Y.—Jas. D. Feeter, of Little Falls, N. Y., is reported to have been appointed receiver for the Dolgeville Electric Light & Power Co.

ELMIRA, N. Y.—Geo. L. Gray, Alderman, writes us that the council has accepted a bid of the Elmira Illuminating Co. to light the streets for five years with 1,200-c. p. arc lights, at $80 a light a year. By the closing of this contract the question of building a municipal plant has been abandoned.

FULTONVILLE, N. Y.—H. W. Post, of the Cayadutta Generating Co., writes us that the company has about completed negotiations for water wheels, and will probably use the General Electric or Westinghouse generators, and will give the one or other the entire electrical contract for station and line equipment, etc. The plant will have a capacity for 50 2,000-c. p. arc and 1,000 16-c. p. incandescent lights.

HOMER, N. Y.—The Cortland & Homer Traction Co. has been granted a 5-year franchise for lighting this city.

MORRIS PLAINS, N. J.—Bids are asked by the board of managers until July 7 for furnishing and installing a plant, etc., at the New Jersey State Hospital at Morris Plains. Arch., Robt., C. Walsh, Morristown, N. J.

SEA ISLE CITY, N. J.—Bids are asked until July 7 for lighting the streets for 10 years with 80 32-c. p. incandescent lights. In addition to the city lighting there will be considerable commercial lighting. A. H. Sickles, Mayor, Sea Isle City, and 510 Minor St., Philadelphia.

LANCASTER, PA.—The Martic Water & Power Co. has leased the Columbia Dam from E. J. D. Cross for a term of 99 years for $75,000.

DURHAM, N. C.—The question of issuing $225,000 in bonds for the purchase of the plant of the Durham Electric Light Co. and water-works of the Durham Water Co., etc., will be voted upon Aug. 1.

FAYETTEVILLE, N. C.—The council is reported as considering the question of granting a franchise to a company for a plant and water-works.

LAFAYETTE, ALA.—It is stated that the council wants to purchase dynamos for 25 arc and 800 incandescent lights, etc. L. L. Torbert may be addressed.

PADUCAH, KY.—A consolidation of all the street car lines and electric light plants in this city has been made and a new company organized into which all the separate companies have been merged. The new bond issue and financial plan incidental to the reorganization was arranged by R. S. Vivian, Investment Broker, Portland Block, Chicago. The Paducah Ry. & Electric Light Co. was incorporated in June, with a capital stock of $200,000, by Geo. C. Thompson, T. J. Flournoy, Geo. C. Wallace and others.

COLUMBUS, O.—J. W. Jones, Supt. Deaf and Dumb Institute, writes us that an engineer has been appointed to prepare plans and specifications for the proposed plant. It will have a capacity for 12 arc and 1,200 incandescent lights; estimated cost, $7,000. The appropriation is made available after Feb. 15, 1899.

LEBANON, O.—Bids are asked until July 25 for the purchase of $20,000 of 5% electric lighting bonds, according to reports. R. B. Corwin, Village Clk.

PAINESVILLE, O.—Bids are asked until July 9 for furnishing two 60-light 2,000-c. p. arc dynamos, according to reports. E. D. Hartwell, Village Clk.

WELLINGTON, O.—It is stated that the following contracts were let June 24 for furnishing and constructing the plant and water-works, to cost $30,000: Electrical equipment, the Fort Wayne Electrical Corporation, Fort Wayne, Ind.; steam equipment, the Arbuckle-Ryan Co., Toledo, O.; stand pipe construction, the Standard Bridge & Boiler Co., Bellaire, O.; pipe distribution and pumps, T. S. & H. M. Brooks, Jackson, Mich. Bonds at 4% have been sold by the village for this plant and water-works.

TERRE HAUTE, IND.—Andrew J. Crawford, Terre Haute, has purchased the plant of the Terre Haute Electric Light & Power Co. for $40,000.

BELLAIRE, MICH.—This place voted June 20 to build a plant.

DETROIT, MICH.—M. E. Rasemann, 38 Buhl Block, is preparing plans for an addition to the plant of the Edison Illuminating Co.; estimated cost, $28,000.

EATON RAPIDS, MICH.—Bids are asked until July 8 for furnishing the machinery, etc., and installing a plant. The city proposes to contract for 30 or more arc lights for street lighting, the contract to be made for five years. Bids are requested to be made for 1,200 and 2,000 c.-p. arc lights, to be operated every night in the year from dusk to midnight. Bids should also include a schedule for commercial and residence incandescent lighting, to be operated every night during the year and during the whole of each night. H. L. Boice, Recdr.

GRAND RAPIDS, MICH.—Press reports state as follows: Another victory was won by the city June 25 in the struggle for a municipal plant. When the contracts were awarded for the plant recently, one of the bidders obtained an injunction restraining the city from executing the contract, on the ground that his was the lowest bid. Judge Burlingame on June 25 dissolved the injunction as the city charter provides that the board may award the contracts to any responsible bidders and not necessarily to the lowest. This will probably end all the litigation and the plant will now be built.

YALE, MICH.—Bids are asked until July 26 for furnishing and constructing a plant, as stated in our advertising columns. E. F. Fead, Clk.

WEST SUPERIOR, WIS.—The American Steel Barge Co., it is reported, will soon begin the construction of a new stone and brick power house, etc., to cost about $50,000.

ADA, MINN.—It is reported that Dr. Stuart is considering the question of building a plant.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Co. is making an extension to its underground conduit system of about a mile of conduit. It is using the McRoy Vitrified Clay Conduit and laying from 4 to 16 ducts.

RICEVILLE, IA.—The construction of a plant is proposed, according to reports.

WATERTOWN, S. DAK.—L. D. Lyons writes us that nothing has yet been done with regard to the proposed plant. The city is at present moving slowly with the question.

KANSAS CITY, MO.—C. S. Sweetland, of the electric light company, of Kansas City, Kan., and R. J. Ingraham have applied for a franchise to supply this city with cheaper electric lights. The power will be transmitted from the plant at Riverview, which plant it is proposed to enlarge.

MOUNT GROVE, MO.—We are informed that the Star Roller Mills will want a 100-light dynamo for its new plant at once.

BATESVILLE, ARK.—Bids are asked until July 14 for furnishing the machinery and for constructing the plant and water-works; estimated cost, $25,000. Engr., Owen Ford, Security Bldg., St. Louis, Mo.

BUTTE, MONT.—Press reports state that liens have been brought against the Montana Power Co. for $54,955. The company was organized some time ago by St. Paul parties to furnish power, light and water, to the mines, etc. It is probable that the works are not yet completed.

NEW WHATCOM, WASH.—It is reported that the electric plant and the mill of the Bellingham Bay Improvement Co. were destroyed by fire June 28, causing a loss of about $400,000. The electric light plant is said to have had a capacity for 200 arc lights. Mgr., C. L. Anderson.

OAKLAND, CAL.—T. C. Bullock, of the St. and Electric Co., has applied for a 50-year franchise for transmitting electric power from the Blue Lakes, Amador county, to this city.

WALLACE, IDAHO.—The Wallace Mfg., Electric & Water Co., it is reported, has completed plans for a new power station to be 36 × 73 ft. A 150-HP. engine will be put in. The station, it is expected, will be completed by Sept. 1.

SANTIAGO DE CHILI, CHILI.—It is reported that a company has been formed at Berlin, Germany, under the name of the Electric Power Co. of Santiago de Chili, with a capital stock of 24,000,000 marks, of which Wernher, Beit & Co., of Berlin, take as much as 12,000,000 marks, while the balance is taken in equal proportion by the Societe Generale d'Electricite. Part of the capital will be offered for subscription in England. Extensive electrical undertakings in Chili are soon to be started by the company.

NEW COMPANIES.—Standard Electric Vapor Motor Co., New York; $50,000; S. W. Warner, E. L. Warner, W. M. Warner, Yonkers.

Lima-Honoeye Electric Light Co., Honoeye Falls, N. Y.; $125,000; H. H. Sitoll, R. L. Fryer, J. C. Conway, P. P. Miller, H. W. Box, A. L. Williams, A. M Holdin, H. C. Gilbert, Clarence McGregor, Buffalo.

Salem Electric Co., 93 Market St., Salem, N. J.; $50,000, with $15,050 paid in; John M. Carpenter, Wyatt W. Miller, Jr., Robt. Gwynne, Henry Kirk.

Port Chester Electric Lighting Co., Port Chester, N. Y.; $50,000; to operate in the towns of Westchester county; William L. Ward, Addison Johnson, Port Chester; William E. Ward, Rye, N. Y.

United States Light, Water & Power Co., 222 Washington St., Jersey City, N. J.; $125,000; F. W. Kalbfleisch, W. Curry, Brooklyn; George Weldon, Summit Ave., Jersey City. The company will purchase water-works, operate them and build electric light and power plants.

Illinois Power Co., Louisville, Ky.; $50,000; Robert E. Woods, H. S. Brashear, C. C. Boswell, D. E. Coulter, Louisville; R. A. Brashear, Gas City, Ind.

Cayadutta Electric Generating Co., Fultonville, N. Y.; to build a power plant and dam on Cayadutta Creek, near Sammonsville; a plant for furnishing 800 incandescent and 50 arc lights; A. Z. Wemple, Dr. H. W. Post, Fultonville; J. S. Wilson, Fonda, N. Y.

Ephrata Electric Co., Ephrata, Pa.; $15,000; F. E. Bailey, Philadelphia; A. W. Mentzer, Treas.; H. G. Mentzer, Ephrata; S. N. Bailey, Dillsburg, Pa.

North Jersey Light & Power Co., Montclair, N. J.; $15,000, with $1,050 paid in; Wm. T. Francisco, Albert C. Williams, Harry M. Warren, Montclair.

Beacon Light Co., three companies to operate in Ridley Park, Darby and Glenolden, Pa.; $1,000, with $100 paid in; J. Engle Cochran, Jr., Treas., 704 E. 14th St., Chester, Pa.; Geo. C. Hetzel, Ridley Park, Pa.; Ernest H. Davis, Brooklyn, N. Y.

Albion Power Co., Albion, N. Y.; $50,000; Raymond B. Johnson, Buffalo; S. T. Church, Albert Culver, Albion; W. C. Johnson, F. A. Dudley, Niagara Falls, N. Y.

Rocky Mountain Power Co., Denver, Colo.; $500,000; to operate in Arapahoe, Boulder, Jefferson, Clear Creek and Gilpin; Mina S. Page, J. G. O'Bryan, C. E. Rich, R. C. Bogy, A. C. Foster.

BRIDGES.

RUMFORD, ME.—Bids are asked until July 20 for constructing a steel truss bridge, 198 ft. long and 20 ft. wide, over the Androscoggin River, at Rumford Falls, to cost about $16,000. Chas. A. Mixer, Engr., Rumford Falls; J. H. Martin, First Selectman.

NEW CASTLE, N. H.—Plans have been completed by Dudley & Doherty, Engrs., Manchester, for the construction of three bridges, on the proposed Ocean Boulevard, over Rye Harbor and Hampton River.

BUFFALO, N. Y.—The board of public works will soon ask bids for the construction of a bridge over the Buffalo River at Seneca St. Frank W. Goethoefer, Cy. Clk.

HYDE PARK, N. Y.—D. Cuozzo, 150 Nassau St., New York, has commenced work on the new masonry arch bridge of 70-ft. span across Crum Elbow Creek on the New York & Albany Post Road, and retaining walls for the road embankments, for F. W. Vanderbilt and the town of Hyde Park, jointly; estimated cost, about $13,000, of which Mr. Vanderbilt shares three-fourths. Owen Morris, Engr. Hyde Park.

CAMDEN, N. J.—The following bids were received June 29 for constructing a steel bridge over Cooper's Creek at State St., as advertised in Engineering News. J. J. Albertson, County Engr.: Owego Bridge Co., Owego, N. Y., $23,000; Groton Bridge & Mfg. Co., Groton, N. Y., $[illegible] B. F. Sweeten & Son, Camden, N. J. (accepted), $22,776.

TUCKAHOE N. J.—J. C. R. Smith, Clk. Com. Bd. Freeholders, Ocean View, informs us that the following bids were received June 28 for a steel bridge 120 ft. long over the Tuckahoe River, as advertised in Engineering News. F. R. Long, Engr., 320 Broadway, New York:

Wrought Iron Bridge Co., Canton, O.	$4,213
New Jersey Steel & Iron Co., Trenton, N. J.	4,675
New Columbus Bridge Co., Columbus, O.	4,300
King Bridge Co., Cleveland, O.	5,750
Horseheads Bridge Co., Horseheads, N. Y.	4,248
Nelson & Buchanan, Chambersburg, Pa. (accepted).	3,990
Canton Bridge Co., Canton, O.	4,175
Berlin Iron Bridge Co., East Berlin, Conn.	4,590
F. R. Long & Co., New York	5,100
Toledo Bridge Co., Toledo, O.	5,750
Bracket Bridge Co., Cincinnati, O.	3,998
Youngstown Bridge Co., Youngstown, O.	5,350
Groton Bridge & Mfg. Co., Groton, N. Y.	4,430
Champion Bridge Co., Wilmington, O.	4,375
Owego Bridge Co., Owego, N. Y.	5,150

TOWSON, MD.—Bids are asked until July 13 for constructing an iron bridge 116 ft. long and 16 ft. wide, on stone foundation. B. H. Mays, Engr., Philopolis; C. H. Callings, Ch. Clk. County Comrs, Baltimore.

NEWPORT NEWS, VA.—The council has passed an ordinance authorizing the issue of $40,000 in bonds for the construction of three bridges over the Chesapeake & Ohio Ry.

SPRINGFIELD, TENN.—Bids will soon be asked for the construction of an arch bridge across Black Branch. Address Mayor Bell or Alderman McMurray.

CINCINNATI, O.—Bids are asked until July 30 for constructing an iron truss bridge and substructure, in Colerain township. Eugene L. Lewis, County Audr.

DAYTON, O.—Bids are asked until July 12 for constructing a bridge over the Great Miami River, according to reports. A. G. Feight, County Audr.

LISBON, O.—C. H. Smith, Gen. Mgr., Pittsburg, Lisbon & Western Ry. Co., Lisbon, informs us that it is proposed to construct two new bridges, of stone and steel; estimated cost, $4,500.

NEW PHILADELPHIA, O.—New bids will be asked by the county commissioners for the construction of an iron bridge over the river at Blicktown, to cost about $8,000.

YOUNGSTOWN, O.—Bids are asked until July 8 for the purchase of $90,000 of 4½% bridge bonds. C. F. Brenner, County Audr.

DETROIT, MICH.—The Detroit & Lima Northern Ry. Co. will apply to the county supervisors on July 29 for permission to construct a 102-ft. draw-span plate girder bridge over the Ecorse River, to replace the present structure. J. R. Megrue, Vice-Pres. and Gen. Mgr., Detroit.

DETROIT, MICH.—Commissioner Kallman, Bd. Pub. Wks., has written Mayor Maybury to urge the construction of a wider bridge from Owen Park to Belle Isle; $30,000 was left over from last year's appropriation.

MUSKEGON, MICH.—Bids are asked until July 18 for building a bridge over Muskegon Lake and for the substructure of three iron bridges, as described in our advertising columns. J. Bierma, Chn. County Comrs.

IVESDALE, ILL.—Bids are asked until July 7 for constructing an iron bridge 40 × 14 ft. Ira O. Baker, Engr., Champaign, Ill.

SIOUX CITY, IA.—J. M. Lewis, Acting Cy. Engr., informs us that a contract has been awarded to C. E. H. Campbell, Council Bluffs, for constructing a 100-ft. span steel bridge over Floyd River, on Charles St.

FARGO, N. DAK.—Bids are asked until July 8 for constructing eight pile bridges, from 30 to 50 ft. long. O. J. Olson, County Audr.

TOPEKA, KAN.—S. S. McFadden, Cy. Clk., informs us estimates have been submitted for the construction of a pile bridge at Lake St., to cost about $1,251. Bids have not yet been asked.

WICHITA, KAN.—Bids are asked by the county clerk until Aug. 1 for constructing three iron bridges; estimated cost, $650, $850 and $900 each. R. H. Brown, Des. Engr., Wichita.

STOCKTON, MO.—Bids are asked until Aug. 1 for the construction of a steel bridge about 112 ft. long, on stone foundation. Address H. W. Englman, Bear Creek, Mo.

CHEHALIS, WASH.—The county commissioners have decided to construct two bridges across the Chehalis River this summer, one at Claquato, to cost about $3,500, and at Centralia, to cost about $10,000.

WEISER, IDAHO.—Bids are asked until July 9 for repairing the Middle Fork wagon bridge, consisting of 112 ft. of trestle approach. I. F. Smith, County Clk.

BROOKE, ONT.—Bids are asked until July 11 for constructing two bridges, according to reports. Address L. Lindsay.

BUILDINGS

BATH, ME.—A fire in this city July 4 destroyed a number of buildings, causing a reported loss of $100,000.

BARRE, VT.—All bids for erecting a new city hall building have been rejected owing to the high figures. It is likely that the granite part of the present plans will have to be omitted or an extra $10,000 added to the original appropriation.

PITTSFIELD, MASS.—The contract for rebuilding the American House is stated to have been awarded to Dodge & Devanney, of this city, at a cost of about $60,000.

SPRINGFIELD, MASS.—Bids are asked until July 11 for the erection and plumbing of new outbuildings for the Elm St. school. Arch., F. R. Richmond; also until July 13 for the erection of the Brightwood school building. Arch., B. Hammett Seabury, Gill's Block. C. E. Brown, Chn. Cy. Property Com.

NEWPORT, R. I.—The following bids were received June 28 for the erection of a naval hospital for contagious diseases at the U. S. naval station at Newport: Wm. F. Wilber & Frank E. Manchester, $9,834; James M. Gillies, $9,842 (informal). As all bids were in excess of the appropriation no award will be made.

BROOKLYN, N. Y.—George Mertz & Son, of Port Chester, N. Y., are said to have received the general contract for the $30,000 residence, 72 × 98, to be erected at 99th St. and Shore Road for Kate M. Johnson, 268 23d St. Archs., Little & O'Connor, 18 West 34th St., New York. ——Henry J. Brown & Son, 1534 Fulton St., have been awarded the mason, carpenter and iron contract, and James Keenan, Fulton St., near Grand Ave., has the plumbing contract for the alterations to the building at Throop Ave. and Hancock St. for Theodore Kruger. Archs., Dodge & Morrison, 41 Wall St., New York.

LITTLE FALLS, N. Y.—Contractor Dove, of Little Falls, is said to have been awarded the contract for the construction of the new high school building, exclusive of heating, plumbing and ventilating, at $55,589.

NEW YORK, N. Y.—Plans have been filed by Smith & Raffler, 130 East 86th St., for a 5-story brick flat and store building at 107th St. and Manhattan Ave., to cost $140,000. Archs., Neville & Bagge, 217 West 125th St.; by Eaton & Mains, for the Methodist Book Concern, for an 8-story brick business building at 4 West 20th St., to cost $50,000. Archs., E. H. Kendall; by P. J. Herter, 1032 Lexington Ave., for two 5-story brick flat and store buildings at 433 and 435 West 24th St., to cost $50,000. Archs., P. Herter & Son; by Rachel Weinstein, for two 6-story brick flat and store buildings at 50 and 52 Lewis St., to cost $50,000; Archs., Horenburger & Straub, 122 Bowery, by Julius and Gus J. Fleischman, 19 West 124th St., for four 5-story brick flat buildings at 5th Ave. and 118th St., to cost $70,000, and for three 5-story flat buildings on 118th St., near 5th Ave. Arch., Geo. F. Pelham, 503 5th Ave.; by Bernard Havanagh, 469 West 147th St., for six 4-story brick flat buildings on Brook Ave., near 169th St., to cost $60,000. Arch., John P. Walther, 205 East 125th St.

SCHENECTADY, N. Y.—The Van Dorn Iron Works, of Cleveland, O., has received the contract for erecting the new county jail building, and John McEncroe, of Schenectady, will build the mason work. Contracts have not yet been awarded for heating and ventilating.

SONYEA, N. Y.—Bids are asked by the managers of the Craig Colony for Epileptics until July 19 for the construction of 15 dormitory buildings and a superintendent's residence. Archs., Carrere & Hastings, 28 East 41st St., New York.

SYRACUSE, N. Y.—Plans and specifications are asked by the supervisors of Onondaga county until August 1 for improvements and additions to the county penitentiary and jail buildings. Address Ray B. Smith, 618 Kirk Block, Syracuse.

TROY, N. Y.—Bids are asked until July 19 for the erection of a new public school building in this city. E. Ogden Ross, Secy. Contracting Board.——Plans have been prepared for a new 5-story brick addition to the Windsor Hotel, for J. T. Quackenbush, to cost about $18,000. Arch., E. W. Loth, 253 Broadway.——An addition will be erected to the Troy "Times" Building, at 3d St. and Broadway, to cost about $35,000. Arch., M. F. Cummings & Son, Times Bldg.

NEW BRUNSWICK, N. J.—Plans have been accepted for a 2-story brick and stone 12-room school building, 73 × 124 ft., to be erected on French St. We are informed that bids will soon be asked. Otto Stillman, Chn. Bldg. Com.; Geo. K. Parsall, Arch., 86 Church St.

ALLEGHENY, PA.—The Third Ward school board has awarded the contract for erecting new school buildings at North Ave. and James St. to S. H. McCain, of Allegheny, at $109,690. Work will begin about July 1.

ANNAPOLIS, MD.—C. R. Parlett, of Norfolk, Va., has been awarded the contract for erecting four double dwelling houses for the Naval Academy at this place, at $53,261. Morrow Bros., of Baltimore, were the next lowest bidders at $56,135.

BALTIMORE, MD.—Bids are asked until July 20 for erecting a new elevator in the City Hall; deposit required, $500. Everett J. Dowell, Inspector of Bldgs.

WESTMINSTER, MD.—Plans are said to have been accepted for a new bank and office building to be erected at this place. Arch., J. A. Hunter, Hagerstown, Md.

WASHINGTON, D. C.—A bill has been favorably reported to the Senate authorizing the purchase of three squares, 227,157 sq. ft., north of the Congressional Library and east of the Capitol, as a site for the proposed Supreme Court Building.——Hornblower & Marshall, 1509 H St., N. W., have prepared plans for a new building of

Law and Diplomacy to be erected on H St., near 15th St., by the Columbian University.——An appropriation of $50,000 has been made for the purpose of purchasing a site and beginning the construction of a manual training school for the first eight divisions, the commissioners being authorized to contract for the construction of the entire building at a cost not to exceed $125,000.——Fifty thousand dollars have been appropriated for the construction of two hospital buildings for minor contagious diseases, one on the grounds of the Providence Hospital, the other on the grounds of the Garfield Memorial Hospital.——The following bids were received by the supervising architect June 30 for repairs to the heating and power plant, etc., of the U. S. Treasury, the Winder and Marine Hospital (Butler) buildings at Washington:

Zellers & Co., Washington, D. C.	$16,065	70 days
Phila. Steam Heating Co., Washington	13,445	Sept. 15
E. Keeler & Co., Williamsport, Pa.	11,850	65 days
Wallace & Stebbens, Baltimore, Md.	16,248	Sept. 15
G. A. Suter & Co., New York	17,342	"
Bromell, Schmidt & Co., York, Pa.	12,525	"
E. Rutzler, New York	16,693	"
Blake & Williams, New York	14,175	"
Edward P. Bates, Albany, N. Y.	31,155	79 days

RICEVILLE, VA.—D. B. Petty informs us that bids will be received until July 25 for a fireproof county clerk's office. Address W. B. Sheppard, Chatham, Va.

NASHVILLE, TENN.—Bids are asked until July 15, according to press reports, for the construction of the new union railway station for the Louisville & Nashville Terminal Co. Pres., Major E. C. Lewis.

BOURNEVILLE, O.—Elmer E. Crone, Roxibel, O., was awarded the contract June 25 for erecting a new school building at Bourneville at $1,617.

DAYTON, O.—Bids are asked until July 21 for the erection of an 8-room addition to the 17th District school building. Clk., Wm. G. Haeussler.

MANSFIELD, O.—Bids are asked until July 25 for erecting certain additions to the East 4th St. and the Bloom St. school buildings. Chas. B. Jameson, Clk. Bd. of Education.

WOODSTOCK, O.—Bids are asked until July 18 for erecting a council chamber and jail. Minard Sessions, Village Clk.

CHICAGO, ILL.—Bids are asked until July 8 for the plaster, marble, bronze, iron and other finish for the engine room of the Chicago Public Library. Secy., W. B. Wickersham.——Bids are asked until July 15, according to reports, for erecting a 3-story apartment building on Calumet Ave., near 61st St., to cost about $40,000. Arch., Henry L. Newhouse, 4630 Prairie Ave.——Reports state that Harper Bros., mason contractors, 3635 5th Ave., contemplate the erection of a 4-story brick and stone apartment building at Indiana Ave. and 58th St., to cost about $30,000.

WAUSAU, WIS.—Reports state that the following bids have been received for the erection of the high school building. Archs., Van Ryne & De Gelleke, Milwaukee, Wis.: Fred. W. Krause, Wausau, $39,800; John Miller, Wausau, $43,380; John Andreres, Wausau, $43,344; Hackworthy Construction Co., Appleton, Wis., $49,000; Chas. Getzkow, Milwaukee, $49,900; Bonnett, Michie & Co., Milwaukee, $44,990; John H. Foster & Son, Ashland, Wis., $51,743.

CLINTON, IA.—Bids are asked until July 20 for a system of heating and ventilation, etc., for the Ringwood Park school building. Secy., A. H. Paddock.

DES MOINES, IA.—Plans are about prepared, according to reports, for the new Iowa Art and Memorial Hall, only one wing of which is to be built at present. Estimated cost, $57,000. Archs., Smith & Gutterson.

MINNEAPOLIS, MINN.—John Wunder, 11 Lumber Exchange, has been awarded the contract for erecting a 2-story brick sub-station, 42 × 52 ft., at 26th St. and 1st Ave., for the Northwestern Telephone Co., to cost $7 [illegible] It is reported that the architect, W. B. Dunnell, Bank of Commerce Bldg., has plans for a duplicate of this building to be erected in St. Paul.

ST. PAUL, MINN.—Bids are being received, according to reports, for the erection of a new church building, 85 × 175 ft., for St. Bonifacius German Catholic Church, to cost about $34,000. Archs., Herman Kretz & Co., New York Life Bldg., St. Paul.

COLUMBUS, NEB.—We are informed that $25,000 of school bonds have been sold, and that plans are now being made for the erection of a $18,500 school building. Bids will probably be received in the first part of July.

CHEYENNE, WYO.—The following bids were received June 30 by the supervising architect, Washington, D. C., for excavation, foundation, stone and brick work of basement and area walls, basement columns, first floor steel beams, girders, etc., for the U. S. Building at Cheyenne.

Moses O'Keefe & R. W. Bradley, Cheyenne	$35,800	4 mos.
G. W. Atkinson, Colorado Springs, Colo.	38,341	"
Bentley Construction Co., Milwaukee, Wis.	42,421	"
Geddis & Seerie Stone Co., Denver, Colo.	34,950	"
Jas. R. Gremis, Cheyenne	42,775	"
B. J. Jobst, Omaha, Neb.	35,950	"

KANSAS CITY, MO.—The following bids were received by the supervising architect, Washington, D. C., June 29, for the rear wall, steel and iron work, skylights, brick and terra cotta floor arches and certain changes in the U. S. Building at Kansas City, Mo.; L. L. Leach & Sons, Chicago, Ill., $43,000, time, 8 months; Pioneer Fireproof Construction Co., Chicago, Ill., $45,613, 7 mos.; Empire Fireproofing Co., Chicago, Ill., $42,500, 6 mos.; Dugan & Hayde, Kansas City, Mo., $45,748, 8 mos.; Wm. Harmon, Kansas City, $54,895, 5 mos.

ST. LOUIS, MO.—The Anderson Construction Co., 603 American Central Bldg., formerly Anderson Bros., has received the contract for remodeling the five buildings at 6th and Washington Aves., for D. Crawford & Co.

SEATTLE, WASH.—Nichols & Crothers have been awarded the contract for the construction of the Magnolia Bluff army barracks, at $82,000.

MORO, ORE.—Bids are asked until July 27 for the erection of a new church building for the Methodist Church. R. E. Hoskinson may be addressed.

ST. THOMAS, ONT.—We are informed that bids are asked until October 1 for the equipment of a 12-room school building to be erected in this city. Contracts for the erection of the building were to have been awarded June 30; heating, ventilating and seating bids have not yet been asked for. Estimated cost of building, $25,000; of equipment, $4,000. Archs., B. Long & Son, St. Thomas.

KASLO, B. C.—The plans of Ewart & Carrie are said to have been accepted for the municipal building to be erected here.

WATER-WORKS.

WINTHROP, MASS.—S. G. Irvin, Chn. Com., writes us that no information can be given as yet in regard to the proposed purchase of the works in this city. The committee has only got as far as to have an act passed authorizing the purchase of the works; population, 6,000.

WORCESTER, MASS.—The committee has recommended an appropriation of $72,000 for new water mains in about 20 streets. There will be required about 17,000 ft. of 8 to 40-in. mains.

FULTON, N. Y.—O. C. Breed, Cy. Engr., writes us that this city voted June 28 to build city works to cost $115,000. Developments await the action of the commission. General plans have already been prepared. Consult. Engr., Wm. R. Hill, Supt. and Engr. Water-Works Dept., Syracuse, N. Y.

MONTOUR FALLS, N. Y.—Dr. Geo. M. Post, Pres. village, writes us that this place voted June 29 to issue $34,000 in bonds to put in works. It is expected to [illegible] for bids soon for constructing the works. Engr., Alex. Potter, 137 Broadway, New York.

ASBURY PARK, N. J.—The Monmouth Water Supply Co. has been organized to construct new works for Neptune township, Asbury Park; capital stock, $100,000.——The question of issuing $40,000 in bonds for purchasing the present water supply in Avon and also for extending it is being considered. Jas. A. Bradley, Asbury Park, may be addressed.

JERSEY CITY, N. J.—The question of putting water-meters in the houses and buildings of this city is being considered by the city officials. It is stated that about 26,000 meters will be required.

PERTH AMBOY, N. J.—The Snow Steam Pump Works, Buffalo, N. Y., have been awarded the contract for furnishing and installing a 4,000,000-gallon pumping engine at Runyon. This award will be contested by the companies which bid lower, according to reports.

BARNESBORO, PA.—An election will be held July 9 to vote on the question of issuing $9,500 in bonds for works, according to reports.

MILLHALL, PA.—Jos. Jeffries, Secy. Millhall Water Co., writes us that no steps have yet been taken toward building the works.

PHILADELPHIA, PA.—An ordinance has been introduced in the common council authorizing an appropriation of $500,000 for a filtration plant.

BALTIMORE, MD.—It is reported that the council is considering the question of building a filtration system at the water-works at a cost of $1,500,000. Ch. Engr., E. G. Kenly.

WASHINGTON, D. C.—The chief of engineers has been directed to prepare plans and estimates for a method of filtering the Potomac water.——The American Pipe & Foundry Co., Chattanooga, Tenn., was awarded the contract June 27 for furnishing water pipe during the year ending June 30, 1899.

BESSEMER, ALA.—The Bessemer Land & Improvement Co. is reported as making surveys for increasing the water supply of the town.

CROWLEY, LA.—J. E. Barry, Mayor, writes us that the Consolidated Engineering Co., Ltd., New Orleans, La., has been awarded the contract for building the works and light plant for this place.

CINCINNATI, O.—Bids are asked until July 29 for constructing seven sluice gates for the intake for the Eastern pumping station, as described in our advertising columns. Chas. G. Roth, Clk. Bd. Water Comrs.

ELYRIA, O.—W. H. Park writes us that this place voted June 27 to purchase the works of the Elyria Gas & Water Co. for $45,000. The city was to take possession of the property July 1. Supt., G. E. Crisp.

GLOUSTER, O.—This place voted June 23 to build works, according to reports.

NORWALK, O.—The following contracts are reported to have been let June 29 for furnishing and constructing the stand-pipe, pumping station, etc., as advertised in Engineering News: B. P. Foster, Norwalk, stand-pipe, $2,300; Standard Boiler & Bridge Co., Alliance, metal work for stand-pipe, $6,588: the Snyder-Hughes Co., Cleveland, pumping engine, $7,830: S. Tolliat, Alliance, O., pumping station, building and chimney, $6,471; Erie City Iron Works, Erie, Pa., boiler, $1,085.

DELPHI, IND.—Bids are asked until July 19 for furnishing the materials and for constructing a 250,000-gallon masonry lined reservoir for the water-works. Wm. C. Smith, Cy. Attorney.

WHITING, IND.—Bids are asked until July 18 for furnishing and laying 6 to 10-in. cast-iron water pipe, hydrants, valves, etc. J. G. Erdlitz, Town Clk.

CASS CITY, MICH.—Bids are asked until July 20 for the purchase of $18,000 of 4% water and light bonds. H. W. Seed, Clk.

YALE, MICH.—Bids are asked until July 19 for furnishing and constructing works, as described in our advertising columns. E. F. Fead, Clk.

DUQUOIN, ILL.—Bids were asked until July 5 for furnishing the material and for building a dam, gate house, pumping station, pumps, etc., for completing the works, the contracts for a part of which were let last year. Job Cook, Cy. Clk.; D. W. Dunn, Mayor.

BLAIR, WIS.—E. L. Immell, Village Pres., writes us that the proposed works will have a reservoir on a hill 200 ft. high, three-quarters of a mile of 8-in. mains, etc.; estimated cost, $4,000; population, 500. E. O. Gellfellan is on the committee.

MENASHA, WIS.—Henry M. Northrup, Menasha, is reported to have applied for a franchise, the supply to be secured from wells. Population, 8,000. W. W. Reed, Cy. Engr.

ALDEN, IA.—M. Pritchard, Mayor, writes us that the city is ready to receive bids for furnishing and constructing works to cost $5,000. The works will have a 50-ft. steel tower, a 20 × 20-ft. wooden tank, 4 and 6-in. pipe, etc. The pump will not be determined upon until the well is completed. Engrs., Jackson & Moss, Des Moines, Ia.

MINDEN, IA.—Jno. W. Crow, Mayor, writes us that the following bids were received June 30 for furnishing the material, etc., and for building works:

	Per specifications.	Amended bids.
Casselbery & Schriner, Des Moines	$5,800	....
U. S. Supply Co., Omaha, Neb.	4,668	$4,293
Connelly & Shaw, Omaha, Neb.	4,750	4,002

The contract was awarded to Connelly & Shaw at $4,002. The council after considering the bids asked the bidders to put in a bid for steel tower and Roots spiral pipe, which resulted as follows: Connelly & Shaw, deduct $623 from original bid on tower and $125 on Roots pipe; U. S. Supply Co., deduct $150 and $225, respectively.

SPARTA, MINN.—Bids are asked until July 22 for furnishing and constructing works to cost $6,000; bond, $4,000. Engrs, Patton & Frank, Duluth, Minn.; Recdr., Clyde Bender.

BATESVILLE, ARK.—Bids are asked until July 14 for furnishing the material and for constructing the proposed works and light plant; estimated cost, $25,000. Engr., Owen Ford, 710 Security Bldg., St. Louis, Mo.; Chn. Com., C. R. Handford.

SAN JOSE, CAL.—Bids are asked by the supervisors until July 18 for furnishing and constructing a steel water tower and tank, etc., for the infirmary.

TRENTON, ONT.—Bids were asked until June 30 for furnishing the machinery and for constructing works. J. D. Evans, Engr. Trenton Water Co.; A. W. Hawley, Pres.

IRRIGATION.

NEW COMPANIES.—Sun River Operative Ditch Co., Helena, Mont.; $10,000; to construct a ditch in Cascade county; G. M. Bourquin, A. S. Douglas, Benj. Borgstede.

Pleasant Valley Canal Co., Helena, Mont.; $5,500; to construct an irrigation ditch or canal, taking the water from Rock Creek; Jeff Dinsdale, William Tennet, E. E. Esselty, L. D. Miller, D. W. Long, Martin Johnson, John McCune, W. P. Meyer, J. C. Simpson, William McIntyre.

Beaumont Irrigating Co., Beaumont, Tex.; $75,000; W. S. Davidson, J. B. Goodhue, J. E. Broussard, A. L. Goodhue and I. K. Bordages.

SEWERAGE.

BRENTWOOD, N. H.—The sewage disposal plant and filter beds at the Rockingham county farm, Brentwood, N. H., are to be enlarged and improved in accordance with plans submitted by Dudley & Doherty, 936 Elm St., Manchester, N. H.

BOSTON, MASS.—Bids are asked until Sept. 3 for furnishing and constructing a sewage pumping station, as described in our advertising columns. Wm. M. Brown, Jr., Ch. Engr. and Supt. Metropolitan Sewerage Comrs., 1 Mount Vernon St.

HOLYOKE, MASS.—Chas. P. Ferry, of the Bd. Pub. Wks., writes us that it is probable that an appropriation for sewering the Highlands will be made soon. A local paper states that the whole system for the Highlands will cost about $75,000.

SPENCER, MASS.—This place has voted to extend the Cherry St. sewer. N. E. Craig, Supt. Sewers.

DERBY, CONN.—E. S. Gordy writes us that the whole question of a system rests in abeyance. It is hoped to accomplish something during the next 12 months.

AMSTERDAM, N. Y.—Bids are asked until July 21 for constructing sewers in four streets. Geo. McClumpha, Secy. Sewerage Comm.

TONAWANDA, N. Y.—The boards of public works of this city and North Tonawanda are reported as again considering the question of improving the systems of these places.

JERSEY CITY, N. J.—The street and sewer board has asked the finance committee for $60,000 to reconstruct certain sewers.

WEST HOBOKEN, N. J.—The officials of this place and Jersey City are considering the question of building a joint sewer in New York Ave.

CAMBRIDGE SPRINGS, PA.—Ross & Robinson have been awarded the contract for constructing sewers in Main St. and Beach Ave.

ESPLEN, PA.—Bids are asked until July 7 for constructing a 24-in. pipe sewer with laterals in Third St. Engr., G. A. Gilfillan, 8 Fidelity Bldg., Pittsburg; Clk., A. W. Gibson, Esplen, P. O. McKee's Rocks, Pa.

PHILADELPHIA, PA.—Councils have appropriated $500,000 for building certain main sewers.

PHILADELPHIA, PA.—Bids will soon be asked by the director of the department of public works for constructing sewers in about 40 streets. Chas. F. Warwick, Mayor.

TAMAQUA, PA.—Samuel Beard, Town Clk., informs us that Ward & Stucker, Harrisburg, have been awarded the contract for building pipe sewers, as advertised in Engineering News. The bids were as follows:

Samuel W. Frescoln, Reading, Pa.	$4,949
E. H. Post, Wilkesbarre, Pa.	6.218
Phil. J. Boyle & Co., Hazleton, Pa.	6,099
Ward & Stucker, Harrisburg, Pa.	4,559
P. J. Cleary, Shenandoah, Pa.	6,8[illegible]0
W. J. Coons, Kingston, Pa.	5,140
Humphreys & Rowe, Ashland, Pa.	8,158
J. B. Urie, Tamaqua, Pa.	6,944
Hadesty & Kitchen	7,048

WARREN, PA.—Bids are asked until July 9 for building 2,900 ft. of pipe sewer in the 5th and 6th Wards. R. G. Mead, Chn. Com.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 16 for constructing sewers.——Congress has appropriated $25,000 for the purchase of land and for preparing plans for the proposed sewage pumping station, under the approved project for sewage disposal in the District of Columbia.

GOLDSBORO, N. C.—Bids are asked until July 21 for furnishing and constructing about 12 miles of 20 to 6-in. pipe sewers, as stated in our advertising columns. Engr., J. L. Ludlow, Winston, N. C.; Cy. Clk., D. J. Broadhurst.

SPARTANBURG, S. C.—J. M. Elford, Clk. and Treas., writes us that the contract for surveys, plans and specifications for a system has been let to J. L. Ludlow, Winston, N. C. Arrangements have also been made for awarding the contracts.

WAYCROSS, GA.—Press reports state as follows: The proposition of C. G. McCranie to build the system for Waycross for about $36,000 includes seven miles of additional sewers than was designated in Mayor Knight's estimate. It is presumed that Mr. McCranie's offer is bona fide, and in case the $50,000 bonds shall be voted he will stand a good chance of getting the contract. There is some little opposition to the bonds, but the only objection raised so far by the opposition is that $100,000 is preferable to $50,000, and that the time is not opportune.

MEMPHIS, TENN.—A. T. Bell, Cy. Engr., writes us that 17½ miles of sewers have been built this year. Nothing more will be done before the spring of 1899.

LEXINGTON, KY.—Local papers state that arrangements are being made for constructing a larger sewer at the Main St. railway crossing.

DETROIT, MICH.—Bids are asked until July 8 for furnishing such sewer pipe as may be required during the year ending June 30, 1899. D. W. H. Moreland, Pres. Bd. Pub. Wks.

MARSHALL, MICH.—Riggs & Sherman, 613 The Nasby, Toledo, O., have been engaged to prepare plans and specifications for the proposed system and certain paving.

TRENTON, MICH.—The council will probably soon issue $1,500 in bonds for building 2,500 ft. of 18-in. pipe sewer.

ST. PAUL, MINN.—Anderson & Johnson have been awarded the contract for constructing a sewer in Gauitier St. at $4,923.

HUDSON, WIS.—J. W. Bashford, Mayor, writes us that no sewers will be built this year.

DENVER, COLO.—Plans are reported as about completed for the proposed system of storm sewers for East Denver. L. N. Wood, Pres. Bd. Pub. Wks.

SAN LOUIS OBISPO, CAL.—The city engineer has submitted estimates for extending the system, at a cost of about $35,000.

CHARLOTTETOWN, P. E. I.—Bids are asked until July 8 for furnishing sewer pipe, etc., for the proposed system. Engr., F. C. Coffin, 53 State St., Boston, Mass.; Chn. Com., David Laird.

GUADALAJARA, JALISCO, MEX.—It is reported that the W. S. Dickey Clay Mfg. Co., Kansas City, Mo., has secured the contract to furnish this city with 300 carloads of sewer pipe for the proposed system for this city. The system will cost complete about $500,000.

GARBAGE DISPOSAL—STREET CLEANING

MANCHESTER, N. H.—It is reported by the local papers that the council will probably soon ask for bids for removing the garbage and refuse of the city. A citizen has applied for a franchise for the work, the city to pay him $18,000 a year.

CRANSTON, R. I.—Bids were asked until July 5 for collecting and removing the garbage from the villages of Auburn, Arlington, Cranston, Edgewood, Knightsville, Meshanticut and Pawtuxet during the ensuing year. Daniel D. Waterman, Council Clk.

ATLANTIC CITY, N. J.—The council has voted to issue $40,000 in bonds for building a crematory; the lot will cost, $6,000 and the plant $32,000. Councilmen Kelly and Lee may be addressed.

JERSEY CITY, N. J.—The street and water board has asked the council to appropriate $75,000 in addition to the usual appropriation for cleaning the streets.

MILWAUKEE, WIS.—Judge Ludwig has dissolved the temporary injunction restraining the city from selling $160,000 in bonds for the proposed garbage disposal plant, according to reports.

ST. LOUIS, MO.—Bids are asked by the board of health until July 8 for collecting and disposing of the garbage and refuse of the city for 10 years. The present contract with Edward Butler expires July 14.

STREETS AND ROADS.

DEERING, ME.—D. F. Griffin & Bros. submitted the lowest bids June 28 for laying 8,000 sq. yds. of granite paving, at $13,440.

NEW CASTLE, N. H.—The survey of the Ocean Boulevard has been completed and plans and estimates will be submitted at the next meeting of the council. Dudley & Doherty, Engrs., Manchester.

BURLINGTON, VT.—Bids are asked until July 10 for the purchase of $20,000 of 4% street improvement bonds. L. C. Grant, Cy. Treas.

REVERE, MASS.—Miric & Wentworth, Malden, have been awarded a contract at $9,600 for street work.

NEWPORT, R. I.—Bids are asked until July 15 for 6,630 sq. yds. of asphalt paving. William Hamilton, St. Comr.

BRIDGEPORT, CONN.—Main St. will be paved with asphalt at a cost of about $8,060. Thos. P. Taylor, Mayor.

HARTFORD, CONN.—Bids are asked until July 13 for constructing about 2,000 sq. yds. of Trinidad sheet asphalt and furnishing and laying concrete foundation. Chas. H. Northam, Pres.

NEW HAVEN, CONN.—Bids are asked until July 8 for paving Wall St. with concrete, from York St. to State St., and for furnishing crushed stone for the year. C. W. Kelly, Cy. Engr.

WATERTOWN, CONN.—Bids are asked until July 13 for improving a road from Watertown to Waterbury. Geo. A. Harper, First Selectman.

BINGHAMTON, N. Y.—Bids are asked until July 15 for brick paving in Court St., from Exchange to Carroll St. B. W. Mosher, Cy. Clk.

EAST AURORA, N. Y.—Bids are asked until July 11 for paving in Main St. C. H. Addington, Clk.

KINGSTON, N. Y.—J. T. Cummings, Cy Clk., has been ordered to advertise for bids for grading and curbing several streets.

NEW YORK, N. Y.—Bids are asked by the department of highways, 150 Nassau St., until July 14, for furnishing broken stone and screenings and 100,000 gallons of No. 6 paving cement; also for repairing asphalt pavement in certain streets in the Borough of Brooklyn. Jay A. Keating, Comr.

NORWICH, N. Y.—The board of trustees will vote on a resolution July 11 to pave East Main St., West Main St. and Broad St. with brick, to cost about $35,000. John W. Bingham, Clk. Bd.

POUGHKEEPSIE, N. Y.—The board of public works has awarded a contract to Cornelius Daley, at $14,602, for paving in Main St.

ROCHESTER, N. Y.—The following are the lowest bids received by the board of public works June 27 for paving: Warren-Scharf Asphalt Paving Co., asphalt, Columbia Ave., $41,431; asphalt, Tremont Place, $1,457; Chambers & Casey, macadam, Post St., $4,949.

TROY, N. Y.—Bids are asked until July 12 for paving Franklin St. with brick, from Congress St. to Ferry St. E. Ogden Ross, Secy. Contracting Bd.——Contracts were awarded June 28 to M. J. Jackson & Son, at $21,217, and Frank Besch, at $27,389, for brick paving in two streets.

FREEHOLD, N. J.—Bids are asked until July 13 for constructing 7,871 lin. ft. of gravel road, in Millstone township. J. D. Honce, Clk. Bd. Freeholders.

MORRISTOWN, N. J.—The board of freeholders have awarded a contract to Augustus Munson & Co., at $19,167, for grading and macadamizing the Basking Ridge Road.

NEWARK, N. J.—Bids are asked until July 7 for furnishing the materials and paving six streets with asphalt or granite. M. F. McLaughlin, Supt. Bd. St. Comrs.

CARBONDALE, PA.—Bids are asked until July 23 for about 7,460 sq. yds. of paving, as stated in our advertising columns. F. B. Clifford, Cy. Clk.

ERIE, PA.—Proposals will soon be asked for curbing several streets. T. Hanlon, Cy. Clk.

READING, PA.—Bids will soon be asked by the board of public works for brick paving in portions of nine streets, to cost about $100,000.

SUNBURY, PA.—Bids were received July 5 for about 5,350 sq. yds. of brick paving, 2,700 lin. ft. of curb, etc. P. H. Moore, Ch. Burgess.

TARENTUM, PA.—Bids are asked until July 20 for constructing 5,950 sq. yds. of pavement, according to reports. John Duster, Chn. Com.

DURHAM, N. C.—An election will be held on Aug. 1 to vote on the question of issuing $225,000 in bonds for street improvements, an electric light plant and water-works.

ASHLAND, O.—Bids are asked until July 30 for 1¼ miles of brick paving, as stated in our advertising columns. E. B. Westover, Clk.

COLUMBUS, O.—Bids are asked until July 12 for furnishing the material and constructing seven roads. W. H. Halliday, County Audr.

SOUTH BEND, IND.—Bids are asked until July 25 for constructing 26,000 sq. yds. of sheet asphalt pavement in West Washington St., from Michigan St. to South Walnut St. Wm. H. Rosencrans, Cy. Engr.

DETROIT, MICH.—The board of public works has awarded a contract to the Michigan Stone & Supply Co., at $16,993, to macadamize La Salle Ave.

DETROIT, MICH.—Bids are asked until July 11 for furnishing the material and constructing about 32,000 sq. yds. of cedar block paving on concrete. D. W. H. Moreland, Pres. Bd. Pub. Wks.

GRAND RAPIDS, MICH.—The Warren-Scharf Asphalt Paving Co. has been awarded a contract at $21,074 to pave Crescent Ave.

MARSHALL, MICH.—Riggs & Sherman, Engrs., 613 The Nasby, Toledo, O., are preparing plans and specifications for paving.

CHARLESTON, ILL.—Bids will be asked about July 27 for paving, according to reports. T. V. Miles, Cy. Clk.

CHAMPAIGN, ILL.—Bids are asked until July 14 for brick paving, as stated in our advertising columns. J. R. Scott, Pres. Bd. Local Improvements; R. P. Brower, Cy. Engr.

DECATUR, ILL.—It is proposed to pave portions of Jasper and Sangamon Sts. with asphalt; estimated cost, $19,899.

WAUKEGAN, ILL.—The board of local improvements has decided to pave and construct sidewalks in Water St., to cost about $6,900.

PORTAGE, WIS.—Bids are asked until July 8 for brick paving, according to reports. J. E. Jones, Mayor.

CEDAR FALLS, IA.—F. O. Jackson, Cy. Clk., informs us that bids will be asked after July 11 for brick paving in six blocks. D. M. Rosser, Engr., Cedar Falls.

DES MOINES, IA.—The council will vote July 11 on a resolution to pave two alleys with brick. John MacVicar, Mayor.

IOWA CITY, IA.—Bids are asked until July 15 for furnishing the material and constructing 3,090 sq. yds. of brick pavement, 1,727 lin. ft. of curb and 1,292 cu. yds. of grading. W. J. Bowen, Cy. Clk.; Arthur J. Cox, Cy. Engr.

SIOUX CITY, IA.—Bids are asked until July 12 for the following pavement: 6,258 sq. yds. of sheet asphalt, 24,572 sq. yds. of brick on concrete base and 12,313 sq. yds. of brick on sand foundation. J. M. Lewis, Acting Cy. Engr.

ANACONDA, MONT.—Bids are asked until Aug. 2 for laying out the Lincoln & Hehnville Road for a distance of 12 miles. H. B. Davis, County Surveyor; M. Martin, Clk.

HOUSTON, TEX.—An ordinance authorizing the city to borrow $100,000 for paving and sewer purposes has been referred to the ordinance committee.

SEATTLE, WASH.—Reports state that the question of constructing a road and bicycle path from Seattle to Tacoma is being considered. F. M. Little, Supt. Sts., may be addressed.

SPOKANE, WASH.—Bids are asked until July 14 for paving in Riverside Ave. with sheet asphalt on concrete foundation; also for maintaining the same for 10 yrs. B. H. Fowle, Secy. Bd. Pub. Wks.

ST. JOHN, N. B.—The board of public works has received estimates for the improvement of about 20 streets. Director Smith of Superintendent Martin may be addressed.

MANUFACTURING PLANTS.

BRIDGEPORT, CONN.—The factory of the Coach Lace Co., on John St., has been damaged by fire. The building is a 4-story brick structure, 150 × 50 ft., and the loss is estimated at $75,000.

BUFFALO, N. Y.—We are informed that Henry S. Schaefer's Sons, Oak and Virginia Sts., Buffalo, have received the contract for the erection of a new 8-story fireproof building, 182 × 150 ft., for the Larkin Soap Co.; estimated cost, $200,000. Arch., Robt. J. Reidpath, Real Estate Exchange, Buffalo.

BRONXVILLE, N. Y.—The factory of the Ward-Leonard Electric Co., in this village, was burned, July 2, causing a reported loss of $45,000.

ORANGE, N. J.—The hat factory of Austin Drew & Co., on Nassau St., was destroyed by fire July 4, causing a loss of about $80,000.

CONNELLSVILLE, PA.—It is reported that the Slaymaker-Barry Co. has decided to rebuild at once the lock works at South Connellsville, at a cost of about $40,000. Pres., S. R. Slaymaker.

YORK, PA.—The York Mfg. Co. will erect a 2-story machine shop at this place, according to reports. Electrical equipment will be required.

LOUISVILLE, KY.—Press reports state that the iron foundry of Snead & Co., which was destroyed by fire on June 23, will be rebuilt at once. Estimated loss, $150,000; insurance, $136,800. Vice-Pres., Udolpho Snead.

SIOUX CITY, IA.—Bids are still being received, according to reports, on the equipment for the new brewing plant which will be built in this city for the Sioux City Brewing Co., at an estimated cost of $250,000 for the buildings and $100,000 for the equipment. We are informed that there will be installed therein several Corliss engines, tubular boilers, an electric light plant capable of supplying 150 lights, etc. Arch., Wilhelm Greisser Engineering Co., 909 Schiller Bldg., Chicago, Ill.

KANSAS CITY, MO.—M. G. Orendorff, Secy. and Treas., Parlin & Orendorff Co., of Canton, Ill., informs us that the company will erect a 6-story building, 192 × 127 ft., in this city, for use as an agricultural implement and jobbing warehouse. Plans have not yet been decided upon, and no contracts have been awarded. Plans will probably be received on architect's specifications some time this month. Electric lights will be used; no engines other than electric dynamos for operating elevators will be required. Estimated cost of full equipment, $75,000.

MOUNT GROVE, MO.—The Star Roller Mills, of Mount Grove, informs us that the capacity of the flour mills will be increased to 200 barrels. No engines or boilers are required, but a dynamo to supply 100 electric lights will be bought. No contracts have been let.

FAIRHAVEN, WASH.—Reports state that H. L. & J. W. Roan will erect an ice and cold storage plant at this place at a cost of about $25,000.

GAS PLANTS.

FRANKLIN, N. Y.—A. J. Richardson will lay gas mains to supply the city with natural gas.

CAMDEN, N. J.—Bids are asked until July 20 for supplying this city with gas light during the ensuing year. Chas C. Southard, Chn. Lighting Com.

DELAWARE, O.—J. C. Childs, owner of the natural gas fields at Mount Vernon, is reported to have been granted a franchise to supply this city with gas.

NEW COMPANIES.—Henry G. Thompson Co., New Haven, Conn.; $50,000; to manufacture gas meters and other machinery; Henry G. Thompson, Samuel G. Mower, H. Grant Thompson, New Haven.

Uniontown Cotton Oil Co., Uniontown, Ala.; $40,000; J. H. White, W. H. Taylor, G. B. Johnstone, W. J. White.

American Illuminating Gas & Fuel Co., Boston, Mass.; $1,000,000, with $125 paid in; E. D. Luxton, New York; H. W. Bates, J. D. Huhn, Boston.

MISCELLANEOUS CONTRACTS.

FIRE ENGINES.—Lincoln, Neb.—The council has decided to purchase a fire engine.

FIRE APPARATUS.—Montgomery, Ala.—The mayor has been authorized to purchase new fire apparatus.

TELEPHONE LINE.—Hanover, Pa.—The Hanover Telephone Co. has decided to extend its line to Glenville.

TELEPHONE SYSTEM.—Windsor, Mich.—The council has granted a 20-year franchise to the People's Telephone Co.

FIRE ALARM SYSTEM.—Peoria, Ill.—The fire and water committee is investigating the cost of installing a fire alarm system.

FIRE ENGINE.—Cleveland, O.—Bids are asked until July 14 for furnishing one first size steam fire engine. G. L. Hechler, Dir. Fire Service.

BONDS.—Holly Springs, Miss.—Bids are asked until Aug. 2 for the purchase of $43,000 of 6% bonds. John Calhoon, Mayor; G. C. Cannon, Clk.

RETORTS.—Hamilton, O.—Bids are asked until July 15 for constructing three benches of retorts with new iron work for the same. M. O. Burns, Cy. Clk.

RECREATION PIER.—Brooklyn, N. Y.—The dock department will soon call for bids for completing the Brooklyn recreation pier; estimated cost, $8.000.

DREDGING.—Waukegan, Ill.—Bids are asked until July 9 for dredging the channel of the harbor of this city, making the same 18½ ft. below datum. H. Thacker, Cy. Clk.

DIKE.—York River, Va.—Bids are asked until Aug 6 for constructing a dike at York River, as stated in our advertising columns. Lt.-Col. Chas. J. Allen, U. S. Engr., Washington, D. C.

WHARF AND FREIGHT SHED.—Halifax, N. S.—Bids are asked by the Intercolonial Railway Co. until July 15 for constructing a wharf and freight shed at this place, according to reports. D. Pottinger, Gen. Mgr., Moncton, N. B.

DREDGING, ETC.—Virginia.—Bids are asked until Aug. 6 for dredging and rock excavation in Rappahannock River and Urbanna Creek, Va., as stated in our advertising columns. Lt.-Col. Chas. J. Allen, U. S. Engr., Washington, D. C.

CHANGING CHANNEL.—Dayton, O.—The contract for changing the channel of the Miami River from the north corporation line to the Dayton & Michigan R. R., was awarded, June 30, to John Williams & Co., at $38,079, according to reports.

PIER AND DREDGING.—Cleveland, O.—L. P. & J. A. Smith Co., Cleveland, has submitted the lowest bid, at $451,264, for constructing and removing a part of the west pier, dredging and completing the east breakwater. Col. J. A. Smith, U. S. Engr.

UNDERGROUND CROSSING.—Kingston, N. Y.—Bids are asked until July 16 for furnishing the material and for constructing an underground crossing for the Colonial City Traction Co., as stated in our advertising columns. (Postponement from July 9.) C. Gordon Reel, Supt. and Engr.

MONITORS AND TORPEDO-BOATS.—Washington, D. C.—Bids are asked by the navy department until Aug. 9 for furnishing and constructing torpedo-boats and destroyers and until Oct. 1 for four monitors about 225 ft. long and 50 ft. wide, to cost about $1,200,000 each, exclusive of armament.

DRAIN.—Coldwater, Mich.—Bids are asked until July 15 for the construction of Kinderhook No. 1 drain, including a catchbasin. Work will be let in five contracts, as follows: Furnishing tile drain, constructing tile drain, constructing open drain, cleaning old drain and constructing catch basin. Danl. E. Weage, County Drain Comr., Coldwater.

DREDGING, QUAY WALL, ETC.—Brooklyn, N. Y.—Bids are asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 16, for dredging Whitney Basin and Wallabout Bay, for constructing quay wall between Dry Dock No. 1 and Main St., and for constructing quay wall, coal dock, all at the U. S. Navy Yard, Brooklyn, New York (three bids). Mordecai T. Endicott, Chf. of Bureau, Washington, D. C.

DREDGING.—Boston, Mass.—The following bids were received June 28 by the harbor and land commissioners for dredging in South Bay, as advertised in Engineering News, and either depositing the material within the harbor lines or at sea:

	First alternative.	Second alternative.
Pan-American Dredging Co., Boston..	$29,987	$33,500
Eastern Dredging Co., Boston.........	43,650	43,894
International Contracting Co.........	43,500	38,000
Albert Hussey, New York............	36,118	36,148

CONTRACT PRICES.

SEWERAGE SYSTEM.—Mercer, Pa.—G. B. Zahniser, Engr., Clendenin Block, New Castle, Pa., informs us that the following bids were received June 27, 1898, for a sewerage system for the east side, as advertised in Engineering News; minimum grade, 50%; maximum grade, 22%; Cy. Clk., J. M. Campbell:

	Pipe, a ft.						
	Sewer, laid.			Iron.			
Bidder.	6-in., 10,700 ft.	8-in., 1,300 ft.	10-in., 565 ft.	36 ft.	Flushtanks, 3, each.	Manholes, 3, each.	Lampholes, 19 each.
J. M. Dieterle ..	$0.26	$0.27	$0.32	$1.30	$50.00	$17.00	$3.00
C. R. De Gradt..	.30	.34	.36	2.50	55.00	25.00	8.00
J. W. Mitchell...	.23	.28	.30	1.05	36.00	22.00	4.00
W. H. Mitchell..	.21	.22	.25	.88	50.00	18 00	3.50
C.T.S. McQuiston	.30	.335	.43	1.75	50.00	25.00	4.00
T. McGuiggan...	.24	.31	.35	2.667	45.00	30.00	4.75
J. W. Kelley....	.34	.37	.43	1.10	60.00	28.00	4.30

F. F. Sutliff & Son, lump sum for system complete...$3,310

BRICK PAVING.—Wilmington, Del.—Harvey J. Wiley, Secy. St. Depart., informs us that a contract was awarded to Simmons & Bros., June 21, for constructing 30,000 sq. yds. of brick pavement at 5½ cts. a sq. yd. Francis McCloskey, St. Comr.

PIER WORK.—Cleveland, O.—We are informed that the following bids were received June 23, 1898, for constructing a part of West Pier, removing part of old West Pier, dredging and completing East Breakwater at Cleveland Harbor, as advertised in Engineering News; Col. Jared A. Smith, U. S. Engr., at Cleveland:

Bids Received at Cleveland, O., June 23, 1898, for Pier Work.

Quantities.	D. & G. Griese, Cleveland, O.	I. V. Hoag, Jr, Pittsburg, Pa.	Jno. Gill & Sons, Cleveland, O.	Michael Rabbitt, Toledo, O.	Carkin, Stickney & Cram, Detroit, Mich.	James B. Donnelly, Buffalo, N.Y.	J. A. Smith Co., Cleveland, O.	A. F. Chapman & Co., Buffalo, N.Y.	Joseph J. Churchyard, Buffalo, N.Y.
Hemlock timber 7,059,959 ft. B.M.	$19.00	$23.00	$17.75	$23.25	$15.50	$15.00	$15.50	$17.90	$17.50
White p. timber 2,780,279 " "	29.50	30.00	31.75	33.25	21.50	24.00	25.00	27.00	27.50
Sheath'g, old w'k*204,462 " "	39.00	125.00	87.50	65.00	60.00	75.00	50.00	75.00	60.00
" new wk*455,720 " "	37.00	100.00	38.00	65.00	60.00	15.00	40.00	75.00	54.00
Other than sh't'g*111,264 " "	31.00	150.00	35.00	38.00	35.00	36.80	30.00	34.00	34.50
White oak piles... 9,720 lin. ft..	.40	.45	.45	.45	.26	.42	.25	.35	.25
Tie rods ....617,570 lbs.....	.035	.03	.025	.0325	.025	.02	.02	.03	.03
Bolts and washers871,055 "	.035	.03	.025	.035	.0225	.035	.02	.03	.03
Lag screws .....313,150 "	.035	.03	.05	.135	.035	.026	.025	.02875	.04
Drift bolts ....758,366 "	.03	.03	.02	.035	.02	.02	.015	.0275	.02
Spikes .... 17,200 "	.04	.03	.03	.045	.035	.03	.02	.035	.03
Straps ....193,435 "	.04	.07	.035	.035	.02	.03	.03	.04	.03
Bent plates ...... 9,280 "	.03	.07	.03	.10	.02	.025	.03	.045	.05
Wire nails ...... 1,400 "	.03	.03	.03	.06	.04	.02	.02	.03	.03
Mooring rings ... 180 "	.08	.07	.20	.135	.06	.10	.03	.06	.10
Stone, filling cribs and pier fudtn.131,500 tons....	1.10	1.50	1.06	1.12	1.15	.81	.80	1.15	1.90
Leveling fndtn†. 3,500 " ...	2.50	1.80	1.25	1.50	1.15	.81	.80	1.20	1.00
Riprap protectn† 25,000 " ...	1.75	2.25	1.06	1.60	1.15	1.05	.80	1.45	1.20
Sand filling. ..... 3,600 cu. yds.	.60	.75	.50	.67	.15	.70	.20	.20	.40
Conc. or stne blks 43,368 cu. ft...	.23	.70	.375	.47	.40	.26	.40	.42	.40
Concrete in place. 4,565 " "	3.65	8.00	5.35	7.29	6.40	5.72	5.00	7.00	5.25
Rmvg West Pier.. 1,540 lin. ft..	16.00	27.00	5.00	4.50	5.00	5.00	1.00	8.00	3.00
Dredging ....140,000 cu. yds.	.16	.21	.13	.12	.12	.12	.08	.125	.14
Moving store-house	350.00	100.00	250.00	150.00	500.00	150.00	50.00	250.00	200.00
Total	$616,240	$818,877	$571,648	$708,542	$537,230	$478,350	$450,274	$614,101	$541,371

*White oak. †East breakwater.

SEWERS.—North Tarrytown, N. Y.—W. E. Crane, Engr., informs us that the following bids were received June 16, 1898, for constructing sewers in Sections 2 and 3, as advertised in Engineering News; bids were called for four items—(G) 90 ft. cast-iron pipe under N. Y. C. & H. R. R. R. tracks, and (J) 90 ft. wrought-iron, which is selected; also items (H) and (U) cast-iron outlet and wooden stave outlet pipe into Hudson River; iron pipe is selected to low water line and wooden stave the remaining distance:

BIDS RECEIVED AT NORTH TARRYTOWN, N. Y., JUNE 16, 1898, FOR CONSTRUCTING SEWERS IN SECTIONS 2 AND 3.

Quantities.		Job Small, Sing Sing, N. Y.	C. H. Connel, New York,	S. W. Frescoln, Reading, Pa.	Alex. S. Traub, New York.	D. F. Minihan & Son, Orange, N. J.	Joseph Murphy, Yonkers, N. Y.	John Callery, Weehawken, N. J.	C. M. Haines & Co., Rhinebeck, N. Y.	Ward & Stucker, Harrisburg, Pa.	James J. Shaw, White Plains, N. Y.	Bellew & Merrit Co., Tuckahoe, N. Y.	J. W. McConnell, Brooklyn, N. Y.	G. H. Eldridge, Sing Sing, N. Y.	Baker, Banker & Co., Gloversville, N. Y.	Clapp & Shipman, New York.	Van Vranken & Duel, Tarrytown, N. Y.	Edward H. Post, Wilkes Barre, Pa.
Excavation Earth	14,638 cu. yds.	$0.40	$0.45	$0 30	$0.40	$0.50	$0.40	$0.49	$0.27	$0.33	$0.43	$0.59	$0.26½	$0.35	$0.40	$0.55	$0.40	$0.54
Excavation Rock	3,366 " "	1.20	2.50	1.30	2.90	2.85	.40	1.50	2.45	2.30	3.00	2.19	1.70	2.45	2.10	2.00	2.50	2.00
Masonry Concrete	271 " "	2.50	7.00	4.00	4.00	5.60	4.00	4.00	4.50	4.50	4.00	5.00	4.00	7.00	5.00	3.50	4.50	5.00
Masonry Brick	197 " "	6.50	8.00	8.00	7.00	7.70	7.00	7.50	6.25	7.00	5.25	11.00	7.00	8.50	10.00	8.50	8.00	9.00
Masonry Rubble	26 " "	3.00	5.00	4.00	3.00	5.40	5.00	10.00	4.00	4.50	5.00	4.50	4.00	5.00	5.00	4.00	4.50	4.00
Manholes and covers	58 each...	24.00	14.00	10.00	10.00	10.00	10.00	7.00	7.95	7.50	12.50	8.25	7.50	10.50	7.50	8.00	10.00	16.00
Sewer pipe (G)20-in., c.i.	20 lin. ft..	4.00	6.00	3 65	3.00	16.00	15.00	2.70	7.00	3.20	7.00	4.80	3.00	5.00	7.00	5.00	3.50	7.00
(H)18-in., c. i.	200 " "	3.72	3.50	8.50	4.00	15.00	3.50	2.35	3.25	2.80	3.00	4.30	5.00	8.00	6.50	3.00	5.75	6.50
All other c.i.	500 lbs.....	.03	.02	.03	.02	.04	.03	.05	.01¾	.02½	.05	.01	.02½	.01½	.05	.04	.10	.025
(J)20-in, wt. i.	90 lin. ft..	5.00	8.00	5.00	3.00	14.00	15.00	15.00	7.85	6.20	6.50	6.70	10.00	10.00	8.00	6.00	7.50	6.50
All othr wt.i.	1,910 lbs.....	.10	.05	.05	.02	.04	.05	.05	.02½	.02½	.10	.04	.04	.05	.10	.04	.10	.07
20-in., vit'f'd	1,828 lin. ft..	.78	.65	.55	.60	.80	.87	.73	.47	.45	.58½	.92	.58	.67	.65	.66	.60	1.00
18-in., "	1,300 " "	.60	.55	.43	.45	.45	.70	.62	.38	.34	.46	.63	.49	.54	.55	.54	.46	1.10
15-in., "	240 " "	.48	.40	.33	.35	.40	.65	.50	.30	.27	.36	.48	.40	.42	.45	.40	.40	.72
12-in., "	3,780 " "	.41	.26	.23½	.22	.25	.55	.35	.22	.17	.26½	.34	.28½	.31	.30	.29	.27	.43
10-in., "	5,500 " "	.33	.22	.16½	.18	.20	.50	.25	.18	.13	.21½	.25	.20	.26	.22	.25	.19	.30
8-in., "	10,922 " "	.24	.15	.11½	.15	.18	.40	.15	.14¾	.11	.15¼	.23	.17	.18	.15	.12	.14	.25
6-in. undrdns	760 " "	.20	.15	.16	.20	.40	.12	.12	.11	.10	.20	.28	.12	.12	.25	.07	.15	.30
Piling driven	4,100 " "	.26	.25	.20	.25	.55	.35	1.00	.22½	.30	.30	.30	.26	.35	.25	.20	.20	.25
Piling cut off	1.........	.26	.25	.06	.22	.40	.35	.25	.12	.20	.10	.30	.10	.10	.12½	.15	.40	.25
Grillage Pine	29,000 ft. B.M.	.22	30.00	32.00	35.00	32.00	25.00	30.00	30.00	27.00	...	26.00	28.00	26.50	28.00	30.00	35.00	45.00
Grillage Spruce	1,000 " "	.20	35.00	30.00	33.00	25.00	20.00	30.00	23.00	21.00	28.50	25.00	19.00	23.50	25.00	25.00	30.00	30.00
Grillage Hemlock	1,000 " "	.18	30.00	28.00	30.00	22.00	18.00	30.00	18.00	16.00	25.50	23.00	14.00	20.00	20.00	22.00	30.00	30.00
(U)18-in. w'den pipe.	200 lin. ft..	5.40	2.50	7.50	7.00	6.50	3.50	1.50	2.75	3.75	3.00	3.50	1.50	6.00	6.00	3.50	4.50	6.70
Sheeting and shoring	2,200 ft. B.M.	20.00	15.00	20.00	10.00	20.00	20.00	20.00	19.00	15.00	25.00	15.00	15.00	16.00	20.00	20.00	20.00	30.00
Earth embankment..	150 cu. yds.	.50	1.50	1.25	.40	1.10	.90	1.00	.90	.50	.95	.80	.50	1.00	1.00	.40	.75	1.00
Lamphole casting ..	18 each...	6.00	5.00	3.00	5.00	5.00	4.00	25.00	2.30	4.00	7.50	4.00	4.00	4.00	3.00	3.00	4.00	4.50
Flushtnk appliances.	10 " ...	20.00	50.00	25.00	25.00	30.00	15.00	50.00	23.50	20.00	40.00	26.00	16.00	31.00	20.00	25.00	30.00	30.00
Stone riprap	52 cu. yds.	1.75	2.50	2.00	1.50	3.00	1.00	1.50	1.50	1.25	1.75	2.75	2.00	3.00	2.00	2.00	1.50	2.50
Total		$26,878	$30,860	$23.459	$29,502	$38,215	$29.179	$30,870	$25,110	$24,350	$29,856	$33,457	$23,432	$31,185	$29,492	$28,445	$29,040	$35,534

Note.—Four items, (G), (H), (J) and (U) are double items—only two, i. e., 18-in. wooden outlet pipe, 18-in. cast-iron outlet pipe, one selection; 20-in. wrought iron (R. R.), 20-in. cast-iron (R. R.) the city's selection, are to be selected.

BRICK PAVING.—Nanticoke, Pa.—Rebesser & Edmunds have been awarded the following contract for brick paving in Main St.: Park wire cut brick, $1.18 a sq. yd.; straight curbing, a ft., 63 cts.; resetting old curbing, a ft., 15 cts.; granite curbing, a ft., 90 cts. Dr. W. T. Mahon, Pres. Council.

CEMENT SIDEWALKS.—Hastings, Minn.—E. E. Tuttle, Chn. Com., writes us that the Portland Stone Co., St. Paul, has been awarded the contract for cement tile sidewalks, at 72 cts. a sq. yd.

GRANITE PAVING, ETC.—Richmond, Va.—W. E. Cutshaw, Cy. Engr., writes us that the council committee awarded the following contracts, June 28, for granite spall paving, granite curbing, etc. Paving, Chas. Ganer and J. A. Gude, 65 cts. a sq. Byd.; curbing, Albin Netherwood, 53 cts. to 58 cts. a lin. ft.; brick paving, M. E. Billings, a half square, 63 cts a sq. yd.

PAVING AND SEWERS.—Meadville, Pa.—We are informed that the following bids were received June 29, 1898, for building a pipe storm sewer and for paving, as advertised in Engineering News; D. T. McKay, Jr., Cy. Clk.:

Bids Received at Meadville, Pa., June 29, 1898, for Paving and Pipe Storm Sewer.

Items and quantities.		*Peter Schenck, Butler, Pa.	James McAffee & Co., Allegheny, Pa.	Osborn & Fredericks, Franklin, Pa.	Sheehan & McGahn, Bradford, Pa.	Ross & Robinson, Meadville, Pa.	Thomas McGuigan, Meadville, Pa.
Brick paving, concrete foundation, 11,160 sq. yds. Mack	Wire-cut.........	$1.34	$1.33½	.....	.....	$1.47½	$1.48
	Repressed........	....	1.40	.....	.....	1.47½	1.53
	Block............	1.39	1.43	.....	.....	1.47½	.....
Park	Wire-cut.........	1.29	1.26	.....	$1.40	1.43½	1.43
	Repressed	....	1.34	.....	1.45	1.43½	1.48
Brady Run........	Wire-cut..........	1.33	1.31	.....	1.45	1.45	1.47
	Repressed	....	1.37	.....	1.49	1.45	1.52
Franklin	Wire-cut..........	1.29	1.29	.....	....	1.46	1.43
	Repressed	....	1.30½	$1.40	....	1.46	1.47
5×26-in. curbing, including cors....2,640 ft.	Natural flag..	.42	.50	.50	.48	.45	.50
	Sandstone.....	.42	.45	.45	.40	.44	.48
5×22-in. curbing, including cors.... 482 ft.	Natural flag..	.38	.45	.50	.48	.45	.48
	Sandstone.....	.38	.43	.35	.40	.44	.42
4×18-in. crossing curb .... 190 ft.	Natural flag..	.30	.30	.40	.28	.30	.36
2½×12-in. edgestones	750 lin. ft..	.20	.20	.30	.25	.15	.12
Castings, inlets, gutter plates, etc.	7,900 lbs.....	.01¾	.02	...	.01¾	.02½	.01¾
Catchbasins, standard	4 each...	25.00	24.00	25.00	23.00	18.00	30.00
" special top	7 " ...	34.00	35.00	35.00	33.00	26.00	30.00
18-in. storm sewer	380 lin. ft..	.65	.80	.52	.60	.50	.55
15-in. " "	420 " "	.46	.70	.37	.55	.45	.45
12-in. " "	260 " "	.35	.65	.32	.45	.34	.35
10-in. " "	240 " "	.31	.55	.29	.30	.28	.30
4-in. underdrain	100 " "	.12	.10	.23	.06	.07	.10
Total		$18,638	$19,359	$20,024	$20,454	$20,462	$20,671
Days to complete		100	90	120	90	90	140

*Awarded contract for Park brick.

ASPHALT PAVING.—Newark, N. J.—The Newark Asphalt Paving & Construction Co. has been awarded the contract for 20,000 sq. yds. of asphalt paving, at $1.41.

CEMENT SIDEWALK.—Milwaukee, Wis.—D. W. Cutter has been awarded the contract for 5,350 sq. ft. of cement sidewalk, at 10⅞ cts. a ft., and for 550 ft. of combination cement curb and gutter, at 36 cts. a ft.

DREDGING.—Philadelphia, Pa.—It is stated that the International Contracting Co., Syracuse, N. Y., has been awarded the contract for removing a ledge and for dredging in the Schuylkill River between Yankee Point and 58th St., at $5 and 33¾ cts. a cu. yd., respectively. In both cases the material is to be placed above high water mark within the city limits; and for ledge rock deposited where directed by the department, $5.50 a yd; total, $33,000.

ASPHALT PAVING.—Newark, N. J.—The board of public works awarded to the Newark Paving & Construction Co., the contracts for asphalt paving in two streets, at $1.41 a sq. yd., and in two other streets, at $1.45 a yd.; last year similar work was contracted at $2.35 a yd.

MAIN SEWER.—Allegheny, Pa.—A. V. Purnell has been awarded the following contract for constructing a main sewer in East St.: 1,030 ft. of 24-in. pipe sewer, $2.05 a ft.; 1,050 ft. of 20-in. pipe sewer, $1.55 a ft.; 1,120 ft. of 18-in. pipe sewer, $1.05 a ft.; 5,550 ft. of 9-in. connections, 30 cts. a ft.; 14 No. 1 inlets, $25 each; 16 manhole shafts, $18 each. Total, $7,218. Chas. Geyer, Mayor; Robt. Dilworth, Cy. Clk.

ASPHALT PAVING.—Allegheny, Pa.—The following contract for asphalt paving in Page St. was let to the Sicilian Asphalt Paving Co. June 20, 1898; 1,000 cu.yds. excavation, 50 cts. a yd.; 1,700 sq. yds. sheet asphalt paving, $1.80 a yd.; 1,100 sq. yds. brick sidewalk, 55 cts. a yd.; 1,000 lin. ft. curbing, 45 cts. a ft.; 50 lin. ft. crossing, reset, 15 cts. a ft.; 50 cu. yds. masonry, $4.75 a yd. Total, $4,860.

ARTESIAN WELL.—Casselton, N. Dak.—E. G. Guthrie, Audr., writes us that the following bids were received June 6 for sinking an artesian well: F. M. Wheeler, Casselton, $1.00 a ft. for 550 ft. of galvanized pipe; C. May, 95 cts. for 350 ft.

BLOCK PAVING.—Allegheny, Pa.—The following contract has been let by the council to the Kreps Coal & Sand Co. for Ligonier block paving in Overlook St.: 1,500 cu. yds. excavation, 37 cts. a cu. yd.; 1,450 sq. yds. Ligonier block paving, $1.52 a yd.; 830 sq. yds. vitrified brick sidewalk, 45 cts. a sq. yd.; 1,000 lin. ft. curbing, 45 cts. a ft.; 300 lin. ft. crossing stone, 65 cts. a ft.; 150 cu. yds. masonry, $3.95 a yd.; 20 lin. ft. iron fence, $1.00 a ft. Total, $4,390.

ASPHALT PAVING.—Rochester, N.Y.—The following bids were received by the executive board June 14, 1898, for asphalt paving in Linden and Yale Sts., estimated cost, $20,850; contract awarded Warren-Scharf Asphalt Paving Co.:

Quantities.		Warren-Scharf Asp. Pav. Co., $18,524.	Whitmore, Rauber & Vicinus, $18,821.	Rock Asp. Pavement Co., $18,864.	Rochester Vulcanite Pavmt Co., $18,866.
Pavement:					
Stone, new Medina blk	525 sq. yds.	$2.50	$2.90	$2.90	$2.85
New Trinidad*	5,775 " "	2.25	2.20	2.20	2.25
New 4-in. curbstone....	5,250 lin. ft..	.46	.47	.45	.45
Sewers:					
Main pipe, cleaned...	1,920 " "	.15	.20	.25	.20
New surface	20........	25.00	29.00	28.00	19.00
Repairing & con'ect'g	2........	18.00	18.00	23.00	15.00
New lot laterals†.....	40........	6.00	8.80	9.00	9.00
New manholes	7 each...	35.00	34.00	42.00	45.00
Water serv. pipes, etc.§	5 each...	8.10	7.80	8.75	9.50
Water serv. pipes, etc.‖	35 " ...	12.96	14.20	14.00	14.00

*Sicily rock asphalt. †Each 12 ft. long. §Water service pipes with fixtures, North Side, 4 ft. long. ‖Water service pipes with fixtures, South Side, 19 ft. long.

GRADING, ETC.—Cohoes, N. Y.—The following bids were received last week for grading in several streets: Eveline & Denallo, Waterford, N. Y., hard rock, $1 a cu. yd.; loose rock, 50 cts.; earth, 29 cts. John W. Flynn Waterford, solid rock, $1.15; loose rock, 95 cts.; earth, 34 cts. Houlihan & Larkin, solid rock, 90 cts.; loose rock, 64 cts.; earth, 30 cts. A. H. Hildreth, solid rock, 62 cts.; loose rock, 30 cts.; earth, 15 cts. Warner & Madigan, Mechanicsville, N. Y., solid rock, 94 cts.; loose rock, 57 cts.; earth, 33 cts.

BRICK PAVING.—Troy, N. Y.—M. J. Jackson & Son have been awarded the contract for paving 9th St. with Mack brick, at $1.94 a sq. yd.; total cost, $21,400.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—

New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.75 cts.

Chicago—Angle bars, 1.15 cts. to 1.25 cts.; spikes, 1.50 cts. to 1.60 cts.; track bolts, hexagonal, 1.90 cts. to 2.00 cts.; square, 1.80 to 1.90 cts.

RAILS, STEEL—

New York, new, $18.00 to $19.00; old iron, $11.00 to $11.50; old steel $9.00.
Chicago, new, $20.00 to $22.50; old iron, $12.25 to $12.50, steel, $10.50 to $11.00.
Pittsburg, new, $18.00; old iron, $13.50; steel, $10.50.

STRUCTURAL STEEL—

New York—Beams, 1.30 cts. to 1.35 cts.; channels, 1.30 cts. to 1.35 cts.; tees, 1.35 cts. to 1.40 cts.; angles, 1.15 cts. to 1.20 cts.; plates, 1.20 cts. to 1.30 cts.; rivets, iron, 2.25 cts. to 2.50 cts.; steel, 1.75 cts. to 1.85 cts.; universal mill plates, 1.15 cts. to 1.20 cts.; tank, 1.25 cts. to 1.30 cts.; shell, 1.25 cts. to 1.30 cts.; flange, 1.60 cts. to 1.75 cts.; firebox, 2.25 cts. to 2.50 cts.

Chicago—Beams, 1.30 cts. to 1.35 cts.; channels, 1.30 cts. to 1.45 cts.; tees, 1.35 cts. to 1.40 cts.; angles, 1.20 cts. to 1.25 cts.; universal mill plates, 1.25 cts. to 1.30 cts.; tank, $1.10 cts. to 1.20 cts.; shell, 1.45 cts. to 1.55 cts.; flange, 1.20 cts. to 1.40 cts.; firebox, 1.85 cts. to 5.00 cts.

Pittsburg—Beams, 1.15 cts. to 1.25 cts.; channels, 1.15 cts. to 1.25 cts.; tees, 1.20 cts. to 1.20 cts.; angles, 1.05 cts. to 1.15 cts.; universal mill plates, 1.00 cts. to 1.10 cts.; tank, 1.10 to 1.15 cts.; shell, 1.15 cts.; flange, 1.10 cts. to 1.20 cts.; firebox, 2 cts. upward.

MERCHANT STEEL—

Machinery, per lb., 1.60 cts. to 1.70 cts.
Cast, best in small lots, per lb., 7 cts.
Sheet, per lb., 8.5 cts.

IRON—

Pig Iron:

New York, No. 1, $11.00 to $11.50; No. 2, $10.75 to $11.00.
Chicago, No. 1, $11.50 to $12.00; No. 2, $11.00 to $11.50.
Pittsburg, No. 1, $10.40 to $10.50; No. 2, $10.00 to $10.25.

Bar Iron:

New York, common, 1.08 cts. to 1.15 cts.; refined, 1.15 cts. to 1.20 cts.
Chicago, common, 1.05 cts. to 1.10 cts.; refined, 1.10 cts. to 1.20 cts.

Sheets:

American, per lb., 4 cts. to 4½ cts.
Russia, per lb., 10¼ cts. to 10½ cts.

LUMBER—

New York:

Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.
Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in. butts, 4¼ cts. to 4½ cts.
Spruce, special cargoes, per M, $15.00 to $17.50.
Yellow pine, random cargoes, $14.50 to $17.00.
North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.

San Francisco:

Oregon pine, per M, $15.50 to $17.50.
Redwood, per M, $17.00 to $19.00.
Redwood tank stock, up to 10 ft., $21.00 to $24.00.

GENERAL MATERIALS—

Lead, New York, 3.75 cts. to 3.80 cts.
Nails, Pittsburg, 1.40 cts.
Solder, per lb., 9 cts. to 11½ cts.
Spelter, per lb., 4.00 cts. to 4.50 cts.
Copper, ingots, 11.50 cts. to 12.00 cts.
Granite, rough, New York, cu. ft., 40 cts. to 50 cts.
Limestone, New York, cu. ft., 70 cts. to 80 cts.
Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.
Slate, Penn. block, per square, $4.00 to $5.00.
White lead, American, per lb., 5½ cts. to 6 cts.
Lime, common state, per bbl., 70 cts.

* * *

INDUSTRIAL NOTES.

THE AMERICAN PIPE & FOUNDRY CO., Chattanooga, Tenn., has appointed Mr. Lester E. Wood, 100 Broadway, New York, Eastern Sales Agent.

CRAGE & TENCH, 61 Terrace, Buffalo, N. Y., have the contract for the Millstone extension of the Tionesta Valley Ry., running south from Sheffield, Pa.

THE TURNER ENGINEERING CO., Marion, O., has received an order for two 100-HP. Turner water tube boilers for a college building in Philadelphia.

THE W. S. DICKEY CLAY MFG. CO., Kansas City, Mo., has a contract for 300 carloads of sewer pipe for use in Guadalajara, Mex., at a cost of $80,000, according to report.

THE NILES TOOL WORKS, Hamilton, O., is reported to have purchased a large interest in the Pond Machine Tool Co., Plainfield, N. J. The companies will not be consolidated, but it is said that there will be a co-operation by which the shipping and other like expenses will be reduced. It is also reported that the new tool works in Berlin, Germany, to be known as the Deutsche Niles Werkzeng Machinen Fabrik, will be owned by these two companies.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, is reported to have a contract from the Anniston Consolidated St. Ry., Anniston, Ala., for electrical machinery for the operation of the road, amounting to about $350,000. The contract includes over 200 Westinghouse street railway motors and two large dynamos. A contract has also been received, it is stated, from the Consolidated St. Ry., Baltimore, Md., for 60 Westinghouse street railway motors, at a cost of $50,000.

THE D. A. TOMPKINS CO., Charlotte, N. C., has closed a contract, through Guthrie & Rockwood, Buffalo, N. Y., engineers, for a sewage disposal plant on Waring's system of forced bacterial oxidation, to be installed at the Western Refuge for Women, Albion, N. Y. The plant will have a capacity of 25,000 gallons a day, but, it is claimed, purifies the sewage to the standard of drinking water, the effluent being discharged into a small brook which otherwise is dry in summer. Mr. W. L. Church, 282 Manhattan Ave., is the Resident Engineer of the company in New York.

THE JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., has placed on the market a solid belt dressing in round bars, about 8 ins. long and 2 ins. in diameter, making a package convenient to the hand and easy to apply even to fast running belts. It is not claimed that this solid dressing is as good a preservative of the life and elasticity of the belt as the Dixon paste, as the object has been to meet the demand for a more convenient form of belt dressing and one which may be quickly applied.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., has designed and is erecting for the Syracuse Construction Co., Syracuse, N. Y., new buildings in connection with its electric railway plant, consisting of a fireproof boiler house, 60 × 90 ft., having steel framework covered with corrugated iron on the sides and roof; an engine room 65 × 80 ft., with a steel frame and brick sides, and a car-barn and repair shop, 65 × 170 ft., of steel framework construction, with corrugated iron sides.

THE GENERAL ELECTRIC CO., Schenectady, N. Y., at a directors' meeting last week, voted to recommend to the stockholders a reduction in the share capital of the company, both common and preferred, of 40%, so that each holder of one hundred shares of present stock will get 60 shares of the new. On the basis of the new capitalization $1,275,000 will be required annually to pay 7% upon the preferred stock and 6% upon the common stock. A stockholders' meeting will be held Aug. 10, at noon, in Schenectady.

THE VULCAN IRON WORKS CO., Toledo, O., has recently secured several large orders and is about to ship five steam shovels to Ogdensburg, N. Y., for use in constructing a large water trench, 40 ft. deep, 150 ft. wide and 4 miles long, with a fall of 60 ft., which taps the St. Lawrence River and is then turned into Grass Creek. This work is being done by an English syndicate, at a cost of $2,000,000. Among other orders are two steam shovels for use in phosphate beds near Charleston, S. C., where several have been previously shipped; also a shovel to the Northwest and one to Pittsburg.

THE BOSTON & LOCKPORT BLOCK CO., 142 Commercial St., Boston, through its President, Mr. Albert D. Bosson, together with the Treasurer, Mr. Myron H. Tarbox, constituting a majority of the Executive Committee, has purchased from the assignees of the Bagnall-Loud Block Co., a Maine corporation, organized in 1894, of which Mr. Robert M. Barnard was President, and Mr. Herbert Loud, Treasurer, all the latter's stock, manufactured and in process, and the machinery, patterns, etc. The finished stock will be at once removed to the store and the balance to the factory at East Boston.

ANDREW J. MORSE & SON, 138 and 140 Congress St., Boston, Mass., report that their diving apparatus, complete for two divers under one pump, has been made the official standard by the Navy Department and sample sets are kept at all naval stations. Since the "Maine" disaster they have supplied what are claimed to be the largest requisitions ever issued by the government for diving apparatus and have delivered and have under construction about 75 sets of the new standard style. They have also supplied their "U. S. Navy" outfits to the new Japanese cruisers "Chitose" and "Kasagi," and for the past three months have been forced to work night and day, including Sundays, to meet the demands of the Navy Department.

THE S. FLORY MFG. CO., Bangor, Pa., has been running its works day and night since last November to keep up with orders for its hoisting engines and suspension cableways. Recently several carloads of engines have been shipped, including one for export to Kobe, Japan, and two carloads of dredging machinery and one of portable hoisting engines to Boston, Mass. The demand for hoisting and conveying machinery has made necessary an increase in the working capacity of the plant. Within the past few months the company has erected four cableways, among them being one for the Empire State Granite Co., Pochuck, N. Y. The quarry is on a hill, about 400 ft. above the yard and railway, and the cableway has a clear span of 900 ft. between the towers, with an individual load capacity of 15 tons. The plant is operated by a 75-HP. Flory special cableway hoist, fitted with two friction drums, and reversible link motion and an 80-HP. boiler of the locomotive type. Formerly the stone was handled by swinging it from derrick to derrick until the yard was reached, which was laborious, slow and expensive. With the cableway the stones are conveyed at a speed of 700 ft. a minute, if desired.

THE AMERICAN WHEELOCK ENGINE CO., Worcester, Mass., and Postal Telegraph Bldg., New York, reports the following recent installations of the Greene-Wheelock engine: Six 1,500-HP., with rope dirves, Chicago City Ry.; one 600-HP. single-cylinder condensing, Worcester (Mass.) wire mill; one 200-HP., Hammond-Reed Co., Worcester, Mass.; one 1,000-HP., B. B. & R. Knight, Providence, R. I.; one 550-HP. single-cylinder and one 550-HP. cross-compound, with rope drives, Syracuse Construction Co., Syracuse, N. Y.; one 400-HP., Willamette Pulp & Paper Co., Oregon City, Ore.; one 300-HP. and one 350-HP., Pejepscot Paper Co., Brunswick, Me.; one 750-HP. direct-connected, New York Heat, Light & Power Co., New York; three 350-HP. direct-connected, J. G. White & Co., New York; two 500-HP. cross-compound, direct-connected, Potomac Electric Power Co., being the second order; the previous order being for two 750-HP. direct-connected engines. The company has installed at the Grosvenordale electric light plant, Grosvenordale, Conn., the high-pressure side of a cross-compound engine, putting its cylinder and valve gear onto a Corliss bed and replacing Corliss cylinders. This is the second Corliss engine in that plant that has been replaced with the Greene-Wheelock cylinder and valve gear. The company is now building for the Bibb Mfg. Co., Macon, Ga., the high-pressure side of a 750-HP. cross-compound, the low-pressure side to be a Greene-Wheelock, low-pressure cylinder with valve gear, replacing the present Corliss cylinder and valve gear.

NEW COMPANIES.—Belvedere Brewing Co., Harpers Ferry, W. Va.; $80,000, commencing with $40; August Kruger, Jacob Schafer, Henry Schafer and Eva Schafer, Harpers Ferry; Elias Hiney, Charlestown, W. Va.

Independent Telephone Co., Lititz, Pa.; $25,000; to operate lines in Lancaster, Berks and Lebanon counties; Israel G. Erb, H. R. Landis, A. M. Amer, P. B. Bucher and A. B. Long, Lititz; E. B. Brubaker, Lexington, Pa.; S. B. Erb, Millway, Pa.; E. L. Garber, Stevens, Pa.; S. W. Buch, Kissel Hill, Pa.; M. L. Weidman, Ephrata, Pa.; Jacob Mace, Reamstown, Pa.; Philip F. Ruhl, Brickerville, Pa.; A. E. Lane, Brunnerville, Pa.

Citizens' Telephone Co., Cambridge City, Ind.; $10,000; James A. Boyd, John W. Marson, John R. Mauk, Horace B. Boyd, Conrad B. Keller, Cornelius T. Wright, George Bridenbucker, Albert W. Bradbury and Wm. B. Barefoot.

Atlantic Coast Telephone Co., Atlantic City, N. J.; $100,000; Edwin L. Reinhold, of Marietta, Pa., and Lewis Kuehnie and James B. Reiley, of Atlantic City.

Pittsburg & Allegheny Telephone Co., of Pittsburg, Pa.; to build a telegraph line in Allegheny county for police and fire alarms and messenger business; L. H. Matthews, John F. Freeman, Pittsburg; John Phelps, Baltimore, Md.

Rural Telephone Co.; $3,000; to maintain a telephone line connecting various towns in Westchester county; Pres., R. S. Haviland; Samuel Thompson, and Treas., C. W. Page, of Chappaqua, N. Y.; W. H. Moore, H. E. Washburn; Secy., G. G. Norton and T. B. Pierce, of Pleasantville, N.Y.

Hicksville Telephone Co.; $10,000; to operate a telephone system at Hicksville, O.; Ed. L. Barber, Frank B. Ufer, W. A. Barber, C. E. Brigham and J. C. King.

Star Mfg. & Chemical Co., Syracuse, N. Y.; $1,000,000, commencing with $50; to conduct a general commercial business; G. O. Chilton, Chas. W. Shith, D. M. Black, C. H. Carwithin and H. H. White, all of Charleston, W. Va.

Henry W. Belcher Co., Jersey City, N. J.; $100,000. commencing with $1,000; to manufacture iron, steel, brass, etc.; James W. Newton, John J. O'Brien and Henry W. Belcher, all of 243 Washington St., Jersey City.

Pridham Sewerage Utility Co., Newark, N. J.; $100,000, commencing with $5,000; to treat and deodorize all kinds of sewerage; Samuel S. Pridham, Paul Buchanan and Ludwig F. Mergott, of Newark; John Whitehead, Morristown, N. J.

General Electric Automobile Co., Philadelphia, Pa.; $2,500,000, commencing with $2,500; to acquire electrical appliances and to do a general manufacturing business; A. B. Pearson, Clarence E. Lent, J. E. Lewis, T. R. Heller and C. W. Cox, all of Philadelphia.

Asphalt and Rubber Supply Mfg. Co., New York; $600, commencing with $50; to manufacture insulating materials, etc.; W. C. Snell, N. J. Hatcher, A. F. Vickers, D. M. Black and A. C. Gunther, all of Charleston, W. Va.

U. S. Steel Cement Co., New York; $1,000,000, commencing with $2,500; to manufacture and sell cement; Geo. F. Averill and Everett Clapp, New York; H. F. Cook, Sag Harbor, New York; Wm. B. Hill and Alexander Cameron, Brooklyn, N. Y.

Mohawk Mfg. Co., Cincinnati, O.; $1,000,000, commencing with $5,000; to conduct a general manufacturing business; G. F. Klotter, Wm. C. Tieman, Geo. H. Stout, E. L. Dillinger and W. M. Berry, all of Cincinnati.

Automatic Incubator Co., Philadelphia, Pa.; $1,000,000, commencing with $1,000; A. A. Freeman, J. K. Freeman, D. L. Busby, Geo. R. Morehouse and Ogden Armstrong, all of Philadelphia.

Frictionless Bearing Co., New York; $1,000,000, commencing with $1,000; to manufacture and deal in bearings; Geo. P. Smith and Chas. L. Turey, New York; James Sawyer, Jr., Stamford, Conn.; Alexander Cameron and Wm. B. Hill, Brooklyn, N. Y.

McManus Contracting Co., Bordenton, N. J.; $25,000, commencing with $5,000; to construct bridges, buildings, etc.; Michael McManus, 1416 Tioga St., and Louis P. Riedenauer, 2336 Jefferson St., of Philadelphia, Pa.; John H. Ayres, Bordenton.

United States Battery & Electrical Mfg. Co., Jersey City, N. J.; $100,000, commencing with $1,000; to manufacture storage batteries, motors, etc.; Conrad N. Jordan and Louis Lieber, New York; W. M. McDougall, East Orange, N. J.

Empire State Rubber Shoe Co., New York; $300,000, commencing with $50; R. W. Fowler, Wm. A. Towner, Frederick Ferris, J. E. Fryer and Darwin Rudd, all of New York.

United States Ball Bearing Co., Elkins, W. Va.; $1,000,000, commencing with $2,500; to manufacture all kinds of anti-friction devices; J. J. Humphill and C. M. Fulton, Washington, D. C.; B. F. Taylor, Elkins; J. D. Richerson, Murfreesboro, Tenn.; W. A. Jones, Warsaw, Va.

Writing Machine Co., New York; $500,000, commencing with $50; to manufacture and deal in typewriting machines and parts thereof; J. T. Williams and N. H. Lucken, Brooklyn, N. Y.; H. F. Frevert, J. M. Creary and Ida C. White, New York.

Compressed Steel Co., 22 Clinton St., Newark, N. J.; $400,000, commencing with $1,000; to manufacture steel, etc.; Henry Dickson and Peter Hassinger, Newark; A. H. Ryan, Chas. F. Spaulding, Frank R. Wickes, A. A. Richmond and Edward E. Bruen, East Orange, N. J.

James P. McDonald Contract Co., 83 Montgomery St., Jersey City, N. J.; $10,000, commencing with $1,000; to build and repair railways, etc.; Frederick Dwight, 10 Wall St.; Frank E. Randall, 80 Broadway, both of New York; John J. Treacy, 446 Third St., Jersey City.

Acme Portland Cement Co., 419 Market St., Camden, N. J.; $1,000,000, commencing with $1,000; to manufacture cements of all kinds; T. H. Wheeler, Orange, N. J.; Wm. M. McKeloy, John Marshall Lockhart, and Chas. E. Pope, of Pittsburg, Pa.

Boston & Costa Rica Land & Investment Co., Jersey City, N. J.; $100,000, commencing with $21,000; H. F. Hatch, William Fillingham and E. G. Maturin, 60 Grand St., Jersey City.

Philadelphia Big Four State Syndicate, Camden, N. J.; $50,000, commencing with $3,000; to quarry slate, stone, etc.; Peter M. Mathieu, J. Wm. Mathieu, Henry A. Mathieu and Geo. H. B. Martin, 419 Market St., Camden, N. J.

Harry C. Nichols Co., Camden, N. J.; $25,000, commencing with $1,000; deal in real estate, and to build houses, water-works, etc.; Wm. S. Darnell, Camden; Joseph L. Dailey and Harry C. Nichols, Philadelphia, Pa.

Cory Tidewater & Improvement Co., Jersey City, N. J.; $100,000, commencing with $50,000; to build docks, wharves, etc.; Herbert D. Cory, David U. Cory and Stuart Lyman, all of Englewood, N. J.

Cleveland Electric Co., Cleveland, O.; $75,000, commencing with $450; to manufacture and deal in all kinds of electrical devices; Wm. P. Bowman, F. C. McMillin, J. E. Mathews, F. W. Root and N. C. Stevens, all of Cleveland.

Rapid Transit Construction Co., New York; $5,000,000, commencing with $1,000,000; to build a rapid transit railway in the Borough of Manhattan; J. W. Reno, I. P. Smith, J. D. Adams, J. B. Bissell and C. A. L. Massie, all of New York

Wilson Mfg. Co., New York; $35,000, commencing with $60; to manufacture and sell scales, tug links, etc.; E. K. Barber, Keesville, N. Y.; R. P. Wilson, East Orange, N. J.; R. E. Oatman, John Leighton and W. W. Tucker, New York.

Miller Car Refrigerating Co., Charleston, W. Va.; $250,000, commencing with $5,000; to build and equip refrigerator cars; G. D. James, Thomas Watson, E. W. Small and E. D. Poor, New York; C. S. Miller, Tiffin, O.

Fairmont Glass Works, Fairmont, W. Va.; $50,000, commencing with $5,500; to manufacture glass, etc.; Z. G. Morgan, J. M. Hartley, J. M. Crane, O. S. McKinney, and M. L. Hutchinson, all of Fairmont.

Linomatrix Co., Washington, D. C.; $5,000,000, commencing with $50; to deal and own letters patent pertaining to matrix-making, lino-typing, stereotyping, etc.; Stilson Hutchins, E. V. Murphy and O. T. Moore, Washington; J. O. Clephane and Andrew Devine, New York.

New York Finance & Construction Co., Jersey City, N. J.; $100,000, commencing with $25,000; to conduct a general construction business; Lee W. Woolston, 141 Broadway, New York; Geo. F. Woolston, Arlington, N. J.; Geo. F. Woolstron, Jr., Pittsburg, Pa.

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies READS ENGINEERING NEWS

AVAIL YOURSELF OF THIS PAPER WHEN BIDS ARE WANTED FOR CONSTRUCTION OR FOR FURNISHING SUPPLIES

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PERSONAL.

Mr. C. L. Brinser, of Harrisburg, Pa., has been appointed Superintendent of the Greensburg, Jeanette & Pittsburg Electric St. Ry.

Mr. Frederick J. Mills, C. E., State Engineer of Idaho, has been commissioned First Lieutenant in the Second Regiment of United States Volunteer Engineers.

Mr. H. R. Sanford, Civil Engineer, U. S. Navy, has been detached from the Bureau of Yards and Docks, Washington, D. C., and ordered to the navy yard, Boston, Mass.

Mr. E. Sherman Gould, M. Am. Soc. C. E., has returned to Yonkers, N. Y., from Tampa and Jacksonville, Fla., where he has been for the last two months at Army Headquarters.

Mr. James R. Lawrence has been appointed City Engineer of Greenville, S. C., to succeed Mr. A. W. Edens, resigned. Mr. Lawrence has already held the office several times.

Prof. Harris J. Ryan, M. Am. Soc. M. E., Professor of Electrical Engineering in Sibley College, Cornell University, Ithaca, N. Y., sailed for Europe June 27, accompanied by his wife.

Mr. W. J. Mallor has been appointed Assistant Superintendent of Bridges and Buildings of the Southern Pacific Ry., with headquarters at Algiers, La., to succeed Mr. C. C. Mallard, promoted.

Mr. John Hays Hammond, mining engineer, formerly of South Africa, has been appointed Consulting Engineer to the Russian Government, which is about to develop rich government mines in the Ural Mountains.

Prof. George F. Becker, of the United States Geological Survey, is reported to have been sent by the government to the Philippines to make a general examination of the islands, including their mineral resources.

Mr. George A. Kimball, M. Am. Soc. C. E., member of the Metropolitan Sewerage Commission, Boston, Mass., has been appointed by the city council of Barre, Vt., as a member of the commission to fix the price of the water-works which the city proposes to purchase.

Mr. E. B. Sturges has been elected President of the New York, Wyoming & Western R. R. The other officers are: Mr. L. A. Watres, Vice-President and General Manager; Mr. T. H. Watkins, Treasurer; Mr. Thos. E. Jones, Secretary, and Mr. Edward L. Jenks, Chief Engineer.

Mr. R. P. Bower, City Engineer, of Champaign, Ill., has been appointed Second Lieutenant in the United States Army, his name, it is stated, being one of the three highest on the army register for proficiency in the study of military science at the University of Illinois.

Mr. John Alexander McDonald, M. Inst. C. E., M. Inst. M. E., M. Am. Soc. C. E., Assistant Engineer in Chief of the Public Works Department of Western Australia, in charge of the Fremantle Harbor Works, still continues to hold that office, newspaper reports to the contrary notwithstanding.

Mr. E. D. Dorchester, Secretary and Assistant General Manager of the Velasco Terminal Ry., with headquarters at Velasco, Tex., has been appointed General Manager, to succeed Mr. L. L. Foster, who has resigned to accept the office of President of the Agricultural and Mechanical College of Texas, College Station, Tex.

Mr. Richard P. Rothwell, M. Am. Inst. M. E., M. Am. Soc. C. E., Editor of the "Engineering and Mining Journal" and of "The Mineral Industry," has been awarded a gold medal by the Societe d'Encouragement pour l'Industrie Nationale of France in consideration of the services rendered to industry by the publication of the latter work.

Mr. A. B. Dunning, civil engineer, has been made the Manager of the Dunning Engineering & Construction Co., Scranton, Pa. Mr. O. D. Shepard, civil engineer, of Scranton, and Col. George E. Waring, Jr., M. Inst. C. E., formerly Street Commissioner of New York city, have been appointed consulting engineers to the company. The latter will act as its New York representative.

Mr. N. C. Grover has been appointed Professor of Civil Engineering in the University of Maine, Orono, Me., to succeed Prof. Geo. H. Hamlin, whose resignation is noted in this issue. Mr. C. P. Weston has been appointed Instructor in Civil Engineering, Mr. Ralph Hamlin, Assistant in Civil Engineering, and Mr. R. H. Mansen, Assistant in Electrical Engineering. Lieut. Herbert N. Royden, U. S. Army, Military Professor, has been ordered to duty as aide-de-camp on the staff of Brig.-Gen. Charles P. Mattocks, U. S. Volunteers.

Mr. J. Francis Le Baron, M. Am. Soc. C. E., of Jacksonville, Fla., has been appointed Chief Engineer of the American Honduras Co., and expected to leave for Honduras July 14 to make physical surveys and examination, with plans and estimates, for building jetties at the mouth of the Patuca River, improving it for navigation, building wharves, warehouses and a railway from the head of navigation to the capital. It is expected that construction will commence immediately after the plans and reports are finished. The company has a valuable concession from the Honduras government.

Mr. Robert C. Barnard, Assistant Engineer of the Chicago Division of the Pennsylvania Lines West of Pittsburg, with headquarters at Logansport, Ind., has been appointed Engineer of Maintenance of Way of the Richmond Division, with headquarters at Richmond, Ind., to succeed Mr. Robert K. Brown, Jr., Assoc. M. Am. Soc. C. E., resigned. Mr. Robert Ferriday, of the engineering department of the Erie & Ashtabula Division, with headquarters at Lawrence Junction, Pa., has been appointed to succeed Mr. Barnard at Logansport. Mr. D. B. Johnston, Assistant Engineer, with headquarters at Lawrence Junction, has been appointed Engineer of Maintenance of Way of the Cincinnati & Muskingum Valley Division, an office for some time vacant. Mr. Paul Jones has been appointed Engineer of Maintenance of Way of the Indianapolis & Vincennes Division.

Prof. George Herbert Hamlin, M. Am. Soc. C. E., Professor of Civil Engineering in the University of Maine, Orono, Me., has resigned, to devote himself to his private business. He was born in Sidney, Me., and graduated from the Maine State College, now the University of Maine, in 1873, being appointed Tutor in Civil Engineering. He held various positions in the university until 1880, when he was made Professor of Civil Engineering, and has held it continuously ever since. For a time he was also City Engineer of Bangor, and he has been consulting engineer for various manufacturing companies. Besides being a member of the American Society of Civil Engineers, to which he was elected July 3, 1895, he is also a member of the American Society for the Promotion of Engineering Education and of the Boston Society of Civil Engineers. On June 27 a supper was tendered to him by Dr. A. W. Harris, President of the university, all the faculty participating.

OBITUARY.

Mr. James Devlin, contractor, of Elizabeth, N. J., died July 4, aged 72.

Mr. Henry D. Fisher, contractor, of Reading, Pa., died July 6, aged 66.

Mr. Charles O. Richardson, Treasurer of the Worcester Construction Co., Worcester, Mass., died July 7, aged 65.

Mr. John De Noyelles Christie, civil engineer, Road Engineer of Rockland County, New York, died at his home, Haverstraw, N. Y., July 2, aged 68.

Mr. Louis R. Townsend, architect, of San Francisco, Cal., died July 6, aged 67. He was the senior member of the firm of Townsend & Wyneken.

Mr. Archalous Wyckoff, the inventor of the Wyckoff paving block, extensively used in this country and Canada, died at Elmira, N. Y., July 6, aged 82.

Mr. B. H. Nelson, Water Commissioner of Granville, N. Y., was killed by the caving-in of a trench in that place, July 10, while engaged in inspecting a water main. He was 50 years of age.

Mr. Andrew Brown, bridge contractor, of Baltimore, Md., died July 5, aged 71. At the time of his death he was the President of the Broadway & Locust Point Steam Ferry Co., of Baltimore.

Mr. D. J. Thayer, Vice-President and Secretary of the Fulton County Narrow Gage Ry., with headquarters at Chariton, Ia., died at Mercy Hospital, Burlington, Ia., June 21. Mr. J. D. Temple, formerly Auditor of the same road, died at Des Moines, Ia., June 24.

Mr. Joseph Curtis Platt, M. Am. Soc. C. E., died at Waterford, N. Y., July 7. He was born in Fair Haven, Conn., Jan. 9, 1845, and was graduated as a civil engineer from the Rensselaer Polytechnic Institute, Troy, N. Y., in 1866. He was a consulting engineer, chiefly engaged in water-works design and construction, and was also a Member of the American Institute of Mining Engineers, the American Society of Mechanical Engineers and of the University and Engineers' Clubs of New York.

Capt. Edward Shanley, of the firm of Shanley & Ryan, contractors, died in New York on July 9. Mr. Shanley was born at Hunter, Greene Co., N. Y., about 64 years ago, and served during the Civil War in the 9th New York Volunteers and attained the rank of Captain. As a contractor he was engaged in bridge work for the West Shore, Erie and Canadian Pacific railways; he also built Sections 22, 23 of the New Croton Aqueduct, and did work for the West Indian Improvement Co. in Jamaica. At the time of his death his firm was building the New York anchorage of the new East River bridge.

Mr. Francisco Javier Cisneros, M. Am. Soc. C. E., Managing Director of the Barranquilla Ry. & Pier Co., with headquarters in London, England, died July 7 of Bright's disease at the Windsor Hotel, New York city. He was born in Santiago de Cuba in 1836, and graduated from the School of Engineering, in Havana, finishing his technical education in the Rensselaer Polytechnic Institute, Troy, N. Y. He was then engaged by an English syndicate to build railways in Cuba, and was one of the promoters of the revolution of 1868, placing his fortune at the disposal of the cause of Cuban freedom. In 1874, having thus impoverished himself, he went to Colombia, where he superintended some important engineering works and again amassed a large fortune. At the outbreak of the present Cuban revolution he again offered his money and services to the Junta, and was in this country at the time of his death on an important secret mission.

Mr. Pedro Jose Sosa, M. Am. Soc. C. E., of Panama, Columbia, was one of the passengers lost on the ill-fated steamship "La Bourgogne," which was sunk in collision, July 4, off Sable Island, Nova Scotia. He was born in Panama, 45 years ago, and graduated from the Rensselaer Polytechnic Institute, Troy, N. Y., in 1873. He returned to his native country and practised his profession in Panama and Guayaquil. In 1879, while he was City Engineer of the former city, De Lesseps made his first visit to the isthmus, and on his return to Paris Mr. Sosa accompanied him as the Colombian delegate to the international congress of engineers, whose report was made the basis of the canal company's plan of operations. The French government made him a Chevalier of the Legion of Honor in 1880, and in 1884 he was elected a member of the American Society of Civil Engineers. He supervised the erection of the lighthouse near Colon, and was Chief Engineer of the Aqueduct at Panama. At the time of the disaster in which he lost his life, he was on his way to Paris to attend a conference of engineers which is to decide whether the completion of the Panama Canal project is practical.

Rear-Admiral Daniel Ammen, U. S. Navy, died at the Naval Hospital, Washington, D. C., July 11. He was born in Brown county, Ohio, May 15, 1820, and entered the U. S. Navy in 1836 as a midshipman. In 1853 he was in charge of a scientific expedition to the Paraguay River on the U. S. S. "Water Witch." During the Civil War he was executive officer of the "Roanoke," and was engaged in the battles of Port Royal and Tybee Island and the attacks against Fort McAllister and Fort Sumter. He was commissioned Commodore April 1, 1872, and Rear-Admiral Dec. 11, 1877, being retired in June of the following year at his own request. He had charge, in 1876, as a member of the Isthmian Canal Commission, of the survey for a canal to connect the Atlantic and Pacific, and endeavored to bring about the construction of the Nicaragua Canal at that time. He was sent to Paris to attend the Interoceanic Ship Canal Congress, which preceded the Panama Canal undertaking. He was the author of a number of naval treatises and the inventor of a number of appliances now used in the navy. In recent years he has been most widely known by his advocacy of the ram in naval warfare, and by the partial adoption of his ideas by the U. S. Navy in the ram "Katahdin." He was led to advocate the ram in naval warfare by the experiences of the Civil War with the "Merrimac" and other rams. His early plans were modified in accordance with the rapid development of warships and armament, and it was not until 1891 that a contract was awarded by the government for a ram upon his designs. The "Katahdin" has never yet had an opportunity to test her equipment in actual combat.

Dr. Cornelius Herz, of Panama Canal notoriety, died at Bournemouth, England, July 6. He was born in Besancon, France, Sept. 3, 1845, and came to the United States with his parents at an early age. He graduated from the College of the City of New York in 1864, and later received the degree of Master of Science from the same institution. He was sent to Heidelberg, Germany, to study medicine, and continued his professional education in Munich, Vienna and Paris. In 1870 he was appointed Assistant Surgeon-General to the Army of the Loire, and for services in the army he was decorated with the Cross of the Legion of Honor. At the end of the Franco-Prussian war he returned to New York and later went to San Francisco, where he soon became a member of the Board of Health. He founded the first electrical works in that city, and in 1877 returned to Paris, where he introduced the electric light, thus overturning the gas monopoly. He founded "La Lumiere Electrique" in that city, now one of the leading electrical journals of the world, and organized the telephone system of France. He was successively raised from the rank of Knight of the Legion of Honor, through the intermediate grades, to Grand Officer. In 1892, when the Panama bubble burst, Dr. Herz was charged with being implicated in the corruption of public officials in connection with that enterprise. He fled to London, where he was arrested on extradition papers, but owing to illness, which confined him to his bed from 1893 to 1896, he was unable to appear in court. On May 2, 1896, the charges against him having been declared to be invalid and unworthy of notice, he was released from custody. His property had been confiscated by the French government, and he demanded of that government as a citizen of the United States the sum of $5,000,000 indemnity. The claim was unsettled at the time of his death.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN SOCIETY OF R. R. SUPERINTENDENTS.
July 13-14. Annual meeting, Alexandria Bay, N.Y. Secy., C. A. Hammond, Asbury Park, N. J.

AMERICAN HEATING AND VENTILATING SOCIETY.
July 15. Atlantic City, N. J. Secy., S. A. Jellett, 704 Arch St., Philadelphia, Pa.

ENGINEERS' CLUB OF MINNEAPOLIS.
July 18. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
July 19. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
WESTERN FOUNDRYMEN'S ASSOCIATION.
July 20. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
July 26 to 29. Annual convention at Detroit. Secy., C. W. Hunt, 220 W. 57th St., New York, N. Y.
WESTERN SOCIETY OF ENGINEERS.
Aug. 3. "Establishment of Street Grades," Chas. P. Chase. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Aug 9. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The Cleveland, O., members of the society have extended an invitation to the members attending the annual convention at Detroit on July 26 to participate in a special excursion on Lake Erie on July 25, the day before the convention. During the excursion visits will be made to special points of interest in the harbor, including the new piers and the steel crib and water-works tunnel now under construction. The headquarters for the day will be at the Weddell House, from which the excursion will start promptly at 2 o'clock p. m. Members can take either the night boat in the evening or the Lake Shore & Michigan Southern Ry. train in the morning and arrive at Detroit in time for the opening session of the convention.

NEW PUBLICATIONS.

LITERARY MAGAZINES.—Those of our readers whose memories go back to the days of the Civil War will recall the destruction of merchant shipping effected by the Confederate vessels "Tallahassee" and "Florida." The July "Century" contains an account of these two vessels and their eventful voyages written by the commander of the former vessel and by a midshipman aboard the latter. It is interesting to note that the latter vessel relied on sails as well as steam for speed, and her best record in a gale when she was making every effort to escape from a pursuing vessel was 13½ knots.

The "Atlantic Monthly" for July has two articles which deserve mention here, one by Mr. James Bryce on "The Essential Unity of Britain and America," and the other by Mr. Henry C. Lea on "The Decadence of Spain." In the July "Popular Science Monthly," Mr. E. J. Prindle writes on "Weather Forecasts," explaining the methods by which the United States Weather Bureau carries on its work. Many of the instruments used are illustrated and described, and the article is on the whole one of the best popular accounts of the Weather Bureau that we recall.

The "North American Review" opens with "An Object Lesson in Anglo-Saxon Rule: What Britain has done in Egypt," which is appropriate at this time when thoughtful Americans are looking forward to some problems with which this country will soon have to wrestle. "The Resources and Industries of Spain" are described by Mr. E. D. Jones in a short paper, which faithfully presents the barren and impoverished condition of much of that country, and the need of a stable government and popular education to bring about an improvement. In the same magazine is an article by Mr. F. B. Thurber, which appears to be a thinly disguised plea for the rehabilitation of the old Ramapo water scheme, by which a party of capitalists planned to secure a fat contract for furnishing an additional water supply to New York city, to be paid for at so much per gallon. The article does no credit to either Mr. Thurber or the magazine in which it is published. Still another article in the same magazine deserves a word of comment here. It is entitled "International Piracy," and advocates a change in international law under which merchant vessels of an enemy will be safe from capture. There is little doubt that such a change will eventually be brought about. On land the property of a non-combatant is respected in civilized warfare, and there is really little more reason why his property afloat should be confiscated. An article on a similar topic is found in the June "Contemporary Review," in which a writer advocates that the British Government in time of war should undertake to cover maritime war risks on merchant vessels under its flag. The most important article in this magazine, however, is by Dr. E. J. Dillon, entitled "The Ruin of Spain," and it is especially notable because the writer defends Weyler as Spain's ablest and most patriotic general. Dr. Dillon has evidently made a thorough study of Spanish politics, and his view of it is one with which few Americans are familar. The "Fortnightly" for June contains an article on "Cuba and Her Struggle for Freedom," from the pen of our own Fitzhugh Lee, and the "Nineteenth Century" has a description of the methods adopted in fighting the bubonic plague in India, by Miss Marion Hunter.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
July 14.	Fire engine, Cleveland, O.	July 7
July 14.	Water-works, etc., Batesville, Ark.	July 7
July 14.	Electric light plant, Batesville, Ark.	July 7
July 14.	Broken stone, etc., New York	July 7
July 14.	Brick paving, Champaign, Ill.	July 7
	Advertised, Engineering News, July 7.	
July 14.	Gas lamps (300), Ironton, O.	June 16
July 14.	Electric lighting, Ironton, O.	June 16
July 14.	Court house, Savannah, Mo.	June 30
July 14.	Paving, etc., Augusta, Me.	July 14
July 14.	Bridge, Sandusky, O.	July 14
July 15.	Electric light plant, New Paynesville, Minn.	July 14
July 15.	Lease electric and water plants, Opelousas, La.	July 14
July 15.	Hoist bridge, Middletown, O.	July 14
July 15.	Bridge, Ingersoll, Ont.	July 14
July 15.	School building, Carnegie, Pa.	July 14
July 15.	Lease water-works, Opelousas, La.	July 14
July 15.	Water-works, New Paynesville, Minn.	July 14
July 15.	Water bonds, Concordia, Mo.	July 14
July 15.	Brick paving, Charleston, Ill.	July 14
July 15.	Street bonds, Milwaukee, Wis.	July 14
July 15.	Electric light plant, Wynne, Ark.	June 30
July 15.	Church building, Scottdale, Pa.	June 30
July 15.	Asylum buildings, Huntington, W. Va.	June 30
July 15.	Church building, Wayne, Neb.	June 30
July 15.	Water department supplies, St. Louis, Mo.	June 30
July 15.	**Electric plant, Lamar, Colo.**	**May 5**
July 15.	**Electric plant, Gaylord, Minn.**	**June 16**
	Advertised, Eng. News, June 16 and 23.	
July 15.	**Bridge, Cincinnati, O.**	**June 23**
July 15.	**Harbor work, Goderich, Ont.**	**June 23**
July 15.	**Post office building, Akron, O**	**June 23**
	Advertised, Eng. News, June 23 and 30.	
July 15.	Railway station, Nashville, Tenn.	July 7
July 15.	Asphalt paving, Newport, R. I.	July 7
July 15.	Wharf, etc., Halifax, N. S.	July 7
July 15.	Paving, etc., Iowa City, Ia.	July 7
July 15.	Apartment building, Chicago, Ill.	July 7
July 15.	Brick paving, Binghamton, N. Y.	July 7
July 15.	Retorts, Hamilton, O.	July 7
July 15.	Drain, Coldwater, Mich.	July 7
July 16.	Underground crossing, Kingston, N. Y.	July 7
	Advertised, Eng. News, July 7 and 14.	
July 16.	Dredging, quay, etc., Brooklyn, N. Y.	July 7
July 16.	Sewers, Washington, D. C.	July 7
	Advertised, Engineering News, July 7.	
July 16.	**Bridge, Norwalk, O.**	**June 23**
July 16.	**Water pipe, Montgomery, Ala.**	**June 23**
	Advertised, Eng. News, June 23 to July 7.	
July 16.	**Brick sewer, etc., Muscatine, Ia.**	**June 16**
July 16.	**County buildings, Beverley, England**	**June 30**
July 16.	Steel bridge, Chillicothe, O.	July 14
July 16.	Sewers, Roanoke, Va.	July 14
July 16.	Sewage disposal beds, Waupaca, Wis.	July 14
July 16.	Macadamizing, Shelby, O.	July 14
July 18.	School building repairs, New York	July 14
July 18.	Iron fence, Pittsburg, Pa.	July 14
July 18.	Pipe sewers, Flint, Mich.	July 14
July 18.	Pipe sewers, Tarentum, Pa.	July 14
July 18.	Pipe sewers, Albany, N. Y.	July 14
July 18.	Steel and cast-iron work, Washington, D.C.	July 14
July 18.	Water bonds, McKinney, Tex.	July 14
July 18.	Water-works, Black Hawk, Colo.	July 14
July 18.	Building, Milwaukee, Wis.	July 14
July 18.	Removing dead animals, Newark, N. J.	July 14
July 18.	Sewers, etc., Rochester, N. Y.	July 14
July 18.	Macadam road, Norwich, Conn.	July 14
July 18.	Water-works, Beaver, Pa.	July 14
July 18.	Brick paving, Albany, N. Y.	July 14
July 18.	Paving, etc., Tuckahoe, N. Y.	July 14
	Advertised, Engineering News, July 14.	
July 18.	Asphalt paving, etc., Reading, Pa.	July 14
July 18.	Paving, Toledo, O.	July 14
July 18.	Grading, St. Paul, Minn.	July 14
July 18.	Iron bridge, Birmingham, Ala.	June 30
July 18.	Grading and paving, Scottdale, Pa.	June 30
	Advertised, Eng. News, June 30 and July 7.	
July 18.	Removing wreck, Philadelphia, Pa.	June 30
July 18.	Weirs road, Laconia, N. H.	June 30
	Advertised, Eng. News, June 30 and July 7.	
July 18.	Street work, Union City, Ind.	June 30
July 18.	Water pipe, (3,060 ft.), Whiting, Ind.	June 30
July 18.	Electric light plant, Fitzgerald, Ga.	June 30
	Advertised, Engineering News, June 30.	
July 18.	Water-works, Fitzgerald, Ga.	June 30
	Advertised, Engineering News, June 30.	
July 18.	Hospital building, Toledo, O.	June 30
July 18.	Street railway franchise, Salinas, Cal.	June 23
July 18.	Steel water tower, San Jose, Cal.	July 7
July 18.	Substructure, etc., Muskegon, Mich.	July 7
	Advertised, Engineering News, July 7.	
July 18.	Jail building, Woodstock, O.	July 7
July 19.	Water-works, Yale, Mich.	July 7
	Advertised, Engineering News, July 7.	
July 19.	School building, Troy, N. Y.	July 7
July 19.	Dormitory buildings (15), Sonyea, N. Y.	July 7
July 19.	Reservoir, Delphi, Ind.	July 7
July 19.	Bridge construction, Chillicothe, O.	June 23
	Advertised, Engineering News, June 23.	
July 19.	Granite paving, Rensselaer, N. Y.	June 30
July 19.	Lighting fixtures, Binghamton, N. Y.	June 30
	Advertised, Eng. News, June 30 and July 7.	
July 19.	Sewers, Nevada, Mo.	July 14
July 19.	Sewers, Philadelphia, Pa.	July 14
July 19.	Sewers, Camden, N. J.	July 14
July 19.	Sewerage system, Bellevue, Pa.	July 14
	Advertised, Engineering News, July 14.	
July 19.	Pipe sewers, Milwaukee, Wis.	July 14
July 19.	Brick paving, Troy, N. Y.	July 14
July 19.	Paving, Garrett, Ind.	July 14
July 20.	Paving, etc., Indianapolis, Ind.	July 14
July 20.	Iron bridge, Algona, Ia.	July 14
July 20.	Building elevator, Baltimore, Md.	July 14
July 20.	School building, Graceville, Minn.	July 14
July 20.	School building, Garland, Utah.	July 14
July 20.	Macadamizing, Windham, Conn.	July 14
July 20.	Brick paving, etc., Des Moines, Ia.	July 14
July 20.	Pipe sewers, Davenport, Ia.	June 30
July 20.	**Bridges, etc. (11), Chicago, Ill.**	**June 2**
	Advertised, Engineering News, June 2.	
July 20.	**Embankment, etc., Lemont, Ill.**	**June 2**
	Advertised, Engineering News, June 2.	
July 20.	**Capitol building plans, Phoenix, Ariz.**	**June 2**
July 20.	**Heat regulating system, Athens, O.**	**June 9**
July 20.	Truss bridge, Rumford, Me.	July 7
July 20.	Building elevator, Baltimore, Md.	July 7
July 20.	Heating, etc., Clinton, Ia.	July 7
July 20.	Water and light bonds, Cass City, Mich.	July 7
July 20.	Paving, Tarentum, Pa.	July 7
July 21.	School building, Dayton, O.	July 7
July 21.	Sewers, Amsterdam, N. Y.	July 7
July 21.	Heating and ventilating, Syracuse, N. Y.	July 14
July 21.	Widening bridge, Paterson, N. J.	July 14
July 21.	Water tower, hydrants, etc., Chicago Junct'n, O.	July 14
July 21.	School building, Poplar Bluff, Mo.	July 14
July 21.	Sewerage system, Goldsboro, N. C.	July 14
	Advertised, Eng. News, July 7 and 14.	
July 21.	Brick paving, Scranton, Pa.	July 14
July 22.	street work (1 street), Duluth, Minn.	July 14
July 22.	Water-works, Cass City, Mich.	July 14
July 22.	Repairing garbage dumper, New York	July 14
July 22.	Electric light plant, Cass City, Mich.	July 14
July 22.	Main brick sewer, Louisville, Ky.	July 14
July 22.	Gravel road, Waterbury, Conn.	July 14
July 22.	Paving, Lima, O.	July 14
July 22.	Paving, Louisville, Ky.	July 14
July 22.	Water-works, Sparta, Minn.	July 7
July 22.	**Hydraulic dredge, St. Louis, Mo.**	**June 23**
	Advertised, Eng. News, June 23 to July 14.	
July 22.	Grading, road work, etc., California, O.	June 30
July 23.	Water-works, Beatrice, Neb.	June 30
July 23.	**Cement sidewalks, Washington, D. C.**	**June 23**
	Advertised, Engineering News, June 23.	
July 23.	Paving, Carbondale, Pa.	July 7
	Advertised, Eng. News, July 7 to 21.	
July 23.	Embankment, etc., Shelton, Wash.	July 14
July 23.	Water pipe, Batavia, Ill.	July 14
July 23.	Iron bridges (4), Wilkes Barre, Pa.	July 14
	Advertised, Eng. News, July 14 and 21.	
July 23.	Church building, Bay City, Mich.	July 14
July 24.	Bridge work, St. Joseph, Mo.	July 14
July 25.	Church building, Holgate, O.	July 14
July 25.	County building, Chatham, Va.	July 14
July 25.	School building, Spencer, O.	July 14
July 25.	Municipal building, etc., Stratford, Ont.	July 14
July 25.	Jail, etc., Ottawa, O.	July 14
July 25.	Heating, etc., Columbus, Neb.	July 14
July 25.	Sewerage system, Kewanee, Ill.	July 14
	Advertised, Engineering News, July 14.	
July 25.	Retaining wall, Cincinnati, O.	July 14
July 25.	Drainage ditch, Harvel, Ill.	July 14
July 25.	Lighthouse supplies, Tompkinsville, S. I.	July 14
	Advertised, Eng. News, July 14 and 21.	
July 25.	Cement sidewalks, South Bend, Ind.	July 14
July 25.	Grading, paving, etc., Sullivan, Ind.	July 14
July 25.	Lighting bonds, Lebanon, O.	July 7
July 25.	Asphalt paving, South Bend, Ind.	July 7
July 25.	School buildings, Mansfield, O.	July 7
July 25.	**Water-works, Winnipeg, Man.**	**June 2**
	Advertised, Eng. News, June 2 to 23.	
July 25.	**Timber, Willetts Point, N. Y.**	**June 30**
July 26.	**Electric light plant, Sycamore, O.**	**June 30**
July 26.	**Water-works, Sycamore, O.**	**June 30**
July 26.	**Electric light plant, Yale, Mich.**	**July 7**
	Advertised, Engineering News, July 7.	
July 26.	School building, Columbus, Neb.	July 14
July 27.	Fire engines, repairs, etc., New York	July 14
July 27.	Dam, lay'g water pipe, etc., Huntington, Mass.	July 14
July 27.	Asphalt paving, etc., Jersey City, N. J.	July 14
July 27.	Heating plant, Madison, Wis.	July 14
July 27.	Church building, Moro, Ore.	July 7
July 27.	Paving, Charleston, Ill.	July 7
July 27.	**Water supply, Ridgewood, N. J.**	**June 23**
	Advertised, Engineering News, June 23.	
July 27.	**Bridge, Carthage, O.**	**June 30**
July 28.	**Masonry work, Louisville, Ky.**	**June 30**
	Advertised, Eng. News, June 30 to July 21.	
July 28.	Water pipe, hydrants, etc., Renovo, Pa.	July 14
	Advertised, Eng. News, July 14 and 21.	
July 29.	Hospital building, Cleveland, O.	July 14
July 29.	Pike road, Spencer, Ind.	July 14
July 29.	Sluice gates, Cincinnati, O.	July 7
	Advertised, Eng. News, July 7 to 21.	
July 30.	Brick paving, Ashland, O.	July 7
	Advertised, Eng. News, July 7 and 14.	
July 30.	Iron bridge, Cincinnati, O.	July 7
July 30.	Gas and naphtha lighting, Washington, D.C.	July 14
	Advertised, Engineering News, July 14.	
July 30.	Buildings, Ellis Island, N. Y. H.	July 14
July 30.	Court house and jail, Cando, N. Dak.	July 14
July 30.	School building, Provo City, Utah.	July 14
July 30.	School building, Elbowoods, N. Dak.	July 14
July 30.	Electric lighting, Washington, D. C.	July 14
	Advertised, Engineering News, July 14.	
July 31.	Brick paving, Independence, Kan.	July 14
July 31.	**Water supply, Tangier, Morocco**	**June 23**
Aug. 1.	**Electric light plant, Charleston, S. C.**	**June 30**
	Advertised, Eng. News, June 30 to July 21.	
Aug. 1.	**Power canal, Ellensburg, Wash.**	**June 30**
Aug. 1.	**Bonds ($8,000.) Ellensburg, Wash.**	**June 30**
Aug. 1.	**Jail building plans, Syracuse, N. Y.**	**July 7**
Aug. 1.	**Steel bridge, Stockton, Mo.**	**July 7**
Aug. 1.	**Iron bridges (3), Wichita, Kan.**	**July 7**
Aug. 1.	School building, Bloomfield, N. J.	July 14
Aug. 1.	Steel bridge, Lake Belt, Minn.	July 14
Aug. 1.	Pile bridges (3), Red Cloud, Minn.	July 14
Aug. 1.	Boilers, heaters, etc., Concord, Mass.	July 14
	Advertised, Engineering News, July 14.	
Aug. 1.	Macadamizing, Toledo, O.	July 14
Aug. 1.	Macadam road, Proviso, Ill.	July 14
Aug. 1.	Paving, Kewanee, Ill.	July 14
Aug. 2.	Bridge, Jackson, Miss.	July 14
Aug. 2.	Steam heating, Hartwell, O.	July 14
Aug. 2.	Pumping station, Albany, N. Y.	July 14
Aug. 2.	Dredging, Lorain, O.	July 14
	Advertised, Eng. News, July 14 and 21.	
Aug. 2.	Bonds, Holly Springs, Miss.	July 7
Aug. 2.	Road work, Anaconda, Mont.	July 7
Aug. 2.	Arc lighting, Lebanon, Pa.	June 30
Aug. 2.	Steel rails, Ottawa, Ont.	June 16
Aug. 3.	**Levee work, West Memphis, Ark.**	**June 30**
	Advertised, Eng. News, June 30 to July 28.	
Aug. 3.	Paving, etc., Cincinnati, O.	July 14
Aug. 3.	Electric light plant, London, Ont.	July 14
	Advertised, Eng. News, July 14 and 21.	
Aug. 5.	Pier, Cleveland, O.	July 14
Aug. 6.	Street work, Mansfield, O.	July 14
Aug. 6.	**Dike, York River, Va.**	**July 7**
	Advertised, Eng. News, July 7 to 28.	
Aug. 6.	Dredging, etc., Virginia.	July 7
	Advertised, Eng. News, July 7 and 14.	
Aug. 8.	**Water pipe, etc., Winnipeg, Man.**	**June 16**
	Advertised, Eng. News, June 16 to 30.	
Aug. 8.	Brick paving, Anderson, Ind.	July 14
Aug. 8.	Repairing asphalt, Cincinnati, O.	July 14
Aug. 9.	Street work, Orrville, O.	July 14
Aug. 9.	Torpedo boats, Washington, D. C.	July 7
Aug. 10.	Bridge bonds, Cincinnati, O.	July 14
Aug. 10.	Bridge masonry work, Norristown, Pa.	July 14
Aug. 10.	Water-works, Pomeroy, O.	July 14
	Advertised, Engineering News, July 14.	
Aug. 10.	Macadamizing, Cincinnati, O.	July 14
Aug. 15.	**Exhibition bldg. plans, Glasgow, Scotland.**	**June 2**
Aug. 18.	Water supply, Jersey City, N. J.	July 14
Aug. 20.	Electric lighting, Whitesboro, N. Y.	July 14
	Advertised, Eng. News, July 14 and 21.	
Aug. 23.	**Water pipe, Coolgardie, West Australia,**	**June 2**
Aug. 26.	Pumping engines (2), Minneapolis, Minn.	July 14
Aug. 31.	**Custom house, Guayquil, Ecuador**	**Apr. 21**
Sept. 1.	**Battleships (3), Washington, D. C.**	**June 23**
Sept. 1.	**Drainage system, Savannah, Ga.**	**June 30**
	Advertised, Eng. News, June 23 to Aug. 25.	
Sept. 3.	**Sewage pumping station, Boston, Mass.**	**July 7**
	Advertised, Eng. News, July 7 and 14.	
Sept. 12.	**Hospital plans, San Francisco, Cal.**	**Mar. 24**
Oct. 1.	Monitors (4), Washington, D. C.	July 7
Oct. 1.	**School building (equipment), St. Thomas, Ont.**	**July 7**
Oct. 24.	**Markets, etc., Belem, Brazil**	**Apr. 28**
Oct. 30.	**School building, Chehalis, Wash.**	**June 16**
Dec. 31.	**Plans for station, etc., Stockholm, Sweden.**	**June 23**

RAILWAYS.

ALLEGHENY & WESTERN.—J. M. Floesch, Ch. Engr., Kittanning, Pa., informs us that the construction of this line is now under contract between Lindsey and Butler, 62 miles, as follows: To C. J. Ryan & Son, 43 West 33d St., New York, for 30 miles; to Thomas Collins & Co., of Bellefonte, Pa., 10 miles; to the Pennsylvania Construction & Improvement Co., Curwensville, Pa., for 22 miles. Contracts are being carried out all along the line, and it is expected to complete the grading by December. Jutte & Foley, of Pittsburg, Pa., have also been awarded the contract for the masonry work and about 9,000 cu. yds. of earthwork for the 1,500-ft. bridge to span the Allegheny River at Moss Grove. The contract for the superstructure of this bridge has not yet been let. A further extension of this railway from Butler to New Castle is contemplated, and it is expected that work will be completed by next June.

ALTOONA & PHILLIPSBURG CONNECTING.—Press reports state that the Harlan & Hollingsworth Co., Wilmington, Del., manufacturers of cars, has filed a bill in equity in the Philadelphia courts against the Altoona & Phillipsburg Connecting R. R. Co. and the Union Trust Co., trustees of the mortgage dated June 1, 1893, on the railway, property and franchises, securing an issue of bonds amounting to $400,000, asking for the foreclosure of the mortgage and the appointment of a receiver. The railroad is 18 miles long, running between Altoona and Phillipsburg, Pa., in the Clearfield coal district. Pres., Henry Levis, Drexel Bldg., Philadelphia, Pa.

ASTORIA & COLUMBIA RIVER.—T. H. Curtis, Ch. Engr., Astoria, Ore., informs us that this line is completed from Goble to Seaside, via Astoria, with a branch at Flavel, Ore., a distance of 81 miles. No extension is proposed. Pres., A. B. Hammond, Astoria.

CHESAPEAKE BEACH.—About 12 miles of grading is said to be completed on this new line between Washington, D. C., and Marlboro, Md., and work is to be carried 18 miles farther on to Chesapeake Beach. Green & Burrows, Atlantic Building, Washington, have the contract for grading. L. H. Hyer, Ch. Engr., Chesapeake Bay Construction Co., 1420 New York Ave., Washington, may be addressed.

CHICAGO TERMINAL TRANSFER.—F. E. Paradis, Ch. Engr., Chicago, Ill., informs us that this company is constructing an extension to its system from Franklin Park to Mayfair, Ill., seven miles. The right of way and the necessary capital has been secured, and grading is completed, having been done by the McArthur Bros. Co., of Chicago. The steel bridge work will be done by the Wisconsin Bridge & Iron Co., Milwaukee, Wis.; and the trestle work by Thomas Phee, of Chicago. Pres., Edward D. Adams, 35 Wall St., New York.

CLEARFIELD SOUTHERN.—This company was incorporated in Pennsylvania, July 6, with a capital stock of $30,000, to construct a steam railway from the mouth of Little Clearfield Creek to Belsena Mills, a distance of 15 miles. The incorporators are, Pres. A. W. Lee, W. B. Townsend, Samuel C. Stewart and Geo. H. Gearhart, all of Clearfield; David McGaughey, Osceola Mills, Pa.

COLOMBIA.—Press reports state that J. Ed. Buckley, 1906 Pacific Ave., Spokane, Wash., contemplates the construction of a narrow-gage railway from the head of navigation on the Magdelena River to Bucaramanga, a distance of about 90 miles. It is said that a 50-lb. rail will be used, and that the maximum cost of construction is estimated at $47,000 a mile. The government has given Mr. Buckley a concession for building the line, with a grant of 150,000 acres of land.

COLUMBIA SOUTHERN.—An extension of this line from Wasco to Klondike, five miles, has recently been completed, and work is in progress on the further construction of the line to Moro, Ore., making a total of 17 miles of new road. Track is expected to be laid to Moro by October 1. Pres., E. E. Lytle; Ch. Engr., E. E. Cooper, both of Wasco, Ore.

DELAWARE.—This company was incorporated in New York July 6 with a capital stock of $200,000, to construct and operate a steam railway from Delhi to Andes and Bovina Center, Delaware county, on the New York, Ontario & Western Ry., a distance of 15 miles. The directors are Herbert Sewell, of Walton, N. Y.; T. E. Hastings and Alexander Wilson, of Bovina Center; James F. Copp and W.C. Oliver, of Andes; S. P. Wilbur, Henry Honeywell, Henry Davies and G. W. Youmans, of Delhi, N. Y.

DULUTH & IRON RANGE.—Grading has been completed on the extension of this line from Waldo, Minn., to the Cloquet River; the laying of five miles of additional spur track is projected. J. L. Greatsinger, Pres. and Gen. Mgr., Duluth, Minn.

EASTERN CAROLINA.—This company has been incorporated in North Carolina, with a capital stock of $100,000, to construct and operate a railway from Tarboro to Crisp, N. C. Among the directors are B. F. Finney, Savannah, Ga.; Jefferson Cobb and Edward Pennington, Tarboro, N. C.

MEXICO.—Reports state that the Mexican government has executed a contract with Sir Weltman Pearson for the construction of harbors at Coatzacoalcos and Salina Cruz, and for the lease of the National Interoceanic Ry., Isthmus of Tehuantepec, which connects these two ports. The main object of these works, which will cost about $7,500,000, is to create a new interoceanic route, which, it is expected, will almost entirely supersede that of the Isthmus of Panama.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Thomas Greene, Acting Ch. Engr., Minneapolis, Minn., informs us that this company is at present engaged in grading its extension from Kulm, in La Moure county, to section 9 in the northern part of McIntosh county, N. Dak., where a junction will be formed with the old grade of the Aberdeen, Bismarck & North Western Ry., which was built in 1887 from Aberdeen, S. Dak., to Bismarck, N. Dak., but not ironed; it is now the property of this company. It is also intended to relay about 80 miles of the eastern division in Wisconsin and Michigan, between the station of Pennington and Gladstone, this summer with 72-lb. steel rails. The Kulm extension is to be completed in time to handle this year's harvest.

MINNESOTA, IOWA & GULF.—This company is said to have been incorporated at Des Moines, Ia., to construct a railway through Minnesota, Iowa and Missouri.

MISSISSIPPI, COLESBURG & MANCHESTER.—The Southwest Construction Co., of Kansas City, Mo., is said to have been awarded the contract for the construction of this new line of railway from Dyersville to Colesburg, via New Vienna and Petersburg, Ia. There will be no grade to exceed 1½% and no curves to be more than 4°; 60-lb. steel rails are expected to be used. Secy., W. C. Kirchheck, Colesburg, Ia.

MISSOURI & IOWA SOUTHERN.—J. E. House, Ch. Engr., Omaha, Neb., is said to be making the final survey for this proposed standard gage railway to be built from Sedalia to Miami, via Marshall, a distance of about 50 miles. It is expected to construct the line this year.

MISSOURI RIVER, ALBION & WESTERN.—This company was incorporated in Nebraska, July 12, with a capital stock of $100,000, to construct a line from the eastern boundary of the state at Decatur through Albion, and thence north and west to the South Dakota line.

NAVASOTA & MADISONVILLE.—R. J. Camp, Madisonville, Tex., informs us that the necessary subscriptions have been made for this proposed railway from Keith to Madisonville, via Bedias, Tex., 45 miles. It is now desired that some one will stock and operate the line, or take enough bonds to pay for the construction. This company proposes to build the road bed and lay the ties if the subsequent laying of rails and operation over the route is assured. Pres., J. E. Morris, Madisonville; Ch. Engr., B. F. Goodrich, Houston, Tex.

REIDSVILLE & DORCHESTER.—This company has been organized in Georgia, with a proposed capital stock of $100,000, to construct a railway from Dorchester to Greenville and Reidsville, Ga. Among those interested are George W. Perkins and T. W. Hardwick, of Tennille, Ga.; Henry C. Perkins, Augusta, Ga.; William Rawlings and R. L. Warthen, of Sandersville, Ga., and others. G. W. Perkins, of Tennille, informs us that preliminary surveys have been made over the route, 45 miles, and that the right of way has been donated wherever there is a permanent location. The entire capital has not yet been secured, but it is expected to let contracts as soon as the line is permanently located.

RIO GRANDE WESTERN.—E. J. Yard, Ch. Engr., Salt Lake City, Utah, informs us that Deal Bros. & Mendenhall, of Springville, Utah, have the contract for the building of a spur eight miles long, leaving the main line at Mile Post 138.1. Grading is nearly completed. Pres., W. J. Palmer, 11 Broadway, New York.

ST. FRANCOIS VALLEY.—Louis B Houck, Pres., Cape Girardeau, Mo., informs us that the survey has been made, the right of way obtained and the capital secured for this proposed railway, ten miles in length, to the north of Campbell, Mo. The contract is held by Louis Houck, of Cape Girardeau, and he has already graded about one mile additional road and cleared the right of way. Seven miles of the line was previously built and was known as the "Ward Road." A. R. Ponder, Ch. Engr., Cape Girardeau.

TEXAS CITY TERMINAL.—D. H. Wilson, Supt., Texas City, Tex., informs us that the only improvements being undertaken by this company are the construction of one mile of new track at the Texas City yards, and one-half mile of new sidings.

UNION TERMINAL.—The Union Terminal Association has filed articles of incorporation with the county clerk at Newark, N. J., to have a capital stock of $5,000,000, with $1,000 paid in, to acquire and control the property of the Kansas City & Atlantic R. R. Co., of Missouri; the Terminal Improvement Co., of Kansas City, and the Missouri Agricultural Fair Grounds Association, of Galliton township, Mo. The incorporators named are Jesse R. Salmon and Cortlandt Parker, Jr., of Newark; William H. Lee, Greenwood, Mass.; Vernon O. Taylor, Providence, R. I.; Francis E. Dana, Summit, N. J.; Stephen Salisbury and Theodore C. Bates, Worcester, Mass. Address Cortlandt Parker, Jr., 765 Broad St., Newark, N. J.

WESTERN MARYLAND.—C. O. Vandevanter, Principal Assistant Engr., Baltimore, Md., informs us that the improvements which this company is now making includes the construction of a branch line from Hagerstown to a point near Altenwald, Pa., 5.30 miles, and known as the Hagerstown & State Line R. R.; and the Washington & Franklin branch in Pennsylvania, 9.07 miles in length; work is to be completed by Oct. 1. As stated in a former issue, the contract for the grading, masonry and ballasting is held by J. R. Serpell & Co., of Louisville, Ky. A 17-stall round house is also being erected at Hagerstown, eight stalls of which are to be used as a machine shop; this is under contract to be completed by Aug. 31.

STREET AND ELECTRIC RAILWAYS.

DEDHAM, MASS.—The selectmen have granted a franchise to the Roxbury & Roslindale St. Ry. Co. to lay tracks in this place from Tracy Square to Oakdale Square, one mile.

FRAMINGHAM, MASS.—The Framingham, Southboro & Marlboro St. Ry. Co. has been incorporated, with a capital stock of $120,000, to build an electric street railway from Worcester St. in this place to Marlboro, via Southboro, nine miles. The directors are: S. H. Howe, F. D. Newton, C. B. Sawin, J. R. Entwistle, W. B. Ferguson, C. E. Barnes and G. A. Butman.

NEW BEDFORD, MASS.—The New Bedford, Middleboro & Brocton St. Ry. Co. was granted a hearing by the board of public works, June 30, on its petition for a franchise to build its line in this city. No action was taken on the petition. Abbott P. Smith, Frederick C. Hinds and L. Le B. Holmes represented the company.

WICKFORD, R. I.—The Sea View Electric Ry. Co. is planning to extend its line, which has just been put in operation from Narragansett Pier to Saunderstown and Wickford, according to reports.

BROOKLYN, N. Y.—Frederick Uhlman, Receiver of the Brooklyn Elevated R. R., is reported to be at work upon plans for connecting the Flatbush Ave. line of the road with the Long Island R. R. by a loop, for the purpose of running through trains from City Hall, New York, across the Brooklyn Bridge to Jamaica, L. I.——The Brooklyn Heights R. R. Co. has begun work on changing the motive power of the Sea View Elevated R. R., running from Brighton Beach to West End, Coney Island, from steam to electricity, besides building several hundred feet of bulkhead and filling, at a total cost of about $20,000, according to report.

BUFFALO, N. Y.—The Buffalo Valley R. R. Co. has applied to the railroad commissioners for a charter to build a railway from Java to this city, according to report.——The Buffalo Ry. Co. has filed plans with the board of public works for enlarged conduits for its wires in Niagara and Pearl Sts.

NEW YORK, N. Y.—The Union Ry. of the Borough of the Bronx is expected to open its branch from Mt. Vernon to New Rochelle Aug. 1.

HADDONFIELD, N. J.—Vice-Chancellor Reed has filed an opinion denying the injunction asked for by citizens of this place to restrain the West Jersey Traction Co. from constructing an electric railway on Main St. E. A. Armstrong and D. J. Pancoast represented the company at the hearing.

ORANGE, N. J.—The Suburban Traction Co.'s property in the Oranges and Bloomfield was purchased at auction sale July 6 by the Orange & Passaic Valley Ry. Co., the incorporation of which was noted in our issue of June 23. Col. Chas. A. Sterling, Pres. of the National Storage Co., represented the latter railway company, which assumes $60,000 in first mortgage bonds and $150,000 bonds held by the Manhattan Trust Co., which it expects to pay in full. The line will be made standard gage and will be improved, and the Bloomfield end extended to Passaic, through Brookdale, with a branch from the latter place to Upper Montclair. Plans have also been filed with the Secretary of State for an extension to South Orange.

PLAINFIELD, N. J.—The common council has refused to grant a franchise to the Plainfield St. Ry. Co. to operate a line on East 2d St. Adrian Riker, Secy. and Treas.

ALLENTOWN, PA.—Work has been begun on the extension of the Allentown & Kutztown Electric Ry., 18 miles long. An extension from this place to Emaus, six miles, is also under construction. It is also said that a line is projected through the cement regions of Lehigh county.

GREENSBURG, PA.—The Greensburg, Jeanette & Pittsburg Electric St. Ry. Co., running from this place to Manor, has been sold to a syndicate of Harrisburg capitalists, of which Benj. Myers and Patrick Russ are the principal members. The company proposes to improve the line and to extend it to Irwin. It will also purchase, according to report, the Greensburg & Hempstead Electric St. Ry., changing it to standard gage and extending it to Mount Pleasant. Supt., C. L. Brinser, Harrisburg, Pa.

HARRISBURG, PA.—The officers of the Cumberland Valley R. R. Co. have purchased a controlling interest in the Harrisburg & Mechanicsburg Electric Ry. Co., and will complete the line from New Cumberland to this city, according to report. Spencer C. Gilbert, Pres.

NEWTOWN, PA.—The Newtown Electric St. Ry. Co. is reported to be making surveys for an extension of its line from this place to Doylestown. There will be a number of overhead crossings of turnpikes and railways and a new bridge will have to be built over Mill Creek. Thos. P. Chambers, Pres.

PHILADELPHIA, PA.—The select and common councils have granted permission to the Union Traction Co. to remove one of its tracks on East Susquehanna Ave. and to lay in its stead a track on East Norris St., from Girard Ave. to East Thompson St., and also to reconstruct its line on Wayne Ave., Germantown. Permission has also been granted by the councils to the same company to extend its tracks and overhead system on Hunting Park Ave. from its present terminus to Old York Road, amending an ordinance of Feb. 25. Geo. D. Widener, Pres.

PORT CARBON, PA.—The Port Carbon & Middleport Electric Ry. Co. has been incorporated, with $100,000 capital, to build an electric street railway from this city to Middleport, seven miles. John A. Pattee, Pres.; R. S. Martin, Claude S. Jarvis, John D. Rishel and Henry E. Thale are the incorporators, all of Philadelphia.

WILMINGTON, DEL.—The street and sewer department has granted franchises to the Wilmington City Ry. to build new lines on Walnut St., from Front St. to East 8th St., and to build a line on Vandever Ave., from Claymont to Market St.——The Wilmington & Chester Traction Co. is now building its line between these cities. Pres., Clarence M. Clark.

WASHINGTON, D. C.—The Washington & University R. R. Co. has been incorporated to build a street railway in this city.

PETERSBURG, VA.—The Piedmont Traction Co. has asked for a franhcise to build an electric street railway in this city, six miles in length. T. O. Troy, Pres.

BIRMINGHAM, ALA.—The Birmingham Traction Co. is reported to have been granted a franchise to build its electric railway system in this city.

AKRON, O.—The Cleveland & Eastern R. R. Co. is about to apply to the county commissioners for a franchise to extend its line to this city, according to report.

SPRINGFIELD, O.—The Springfield Ry. Co. is considering the building of an extension to its electric railway from this city to Yellow Springs, according to report. S. L. Nelson, Mgr.

TOLEDO, O.—Dr. Smith, of Adrian, Mich., is reported to be interested in building an electric railway from Lyons to this city, via Sylvania, 28 miles.

BERRIEN SPRINGS, MICH.—The village council is reported to have granted a franchise to a party of South Bend, Ind., capitalists, to build an electric line from the latter city to Benton Harbor, via Berrien Springs.

DETROIT, MICH.—The Grand River Electric R. R. has begun operation between this city and Sand Hill. Seymour Brownell, Consult. Engr.

GRAND RAPIDS, MICH.—It is reported that the Grand Rapids & Lake Michigan Electric R. R. Co. will apply to the common council for a franchise to build its line from this city to Grand Rapids, 35 miles. The company has $500,000 capital stock, and the promoters are: Alex. E. Riopelle and Robert Hanneman, of Detroit, Mich.; Wm. J. Hess, Grand Rapids.

LANSING, MICH.—Surveys are being made for the Lansing, Dexter & Ann Arbor Electric Ry. Secy. Taylor may be addressed.

MOUNT CLEMENS, MICH.—The city council has granted a franchise to the Rapid Ry. Co. to lay tracks in this city, and to the Detroit, Lake Shore & Mount Clemens Ry. Co. to extend its tracks on East St. to Avery Square, according to reports.

EDWARDSVILLE, ILL.—The Mississippi Valley R. R. Co. has been incorporated to build an electric railway from St. Louis to Alton, through this city. The officers are: C. E. Carroll, Pres., St. Louis, Mo.; J. A. Mehling, Vice-Pres., Cleveland, O.; A. Holthaus, Secy. and Treas., St Louis, Mo.

HOWARD, ILL.—The common council has granted an extension of the franchise for the proposed electric railway to Geneva Lake until Sept. 1, 1899, the town board of Walworth having extended it until the same date. H. T. Windsor, Chicago, may be addressed for particulars.

OREGON, ILL.—The entire issue of $500,000 bonds for the Rock River Electric Ry. is reported to have been taken by Hirsch Bros, New York, and the Western Trust Co., Chicago. Construction will begin as soon as contracts have been let and the necessary water power, which is located at this place, has been purchased. Pres., E. M. Hopkins, Chicago.

DULUTH, MINN.—Luther Mendenhall, President of the Duluth St. Ry. Co., has been appointed its receiver, on application of Thomas Lowry, Minneapolis, who holds a judgment for $1,988 against the company.

WINONA, MINN.—The Winona Ry. & Light Co. has asked permission of the city council to relay its tracks at the east end of the city through a better residential district.

HAVELOCK, NEB.—The council has decided to submit the proposition on permitting the Lincoln Traction Co. to extend its lines to this city, to the vote of the people, according to report. Supt. Humpe may be addressed.

KANSAS CITY, MO.—The Central Electric Ry. Co. has been incorporated with $1,000,000 capital, to build and operate street railways in this and adjoining cities, to be operated by electricity, cable or other motive power. The incorporators are Wm. M. Reid, E. S. Yeomans, E. G. Vaughan, Frank S. Groves and Wm. C. Scarritt, of this city; S. M. Jarvis and Roland R. Conklin, New York. The company will begin construction of lines running from Kansas City, Kan.; Argentine, Armourdale, Westport, Washington Park and Fairmount Park, using the underground Budapest system, for which three large power houses will be constructed.——The Metropolitan St. Ry. Co. will commence immediately the construction of the Broadway electric line from 6th and Delaware Sts. to 17th St. and Madison Ave. Engineer, E. Butts.

ST. LOUIS, MO.—The St. Louis & Belleville Electric Ry. Co. has filed a mortgage for $500,000 with the Mississippi Valley Trust Co. of this city to secure bonds which will be used to complete the construction and equipment of its road, according to report.

OAKDALE, CAL.—The Oakdale Transit Co. has applied for a franchise to build an extension to its lines on 12th St., from Broadway to Oak St., and thence to 11th St.

SAN BERNARDINO, CAL.—J. H. Boyd is reported to be interested in the construction of an electric railway from this city to Redlands.

ELECTRIC LIGHT AND POWER.

DEERING, ME.—The Deering Electric Light Co. has been awarded the contract for furnishing 273 25-c. p. incandescent lights for one, three or five years, beginning Oct. 1.

WATERBURY, VT.—W. P. Dillingham, of Waterbury; Mr. Briggs, of Brandon, Vt., and three engineers, have made surveys and a report for the National Life Insurance Co. of the proposed plant at Bolton Falls for the Bolton Falls Power Co. The insurance company, it is stated, has been asked to advance money for the construction; estimated cost, $75,000.

CONCORD, MASS.—Bids are asked until Aug. 1 for furnishing and installing two boilers, a feed pump, condenser, two heaters, etc., for the electric light plant, as stated in our advertising columns. Engrs., Stone & Webster, 4 Post Office Square, Boston, Mass.; Chn. Com., R. F. Barrett.——A press report states that at a town meeting July 9 it was voted to appropriate an additional $15,000 to the $35,000 already appropriated for the plant. The additional sum is required for placing 3½ miles of wire under ground.

GLOUCESTER, MASS.—Frank E. Davis, Mayor, writes us that nothing will be done this year in regard to the proposed plant.

MANSFIELD, MASS.—Chas. C. Hagerty, Clk., writes us that it is not likely that the water supply district will vote to accept the act authorizing it to establish a plant for electric lighting.

WOBURN, MASS.—The Woburn Light, Heat & Power Co. has let the contract for furnishing three 400-HP. direct-connected, cross-compound condensing engines for its plant to the Blake Engine Co., Warren, Mass. The company, it is stated, will let other contracts this week.

BUFFALO, N. Y.—Preparations are being made to erect a terminal station for the Cataract Power & Conduit Co., it to be located a short distance north of the Bullymore malthouse, in Niagara St. The new malthouse in course of construction by the Curtiss estate will probably use power distributed from the new terminal station. Consult. and Des. Engrs., Hand & Greenburg and Carlton & Meadows, Buffalo; Gen. Mgr., Chas. R. Huntley.

COXSACKIE, N. Y.—A. E. Rowell, Village Pres., writes us that the contract for furnishing and constructing the proposed plant is probably already let. The poles are now being delivered. The plant will be owned by the J. G. Newbury Co.

SPENCER, N. Y.—T. C. Washburn, Village Pres., writes us that all contracts for furnishing and building the plant to be owned by S. A. Seely have been let. The plant will have a capacity for one or two arc and 40 32-c. p. incandescent lights. Des. Engr., Maurice Moon.

SYRACUSE, N. Y.—The question of erecting ornamental electric light poles on Salina and certain other streets is being considered, according to local papers.

WHITESBORO, N. Y.—Bids are asked until Aug. 20 for lighting this village with about 30 2,000-c.p. arc lights for a term of five or more years, as stated in our advertising columns. Engr., W. G. Stone, Utica, N. Y.; Clk., G. A. Kirkland.

JERSEY CITY, N. J.—The People's Light & Power Co. is erecting a new boiler house in connection with its electric plant. It is 60 ft. wide and about 90 ft. long, contains space for large upright boilers, and has an arrangement for the storage of coal in the steel bunker inside the building, so that the fuel can be easily taken direct to the boilers. The tracks are arranged so that railway cars will run into the building, and discharge the coal directly into the bunker. It is of fireproof construction throughout, with steel frame, brick side walls, and iron roof covering, well lighted and ventilated. The steel work is being furnished and erected by the Berlin Iron Bridge Co., of East Berlin, Conn. Sandford & Stillman, of Jersey City, have the contract for the building.

PHILADELPHIA, PA.—The D'Olier Electric Co., 129 South 11th St., Philadelphia, has been awarded the contract at $9,319 for furnishing and placing the tubing, electric wires, etc., in the new Central high school building. The contract for the plant was let July 11 to Walker & Kepler, 531 Chestnut St., at $26,780.

WILLIAMSPORT, PA.—The city clerk writes us that nothing new has developed in regard to putting in a plant.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 30 for lighting the streets with incandescent and electric arc lights for the year ending June 30, 1899, as stated in our advertising columns.

WILLIAMSPORT, MD.—M. Emmett Cullen, Town Treas., writes us that the burgess named one set of supervisors to execute the act authorizing the town to erect a plant and issue $20,000 in bonds for the same. The supervisors were not confirmed, and the burgess has so far failed to nominate others or say when he intends to do so.

DARLINGTON, N. C.—The Charlotte Electrical Engineering & Supply Co., Charlotte, N. C., has been awarded the contract for furnishing and putting in a plant for the Darlington Mfg. Co.

LAFAYETTE, ALA.—We are informed that bids are wanted by the city at any time for furnishing and constructing a plant. It will have a capacity for 25 2,000-c. p. arc and 800 incandescent lights; estimated cost, $10,000. Charles Schurssler may be addressed.

UNION SPRINGS, ALA.—P. L. Cowan, Clk., writes us that we made a mistake in our issue of June 30 in stating that the city had not sold $20,000 in bonds for the proposed plant. The town issued $10,000 in bonds several months ago, and were sold the latter part of May to D. M. Farsen, Chicago. Mayor, A. D. Fielder.

OPELOUSAS, LA.—Bids are asked until July 15 for leasing the plant and water-works about constructed. The lessor is to supply the city with 40 arc and four incandescent lights free of charge. Thos. H. Lewis, Jr., Cy. Clk

COVINGTON, KY.—The aldermen are considering the question of authorizing the city clerk to ask for bids at once for lighting that portion of the city which is not lighted with gasoline. Bids will be wanted for electric, gas and gasoline lighting. The present contract for the gasoline lighting expires in September.

TOLEDO, O.—H. E. Marion writes us that the Toledo Heating & Lighting Co., just incorporated, is the successor to the Home Heating & Lighting Co. The old plant will be operated for the present, and it is not probable that a new plant will be erected this season. Gen. Mgr., H. J. Yaryan.

BELLAIRE, MICH.—C. S. Guile, Pres., writes us that the town is not yet ready to take action with regard to putting in a plant.

CASS CITY, MICH.—Bids are asked until July 22 for furnishing and constructing a plant and water-works. Engr., Geo. C. Morgan, 808 Royal Insurance Bldg., Chicago, Ill.; H. W. Seed.

DECATUR, MICH.—E. J. Rawson, Clk., writes us that bids will be wanted the latter part of July for furnishing and constructing a plant to cost $6,000. Plans have not yet been prepared.

HOLLAND, MICH.—It is reported that this place will extend the plant, at a cost of about $3,361. Supt., F. W. Fairfield.

SAULT STE. MARIE, MICH.—Local papers state that Mason, Hoge & Co., Chicago, Ill., and Erskine D. Smith & Co., Philadelphia, Pa., submitted the lowest bids July 1 for constructing the power canal for the American Lake Superior Water Power Co., advertised in Engineering News. The bids on the intake are said to have ranged from $75,000 to $350,000. The entire work will cost from $1,275,000 to $2,000,000. The canal is to be completed by Jan. 1, 1900. Ch. Engr., H. von'Schon, Sault Ste. Marie.

BELOIT, WIS.—The Beloit Electric Light & Power Co. has purchased the old Rock River Paper Mill property, and will change the property into an electric light and power plant. The purchase carries with it a valuable water power. The electric company will spend $25,000 in improvements, according to reports. G. L. Cole, Vice-Pres. and Purchasing Agent.

SUPERIOR, WIS.—It is stated that the Great Northern elevators are to be equipped with electricity instead of steam. Ground has already been broken for the engine house, to be 84 × 64, and for the boiler house, to be 77 × 44 ft.

DULUTH, MINN.—Press reports state that the council light committee will probably have a proposition for submission in regard to the question of electric lights. The contract under which the lighting is now done expired last month, but lights are being continued under it. It is probable that the $50,000 paid yearly for lights will be cut in two by the committee and that naphtha lamps will be used in the suburbs, instead of arc lights as now. The city will make a contract for what electric lights it will be willing to take for one year, and before its expiration will have decided what it wants to do, and construct its own plant. Several other systems of lighting other than electricity are being considered, but whatever system is put in the municipality will be in control and ownership.

NEW PAYNESVILLE, MINN.—Bids are asked until July 15 for furnishing and constructing the proposed plant and water-works, according to reports. Engrs., Fairbanks, Morse & Co., St. Paul, Minn.

TOPEKA, KAN.—The executive council is considering the question of putting in a plant at the state house.

AURORA, NEB.—The question of building a plant is being considered, according to reports.

LITTLE ROCK, ARK.—Geo. C. Strong, formerly of Peoria, Ill., submitted a proposition to the board of trade July 1 for developing the water power of the Quachita River. Plans are being prepared by Geo. M. French, Hot Springs, Ark., for a dam and plant on this river. The dam will be 1,100 ft. long and 15 ft. high, and is estimated to cost about $70,000. Surveys for a plant at Rockfort have also been made by Chas. G. Woodbury. M. M. Cohn, Pres. Bd. of Trade; Geo. G. Harkness, Secy.

LAFAYETTE, COLO.—Press reports state that the Rocky Mountain Power Co., recently incorporated, will build a plant in this town to furnish light and power in the mining camps in this vicinity. Over 2,000 HP. will be developed. Estimated cost, about $2,500,000. Capital stock, $500,000. Chas. T. Brown, attorney for the Northern Coal Co., is interested.

DAVENPORT, WASH.—It is stated that Councilman David Wilson has submitted a proposition to put in a plant with a capacity for 20 arc and 600 incandescent lights.

LONDON, ONT.—Bids are asked until Aug. 3 for furnishing and constructing a plant, as stated in our advertising columns. Samuel Stevely, Acting Chn.; Ormsby Graydon, Cy. Engr.

MONTREAL, QUE.—Plans for a water power plant have been made public here by the Shawinigan Water & Power Co., of Montreal, which company has bought from the government all the water power rights at Shawinigan Falls, on the St. Maurice River, Que. There is at this point a natural fall of 165 ft. The company proposes immediately to install a plant which will develop about 100,000 HP., according to reports.

NEW COMPANIES.—Paris Light & Power Co., Paris, Tex.; $60,000; T. J. Record, J. A. Porter, D. H. Scott, J. D. Crook, B. J. Baldwin, Jr., Paris

Michigan Lake Superior Power Co., Sault Ste. Marie, Mich.; $500,000; to excavate, construct and maintain water courses, with water power appurtenances thereto, etc.; Francis H. Clergue, Sault Ste. Marie; E. V. Douglas, Walter P. Douglas, F. S. Lewis, Philadelphia; Lynde Harrison, New Haven, Conn.

Oakwood Water & Light Co., Van Buren township, Montgomery county, Oakwood, O.; $10,000; H. E. Talbott, D. A. Eichelberger, R. T. Houk, Hugo Cook and D. G. Porter.

Manning Signal Light Co., Des Moines, Ia.; $100,000; Edward S. Manning, H. J. Mills, Samuel Compton, C. A. Bishop, W. D. Sheehan.

Toledo Heating & Lighting Co., Toledo, O.; $125,000; H. T. Yaryan, H. E. Marion, Irving B. Hiett, T. W. Childs, R. R. Lee, Geo. H. Beckwith.

BRIDGES.

NEW HAVEN, CONN.—The board of aldermen have authorized the issue of $290,000 in bonds for the construction of bridges. The committee has recommended that bridges be built at Chapel St., over Mill River, to cost $150,000, at Derby Ave., cost $20,000, and Willow St., cost $10,000.

ROCHESTER, N. Y.—The following bids were received July 5 for constructing a lift bridge over the canal at Fitzhugh St.:

Rochester Bdg. & Iorn Wks., Rochester (accepted).	$23,932
Havana Bridge Works, Montour Falls, N. Y.	24,227
King Bridge Co., Cleveland, O.	27,653

GARFIELD, N. J.—The freeholders of Bergen and Passaic counties have awarded a contract to Frank R. Long & Co., at $28,950, for constructing a bridge over the river at this place.

JERSEY CITY, N. J.— Maguire & Hall have been awarded a contract for the construction of the viaduct on the Hudson County Boulevard. The bids were $62,025 with superstructure of through span, $48.755 without superstructure of through span. E. W. Harrison, Ch. Engr. Bd. Freeholders, Fuller Bldg.

PATERSON, N. J.—Bids are asked by the park commission until July 21 for widening the bridge at West Side Park, to cost about $1,000.

NORRISTOWN, PA.—Bids are asked until Aug. 10 for constructing the masonry work on three bridges. D. H. Hitner, County Clk.; A. W. Carson, Engr.

WILKES-BARRE, PA.—Bids are asked until July 23 for constructing four iron bridges, as stated in our advertising columns. Joseph D. Lloyd, Controller.——We are informed that bids are also asked until the same date for the construction of 48 stone arch bridges, ranging in cost from $125 to $1,200 each. Appropriation, $19,335. C. H. Phillips, County Clk.

JACKSON, MISS.—Bids are asked until Aug. 2 for constructing a steel truss bridge 100 ft. wide and 86 ft. long, on masonry abutments, and for removing the old iron structure; also for a brick or Melan arch bridge. The plans for the Melan bridge were prepared by the Melan Arch Construction Co., 35 Nassau St., New York. Walter G. Kirkpatrick, Cy. Engr.

CINCINNATI, O.—Bids are asked until Aug. 10 for the purchase of $107,000 of bridge bonds, according to reports. Fred. Bader, Pres. County Comrs.

MIDDLETOWN, O.—Bids are asked until July 15 for constructing an iron hoist bridge over the canal at 3d St. Frank X. Duerr, County Audr., Hamilton.

SANDUSKY, O.—Bids are asked until July 14 for constructing a steel plate girder bridge, 53 ft. × 20 ft., with a capacity of 200 lbs. per sq. ft. A. W. Miller, Cy. Clk.

CHILLICOTHE, ILL.—Bids are asked until July 16 for constructing a three-span low truss steel bridge over the East Branch of the Illinois River. Chas. Dougherty, Chn. Com.

URBANA, ILL.—The county commissioners have awarded the following contracts for constructing highway bridges: 30-ft. span, Austin Mfg. Co., Chicago, Ill., $553; 34-ft. span, Central Bridge Co., St. Louis, Mo., $550; 40-ft. span, Canton Bridge Co., Canton, O., $670; 50-ft. span, $2,190; 70-ft. span, $1,180; 64-ft. span, Massillon Bridge Co., Massillon, O., $1,212; 90-ft. span, $2,032.

LAKE BELT, MINN.—Bids are asked until Aug 1 for constructing a steel bridge over Ten Mile Creek. E. J. Wiltse, Town Clk.

RED CLOUD, NEB.—Bids are asked until Aug. 1 for constructing three 24-ft. pile bridges. J. P. Hale, County Clk.

ALGONA, IA.—Bids are asked until July 20 for the construction of an iron bridge 130 ft. long and 18 ft. wide, according to reports. F. O. Calkins, County Audr.

GALENA, KAN.—F. L. Moore, Carthage, Mo., informs us that the Southwest Missouri Electric Ry. Co. has been considering the question of constructing a bridge over Short Creek at this place, but nothing definite has been decided.

ST. JOSEPH, MO.—Bids are asked until July 24 for constructing and repairing eight bridges. Theo. Steinacker, County Surveyor.

INGERSOLL, ONT.—Bids are asked until July 15 for furnishing the plans and for the construction of a 100-ft. span iron or wood bridge over the Thames River.

PETERSBOROUGH, ONT.—S. R. Armstrong informs us that a by-law has been passed authorizing the borrowing of $7,000 for the construction of bridges over the creek through this town. S. Belcher, Cy. Engr.

BUILDINGS.

BRIDGEPORT, CONN.—It is reported that plans have been prepared for a church and an 8-room parsonage building for the Church of St. Stephen. Pastor, George Csaba, 126 Hancock Ave., Bridgeport; Arch., Edmund Gallauner, 1 Madison Ave., New York.

WINSTED, CONN.—Decker & St. Clair, Seabright, N. J., have been awarded the general contract for the erection of new church and chapel buildings for the Second Congregation Church of West Winsted, at Main and Spencer Sts., Winsted; estimated cost, $35,000. Pastor, N. M. Calhoun; Arch., A. B. Jennings, 41 Wall St., New York.

BUFFALO, N. Y.—Henry Schaefer's Sons have been awarded the contract for the erection of the new buildings for the St. Vincent Orphan Asylum, to cost about $85,000. Archs., Green & Wicks, 110 Franklin St.——Plans are to be prepared for a brick annex to school building No. 25.

ELLIS ISLAND, N. Y. H.—Bids are asked by the supervising architect, Washington, D. C., until July 30, for the masonry, carpentry and structural iron work required in the construction of the main buildings of the U. S. immigrant station, on Ellis Island, New York Harbor. Archs, Boring & Tilton, 32 Broadway, New York.

HUNTINGTON, N. Y.—August Heckscher, of Tuxedo Park, N. Y., has bought the Belknap property at this place, according to reports, and contemplates the making of improvements at a cost of about $45,000, including a new $10,000 barn. Arch., Montrose W. Montrose, 45 Exchange Place, N. Y.

NEW YORK, N. Y.—Bids are being received, according to reports, for erecting a 4-story and basement residence, 25 × 100 ft., for E. B. Grigsby, at Park Ave. and 67th St. Archs., Cable & Lucas, 1183 Broadway.——The general contract for the erection of a new 5-story brick and stone building, 80 × 76 ft., at Rivington and Eldridge Sts., for the University Settlement Society, has been awarded to John Weber & Sons, 12 East 23d St., to cost about $90,000.——The Collier-Weeks Co. were the lowest bidders for erecting the new fire department building at Broome and Elizabeth Sts., at $24,094.——It is said that an appropriation of $50,000 has been made by Congress to provide for the making of some improvements at the Appraiser's Stores Building, including a pneumatic tube system and a telephone system.——Plans have been filed by the City & Suburban Homes Co., 281 4th Ave., for two 6-story brick flat and store buildings on 1st Ave., near 64th St., to cost $150,000. Archs., J. E. Ware & Son, 487 5th Ave.; by W. P. Reden, 17 East 99th St., for six 5-story brick flat and store buildings at 90th St. and 1st Ave., to cost $178,000. Arch., Louis Entzer, 78 East 96th St.; by William H. Hall, 265 West 73d St., for four 5-story brick flat buildings on 131st St., near Lenox Ave., to cost $92,000. Archs., Neville & Bagge, 217 West 125th St.

NEW YORK, N. Y.—Bids are asked by the board of education, at 585 Broadway, until July 18, for heating and ventilating apparatus for new Public School 153, Bronx; also for heating and ventilating apparatus and electric lighting plant for new Public School 158, Manhattan; also for heating and ventilating apparatus and electric lighting plant for new Public School 160, Manhattan; also for furniture for new Public School 63, Bronx; also for furniture for new Public School 102, Bronx; also for alterations, repairs, etc., at Public Schools 96 and 135, Manhattan.——Plans have been filed by Charles Buek, 109 West 42d St., for four 4-story brick dwellings on 107th St., near Riverside Drive, to cost, $120,000. Arch.. Charles Brendon, 264 Columbus Ave.

ORIENT, N. Y.—The contract for constructing ten buildings at Plum Island, N. Y., has been awarded to O. T. Curtis, New Britain, Conn., at $44,473. The contract for heating and plumbing was awarded to the Wheaton Bldg. & Lumber Co., Putnam, Conn.

SYRACUSE, N. Y.—Bids are asked by the board of education until July 21 for heating and ventilating Jefferson school building. Clk., P. D. Cooney.

ASBURY PARK, N. J.—Plans are being prepared for new stone church and parsonage buildings for the First Methodist Episcopal Church, to cost about $75,000. Arch., George W. Kramer & Co., 1 Madison Ave., New York.

BLOOMFIELD, N. J.—Bids are asked until Aug. 1 for the erection of the Essex Ave. school building. George W. Pantcoast, Chn. Bldg. Com.; Arch., Chas. G. Jones, 280 Broadway, New York. Address Wm. A. Baldwin, District Clk., Bloomfield.

BRIDGETON, N. J.—Bids are asked until July 15 for repairing and refitting the City Hall, and for installing a heating apparatus therein. Joseph H. Powell, Chn. Com., 48 East Commerce St., Bridgeton.

ALLEGHENY, PA.—The contract for erecting the new 3d Ward school building has been awarded to R. M. E. Cain & Son, at $169,700.

CARNEGIE, PA.—Bids are asked until July 15 for the erection of a new high school building. D. C. Turney, Secy. School Board; F. J. Osterling, Arch., Times Bldg., Pittsburg, Pa.

PHILADELPHIA, PA.—The council has appropriated $900,000 for school purposes, $375,000 of which is for the completion of the boys' high school building, and the remaining $525,000 for the erection of district school buildings.——Bennett & Rothrock have been awarded the contract for erecting a new church building for the Allegheny Ave. Baptist Church at Allegheny Ave. and Frankfort St., to cost about $30,000. Archs., Stearns & Castor, Philadelphia Bourse.

POTTSVILE, PA.—The following bids were received by the supervising architect July 9 for the construction (except heating and ventilating apparatus) of the Post Office Building at Pottsville:

Prescott, Bukley & Callanan, Albany, N.Y.	$32,440	8 mos.
H. M. Moyer, Pottsville	37,492	9 "
Barry D. Lane, Chester, Pa.	45,000	10 "
Louis D. Beaman, Cincinnati, O.	44,697	10 "
Miles & Bradt, Atlanta, Ga.	37,000	10 "
L. L. Leack & Son, Chicago, Ill.	36,943	10 "
P. J. Carlin & Co., Brooklyn, N. Y.	39,144	10 "
Henry Schenk, Erie, Pa.	42,967	
A. Frederick & Son, Rochester, N. Y.	34,977	Mar 12
Wm. Yost & Bro., Washington, D. C.	49,191	9 mos.
Herman Riebs, Lansford, Pa.	35,000	5 "
Richardson & Burgess, Washington, D. C.	38,300	10 "
M'Ilvon, Unkeefer & Co., Pillsbury, Pa.	32,745	10 "

RANKIN, PA.—Reports state that the Homestead & Highlands St. Ry. Co. will erect a new brick and steel car barn, 120 × 230 ft., after plans by Wilkins & Davison, Engrs., of Pittsburg.

WASHINGTON, PA.—Maginn & Lewis, of Pittsburg, have been awarded the contract for installing a steam heating apparatus in the new county court house, and Halpin, Kennedy & Co., for the plumbing, gas fixtures, etc.

WASHINGTON, D. C.—Bids are asked until July 18 for furnishing the steel and cast-iron work required for galleries in four halls in the U. S. National Museum. Address J. Elfreth Watkins, Ch. Bldg. Division, Smithsonian Institution.

BALTIMORE, MD.—Bids are asked until July 20 for a new elevator in the city hall; deposit required, $500. Everett J. Dowell, Inspector of Bldgs.

CHATHAM, VA.—Bids are asked until July 25 for building a fireproof clerks office for the county and circuit courts, etc., for Pittsylvania county. Clk., W. B. Shepherd, of Chatham.

MOBILE, ALA.—The quarantine station at Mobile Bay was burned July 8, causing a loss to the fumigating machinery, wharf, etc., of about $50,000; insurance, $13,000.

NEW ORLEANS, LA.—It is reported that preliminary plans have been prepared for a new brick and stone church building for the Baptist Church, to cost about $80,000. Arch., H. W. Phillips, 40 State St., Rochester, N. Y.

CLARKSVILLE, TENN.—The following bids were received by the supervising architect, Washington, D. C., July 9, for a low pressure, return circulation steam heating and ventilating apparatus for the Post Office Building at Clarksville:

Blohe & Williams, New York	$2,653	65 days*
Bayley Heating Co., Milwaukee, Wis.	2,182	60 "
Chas. A. Moses, Chicago, Ill.	3,100	45 "
Chas. E. Roesch, Nashville, Tenn.	2,700	65 "
Edwin Wehle, Louisville, Ky.	2,187	65 "
T. J. Mooney, Nashville	2,450	60 "
Pittsburg H. & S. Co., Pittsburg, Pa.	2,000	60 "
Peet-Hammond Co., Cincinnati, O.	3,327	60 "

*Working days.

CLEVELAND, O.—Bids are asked until July 29 for the construction of the detention hospital building for the department of charities and correction of this city. Director, Wm. J. Akers.——A fire in this city July 9 damaged the 5-story brick dwelling on Erie St., near Vincent St., occupied by the Britton Printing Co.; reported loss, $80,000.

CINCINNATI, O.—The building commission for the new state capitol building to be erected in this city has selected the designs of Samuel Hannaford & Sons, Hulbert Block, Cincinnati, O.

HARTWELL, O.—Bids are asked by the board of city affairs of Cincinnati, until Aug 2, for installing the steam heating apparatus required for the annex for the harmless insane, at the city infirmary, at Hartwell. Pres., A. B. Rattermann; Archs., Samuel Hannaford & Sons, Hulbert Block, Cincinnati.

HOLGATE, O.—Bids are asked until July 25 for erecting a new tower and remodeling the old church building of the Wesley Chapel M. E. Church. Pastor, A. E. Delaney.

OTTAWA, O.—Bids are asked until July 25, according to reports, for the erection of a county jail and sheriff's residence. J. C. Jones, County Audr.

SPENCER, O.—Bids are asked until July 25 for constructing a school building, 24 × 32 ft., in Sub-District No. 3, Spencer township. C. M. Woods, Pres. Township Bd. of Education, Spencer.

BAY CITY, MICH.—Bids are asked until July 23 for erecting a new brick church building for the Universalist Church, to cost about $18,000. Arch., D. P. Clark, Phoenix Bldg.

CASSOPOLIS, MICH.—Biggerstaff & Atkins, Kalamazoo, Mich., have been awarded the contract for the erection of a new court house for Cass county, at $31,939. Archs., Rush, Bowman & Rush, Grand Rapids.

DETROIT, MICH.—Plans have been prepared, according to reports, for a 2-story marble bank building, 100 × 138 ft., to be erected in this city for the State Savings Bank at a cost of $200,000. Archs., McKim, Mead & White, 160 5th Ave., New York; Associate Archs., Donaldson & Meier, 89 Moffat Bldg., Detroit.——A. Chapoton is said to have been awarded the contract for the erection of a new opera house on Monroe Ave., to cost about $150,000.

CHICAGO, TLL.—Plans are being prepared for a 4-story brick, stone and terra cotta apartment building on West Monroe St., near Jefferson Park, for the Foss Estate, of Philadelphia, Pa.; estimated cost, $200,000. Bids for erection will be received about August 1. Arch., John Hulla, Jr., 1496 West Madison St.——Plans have been prepared, according to reports, for a 6-story store and apartment building to be erected at 359 and 361 East Indiana St. for Mrs. Augusta Heberlein; estimated cost, $40,000. Arch., Robert S. Smith, Adams Express Bldg.——Thomas Keating & Son, 197 Center Ave., have been awarded the contract for the mason work on the new church building, 87 × 138 ft., to be erected at Garfield Boulevard and Peoria St. for the Church of the Visitation; estimated cost, $90,000. Arch., Martin Carr, 134 Van Buren St.

ELGIN, ILL.—The contract for the masonry work on the new church building for the Church of the Immaculate Conception has been awarded to Lilly & Palm, of Elgin; estimated cost of building, $40,000. Pastor, John Mackin.

MADISON, WIS.—Bids are asked until July 27 for the installation of a heating apparatus in the new building being erected for the State Historical Library. Secy., I. S. Bradley.

MILWAUKEE, WIS.—Bids are asked until July 18 for the erection of a 3-story brick and stone building at River and Oneida Sts., for the Milwaukee Electric Light & Ry. Co. Pres., W. N. Cromwell.

GRACEVILLE, MINN.—Bids are asked until July 20 for the erection of an addition to the school building at Graceville. M. J. McDonnell, Secy. Bd. of Education; E. Strassburger, Arch., Wyoming and Stryker Aves., St. Paul, Minn.

MANKATO, MINN.—Bids are asked until July 16 for the erection and completion of a 4-story brick and stone bank and hotel building, 83 × 126½ ft. to be erected for M. K. Armstrong, of St. James, Minn. Arch., Frank Thayer.

MINNEAPOLIS, MINN.—The general contract for the erection of the new Chicago Great Western elevator at Oak and Chambers Sts., S. E., to cost about $30,000, has been awarded to James L. Record, 306 Corn Exchange.

TOPEKA, KAN.—Plans are said to have been prepared for a brick and stone church building, 60 × 130 ft., to be erected in this city for the St. Joseph's R. C. Church, at a cost of about $35,000. Arch., Geo. P. Standuhar, Rock Island, Ill.

COLUMBUS, NEB.—Bids are asked by the board of education until July 25 for the heating, ventilating and plumbing of a 12-room school building in this city; also until July 26 for the erection of the building. Secy., H. F. J. Hockenberger, Columbus; Archs., W. R. Parsons & Son Co., 317 East 5th St., Des Moines, Ia.

GERING, NEB.—The contract for building the new Scott's Bluff county court house in this city has been let to Ed. W. Sayre. The building will be a 2-story brick structure, 28 × 42 ft.

CANDO, N. DAK.—Bids are asked by D. K. Brightbill, Audr. of Towner county, until July 30 for the erection of a brick court house and jail at Cando; separate bids will be received for the plumbing and steam heating. Arch., A. J. O'Shea, Fargo, N. Dak.

ELBOWOODS, N. DAK.—Bids are asked by the U. S. Indian Service, Fort Berthold Agency, Elbowoods, until July 30 for erecting a brick school and dormitory building. Agt., Thomas Richards.

POPLAR BLUFF, MO.—Bids are asked until July 21 for the erection of an 11-room school building for the board of education. Secy., Lemuel Mills; Arch., Wm. F. Schrage, 562 Scheidley Bldg., Kansas City, Mo.

ST. JOSEPH, MO.—The Hotel St. Joseph was destroyed by fire July 10, causing a reported loss of $130,000; insurance, $17,000.

ST. LOUIS, MO.—We are informed that the following bids were received by the board of public improvements, July 8, for the work complete of finishing the rooms in the new city hall, to be occupied by the city council and house of deelgates; the contract will be awarded July 15 to lowest bidder; all bidders are residents of St. Louis: Porter White, $59,000; C. Kellerman, $63,765; John Fitzgerald & Co., $66,700; Kerr & Allen, $65,639.

CARTHAGE, TEX.—Bids are asked until July 16 for erecting a 2-story brick bank building for the Bank of Carthage. Arch., Alfred Giles, San Antonio, Tex.

DENVER, COLO.—Philip Funke was awarded the contract for erecting the new Lafayette school building, July 2, at $33,912.

SEATTLE, WASH.—The Mutual Life Insurance Co., of New York, has taken out a permit for $70,000 worth of improvements on its local building on First Ave., including, among other things, the making of the entire structure fireproof.

COQUILLE, ORE.—Bids are asked until July 16 for erecting a 6-room school building in Coquille. Geo. F. Boutell, Clk. of School District No. 8, Coos county; Chas. H. Burggraf, Arch., Salem, Ore.

SAN FRANCISCO, CAL.—Thomas Marshall, of Pittsburg, Pa., has been awarded the contract for the steel and iron work for the San Francisco Court House, at $154,715; time, 8 months.——It is reported that the Bank of California will erect a brick warehouse on Battery St., near Broadway, to cost about $50,000.——A new $60,000-residence is to be built at Jackson and Octavia Sts. for Mrs. Adolph Roos. Arch., J. C. Kraft, 71 Academy of Science.

GARLAND, UTAH.—Bids are asked by Carl Jensen, of Bear River City, Utah, until July 20, for erecting a brick school building at Garland School District No. 13.

PROVO CITY, UTAH.—Bids are asked until July 30 for the erection of an 8-room school building in this city. Address R. C. Watkins.

NIAGARA FALLS, ONT.—It is reported that a large hotel building will be built here by the railway companies between the old Clifton House and Table Rock; estimated Cost, $500,000. Arch., Bruce Price, 150 5th Ave., New York.

ST. THOMAS, ONT.—The board of education has awarded the following contracts towards the erection of the Balaclava St. school building; Archs., B. Long & Son, St. Thomas: For masonry, Ponsford Bros., at $8,670; cut stone work, Doggett & Co., $1,302; carpentry, R. Cole, $5,959; plastering, James Stewart, $635; slating, John Riddle, $886; painting and glazing, W. T. Mossop, $774; ceiling, Ormsby & Co., Toronto, $743; sheet metal work, Ormsby and Co., $134.——The court house and county jail at St. Thomas was burned July 2, causing a loss of about $50,000.

STRATFORD, ONT.—Bids are asked until July 25 for the erection of a municipal building in this city; Arch., George W. King, 9½ Adelaide St. E., Toronto, Ont.——Bids are also asked for the rebuilding of the old City Hall; Arch., Alexander Hepburn, Stratford; F. Ingram, Chn. Market and Police Com.

WATER-WORKS.

DANFORTH, ME.—We are informed that this place will not build works this season, as has been reported.

DEXTER, ME.—This town has taken no action on the matter of water-works, and the intention at present is to abandon the idea. The town has a partial fire service, and several private pipe lines from the springs are owned by individuals. Engr., P. H. Coombs, Bangor, Me.

ENFIELD, MASS.—H. M. Smith writes us that no work will be done on the proposed new works or in enlarging the present reservoir this season. No money has been appropriated by the town for works.

HUNTINGTON, MASS.—Bids are asked by the commissioners until July 27 for building a dam, laying about four miles of water pipe, etc., for the proposed works. There will be required 700 cu. yds. of rubble masonry and 1,200 yds. of earth filling. Engrs., E. C. & E. E. Davis, Northampton, Mass.

WATERTOWN, MASS.—Dr. Bennett F. Davenport, Chn. Com., writes us that the Watertown Water Supply Co. having rejected the offer made by the committee to accept in payment for its works, which the town had taken, the sum of $400,000, the case is being prepared for trial before the commissioners.

ALBANY, N. Y.—Bids are asked until Aug. 2 for furnishing and constructing a pumping station at the new filtration plant. Geo. I. Bailey, Supt.

OSWEGO, N. Y.—It is proposed to extend the water mains in several streets.

ALDEN, N. Y.—The people are considering the question of holding another election to vote on the proposition to issue bonds for works. It was reported last year that J. F. Witmer, 705 Ellicott Sq., Buffalo, had prepared plans.

WEST TROY, N. Y.—The water commissioners of Watervliet are considering the question of building new works. The water supply would be secured from the Tomhannock Creek, a short distance east of Troy. Estimated cost, about $200,000. Consult. Engr., Elnathan Sweet, 13 Tenbroeck St., Albany.

ASBURY PARK, N. J.—The township committee has granted a franchise to the Ocean Grove Association to supply water to West Grove and Bradley Park. Township Clk., Jos. Harris.

JERSEY CITY, N. J.—Bids are asked by the street and water board until Aug. 18 for furnishing this city with a water supply. The new specifications call for a 50,000,000 gallon supply with the option of increasing the supply to 70,000,000 gallons. Two pipe lines will be constructed, one of a 50,000,000 gallon capacity, and the other capable of carrying a 30,000,000 gallon supply.

NEWARK, N. J.—Press reports state as follows: Engineers have selected a site for a 700,000,000-gallon storage reservoir half a mile south of Great Notch, back of the Orange Mountain range and in a natural basin quite near the conduits which supply the city from the Pequannock watershed. The report states that this action was caused by the warning from the East Jersey Water Co. that the city was using more than 2,700,000 gallons daily, which is the quantity fixed by the contract until the city makes its final payment for the works in 1900.

BEAVER, PA.—Bids are asked until July 18 for furnishing and laying about 5,000 ft. of 10-in. cast-iron water pipe, sinking a pump well and erecting a pumping station, furnishing two triplex power pumps of 500,000 gallons each, and two gas engines, and for constructing a 1,000,000-gallon reservoir, etc. Engr., J. P. Leaf, Brighton St., Rochester, Pa.; Jno. Aiken, Chn. Com.

BOYERTOWN, PA.—The council has issued $35,000 in bonds for the proposed works. J. K. Grant, Borough Solicitor.

CAMBRIDGE SPRINGS, PA.—Geo. L. Wade, Clk., writes us that Chandley Bros. & Co., Beaver Falls, Pa., were awarded the contract July 11, at $18,964, for constructing the works. The itemized bids of the contract will be given next week.

GLENSIDE, PA.—The Glenside Water Co. was incorporated July 7, with a capital stock of $1,000, by W. T. B. Roberts, F. A. Roberts, James P. P. Brown, C. E. Albright, C. F. Mehns, Philadelphia.

BALTIMORE, MD.—The Tuxedo & Embla Parks Water & Electric Light Co. has been organized by Granville O. Wilson, Henry A. Leonard, John H. Neudecker, Frederick E. Wilson and William F. Smith. The company is limited to 40 years, and has a capital stock of $25,000. The purpose of the corporation is to supply the residents of Tuxedo and Embla Parks with water, and ultimately with electric light. The board of directors will consist of the incorporators and William Coney, William W. Fulton, A. M. Irving and Alphonse Lowekamp.

RENOVO, PA.—Bids are asked until July 28 for furnishing 9,000 ft. of 6 and 8-in. cast-iron water pipe, 22 hydrants, valves, etc., and for laying and setting same, as stated in our advertising columns. J. H. Baird, Chn. Com.; Wm. J. Straley, Secy.

BLAKELY, GA.—This place is reported to have voted against issuing $10,000 in bonds for the proposed works.

OPELOUSAS, LA.—Bids are asked until July 15 for the lease of the works and the electric light plant, now under construction, for a term of five years. The lessors to take charge of plant as delivered by contractors to the town, and to supply the town, free of any cost, with light from 40 arc lights now erected, and also 4 incandescent lights, and also to supply the town with water for fire purposes from hydrants now erected, as well as from any hydrants the town may hereafter place in present mains or extensions that may be made. Water and electric light rates for private parties to be agreed upon between the lessees and lessors, which rates are not to exceed rates being charged by similar plants in adjoining parishes. Thomas H. Lewis, Jr., Cy. Clk.

CHICAGO JUNCTION, O.—Bids are asked until July 21 for furnishing and installing a water tower and tank, hydrants, valves, and pipe laying and for constructing a reservoir. Louis Simmeracher, Secy. Water-Works Trustees; L. C. Hess, Mayor.

POMEROY, O.—Bids are asked until Aug. 10 for furnishing and constructing works for the Pomeroy & Middleport Water Co., 800 Broad St., Newark, N. J., as described in our advertising columns. Pres., Geo. MacDonald, Newark, N. J.; Engr., J. W. Ledoux, 112 North Broad St., Philadelphia.

GLOUSTER, O.—The city clerk writes us that the city has not decided on the kind of pump to be installed at the proposed works. A stand-pipe will be wanted. The works will cost $12,000. Correspondence is solicited. Population, 3,000.

INDIANAPOLIS, IND.—The Indianapolis Water Co. has offered to sell its works to the city for $1,200,000.

BAY CITY, MICH.—The question of laying water mains in certain streets is being considered.——Alderman Flajole is urging the board to consider the question of securing a better water supply. City Engineer Blomshield may be addressed.

CASS CITY, MICH.—Bids are asked until July 22 for furnishing and installing the pumping machinery, boilers, pipe, lead, castings, etc., for the proposed works; estimated cost, with electric plant, $18,000. Engr., G. C. Morgan, Royal Insurance Bldg., Chicago; Village Clk., Hugh W. Seed.

BATAVIA, ILL.—Bids are asked until July 23 for furnishing and laying about 5,741 ft. of 4 and 6-in. cast-iron water pipe, setting hydrants, valves, etc., according to reports. Geo. H. Burnett, Cy. Clk.

CHICAGO, ILL.—It is reported by local papers that the following contracts have been let for the superstructure of the crib for the new northwest tunnel; it will be located three miles out in the lake: The FitzSimons & Connell Co., general work, $14,476; electric work, $1,865; Pittsburg Bridge Co., steel work, $10,400; J. J. Wade & Son, plumbing, $375; M. J. Cragin, steam heating, $4,026.

MURPHYSBORO, ILL.—The council is reported to have been petitioned to purchase the works, plants, etc., of the Murphysboro Water-Works, Electric & Gaslight Co. for $145,000.

OREGON, ILL.—L. Wilson, 53 Dearborn St., Chicago, has been awarded the contract for drilling an artesian well 1,200 ft. for an increased water supply.

ROCK ISLAND, ILL.—Bids are asked until Aug. 1 for cast-iron water pipe, special castings, valves, lining for reservoirs, gravel, sand, etc. We are informed that this will complete the new improvements to the water supply. The work upon the improvement, which consists of the construction of a system of settling basins, natural or slow sand filters and distribution reservoir, and reinforcement of the system of mains, has been started. Jacob A. Harman, Consult. Engr., Peoria, Ill.

AUGUSTA, WIS.—E. M. Bradford, Mayor, writes us that this place voted July 6 to issue $12,000 in bonds for the proposed works. The contract for building the works will be let at once. Population, 1,500.

MINNEAPOLIS, MINN.—Bids are asked by the water committee until Aug. 26 for furnishing and installing one or two new pumps, with a capacity of 10,000,000 gallons each, for the North Side station. F. W. Cappelen, Cy. Engr.

NEW PAYNESVILLE, MINN.—Bids are asked until July 15 for furnishing and constructing the works and electric plant, according to reports. The works will cost $8 000. Engrs., Fairbanks, Morse & Co., St. Paul, Minn.; Attorney, Frank Tolman.

DES MOINES, IA.—An election will be held Aug. 29 to vote on the question of purchasing the works for $850,000.

CEDARVALE, KAN.—This place voted June 21 to issue $5,000 in bonds for works. J. P. Tabler, Mayor.

SIOUX FALLS, S. DAK.—S. B. Howe, Cy. Engr., has submitted estimates, etc., for municipal works to cost about $130,000.

GREAT FALLS, MONT.—An election will be held July 26 to vote on the question of issuing $260,000 in 20-year 6% bonds for the proposed municipal works, noted in our issue of June 30.

CONCORDIA, MO.—Bids are asked until July 15 for the purchase of $5,000 of 20-year 5% bonds for the proposed works. Population, 1,000. Otto Walkenhorst, Cy. Clk.

KIRKSVILLE, MO.—James E. Adams, 3 Wells Bldg., Quincy, Ill., has not yet secured the franchise for extending the city works, as has been reported. It is probable he will get the contract or franchise later. The source of the new supply will be the Chariton River.

McKINNEY, TEX.—Bids are asked until July 18 for the purchase of $18,000 of 20 and 40-year 5% bonds for the proposed works, according to reports. J. M. Pearson, Mayor.

BLACK HAWK, COLO.—Bids are asked until July 18 for furnishing the material and for constructing the proposed new works; estimated cost, $35,000. F. A. Rudolph, Cy. Clk.

WARD, COLO.—Estimates are reported as being prepared for the proposed works by D. J. McCanne, 1700 17th St., Denver, for the proposed works for this place; estimated cost, $15,000. Population, 2,000. Mayor N. D. Sibley; Wm. Thompson is on the committee.

CONDON, ORE.—It is reported that this place has decided to put in works this year at a cost of about $4,000. W. A. Darling, Cy. Recdr.

OAKLAND, CAL.—A new water company is reported as about to be organized by Hugh Forgie, J. B. Hume and Dr. Allen, to build works to cost about $30,000.

BERKELEY, CAL.—It is stated that a committee has been appointed to prepare a preliminary report with regard to municipal works.

LONG BEACH, CAL.—The Bouton Water Co. has applied for a franchise for laying a 16-in. main in this place, according to reports.

BOUNTIFUL, UTAH.—The council is reported as arranging to sell $10,000 of 20-year 6% bonds for constructing works.

ASHBURN, ONT.—Press reports state that an election will be held here July 20 to vote on the question of issuing $15,000 in bonds for works.

HAMILTON, ONT.—The committee has decided to improve the pumping engines at a cost of about $4,000; and also to purchase of site for high-level reservoir.

LISTOWEL, ONT.—This place voted July 6 against issuing $19,500 in bonds for the proposed works, bids for which were received June 29.

OTTAWA, ONT.—It is stated that the Ottawa Suburban Water-Works Co., Ltd., has incorporated with a capital stock of $80,000.

IRRIGATION.

ALBUQUERQUE, N. MEX.—The Albuquerque Land & Irrigation Co. has decided to construct a new canal for irrigation in this vicinity.

WINSLOW, N. MEX.—The contract for the storage dam at Hay Lake has been let to McDonald & Leonard, Lamar, Colo. The dam is to be 24 ft. high and 850 ft. long.

OXFORD, IDAHO.—The Interstate Canal Co. has considered favorably a proposition to extend its canal into the Salt Lake Valley.

NEW COMPANIES.—West Irrigation Co., Sandy, Utah; $1,000; George Marriott, Pres.; Samuel Spencer, Vice-Pres.; A. White, Secy.; Knud Bendixsen, Treas.; L. A. Lundgren, David E. Jones.

New York Improvement Co., Columbus, Neb.; $300,000; O. T. Roen, J. Dayton Stires, Clayton A. Gates, Orlando Nelson, Ira E. Gates and Charles A. Woolsey.

SEWERAGE

FALL RIVER, MASS.—Beattie & Wilcox, Fall River, have been awarded the contract at $10,300 for constructing an outlet sewer in Odd St.

MILLER'S FALLS, MASS.—This town has appropriated $1,000 for a sewer in Grand Ave.

HARTFORD, CONN.—It is proposed to construct a 4-ft. sewer in Lawrence St., between Grand and Park Sts.

ALBANY, N. Y.—Bids are asked until July 18 for constructing an 18-in. and 15-in. pipe sewer in Dove St.; two sureties of $2,000 each. Thos. J. Lanahan, Clk. Bd. of Contract.

BUFFALO, N. Y.—Bids are asked until July 22 for constructing a pipe sewer in Carlyle Ave. R. G. Parsons, Secy. Dept. Pub. Wks.

LITTLE FALLS, N.Y.—The council has voted to build sewers in a number of streets. Councilmen Cook and Newell and Mayor Dasey may be addressed.

ROCHESTER, N. Y.—Bids are asked by the executive board until July 18 for constructing a pipe sewer in Manhattan St. to cost $1,750, a pipe sewer in Eiffel Park to cost $2,020, and also for improvements in three streets to cost about $4,175.

TROY, N. Y.—It is proposed to construct a pipe sewer in Bond St., instead of a brick sewer. City Engineer Schenck may be addressed.

CAMDEN, N. J.—Bids are asked until July 19 for constructing sewers in several streets. Wm. Z. Gibson, Chn. Com.; L. E. Farnham, Cy. Engr.

FLEMINGTON, N. J.—Waring, Chapman & Farquhar, 874 Broadway, New York, have been engaged to prepare plans for and superintend the construction of a system and land disposal works. Surveys are now being made. About six miles of sewer will be built.

WEST ORANGE, N. J.—The township committee is considering the question of constructing a 30-in. drain, to cost about $4,000.

BELLEVUE, PA.—Bids are asked until July 19 for constructing a system. It will have about 82,500 ft. of 24 to 8-in. pipe sewers. Engrs., Edeburn, Cooper & Co., 410 Grant St., Pittsburg, Pa.

CRAFTON, PA.—It is reported that this place will vote July 26 on the question of issuing $3,500 in bonds for extending the system.

McKEES ROCKS, PA.—An election is reported to have been called for July 20 to vote on the question of issuing $10,000 in bonds for extending the system.

MOUNT PLEASANT, PA.—City Engineer Neel is preparing plans for a sewer in a certain street, from Main to Quarry St.

PHILADELPHIA, PA.—Bids are asked until July 19 for constructing branch sewers. Thos. M. Thompson, Dir. Dept. Pub. Wks.

RANKIN, PA.—A. F. Duffy, Borough Solicitor, is preparing a proposition to be submitted to the voters authorizing the issuance of $25,000 in bonds for sewers and street improvements.

TARENTUM, PA.—Bids are asked until July 18 for constructing about 11,000 ft. of 30 to 8-in. pipe sewers, 43 manholes, 2 flushtanks, etc. John Duster, Chn. Com.

ROANOKE, VA.—Bids are asked until July 16 for constructing sewers in section 21 of the system. J. H. Wingate, Cy. Engr.

GOLDSBORO, N. C.—Bids are asked until July 21 for furnishing the material and for constructing a system, as stated in our advertising columns.——We are informed that the city has sold $30,000 of sewer bonds. Engr., J. L. Ludlow, Winston, N. C.; Chn. Com., N. O'Berry.

DALTON, GA.—J. L. Ludlow, 434 Summit St., Winston, N. C., has been engaged to prepare plans, etc., for a system for this city.

LOUISVILLE, KY.—Bids are asked by the board of public works until July 22 for enlarging to 3 ft. the main sewer in a portion of Breckinridge St.

CINCINNATI, O.—The city engineer is reported as preparing plans and specifications for a main sewer in Camp Washington, from the Maimi Canal to Mill Creek; estimated cost, $100,000.

HAMILTON, O.—The council has voted to spend $3,500 for a storm sewer in district No. 7. M. O. Burns, Cy. Clk.

MARYSVILLE, O.—Dr. C. O. Probst, Secy. State Bd. of Health, Columbus, has been directed to prepare plans for a system; the outlet to be into Mill Creek or onto sewage disposal beds.

NAPOLEON, O.—Riggs & Sherman, 613 The Nasby, Toledo, have been engaged to prepare plans, etc., for a system for this place.

FRANKLIN, IND.—A sewer is to be built in a street to extend from Washington to Ohio St.

COLDWATER, MICH.—Riggs & Sherman, The Nasby, Toledo, O., have been engaged to prepare plans, etc., for a system and for certain paving.

FLINT, MICH.—Bids are asked until July 18 for constructing an 8-in. pipe sewer in Clifford St., from Kearsley St. to the Flint River. F. P. Barker, Clk. Bd. Pub. Wks.

OWASSO, MICH.—John Granville, Saginaw, Mich., is reported to have been awarded the contract for constructing a mile of 30 to 8-in. pipe sewers.

KEWANEE, ILL.—Bids are asked until July 25 for constructing a system, as described in our advertising columns. J. H. Pierce, Pres. Bd. Local Improvements; J. C. Quade, Cy. Engr.

EAST ST. LOUIS, ILL.—It is proposed to extend the 8th St. sewer from Walnut Ave. to Bradley Ave., at a cost of about $4,500. Mayor Stephens may be addressed.

MILWAUKEE, WIS.—Bids are asked until July 19 for pipe sewers in certain streets. G. H. Benzenberg, Chn. Comrs. Pub. Wks.

WAUPACA, WIS.—Bids are asked until July 16 for grading, etc., for the sewage disposal plant, at the Wisconsin Veteran's Home. Engr., G. Steinhagen, Room 44, Mack Block, Milwaukee; Pres. Trustees, Geo. A. Thomas.

MUSCATINE, IA.—Wm. Horrabin, Iowa City, Ia., has been awarded the contract for constructing a main sewer in District No. 2 at $3,691.

INDEPENDENCE, MO.—Andrew Rosewater, Bee Bldg., Omaha, Neb., is preparing plans for a system for this city. It is proposed to receive bids soon and before the question is submitted to the vote of the people. H. H. Pendleton, Cy. Engr.

NEVADA, MO.—Bids are asked until July 19 for constructing sewers in several streets. L. H. McDaniel, Clk.

POPLAR BLUFFS, MO.—W. H. Hipolite, Cy. Engr., and H. W. Kerr, St. Louis, Mo., are making surveys and plans for the proposed system. It is stated that bids will be asked in a few weeks.

ST. JOSEPH, MO.—The council has voted to ask for bids for constructing sewers in a number of streets. Mayor, P. J. Kirschner; Clk., C. S. Shepherd.

GALVESTON, TEX.—G. Z. Little, Cy. Clk., writes us that no steps have yet been taken toward securing a system. The committee consists of Dr. H. A. West, Chn.; J. D. Skinner, W. F. Stewart and C. Van Sickle. A report states that the committee is about to recommend the purchase of a private system.

McKINNEY, TEX.—The New Odorless Sewerage Co. has been incorporated with a capital stock of $10,000, by Jack Steele, M. P. Kelly and W. H. Steele.

SHERMAN, TEX.—Tom Randolph writes us that the council is considering a proposition made by the Pennsylvania Sanitation Co., Betz Bldg., Philadelphia, to put in a system in this city. The sewerage committee of the council is composed of C. P. Gregory, M. H. Andrews and R. R. Dulin.

VICTOR, COLO.—Andrew Rosewater, Bee Bldg., Omaha, Neb., has been engaged to prepare plans for a system.

SEATTLE, WASH.—C. J. Erickson has been awarded a contract for constructing a sewer in Jackson St., at $1,037.

EMERYVILLE, CAL.—It is stated that arrangements are being made by the board of trustees for constructing the proposed system for which plans have been prepared by the city engineer. There will be required 19,260 ft. of 14 to 6-in. pipe sewers. Engr., Thos. N. Badger; J. S. Emery, Chn. Com.

POMONA, CAL.—The question of building a system is being considered, according to reports.

BERLIN, ONT.—An election will be held July 30 to vote on the question of issuing $5,000 in bonds for extending the system. Engr., Herbert J. Bowman; Clk., H. Aletter.

MEXICO, MEX.—Cleveland, O, papers state that H. A. Robinson, formerly of Akron, O., now manufacturing sewer pipe in Mexico, has been awarded a contract, at about $1,500,000, by Vezin & Letellier, Paris, France, the general contractors, for furnishing all the pipe required for the proposed system.

GARBAGE DISPOSAL—STREET CLEANING

MATTEAWAN, N. Y.—The village board has directed the clerk to ask for bids for removing ashes and garbage for the year beginning Aug. 5.

NEW YORK, N. Y.—Bids are asked until July 22 for repairing the steam garbage dumper "Cinderella;" surety, $3,000. James McCartney, Comr. St. Cleaning, 346 Broadway.

UTICA, N. Y.—The following bids were received by the council July 1 for removing and disposing of the garbage, night soil, etc.: McKeough Bros., Utica, five years, $18,000 a year; 10 years, $12,000 a year. They propose to use the Holthaus system. Henry Stappenbeck, five years, $8,000 a year; 10 years, $6,500 a year. Kirk, Driscoll & Co., Syracuse, five years, $11,000 a year; 10 years, $10,500 a year, using the system now being used at Syracuse. William Hatfield offered to do the work by placing the garbage in trenches on his farm.

NEWARK, N. J.—Bids are asked until July 18 for removing and disposing of all dead animals from this city; bond, $1,000. L. J. Wendell, Cy. Clk.

ALAMEDA, CAL.—The board of health committee has submitted a report recommending that no garbage disposal plant be built this year.

SANTA BARBARA, CAL.—The council has directed the city engineer to prepare plans for a system of pipes for furnishing the city with salt water for sprinkling the streets.

STREETS AND ROADS.

AUGUSTA, ME.—Bids are asked until July 14 for furnishing and laying edgestones, flagging and 2,485 sq. yds. of granite block in Oak and Winthrop Sts. L. D. Carver, Chn. Com.

WATERVILLE, ME.—The council has authorized the purchase of a stone crusher and will improve College Ave. this summer.

BOSTON, MASS.—The council has voted to appropriate $167,520 for street improvements.——The Massachusetts State Highway Commission has appropriated money for road construction as follows: Ashfield, $5,000; Ashby, $5,000; Auburn, $5,000; Beverly, $5,500; Bourne, $7,500; Brimfield, $5,000; Brockton, $4,000; Brookfield, $5,000; Buckland, $5,000; Chicopee, $5,000; Colrain, $5,470; Concord, $5,000; Dartmouth, $5,000; Erving, $5,000; Greenfield, $5,000; Hadley, $5,000; Holden, $5,000; Lunenburg, $5,000; Marlboro, $5,000; Marshfield, $5,000; Merrimac, $5,500; Middleboro, $3,000; Northampton, $5,000; Northboro, $5,000; North Reading, $5,000; Paxton, $6,000; Phillipston, $5,000; Pittsfield, $8,000; Plymouth, $6,000; Russell, $5,000; Shrewsbury, $6,000; Sandwich, $7,500; South Hadley, $5,000; Sterling, $5,000; Sudbury, $6,000; Taunton, $5,000; Townsend, $5,000; Truro, $2,295; Uxbridge, $5,000; Walpole, $7,000; Warren, $5,000; West Boylston, $5,000; Westminster, $5,000; Williamstown, $8,195; Wrentham, $7,000; total, $240,960.

BROOKLINE, MASS.—Reports state that A. H. French, Cy. Engr., has estimated the cost of widening Boylston St., from Cypress St. and the town line, at $263,000.

WATERBURY, CONN.—Bids are asked until July 22 for constructing a gravel road. Wm. G. Smith, Engr., 140 Grand St., Waterbury; P. C. Morris, First Selectman.

NORWICH, CONN.—Bids are asked until July 18 for building about 2,000 ft. of macadam road. A. S. Spalding, First Selectman.

WINDHAM, CONN.—Bids are asked until July 20 for grading and macadamizing a section of road. E. H. Holmes, First Selectman.

ALBANY, N. Y.—Bids are asked until July 18 for paving Partridge St. with brick from Madison Ave. to Western Ave. T. J. Lanahan, Clk.

BUFFALO, N. Y.—The Barber Asphalt Paving Co., New York, submitted the lowest bid July 7 at $9,000 for resurfacing Lafayette Ave.

KINGSTON, N. Y.—J. T. Cummings, Cy. Clk., informs us that the committee has not fully decided upon the question of paving 4,000 sq. yds. with asphalt, estimated cost $10,000. W. Klingberg, Cy. Engr.

PEEKSKILL, N. Y.—The board of trustees have appropriated $4,000 for street work. Geo. W. Robertson, Pres.; L. F. Crumb, Clk.

PORTCHESTER, N. Y.—J. A. Kirby, Engr., Portchester, writes us that the village trustees have decided to pave a portion of Main St. and Westchester Ave. with brick, about 16,000 sq. yds.

TUCKAHOE, N. Y.—Bids are asked until July 18 for furnishing material and paving in Eastchester, as described in our advertising columns. Wm. J. Fisher, Town Clk.

TROY, N. Y.—Bids are asked until July 19 for paving portions of North St. and Ingalls Ave. with brick, 6,200 sq. yds., estimated cost $11,000. E. Ogden Ross, Secy. Contracting Bd.; Martin Schenck, Cy. Engr.

JERSEY CITY, N. J.—Bids are asked until July 27 for 2,733 sq. yds. of asphalt paving, curbing, etc., on Cottage St., from Summit Ave. to the Hudson Boulevard. Geo. T. Bouton, Clk. St. Comrs.

MOUNT HOLLY, N. J.—Bids are asked by the township committee for paving in Water St., with cobblestone.

CAMDEN, N. J.—A gravel roadway will be constructed on Ephraim Ave., from Starr's crossing to Ferry Ave.

PHILADELPHIA, PA.—The council has passed ordinances to pave portions of three streets with asphaltum and eight streets with brick. Chas. F. Warwick, Mayor.

PITTSBURG, PA.—Bids will soon be asked for grading, paving and constructing sidewalks in Cora and Iowa Sts.; grading, paving and curbing in Cooper and Ophelia Sts., and for grading a portion of Anna St. and Woods Run. Chas. Geyer, Mayor; Robt. Dilworth, Cy. Clk.

READING, PA.—Bids are asked until July 18 for 30,000 lin. ft. of granite curbing and 51,400 sq. yds. of sheet asphalt paving, appropriation $107,000. S. S. Hoff, Cy. Engr.; H. H. Hammer, Cy. Clk.

SCRANTON, PA.—Bids are asked until July 21 for constructing about 43,708 sq. yds. of brick pavement on concrete on Providence Road and North Main Ave. Joseph P. Phillips, Cy. Engr.

SHAMOKIN, PA.—An election will be held Aug. 23 to vote on the question of borrowing $65,000 for paving. President Reed may be addressed.

BRIDGEPORT, W. VA.—A resolution will be presented to the council to authorize an issue of $60,000 in bonds for paving, etc.

MERIDIAN, MISS.—C. M. Buckhalter & Co., 708 South 23d St., Birmingham, Ala., has been awarded a contract for paving at about $25,000.

NEW ORLEANS, LA.—Bids will soon be asked for paving Canal St. and for improving Neutral and Grand Sts., estimated cost $163,000. A. C. Bell, Cy. Engr.

CLEVELAND, TENN.—The county court has voted against a proposition to issue $100,000 in bonds for the construction of roads. It is stated that money will be raised by taxation.

LOUISVILLE, KY.—Bids are asked by the board of public works until July 22 for paving in Von Borries Ave., and Hepburn Ave., under a 10-year guarantee.

CINCINNATI, O.—Bids are asked until Aug. 8 for repairing asphalt pavement in certain streets for a period of five years. A. P. Butterfield, Clk. Bd. Cy. Affairs.

CINCINNATI, O.—Bids are asked until Aug. 3 for asphalt paving in Bates Ave., macadamizing in Western Ave., and improving seven other streets. A. P. Butterfield, Clk. Bd. Cy. Affairs.——Bids are asked until Aug. 10 for macadamizing a portion of the Montgomery Pike road, in Columbia township. E. L. Lewis, County Audr.

HAMILTON, O.—L. A. Dillon, Cy. Engr., has submitted four estimates for paving 2d St., from Central Ave. to Black St., with brick, sheet asphalt and block asphalt, to cost from about $37,834 to $63,984.

LIMA, O.—Bids are asked until July 22 for paving South Main St. R. H. Gamble, Cy. Engr.——Specifications are being prepared for asphalt instead of brick paving in North St.

MANSFIELD, O.—Bids are asked until Aug. 6 for improving Hedges St., from Park Ave. to Home Ave. F. M. Remy, Cy. Clk.

ORRVILLE, O.—Bids are asked until Aug. 9 for material and work for improving Market St. E. Wirth, Cy. Clk.

WARREN, O.—It is reported that a contract has been awarded to T. J. Mulligan, Ironton, at about $24,000 for asphalt block paving.

SHELBY, O.—Bids are asked until July 16 for macadamizing five miles of road, in Sharon township. W. F. Sonnanstine, Clk.

TOLEDO, O.—Bids are asked until July 18 for furnishing material and paving Fassett St., from Oak St. to the bridge. L. P. Harris, Cy. Clk.——Bids are asked until Aug. 1 for macadamizing a portion of the Monclova Road. Wm. M. Godfrey, County Audr.

ANDERSON, IND.—Bids are asked until Aug. 8 for constructing 18,000 sq. yds. of brick pavement. H. H. Rogers, Cy. Engr.

GARRETT, IND.—Bids are asked until July 19 for furnishing material and paving the alley through block 25. J. P. Crimmins, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until July 20 for grading, curbing, paving, etc., in Northwestern Ave., Roanoke St. and other streets. M. A. Downing, Chn.

SOUTH BEND, IND.—Bids are asked until July 25 for constructing cement sidewalks in portions of four streets. L. A. Hull, Cy. Clk.

SPENCER, IND.—Bids are asked until July 29 for constructing a pike road about 2½ miles long, estimated cost $4,733. J. B. Workman, County Audr.

SULLIVAN, IND.—Bids are asked until July 25 for grading and paving a portion of Wall St. J. M. Sinclair, Clk.

COLDWATER, MICH.—Riggs & Sherman, Engrs., 613 The Nasby, Toledo, O., are preparing plans for paving.

DETROIT, MICH.—The following paving contracts have been awarded by the board of public works, according to reports: William Lappin, 1st St., cedar block, $4,369; G. E. Currier & Co., Grand River Ave., cedar block, $22,963.——Bids will soon be asked for paving portions of Crane Ave., Montcalm St. and Mt. Elliott Ave.

KALAMAZOO, MICH.—East Main St. will probably be paved this summer with brick at a cost of about $13,000. Alderman Westbrook may be addressed.

PORT HURON, MICH.—F. F. Rogers, Cy. Engr., informs us that a contract has been awarded to B. D. Barton, at $11,479, for 10,800 sq. yds. of cedar block on concrete on Erie St.

SAULT STE. MARIE, MICH.—W. M. Sewell, Clk., informs us that the county commissioners have purchased a stone crusher from the Indiana Road Machine Co., and do not expect to do any work by contract.

CHARLESTON, ILL.—Bids are asked until July 15 for about 6,000 sq. yds. of brick paving. T. V. Miles, Cy. Clk.

PROVISO, ILL.—Bids are asked until Aug. 1 for constructing four miles of macadam road. R. E. Williams, Engr., 84 La Salle St., Chicago; Jacob Bohlander, Town Clk., Maywood.

KEWANEE, ILL.—Bids are asked until Aug. 1 for paving Tremont St.; appropriation, $45,000. J. C. Quade, Cy. Engr. ——The council has appropriated $20,000 for sidewalks, etc.

MILWAUKEE, WIS.—Bids are asked until July 15 for the purchase of $140,000 of street improvement bonds. Wm. J. Fiebrantz, Comptroller.

OSHKOSH, WIS.—The council is considering a proposition to spend $40,000 for macadamizing in seven streets. A. B. Ideson, Mayor.

DES MOINES, IA.—Bids are asked until July 20 for cement curb and brick paving on Pleasant St. E. W. Woodruff, Cy. Clk.

MUSCATINE, IA.—The council has awarded contracts for brick paving in District No. 14, to Edwards & Walsh, at $10,496, and in District No. 15, to Fuller Bros., at $8,618.

DULUTH, MINN.—Bids are asked until July 22 for improving Fifth St., between 26th Ave. and 27th Ave. R. Murchison, Clk. Bd. Pub. Wks.

MINNEAPOLIS, MINN.—Bids are asked until July 29 for furnishing artificial combined curb and gutter, to be used during the season of 1898; surety, $200. F. W. Cappelen, Cy. Engr.; L. A. Lydiard, Cy. Clk.

ST. PAUL, MINN.—Bids are asked until July 18 for grading the extension of Cleveland Ave. D. M. Sullivan, County Audr.

INDEPENDENCE, KAN.—We are informed that bids are asked until July 31 for 23,000 sq. yds. of brick paving, requiring 7,000 cu. yds. of excavation. John M. Walker, Cy. Engr.

TOPEKA, KAN.—The Gilsonite Paving & Roofing Co., St. Louis, Mo., has been awarded a contract, by the council, at $10,291 for paving the driveways, walks, etc., in the state house square.

SHERMAN, TEX.—Tom Randolph writes us that the council is considering a proposition for certain paving. It is not yet ready to ask for bids for the work. Councilmen C. P. Gregory, M. H. Andrews and R. R. Dulin may be addressed.

OAKLAND, CAL.—Bids are soon to be asked for macadamizing three county roads.

MANUFACTURING PLANTS.

BUFFALO, N. Y.—It is said that the plant of the Buffalo Co-operative Brewery will be rebuilt at a cost of $25,000.—— G. Fred Zellers Sons will build an addition to their tannery to cost $10,000.

ROCHESTER, N. Y.—Plans have been prepared for a 6-story brick and stone factory building, 285 × 75 ft., to be erected here for the Utz & Dunn Shoe Mfg. Co.; reported cost, $10,000. Archs., Ellis & Ellis, Powers Bldg., Rochester.

JERSEY CITY, N. J.—A new silk factory will probably be erected in this city for C. Stohn's Sons, Summit Ave. and Bleecker St.; estimated cost, $20,000. Arch., Emil Guhl, 19 Charles St., Jersey City.

PHILLIPSBURG, PA.—H. L. Forte & Co., Drexel Bldg., Philadelphia, Pa., have been awarded the contract for the erection of six additional buildings to the plant of the Vulcanite Portland Cement Co., at Vulcanite Station, on the New Jersey Central R. R., near Phillipsburg. Two of the buildings are 2-story and four 1-story, the largest measuring 600 × 80 ft.; estimated cost, $100,000. Archs., Hales & Ballinger, 11th and Chestnut Sts., Philadelphia, will supervise the work, which will be started at once.

PHILADELPHIA, PA.—The 5-story brick factory building of Halton & Shoemaker, at Boone and Diamond Sts., was destroyed by fire July 10, causing a loss of about $100,000; fully insured.

YORK, PA.—The York Mfg. Co., of York, informs us that it will erect a new 2-story addition to its plant, 130 × 80 ft., to be built of slow burning material. The power equipment will be furnished by the company.

NATIONAL SOLDIERS' HOME, VA.—The Hendrick Mfg. Co., Carbondale, Pa., has been awarded the contract for building the extension of the Pontifex ice machine plant at the southern branch of the National Home for Disabled Soldiers, at this place, at $4,990.

EAST DURHAM, N. C.—It is reported that the Durham Cotton Mfg. Co., of East Durham, will build an addition, 125 × 250 ft., requiring the installation of 5,400 additional spindles and 160 looms.

CEDARTOWN, GA.—A. F. Walker, 517 Austin Bldg., Atlanta, Ga., informs us that work has just commenced on the construction of the Paragon Mills in Cedartown. This plant will manufacture hosiery yarns, and will have a present equipment of 10,640 spindles.

COVINGTON, GA.—A 3-story addition, 300 × 80 ft., will be erected for the Porterdale Mills at Covington, and with other improvements, including 15,000 spindles, will cost about $150,000. Pres., J. F. Hanson, of Atlanta, Ga.

CROWLEY, LA.—It is reported that a rice mill will be built at this place, consisting of a 4-story building, 40 × 40 ft., and a 2-story warehouse, 100 × 150 ft. Contracts for construction and machinery are said to have been let. Pres., J. D. Crowley.

LOUISVILLE, KY.—The plant of the Globe Refining Co., situated on the outskirts of the city, was entirely destroyed by fire July 3, entailing a loss of $200,000; insurance, about $135,000. Secy., C. J. Hewitt.

PORTSMOUTH, O.—B. F. Vincent, Secy. and Treas., Burgess Steel & Iron Works, of Portsmouth, informs us that nothing definite has yet been done towards the erection of the proposed addition to the company's plant, but that a location will probably be decided upon within 30 days and the erection of the plant be begun.

LAWRENCEBURG, IND.—A fire in this city July 4 destroyed property valued at $100,000, including the Walsh distillery, cattle pens and the Oaster pens.

HAMMOND, IND.—The Western Starch Manufacturers' Association's plant at West Hammond was damaged by fire July 10, causing a reported loss of $250,000.

HOQUIAM, WASH.—Reports state that the F. K. Wood Lumber Co. will soon erect a complete dry kiln, 140 × 104 ft., at this place. H. J. Starr, Supt. of Construction.

MISCELLANEOUS CONTRACTS.

DREDGING.—Petaluma, Cal.—N. S. Frost, Cy. Engr., writes us that he is making surveys for 6,000 lin. ft. of tidal river for dredging.

RETAINING WALL.—Cincinnati, O.—Bids are asked until July 25 for building a retaining wall. A. P. Butterfield, Clk. Bd. City Affairs.

DREDGING.—Lorain, O.—Bids are asked until Aug. 2 for dredging Black River, as stated in our advertising columns. G. A. Resek, Cy. Clk.

DOCK.—Albany, N. Y.—F. A. Harrington, Pier Supt., has been directed to apply to the council for an appropriation to construct from 800 to 1,000 ft. of new dock.

EMBANKMENT, ETC.—Shelton, Wash.—Bids are asked until July 23 for strengthening the banks of Goldsboro Creek; estimated cost, $1,000. W. S. Covill, Town Clk.

PIERS.—Cleveland, O.—Bids are asked until Aug. 5 for constructing pile and timber piers, with stone filling at Erie St. and at Seneca St.; surety, $5,000. Geo. R. Warden, Dir.

IRON FENCE.—Pittsburg, Pa.—Bids are asked until July 18 for furnishing and erecting 400 ft. of iron fence at the Pittsburg City Home, at Marshalsea. Geo. Booth, Dir. Dept. Charities, 511 Fourth Ave.

TELEPHONE LINE.—Portland, Ore.—Reports state that the Columbia Telephone Co. is arranging to construct a line from this city to Washougal, Wash. General Manager Lamont, Portland, may be addressed.

DITCH.—Harvel, Ill.—Bids are asked until July 25 for constructing about 11 miles of drainage ditch. There will be required about 60,000 cu. yds. of earth excavation; bond, $1,000. Fred. Bertman, Chn. Drainage Comrs. of Bug River District.

LIGHTHOUSE SUPPLIES.—Tompkinsville, N. Y.—Bids are asked until July 25 for furnishing miscellaneous articles for the lighthouse establishment for the year ending June 30, 1899, as stated in our advertising columns. Lieut.-Col. D. P. Heap, U. S. Engr.

TELEPHONE WIRES, ETC.—St. Louis, Mo.—The general appropriation bill will include an item for $53,000 to purchase new wires for telephone, etc., to be placed underground, according to reports. Robt. E. McMath, Pres. Bd. Pub. Improvements.

TELEPHONE EXCHANGES.—New Orleans, La.—Reports state that a contract has been awarded to the Detroit Telephone, Switchboard & Construction Co., Detroit, for installing a 5,000-telephone exchange. Work will commence by Sept. 1. Manager Ahren may be addressed.

FIRE ENGINES, REPAIRS, ETC.—New York, N. Y.—Bids are asked by the fire department, 157 East 67th St., until July 27, for furnishing three fourth-size steam engines, having La France, New American and Amoskeag pumps and boilers, respectively; also for repairing four fourth-size Clapp & Jones fire engines. John J. Scannell, Fire Comr.

CHANNEL WORK.—Barnstable, Mass.—Frederick N. Wales, Clk., State House, Boston, informs us that the following bids were received July 7 for constructing oak pile jetties and excavating a channel through Dead Neck Beach, advertised in Engineering News June 30: Geo. H. Cavanagh, 166 Devonshire St., Boston, $13,690; Benj. Young, 17 Otis St., Boston, $20,980; R. G. & J. S. Packard, 130 Pearl St., New York, N. Y., $22,115.

SHIP CANAL.—Japan.—Press reports state as follows: Japanese government officials are at present discussing a scheme for constructing a ship canal from Osaka Bay on the Pacific to Isuruga on the Japan Sea, by way of Lake Biwa. Lake Biwa's present surface is 279 ft. above sea level and will supply 46% of the distance to be covered. As the lake is 262 ft. deep it is calculated that it can be lowered 135 ft., thereby producing a large area of dry land on its shores. It it estimated that the work can be completed in 10 to 15 years, at an expense to the government of $7,000,000 to $10,000,000 a year.

FLOATING DOCKS.—Washington, D. C.—Press reports of July 12 state as follows: The navy department is asking for bids for two floating docks, the two to cost not more than $250,000. M. T. Endicott, Chief Bureau of Yards and Docks, has been anxious to get some of these floating structures in order to send them to the Gulf and possibly to Cuba, where cruisers, gunboats and auxiliary craft could be docked in them, obviating the necessity of sending the ships to Northern docks. There are a number of floating docks in view, and it is expected that two of these will be secured under the bids asked July 12, without waiting the long time necessary to build such structures. Two such docks are at New York and three more are in and about New Orleans. An officer of the Bureau is now in New Orleans looking over the docks, in anticipation of their being offered to the government. The choice will be made with little delay. The bids for the floating docks to be built at New Orleans will be called for in about ten days.

CONTRACT PRICES.

STAND-PIPE.—Seattle, Wash.—Frank Olesen, Secy. Bd. Pub. Wks., informs us that the following bids were received June 30 for furnishing the material and for constructing a stand-pipe for the Cedar River water supply; the contract for the foundation has been let to T. Ryan, at $5,340:

Bids Received at Seattle, Wash., June 30, 1898, for Material and Constructing a Stand-pipe.

Quantities.		Moran Bros. Co., Seattle, Wash.	Wolfe & Zwiker Iron Wks., Portland, Ore.	Nelson & Phelps, 115 Dearborn St., Chicago.	Gillette-Herzog Mfg. Co., Minneapolis, Minn.	Chicago Bridge & Iron Co., Chicago, Ill.	Great Western Boiler Works, Seattle, Wash.
Steel in place	130,000 lbs.	$0.06⅓	$0.04½	$0.05¼	$0.0405	$0.04	$0.05⅝
Special castings	2,000 "	.10⅝	.03	.04½	.05	.03	.04
12-in. cast-iron pipe	2,200 "	.06⅓	.02¼	.04½	.03	.03	.04
12-in. Kalamin pipe	40 lin. ft.	1.53	1.40	4.40	4.00	2.00	1.60
12-in. gate valves	2 each	47.70	42.00	90.00	50.00	42.50	35.00
11×18-in. manhole heads in place	1	17.65	40.00	25.00	35.00	15.00	40.00
12-in. swing gate	1	54.20	79.50	90.00	50.00	65.00	40.00
Asphalt coating	1,400 sq. yds.	.14¾	.10	.25	.15	.05	.02½
Total		$9,020	$6,359	$7,835	$5,986	$5,641	$7,730

GAS PLANTS.

MARCUS HOOK, PA.—Reports state that the Standard Oil Co.'s plant at this place has been burned at a loss of about $70,000.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 30 for lighting the streets with gas and naphtha, for the year ending June 30, 1899, as stated in our advertising columns.

PIPE SEWERS.—Erie, Pa.—The following contract was let July 1, 1898, to Edward Driscoll for constructing a 15-in. pipe sewer in 11th St.: Straight and curved pipe, $1.45 a ft.; 9-in. pipe, 40 cts. a ft.; 6-in. pipe, 40 cts. a ft.; Y and T branches pipe, $1.90; manholes, $40 each.

BRICK PAVING.—Alton, Ill.—David Ryan has been awarded the contract for paving Front St., from Market to Alby, and Market St., from 2d to 3d st, with Alton brick at 95 cts. a sq. yd.

LEVEE WORK.—Memphis, Tenn.—The following bids were received July 6 by Capt. H. C. Newcomer, U. S. Engr., for levee construction in the Lower Yazoo District:

Bids Received at Memphis, Tenn., July 6, 1898, for Levee Work.—Lower Yazoo Levee District, Below Greenville.

Bidder.	Stations, 200 to 300, 483 L., 69,000 cu.yds. cts.	300 to 400, 485 L., 54,000 cu.yds. cts.	400 to 500, 487 L., 60,000 cu.yds. cts.	500 to 600, 489 L., 62,000 cu.yds. cts.	600 to 700, 491 L., 64,000 cu.yds. cts.	700 to 790, 492 L., 77,000 cu.yds. cts.	811 to 900, 492 L., 108,000 cu.yds. cts.	900 to 1000, 493 L., 100,000 cu.yds. cts.	1000 to 1100, 494 L., 99,000 cu.yds. cts.	1100 to 1200, 495 L., 84,000 cu.yds. cts.
J. H. Cary, Memphis, Tenn.	11	13	13	10.45	15	20	26	14	12	11
John Scott & Sons, St. Louis, Mo.	11	14	..	14.5	..	19.45	24.45	14.24	14.99	14.5
L. C. Dresbach & Bro., Memphis	12.75	..	..	11.74	..	..	..	..	..	14.75
J. E. Moore, Memphis, Tenn.	..	11.38	..	..	14.45	..	..	16.45	..	..
Shippey & Kilpatrick, Memphis	14	14	14	14	..	..	29	..	..	..
J. & A. Wynn, Wilczinski, Miss.	9	..	22.5	11	..	..	..	13.63	12.38	10.90
†T. Mike, Greenville, Miss.	9.20	13	13.5	*8.74	18	..	..	..	12	*9.5
Hugh Morgan, Memphis, Tenn.	12.5	12.5	..	12.5	..	..	..	..	..	..
Green Clay, Mexico, Mo.	12.75	10.80	13.90	14	14.87	15	32	23	13.88	13.24
‖Aderholdt & Lowrance, Friars Pt, Miss	13	15.5	13.75	13.5	20.75	20.75	24.75	16	15.75	13.75
C. A. Winter, Greenville, Miss.	..	..	..	..	*13.88	*13.38	24.88	17.74	14.13	10.75
W. M. Bates, Arkansas City, Ark.	11	12	13.5	12	15	14	23.75	17	15	12
Robert Johnsen, Memphis, Tenn.	14.25	14	14.5	13.5	14.25	25	24.90	17	14	12.5
§H. F. Watkins, Australia, Miss.	10	10.95	12	10.23	14.99	14.99	27	13.49	15	10.95
‡John G. Sessions, Greenville, Miss.	10.5	*10.5	..	10.5	14.90	14.5	..	..	..	..
L. C. Dulaney, Duncansby, Miss.	11.98	17	21	14	14	18	28	26	20	18
McCadden & Roach, Memphis, Tenn.	12.50	12.5	22.50	14.50	17.50	22.50	30	18.95	14.15	12.25
Bush Bros., Artonish, Miss.	14	16.5	18	12.5	15	25	25	22.5	20	14
P. H. Rogers, Stovall, Miss.	12	..	14	13	..	..	..	..	..	..
[1]Thomas & Co., Memphis, Tenn.	13.99	13.99	13.99	13.99	13.99	..	..	..	..	..
[2]Ernest Hyner, Greenville, Miss.	13	11	13	11.50	25	20	21	16	14	11
[3]J. E. Kerr, Paxton, Ill.	16.60	18.90	19.50	16.80	22.9	23	50	20	18.10	14.30
Martin Jennings & Co., Memphis	13.5	14.75	14.75	12.75	16	16.5	24.75	14.63	12.38	11.88
Gilchrist & Crow, Greenville, Miss.	11.90	16	..	11	..	..	..	15	15.25	12.5
Thompson & Powell, Memphis, Tenn	10.90	13.24	..	13.75	..	..	..	..	15	12.98
J. H. McTighe, Memphis, Tenn.	..	12.5	*12.5	11	..	..	..	..	..	14.40
[4]J. B. Lewis, Memphis, Tenn.	11.75	12.4	13.4	11.75	14.9	15.75	24.75	*13.25	*11.9	11.40
[5]N. I. McLeod, Memphis, Tenn.	12.23	12.97	..	11.73	..	..	..	..	..	10.70
[6]Batt O'Brien, Morville, La.	14	..	..	..	..	..	..	..	14	14
[7]John C. McIntyre, Memphis, Tenn.	11.38	12.5	13.25	13.75	17.38	16.38	*16.63	14.38	13.38	11.38
[8]Helgason Bros., L'Argent, La.	14	..	..	..	..	..	..	..	14	14
[9]Morrow & Carter, Memphis, Tenn.	12	12	12	14	14	..	..	..	16	13.45
Ben Talley, Memphis, Tenn.	11	11	11	10.75	..	..	..	..	14	10.25

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*Accepted. †1 ct. for each 100 ft. or fraction over 300 ft. haul. ‖Limit 500,000 cu. yds. §5 cts. extra for material hauled over levee. ‡Limit, 300,000 cu. yds. [1]All or none—limit 325,000 cu. yds. [2]From 600 to 700 at 11 cts. if material from land side and enlargement on land side. [3]Limit, 300,000 cu. yds. 1100 to 1300, both or neither. [4]Limit, 250,000 cu. yds. [5]Limit 200,000 cu. yds. [6]Limit 150,000 cu. yds. [7]4 cts. extra for material hauled over levee. [8]Limit 225,000 cu. yds. [9]From 200 to 700, all or none.

DREDGING.—Philadelphia, Pa.—Lieut.-Col. C. W. Raymond, U. S. Engr., Philadelphia, informs us that the following bids were received July 5, 1898, for dredging in Delaware River, as advertised in Engineering News; River & Harbor Improvement Co.'s bid was recommended for acceptance:

Bidder.	1,050,000 cu. yds.	
P. Sanford Ross, Jersey City, N. J.	$0.09⅗	$100,800
Atlas Dredging Co., Wilmington, Del.	.10	105,0 0
American Dredging Co., Phila., Pa.	.07⅖	77,700
International Contracting Co., Syracuse	.11¾	123,375
River & Harbor Imp. Co., Camden, N.J.	.06⅞	72,188
Baltimore Dredging Co., Baltimore, Md.	.10	105,000
Morris & Cumings Dredg. Co., N. Y.	.09	94,500
Virginia Dredg. Co., Richmond, Va.	.0849	89,145
Frank H. Brainard, New York, N. Y.	.09½	99,750

BRICK PAVING.—Des Moines, Ia.—The following bids were received July 2, 1898, for brick paving and grading 10th St., from Center to School St.: Two-course brick with sand filter, Capital City B. & P. Co., $1.14 a sq. yd.; J. W. Campbell, $1,14⅞; Likes Improvement Co., $1.14; Smith, Moss & Brown, $1.24; Magden, Sheely, Herrick & Co., $1.17⅞. Concrete base, brick paving, grout filler, Cottage Grave Ave., from 19th to 28th St, and Crocker, from 17th to 19th St.: Capital City B. & P. Co., $1.459; J. W. Campbell, $1.449; Smith, Moss & Brown, $1.46; Magden, Sheeley, Herrick & Co., $1.40⅞. Curbing, 8th St., from Forest to College Ave., T. O'Brien & Co., 33½ cts. a lin. ft.; Magden & Sheeley, 31.3 cts.; Mills St., from 19th to 20th St., O'Brien & Co., 34¾ cts.; Magden & Sheeley, 34.3 cts..

GRANITE.—Brooklyn, N. Y.—The dock board has let a contract to A. C. Gildersleeve for furnishing 8,600 cu. ft. of granite; cut to exact dimensions, for use on piers now building, at 94.6 cts. a ft.

LEVEE WORK.—Memphis, Tenn.—C. B. Duke, Ch. Clk., in the absence of Capt. H. C. Newcomer, U. S. Engr., Equitable Bldg., has sent us the following table of bids received July 6 for levee construction on the Lower Yazoo District:

Bids Received at Memphis, Tenn., July 6, 1898, for Levee Work.—Lower Yazoo Levee District, Below Greenville.

Bidder.	Stations, 1200 to 1300, 497 L., 75,000 cu.yds. cts.	1300 to 1400, 499 L., 89,000 cu.yds. cts.	1400 to 1500, 500 L., 124,000 cu.yds. cts.	1500 to 1600, 502 L., 91,000 cu.yds. cts.	1600 to 1700, 503 L., 75,000 cu.yds. cts.	1700 to 1800, 504 L., 58,000 cu.yds. cts.	1800 to 1900, 505 L., 71,000 cu.yds. cts.	1900 to 2000, 512 L., 50,000 cu.yds. cts.	2000 to 2060, 513 L., 100,000 cu.yds. cts.	2060 to 2100, 514 L., 100,000 cu.yds. cts.
†J. H. Cary, Memphis, Tenn.	18.50	18.50	18.50	18.50	18.50	..	..	..	..	..
John Scott & Sons, St. Louis, Mo.	17	18.45	22	32	..	..	..	..	10.23	10.23
L. C. Dresbach & Bro., Memphis	..	..	..	..	..	16.67	..	..	10.9	11.5
Shippey & Kilpatrick, Memphis	..	..	33	..	..	..	..	..	..	..
J. & A. Wynn, Wilczinski, Miss.	12.75	16	12.88	..	..	14	*10	10.1	8.85	9.5
M. McTighe, Memphis, Tenn.	13.25	17	18	28	..	..	14	13.5	12.15	12
T. Mike, Greenville, Miss.	*9.99	..	..	..	..	..	..	..	11	..
Green Clay, Mexico, Mo.	13.40	14.75	19	20	..	..	13.65	12.95	12.50	13
Bryan & King, Rex, Miss.	..	..	..	..	..	13.75	12.50	13	..	..
Aderholdt & Lowrance, Friars Pt, Miss.	13.75	24.5	27.5	21	23	16.50	17	15	12	12.75
C. A. Winter, Greenville, Miss.	11.13	16.97	23.97	21	19.94	..	..	..	..	..
W. M. Bates, Arkansas City, Ark.	12	25	27	25	22	14	12.50	13	12	12.5
Robert Johnsen, Memphis, Tenn	12	*14	24.90	24.90	..	..	14	13.5	11	11
H. F. Watkins, Australia, Miss.	11.99	29	30	27.25	27.25	*11.48	11.74	14.49	10.98	11 98
John A. Cannon, Greenville, Miss.	14	..	..	..	..	13.88	14.88	21.88	12.38	13.5
John G. Sessions, Greenville, Miss.	12.43	23.90	29.72	..	..	19.90	11.93	..	10.90	11.42
W. J. Bentley & Co., New Orleans, La.	..	..	..	..	..	..	..	..	22.45	22.45
L. C. Dulaney, Duncansby, Miss.	16	28	30	22	40	36	18	18	12.25	12.25
McCadden & Roach, Memphis, Tenn.	12.95	27.50	22.45	27.50	30	17.50	13.50	13.75	11	11
Bush Bros., Artonish, Miss.	14	25	28	30	30	16.5	15	15	11	11
C. T. Worthington, Leota, Miss.	..	..	..	..	..	..	..	14.75	9.88	..
‖Thomas & Co., Memphis, Tenn.	..	..	..	..	..	..	11.99	11.99	11.99	11.99
Ernest Hyner, Greenville, Miss.	11.75	25	29	28	29	14.94	12	12	..	..
§J. E. Kerr, Paxton, Ill.	16.90	45	50	50	..	..	21.80	20	13.60	13.80
M. Jennings & Co., Memphis, Tenn.	13.63	21.75	22.38	17.63	19.38	14.38	14.88	11.88	11.38	11.38
Gilchrist & Crow, Greenville, Miss.	14	..	..	..	..	15	13	16	10	10.5
J. H. McTighe, Memphis, Tenn.	15.5	..	34	..	..	..	..	..	12.40	12.40
J. B. Lewis, Memphis, Tenn.	12.90	19.70	23.70	17.70	16.70	12.50	12.90	13.90	10.70	11.70
N. I. McLeod, Memphis, Tenn.	11.77	..	..	..	..	..	..	..	10.23	10.73
Batt. O'Brien, Morville, La.	13.5	19.74	..	..	..	..	..	14.5	11	11.5
John C. McIntyre, Memphis, Tenn.	11.25	24.63	25.38	*15.38	16.63	14.38	13.38	13.38	10.38	10.63
Helgason Bros., L'Argent, La.	13	18	..	..	..	..	..	13.75	10.75	10.90
Morrow & Carter, Memphis, Tenn.	17	26.90	27	22	..	..	..	..	13.50	13.90
‡Ben Talley, Memphis, Tenn.	12	23.5	23.5	..	*14	13	13.5	..	10	10

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*Accepted. †1200 to 17, all or none. ‖1800 to 2100, all or none. §1100 to 1300, both or neither. ‡1300 to 1500, both or neither.

TELFORD-MACADAM PAVING.—Quincy, Ill. — Local papers state that the following bids were received June 24, 1898, for paving 17 blocks of the Boulevard, from Broadway to Harrison St., with telford-macadam: Fred Kordsiemon, grading, 14 cts. a cu. yd.; telford paving, 37½ cts. a sq. yd.; Ebert & Shannahan, grading 15 cts. a cu. yd.; telford paving, 44 cts. a sq. yd.; Zengle Bros., grading, 20 cts. a cu. yd.; telford paving, 45 cts. a sq. yd. The lowest bid aggregated $6,612 for a roadway 16 ft. wide for the 17 blocks, and $5,881 for a 14-ft. roadway. The Park and Boulevard Association has $4,360 for the work—$1,000 appropriated by the city, $1,000 by the county, $300 by Melrose, and the balance contributed by private subscriptions.

GUN CARRIAGES.—Washington, D. C.—It is stated that the following bids were received June 3, 1898, by the chief of ordnance for furnishing 18 12-in. and 6 8-in. disappearing gun carriages: 8-in.—Builders' Iron Foundry, Providence, R. I., 6 carriages, $11,515 each; first in 6 months and one a month thereafter. Walker Co., Cleveland, O., 6 carriages, $10,000 each; first in 120 days, and one every 20 days thereafter. Weimer Machine Works Co., Lebanon, Pa., 4 carriages, $11,750 each; 6 carriages, $11,400 each; first in 6 months and for each additional carriage add 7 weeks. Dixon Mfg. Co., Scranton, Pa., 6 carriages, $12,750 each; first in 6 months, and one every 6 weeks. Morgan Engineering Co., Alliance, O., 6 carriages, $9,985 each; first in 5 months, and one every 30 days. Frazier & Chalmers, Chicago, Ill., 1 carriage, $14,265; 2, $12,850; 6, $11,500; first in 100 days, and one every 20 days. Pond Machine Tool Co., Plainfield, N. J., 6 carriages, $12,500 each, first on Oct. 1, 1898, and one every 3 weeks; or $12,000 each, first on Nov. 1, and one a month. Lake Erie Engineering Works, Buffalo, N. Y., 1 carriage, $11,500; 2, $11,250; 6, $10,650; first in 7 months, second in 9 months, third in 10 months, fourth in 12 months, and one per month thereafter.

12-in.—Lake Erie Engineering Works, 19 carriages, as follows: 3 to 5, $33,500; 6 to 10, $33,250; 11 to 15, $33,000; 16 to 19, $32,750; first in 5 months, second in 7 months, third in 9 months, fourth in 10½ months, fifth in 12 months, and one a month thereafter. Morgan Engineering Co., 5 carriages, $32,250 each; first in 6 months and one every 6 weeks until three are delivered, then one every 30 days. Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, 5 carriages, $33,950 each; first in 6 months and one every 2 months. Robert Poole & Sons Co., Baltimore, 5 carriages, $32,250 each; first in 6 months and one every 1½ months thereafter. Bethlehem Iron Co., South Bethlehem, Pa., 5 or more carriages, $32,250 each; first in 6 months, second and third in 9 months, and one a month. Builders' Iron Foundry, 5 carriages, $39,500 each; first in 8 months, and one every 10 weeks. Weimer Machine Works Co., 3 carriages, $35,500 each; 6, $35,000; more than 6, $34,350 each; first carriage in 7 months, and one every 9 weeks thereafter.

ASPHALT PAVING.—Atlanta, Ga.—J. D. Turner writes us that the Warren-Scharf Asphalt Paving Co., 1 Broadway, New York, was awarded the contract July 5, 1898, for paving Washington St., from Hunter St. to Woodward Ave., at $2.08 a sq. yd.; total, $17,082.

LEVEE WORK.—Memphis; Tenn.—We are informed that the following bids were received July 6 for levee construction in Arkansas; Capt. H. C. Newcomer, U. S. Engr., C. B. Duke, Ch. Clk., Equitable Bldg.:

Bids Received at Memphis, Tenn., July 6, 1898, for Levee Work on the Upper Tensas Levee.

Bidder.	Upper Tensas Levee District, —in Arkansas.					Upper Tensas, —in Louisiana.		
	Sta. 1780 to 1810, 466 R., 20,000 cu. yds.	Sta. 1942 to 2047, 468 R., 67,000 cu. yds.	Sta. 3400 to 3500, 505 R., 106,000 cu. yds.	Sta. 3500 to 3600, 506 R., 104,000 cu. yds.	Sta. 3600 to 3700, 508 R., 94,000 cu. yds.	Sta. 2411 to 2500, 562 R., 120,000 cu. yds.	Sta. 2810 to 2931, 574 R., 100,000 cu. yds.	Sta. 2931 to 3031, 576 R., 100,000 cu. yds.
John Scott & Sons, St. Louis, Mo.	..	..	..	..	..	18	18	21
J. E. Moore, Memphis, Tenn.	13.38	16.63	..	..	..	..	..	..
F. L. Maxwell, Mound, La.	..	..	..	..	..	21.9	14	20.60
M. McTighe, Memphis, Tenn.	..	..	..	19	20	16	12	19
L. Aschaffenburg, Henderson, La.	..	..	..	..	..	*15.74	13.74	23.74
C. A. Winter, Greenville, Miss.	..	..	*13.63	*15	..	..	..	..
C. A. Lacy, Arkansas City, Ark.	12.5	18.99	..	..	..	..	..	..
W. M. Bates, Arkansas City, Ark.	15.94	20	13.98	17.5	17.5	19	12	33.34
Robert Johnsen, Memphis, Tenn.	*11.99	..	..	..	..	22.50	..	..
John A. Cannon Greenville, Miss.	..	..	22.88	22.88	22.88	..	..	..
John G. Sessions, Greenville, Miss.	..	..	..	..	..	..	16.40	..
W. J. Bentley & Co., New Orleans, La.	..	..	21.75	21.75	21.75	19.75	18.60	*18.60
McCadden & Roach, Memphis, Tenn.	..	*14.95	17.25	27.50	30	..	..	..
†Thomas & Co., Memphis, Tenn.	..	..	17.99	17.99	17.99	..	..	..
M. Jennings & Co., Memphis, Tenn.	..	22.38	17.63	..	..	..	13.63	21.38
‡W. R. Lewis & Co., Rex, Miss.	..	..	14.40	14.40	..	..	..	..
J. H. McTighe, Memphis, Tenn.	..	..	..	..	..	..	*9.99	..
J. B. Lewis, Memphis, Tenn.	16	21	15.20	21.70	24.70	..	14	19
Robert Nicholson, Villa Vista, La.	..	..	..	..	..	16.21	..	28
Batt O'Brien, Morville, La.	..	..	16	..	..	17.74	17.5	24
Helgason Bros., L'Argent, La.	..	..	..	..	..	17.5	14.90	19.90
Ben Talley, Memphis, Tenn.	..	..	15	15	*15	..	..	..

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*Accepted. †3400 to 3700, all or none. ‡Both or neither.

INDUSTRIAL NOTES.

THE MARION STEAM SHOVEL CO., Marion, O., writes us that business has been very good, and that it has been very busy all the season.

THE THOMSON METER CO., Brooklyn, New York, sold from Jan. 1, 1898, to July 1, 1898, 11,496 meters, which was 2,595 more than it sold in the first six months of 1897. So far 116,678 meters in all have been sold.

G. M. BURKHALTER & CO., 708 South 23d St., Birmingham, Ala., has just received a $25,000-contract for paving streets at Meridian, Miss. The company is now constructing about two miles of sewers in the same city.

THE WEBER GAS & GASOLINE ENGINE CO., Kansas City, Mo., is reported to have received a contract from the British government for six cable hoisting machines to be used in British Guinea for raising telegraph cables. The machines will have a raising capacity of eight tons elevated 40 ft. a minute, and will cost about $20,000.

THE BETHLEHEM IRON CO., South Bethlehem, Pa., was the builder of the crank, line, thrust and propeller shafts and all other hollow forgings of the U. S. battleship "Oregon," whose performance in steaming from San Francisco, Cal., to Key West, Fla., without a break in her machinery, and reporting immediately upon her arrival for active service, has already been noted in this paper. To have been able to make this record, it was absolutely essential that all parts of the machinery should be of the best, thus showing, it is claimed, the durability of hollow forgings over solid forgings for such purposes. We are informed that all the above-named shafts had a 6-in. hole running through them.

A. B. BOWERS, San Francisco, Cal., has been granted an injunction by the United States Circuit Court of the Southern District of New York, restraining the New York Dredging Co. from infringement of the Bowers patents on hydraulic dredges, but allowing the completion of the latter's contract at League Island, Cal., and also the work at Port Arthur, Tex., on filing bonds for profits and damages. Those interested in the legal aspects of the Bowers hydraulic dredge patents litigation, will find decisions in his cases in 63 Fed. Rep., p. 572; 69 Fed. Rep., p. 640; 77 Fed. Rep., p. 980; 80 Fed. Rep., p. 121; 25 U. S. A., p. 323; 48 U. S. A., p. 120; 80 Fed. Rep., p. 119; 106 U. S. A., p. 720; 81 Fed. Rep., p. 569; 83 Fed. Rep., p. 944. There are some other decisions not yet published.

Contract Work Should Always be Advertised in a Paper Read by Contractors.

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies in North America Reads Engineering News.

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PERSONAL.

Mr. Edwin C. Baggs has been appointed Receiver of the Denver City Cable Co., Denver, Colo.

Mr. Harry T. Litchfield has been appointed Superintendent of the electric light plant at Lilly Dale, N. Y.

Mr. Paul Dato has been appointed Superintendent of the water-works at Hillsboro, Tex., to succeed Mr. O. J. Morris, resigned.

Mr. L. F. Bellinger, civil engineer, of Atlanta, Ga., has been commissioned Captain in the Third Regiment of U. S. Volunteer Engineers.

Gen. Thomas S. Mumford, of Baltimore, Md., has been elected President of the Chesapeake & Ohio Canal Co., to succeed Mr. Stephen Gambrill.

Messrs. Bartl & Smith, civil and mining engineers, have removed their offices from 507 Lackawanna Ave., to the Connell Bldg., Wyoming Ave., Scranton, Pa.

Mr. W. H. Gridley has been appointed Superintendent of the St. Louis, Peoria & Northern Ry., with headquarters at Springfield, Ill., to succeed Mr. L. S. Graves, resigned.

Mr. John W. Hill, M. Am. Soc. C. E., of Cincinnati, O., has been appointed expert for the city of Indianapolis, Ind., to determine the physical condition of the plant of the Indianapolis Water Co.

Mr. Charles H. Meyers, M. Am. Soc. C. E., has resigned his position as Engineer of Sewer Construction in the Borough of Brooklyn, and has resumed private practice at 45 Broadway, New York.

Mr. John F. Hayford, Assoc. M. Am. Soc. C. E., Ithaca, N. Y., has been appointed Expert Computer and Geodesist in the U. S. Coast and Geodetic Survey, and is charged with the duties of chief computer.

Mr. William C. Winter, Assistant, Claim Agent of the Chicago, St. Paul, Minneapolis & Omaha Ry., with headquarters in St. Paul, Minn., has been appointed an Assistant Superintendent of the Union Pacific R. R.

Mr. Eugene W. Stern, M. Am. Soc. C. E., for the past six years Engineer of the Koken Iron Works, St. Louis, Mo., has accepted the position of Chief Engineer of the Jackson Architectural Iron Works, New York city.

Mr. Almon B. Atwater, M. Am. Soc. C. E., Division Superintendent of the Western Division of the Grand Trunk Ry., with headquarters at Detroit, Mich., has been appointed Assistant General Superintendent of the Michigan Central R. R.

Mr. Stewart Brown, Vice-President and Manager of the National Surety Co., of New York city, has been elected President of the Erie & Central New York Ry., to succeed Mr. Wayland D. Tinsdale, resigned, with headquarters at Cortland, N. Y.

Mr. Howard Gould has been elected President of the Tubular Dispatch Co., New York city, to succeed Mr. John E. Milholland. This company controls the New York Mail & Transportation Co., which owns the pneumatic mail tube lines crossing the New York and Brooklyn Bridge.

Mr. George Chipman Martin, C. E., formerly a member of the staff of Engineering News, has been appointed a Second Lieutenant of Infantry in the regular army of the United States. Mr. Martin is a graduate of the Engineering Department of the University of Vermont, in the class of 1892.

Mr. J. Francis Le Baron, M. Am. Soc. C. E., of Jacksonville, Fla., has been appointed a Captain in the Tenth U. S. Volunteer Infantry, but has declined in order to go to Honduras, where he has been appointed Chief Engineer of the Improvement of the Patuca River and Bar, as noted in our last issue.

Mr. Hadley Baldwin, Supervisor of Track of the Cleveland, Cincinnati, Chicago & St. Louis Ry., with headquarters at Terre Haute, Ind., has been appointed Engineer of Maintenance of Way of the Chicago Division, with headquarters at Indianapolis, Ind., to succeed Mr. T. O. Morris.

Mr. David Molitor, M. Am. Soc. C. E., United States Assistant Engineer on River and Harbor Improvements, with offices in the Telephone Bldg., Detroit, Mich., will take charge of a precise level party which will run a duplicate line between Lake St. Francis and Cape Vincent, along the St. Lawrence River, Ontario, for the United States Deep Water-Ways Commission and the United States Lake Survey.

Maj. A. Macomb Miller, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, with headquarters in New York city, has relieved Col. T. A. Bingham, temporarily in charge of the Washington Aqueduct. He will assume the work of completing the Lydecker tunnel and reservoir, authorized by a recent act of Congress.

Mr. William P. Richards, civil engineer, has been appointed Surveyor of the District of Columbia, to succeed Capt. Henry Brigham Looker, Assoc. M. Am. Soc. C. E., First District of Columbia Volunteers, who is at the front. Mr. Richards for the past seven years has had charge of the extension of streets in the district.

Mr. Alfred M. Quick, formerly an assistant in the City Engineer's Office, Providence, R. I., and to Mr. Samuel M. Gray, M. Am. Soc. C. E., of the same city, and recently Assistant Engineer of the Water Department, Baltimore, Md., has become associated as a member of the firm of Hill & Howard, consulting engineers, with offices in the Manufacturers' Record Bldg., Baltimore.

Mr. William Ogilvie has been appointed by the government of the Dominion of Canada as Commissioner of the newly organized Yukon Territory, at a salary of $5,000 a year. He was born near Ottawa, Ont., 52 years ago, and became a land surveyor, entering the government service in June, 1875. His first permanent position was that of a chief clerk and astronomer in the Interior Department. In April, 1887, he was first sent to the Yukon region and commissioned to produce the 141st meridian, which, by the treaty of St. Petersburg, is designated as the dividing line between Canada and Alaska, from Mount St. Elias to the Arctic Ocean. On this work he was engaged for many months, and during that time made a survey of the region around the Mackenzie River and Lake Athabaska. He started on his second trip to the Yukon, June 19, 1895, and did not return for two and a half years. He was there when the rush of gold seekers to the Yukon began, and immediately became a commanding figure. His report to the Dominion government on the Yukon gold fields, which he presented upon his return, is the best description of this region that has ever been made. His appointment is a well-deserved recognition of a faithful and capable official.

OBITUARY.

Mr. Henry Amerige, formerly Superintendent of Streets of Malden, Mass., died July 14, aged 80.

Hon. Eliada S. Merrell, President of the Board of Water Commissioners of Lowville, N. Y., died July 4.

Mr. Napoleon B. Hafer, who is said to have been the first one to introduce brick paving in the West, died in Bloomington, Ill., July 10, aged 73.

Mr. F. A. Bishop, civil engineer, of Bristol, Conn., died July 4, aged 68. He went to California in 1855 and spent many years there, holding the position of Engineer to the State Board of Harbor Commissioners until 1884.

Sir Robert Rawlinson, the famous English sanitary engineer, who died on May 31, 1898, as announced in our issue of June 16, left a personal estate of $414,155. In his will, lately proven, he leaves the income of his residuary estate to Lady Rawlinson during her life, with power to dispose of one moiety of the estate. He leaves $5,000 to the Institution of Civil Engineers, and the ultimate remainder, estimated at about $175,000, will be paid to the trustees of St. Thomas Hospital.

Mr. Charles A. Ellis, contractor, of Kansas City, Mo., was drowned at Noel, Mo., July 4. He was born in Boone county, Ind., 34 years ago, and was educated at Earlham College, Richmond, Ind. In 1884 he went to Kansas City, Kan., and entered the office of the County Surveyor. He left this to enter the office of the City Engineer, and was himself appointed to the latter office five years later, in 1891. He served in this capacity for six years, and then resigned to engage in the contracting business, which he followed until his death.

Mr. Carl A. Trik, Superintendent of Bridges of the Bureau of Highways, of Philadelphia, Pa., died July 10. He was born April 28, 1841, at Wildberg, Germany, and became County Surveyor of Ulm. As one of the Royal Commissioners he established the boundary between Bavaria and Wurtemberg, and in 1881 came to this country. He became an assistant to Mr. Rudolph Hering, M. Am. Soc. C. E., of New York, and later entered the Survey Bureau of Philadelphia, as an Assistant Engineer, being in charge of the designing of the city's sewerage system. In 1888 he was appointed Superintendent of Bridges, which office he held continuously until the time of his death. About four or five months ago he was stricken with paralysis and later contracted a severe cold which developed into pneumonia.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 26. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
July 26 to 29. Annual convention at Detroit. Secy., C. W. Hunt, 220 W. 57th St., New York, N. Y.
WESTERN SOCIETY OF ENGINEERS.
Aug. 3. "Establishment of Street Grades," Chas. P. Chase. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
OHIO INSTITUTE OF MINING ENGINEERS.
Aug. 4. Summer meeting, Toledo, Ohio. Secy., Robert M. Hazeltine, Columbus, O.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Aug. 5. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
MONTANA SOCIETY OF ENGINEERS.
Aug. 13. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
ENGINEERS' CLUB OF MINNEAPOLIS.
Aug. 15. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Aug. 17. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
NEW ENGLAND ROAD MASTERS' ASSOCIATION.
Aug. 17. Annual meeting, Boston, Mass. F. C. Stowell, B. & M. R. R., Ware, Mass.
SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
Aug. 18 to 20. Annual meeting at Massachusetts Institute of Technology, Boston, Mass. Secy., Albert Kingsbury, Durham, N. H.
AMERICAN CHEMICAL SOCIETY.
Aug. 22-23. Annual meeting, Boston, Mass. Secy., Albert C. Hale, 551 Putnam Ave., Brooklyn, N. Y.
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Aug. 22-27. Annual meeting, Boston, Mass. Secy., F. W. Putnam, Salem, Mass.

OHIO INSTITUTE OF MINING ENGINEERS.—The annual summer meeting of this society will be held at Toledo on Aug. 4. The program includes a trip by water from Cleveland. About 100 are expected to attend.

CIVIL ENGINEERS CLUB OF CLEVELAND.—At the regular meeting held July 12 Mr. Oliver S. Hubbell, of the firm of Hubbell & Benes, delivered an address entitled "Marble versus granite." An abstract is given elsewhere in this issue. Wm. H. Searles, Secy.

INDEPENDENT TELEPHONE ASSOCIATION.—The 2d annual convention of this association was held at Chicago, Ill., June 30 and July 1-2. As the sessions were private, none but members being allowed to attend, nothing can be said of the work done, aside from the fact that a committee was appointed to propose changes in the constitution. The committee submitted a number of changes and amendments. Attendance was good, there being present representatives from independent companies in 14 states.

IRON AND STEEL INSTITUTE.—At the autumn meeting of this association scheduled for Aug. 26-27 at Stockholm, the following papers will be presented: "The Development of the Swedish Iron Industry," Richard Akerman; "The Most Prominent and Characteristic Feature of Swedish Ore Mining," Prof. G. Nordenström: "The Danger of Using Too Hard Rails," C. P. Sandberg; "The Action of Explosives on the Tubes of Steel Guns," Prof. W. C. Roberts-Austen; "Brittleness in Steel Produced by Annealing," J. E. Stead; "The Micro-Chemistry of Cementation," Prof. J. O. Arnold; "The Influence of Metalloids on Cast Iron," Guy R. Johnson.

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NEW PUBLICATIONS.

ARIZONA WEATHER AND CLIMATE.—Bulletin No. 27, Arizona Agricultural Experiment Station, Tucson, Ariz. By Edw. M. Boggs, Irrigation Engineer and Meteorologist. Rewritten and added to by Nathan H. Barnes, Irrigation Engineer and Meteorologist. Paper; 6 × 9 ins.; pp. 50; tables.

The tables in this bulletin give temperature, dew point, humidity, vapor pressure, sunshine, cloudiness, evaporation, wind movement and barometric pressure records for varying periods, the longest being from October, 1891, to December, 1897. Besides these tables the text describes the methods employed in making the observations and discusses some of the most important features of the climate of Arizona.

UNSTEADY FLOW OF WATER IN PIPES.—By Prof. Irving P. Church. Reprinted from "Transactions of Association of Civil Engineers of Cornell University," 1898. Pamph.; 6 × 9 ins.; pp. 44. Address Prof. C. L. Crandall, Ithaca, N. Y., Secretary Association of Civil Engineers of Cornell University.

In this pamphlet the author develops formulas for the variation of pressure in long pipes when the flow therein is checked or accelerated, and compares the results with experimental results obtained in a thesis investigation made by Mr. B. F. Lattig, a graduate of Cornell in the class of 1894. A substantial agreement is shown. The paper should be practically useful to every engineer who has to do with water power development under high heads, and may be studied in connection with the editorial discussion in Engineering News of July 8, 1897.

REPORT OF THE PROVINCIAL INSTRUCTOR IN ROAD-MAKING, ONTARIO, 1897.—Published by the Ontario Department of Agriculture and printed by order of the Legislative Assembly of Ontario, Toronto. Paper; 9¾ × 6½ ins.; pp. 71; illustrated. Address Mr. A. W. Campbell, Provincial Instructor in Road-Making, Parliament Building, Toronto, Ontario.

A year or more ago we had occasion to favorably review the report of Mr. Campbell for 1896. The present report is a similar straightforward and useful document. Country roads take up the larger part of this issue and much good advice is given as to selecting and applying the road material, in repairing the roads and in adopting methods of paying for them. Boiled down, this section calls for systematic permanent work, thorough drainage, the proper application of good materials, the use of road machinery, prompt repairs, and stone, concrete or iron bridges. In other words, it pays to build only good roads. The numerous reports from cities, towns and villages include much useful information. Mr. Campbell notes as complete and excellent the frontage-tax system in force in Blenheim, Kent Co., Ontario. While this system differs but little from many in use in the United States, Mr. Campbell's description is valuable for its explanatory detail of the requirement under the law.

BRITISH RAILWAY STATISTICS.—Pub. Doc., London. Eight pamphlets; 8½ × 13 ins.; pp. 420.

These pamphlets contain the returns by the railways of Great Britain of the statistics of train accidents for the calendar year of 1897, and of continuous brake equipment for the last six months of the same year, and a half dozen special acts authorizing the construction of as many "light railways" in different parts of the kingdom.

Altogether 34 persons were killed and 476 were injured by accidents to trains during 1897, as compared with eight killed and 549 injured in 1896. Including accidents in which no personal injury was sustained three were reported during the twelve months; 31 collisions between passenger trains; 39 collisions between passenger trains and freight trains; 34 freight train collisions; one collision between train and cars standing foul of the line; 23 collisions between trains and buffer stops; 40 derailments of passenger trains; 20 derailments of freight trains; 255 cases of trains running through gates at level crossings or other obstructions; 11 cases of fire on trains, and 5 miscellaneous accidents. Including railway accidents of all kinds, 1,165 persons were killed and 6,102 persons were injured.

The figures on continuous brakes show that on Dec. 31. 1897, 99.8% of the locomotives and 99.4% of the total passenger cars owned by British railways were provided either with vacuum brakes or Westinghouse automatic brakes.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

WATER AND GAS SPECIALTIES.—H. Mueller Mfg. Co., Decatur, Ill. Pamphlets; paper.

These six pamphlets, with two to eight pages each, deal with various specialties, including the Mueller water main tapping machine, water pressure regulator, flange coupling, spiral screw and tool drivers, and an extensive line of cocks, taps, etc.

PRESS CLIPPINGS.—Robert & Linn Luce, 68 Devonshire St., Boston, Mass. Pamph.; 7 × 4½ ins.; 32 pp.; illustrated.

This pamphlet gives a history of The Press Clipping Bureau and a list of some of its patrons. The bureau was started in Boston, in 1888, and now has well established reading rooms in Boston, New York, Cincinnati and Denver. It claims to cut and deliver nearly 15,000 newspaper clippings a day at its different offices.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
July 21.	School building, Dayton, O.	July 7
July 21.	Sewers, Amsterdam, N. Y.	July 7
July 21.	Heating and ventilating, Syracuse, N. Y.	July 14
July 21.	Widening bridge, Paterson, N. J.	July 14
July 21.	Water tower, hydrants, etc., Chicago Junct'n, O.	July 14
July 21.	School building, Poplar Bluff, Mo.	July 14
July 21.	Sewerage system, Goldsboro, N. C. Advertised, Eng. News, July 7 and 14.	July 14
July 21.	Brick paving, Scranton, Pa.	July 14
July 21.	Pipe sewers, Brewer, Me.	July 21
July 21.	Pipe sewers, East St. Louis, Ill.	July 21
July 21.	Laying water pipe, Boston, Mass.	July 21
July 22.	Ventilating, wiring, etc., Newark, N. J.	July 21
July 22.	Brick paving, etc., East St. Louis, Ill.	July 21
July 22.	Bridge abutment, Summerville, Ont.	July 21
July 22.	street work (1 street), Duluth, Minn.	July 14
July 22.	Water-works, Cass City, Mich.	July 14
July 22.	Repairing garbage dumper, New York	July 14
July 22.	Electric light plant, Cass City, Mich.	July 14
July 22.	Main brick sewer, Louisville, Ky.	July 14
July 22.	Gravel road, Waterbury, Conn.	July 14
July 22.	Paving, Lima, O.	July 14
July 22.	Paving, Louisville, Ky.	July 14
July 22.	Water-works, Sparta, Minn.	July 7
July 22.	Hydraulic dredge, St. Louis, Mo. Advertised, Eng. News, June 23 to July 14.	June 23
July 22.	Grading, road work, etc., California, O.	June 30
July 23.	Water-works, Beatrice, Neb.	June 30
July 23.	Cement sidewalks, Washington, D. C. Advertised, Engineering News, June 23.	June 23
July 23.	Paving, Carbondale, Pa. Advertised, Eng. News, July 7 to 21.	July 7
July 23.	Embankment, etc., Shelton, Wash.	July 14
July 23.	Water pipe, Batavia, Ill.	July 14
July 23.	Iron bridges (4), Wilkes Barre, Pa. Advertised, Eng. News, July 14 and 21.	July 14
July 23.	Church building, Bay City, Mich.	July 14
July 23.	Lamp posts (300), Washington, D. C.	July 21
July 23.	Bridge, Aitken, Minn.	July 21
July 24.	Bridge work, St. Joseph, Mo.	July 14
July 25.	Church building, Holgate, O.	July 14
July 25.	County building, Chatham, Va.	July 14
July 25.	School building, Spencer, O.	July 14
July 25.	Municipal building, etc., Stratford, Ont.	July 14
July 25.	Jail, etc., Ottawa, O.	July 14
July 25.	Heating, etc., Columbus, Neb.	July 14
July 25.	Sewerage system, Kewanee, Ill. Advertised, Engineering News, July 14.	July 14
July 25.	Retaining wall, Cincinnati, O.	July 14
July 25.	Drainage ditch, Harvel, Ill.	July 14
July 25.	Lighthouse supplies, Tompkinsville, S. I. Advertised, Eng. News, July 14 and 21.	July 14
July 25.	Cement sidewalks, South Bend, Ind.	July 14
July 25.	Grading, paving, etc., Sullivan, Ind.	July 14
July 25.	Lighting bonds, Lebanon, O.	July 7
July 25.	Asphalt paving, South Bend, Ind.	July 7
July 25.	School buildings, Mansfield, O.	July 7
July 25.	Water-works, Winnipeg, Man. Advertised, Eng. News, June 2 to 23.	June 2
July 25.	Timber, Willetts Point, N. Y.	June 30
July 25.	Sewers, Chicago, Ill.	July 21
July 25.	Grading, Malvern, Pa.	July 21
July 25.	Sterilizing apparatus, Dunning, Ill.	July 21
July 25.	Protection dikes, Bridgeport, Okla.	July 21
July 25.	Brick sewer, McKees Rocks, Pa.	July 21
July 25.	Pipe sewers, New Ulm, Minn.	July 21
July 25.	Brick school building, Laurel, Md.	July 21
July 25.	Dry air system, Dunning, Ill.	July 21
July 25.	Club house, Lawrence, Kan.	July 21
July 25.	Relaying water pipe, Tonawanda, N. Y.	July 21
July 25.	Water bonds, White Plains, N. Y.	July 21
July 25.	Asphalt or brick paving, McKees Rocks, Pa.	July 21
July 25.	Brick paving, Norwich, N. Y. Advertised, Engineering News, July 21.	July 21
July 25.	Macadamizing, etc., Mount Vernon, N. Y.	July 21
July 25.	Paving, Cortland, N. Y. Advertised, Engineering News, July 21.	July 21
July 25.	Graveling, etc., New Ulm, Minn.	July 21
July 25.	Street bonds, Jefferson City, Mo.	July 21
July 26.	Sewers, Huntington, Ind.	July 21
July 26.	Water meters, Camden, N. J.	July 21
July 26.	Naval station, Newport, R. I.	July 21
July 26.	Annex to pumping station, etc., Philadelphia	July 21
July 26.	Water-works, Yale, Mich. Advertised, Engineering News, July 7.	July 21
July 26.	Bridge work, Annapolis, Md.	July 21
July 26.	Electric light plant, Sycamore, O.	June 30
July 26.	Water-works, Sycamore, O.	June 30
July 26.	School building, Columbus, Neb.	July 14
July 27.	Fire engines, repairs, etc., New York	July 14
July 27.	Dam, lay'g water pipe, etc., Huntington, Mass.	July 14
July 27.	Asphalt paving, etc., Jersey City, N. J.	July 14
July 27.	Heating plant, Madison, Wis.	July 14
July 27.	Church building, Moro, Ore.	July 7
July 27.	Paving, Charleston, Ill.	July 7
July 27.	Water supply, Ridgewood, N. J. Advertised, Engineering News, June 23.	June 23
July 27.	Bridge, Carthage, O.	June 30
July 27.	Brick paving, Meadville, Pa. Advertised, Engineering News, July 21.	July 21
July 27.	Paving, Buffalo, N. Y.	July 21
July 27.	Dredging, Brooklyn, N. Y.	July 21
July 28.	Electric light plant, Gaylord, Minn. Advertised, Engineering News, July 21.	July 21
July 28.	Street railway, Plymouth, Mass.	July 21
July 28.	Sewers, North Braddock, Pa.	July 21
July 28.	Stone flag, etc., Brooklyn, N. Y.	July 21
July 28.	Pipe sewers, New York, N. Y.	July 21
July 28.	Iron sewer pipe, etc., London, Ont.	July 21
July 28.	Water mains, New York, N. Y.	July 21
July 28.	Cleaning paved streets, Buffalo, N. Y.	July 21
July 28.	Iron bridge, New Philadelphia, O.	July 21
July 28.	Masonry work, Louisville, Ky. Advertised, Eng. News, June 30 to July 21.	June 30
July 28.	Water pipe, hydrants, etc., Renovo, Pa. Advertised, Eng. News, July 14 and 21.	July 14
July 29.	Hospital building, Cleveland, O.	July 14
July 29.	Pike road, Spencer, Ind.	July 14
July 29.	Sluice gates, Cincinnati, O. Advertised, Eng. News, July 7 to 21.	July 7
July 29.	Pine timber, New York, N. Y.	July 21
July 29.	Viaduct, Chicago, Ill.	July 21
July 29.	Sewers, Omaha, Neb.	July 21
July 29.	Telephone system, Mankato, Minn.	July 21
July 29.	Addition to school, Buffalo, N. Y.	July 21
July 29.	Grading, etc., Richmond, Ind.	July 21
July 29.	Paving, Omaha, Neb.	July 21
July 30.	Sewer system, disposal beds, Flemington, N. J. Advertised, Eng. News, July 21 and 28.	July 21
July 30.	Pipe sewers, Aurora, Ind.	July 21
July 30.	Street bonds, Ashland, O.	July 21
July 30.	Bridge, St. Hermenegilde, Que.	July 21
July 30.	Brick paving, Ashland, O. Advertised, Eng. News, July 7 and 14.	July 7
July 30.	Iron bridge, Cincinnati, O.	July 7
July 30.	Gas and naphtha lighting, Washington, D. C. Advertised, Engineering News, July 14.	July 14
July 30.	Buildings, Ellis Island, N. Y. H.	July 14
July 30.	Court house and jail, Cando, N. Dak.	July 14
July 30.	School building, Provo City, Utah	July 14
July 30.	School building, Elbowoods, N. Dak.	July 14
July 30.	Electric lighting, Washington, D. C. Advertised, Engineering News, July 14.	July 14
July 31.	Brick paving, Independence, Kan.	July 14
July 31.	Water supply, Tangier, Morocco	June 23
July 31.	Street bonds, Canton, O.	July 21
Aug. 1.	Macadamizing, etc., Suffield, Conn.	July 21
Aug. 1.	Pipe sewers, Elizabeth, N. J.	July 21
Aug. 1.	School bonds, Taylorsville, Ill.	July 21
Aug. 1.	Lighthouse, New Haven, Conn. Advertised, Eng. News, July 21 and 28.	July 21
Aug. 1.	Street bonds, Berea, O.	July 21
Aug. 1.	Jail building, Richfield, Utah	July 21
Aug. 1.	Asphalt paving, Buffalo, N. Y.	July 21
Aug. 1.	Water pipe, etc., Rock Island, Ill.	July 14
Aug. 1.	Bridge, Centralia, Wash.	July 21
Aug. 1.	Bridges (3), Chehalis, Wash.	July 21
Aug. 1.	Bridges (200 ft.), Claquato, Wash.	July 21
Aug. 1.	Electric light plant, Charleston, S. C. Advertised, Eng. News, June 30 to July 21.	June 30
Aug. 1.	Power canal, Ellensburg, Wash.	June 30
Aug. 1.	Bonds ($8,000.) Ellensburg, Wash.	June 30
Aug. 1.	Jail building plans, Syracuse, N. Y.	July 7
Aug. 1.	Steel bridge, Stockton, Mo.	July 7
Aug. 1.	Iron bridges (3), Wichita, Kan.	July 7
Aug. 1.	School building, Bloomfield, N. J.	July 14
Aug. 1.	Steel bridge, Lake Belt, Minn.	July 14
Aug. 1.	Pile bridges (3), Red Cloud, Minn.	July 14
Aug. 1.	Boilers, heaters, etc., Concord, Mass. Advertised, Engineering News, July 14.	July 14
Aug. 1.	Macadamizing, Toledo, O.	July 14
Aug. 1.	Macadam road, Proviso, Ill.	July 14
Aug. 1.	Paving, Kewanee, Ill.	July 14
Aug. 2.	Bridge, Jackson, Miss.	July 14
Aug. 2.	Steam heating, Hartwell, O.	July 14
Aug. 2.	Dredging, Lorain, O. Advertised, Eng. News, July 14 and 21.	July 14
Aug. 2.	Bonds, Holly Springs, Miss.	July 7
Aug. 2.	Road work, Anaconda, Mont.	July 7
Aug. 2.	Arc lighting, Lebanon, Pa.	June 30
Aug. 2.	Steel rails, Ottawa, Ont.	June 16
Aug. 2.	Bridge, Lodi, Cal.	July 21
Aug. 2.	Electric light plant, Indianapolis, Ind.	July 21
Aug. 2.	City hall, Centralia, Ill.	July 21
Aug. 2.	Repairing asphalt, etc., Brooklyn, N. Y.	July 21
Aug. 2.	Pipe sewer, Wallingford, Conn. Advertised, Eng. News, July 21 and 28.	July 21
Aug. 2.	Wharf, Point Wilson, Wash.	July 21
Aug. 2.	Electric light plant, Yale, Mich. Advertised, Engineering News, July 7.	July 21
Aug. 2.	Y. M. C. A. hall, Waterloo, Ia.	July 21
Aug. 2.	Pumping station, Albany, N. Y. Advertised, Engineering News, July 21.	July 21
Aug. 2.	Paving cement, New York, N. Y.	July 21
Aug. 2.	Bridge, Bloomfield, Cal.	July 21
Aug. 3.	Hoist bridge, Sidney, O.	July 21
Aug. 2.	Brick paving, Kewanee, Ill.	July 21
Aug. 3.	Levee work, West Memphis, Ark. Advertised, Eng. News, June 30 to July 28.	June 30
Aug. 3.	Paving, etc., Cincinnati, O.	July 14
Aug. 3.	Electric light plant, London, Ont. Advertised, Eng. News, July 14 and 21.	July 14
Aug. 4.	Dam, tunnel, etc., Ogden, Utah Advertised, Engineering News, July 21.	July 21
Aug. 4.	Addition to court house, York, Pa.	July 21
Aug. 4.	Water pipe, Cattaraugus, N. Y.	July 21
Aug. 5.	Pier, Cleveland, O.	July 14
Aug. 6.	Street work, Mansfield, O.	July 14
Aug. 6.	Dike, York River, Va. Advertised, Eng. News, July 7 to 28.	July 7
Aug. 6.	Bridge work, Olympia, Wash.	July 21
Aug. 6.	Dredging, etc., Virginia. Advertised, Eng. News, July 7 and 14.	July 7
Aug. 8.	Sewers, Toledo, O.	July 21
Aug. 8.	School building, Peterson, Utah	July 21
Aug. 8.	Street bonds, Lima, O.	July 21
Aug. 8.	Paving, Toledo, O.	July 21
Aug. 8.	Street work, Lafayette, Ind.	July 21
Aug. 8.	Water pipe, etc., Winnipeg, Man. Advertised, Eng. News, June 16 to 30.	June 16
Aug. 8.	Brick paving, Anderson, Ind.	July 14
Aug. 8.	Repairing asphalt, Cincinnati, O.	July 14
Aug. 9.	Street work, Orrville, O.	July 14
Aug. 9.	Torpedo boats, Washington, D. C.	July 7
Aug. 9.	Furniture, Binghamton, N. Y. Advertised, Eng. News, July 21 and 28.	July 21
Aug. 10.	Bridge, Batavia, O.	July 21
Aug. 10.	Iron truss bridge, Cincinnati, O.	July 21
Aug. 10.	Bridge bonds, Cincinnati, O.	July 14
Aug. 10.	Bridge masonry work, Norristown, Pa.	July 14
Aug. 10.	Water-works, Pomeroy, O. Advertised, Engineering News, July 14.	July 14
Aug. 10.	Macadamizing, Cincinnati, O.	July 14
Aug. 12.	Art building addition, Des Moines, Ia.	July 21
Aug. 15.	Paving, etc., Fremont, O.	July 21
Aug. 15.	Grading, Omaha, Neb.	July 21
Aug. 15.	Exhibition bldg. plans, Glasgow, Scotland	June 2
Aug. 16.	Electric light plant, Minster, O.	July 21
Aug. 17.	Bridge substructures (2), Cleveland, O.	July 21
Aug. 18.	Water supply, Jersey City, N. J.	July 14
Aug. 20.	Electric lighting, Whitesboro, N. Y. Advertised, Eng. News, July 14 and 21.	July 14
Aug. 20.	Street bonds, Malta, O.	July 21
Aug. 23.	Water pipe, Coolgardie, West Australia	June 2
Aug. 26.	Pump engines (2), Minneapolis, Minn. Advertised, Eng. News, July 21 to Aug. 11.	July 21
Aug. 30.	Plans for electric traveling crane, Chicago	July 21
Aug. 31.	Custom house, Guayquil, Ecuador	Apr. 21
Sept. 1.	Battleships (3), Washington, D. C.	June 23
Sept. 1.	Drainage system, Savannah, Ga. Advertised, Eng. News, June 23 to Aug. 25.	June 30
Sept. 1.	Electric light plant, Cullman, Ala.	July 21
Sept. 1.	Water-works, Norwood, N. Y.	July 21
Sept. 3.	Sewage pumping station, Boston, Mass. Advertised, Eng. News, July 7 and 14.	July 7
Sept. 12.	Hospital plans, San Francisco, Cal.	Mar. 24
Oct. 1.	Monitors (4), Washington, D. C.	July 7
Oct. 1.	School building (equipment), St. Thomas, Ont.	July 7
Oct. 24.	Markets, etc., Belem, Brazil	Apr. 28
Oct. 30.	School building, Chehalis, Wash.	June 16
Dec. 31.	Plans for station, etc., Stockholm, Sweden	June 23
No date.	Pump engine, Martinsburg, W. Va.	July 21
"	Water-works, Smith's Grove, Ky.	July 21
"	Garbage disposal plant, Newport, Ky. Advertised, Engineering News, July 21.	July 21

RAILWAYS.

CATSKILL & TANNERSVILLE.—Thos. E. Brown, Ch. Engr., 38 Park Row, New York, informs us that the line is under construction from Otis Summit to Twilight Park, about 4½ miles, the contract having been let to the Otis Engineering & Construction Co., New York. Grading has just been commenced on 3½ miles of road. The motive power has not yet been decided upon. Pres., C. L. Rickerson, 54 Harrison St., New York.

CENTRAL ONTARIO.—John D. Evans, Ch. Engr., Trenton, Ont., informs us that surveys will be commenced Aug. 1 on the proposed extension of this railway from Ormsby to Bancroft, via L'Amable, Ont. Financial arrangements have not yet been completed, so it is at present uncertain when construction work will begin. Pres., Stevenson Burke, Cleveland, O.

CHEAT VALLEY.—J. J. Stoer, Girard Bldg., Philadelphia, Pa., informs us that seven miles of this new line have been built and the new town of Manheim started. The proposed route is from Rowlesburg to Uniontown, via Manheim, Stoer and Warthman, Pa., a distance of 33 miles. A. P. Hamilton, Rowlesburg, W. Va.

CHOCTAW, OKLAHOMA & GULF.—Bids are asked until July 25 for about 4,500 lineal ft. of protection dike work at Calvin, Ind. Ter., and Bridgeport, Okla., over the South Canadian River. The work is in three portions, 2,600 ft., 900 ft. and 1,000 ft. long, respectively. Ch. Engr., F. A. Molitor, South McAlester, Ind. Ter.

DECKERSVILLE, OSCEOLA & NORTHERN.—Improvements in the roadbed are now being made on this line between Deckersvile, on the Kansas City, Fort Scott & Memphis R. R., and Wardell, Ark. It is also intended to extend the road through Mississippi county, Ark., and Pemiscott and New Madrid counties, Mo., to connect with the Cotton Belt Ry. at Pawpaw Junction, via Osceola and Blythesville, Ark., and Covington, Hayti, Bragadocia and Portageville, Mo., thus passing through a rich timber district. Bonds for this proposed extension have not yet been placed, and until that is done no new work can be undertaken. E. M. Ford, Vice-Pres., Deckersville, Ark.

DELAWARE.—W. C. Oliver, Andes, N Y., writes us that surveys have been completed and the right of way obtained for this line, the incorporation of which was noted in our last issue. It is expected that the contract to construct the road will be let about Aug. 1. Pres., Henry Davie, Delhi; Ch. Engr., Thos. Murray, Delhi, N.Y.

DENTON & CAMBRIDGE—M. Bates Stephens, Denton, Md., informs us that owing to the fact that the question of having the county vote a subscription to aid the construction of this line cannot come up for another year, nothing can be done at this time toward building. It is proposed to construct a railway between Denton and Cambridge, Md., about 30 miles, which will act as a feeder to the Queen Anne's R. R.

DES ARC & NORTHERN.—W. H. Hipolite, Ch. Engr., Poplar Bluffs, Mo., writes us that construction will probably begin July 25 on the four-mile extension into Des Arc, and that it is hoped to complete the work about Sept. 15. New stations will be required at Higginson and Des Arc, Ark.

DULUTH & NEW ORLEANS.—Surveys for this new line are expected to be commenced shortly in Winnebago county, Ia. The company was incorporated June 10, with a capital stock of $300,000, to construct a railway from Duluth, Minn., to some convenient Gulf port, with headquarters at Nevada, Ia. The first 30 miles will be built as soon as possible. Robert B. Hunter, Ch. Engr., Mitchell, Ia.

DULUTH & NORTHERN MINNESOTA.—R. N. Marble, Asst. Gen. Mgr., Duluth, Minn., writes us that the grading is about three-quarters and the bridging about one-third finished on the first six miles of this line. The work is being done under the direction of the superintendent by day labor. Pres., M. S. Smith, Detroit, Mich.

EAST CAROLINA.—James Pender, Secy., Tarboro, N. C., informs us that the proposed route for this line, from Daviston to Crisp, N. C., a distance of 11 miles, has been surveyed twice, and about seven miles have been located, and the right of way obtained; there are already four miles of road built and in operation. Part of the capital stock has been secured, and the construction work will probably be done by the company. Pres., Henry Clark Bridgers, Tarboro, N. C.

FLORIDA & ALABAMA.—This company has applied for a charter in Alabama, to have a capital stock of $200,000, to construct a railway from Garland, on the Louisville & Nashville Ry., by River Falls, to Geneva, Ala., and thence into Florida. The incorporators are G. B. Frierson, P. J. Grant, Henry Stanley and E. C. Lewis, of River Falls, Ala., and J. H. Eakin, John S. Lewis and E. L. Moore, of Nashville, Tenn.

GALLATIN.—Frank A. Hall, Vice-Pres. and Gen. Mgr., of Bozeman, Mont., is quoted as saying that this company intends to begin work at once on the proposed extension of this line from Three Forks, Mont., up the Gallatin River to Yellowstone Park. A preliminary survey has been made.

GEORGIA.—Henry T. Clarke, care of B. F. Finney, 99 Bay St., Savannah, Ga., is constructing a connecting link of railway, 25 miles long, six miles of which has already been constructed, between two systems of railways. This link, when completed, will shorten the distance ten miles. Mr. Clarke desires to have a bond issue of $200,000 for the purpose of completing this road. Parties who desire information and prospectus of proposed work may address Mr. Clarke.

GROVE HILL & WHATLEY.—A. S. Johnston, Grove Hill, Ala., informs us that this proposed standard-gage road will run from Grove Hill, the county seat of Clarke county, to Whatley, six miles, connecting with the Mobile & Birmingham. A large amount of the stock has already been subscribed, and the survey will be made next week. Work will probably begin by Aug. 15.

GULF, BEAUMONT & KANSAS CITY.—Reports state that construction will soon commence on a 17-mile extension of this line from Silsbee, Tex., north. An extension is also proposed from Kirbyville to Tanaha, via Jasper, Tex., 100 miles. John H. Kirby, Vice-Pres. and Gen. Mgr., Houston.

GULF, COLORADO, & SANTA FE.—It is announced that a contract has been made by this company with the St. Louis Southwestern R. R. Co., whereby the former will have an entrance for its trains into Sherman, Tex., over the tracks of the St. Louis Southwestern. It is believed that this new arrangement will affect a large amount of business in northern Texas. C. F. W. Felt, Ch. Engr., Galveston, Tex.

JAMAICA.—Press reports from Kingston, Jamaica, state that the local government has assumed control of the Jamaica Ry., as the West India Improvement Co., which controlled the line, was unable to meet its liabilities. As the government cannot operate it to advantage, it is expected that the property will be sold.

LITTLE COAL RIVER.—H. J. Tondy, Huntington, W. Va., a member of this company, the incorporation of which was noted in our issue of July 7. writes us that the preliminary survey has been made and the right of way secured for nearly the whole length. The contract has been let to Henry S. Hopkins, St. Louis, Mo. Pres., L. Roswell Sheffer, New York; Ch. Engr., Mr. Leete, Huntington, W. Va.

PENNSYLVANIA LINES WEST OF PITTSBURG.—The Pittsburg, Fort Wayne & Chicago division of this system is said to have completed the regrading of its line from Rochester to New Brighton, three miles, and to be about to begin the laying of a fourth track from Baden to New Brighton, six miles, and the general improvement of the terminal yards at Conway. The improvements will cost about $70,000, The extension and improvements will be made to facilitate the ore and coal business on the Lake Erie lines, for which the yards act as the terminal. Supt., A. B. Starr, Allegheny, Pa.

PONTOTOC & STARKSVILLE.—We are informed that the survey for this proposed railway will be made as soon as the services of a competent engineer can be secured. The company was recently incorporated in Mississippi, as stated in our issue of July 7, to build a line from Pontotoc to Starksville, via Algona, Houlka, Houston and Sparta, Miss., a distance of 60 miles. Communication on the subject of surveys is solicited by N. W. Bradford, Houston, Miss. Pres., N. B. Crawford, Atlanta, Miss.

STOCKTON & TUOLUMNE.—Surveys for this proposed railway from Stockton to Summerville, via Sonora, Cal., 65 miles, are completed from Stockton to the Stanislaus River, a distance of 45 miles, and it is estimated that the cost of constructing this section of the road will be $8,927 a mile. Surveys are also in progress on the rest of the route, and it is said that Charles Erickson & Son, the contractors, are at work along the line. The company expects to use 60-lb. steel rails on the first 25 or 30 miles, which is to cross the San Joaquin Valley, and 65-lb. rails on the mountain division; 3,000 cross ties will be laid on each mile of main track. Pres., Mrs. Annie Kline Rikert; Ch. Engr., Henry A, Brainerd, with offices at Grand Hotel, San Francisco, Cal.

UNION COVE & VALLEY.—G. E. Howe, Ch. Engr., Union, Ore., informs us that the surveys have been made and grading has been commenced on this steam line from Cove to Union, 12 miles. The work is being done by day labor. Pres., E. P. McDaniel, Cove, Ore.

UNION PACIFIC.—J. B. Berry, Ch. Engr., Omaha, Neb., informs us that no extension to this system are contemplated, and that the only improvements projected include a small number of new sidings and a few trestles.

STREET AND ELECTRIC RAILWAYS.

EAST ROCHESTER, N. H.—Wm. A. Roberts is reported to be interested in the project to build an electric railway from this place to Somerville.

BURLINGTON, VT.—Surveys are now being made for the Burlington & Grand Isle R. R., as far as Malletts Bay. Seneca Haselton may be addressed.

AUBURN, MASS.—The selectmen have granted a franchise to the Worcester & Webster Electric Ry. Co. to build an electric railway through this place, according to report. E. E. Carpenter is a member of the company.

BOSTON, MASS.—The railroad commissioners have approved the plans of the Boston Elevated Ry. Co., according to report.

FRAMINGHAM, MASS.—J. J. Hennesy, Supt., writes us that the Framingham, Southboro & Marlboro St. Ry. is nearly finished and will probably be running by Aug. 1.

PLYMOUTH, MASS.—Bids are asked until July 28 for building the first section of the Plymouth & Sandwich St. Ry., from Hotel Pilgrim to Manomet P. O., and also for the first and second sections, combined, from Hotel Pilgrim to Fresh Pond. Engrs., Harriman Bros., 3 Somerset St., Boston. Address D. E. Damon, Plymouth.

BRISTOL, R. I.—The town council granted a hearing July 7 to the Barrington, Warren & Bristol St. Ry. Co. on its application for a franchise in this place. No decision was rendered. Albert F. Cotter, Pres.

HARTFORD, CONN.—E. S. Goodrich, Pres. of the Hartford St. Ry. Co., was heard by the street board July 13 in regard to plans for the construction of a street railway on Charter Oak and Huyshope Aves., for which the company has asked for a franchise. It was voted to recommend the construction of the road to the council.——The Suburban Electric Ry. has decided to extend its line from Unionville to Collinsville, seven miles, through the Farmington valley. The work will be done by the company; employing day labor.

BUFFALO, N. Y.—The contract for the construction of the proposed Buffalo, Hamburg & Aurora Electric Ry. is about to be let, according to report. U. L. Upson, Secy. and Gen. Mgr.

BUFFALO, N. Y.—The Buffalo, Tonawanda & Niagara Falls Electric R. R. opened for traffic an extension, July 16, beginning at Tonawanda and O'Neil Sts., on northerly limits of the city, thence to Niagara St. and along it about one mile to a ferry on the Niagara River, running to Grand Island. The line will be further extended along Niagara St. to Tonawanda, thus forming another electric line between Niagara Falls and this city. Henry B. Smith, Bay City, Mich., is the principal stockholder.

CLINTON, N. Y.—The New Hartford & Clayville Electric R. R. Co. is reported to have petitioned village trustees for a franchise to build a street railway through this place. The company has also asked the town board of Kirkland for a similar franchise. C. L. Fitchard, Utica, is interested.

HUDSON, N. Y.—It is reported that the Jansen Kill Power Co. has bought the Hudson St. Ry. and will extend it to Claverack and Philmont, building two power houses of a total capacity of 2,600 to 2,800 HP., one of which will be at Bingham's Mills, on Jansen Kill, and the other four miles below. The electricity will also be used for manufacturing purposes in the city.

LOCKPORT, N. Y.—The Buffalo & Lockport Electric Ry. Co., which was reported in our issue of June 16 to have bought the Lock City Electric Ry., has been granted a franchise to build an extension in West Ave. and Transit St. with the privilege of transporting freight between 11 p. m. and 6 a. m. W. Caryl Ely, Pres., Niagara Falls.

LONG ISLAND CITY, N. Y.—It is reported that a mortgage of $1,500,000 has been filed by the New York & North Shore Ry. Co. to enable it to build the proposed line from the present terminus in Middle Village to Flushing, via Richmond Hill and Jamaica. It is also proposed to build an extension from Flushing to Bayside and Manhasset, via Whitestone.

NEW YORK, N. Y.—The Metropolitan St. Ry. Co. has asked permission of the dock board to build a power house on the wharves between 95th and 96th Sts., on the East River, to furnish electric power to its lines of cars run by the underground electric system. C. E. Warren, Secy.; A. C. Tully, Pur. Agt.

NIAGARA FALLS, N. Y.—Geo. P. Smith, North Tonawanda, it is stated, has asked for a franchise for an electric railway in this city. A hearing will be granted him the latter part of this month.——It is also reported that the Niagara Falls St. R. R. Co. has asked for a franchise to build an electric railway line on Niagara St., from the State Reservation. The railroad commissioners approved the construction of the road about a year and a half ago, but nothing has been done. The company has lately been reorganized and the work will now be pushed to completion.

NORTH TONAWANDA, N. Y.—The injunction obtained by the city against the Buffalo & Niagara Falls Electric Ry., restraining it from constructing a turnout and switch on Sweeney St., has been dissolved and the work will be completed at once, connecting the above road with the Erie R. R. W. Caryl Ely, Pres.

ONEONTA, N. Y.—Owen Phillips, Engr., writes us that the Oneonta & Otego Valley R. R. is now completed and will be running from this place to West Oneonta in a few days. There are 7¼ miles of track, including three branches, and an extension to Laurens, 5 miles, has been located.

PEEKSKILL, N. Y.—The highway commissioners of Cortland have granted a franchise to the Peekskill Traction Co. to build an electric railway in that town, according to report.

PENN YAN, N. Y.—The Penn Yan & Savona R. R. Co. has been organized to build an electric railway from this place to Savona, via Keuka. J. D. Nares is the promoter of the road; Geo. F. Andrews, Pres., Owego.

SYRACUSE, N. Y.—The Eastwood R. R. Co. has asked for a franchise to enable it to construct a line of electric railway from this city to East Syracuse, via Eastwood, according to report. R. E. Drake and Clinton S. Carr are attorneys for the company.

WATERTOWN, N. Y.—The Black River Traction Co. has decided to extend its line to Dexter in the fall, according to report. J. A. Lebkuecher, Newark, N. J., Pres.; Geo. H. Walker, Secy.

ELIZABETH, N. J.—The roads committee of the board of freeholders reported July 14 on the plan of widening Westfield Ave., from this city to Plainfield, 12 miles, the cost to be covered by selling a franchise for a trolley line over the entire length to the highest bidder. The work is estimated to cost $300,000 and an additional $50,000 if the avenue is widened through Cranford. Bids for the franchise will be called for in a few days. John Kean is reported to have offered $100,000 for it and the North Jersey Electric St. Ry. Co. is also anxious to secure it.

WESTFIELD, N. J.—The Westfield & Elizabeth Ry. Co. has asked for a franchise through South Ave. A hearing will be granted July 21. A. A. Gaddis represents the company.

DOYLESTOWN, PA.—Thos. P. Chambers, Pres., Newtown, writes us that the Newtown Electric St. Ry. Co., which proposes to extend its line from Newtown to this place, 13¾ miles, via Wightstown, Penn's Park, Wycomb, Forestville and Furlong, as stated in our last issue, has completed surveys, obtained the right of way, secured the necessary capital and will probably let the contract within a week.

ERIE, PA.—The Erie Electric Motor Co. informs us that it does not contemplate making any extensions at present.

READING, PA.—A. J. Eberly, Philadelphia, has the contract to construct the electric railway from Boyertown to Stony Creek, near this city, via Pleasantville, for the United Traction Co.

BALTIMORE, MD.—The Security & Trading Co. has purchased all the property of the Columbia & Maryland Ry. Co. for $450,000, and has sold the Baltimore end to the Baltimore Consolidated Ry. Co. for $250,000. The last named company will complete the line to Ellicott City. The Washington end of the Columbia & Maryland has been absorbed by the City & Suburban Co., Washington, D. C., the officers of which are: O. T. Crosby, Pres.; Dana Stevens, Secy.; S. C. Cooper, Treas.

MARTIN'S FERRY, W. VA.—The Martin's Ferry council has granted a franchise to the Wheeling St. Ry. Co. to build an extension from its present terminus to the north end of town.

ATHENS, GA.—The Athens Electric St. Ry. Co. will extend its line to Mitchell's bridge in the fall. W. S. Holman, Pres.

DAYTON, O.—The Dayton & Germantown Traction Co. has been incorporated with $10,000 capital to build an electric railway in this city. The incorporators are: Fred. Shoop, Isaac J. Bassatt, Noah Coler, T. P. Meredith and Theo. C. Lindsey.——The city council has granted a franchise to the Dayton, Spring Valley & Wilmington Traction Co. to build an electric railway in this city, according to report.

SANDUSKY, O.—The Sandusky Electric St. Ry. was sold July 9 to Henry Everett, E. W. Moore and Barney Mahler, of Cleveland, and W. H. Price and Chas. H. Stewart, of Norwalk, for $60,024.

MASON, MICH.—A mass meeting was held in this place July 11 in the interests of the Lansing, Dexter & Ann Arbor Electric R. R., the promoters of the road having asked for $7,000 bonus from this town, which will probably be raised.

CHESTER, ILL.—A company is being organized, according to report, to build an electric railway from Belleville to this place, via Smithton, Hecker, Red Bud, Ruma, Evansville and Ellis Grove.

EAST ST. LOUIS, ILL.—The East St. Louis & Collinsville Electric R. R. Co. has been incorporated with $2,500 capital, by Wm. Ortgrier, T. T. Ramey and W. E. Hadley.

ROCKFORD, ILL.—The City Ry. Co. and the Rockford Traction Co. have consolidated under the name of the Rockford Ry. Light & Power Co. R. N. Baylies, Pres.

EAU CLAIRE, WIS.—E. J. Matchett, Osseo, is reported to have been awarded the contract to construct 30,000 yds. of track for the Chippewa Valley Electric Ry.

KENOSHA, WIS.—The Milwaukee, Racine & Kenosha Electric R. R. Co. has applied for a franchise to build a street railway in this city, according to report.

RACINE, WIS.—The Wisconsin Inland Lakes & Chicago Ry. Co., which was recently organized with $10,000,000 capital, to build an electric railway connecting all of the Wisconsin inland lakes, July 6 filed a trust deed for that amount on the 500 miles of track to be built between Chicago and Watertown, including branch lines to Milwaukee, Wilmette, Madison, Elgin and Desplaines. Construction will be begun as soon as a franchise is secured in this city. Alfred E. Case, Actg. Pres.

WALWORTH, WIS.—The town board has granted an extension of its franchise to the Harvard & Geneva Lake Electric Ry., according to report. H. T. Windsor, Colburn's Hotel, Fontana, may be addressed.

MINNEAPOLIS, MINN.—The board of trade of this city at its meeting July 5 passed a resolution advising the building of an electric railway between Minnehaha and Fort Snelling.

KANSAS CITY, MO.—The Brooklyn Ave. St. Ry. Co. has been granted a franchise to build its proposed line on Grand Ave., from 33d St. to 13th St., as noted in our issue of July 7.——L. E. Myers, Chicago, has been awarded the contract for the construction of the Broadway line of the Metropolitan St. Ry. A. H. Holmes, Gen. Mgr.; E. Butts, Engr.

PASADENA, CAL.—The Los Angeles Terminal Ry. Co. has been granted a franchise to build an electric railway in this city. Bids are asked until Aug. 15 for the purchase of this franchise.

SAN FRANCISCO, CAL.—The board of supervisors has granted three street railway franchises to the Market St. Ry. Co. for lines on Army St., San Bruno and Precita Aves.; Stanyan and Frederick Sts. and Parnassus and Fifth Aves.; Bosworth and Berkshire Sts.——A franchise has also been granted to the San Francisco & San Mateo R. R. Co. to construct an electric line on Howard St. and East St. to the Union Ferries Depot.

ELECTRIC LIGHT AND POWER.

NORTH GORHAM, ME.—Press reports state that the Cumberland Illuminating Co., Deering, Me., will soon build a power plant on the Presumpscot River. It is stated that the power house, to be 36 × 46 ft., is now being built. Geo. W. Brown, Mgr. Deering Electric Lighting Co., is interested.

OLDTOWN, ME.—The Bodwell Water Power Co., Pres., Chas. V. Lord, Bangor, Me., has engaged Lockwood, Greene & Co., Hydraulic Engrs., Boston, Mass., to prepare plans, etc., for the proposed power plant on the Penobscot River, near this place. Treas. and Clk., A. H. Brown.

WESTBROOK, ME.—The question of building a municipal plant in this place is being considered by the council. Councilman I. A. Burgess may be addressed.

SOMERSWORTH, N. H.—Geo. F. West, Portland, Me., has submitted estimates for a municipal plant to cost $14,504. The plant will have 100 1,200-c. p. arc lights.

BRATTLEBORO. VT.—Efforts are again being made for the construction of a dam and power plant on West River, to cost about $50,000.

NEWPORT, R. I.—The council is considering two resolutions authorizing the committee to ask for bids for lighting the streets with 110 2,000-c. p. arc lights for three, five or ten years, or for constructing a municipal plant of 300 arc lights capacity.

CLINTON, N. Y.—T. T. Thompson, Pres. Village, writes us that this town has given up the idea for the present of lighting the streets with electricity.

GREENSBURG, PA.—A. M. Crawford, Burgess, writes us that no steps have yet been taken for the erection of a plant in South Greensburg.

PHILADELPHIA, PA.—Stacey, Reeves & Son, 1611 Filbert St., are securing estimates for a 1-story power-house to be erected at 19th St. and Allegheny Ave., for the Electric Storage Battery Co. It will be 35 ft. square, brick and iron construction.

RIDLEY PARK, PA.—It is reported that the council is considering the question of asking for bids for lighting the streets of this borough. It is possible, however, that a contract, without advertising, will be made with the Beacon Light Co.

WEST CONSHOHOCKEN, PA.—The Conshohocken Electric Co. submitted the lowest bid July 6 for lighting this place with electricity for five years. The only other bid was that of Dr. Lefferts, representing a syndicate.

OAKLAND, MD.—R. S. Jamison, Mayor, writes us that the council as yet has not taken action in regard to a plant and water-works.

WASHINGTON, D. C.—Bids are asked by the district commissioners until July 23 for furnishing 300 lamp posts.

SUFFOLK, VA.—John B. Norfleet, Chn. Com., writes us that the council has made a contract with the old electric company for lighting this city for three years.

WINCHESTER, VA.—Wm. R. Willis, Councilman, writes us that the council is considering the question of a municipal plant, to be operated in connection with the pumping station owned by the city. There are two Corliss engines at the pumping station suitable for the purpose. While the town recently voted by a large majority for the plant the council majority does not favor the plant. The plant is planned to have a capacity for 70 2,000-c. p. arc lights.

SPARTANBURG, S. C.—We are informed that a company has secured the contract to light this place for a term of years. The necessary power will be obtained by developing the water power near here. William Whitner and Frank Whitner, Anderson, S. C., are interested.

ARCADIA, FLA.—The clerk writes us that steps have not yet been taken in regard to erecting a plant.

JACKSONVILLE, FLA.—C. O. Patterson, Supt. Electric Light Plant, has made plans and estimates for extending the light wires through Springfield, Campbells Addition, La Villa, etc. In La Villa alone it is proposed to construct three circuits of 60 arc lights and nine miles of wire each.

CULLMAN, ALA.—Jas. E. Clark, owner of the franchise of the Cullman Water & Lighting Co., writes us that the company is being organized. Bids for furnishing and constructing the plant will be asked about Sept. 1. The plant will have a capacity for 21 1,200 to 2,000-c. p. arc and 1,000 16-c. p. incandescent lights; estimated cost, $15,000.

HENDERSON, KY.—R. P. Farnsworth writes us that the council lacks one vote of a majority in favor of the proposed plant.

AKRON, O.—The council has voted to award a contract for lighting the city to the Akron St. Ry. & Illuminating Co. The question will have to be voted upon by the city commissioners.

FOSTORIA, O.—Press reports state that the directors of the Fostoria Light & Power Co. are considering an offer for the purchase of the plant by a Philadelphia company, represented by S. R. Bullock, of that city.

McARTHUR, O.—J. W. Darby. W. J. Kennard and Paris Horton are on the committee to build the proposed plant.

MINSTER, O.—Bids are asked until Aug. 16 for furnishing the materials and for constructing a plant. There will be required an 80-HP. engine, two 54-in. × 14-ft. boilers, a feed pump, three 40 K-W. dynamos, etc. Consult. Engr., G. A. McKibben, Van Wert, O.; Clk., August Schunck.

INDIANAPOLIS, IND.—Bids are asked by the board of trustees of the Indiana Institution for the Education of the Blind until Aug. 2 for furnishing and constructing a plant.

DECATUR, MICH.—Geo. S. Pierson, Kalamazoo, Mich., is preparing plans for a plant for this place, for which $16,000 in bonds was voted recently.

FENTON, MICH.—Rev. F. S. Thompson is reported to have purchased the plant in this city for $9,000.

GRAND RAPIDS, MICH.—The council has sustained Mayor Perry's veto of the contract for the electric light plant. The board of public works was instructed July 11 to prepare new specifications and readvertise for bids.

YALE, MICH.—Bids are asked until Aug. 2 for furnishing and constructing a plant, as advertised in Engineering News July 7. (Postponement from July 26.) E. F. Fead, Village Clk.

BRACEVILLE, ILL.—This place has voted to build a plant, according to reports.

RIDGEFARM, ILL.—The board is reported as considering the question of building a plant. C. M. Harrold, Clk.

ROCKFORD, ILL.—The Rockford Ry., Light & Power Co., recently reorganized by the consolidation of the two companies, has applied for an extension of the franchises, according to reports.

MILWAUKEE, WIS.—Bids were received July 18 by H. J. Esser, Arch., 902 Pabst Bldg., for constructing a power station is this city to be 100 × 130 ft.

SUPERIOR, WIS.—The council has let a contract for furnishing 150 2,000-c. p. arc lights to the Superior Water, Light & Power Co.

GAYLORD, MINN.—Bids are asked until July 28 for furnishing and constructing a plant, as stated in our advertising columns. C. W. Clasen, Village Recdr.

MITCHELL, S. DAK.—F. C. Duffy, Ripon, Wis., owner of the plant in this city, has submitted a proposition to either lease or sell the plant to the city.

KANSAS CITY, KAN.—Local papers state that Lemuel Crosby has secured the contract for building the new electric light plant for the Consolidated Electric Light & Power Co., on the west of the Kaw River bridge. This plant is designed to furnish electric light and power for Kansas City. The building alone will cost about $25,000, and some $50,000 more will be required for the engines, dynamos, etc. There will be 15 dynamos of an aggregate of about 1,000 HP. The smokestack will be 150 ft. high and 8 ft. inside diameter. The building will be 100 × 140 ft., two stories high.

BATESVILLE, ARK.—Owen Ford, Consult. Engr., Security Bldg., St. Louis, Mo., writes us that the contracts for furnishing and building a plant and water-works has been let to G. Jaeger, Rich Hill, Mo., at $24,720.

PARIS, TEX.—We are informed that the Paris Light & Power Co., recently incorporated, is a consolidation of two companies.

REDLANDS, CAL.—The stockholders of the Redlands Electric Light & Power Co., 14 West State St., will meet July 21 to consider the question of increasing the capital stock from $200,000 to $500,000 for making improvements, etc., to the plant. Secy., Fulton G. Ferand.

SAN FRANCISCO, CAL.—The supervisors have received bids for lighting the city with electricity by districts for a term of two years from Aug. 1. John A. Russell, Clk.

IDAHO FALLS, IDAHO.—An election will be held Aug. 9 to vote on the question of issuing $25,000 in bonds for the purchase of the plant and water-works, according to reports.

BUENOS AYRES, ARGENTINE REPUBLIC.—Press reports state that a German electric light and traction company has been formed in Buenos Ayres, with a capital of $5,000,000. It has acquired some electrical railway privileges in the capital, and is to construct a central station which will cost about $800,000. Gaster Fredersking is the principal party interested in this undertaking.

NEW COMPANIES.—Tuxedo Park Water & Electric Light Co., Towson, Baltimore, Md.; to furnish water and electric light to the residents of Tuxedo Park; G. O. Wilson, H. O. Leonard, John Neubaker, Fred E. Wilson, William F. Smith.

Cleveland Electric Co., Cleveland, O.; $4,400; W. P. Bowman, F. C. McMillan, James E. Matthews, F. W. Post, W. C. Stevens, Cleveland.

Vigo Light & Power Co., Terre Haute, Ind.; $50,000; W. R. McKeen, Herman Hulman, James A. J. Crawford, J. A. Crawford.

Western Electric Co., Chicago, Ill., and Detroit, Mich.; $1,000,000.

Kearney Power & Irrigation Co., Kearney, Neb., and 145 South 11th St., Lincoln, Neb.; $230,000; W. A. Lindley, J. P. Hibard, Theo. Tychsen.

Newman-Spranley Co., Ltd., New Orleans, La.; $30,000; to conduct a general electrical business; J. K. Newman, Isidore Newman, Edgar Newman, C. H. C. Brown and William T. Spranley.

Standard Electro Vapor Motor Co., New York, N. Y.; $50,000; S. W. Warner, B. L. Warner and W. M. Warner, Yonkers.

Manhattan Illuminating Co., New York, N. Y.; $100,000; to manufacture devices for use with gas, hydrocarbon oils or other fluid combustibles for lighting purposes; De Witt H. Palmer. Brooklyn; William Walters and Chas. R. Lindsay, Jr., New York.

BRIDGES.

HARTFORD, CONN.—The city attorney has been instructed to procure an order for the construction of a bridge over the railroad tracks at Broad St.

HERKIMER, N. Y.—The town has voted to appropriate $13,500 for constructing the proposed bridge across West Canada Creek.

WHITE PLAINS, N. Y.—The county supervisors have voted to issue bonds for the construction of bridges over Rowley Brook and Hastings Ravine on the Warburton Ave. extension.

PITTSBURG, PA.—Reports state that a contract has been awarded to the Pittsburg Ornamental Works for constructing 29 arches to cost about $6,820, to decorate the thoroughfares for the Knights Templars triennial conclave.

ANNAPOLIS, MD.—Bids are asked until July 26 for converting the Severn River rolling draw bridge into a pivot draw, and for constructing two pile bridges. A. K. Starlings, County Clerk. Address the Engineer, 15 East Lexington St., Baltimore.

BALTIMORE, MD. — The county commissioners have awarded a contract to the Wrought Iron Bridge Co., Canton, O., at $2,397, for constructing a bridge 119 ft. long and 16 ft. wide, over Big Gunpowder River, near Parkton.

LEXINGTON, KY.—Alex. Pearson, J. V. Nichols and others, have petitioned the fiscal court for an appropriation of $2,600 to erect a viaduct on the Maysville and Lexington turnpike.

BATAVIA, O.—Bids are asked until Aug. 10 for constructing a 160-ft. bridge over the east fork of Little Miami River. John W. Davis, County Audr.

CINCINNATI, O.—Bids are asked until Aug. 10 for constructing an iron truss bridge over the Miami Canal, on Township Ave. E. L. Lewis, County Audr.

CLEVELAND, O.—Bids are asked until Aug. 17 for furnishing the material and for constructing the substructures for a bridge over the Cuyahoga River, near the South Park Station, and for a bridge over the Ohio Canal, on the Howard Road, in Newburg township. J. C. Dorn, Clk. Bd. County Comrs.

MASSILLON, O.—The Massillon Bridge Co. has been awarded a contract to construct a foot bridge 600 ft. long over the river and canal; estimated cost, $2,000.

NEW PHILADELPHIA, O.—Bids are asked until July 28 for constructing an iron bridge over the Tuscarawas River, according to reports. E. C. Browne, County Audr.

SIDNEY, O.—Bids are asked until Aug. 3 for constructing a hoist bridge at Water St., according to reports. J. S. Laughlin, County Audr.

SAGINAW, MICH.—Reports state that the street railway company has made a proposition to the council to construct a bridge for its own use at Johnson St., to cost about $40,000.

CHICAGO, ILL.—Bids are asked until Aug. 3 for furnishing the material and constructing 11 superstructures over the main drainage channel, as advertised in Engineering News June 2. (Postponement from July 20.)

CHICAGO, ILL.—Bids are asked until July 29 for removing and reconstructing the 61st St. viaduct, between Clark and State Sts. L. E. M'Gann, Comr. Pub. Wks.

AITKEN, MINN.—Bids are asked until July 23 for constructing a bridge across Ripple River at Knox St. F. M. Shook, Pres.

DES MOINES, IA.—A petition has been presented to the council for the construction of a bridge over the Des Moines River at East Sixth St.

TOLEDO, IA.—Bids are asked until July 28 for constructing a steel bridge with a span of 168 ft., on caisson foundation, two miles west of Chelsea. C. H. Miller, County Audr., Toledo.

WAVERLY, IA.—Bids are asked by the county supervisors for constructing the superstructure of a bridge 38 ft. wide across the Cedar River, to cost about $15,000.

CENTRALIA, WASH.—Bids are asked until Aug. 1 for constructing a bridge with a span of 260, 270 or 280 ft. over the Chehalis River. Allen P. Schooley, County Audr., Chehalis.

CHEHALIS, WASH.—Bids are asked until Aug. 1 for constructing bridges of 160, 75 and 80 ft. long; also for repairing the jetty at the Toledo bridge. Allen P. Schooley, County Audr.

CLAQUATO, WASH.—Bids are asked until Aug. 1 for the construction of a 200-ft. span bridge over the Chehalis River. Allen P. Schooley, County Audr., Chehalis.

OLYMPIA, WASH.—Bids are asked until Aug. 6 for constructing a crib around the south piers of the Rochester and Grand Mound bridges. R. A. Graham, County Audr.

SPOKANE, WASH.—A contract was awarded to the Gillette-Herzog Mfg. Co., Minneapolis, Minn., at $8,197, on July 5, for constructing a trestle 500 ft. long to carry the water mains over the Spokane River. B. H. Fowle, Secy.

HILLSBORO, ORE.—The county commissioners will replace the bridge over Dairy Creek with a 46-ft. span truss bridge.

BLOOMFIELD, CAL.—Bids are asked by the county clerk at Santa Rosa until Aug. 2 for constructing a bridge on the Monterey Road.

LODI, CAL.—Bids are asked until Aug. 2 for constructing a steel and iron bridge across the Mokelume River, near this place. G. A. Atherton, County Engr.; Otto Grunsky, Clk., Stockton.

SANTA ROSA, CAL.—J. A. McMahon, San Francisco, has been awarded a contract by the county supervisors for constructing a bridge across Russian River, at $3,895, and for a new span for the Alexander bridge, at $4,465.

ST. HERMENEGILDE, QUE.—Bids are asked until July 30 for constructing a bridge across Kinney Brook, according to reports. Address J. D. Dupont.

QUEBEC, ONT.—Engineer Hoare, of the Quebec Bridge Co., has made a report on the proposed bridge construction for this year, involving a cost of about $500,000. Bids will probably be asked by Sept. 1, according to reports.

SUMMERVILLE, ONT.—Bids are asked until July 22 for constructing a concrete or stone abutment for a bridge over the Etobicoke River, on Dundas St. J. McDougall, County Engr., Toronto.

BUILDINGS

FRAMINGHAM, MASS.—This town has voted to borrow $35,000, to be used for school purposes.

NORTHAMPTON, MASS.—Reports state that the trustees of Smith College have accepted plans by York & Sawyer, Archs., New York, for the erection of Seelye Hall, to cost $50,000.

NEWPORT, R. I.—Bids are asked until July 26 for the erection of a naval station. W. K. Van Reypen, Surgeon-Gen., U. S. N., Navy Dept.

NEW HAVEN, CONN.—Bids are asked until Aug. 1 for metal work for the New Haven Harbor breakwater light, as stated in our advertising columns. Lt.-Col. D. P. Heap, U. S. Engrs., Tompkinsville (S. I.), N. Y.

BUFFALO, N. Y.—Bids are asked by the department of public works until July 29 for the erection of a 2-story, 8-room brick addition to School No. 28, at Abbott Road and Triangle St. Secy., R. G. Parsons.

NEW YORK, N. Y.—The contract for the iron work on the new 10-story business building, 28 × 175 ft., to be erected at Broadway and Walker St., has been awarded to J. B. & J. M. Cornell, 26th St. and 11th Ave. Archs., Wm. H. Birkmire, 320 Broadway.——Plans are being prepared, according to reports, for three 5-story flat buildings to be erected on 101st St., near Park Ave., for Nathan Goldstein, 144 Monroe St. and Simon Preusky, 1921 2d Ave., at a cost of $60,000. Arch., S. D. Cohen, 203 Broadway.—Robinson & Wallace, 123 East 23d St., are said to have been awarded the contract for the erection of new buildings for the New York Hospital, 15th and 16th Sts., near 5th Ave., to cost about $500,000. Archs., Cady, Berg & See, 31 East 17th St.——Plans have been filed by Robert Kelly, 274 East 74th St., for six 3-story brick dwellings, on Hamilton Terrace, near 141st St., to cost $78,000. Arch., William Strom, 44 Broad St.; by Bridget Cooney, 220 9th St., for four 5-story brick tenement buildings on 63d St., near West End Ave., to cost $72,000. Arch., S. Sass, 23 Park Row; Frederick Klingman, 132 East 44th St., for a 7-story brick apartment house at 107th St. and West End Ave., cost $70,000. G. F. Pelham, Arch.; Joseph Polstein and Wm. Feinberg, for a 6-story brick flat, Nos. 242 to 246 Madison St., to cost $54,000. Michael Bernstein, Arch.

NEW YORK, N. Y.—John F. O'Rourke, 44 Broadway, has been awarded a contract for furnishing eight pneumatic caissons for the foundation of the new residence to be erected by Mrs. M. L. V. Shepard, Scarsboro, N. Y., at Nos. 11 and 13 East 62d St., to cost $75,000. Archs., Haydell & Shepard, 156 5th Ave.——Plans have been filed by James A. Timpson, 130 St. Ann's Ave., for a 5-story brick flat, on Melrose Ave., near 157th St., to cost $19,000. W. C. Dickerson, Arch.

NEWARK, N. J.—Bids are asked until July 22 for plumbing, heating, ventilating and electric wiring, in the county court house. C. W. Heilman, Chn. Com., Bd. Freeholders.

PATERSON, N. J.—Official notice is given that the True Reformed Dutch of Acquackanonk intends to erect a new church building adjoining its present structure.

PHILADELPHIA, PA.—Doyle & Doak, 133 South 15th St., Philadelphia, have been awarded a contract at $175,000 for constructing the buildings of the Jefferson Medical College. Arch., J. H. Windrim.

PHILADELPHIA, PA.—Robert A. Pitts, Arch. and Builder, 223 South 3d St., has been awarded a contract to construct 93 3-story brick and stone dwellings on Hazel Ave. and 48th and 49th Sts., to cost $300,000.

PHILADELPHIA, PA.—Bids are asked by Supt. J. H. Vail, of the Pennsylvania Light & Power Co., 10th and Sansom Sts., for alterations and additions to station 5, Callowhill St. James H. Windrim, Arch.

YORK, PA.—Bids are asked until Aug. 4 for alterations and additions to the county court house. Arch., J. A. Dempwolf, York.

ANNAPOLIS, MD.—A contract was awarded to Taylor & Chance, Annapolis, at $12,671, on July 6, for erecting a library and laboratory for St. James' College.

BALTIMORE, MD.—The Consolidated Ry. Co. has awarded a contract to John Hiltz for the construction of a new car house, to cost about $70,000, according to reports. Baldwin & Pennington, Archs.——Lerch Bros. propose to erect a 7-story stone and iron warehouse, to cost about $60,000, according to reports.

LAUREL, MD.—Bids are asked until July 25 for constructing a 2-story brick school building to cost $10,000. R. W. Kerr, Secy. Com.; Albert Mason, Arch., Baltimore.

WASHINGTON, D. C.—Plans have been filed by R. H. Darby for a fireproof printing establishment at 14th St., near Pennsylvania Ave. T. F. Schneider, Arch.; R. N. Harper, for a fire-proof manufacturing building on C St., near 6th St.; Navy department, for a steel storage building at the navy yard. M. T. Endicott, Ch. Bureau Yards and Docks.

AKRON, O.—The following bids were received July 15 by the supervising architect, Washington, for the construction (except heating apparatus and electric wire conduits) of the post office building:

Michael Robett, Toledo, O.	$65,342	10	mos.
D. W. Thomas, Baltimore, Md.	51,875	8	"
Bennett & Rothrock, Williamsport, Pa.	61,503	10	"
Henry Shenk, Erie, Pa.	57,924	10	"
P. J. Carlin & Co., Brooklyn, N. Y.	62,000	10	"
Sam. C. Moore & Son, Kokomo, Ind.	48,892	10	"
Louis D. Beman, Cincinnati, O.	59,976	10	"
L. L. Leach & Son, Chicago, Ill.	54,797	10	"
Chas. Gindele Co., Chicago, Ill.	50,500	10	"
Bailey, Koerner & Co., Louisville, Ky	56,544	10	"
J. A. Reaugh & Son, Cleveland, O.	48,600	7	"
Miles & Bradt, Atlanta, Ga.	45,400	10	"
J. W. Myers & Co., Ashland, O.	43,819	9	"
Bennett, Michie & Co., Milwaukee, Wis.	47,490	11	"
McIlvain, Unkefer & Co., Pittsburg, Pa.	45,300	9	"

PORT CLINTON, O.—The county has voted to issue $40,000 of court house bonds.

CENTRALIA, ILL.—Bids are asked until Aug. 2 for the erection of a city hall and jail, according to reports. J. J. Bundy, City Atty.

CHICAGO, ILL.—Egan & Prindville, Archs., have completed plans for a convent to be erected between 49th and 50th Sts., and Evans and Liberty Aves., to cost $250,000. ——A permit has been granted for the erection of a $100,000 school building at 69th St. and Stewart Ave.——S. R. McCormick will construct three 6-story fireproof buildings on Michigan Ave., between Madison and Monroe Sts.——Mrs. Augusta Heberlein will erect an apartment building at 359 and 361 East Indiana St., at a cost of $40,000. Robt. S. Smith, Arch., Adams Express Building.

CHARLESTON, ILL.—The county supervisors have passed a resolution to build a new court house, at a cost of about $100,000.

DUNNING, ILL.—Bids are asked until July 25 for furnishing material and plans and installing a dry air system at the Dunning Institution. E. D. Northam, Supt. Pub. Service, Chicago.

STREATOR, ILL.—Plans are being prepared by Geo. P. Standuhar, Arch., Rock Island, for a 4-story office and club building, 146 ft. × 260 ft., for D. Heenan & Co., Streator; estimated cost, $130,000.

OSHKOSH, WIS.—Reports state that bids will soon be asked by the library commission for furnishing plans for a $40,000 library building. H. L. Battis, Chn.

RACINE, WIS.—The building belonging to the Racine Malleable & Wrought Iron Co. has been destroyed by fire, at a reported loss of $100,000.

MINNEAPOLIS, MINN.—Plans have been completed by E. P. Overmire, Arch., 1043 Lumber Exchange, for a 3-story apartment house, costing $50,000.

RUSH CITY, MINN.—F. C. Norlander, 1025 Bradley St., St. Paul, has been awarded a contract at $10,747 for constructing a school building. Archs., Omeyer & Thori, St. Paul.

CORNING, IA.—The mayor has appointed a committee to investigate the cost, etc., of constructing a new city hall.

DES MOINES, IA.—Bids are asked until Aug. 12 for constructing the west wing of the Iowa State Memorial Historical & Art Building, to cost $50,000, according to reports. Archs., Smith & Gutterson.

WATERLOO, IA.—Bids are asked until Aug. 2 for constructing a 3-story brick Y. M. C. A. Hall in this city. Archs., Murphy & Ralston; Chn. Com., A. N. Ferris.

BUTTE, MONT.—The school trustees received the following bids July 1 for constructing a school building: John F. Hogan, building complete, except plumbing and heating plant, $27,745; J. A. Riddell, complete, except heating plant, $28,337; Loss & Co., complete, $28,984; Laurence Burke, complete, $29,574, or stone and brick work only, $10,833; Thos. Laurier, complete, $29,545; C. C. Goddard & Co., complete, except heating plant, $34,743; Moses Benoit, complete, $28,673; Strunk & Maiette, stone foundation, cut stone and brick work, $12,550; I. Kruger, plumbing, $522; gas fitting, $235; steam heating, $3,550; Wm. C. Bryant, heating and ventilating, $3,830; Canney & Wright, plumbing and gas fitting, $620; Montana Hardwall Plastering Co., plastering, $1,757; Anaconda Mining Co., hardware department, steam heating $3,218; Echle Plumbing & Heating Co., steam heating, $3,893.

HELENA, MONT.—Press reports state as follows: The Supreme Court on July 5 declared valid the contract between Bell & Kent, formerly of Counicl Bluffs, Ia., but now of Helena, and the capitol building commission. Montana law requires capitol architects to be citizens of the state. Bell & Kent established their residence March 18, and the contract was let to them the following day. Action, it is said, was brought to break the contract by Butte architects. The decision will permit work on the $350,000 capitol to be commenced next fall.

LAWRENCE, KAN.—Bids are asked until July 25 for constructing a club-house for the Merchants' Athletic Building Association. F. W. Barteledes, Chn. Com.

KANSAS CITY, MO.—Root & Siemans have prepared plans for a warehouse, 42 × 120 ft., for the U. S. Water & Steam Supply Co.; estimated cost, $18,000. Gen. Mgr., H. S. Ferguson, 1211 W. 12th St.

ST. JOSEPH, MO.—P. P. Buddy, St. Joseph, has been awarded the contract for building a $100,000 live stock building at the St. Joseph Stockyards. The building will be of brick and four stories high. Work will begin at once, and will be completed Dec. 1.

HOUSTON, TEX.—The council has passed an ordinance to issue $60,000 in bonds for erecting school buildings.

YOAKUM, TEX.—The San Antonio & Arkansas Pass Ry. Co. will soon begin the construction of a new storage house to be 40 × 150 ft.

OAKLAND, CAL.—Plans for the proposed school of manual training were filed July 5 with board of education. They call for a building to cost $17,000. Nothing will be done in regard to the school at present on account of lack of funds.

SAN RAFAEL, CAL.—Competitive plans and specifications will be received by the high school board for erection of a high school building in San Rafael; building to cost not over $11,000. Thos. Hansen, Secy.

PETERSON, UTAH.—Bids are asked until Aug. 8 for erecting a 3-room brick school building at this place. Arch., R. C. Watkins, Provo and Ogden, Utah; Chn. Trustees, Martin Gaarder.

RICHFIELD, UTAH.—Bids are asked until Aug. 1 for erecting a county jail building. Arch., R. C. Watkins, Provo; S. F. Clark, Clk.

SALT LAKE CITY, UTAH.—It is stated that the contract for erecting an 8-room school building has been let to the Salt Lake Bldg. & Mfg. Co. at $15,536.

WATER-WORKS.

HAMPTON, N. H.—C. M. Lamprey, Clk. Hampton Water-Works Co., writes us that the directors will submit the question of building works to the town. The works will be built in another year by the town or by capitalists. The delay is caused by the difference of opinion as to who shall build the works, private parties or the town.

BOSTON, MASS.—Bids are asked until July 21 for laying 4,925 ft. of 16 and 450 ft. of 12-in. cast-iron water pipe in Watertown and Belmont. Wm. N. Davenport, Secy. Metropolitan Water Bd., 3 Mount Vernon St.

HOLDEN, MASS.—Chas. E. Parker writes us that the town has not yet voted to secure a water supply from Lake Murchepange, but a gain in the number of votes for it has been made at each trial. A special town meeting will probably be called soon when it is likely another vote will be taken.

TAUNTON, MASS.—The water commissioners are reported as considering the question of making improvements to the works and of adding a new 8,000,000-gallon engine; estimated cost, $60,000. Supt., Geo. F. Chace.

ALBANY, N. Y.—Bids are asked until Aug. 2 for furnishing and installing a pumping station and intake for the filtration plant, as stated in our advertising columns. Ch. Engr., Allen Hazen, St. Paul Bldg., New York; Supt., Geo. I. Bailey.

CATTARAUGUS, N. Y.—Bids are asked until Aug. 4 for furnishing three-fourths of a mile of 4-in. pipe. Frank S. Oakes, Village Pres., writes us that $7,000 4% 20-year bonds are to be issued for extending the works for a distance of four miles for an increased water supply. Only about three-fourths of a mile of new 4-in. pipe will be required. Engr., W. J. White, Buffalo.

FORESTVILLE, N. Y.—The Forestville Water Co. has been incorporated with a capital stock of $10,000 by Howard M. Fordham, Buffalo, N. Y., and Albert Herrig and Richard J. Monahan, Forestville. There is a small plant here that is owned by the town.

JAMESTOWN, N. Y.—C. B. Jones, Cy. Clk., writes us that no steps have yet been taken toward securing new works.

MAYVILLE, N. Y.—This place voted July 2 to extend the works, according to reports. E. Delavan Smalley, Engr., Syracuse, N. Y., may give information.

NEW YORK, N. Y.—Bids are asked by the department of water supply, 150 Nassau St., until July 28, for furnishing and laying water mains in Fordham Road across the Harlem River ship canal and in 109th St., etc.

NORWOOD, N. Y.—Watson B. Berry, Pres. Norwood Water Co., Massena, N. Y., writes us that bids will be asked about Sept. 1 for furnishing and constructing five miles of cast-iron water pipe, hydrants, standpipe, etc., for the proposed works. A filtration plant will also be put in. The source of supply will be the Racquette River.

NYACK, N. Y.—Jas. S. Haring, Engr., writes us that the private works known as the Onderdonk Water-Works, owned by Mrs. Rachel C. Odell, is only a small plant, having 1¼ and 1½-in. pipe and some 3 and 4-in. cast-iron pipe. It is a gravity plant from springs at an elevation of 175 ft. The town will vote on the question of issuing $15,000 in bonds for the purchase of the same.

TONAWANDA, N. Y.—Bids are asked until July 25 for taking up and relaying the 12-in. water main across the Niagara River, etc. J. H. Vickers, Clk.

WHITE PLAINS, N. Y.—Bids are asked until July 25 for the purchase of $130,000 of 4% water bonds. Howard E. Foster, Treas.

CAMDEN, N. J.—Bids are asked by the water committee until July 26 for furnishing water meters to be placed in factories, mills and the railway yards.

FREEPORT, PA.—The South Buffalo Water Co. has been incorporated to supply water in South Buffalo township, Armstrong county; capital stock, $5,000; incorporators, Frank Maxler, Treas.; D. S. Wallace, J. B. Patterson, J. E. Williams, J. T. McCulloch and John A. Singer, Freeport.

OIL CITY, PA.—The following bids were received June 15 for furnishing a pump and four 50-HP. gas engines, as advertised in Engineering News; all the bids have been rejected; A. M. Breckinridge, Clk.:

Gas Engines:

Western Gas Const'n Co., Fort Wayne, Ind.	$8,350
Otto Gas Engine Works, Philadelphia, Pa.	6,400
Joseph Reid, Oil City, Pa.	2,590
National Meter Co., 86 Chambers St., New York	8,955
St. Mary's Machine Co., St. Mary's O.	3,200
White & Middleton Gas Eng. Co., Baltimore, Md.	7,300
Roth Gas Engine Co., Indianapolis, Ind.	5,2[illegible]0
Loretz Bros., New York	9,500
Erie Gas Engine Co., Erie, Pa.	4,400

Pumps: Oil City Boiler Works, Oil City, Pa.—$20,737 for one 300,000-gallon and two 1,500,000-gallon Gould Power Pumps, or $27,362 for same capacity as above with Snow Power Pumps; Snow Steam Pump Works, Buffalo, N. Y.—$38,610 for vertical triple expansion pumping engine, or $28,390 for vertical cross-compound pumping engine; Nordberg Mfg. Co., Milwaukee, Wis., $30,750 for vertical cross-compound pumping engine; Loretz & Son, 126 Liberty St., New York—$21,000 for vertical triple expansion pumping engine, or $16,000 for three power pumps as above.

LATROBE, PA.—The Latrobe Water Co. has let the contracts as follows for its proposed works: Pumping engines, Henry R. Worthington, New York; boilers, the Erie City Boiler Works, Erie, Pa.; pipe laying, H. F. Stark, Greensburg, Pa. The contracts for building the pumping station and reservoir will be let later. The pumps will have a capacity of 3,000,000 gallons. There will be three miles of 6 to 16-in. pipe and a reservoir of 9,000,000 gallons capacity. Engrs., Wilkins & Davison, Westinghouse Bldg., Pittsburg.

NAZARETH, PA.—Surveys have again been made for the proposed increased water supply for the works of the Nazareth Water Co. John W. Trumbower and C. Edward Michael may be addressed. Frank Kunkel, Borough Surv.

PHILADELPHIA, PA.—Bids are asked until July 26 for building and for furnishing boilers and 48-in. cast-iron water pipe. T. M. Thompson, Dir. Dept. Pub. Wks.——Plans are reported as being prepared for a reservoir on Georges Hill for an increased water supply for West Philadelphia; estimated cost, $500,000.

WARREN, PA.—Wm. O'Neil, Chn. Com., writes us that this city voted July 12 to issue $50,000 in bonds for constructing city works. About 90% of the vote cast was in favor of the works. A report dated July 15 states that Judge Lindsey has granted a temporary injunction, asked for by the Warren Water Co., restraining the city from building the proposed works.

CUMBERLAND, MD.—Mayor Kean has recommended that the council appropriate $2,000 for use by the committee for investigating the advisability of securing a better water supply.

MARTINSBURG, W. VA.—Bids are asked by the water board for furnishing and installing a compound condensing duplex pump of 2,500,000 gallons capacity.

PARKERSBURG, W. VA.—We are informed that the following bids were received July 11 for furnishing and laying 36 and 14-in. submerged water pipe, as advertised in Engineering News; the contract for the 36-in. pipe was let to Thos. H. Regan & Son, Philadelphia, at $12,601, as noted under Contract Prices; the bids for the 14-in. pipe were rejected: A. G. Hallock & Co., Wheeling, W. Va., $15,700 and $1,400, respectively, for 36 and 14-in. pipe, and Jos. Cavanaugh, Parkersburg, $15,800 and $1,450, respectively.

SMITH'S GROVE, KY.—Bids are asked by J. R. Kirby, Farmers' Bank, for furnishing the material and for constructing works, according to reports. There will be a standpipe 12 × 40 ft.

CAMDEN, O.—It is stated that this place is considering the question of building works.

LANCASTER, O.—It is stated that Ingham & Neeb, Lancaster, have been awarded the contract for furnishing the material and for constructing the works and sewerage system for the Boys' Industrial School as follows: Sewerage system, $5,861; sewage purification works, $9,029; pumping station for water-works, $8,827; water-works complete, $10,780; boiler house for steam plant, $7,466; stack for boiler house, $2,300. Addyston Pipe & Steel Co., Cincinnati, O., secured the contract for the cast-iron pipe and specials at $1,963. The contract for the steam plant was not let. C. D. Hilles, Secy. Bd. Trustees.

PAW PAW, MICH.—We are informed that this place voted July 11 to issue $18,000 in bonds for works. The council will be ready for bids about Aug. 15. Engr., Geo. S. Pierson, Kalamazoo, Mich.; Clk., Wm. H. Mason.

YALE, MICH.—Bids are asked until July 26 for constructing the proposed works, as advertised in Engineering News July 7. (Postponement from July 19.) E. F. Fead, Village Clk.

MINNEAPOLIS, MINN.—Bids are asked until Aug. 26 for furnishing and installing one or two 10,000,000-gallon pumping engines, as stated in our advertising columns. F. W. Cappelen, Cy. Engr.; L. A. Lydiard, Cy. Clk.

MORRIS, MINN.—We are informed that the following bids were received July 9 for furnishing the materials and for constructing works. Engrs., Iowa Engineering Co., Clinton, Ia.:

W. I. Gray & Co., Minneapolis, Minn.	$32,645
Fairbanks, Morse & Co., St. Paul, Minn.	29,000
Dubuque Construction Co., Dubuque (accepted)	26,420
P. Doherty, St. Paul	29,893

DES MOINES, IA.—Geo. M. King, Cy. Engr., writes us that the council and the Des Moines Water-Works Co. have reached an agreement. The council has offered the company $850,000 for its works. The company has accepted the same. The question will be submitted to a vote of the people Aug. 29.

GILMORE CITY, IA.—This city is reported to have voted against issuing bonds for works.

GAYLORD, KAN.—The question of putting in a small plant for fire protection is being considered, according to reports. W. H. Haskell may be addressed.

BEATRICE, NEB.—Tests are to be made with a view to securing an increased water supply. W. A. Lapworth, Ch. Engr.

BATESVILLE, ARK.—We are informed that the following bids were received July 14 for furnishing and constructing works and an electric plant; Owen Ford, Engr., Security Bldg., St. Louis, Mo.:

G. Jaeger, Rich Hill, Mo.*	$23,985
Reese Bros., Fayetteville, Ark.	25,750
Brown Machinery Co., Little Rock, Ark.	25,520

*Awarded contract at $24,720; a number of additions making the extra cost.

CORSICANA, TEX.—Press reports state that the receiver for the Corsicana Water Co. is having surveys made south of the city preparatory to the beginning of improvements that will cost about $25,000. The improvements to be made in the plant will consist of an increase of the water shed that supplies the water and an additional reservoir that will in connection with the present storage facilities hold water sufficient for a city twice the size of Corsicana at present.

McKINNEY, TEX.—J. M. Pearson, Mayor, writes us that it is expected to offer a contract for erecting works in about a month or so; estimated cost, $18,000.

WARD, COLO.—D. J. McCanne, Des. Engr., 1700 17th St., Denver, Colo., writes us that the proposed water supply will be furnished by gravity. A reservoir of three acres will be built. There will be required 3,500 ft. of 12-in. riveted steel pipe, 5,000 ft. of 6 and 4-in. pipe, 15 hydrants, 12 valves, 10 boxes, 2,600 lbs. converse hub specials, etc. Bids for the purchase of $8,000 of bonds will be asked first.

SEATTLE, WASH.—The council has voted seven to six in favor of asking for new bids for furnishing and constructing the water tower for the Cedar River supply. The itemized bids were given in our issue of last week. Frank Oleson, Secy. Bd. Pub. Wks.

SACRAMENTO, CAL.—The board of education is considering the question of placing water filters in the public schools.

SONOMA CITY, CAL.—Fred. T. Duhring, Pres. Bd. City Trustees, writes us that the question of building works is still in abeyance while the committee is making investigations on new lines. The matter will not come to a vote before Oct. 25.

IDAHO FALLS, IDAHO.—It is stated that this place will vote Aug. 9 on the question of purchasing the works and light plant of the Eagle Rock Water-Works Co. for $25,000. Geo. Chapin, Chn. Com.

AYLMER, ONT.—The council is reported to have been petitioned to purchase the works for $35,000. Mayor Woods and Councilman Wright may be addressed.

OTTAWA, ONT.—Louis H. Tache, Montreal, Que., is reported to have been awarded the contract for furnishing and constructing the works for Gatineau Point at $30,000. Engr., Ernest Belanger, Montreal, Que.

SEWERAGE.

BREWER, ME.—Bids are asked until July 21 for constructing sewers in several streets. Engr., P. H. Coombs, 11 Exchange Block, Bangor, Me.; Chn. Com., C. C. Worth.——Isaac Lunt, Bangor, has been awarded the contract for constructing sewers in 12 streets at about $7,375.

SPRINGFIELD, MASS.—The harbor and land commissioners have granted this city the right to build a submerged outlet sewer in the Connecticut River.——The committee has visited Worcester, Providence and other cities to study methods for the disposal of sewage, with a view to putting in a system in the Highlands. O. D. Allyn and Gilbert Potvin, Jr., are on the committee.

EAST HARTFORD, CONN.—Wm. H. Olmstead, Surv., is preparing plans, etc., for sewers. It is probable that only a brick sewer will be built this year.

WALLINGFORD, CONN.—Bids are asked until Aug. 2 for furnishing the materials and for constructing 6,600 ft. of 30-in. pipe sewer, as stated in our advertising columns. The committee consists of John E. Downs, Chas. Tooth, Sr., and Wm. I. Todd.

LANCASTER, N. Y.—Allan Gardner, Jamestown, N. Y., has been engaged to prepare plans for a system for this place. Geo. Bingham, Chn. Com.

KINGSTON, N. Y.—J. T. Cummings, Cy. Clk., writes us that it is proposed to construct a 5-ft. brick trunk sewer. It will not be built this year. Other sewers are also proposed. W. Klingberg, Cy. Engr.

NEW YORK, N. Y.—Bids are asked by the commissioners of parks, the Arsenal, Central Park, until July 28 for constructing sewers in Central Park, etc.

ELIZABETH, N. J.—Bids are asked until Aug. 1 for constructing 1,100 ft. of 24 and 12-in. pipe sewers, etc. N. K. Thompson, St. Comr.

FLEMINGTON, N. J.—Bids are asked until July 30 for furnishing the material and for constructing a system and a sewage disposal plant, as described in our advertising columns. Engrs., Waring, Chapman & Farquhar, 874 Broadway, New York; Clk., John H. Shrope.

NEWARK, N. J.—At a conference of officials from Newark, South Orange, Vailsburg and Irvington in regard to the proposed joint sewer, it was decided to ask West Orange to join and then create a commission of five to make surveys, etc. In order to drain Irvington, Vailsburg and that part of Newark which may connect with the proposed sewer, a branch will have to be constructed. This will join the South Orange or trunk sewer at Salem. The cost of the construction of the entire sewer is estimated at $160,000. Councilman Sinclair, South Orange, may be addressed. Ernest Adam, Cy. Engr., Newark.

PATERSON, N. J.—It is proposed to construct 1,200 ft. of 15 and 12-in. pipe sewer. Thos. McLean, Cy. St. Comr.

AVALON, PA.—J. A. Ranson, Sharpsburg, Pa., has been awarded the contract for building the sewers for this place at $25,000, according to reports.

BRADDOCK, PA.—Bids are asked until July 28 for constructing sewers, paving, etc., in Kirkpatrick Ave., North Braddock. Engr., S. A. Taylor, North Braddock, or 339 Fifth Ave., Pittsburg.

OIL CITY, PA.—It is proposed to construct sewers in several streets.

McKEE'S ROCKS, PA.—Bids are asked until July 25 for constructing 3,500 ft. of 72 and 60-in. brick sewers. R. F. Hunter, Borough Engr.; C. K. Barnhardt, Chn. Com.

WASHINGTON, D. C.—The district commissioners have ordered the construction of a 24, 21 and 18-in. pipe sewer in 16th St., from Florida Ave. to Morris St.; estimated cost, $2,875.

WAYCROSS, GA.—R. P. Bird, Clk. Council, writes us that this city voted July 9 against issuing bonds for a system. Another election will be called in January.

LANCASTER, O.—It is stated that the contract for constructing the system for the Boys' Industrial School has been let to Ingham & Neeb, Lancaster, at $5,861; sewage disposal works at $9,029. C. D. Hillis, Secy. Trustees.

TOLEDO, O.—Bids are asked until Aug. 8 for constructing a 24-in. brick sewer and 15 and 10-in. pipe sewers in several streets. L. P. Harris, Cy. Clk.——The committee has rejected the bids received recently for a sewer in Payne Ave.; to cost about $20,000.

AURORA, IND.—Bids are asked until July 30 for constructing sewers in several streets. J. J. Backman, Cy. Clk.

HUNTINGTON, IND.—Bids are asked until July 26 for constructing a 34 × 51 and a 30 × 45-in. brick and 20 to 17-in. pipe sewers in several streets. Frank Guthrie, Cy. Engr.

PORT HURON, MICH.—F. F. Rogers, Cy. Engr., writes us that W. F. Ernst has been awarded the contract for 1,610 ft. of 24 to 8-in. pipe sewer in 14th St., at $2,275.

PORTLAND, MICH.—It is proposed to construct sewers in several streets at a cost of about $3,700. Engr., D. C. Crawford.

CHICAGO, ILL.—Bids are asked until July 25 for constructing sewers in a number of streets, etc. L. E. McGann, Pres. Bd. Local Improvements. J. S. Sheahan, Secy.

EAST ST. LOUIS, ILL.—Bids are asked until July 21 for constructing about 45,000 ft. of 30 to 6-in. pipe sewers, 335,000 brick in manholes, etc. M. M. Stephens, Mayor.

MILWAUKEE, WIS.—Bids are asked by the board for building the proposed sewer tunnel. Geo. H. Benzenberg, Cy. Engr. and Chn. Comrs. Pub. Wks.

DES MOINES, IA.—Geo. M. King, Cy. Engr., writes us that the council has passed a resolution of necessity for constructing 12-in. pipe sewers in Harrison St., from 14th to 13th Sts. and in 13th St., from Harrison to College Ave. and in College Ave., from 13th to 12th St.——According to local papers other sewers are also proposed.

NEW ULM, MINN.—Bids are asked until July 25 for constructing 24 and 18-in. pipe sewers in certain streets. Louis Schilling, Cy. Clk.

OMAHA, NEB.—Bids are asked until July 29 for constructing sewers in district No. 230. Andrew Rosewater, Chn. Bd. Pub. Wks.; Wm. Coburn, Secy.

ANACONDA, MONT.—The council has voted to construct pipe sewers in six streets at a cost of about $8,000. I. O'Leary, Cy. Clk.

TOPEKA, KAN.—The council has voted to build a sewer in Ward No. 1. S. S. McFadden, Cy. Clk.

KANSAS CITY, MO.—The question of building a system for Westport, recently annexed to this city, is being considered; estimated cost, $50,000. If an intercepting sewer is built to the river the cost will be about $300,000. The question of sewers for Mellier Place is also being considered.

GAINESVILLE, TEX.—It is reported that this place has let the contract for building a system here. The fire limits will be supplied first, after which the other parts of the city will be furnished.

DENVER, COLO.—Chief Engineer Lowrie, of the board of public works, is preparing plans for a system of storm sewers for the eastern portion of the city; estimated cost, $750,000.

OAKLAND, CAL.—It has been voted to construct sewers in several streets. J. W. Tompkins, Cy. Clk.

SALINAS, CAL.—Bids are asked until Aug. 1 for furnishing the material and for constructing a sewerage system. J. J. Kelly, Cy. Clk.

LONDON, ONT.—Bids are asked until July 28 for furnishing and laying about 3,300 ft. of 30-in. cast-iron sewer pipe and 300 ft. of 20-in. steel pipe, together with the construction of the syphon chambers, etc. Consult. Engr., Willis Chipman, Toronto; Cy. Engr., Ormsby Graydon; Chn. Com., N. Cooper.

KASLO, B. C.—G. O. Buchanan, ex-alderman, writes us that plans for the proposed system are pending decision of the provincial board of health as to the discharge into Kootenay Lake.

GARBAGE DISPOSAL—STREET CLEANING

BUFFALO, N. Y.—Bids are asked until July 28 for cleaning the paved streets for three or five years, from Aug. 1. R. G. Parsons, Secy. Bd. Pub. Wks.

EAST ORANGE, N. J.—Chas. F. Finan submitted the lowest bid July 11 at $2,900 a year for the scavenger work in this township.

BALTIMORE, MD.—It is proposed to clean the sewers of the city soon at a cost of about $100,000. Street Cleaning Commissioner Bye may be addressed.

WHEELING, W. VA.—A local paper states that the board of health has directed A. L. White, Cy. Engr., to visit eastern cities to study methods of garbage disposal plants. It is estimated that a new plant can be built in this city for $2,500.

NEWPORT, KY.—This city wants estimates, etc., for a garbage disposal plant, as stated in our advertising columns. W. L. Glazier, Cy. Engr.

LOS ANGELES, CAL.—Bids will soon be asked by the council for street sweeping. The present contract expires Nov. 20. The city is paying $5.85 a lin. mile for sweeping the paved streets. It is proposed to have the down-town streets swept next year by hand.

STREETS AND ROADS.

BROOKLINE, MASS.—A. H. French, Cy. Engr., informs us that no action besides making plans and estimates has been taken in regard to the improvement of Boylston St.

MERIDEN, CONN.—Reports state that the council has voted to issue about $200,000 in bonds for paving.

SUFFIELD, CONN.—Bids are asked until Aug. 1 for grading and macadamizing in North St. E. Halladay, First Selectman

BROOKLYN, N. Y.—Bids are asked until Aug. 2 for repairing and maintaining asphalt paving in certain streets and for furnishing broken stone and limestone screenings. The total length is about 16 miles. No bids were received for this work when bids were to be opened recently. It is thought that the method of payment was the cause of no bids being received. J. P. Keating, Comr. Highways, 150 Nassau St., Manhattan.

BUFFALO, N. Y.—Bids are asked until July 27 for paving Clinton St., from Lewis St. to Babcock St. R. G. Parsons, Secy. Bd. Pub. Wks.——Bids are asked until Aug. 1 for paving Porter Ave. with asphalt from Fourth St. to the bridge. G. H. Selkirk, Secy. Park Comrs.

CORTLAND, N. Y.—Bids are asked until July 25 for furnishing the materials and for 22,000 sq. yds. of asphalt and 6,400 sq. yds. of Medina stone or brick paving, as described in our advertising columns. Engr., H. C. Allen, Kirk Block, Syracuse, N. Y.; Clk., W. C. Crombie.

MOUNT VERNON, N. Y.—Bids are asked until July 25 for grading and macadamizing portions of South Columbus Ave. Wm. N. Hoyt, Cy. Clk.

NEWBURGH, N. Y.—The following are the lowest bids received July 1 for paving in South Liberty St.: M. J. Dwyer, granite blocks. $17,285; Hastings Co., New York, asphalt, $25,687; W. R. Johnson, Catskill, brick, $19,760. D. J. Coutant, Clk.

NEW ROCHELLE, N. Y.—The street committee has filed estimates amounting to $125,000 for paving and macadamizing.

NEW YORK, N. Y.—Bids are asked until Aug. 2 for furnishing 100,000 gallons of No. 6 paving cement. J. P. Keating, Comr. Highways, 150 Nassau St.

NORWICH, N. Y.—Bids are asked until July 25 for paving East Main St. and West Main St. with brick, as described in our advertising columns. J. B. Turner, Pres. Bd. Trustees.

ROCHESTER, N. Y.—Contracts were awarded July 8 to the Rochester Vulcanite Paving Co. for asphalt paving in Parsells Ave., at $29,514, and F. A. Brotsch, for brick paving in Spencer St., at $9,965. E. A. Fisher, Cy. Engr.

RIDGEFIELD, N. J.—C. B. Wilson, Clk., informs us that the following bids were received July 12 for constructing a macadam road; advertised in Engineering News, June 23 and 30: Robt. J. Emmer, Highwood Park, complete contract, $8,175; Joseph Murphy, 308 Charles St., West Hoboken, $5,940; D. L. Barrett, Englewood, $7,800; J. A. Winterburn, Edgewater, $4,975; Palisade Construction Co., 1 Montgomery St., Jersey City, $7,976; Cannon & Marronne, $8,400; John Collins, 536 Palisade Ave., Jersey City, curbing, 40 cts. ft.; Telford, 50 cts. sq. yd.; crushed stone, $2 cu. yd.; Brook paving, 12 cts. sq. ft.; excavating, 30 cts. ft.; rock cutting, $2; stone work, 20 cts. ft.; Belgian blocks, $1.50 yd.; mountain dressed stone, 85 cts. yd.; basins, $1.50, complete.

MALVERN, PA.—Bids are asked until July 25 for grading Monument Ave., from Warren Ave. to Sugartown Road. W. G. Watson, Secy. Com.

MEADVILLE, PA.—Bids are asked until July 27 for brick paving, as described in our advertising columns. W. A. Doane, Cy. Engr.; D. T. McKay, Jr., Cy. Clk.

McKEE'S ROCKS, PA.—Bids are asked until July 25 for about 14,000 sq. yds. of asphalt block or brick paving and 10,400 lin. ft. of curbing in Chartiers St. and Bell Ave. R. F. Hunter, Borough Engr.

NANTICOKE, PA.—An ordinance has been passed by the council to pave portions of Main and Market Sts. with brick. Wm. T. Mahon, Pres.; W. J. Burnett, Burgess.

PITTSBURG, PA.—Bids will soon be asked for the construction of five roads, at a cost of about $200,000. Fred. W. Patterson, County Road Engr.

SHAMOKIN, PA.—The council will give a hearing Aug. 23 to vote on the question of borrowing $65,000 for paving.

MANNINGTON, W. VA.—Henry Robrecht, Wheeling, has been awarded a contract for paving with the McMahon, Porter & Co. repressed brick, to cost about $80,000.

BIRMINGHAM, ALA.—A petition has been presented to the county commissioners by the Commercial Club for the construction of a boulevard on the north side of Red Mountain.

BLOUNTVILLE, TENN.—Bids are asked for macadamizing a road between Blountville and Bristol, to cost $3,000. J. H. Cole, Chn. County Comrs.

ASHLAND, O.—Bids are asked until July 30 for the purchase of $60,000 of 5% street and improvement bonds. E. B. Westover, Cy. Clk.

BEREA, O.—Bids are asked until Aug. 1 for the purchase of $3,500 of 5% street bonds. E. S. Loomis, Village Clk.

CANTON, O.—Bids are asked until July 31 for the purchase of $4,834 of 5% street bonds. L. N. Ley, Clk.

FREMONT, O.—Bids are asked until Aug. 15 for paving Hayes Ave. with brick from Front St. to Buckland Ave., and macadamizing and grading a portion of Napoleon St. R. J. Christy, Chn. Improvement Com.

LIMA, O.—Bids are asked until Aug. 8 for the purchase of $73,200 of 5% street improvement bonds. C. E. Lynch, Cy. Clk.

MALTA, O.—Bids are asked by the city clerk until Aug. 20 for the purchase of $10,000 of 5% street bonds.

RAVENNA, O.—An ordinance has been passed to pave Main St. with brick. Work will begin at once.

TOLEDO, O.—Bids are asked until Aug. 8 for furnishing material and paving an alley between St. Clair St. and Superior St. L. P. Harris. Cy. Clk.

LA FAYETTE, IND.—Bids are asked until Aug. 8 for improving portions of seven streets. Thos. W. Burt, Cy. Clk.——A contract will be let in August for constructing about two miles of asphalt pavement; estimated cost, $100,000; and for nearly 20 miles of cement sidewalk; estimated cost, $100,000.

RICHMOND, IND.—Bids are asked until July 29 for grading and paving one alley. J. H. Winder, Clk. Bd.

EAST ST. LOUIS, ILL.—Bids are asked until July 22 for grading, brick paving and sewering a portion of Main and Fourth Sts. M. M. Stephens, Mayor.

KEWANEE, ILL.—Bids are asked until Aug. 2 for brick paving, as stated in our advertising columns. J. C. Quade, Cy. Engr.

WATERTOWN, WIS.—The council has voted to pave Main St. for five blocks.

DES MOINES, IA.—Geo. M. King, Cy. Engr., writes us that the council has passed an ordinance to construct 10,000 sq. yds. of brick pavement.

NEW ULM, MINN.—Bids are asked until July 25 for grading, graveling, etc. Louis Schilling, Cy. Clk.

FARGO, N. DAK.—Reports state that the council is arranging to pave about five miles of streets this summer.

OMAHA, NEB.—Bids are asked until Aug. 15 for about 35,000 cu. yds. of grading D. M. Haverly, County Clk.

OMAHA, NEB.—Bids are asked until July 29 for brick, asphalt or stone paving in 32d Ave., from Davenport St. to Farnham St. Wm. Coburn, Secy. Bd. Pub. Wks.

JEFFERSON CITY, MO.—Bids are asked by the city treasurer until July 25 for the purchase of $6,000 of 5% street bonds.

HOUSTON, TEX.—The ordinance to issue $100,000 in bonds for street improvements has been passed. J. A. Miller, Cy. Engr.

WINDSOR, ONT.—The board of public works has received an estimate of $25,750 for the paving of Second Ave. with asphalt.

MANUFACTURING PLANTS.

ELIZABETH, N. J.—The car repair shops at Elizabethport, belonging to the Central Ry. of N. J., were destroyed by fire July 16, causing a reported loss of about $200,000.

PHILADELPHIA, PA.—The 5-story mill building at American and Diamond Sts., was destroyed by fire July 10, causing a reported loss of $100,000. The building was occupied by Oliver Lupton & Co., Philadelphia Linen Co., Champion Machine Co. and the Franklin Silk Mills Co.

ROCK HILL, S. C.—Wm. O. Webber, Exchange Bldg., Boston, Mass., is reported to have been engaged to prepare plans for enlarging the plant of the Rock Hill Cotton Factory Co. The plant, which has now 7,904 spindles and 192 looms, will be extended to accommodate 10,000 spindles. The improvements will cost about $200,000.

MONTGOMERY, ALA.—The Montgomery Compress Co., it is stated, has let the contracts for building and furnishing its plant; to cost about $30,000. Pres., Jos. P. Ferrell; Secy. and Treas., C. L. Stickney.

LOUISVILLE, KY.—L. K. Ferguson, of the Globe Refining Co., writes us that the contract has been let for the building for the plant. The contracts for the storage tanks, boilers and electrical equipment are to be let as soon as the plans are completed. The company is to manufacture seed oils, etc. Arch., John Chambers, Room 39, American National Bank Bldg., Louisville.

LOUISVILLE, KY.—The building occupied by James Clark, Jr., & Co., electrical supplies, on Main St., belonging to H. Weissinger, was destroyed by fire, at a reported loss of $50,000.

CAMBRIDGE, O.—It is reported that the West End Rolling Mill Co. will erect a building to be used for trimming. It will be 30 × 60 ft.

NEW CASTLE, IND.—Press reports state that the New Castle Bridge Works will be extended by the construction of a few new buildings. Runyon & Mouch own the works.

KALAMAZOO, MICH.—The Clark Engine & Boiler Co. will build an additional machine shop at once, according to reports. It will be 40 × 100 ft.

MOLINE, ILL.—Williams, White & Co., it is stated, are arranging to build a new foundry for its plant to be 60 × 140 ft. A 15-ton electric crane, etc., will be required.

LA CROSSE, WIS.—A fire on July 17 is reported to have destroyed the sash and door factory of Segelke-Kohlhaus Co. and the lumber yards of the John Paul Lumber Co., causing a loss of about $150,000.

RACINE, WIS.—The 3-story structure of the Racine Malleable & Wrought Iron Co. was destroyed by fire July 13, resulting in a loss of $100,000 and of probably eight lives.

STEVENS POINT, WIS.—The mill belonging to the Wisconsin River Pulp & Paper Co. has been destroyed by fire, causing a reported loss of about $175,000. It is stated that a new plant will be built.

ST. PAUL, MINN.—Plans are reported to have been prepared for enlarging the shops of the Great Northern Ry. in this city. Work on the shops will begin in about two months.

COFFEYVILLE, KAN.—It is proposed by the Coffeyville Vitrified Brick Co. to build a plant at Cherryvale to have a capacity of about 100,000 brick a day. Besides the machinery there will be required about 200 iron cars, etc.

KANSAS CITY, MO.—Zachary T. Davis, Arch., Chicago, Ill., is preparing plans for the erection of a packing plant for Schwartzchild & Sulzberger, to cost $600,000, according to reports.

ST. JOSEPH, MO.—It is stated that the Jamieson-Combe Iron Co. proposes to build a machine shop, 50 × 80 ft., on ground in this city it recently purchased.

ELGIN, ORE.—It is reported that the capitalists building a beet factory here will send a representative to Walla Walla, Wash., next week. They will propose to the citizens of that city that for a subsidy of $100,000 they will build a beet sugar plant to cost about $400,000.

OTTAWA, ONT.—Reports state that the New York & Ottawa Ry. Co. will erect work shops for the construction of its new road.

CHIHUAHUA, MEX.—It is reported that the Wellman Seaver Engineering Co., New England Bldg., Cincinnati, O., has entered into a contract for the construction of a steel plant, at this place.

GAS PLANTS.

McPHERSON, KAN.—A. Bass, Cy. Engr., informs us that the city is in litigation with the Water & Light Co. and if a compromise is not made a new company will be organized to construct a water and gas plant.

NEW COMPANIES.—Chester Oil Co., Pittsburg, Pa.; $1,000,000, with $1,000 paid in; to bore for oil and gas; F. M. Lowry, W. S. Watson, Wm. Lyons, Jr., H. G. Wasson, J. P. Cappeau, Pittsburg.

Knickerbocker Gas Co., 419 Market St., Camden, N. J.; $500,000 with $1,000 paid in; to manufacture and construct plants, machinery, etc., and produce gas for light, heat and power; Wilson Waddinghand, Edward P. Baker, Geo. H. B. Martin, 419 Market St., Camden.

Mutual Gas Co., Denver, Colo.; $100,000; J. A. Cooper, T. F. Dunaway, Charles Wheeler, F. A. Bailey and William Ridley.

Milford Gas Co., Milford, Pa.; $10,000; to manufacture and sell acetylene gas in the borough of Milford; Thomas Armstrong, Joseph J. Hart, James S. Gale, Harry T. Baker, Milford, Pa.; Lancelot W. Armstrong, New York.

MISCELLANEOUS CONTRACTS.

PARK WORK.—Spokane, Wash.—An ordinance is before the council for an appropriation of $10,000 for improving the parks.

TELEPHONE PLANT.—Terre Haute, Ind.—Bids are asked by the People's Telephone Co., according to reports, for the construction of a plant.

TELEPHONE FRANCHISE.—Lexington, Ky.—The council has granted a 20-year franchise to the East Tennessee Telephone Co. at an annual rental of $1,200.

RIVER WORK.—Buffalo, N. Y.—City Engineer Bardol has completed the plans for improving Buffalo River by widening and dredging, and bids will be asked.

DREDGING.—Brooklyn, N. Y.—Bids are asked until July 27 for dredging Gowanus Canal, from Douglas St. to Union St. James Kane, Comr. Sewers, Municipal Bldg.

RETAINING WALL.—Cincinnati, O.—Bids are asked until July 25 for constructing a retaining wall, between Russell and Ida Sts. A. P. Butterfield, Clk. Bd. Cy. Affairs.

PINE TIMBER.—New York, N. Y.—Bids are asked until July 29 for furnishing about 1,862,455 ft. B. M. of sawed yellow pine timber. J. S. Crain, Comr. Docks, Pier A.

WHARF.—Point Wilson, Wash.—Bids are asked until Aug. 2 for building a wharf at Point Wilson, Wash. Capt. Harry Taylor, U. S. Engr., Burke Bldg., Seattle, Wash.

TELEPHONE SYSTEM.—Mankato, Minn.—Bids are asked by the Mankato Citizens' Telephone Co. until July 29 for constructing a telephone system, according to reports.

STERILIZING APPARATUS.—Dunning, Ill—Bids are asked until July 25 for installing a sterilizing apparatus at the Dunning Institution. E. D. Northam, Supt. Pub. Service, Chicago.

MONUMENT.—Olean, N. Y.—The G. A. R. is contemplating the building of a soldiers memorial fountain and monument to cost about $5,000. Henry Gale, Commander, may be addressed.

STONE COPING, FLAG, ETC.—Brooklyn, N. Y.—Bids are asked until July 28 for furnishing stone coping, curb and flag. Geo. C. Clausen, Chn. Park Comrs., Arsenal Bldg., Central Park.

TELEPHONE SYSTEM.—Birmingham, Ala.—The council has granted permission to the American Telephone & Telegraph Co. to construct and operate a telegraph and telephone system. F. V. Evans, Mayor.

GRADING.—St. Louis, Mo.—Bids were received until July 20 for about 150,000 cu. yds. of grading in the district north and south of Russell Ave. Address Pitzman Co., Survs. and Engrs., 615 Chestnut St.

PARKS.—Indianapolis, Ind.—The council has passed an ordinance authorizing the expenditure of $235,215 for the purchase of land and laying out parks. Messrs. McGrew, Merrick and Crall, Pub. Improvement Com.

TELEPHONE CABLES.—Buffalo, N. Y.—The National Conduit & Cable Co., New York, has been awarded a contract at $3,515 to furnish saturated cable for constructing a telephone system for the police department.

TRAVELING CRANES.—Chicago, Ill.—Plans are asked until Aug. 30 for the erection of electric traveling cranes for the new pumping stations at Springfield Ave. and at Central Park Ave. L. E. McGann, Comr. Pub. Wks.

FURNITURE.—Binghamton, N. Y.—Bids are asked until Aug. 9 for furnishing desks, tables, filing cases, chairs and other necessary furniture for the new city hall, as stated in our advertising columns. Burr W. Mosher, Cy. Clk.

TELEPHONE SYSTEM.—Baltimore, Md.—J. A. Shriever, Pres. Baltimore & Blaire Telephone Co., has applied to the county commissioners for permission to construct telephone lines to connect with a number of towns throughout the county.

DAM, TUNNEL, ETC.—Ogden, Utah.—Bids are asked until Aug. 4 for constructing a rock-filled dam to be 68 ft. high and an outlet tunnel 180 ft. long, for the Davis & Weber Counties Canal Co., as described in our advertising columns. Pres., C. B. Adams; Ch. Engr., W. M. Bostaph; Consult. Engr., Sam'l Forties.

STEAMSHIPS.—Newport News, Va.—Reports state that the Morgan Line Steampship Co., New York, N. Y., has awarded a contract to the Newport News Shipbuilding & Dry Dock Co., at $2,500,000, for the construction of three steamships 400 ft. long, 50 ft. beam and 35 ft. deep, with a capacity of about 5,000 tons each.

CONTRACT PRICES.

MACADAMIZING.—Easton, Pa.—The following bids were received by the county commissioners July 8 for rebuilding the Delaware road to Snyder's Bridge, a distance of about 6½ miles; the roadbed will be 12 ft. wide, and 9 ins. deep for telford, and 6 ins. deep for macadam; total bid, about $20,000; Engr., J. Marshall Young:

Bids Received at Easton, Pa., July 8, 1898, for Macadamizing.

Bidder.	Excavation, a cu.yd.	Price a lin. ft. — Telford, Limestone.	Telford, Trap rock.	Macadam, Limestone.	Macadam, Trap rock.	Drains, a lin. ft. 10-in.	12-in.	16-in.	18-in.
Osborne & Marcelles, Upper Montclair, N. J.	$0.32	$0.74	$0.89	$0.575	$0.70	$0.80	$1.00	$1.50	$2.00
Standard Construction Co., Easton, Pa.	.35	.755	.91	.59	.72	.75	.95	1.37	2.10
T. M. Lesher & Sons, Easton, Pa. (lowest)	.24	.52	.59	.45	.52	.55	.68	1.00	1.15
Delaware River Quarry Con. Co., Lambertville, N.J.	.25	.53	.62	.48	.53	.58	.70	1.05	1.21
Wright & Lindsley, Orange, N. J.	.25	.81	.93	.62	.74	1.25	1.50	1.90	2.50

PIPE SEWERS.—Albany, N. Y.—The following bids were received by the board of contract July 18, 1898, for constructing a pipe sewer in Dove and Spruce Sts.; contract awarded to Michael F. Dollard:

Quantities.		Michael F. Dollard.	Wm. R. Reynolds.
18-in. ex. heavy vit. pipe	180 lin. ft.	$1.47	$1.56
15-in. " " " "	530 " "	1.04	1.10
6-in. vitrified pipe	900 " "	.12	.11
18-in. Ys	6 each	3.05	3.50
15-in. Ys.	50 "	2.47	2.50
Manholes	2 "	40.00	40.00
Receiving basins	2 "	70.00	75.00
Lampholes	1	12.50	12.00
Lateral trenches	900 lin. ft.	.35	.45
6-in. bends	56 each	.35	.30
Total		$1,633	$1,773

BRICK PAVING.—Albany, N. Y.—The following bids were received by the board of contract July 18, 1898, for brick paving in Partridge St., between Madison and Western Aves.; Ed. T. Dillon awarded contract:

Quantities.		Ed. T. Dillon.	Mulderry Bros.
Brick		Catskill.	Catskill.
Cements		Helderburg Alpha.	Helderburg Portland
Brick pavement	2,260 sq. yds.	$1.98	$2.08
New granite curb	1,270 lin. ft.	.80	.90
Circular curb	115 " "	.90	.90
Pvm't relaid, sand	20 sq. yds.	.20	.50
Relaid, concrete.	5 " "	3.00	3.00
Curb, relaid, sand.	10 lin. ft.	.15	.25
Relaid, concrete.	10 " "	.35	.50
Sod	1,670 sq. yds.	.18	.25
New 5-ft. flag	5,740 sq. ft.	.21	.17
Flag relaid	1,670 " "	.08	.075
Receiving basins	1	95.00	90.00
Altered	2 each	25.00	30.00
House drains	142 lin. ft.	.55	.60
6-in. bends	9 each	.55	.35
Labor, pounding	18 days	1.50	1.50
Total		$7,638	$7,844
Days to complete, at $5 a day		25	16

BRICK SEWER.—Muscatine, Ia.—J. J. Ryan, Cy. Engr., informs us that the following bids were received July 5, 1898, for constructing a main sewer in district No. 2; J. Beckey & Co. made lump bid of $3,998; contract awarded William Horrabin:

Quantities.		Wm. Doering, Muscatine.	Wm. Horrabin, Iowa City.	A. Plepp & Co., Muscatine.
24×38-in. sewer*	618 lin. ft.	$2.24	$2.035	$2.35
28×42-in. sewer†	1,012 " "	2.34	2.11	2.40
10-in. pipe connect'ns	360 " "	.47	.24	.47
6-in. sewer branches.	140 " "	.10	.09	.10
Manholes	6 each	24.00	23.10	27.75
Receiving basins	10 "	4.00	3.50	4.00
Masonry outlet	1	33.00	30.00	36.00
Total		$4,153	$3,696	$4,307

*Average cut, 10½ ft. †Average cut, 12 ft.

SEWERS.—Parkersburg, W. Va.—John V. Dunbar, Cy. Engr., informs us that the following bids were received July 11, 1898, for constructing certain sewers, as advertised in Engineering News; S. E. Irwin received award for whole work; about 1,000 ft. of the 8,371 ft. of 8-in. sewers will be in quicksand, requiring sheet piling, also 1,000 ft. in sand, balance of material is hard clay; 600 ft. of tunnel is expected to be in hard clay, not rock, as anticipated:

Bids Received at Parkersburg, W. Va., July 11, 1898, for Constructing Sewers.

Quantities.		G. Ashman, Cincinnati, O.	T. S. Savage, Parkersb'rg, W.Va.	S. E. Irwin, Hamilton, O.	L. G. Halleck, Wheeling, W.Va.	G. M. Bowery, Parkersb'rg, W.Va.	Martin Hare, Parkersburg, W. Va.	J. Cavanaugh, Parkersb'rg, W.Va.
8-in. pipe sewer:								
Furnishing and laying 8-in. pipe	8,371 lin. ft.	$0.25	$0.13¾	$0.10	$0.58	$0.12½	$0.22	$0.58
Excavation, 8 to 10 ft., and backfilling.	8,371 " "	1.00	.30	.26*	...†	.33⅗	.38½	†...
Manholes	31 each	40.00	75.00§	31.00	35.10	40.65	42.60	35.00
Flushtanks	6 "	60.00	49.00	30.00	43.67	47.87	56.83	42.67
Y's	370 "	.60	...	...	.27	.41	.27	.27
Total		$12,286	$4,964	$4,287	$6,411	$5,519	$6,824	$6,396
15-in. outlet sewer and tunnel:								
Furnishing and laying 15-in. pipe	3,087 lin. ft.	$0.40	.....‡	$0.20	$0.35	.....	$0.58	$0.35
Furnishing and laying 8-in. pipe	20 " "	.25	.45	.75	.15	.....	.25	.15
6-in. chimney pipe	200 " "	.20	.15	.15	.15	.....	.25	.15
Excavating and backfilling, 16 ft. deep	700 " "	1.70	1.49	1.25	2.00	.....	1.00	2.50
" " " 12 to 22 ft.	400 " "	1.70	1.49	1.45	1.97	.....	1.00	1.97
" " " 9 " 12 "	1,387 " "	1.40	1.49	.90	.70	.....	1.00	.70
" tunnel, 5x7 ft.	600 " "	10.00	4.25	2.50	4.66	.....	10.00	4.66
Y or T-branches	100 each	1.50	1.00	5.00	.90	.....	.45	.90
Conc. backing for pipe sewer in tunnel	51⅘ cu.yds.	6.00	4.25‖	3.00	6.75	.....	4.50	6.50
Manholes: (2) 22 ft., (3) 16 ft., (7) 10 ft.	12 each	38.75	38.41	31.00	48.88	.....	55.75	48.88
Lumber in place	48,000 ft. B.M.	20.00	20.00	20.00	.....	.....	35.00	.....
Extra for solid rock		6.00	7.00	5.00	3.50	.....	.....	3.50
Total		$12,492	$7,686	$6,835	$8,063	.....	$12,909	$8,400

*26 and 29 cts. full bid. †This price, 58 cts., covers the furnishing and also the excavation, made by the two bidders. §$75.00 for 1, and $28.00 for 30 manholes. ‡Added to the excavating bid. ‖$4.25 is the price a ft. complete for work in tunnel.

ELECTRIC LIGHTING.—Los Angeles, Cal.—The council received the following bids June 27, 1898, for lighting city with electricity, as described in our issue of June 30: Specifications A—Same system as at present, with 180 new lights, a total of 640 lights; Los Angeles Lighting Co., $6.50 a light; there was no other bid under these specifications. Specifications B—Calling for full 734 lights, removing high poles and substituting for each pole, six arc lights; Los Angeles Lighting Co., $6.70; Edison Electric Co., $6.94. Specifications C—Calling for the construction of a complete pole and wire system, to be owned by the city; San Gabriel Electric Co., $125,930; California Electrical Works, $125,540. Specifications D—For lights alone; California Electrical Co., $7,950 for 500 lights, or $15,000 for 1,000 lights. Specifications E—For furnishing electrical energy for all the lights necessary for lighting the city; San Gabriel Electric Co., $4.25 a light. No bids were received under Specifications F. Specifications G—For power lights and maintenance of a pole and wire system to be owned by the city, 740 lights; the Los Angeles Electric Co., $5.75 a light. The lowest bid of the Los Angeles Lighting Co. is accepted. The city next year will spend for 680 lights, $53,040. This is for all-night, every-night service. This year it spends for 460 lights, midnight, moonlight schedule, $49,680.

MACADAMIZING.—Pekin, Ill.—The following bids were received by the committee of the Citizens Improvement Association for macadamizing a road; the contract being let to the Dunbar Co., Peoria, Ill., for a 14-ft. roadbed, 124 ins. deep, a 12-ton road roller to be used:

	Width of road.	Road roller, tons.	A lin. ft.
Crescent Stone Co., Peoria, Ill	14 ft.	12	$1.04
	14 "	6	.94
	16 "	12	1.10
	16 "	6	1.00
Dunbar & Co., Peoria	14 "	6 to 8	.99
	16 "	6 to 8	1.13
	14 "	..	.94
Campbell & Co., Joliet, Ill	14 "	7½	1.04
	16 "	7½	1.18

BRICK PAVING.—Muscatine, Ia.—We are informed that the following bids were received July 15 for brick paving in districts Nos. 14 and 15; in No. 14 foundation is of old macadam and sand, 6 ins., one course brick; No. 15 foundation, 6 ins. sand, one course brick; J. J. Ryan, Cy. Engr.:

Bids Received at Muscatine, Ia., July 15, 1898, for Brick Paving in Districts Nos. 14 and 15.

Bidder.	District No. 14. Excavation, 7,000 c. yds.	Concrete curb, St., 2,831 lin.ft.	Concrete curb, Alley, 600 lin.ft.	Brick paving 9,400 sq. yds., Buffalo.	Des M'nes.	Total.	District No. 15. Excavation, 4,000 c.yds.	Concrete curb, St., 2,216 lin.ft.	Concrete curb, Alley, 3,000 lin.ft.	Brick paving, 7,075 sq. yds., Buffalo.	Des M'nes.	Total.
E. Baker, Muscatine, Ia.	$0.175	$0.45	$0.39	$0.945	$0.96	$11,616[1]	$0.155	$0.54	$0.39	$0.945	$0.96	$9,663[2]
William Horrabin, Iowa City	.29	.31	.20	...	.87	11,206	.23	.445	.20	...	.885	8,759
Edwards & Walsh Constn Co., Davenport	.12	.38	.20	.90	...	10,496[3]	.15	.50	.20	.91	...	8,737
Fuller Bros., Muscatine, Ia.	.46	.525	.21	.895	...	13,762	.125	.485	.24	.895	...	8,618[3]
Berry & Welch, Iowa City, Ia.	.19	.325	.245	...	.96	11,421	.21	.46	.245	...	.97	9,447

[1] This total is for Buffalo brick; total for Des Moines, $11,757. [2] This total for Buffalo brick; Des Moines brick, $9,769. [3] Awarded contracts.

ASPHALT PAVING.—Montreal, Que.—Bellhouse, Dillon & Co. have been awarded the contract for asphalt paving in Craig St. at $2.41 a sq. yd.

SUBMERGED WATER PIPE.—Parkersburg, W. Va.—We are informed that the following contract was let July 11, 1898, to Thos. H. Regan & Son, Philadelphia, Pa., for furnishing the material and for constructing a 36-in. submerged pipe, etc., as advertised in Engineering News: Pump Well Section (Section O to near Station 2)—Excavating and timbering tunnel, 7×7 ft. in clear, $8.50 a lin. ft.; cofferdam and excavation at shore, for relaying pipe, $9.50 a lin. ft.; relaying 36-in. pipe in the above section, and back filling, $3.75 a lin. ft.; furnishing and putting in place, new gate or valve (plan submitted), $460. River Section [a] (from near Station 2 to Station 10)—Excavating, furnishing and laying 36-in. pipe in cofferdam, to near Station 7, $11.21 a lin. ft:. dredging out trench and laying pipe from Station 7 to channel, 312 ft., from barges or floats, including flexible joints every four lengths, $10.40 a lin.ft. River Section [b]—Dredging and laying pipe, from barges and floats, from near Station 2 to channel in river, 812 ft., including flexible joints every four lengths, $11.21 a lin. ft.; laying about 700 ft. of 14-in. conduit, from near line of low water to channel (city to furnish pipe), $3.98 a lin. ft.; furnishing and laying 12-in. by-pass, connecting discharging main with 36-in. conduit, $7.45 a lin. ft.; furnishing and putting in place a 12-in. stop valve on by-pass, $37.00; 12-in. "Y" or "T" branch on 36-in. conduit, above the price of straight pipe, $27.60 a lin. ft. The contract was let for the 36-in. conduit on Plan [a] at $12,601. Smaller conduit was not let.

BRICK PAVING.—Swanton, O.—We are informed that the following bids were received July 11, 1898, for brick paving, as advertised in Engineering News; Engrs., Riggs & Sherman, The Nasby, Toledo, O.:

Items.	Thos. McKinney, Toledo, O.	M.F. Bramley Cleveland, O.	Fisher, Kenfer & Bailey, Huntington, Ind.	D. R. McArthur & Co., Kenton, O.	J. C. Carland, Toledo, O.
Excavation	$0.10	$0.15	$0.13	$0.15	$0.11
Catchbasin	14.00	16.00	15.50	17.00	22.00
Inlets	10.00	1.00	2.00	7.00	10.00
Monument corners	1.00	4.00	3.50	3.00	1.00
Curbing	.26	.15	.31	.30	.28
Paving: Metropolitan	1.22	1.25	1.28	1.28	1.28
Nelsonville	1.10	1.25	1.22	...	1.25
Townsend	1.14	1.25	...	...	...
Wassail	1.16	1.25	...	1.22	...
Louisville	1.15	1.25	...	1.21	1.28
Blue granite	1.13	1.25	...	...	...
Athens	1.10	1.25	1.22	...	...
Cement filler	.07	.12	.11	.11	.07
Tar filler	.13	.12	.12	.12	.15
Drain tile	.03	.02	.04	.06	.03
Total	$5,984	$6,683	$6,809	$7,022	$6,756

DREDGING.—Marcus Hook, Del.—Lt.-Col. C. W. Raymond, U. S. Engr., Philadelphia, received the following bids July 5, 1898, for dredging from bulkhead bar and Marcus Hook ice pier, Del., approximate quantity of material to be removed, 1,050,000 cu. yds:

	Cts. a cu. yd.
P. Sanford Ross, Inc., Jersey City, N. J	9⅗
Atlas Dredging Co., Wilmington, Del.	10
American Dredging Co., Philadelphia	7⅔
International Contracting Co., Syracuse, N. Y.	11¾
River & Harbor Improvement Co., Camden, N. J.	6⅞
Baltimore Dredging Co., Baltimore, Md.	10
Morris & Cummings Dredging Co., New York	9
Virginia Dredging Co., Richmond, Va.	8.49
Frank H. Brainard, New York	9½

ASPHALT PAVING.—Philadelphia, Pa.—Aaron Ward is reported to have been awarded the contract for asphalt paving in certain streets, at $1.39 a sq. yd.; total, about $200,000.

CURBING AND GRADING.—Kansas City, Mo.—The following contracts were let July 1, 1898, by the Park Commissioners for curbing and grading at the Paseo: Curbing around the Paseo, 9th to 15th St., Kansas City Sidewalk & Cement Co., 71 cts.; guttering and curbing, $1.05 a ft.; from 15th St. to south end of Paseo, M. Schoonmaker, curbing, 65 cts.; curbing and guttering, $1.05.

PAVING.—Kansas City, Mo.—The following contracts have been let by the public improvements committee for certain paving: Asphalt paving—12th St., Prospect Ave., Forest Ave., Barber Asphalt Paving Co., $2.12 a sq. yd., total, $61,567; Brick Paving—18th St., Fred. Feigel, $1.47¼ a sq. yd., total, $6,779; Roberts St., Walter Hickman, $1.52 a sq. yd.; $2,420; 24th St., Boyd Construction Co., $1.50 a sq. yd., $10,950.

WATER-WORKS.—Cambridge Springs, Pa.—We are informed that the following contract was let July 11, 1898, to Chandley Bros. & Co., Beaver Falls, Pa., for furnishing and constructing works, as advertised in Engineering News; Geo. L. Wade, Cy. Clk.: Furnishing about 456 tons of cast-iron water pipe, $15.30 a ton of 2,000 lbs.; about 20,000 lbs. special castings, 2 cts. a lb.; 37 hydrants, with two 2½-in. hose nozzles and 6-in. bottom connections, $22.50 each; 14 hydrants, with two 2½-in. hose nozzles, and 4-in. bottom connections, $21.00 each; 10 10-in. gate valves, $21,00 each;

3 8-in. gate valves,$15.00 each; 25 6-in. gate valves,$10 each; 16 4-in. gate valves, $6.00 each; 54 valve boxes, for above, $2.25 each; laying 5,904 ft. 10-in. pipe, 20 cts. a lin. ft.; 1,008 ft. 8-in. pipe, 18 cts. a lin. ft.; 11,640 ft. 6-in. pipe, 14 cts. a lin. ft.; 8,208 ft. 4-in. pipe, 12 cts. a lin. ft.; rock excavation in trenches, $2 a cu. yd.; furnishing and setting up two power pumps, $1,800; two gas engines, $1,700; pumping station, as per plans and specifications, $1,305; constructing impounding well, $708; furnishing and erecting steel stand-pipe and foundation, as per specifications, $2,235; connecting tubular wells with impounding well, $215. Total, $20,788. One engine and one pump were eliminated from the contract, also substituting 55-in. pipe for 60-in., made the reduction in total bid on proposal blank; total bid, $18,964.

INDUSTRIAL NOTES.

THE AMERICAN IMPULSE WHEEL CO., 120 Liberty St., New York, has the contract to furnish water wheels for the city lighting station, at Columbus, O.

THE WARREN-SCHARF ASPHALT PAVING CO., New York, is reported to have opened an office at 92 Sparks St., Ottawa, Ont., in charge of Mr. W. G. Mackendrick, Supt.

THE PACIFIC FLUSH TANK CO., Chicago, has removed its Canadian agency from Toronto to Niagara Falls, Ont. Mr. Victor Hill, P. O. Box 245, is the manager of this branch.

THE VIRGINIA BRIDGE & IRON CO., Roanoke, Va., has the contract for an 18-ft. roadway steel highway bridge, consisting of two 140-ft. spans on steel cylinder piers, over the Salunda River, Piedmont, S. C.

THE WELLS LIGHT MFG. CO., 44 and 46 Washington St., New York, reports a large number of shipments of its lights for use at fortifications, for coast defence, etc. The company has also made a large consignment of its lights to Cuba within the past few days.

THE DRESSEL RAILWAY LAMP WORKS, New York, has presented to the engineering laboratory of Purdue University, Lafayette, Ind., a complete outfit of locomotive lamps, consisting of a pair of engine classification lamps, one steam gage lamp and one water gage lamp.

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa., has received orders for 80 locomotives from the Russian government for the Manchurian Ry. in the nine weeks ending May 31, 1898, and within the previous six months orders were sent to the works for 138 locomotives.

THE BUSHNELL MFG. CO., Easton, Pa., manufacturers of car seats, spiral springs and car berths, is to have its plant sold at receiver's sale, Aug. 17, 1898, as stated in our advertising columns (page xviii.). Mr. Charles Hansel, 43 Cedar St., New York, is the Receiver and Manager.

JOHN F. O'ROURKE, 44 Broadway, New York, engineer and contractor, has received the contract for eight pneumatic caissons for the foundations of the new five-story residence for Mrs. Margaret L. V. Shepard, to be erected at 11 and 13 East 62d St., New York, at a cost of $75,000.

MR. CLARENCE LIVINGSTON BURGER,patent attorney and expert, has associated Mr. Louis B. Adams with him in the practice of patent and trade-mark law, under the firm name of Burger & Adams. The offices of the firm remain in the Postal Telegraph Bldg., 253 Broadway, New York, where Mr. Adams also continues the general practice of law.

THE SHERIDAN IRON CO., Reading, Pa., controlling two of the largest blast furnaces in Pennsylvania, according to report, has been organized, and the following officers elected: Pres., Mr. Thos. Sobarth, London, England.; Secy., Mr. Hugh Lienebeer, London, England; Mr. E. Bird Grubb, Philadelphia.

HUGHES BROS. & BANGS, Syracuse and New York, contractors for river and harbor work, are the owners of seven lighters and three tugs, all new, which the United States government is reported to have given notice that it intends to impress into the service for war purposes, to be used in landing supplies and troops.

THE INTERNATIONAL BRAKE SHOE CO., Chicago, reports that Mr. W. D. Sargent, its President, sailed for Europe last week to make arrangements for the manufacture of the Diamond "S" shoe in several European countries, including Russia. The success of the shoe since its introduction last fall has been little short of phenomenal, and few if any railway devices have been so thoroughly and consistently pushed on all occasions.

THE PITTSBURG BRIDGE CO., Pittsburg, has secured, through Mr. F. C. Black, Spartanburg, S. C., agent for North and South Carolina, the contract for a 105-ft. steel highway bridge over South Tiger River, near Duncans, S. C.

THE WROUGHT IRON BRIDGE CO., Canton, O., through its agents, Wynkoop & Braly, 1 and 3 Union Square, New York, has received the following contracts. New steel bridge at Whippany, near Morristown, N. J.; steel work for the new building of the New York Sugar Refinery Co., Brooklyn, N. Y., and seven steel bridges from the board of chosen freeholders, Flemington, N. J.

THE W. S. DICKEY CLAY MFG. CO., Kansas City, Mo., opened its new works for the manufacture of sewer and culvert pipe, etc., at Deepwater, Mo., June 27, replacing the plant destroyed by fire last August. The company's property at Deepwater consists of 320 acres of fine clay and coal lands, on which are located two plants, one devoted to the manufacture of sewer pipe and the other to that of building brick, unglazed tile, vitrified and fire brick. The new buildings are of brick, of the company's manufacture, and consist of a main building, 82 × 322 ft., four stories in height; an annex 97 ft. square of the same height, and a power building, 60 × 80 ft., with an iron truss roof, containing three 300-HP. Babcock & Wilcox boilers. The machinery is driven by a Hamilton-Corliss engine, and the plant is lighted by a Fort Wayne Electric Corporation dynamo, operated by a McAlfree high-speed engine. The building also contains two Worthington steam pumps taking water from an artificial lake, 30 ft. deep and several acres in extent, which gives a natural pressure for fire protection.

THE WALKER CO., Cleveland, O., has a contract from the Union Carbide Co., Chicago, consisting of twenty 500-HP. single phase, alternating current dynamos, to deliver a current of 2,500 amperes at 200 volts, and five 100-HP. direct current dynamos, as exciters, besides a complete switchboard for all of the dynamos. The plant will be installed at the falls at Sault Ste. Marie, Mich., where calcium carbide will be produced on the largest scale ever attempted. The Union Carbide Co. has acquired the rights of manufacture for the United States, it is stated, and will make the above its main works. They are being built to accommodate 40 dynamos and an equal number of electric furnaces, in which the lime and carbon are fused into calcium carbide.——On account of the rush of work and the consequent need of additional space, the company has found it necessary to add to the large machine shops at its Cleveland works. The machine shops alone consist of three bays each 400 ft. long and the addition will consist of a fourth bay. Work is being rapidly pushed and the new bay will be shortly completed and ready to receive the large machine tools that are to be placed there.

THE PELTON WATER WHEEL CO., San Francisco, Cal., reports a satisfactory business for the first half of this year. Stations for electric power transmission continue to be an important feature of the business of the company, and among its more recent contracts are the following: A 1,200-HP. plant to operate the Odawara Electric Ry., Japan; the wheel to run under 400 ft. head; 650 HP. to operate a cotton factory in Japan; 500 HP. for the Blue Lakes (Cal.) electric power plant; 300 HP. for the Auburn, Cal., station of the Central California Power Co.; 1,800 HP. for the Tuolumne (Cal.) Electric Power Co.; 750 HP. for the Griffith mine, Tuolumne, Cal.; 250 HP. for the Ventura (Cal.) Electric Light & Power Co.; 1,200 HP. for a British Columbia railway company; 250 HP. for the Salt Lake & Ogden Ry.; 300 HP. for the Farfan Electric Power Co., Peru; seven wheels for the California Powder Works, Santa Cruz, Cal.; four wheels to run air compressor plants in Alaska; nine wheels for various mining companies in Alaska and British Columbia; three wheels for Central America; seven wheels for various mining purposes in Mexico, and 13 wheels for similar purposes in Utah, Montana and Idaho.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, has just sold to the Manufacturers' Building Co.,Providence, R. I., a 250-K-W. 500-volt Westinghouse engine-type dynamo, running at 100 revolutions a minute, to be driven by an Armington & Sims Corliss engine, which will supply power for the operation of motors in the various manufacturing departments of the Manufacturers' building, said to be one of the largest and best equipped power buildings in the United States. The engineering features are under the direction of Lewis & Claflin,consulting engineers. The building has accommodations for upwards of 60 manufacturing concerns, being particularly equipped with conveniences for the production of jewelry, specialties, etc.——The company has installed a large amount of apparatus for the production of refined copper by electrolytic processes, one of the principal installations being at the refinery of the Anaconda Copper Co., Anaconda, Mont., where 10 dynamo of 270 to 300 K-W. capacity have been installed. Another large installation is that of the Boston & Montana Consolidated Copper & Silver Mining Co., Great Falls, Mont., where two 810-K-W. Westinghouse engine-type dynamos are in service.——The Raritan Copper Works, Perth Amboy, N. J., is about to erect a large copper refinery, and has contracted with the Westinghouse company for three 600-K-W. 150-volt engine-type dynamos, making 150 revolutions a minute, with a nine-section switchboard for electrolytic service, and the operation of two 75-K-W. 220-volt engine-type dynamos, which will be used for lighting and power service. This installation, it is stated, will be the most complete of its kind in the world.

NEW COMPANIES.—Long Island Sand Co., 76 Montgomery St., Jersey City, N. J.; $5,000, commencing with $1,080; to deal in all kinds of sand, stone, lime, etc.; Chas. P. Smith, Jersey City; W. J. Timberman, Maywood, N. J.; Lindley M. Franklin, Flushing (L. I.), N. Y.; Wm. E. R. Smith, East Orange, N. J.; E. B. Archer, Hackensack, N. J.

Daylight Glass Co., New York; $505,000, commencing with $600; to manufacture and deal in prismatic glass, etc.; G. K. Cummings, Fort Wadsworth, N. Y. H.; Richard Wagner, William Weterer, J. H. Steinhart and F. A. Ballard, all of New York.

Edgerton Press & Mfg. Co., Jersey City, N. J.; $100,000, commencing with $1,000; to manufacture presses for the treatment of tankage, etc.; Charles Edgerton, E. G. Maturin, Wm. W. Gooch, Horace J. Ettridge and Geo. C. Du Bois, all of 60 Grand St., Jersey City.

Pianophone Co., New York; $300,000, commencing with $50; to manufacture and deal in mechanical specialties; C. W. Youngman, J. R. Lowther, J. L. Schrader, E. G. Boltz and M. A. Jones, of New York.

Philadelphia Utilization Co., Philadelphia, Pa.; $100,000, commencing with $2,500; to manufacture fertilizers, lubricating greases, etc.; William Layer, Wm. H. Wade, Benjamin F. Howland and C. B. Livezey, all of Philadelphia; S. B. Schenck, Newark, N. J.

International Improved Combustion Co., Middlebury, Vt.; $3,000,000, commencing with $100; to manufacture and sell stoves, furnaces, etc.; Robert Cartmell, Allan Calhoun and Oliver Severance, all of Middlebury; C. R. Witherall, Cornwall, Vt.; Dr. J. S. Dodge, Lincoln, Vt.

West Virginia Grubber & Tool Co., Charleston, W. Va.; $100,000, commencing with $50; to manufacture and sell improved farming implements; G. W. Atkinson, U. S. Laidley, H. C. McWhorter, J. A. de Gruyter and Fred Gardner, all of Charleston.

Frank M. Pierce Engineering Co., New York; $10,000; Frank M. Pierce and Philo B. Tingley, New York; George F. Tremain, Hoboken, N. J.

National Boiler Works Co., Syracuse, N. Y.; $40,000; William M. Wood, Media, Pa.; Howard N. Babcock, Syracuse; H. T. Webb. Skaneateles; Robert Joy, Oswego.

Titian Steel Co., Chicago, Ill.; $500,000; Eugene E. Prussing, Frank H. McCulloch, Edward Bernman.

Chicago Portland Cement Co., Chicago, Ill.; $250,000; David R. Fraser, Norman Fraser, Ralph Bates.

Wheeler Compensating Motor Co., Louisville, Ky.; $25,000; to manufacture and sell engines, locomotives, etc., and a rotary compensating motor, patented by Mr. Wheeler; Robert Hewitt Wheeler, S. L. Mason, J. W. Seaton.

Austin Portland Cement Mfg. Co., Austin, Tex.; $50,000; to manufacture cement; E. G. Stolley, A. T. Rose, S. Silverman.

Litchfield Machine Co., Litchfield, Ill.; $50,000; to erect a plant for the manufacture of machinery; S. M. Grubbs, George W. Amsden, E. A. Amsden.

Joseph J. Gleason Co., New York, N. Y.; $10.000; to construct buildings upon property under the leases made by the Manhattan Ry. Co.; Joseph J. Gleason, Michael J. Drummond, William H. Huxley, Frederick D. Mason, New York

Seamless Metal Ware Co., New York, N. Y.; $150,000; to manufacture metal ware; E. G. Fabbri and Allessandro Fabbri, Scarborough, N. Y.; Adolphe E. Borie, Benoni Lockwood, Jr., and Edmund L. Zalinski, New York.

A. L. Sweet Iron Works, Medina, N. Y.; $200,000; Albert L. Sweet, L. M. Sweet, Arthur J. Howard, F. Marion Poler, Albert S. Braughton, Medina.

Stanton Mfg. Co., Portland, Me.; $1,000,000, commencing with $70; to manufacture and deal in machinery; Louis C. Stanton, Pres., Newton, Mass.; G. F. Cunningham, Treas., Boston, Mass.

Phoenix Foundry Co., Pittsburg, Pa.; $12,000; John Jackson, Allegheny; Peter Newlands, Harry Newlands, John P. Provost, Daniel Bingham, Pittsburg.

Southern Illinois Construction Co., East St. Louis, Ill.; Charles L. Gray, Frank L. Thrasher, William J. Eddinger.

Star Mfg., Chemical & Commercial Co., Syracuse, N. Y.; $100,000, commencing with $50; G. O. Chilton, Charles W. Smith, D. M. Black, E. H. Carwithen and H. H. White, Charleston, W. Va.

Bushnell Telephone Co., Chicago, Ill.; $5,000; Joel Lightner, E. E. Johnson, H. A. Cleveland.

International Construction & Improvement Co., Fort Smith, Ark.; $1,000,000; to construct railways, bridges, etc.; Jesse French, John L. French, John Dooley, St. Louis; H. D. Mackay, Ponoma, Mo.; J. S. Drake, Fort Smith.

Buffalo Telephone Co., Buffalo, Wyo.; $5,000; to construct and operate a telephone and telegraph line between Buffalo and Sheridan and other points; C. H. Parmelee, Robert Fotec, W. J. Thom and others.

Reserve Construction Co., Cleveland, O.; $10,000; to construct telephone, telegraph and railway lines and electric plants; S. Prentiss Baldwin, B. Mahler, James B. Hogg, Fred S. Barton and Charles W. Mason.

Oklahoma Telephone Co., Oklahoma City, Okla.; $100,000; to build, sell and operate telephones throughout Oklahoma territory; Harry C. Barter and George R. Gorden, Browningtou, Mo.; Wm. E. Moore and McGregor Douglass, Oklahoma City.

Illinois Telephone & Telegraph Co., Chicago, Ill.; $250,000; Ralph N. Bowman, Samuel N. McLaughlin and Thomas J. Holmes.

Mountain Home & West Plains Telephone Co., Mountain Home, Ark.; $5,000; C. W. Brown, Pres.; M. N. Dyer, B. E. Massey, R. C. Paul, W. F. Eatman and R. C. Love.

Monmouth Telephone Co., Monmouth, Me.; $10,000, with $250 paid in; to operate lines in Monmouth, Wayne and Litchfield; Pres., J. H. Gilman; Treas., H. M. Blake, Monmouth.

Atchison Telephone Co., Topeka. Kan.; $20,000; Ed H. Berry, C. D. Walker, George Storch, J. T. Hersey and S. A. Frazier.

Beverly & Marlinton Telephone Co., Huttonsville, W. Va.; $5,000; Perry Bosworth, J. L. Bosworth, of Huttonsville; A. S. Bosworth, of Beverly; T. C. Russell and C. A. Barlow, of Cricord.

Franklin Telephone & Telegraph Co., Philadelphia, Pa.; $40.000; Pres., D. K. Appenzellar; Secy., H. B. McNulty; Treas., Dr. David Maclay; T. M. Mahon, D. L. Grove, Isaac Lesher, W. I. Minick, John C. Gerbig, Dr. J. O. Skinner, Dr. R. W. Ramsey, A. N. Pomeroy, Alexander Stewart, H. E. Holtsizer, T. J. Kennedy, R. S. Smiley, A. S. Stover. W. C. Hull, John Zullinger, C. C. Gelwicks, Christian Brechbill.

Eastern Solar Gas Machine Co., New York; $100,000; to manufacture machinery for the use of acetylene gas; Walter C. Butler, Orange, N. J.; John U. May and Arthur J. Stewart, Cleveland, O.; J. Severin Charlesson, Calvin Tompkins, John De Witt Warner and Charles A. Wimpfheimer, New York.

Chase Carbide & Gas Generator Co., Portland, Me.; $300,000, commencing with $50; to generate and deal in acetylene gas; Pres., Louis C. Stanwood, Newton; Treas., Edward B. Hitchcock, Newton.

New York Kerosene Oil Engine Co., New York; $50,000; to manufacture kerosene oil, gas. steam and electrical engines and motors for marine and industrial uses; Feodor C. Hirsch, 606 East 134th St., and George R. Moran, New York; James W. Eaton, West Islip, (L. I.), N. Y.

Union Bridge Co., Trenton, N. J.; $1,800,000; to construct public works; Joseph Mayer, E. Ludlow Gould, Nathaniel Haven. Charles S. Smith, New York, and George A. Miller, Montclair.

California Dredging Co., San Francisco, Cal.; $25,000, commencing with $18,088; Wm. E. Palmer, Fred S. Mayhew, Fruitvale, Cal.; William M. Klink, Luther J. Holton, Frank B. Peterson and S. W. Cheyney, San Francisco; J. M. Goodman, Alameda, Cal.

Home Telephone Co., Marion, Ia.; $5,000; J. S. Alexander, Pres.; Geo. M. White, Vice-Pres.; F. C. Schminke, Secy.; T. J. Davis, J. S. Ovington, William M. Downie and C. L. Nye.

Eureka & Mound City Telephone Co., Eureka, Minn.; $2,000; F. W. Boettcher, Walter C. Poehler, Eureka; Louis H. Clyborne, Chauncey E. Eckhart, Mound City; Alvin H. Poehler, Minneapolis.

Montour & Columbia Telephone Co., Vanville, Pa.; $25,000; to run lines in Columbia and Montour counties; James H. McDevitt, C. M. Clement, Sunbury; R. K. Polk, F. C. Angle, E. Carman, C. P. Hancock, Danville; H. E. Murty and J. P. Helfenstein, Shamokin.

Missouri & Iowa Telephone Co., Princeton, Mo.; $25,000; J. S. Rogers, H. G. Orton, E. M. Hyde and others.

Winston Telephone Co., Princeton, Mo.; $1,000; G. Orton, J. B. Hyde, C. P. Rogers and others.

Wilson Mfg. Co., New York; $600; E. K. Baber, Keeseville, N. Y.; R. F. Wilson, East Orange, N. J.; R. E. Oatman, John Leighton and W. W. Tucker, of New York.

Huntington Mining Co., New York; $1,000; C. W. Bradley, G. H. Huntington and D. F. Lloyd, of New York; William Berden, Paterson, N. J.; and James H. Brown, Rutherford, N. J.

Hooker Steam Pump Co., St. Louis, Mo.; $30,000; J. E. Gorman, W. D. Hooker, W. C. Farrar and R. L. McLaren.

Overland Dry Concentrating Co., Lincoln, Neb.; $550,000; Ed. Bignell and Jesse S. Waugh, all of Lincoln; Eugene Waugh, Denver, Colo.

National Arc Lamp Co., Berwick, Me.; $10,000, commencing with $300; to manufacture and deal in electrical and other mechanical devices; Pres., C. C. Barton, Framingham, Mass.; Treas., John R. Hosmer, Boston, Mass.

Standard Quarrying & Construction Co., New York; $1,000,000; Walter J. Roberts, Henry E. Parsons and John F. Clark, New York; offices at Phœnix, Ariz., and New York.

Oklahoma Telephone Co., Oklahoma City, Okla.; $100,000; to build, own, buy, sell and operate telephone lines throughout Oklahoma territory; Harry C. Barter and Geo. R. Gorden, Brownington, Mo., Wm. E. Moore and McGregor Douglass, Oklahoma City.

M. S. Friede Co., New York; $20,000; to supply railway equipments; M. Sergery Friede, 18 East 106th St.; Jos. S. Friede and Harry Harris, all of New York.

Manning Signal Light Co., Des Moines, Ia.; $100,000; to manufacture and dispose of the Manning signal light, which Mr. Manning has invented and has patented with special adaptations to railway work; Edward S. Manning, H. J. Mills, Samuel Compton, C. A. Bishop, W. D. Sheehan.

Cuban Development Co., Jersey City, N. J., incorporated in West Virginia; $5,000,000, commencing with $2,500; to cultivate land in Cuba, and to construct railways, electric light plants, water-works, etc.; Carroll Burman, Washington, D. C.; Julian Cendoya, Bethlehem, Pa.; S. J. Dickerson, G. A. Denham and Raymond Moore, of New York.

Ashburnham Mfg. Co., Boston, Mass.; $1,000,000, commencing with $500; to manufacture railway cars and appliances, etc.; H. W. Bates, John D. Huhn and R. L. Stedman, of Boston; E. A. Petit and E. D. Luxton, of New York.

Feliz Sugar Co., New York; $500,000, commencing with $200; to manufacture and deal in sugar; Michael Dillon, Frederick Blasenbrey, Robert Wheelan, Morris Cooper and S. I. Kelton, all of New York.

Avor Brick Co., 76 Montgomery St., Jersey City, N. J.; $100,000, commencing with $2,000; to manufacture and work clay, metals, etc.; David P. Van Deventer, Jr., Alfred C. P. Quimby and Edward A. O'Collaghan, of 76 Montgomery St., Jersey City; August C. Rader, Montclair, N. J.

Hadaway Electric Heating & Engineering Co., New York; $50,000; Harold S. Mackaye, 225 West 106th St.; Harcourt Brigham and Nelson Hiss, all of New York.

The Circulation of ENGINEERING NEWS among Prominent Contractors Probably EXCEEDS that of any other FIVE PAPERS

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PERSONAL.

Mr. J. Foucart has been appointed City Engineer of Guthrie, Okla.

Prof. E. E. Lawson has opened an office in Dayton, Pa., as a civil engineer and surveyor.

Messrs. Benj. G. Ingalls, Chas. S. Haskell and M. V. B. Jones have been appointed Water Commissioners of Swampscott, Mass.

Mr. Albert E. Loomis has been appointed a member of the Board of Sewer Comissioners, of Oneida, N. Y., to succeed Mr. John V. Richardson, resigned.

Mr. Clifford Lewis, Jr., City Surveyor of Utica, N. Y., has resigned to accept the position of Inspector of Bridges on the Middle Division of the New York Central & Hudson River R. R.

Mr. Peter J. Nichols, General Superintendent of the Union Pacific R. R., with headquarters at Omaha, Neb., has been appointed General Superintendent of the Omaha Bridge & Terminal Ry., a newly created position.

Mr. Ernest W. Bowditch, Jun. Am. Soc. C. E., of 60 Devonshire St., Boston, Mass., has resigned his position as Consulting Engineer and Landscape Gardener of the Park Board of Cleveland, O., which he has held for the past five years.

Col. Charles S. Riche, of the First U. S. Volunteer Infantry, until recently First Lieutenant in the Corps of Engineers, U. S. A., stationed at Galveston, Tex., was married July 16 in that city to Miss Susan Horton Gadberry, of Denison, Tex.

Mr. Fingal C. Black, formerly County Engineer of Spartanburg county, South Carolina, has been commissioned a First Lieutenant in the Third Regiment of United States Volunteer Engineers and has been appointed enrolling officer, with headquarters at Spartanburg.

Col. George E. Waring, Jr., M. Inst. C. E., of New York city, has declined the position which it was stated in this column last week had been offered him, of Consulting Engineer and New York representative of the Dunning Engineering & Construction Co., of Scranton, Pa.

Messrs. Charles A. Schieren, Andrew H. Green, Hugh Kelly, Christopher C. Shayne and Alexander R. Smith, all of New York city, have been appointed by Governor Black as a commission to inquire into the decline of the commerce of that city and suggest legislation to foster its increase.

Mr. Walter C. Allen, Superintendent of Lamps, of Washington, D. C., has been appointed by the District Commissioners Chief Electrical Engineer of the District of Columbia, in charge of the fire alarm, telephone and telegraph systems, electrical conduits, electric railways, etc.

Mr. William L. Darling, M. Am. Soc. C. E., Division Engineer of the Northern Pacific Ry., with headquarters at St. Paul, Minn., has been appointed Assistant Chief Engineer of that railway, a new position. He will have jurisdiction over all lines east of Billings, Mont., with headquarters as heretofore.

Mr. Ferdinand W. Peck, of Chicago, Ill., has been appointed Commissioner-General to the Paris Exposition by President McKinley. He is a graduate of the University of Chicago, of which he is a Trustee, and was Chairman of the Finance Committee of the World's Columbian Exposition of 1898. He will establish his offices at once in the Auditorium Bldg., Chicago.

Mr. Harry C. Southworth, civil engineer, of Stoughton, Mass., was married July 11 to Miss Elizabeth Josephine Hill, of Dedham Centre, Mass. Mr. Southworth was a member of the railway commission on the abolition of the grade crossings on the New York, New Haven & Hartford R. R. Miss Hill has been for some time Supervisor of Drawing in the public schools of Lexington and Braintree.

Mr. Gaylord Thompson, M. Am. Soc. C. E., has been appointed by the common council of Rochester, N. Y., as expert engineer to assist the city assessors in the preparation of the assessment for the East Side trunk sewer, which was designed by Mr. Emil Kuichling, M. Am. Soc. C. E., about ten years ago, and was built by a special commission created for that purpose. It cost nearly $1,000,000, which amount, together with accumulated interest, has now to be assessed upon the territory benefited. Mr. Thompson recently completed the construction of the West Side trunk sewer, also built by a special commission, and which cost about $600,000. The first assessment for the latter sewer, made in 1893, was the subject of such bitter controversy that it was set aside by the legislature in 1895; the commission was reorganized, with Mr. Thompson as engineer, and a new assessment was made which has since met with general approval.

Mr. U. S. G. White, Civil Engineer, United States Navy, who has been recently tried by court-martial on the charge of culpable negligence in connection with the failure of the new Dry Dock No. 3 at the New York Navy Yard, Brooklyn, as stated in our issue of June 23, has been sentenced to be placed on furlough pay for three years and to retain his present position on the list of officers of the same rank, until he shall have lost two numbers. Mr. White was in temporary charge of the work during the absence of Mr. A. G. Menocal, M. Am. Soc. C. E., whose trial was referred to in our issue of June 9.

OBITUARY.

Mr. Richard J. Kessler, contractor, of Reading, Pa., died July 16, aged 43.

Mr. Jesse Hubbard, contractor, of Milwaukee, Wis., died July 22, aged 86.

Mr. F. H. Holly, Superintendent of Water-Works, of Paducah, Ky., died July 23.

Mr. Shepard Allen, railway contractor, of Birmingham, Ala., died July 21, aged 47.

Maj. Wilbur D. Fiske, of the Knowles Steam Pump Co. and the George F. Blake Mfg. Co., died at Melrose, Mass., July 20. He was a veteran of the Civil War, and for many years was a member of the Melrose Water Board, most of the time as its Chairman.

Mr. Ezekiel W. Woodward, civil engineer, died at his home in Tatham, Mass., July 19. He was born in Westmoreland, N. H., Dec. 4, 1828, and at the age of 17 began his career on the preliminary survey of the Cheshire R. R. in that state. He was employed as a rodman and assistant engineer until the early 50's, when he went to Cincinnati, O., and assisted in laying the first T-rail on the Little Miami Ry. He next served as Assistant Engineer of the location and construction of the Cincinnati, Hamilton & Dayton Ry. and on the surveys for the Dayton & Michigan R. R. In 1851 he became the Chief Engineer of the Cincinnati, Wilmington & Zanesville Ry., and in 1855, Superintendent of the Steubenvile & Indiana R. R. He made the surveys for the La Crosse & Milwaukee R. R., and on its completion entered the service of the Ohio & Mississippi R. R., later being advanced to the Superintendency of the Eastern Division. In 1860 he was appointed Superintendent of the Little Miami Ry., and in 1867 was elected President of the company. He held this office for a year, and then resigned to take part in the organization of the Cincinnati & Newport Bridge Co., and was Consulting Engineer for the bridge built by that corporation across the Ohio River at Cincinnati. He was elected President of the Indianapolis & St. Louis R. R. in 1871, and held the office until July, 1875. On Dec. 20, 1878, he was appointed Commissioner to sell the St. Louis Bridge & Tunnel Company's property, after which he was elected Vice-President of the reorganized company, and held the office until Oct. 8, 1881, when he retired from active business.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

WESTERN SOCIETY OF ENGINEERS.
Aug. 3. "Establishment of Street Grades," Chas. P. Chase. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

OHIO INSTITUTE OF MINING ENGINEERS.
Aug. 4. Summer meeting, Toledo, Ohio. Secy., Robert M. Hazeltine, Columbus, O.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Aug. 5. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Aug. 9. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

MONTANA SOCIETY OF ENGINEERS.
Aug. 13. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

ENGINEERS' CLUB OF MINNEAPOLIS.
Aug. 15. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Aug. 16. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Aug. 17. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

NEW ENGLAND ROAD MASTERS' ASSOCIATION.
Aug. 17. Annual meeting, Boston, Mass. F. C. Stowell, B. & M. R. R., Ware, Mass.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
Aug. 18 to 20. Annual meeting at Massachusetts Institute of Technology, Boston, Mass. Secy., Albert Kingsbury, Durham, N. H.

AMERICAN MATHEMATICAL SOCIETY.
Aug. 19-20. Annual meeting, Boston, Mass. Secy., F. N. Cole, Columbus University, New York city.

AMERICAN CHEMICAL SOCIETY.
Aug. 22-23. Annual meeting, Boston, Mass. Secy., Albert C. Hale, 551 Putnam Ave., Brooklyn, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Aug. 22-27. Annual meeting, Boston, Mass. Secy., F. W. Putnam, Salem, Mass.

GEOLOGICAL SOCIETY OF AMERICA.
Aug. 23. Annual meeting Boston, Mass. Secy., H. L. Fairchilds, Rochester, N. Y.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

ENGINEERS' CLUB OF MINNEAPOLIS.—A regular meeting of this club was held July 18, at which the report of the committee of the American Society of Civil Engineers on "Standard Specifications for Cement Testing" was considered.

ST. LOUIS RAILWAY CLUB.—The last meeting of this club was held June 25 on board the steam ferryboat "Andrew Christy." Mr. William H. Bryan read a paper entitled "Recent Improvement in St. Louis Ferries." The various improvements were inspected, the "Christy" carrying the party to and from the railway terminals.

THE AMERICAN INSTITUTE OF MINING ENGINEERS will hold its annual meeting at Buffalo, N. Y., commencing Oct. 18, 1898. The local committee of arrangements has been appointed from the Engineers' Society of Western New York, and communications may be addressed to the President of the Society and Chairman of the committee, Mr. W. C. Johnson, Niagara Falls, N. Y. Further particulars will be given in a later circular. An excursion, at reduced rates, to the Omaha Trans-Mississippi and International Exhibition will be organized at the close of the Buffalo meeting, provided that a sufficient number of members notify Secretary R. W. Raymond of their intention to join such an excursion.

AMERICAN STREET RAILWAY ASSOCIATION.—The following preliminary list of papers is announced by Secretary T. C. Pennington for the annual meeting scheduled for Boston, Sept. 6-9:

"Maintenance and Equipment of Electric Cars for Railways," M. S. Hotchkiss; "To What Extent Should Railway Companies Engage in the Amusement Business," W. H. Holmes; "The Carrying of United States Mail Matter on Street Railways," W. S. Dimmock; "The Comparative Earnings and Economy of Operation Between Single and Double Truck Cars for City Use," Richard McCulloch; "Inspection and Testing of Motors and Car Equipment by Street Railway Companies," Frederick B. Perkins; "Cost of Electric Power for Street Railways at Switchboard; Both Steam and Water," R. W. Conant.

NEW ENGLAND ROADMASTERS' ASSOCIATION.—The 16th annual convention of this association will be held at Boston, Mass., Aug. 17-18, with headquarters at the Revere House. It is desired that those wishing to exhibit models or samples of railway apparatus notify the secretary, Mr. F. C. Stowell, on or before Aug. 14.

The following topics will be discussed and later reported upon by committees:

Minimum and maximum opening at ends of rails in their renewal: length of rails: diameter of bolts and holes in rails and joint bars; number and position of bolts and slots used.

Switch targets: Shall they be double or single, i. e.: Shall they show or not show a target for main line? Should not switch targets for main line switches be differently colored than targets for sidetrack switches?

What is the best wood for railroad ties: at what season of the year should it be cut for the best preservation of the timber? What advantages, if any, have metal ties over wood?

Should gage of tracks be widened on curves? If so, what should be rate of increase per degree of curvature and what the maximum limit of increase? What is the best method of preventing rails from creeping?

The use of cast or wrought-iron pipe for replacing box culverts. How large pipe can be used with safety: the greatest as well as the least amount of material advisable top of pipe. Cost compared with first and second-class masonry.

Mr. F. C. Coates, N. Y., N. H. & H. R. R. will read a paper on "Recent Experiments in Tamping Ties by Compressed Air."

F. C. Stowell, Secy.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE: Mechanical Science and Engineering Section.—The following is the preliminary programme of this section as given out by Prof. John J. Flather, Lafayette, Ind., who is acting secretary. The regular secretary, Prof. W. S. Aldrich, is at present on the U. S. repair ship "Vulcan:" "High-speed Influence Machines," Chas. W. Warner, Cambridge, Mass.; "The Development of the Topographic Work of the United States Geological Survey and its Application to the Solution of Economic and Engineering Problems," Charles D. Walcott, Washington, D. C.; "Instruments and Methods of Hydrographic Measurements used by the United States Geological Survey," F. H. Newell, Washington, D. C.; "Proposed Methods of Determining the Frequency of Alternating Currents," Carl Kinsley, Falls Church, Va.; "On the Efficiency of Refrigerating Plants," Prof. Storm Bull, Madison, Wis.; "Some Experiments on a New Form of Impact Testing Machine," Prof. W. K. Hatt, Lafayette, Ind.; "On a Dynamometer Car and Its Equipment," Prof. L. P. Breckenridge, Champaign, Ill.; "An Integrating Dynamometer for Measuring the Work Done in Drawing a Train," Prof. Thomas Gray, Terre Haute, Ind.; "A Combined Absorption and Transmission Dynamometer for Laboratory Purposes," Prof. J. J. Flather, Lafayette, Ind.; "On the Measurement of Train Resistance by Dynamometer," Prof. F. C. Wagner, Terre Haute, Ind.; "On the Use of Platinum Resistance as a Pyrometer in Boiler Tests," Prof. F. C. Wagner, Terre Haute, Ind.; "A Comparison of the Efficiency of the Rheostat and the Series-Parallel Controller for Electric Cars," Prof. Thomas Gray, Terre Haute, Ind.; "Note on a Curious Example of Elastic Eolotropy in Steel," Prof. Thomas Gray, Terre Haute, Ind. Other papers will be presented, the subject of which will be announced later.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.—The program for the 6th annual meeting of this society to be held Aug. 18-20 in Boston, Mass., has just been announced. The meetings will be held at the

Massachusetts Institute of Technology, Room 22 Walker Bldg. During the three days the following papers will be presented:

Aug. 18: Address, President John B. Johnson; "The Mutual Adjustment of Class-room and Laboratory Instruction, Gaetano Lanza; "The Mounting of a Spherical Blackboard," A. E. Haynes; "Notes on the Organization of an Engineering Laboratory," H. B. Smith; "The Correct Theory and Method of Organization and Conduct of Professional Schools," R. H. Thurston; Report of the Committee on Entrance Requirements, H. W. Tyler, Chairman.

Aug. 19: "Some Phases of Engineering Education in the South," J. J. Wilmore; Report of the Committee on Uniformity of Symbols, T. C. Mendenhall (Chn.); "The Study of Electricity in Courses Other than Electrical," J. P. Jackson; "A Course in Industrial Chemistry for Technical Schools," F. L. Dunlap; "A New Laboratory Apparatus for Illustrating Longitudinal Impact," W. K. Hatt; "The Direct Study of Thermodynamics," S. A. Reeve; "Laboratory Instruction in Electrical Engineering," R. B. Owens; "A Course in Highway Engineering for Civil Engineers," W. R. Hoag; 'Notes on Some Methods in Use in an Engineering Laboratory," F. C. Caldwell.

Aug. 20: "Sanitary Science as a Part of Every Science Course," W. T. Sedgwick; "The Conduct of Thesis Work," Edgar Marburg; "The Construction of Models by Students as an Aid in Teaching Descriptive Geometry," H. S. Jacoby; "The Training of Engineers for the Maintenance of Way Department on Railroads," J. C. Nagle.

The sessions will be held mornings and evenings, leaving the afternoons free for excursions or trips of inspection. Election of officers, appointment of committees and other general business will take place at the close of the last session.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION.—The second annual convention of this association was held June 21 at the Cliff House, San Francisco, Cal. The first session, beginning 2.30 p. m., was executive, during which the various reports were read and acted upon, new members were elected, and the following officers were selected for the ensuing year:

President, W. Frank Pierce, Pres. of the Blue Lakes Water Co.; Vice-President, Carroll N. Beal, Secy. and Treas. of the Power Development Co.; Secretary, Geo. P. Low, editor and proprietor of "The Journal of Electricity;" Treasurer, William Angus, Secy. of the Standard Electric Co., of California; Executive Committee, the officers named, and Dr. C. Van Nordon, Pres. Central California Electric Co.

In opening the convention proper the president briefly stated the objects of the society which bore the same relation to the Pacific Coast electrical interests that the National Electric Association does towards Eastern electric companies.

The first paper, "Random Notes on Extremely High Potentials," by Leon W. Bly, was read by the secretary in the absence of the author. This was a brief review of some of the experiments with practical high tension transmission during the last two years and a statement of the conclusions to be drawn. These dealt mainly with the construction and insulation of the transformers and in a few words are: that manufacturers will guarantee transformers for services up to 60,000 volts, but 35,000 may be selected as a present safe limit. In very high tension work high efficiency is obtained by a sacrifice of insulation or regulation qualities; oil is an indispensable medium for insulation; a very high safety factor must be used in designing; in bringing out terminals the greatest care must be observed, and high tension coils should be subdivided and properly spaced.

In all apparatus, such as switches, instruments, etc., a liberal space allowance must be made to prevent arcing.

In transmission circuits the pin and insulator should be considered an integral part, and while iron pins add strength they are a constant invitation to puncture. Capacity on high potential lines is receiving more attention, and while this could be balanced by reactance such a remedy affected the regulation of the line. The discussion which followed was practically all opposed to the author's recommendation of the use of oil, it being stated that air blast types of transformers were the most satisfactory and easiest repaired.

The fact, not heretofore properly considered, that the insulation materials used in transformer construction are subject to a somewhat rapid deterioration under the continuous strain of actual work was pointed out.

At the evening session a paper "On the Electrical Operation of Centrifugal Pumps," prepared by Mr. John Richards, was read by Mr. Robert McF. Doble. This was a description of a plan submitted to the Drainage Commission of New Orleans, La. In a letter contributed by the author and read in connection with the paper, was given the following table, which he employs in designing centrifugal pumps. This table shows that the common opinion that these pumps can only be designed for a constant head is a mistake. From the table it will be seen that a pump running at a constant speed may operate at any head over a considerable range:

Head to produce the flow, ft.	Flow in ft. per minute.	Discharge, galls. per in. of area.
0.5	240	12
0.6	300	15
0.75	360	20
1.0	480	25
2.0	600	31
2.5	720	37
4.0	900	46
7.0	1,200	62

NEW PUBLICATIONS.

THE RELATION OF WATER TO TYPHOID FEVER.—A Lecture Delivered Before the Faculty and Students of the Ohio State University, Columbus, O., Feb. 7, 1898, and in Part Before the Denver and Arapahoe County Medical Society, Denver, Colo., March 8, 1898. By John W. Hill, C. E., Cincinnati, O. Printed for private circulation. Paper; 6 × 9 ins.; pp. 32; tables.

This pamphlet makes available Mr. Hill's latest ideas and information on this important subject. It contains much interesting and valuable material.

NEW TESTS OF CERTAIN PUMPS AND WATER LIFTS USED IN IRRIGATION.—By Ozni P. Hood, Professor of Mechanics and Engineering at the State Agricultural College, Manhattan, Kan. No. 14, Water Supply and Irrigation Papers of the U. S. Geological Survey, Chas. D. Walcott, Director, Washington, D. C. Address the Director or Members of Congress. Paper; 6 × 9 ins.; pp. 89; one plate and 58 figures in the text; tables.

The first part of this pamphlet consists of descriptions of various types of simple lift pumps. Following this are descriptions and the results of tests of the Mark, Frizell, Van Voorhis and Cook pumps, and a discussion of the resistance to rotation offered by various crank-driven pumps. After this a few bucket and other forms of water lifts are described. The whole is amply illustrated and appears to be clearly written.

SANITARY CONVENTION at Detroit, Mich., Dec. 9 and 10, 1897. Supplement to the Report of the Michigan State Board of Health for the Year 1898. Paper; 6 × 9 ins.: pp. 160. Henry B. Baker, Secretary, Lansing, Mich.

Among the papers in this pamphlet the following may be named: "Streets and Alleys and Their Relation to the Public Health," by John McVicar, Detroit; "Typhoid Fever and the Water Supply of Detroit," by Gardner S. Williams, Detroit; "Bicycling, from Social, Business and Healthful Standpoints," by Theo. R. MacClure, Lansing. The paper by Mr. Williams contains a very interesting account of an abnormal increase in the deaths from typhoid fever in Detroit in 1892, which he believes was connected with dredging near the outlets of the sewers of Port Huron and dumping the material removed in the St. Clair River. Estimates indicate that the time required for the infected river water to flow to Detroit would be from 6 to 12 days. The number of deaths from typhoid fever in Detroit in 1892 was 209, or 19.9 per 10,000 living. In the other eight of the nine years from 1889 to 1897, inclusive, the greatest number of deaths occurred in the year following the outbreak named, being 97, or 3.95 per 10,000. In 1897 only 31 deaths, or 1.1 per 10,000, were reported.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins.. and 9 x 12 ins.)

STEAM AND HYDRAULIC PACKING.—La Favorite Rubber Mfg. Co., Paterson, N. J. Pamph.; 4¾ × 7½ ins.; pp. 31.

A descriptive list of rubber compound packings for boilers, pipes, etc., and other rubber specialties.

SMALL ENGINES AND BOILERS.—Sipp Machine Works, Paterson, N. J. Pamph.; 6 × 9 ins.; pp. 40.

Engines and boilers from ¼ to 2 HP. are illustrated in this catalogue; also castings for model engines for amateurs, students, etc. The Weed gas engine, and the Weed water motor are also illustrated.

MOTOR SUSPENSION—THE PATENT SITUATION.—The Walker Co., Cleveland, O.

The circular describes the points of difference between the General Electric method of suspending motors on electric cars and that of the Walker Co., with special reference to the patent litigation between the two companies.

PUMPING ENGINES.—Battle Creek Steam Pump Co., Battle Creek, Mich. Paper; 6½ × 7¼ ins.; pp. 12 and 4.

The larger of these pamphlets contains a description of the Marsh deep-well engine, with lists of sizes and prices, and tables of capacity. The smaller pamphlet describes the Marsh sinking pump for sinking or recovering shafts and for general mining work.

BALDWIN LOCOMOTIVE WORKS.—Burnham, Williams & Co., Philadelphia, Pa.; pamph, 9 × 6 ins.; pp. 32; illustrated.

This pamphlet contains a brief description of the Baldwin Locomotive Works, illustrated by numerous half-tone engravings from photographs taken in and about the offices and shops.

ELECTRIC RAILWAY MOTOR SUSPENSION CASE.—Pamph.; 6 × 9 ins.

This pamphlet gives the full text of Judge Buffington's opinion in the case of the Sprague Electric Railway & Motor Co. vs. The Steel Motor Co., filed in the U. S. Circuit Court, Western District of Pennsylvania, July 12, 1898.

GRAPHITE AS A LUBRICANT.—Joseph Dixon Crucible Co., Jersey City, N. J. Pamph.; 5 × 7 ins.; pp. 32.

The contents of this pamphlet are chiefly the same as those of the 1897 edition, with a few additions. One of them is an account of the use of graphite for lubricating gas engine cylinders, and another describes an oil pump for feeding graphite into cylinders.

CHAPSAL'S PATENT ELECTRO-PNEUMATIC BRAKE.—The Miller, Du Brul & Peters Mfg. Co., 507 East Pearl St., Cincinnati, Ohio.

This pamphlet describes a French invention, consisting of an electric attachment to any ordinary air brake, by means of which the valves are operated by electricity. It is said that this invention is meeting with some favor on French railways, which is another example of the fondness for complicated machinery which is a noticeable feature of French mechanical engineering. We feel entirely safe in saying that no American railway manager could be induced to add the complications of electric attachments of any sort whatever to the air brakes on his rolling stock.

AIR COMPRESSORS.—The Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York. Catalogue No. 32. Pamph.; 6 × 9 ins.; pp. 96.

This is an illustrated description, with lists of sizes, etc., of the air compressors built by this well-known firm. It contains much useful information on compressed air, which should be in the hands of every engineer who is interested in the subject.

ELECTRIC MINE HAULAGE.—Baldwin Locomotive Works and the Westinghouse Electric Mfg. Co., Philadelphia, Pa., or Pittsburg, Pa. Pamph.; 6 × 9 ins.

This is a neat pamphlet, briefly describing a new form of electric locomotives for mine service in which a number of improvements have been introduced. A table is included giving the general dimensions for sizes from 20-HP. to 150-HP.

HYDRAULIC MACHINERY.—Chambersburg Engineering Co., Chambersburg, Pa. Catalogue No. 23. Pamph.; 6 × 9 ins.; pp. 16.

The machinery illustrated in this catalogue comprises hydraulic cranes, accumulators and riveters, in different styles. The company makes a specialty of designing and building special machines to order, and also builds steam engines of several kinds.

GASOLINE LEAD-MELTING FURNACE.—Wm. E. Virtue, 59 Pennsylvania Ave., Newark, N. J. Paper; 3½ × 6 ins.; pp. 6; illustrated.

This pamphlet describes a lead-melting pot mounted above a gasoline burner. The furnace is made in several sizes. Convenience and economy of time and fuel are claimed for the device, which is said to be in use in Newark, Washington and other cities.

GASOLINE ENGINES.—Waterous Engine Works Co., St. Paul, Minn. Pamph.; 9 × 6 ins.; pp. 19.

The engine described in this catalogue is of the horizontal type. It is built in many sizes. A combined gasoline engine and pump is illustrated, the pump being driven from the engine shaft through spur gearing. A gasoline fire engine is also shown. It appears to be suitable for the fire service of small villages.

CENTRIFUGAL PUMPS.—The Lawrence Machine Co., Lawrence, Mass. Catalogue No. 8. Pamph.; 8 × 5 ins.; pp. 48.

This pamphlet contains lists of centrifugal pumps in a variety of styles, both vertical and horizontal, driven by belt, steam engine or electric motor. Sies up to 60 ins. are listed. On the cover the word pumps is spelled pvmps. This fad of using a V for a U should be left to the architects, and they ought to be ashamed of it.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
July 28.	Electric light plant,	Gaylord, Minn.	July 21
	Advertised, Engineering News, July 21.		
July 28.	Street railway,	Plymouth, Mass.	July 21
July 28.	Sewers,	North Braddock, Pa.	July 21
July 28.	Stone flag, etc.,	Brooklyn, N. Y.	July 21
July 28.	Pipe sewers,	New York, N. Y.	July 21
July 28.	Iron sewer pipe, etc.,	London, Ont.	July 21
July 28.	Water mains,	New York, N. Y.	July 21
July 28.	Cleaning paved streets,	Buffalo, N. Y.	July 21
July 28.	Iron bridge,	New Philadelphia, O.	July 21
July 28.	Masonry work,	Louisville, Ky.	June 30
	Advertised, Eng. News, June 30 to July 21.		
July 28.	Water pipe, hydrants, etc.,	Renovo, Pa.	July 14
	Advertised, Eng. News, July 14 and 21.		
July 28.	Electric light plants,	Syracuse, N. Y.	July 28
July 28.	Asphalt paving,	Peoria, Ill.	July 28
July 28.	Granite paving,	Lewiston, Me.	July 28
July 28.	Pipe sewers,	Reading, Pa.	July 28
July 28.	Sewers,	Lima, O.	July 28
July 28.	Asphalt sidewalks,	Riverton, N. J.	July 28
July 28.	Artificial curb, etc.,	Minneapolis, Minn.	July 28
July 29.	Brick paving,	Laporte, Ind.	July 28
July 29.	Ditch,	Lafayette, Ind.	July 28
July 28.	Hospital building,	Atlanta, Ga.	July 28
July 29.	Superstructure,	Woodsfield, O.	July 28
July 29.	Hospital building,	Cleveland, O.	July 14
July 29.	Pike road,	Spencer, Ind.	July 14
July 29.	Sluice gates,	Cincinnati, O.	July 7
	Advertised, Eng. News, July 7 to 21.		
July 29.	Pine timber,	New York, N. Y.	July 21
July 29.	Viaduct,	Chicago, Ill.	July 21
July 29.	Sewers,	Omaha, Neb.	July 21
July 29.	Telephone system,	Mankato, Minn.	July 21
July 29.	Addition to school,	Buffalo, N. Y.	July 21
July 29.	Grading, etc.,	Richmond, Ind.	July 21
July 29.	Paving,	Omaha, Neb.	July 21
July 30.	Sewer system, disposal beds,	Flemington, N. J.	July 21
	Advertised, Eng. News, July 21 and 28.		
July 30.	Pipe sewers,	Aurora, Ind.	July 21
July 30.	Bridge,	St. Hermenegilde, Que.	July 21
July 30.	Brick paving,	Ashland, O.	July 7
	Advertised, Eng. News, July 7 and 14.		
July 30.	Iron bridge,	Cincinnati, O.	July 7
July 30.	Buildings,	Ellis Island, N. Y. H.	July 14
July 30.	Court house and jail,	Cando, N. Dak.	July 14
July 30.	School building,	Provo City, Utah	July 14
July 30.	School building,	Elbowoods, N. Dak.	July 14
July 30.	Electric lighting,	Washington, D. C.	July 14
	Advertised, Engineering News, July 14.		
July 30.	Sewers,	Winthrop, Mass.	July 28
July 30.	Bridge repairs,	Ukiah, Cal.	July 28
July 30.	Bridge,	Northfield, Mass.	July 28
July 30.	Stand-pipe foundation,	Newburyport, Mass.	July 28
July 30.	Brick paving,	Jamestown, N. Y.	July 28
July 30.	Cedar block paving,	Detroit, Mich.	July 28
July 31.	Brick paving,	Independence, Kan.	July 14
July 31.	**Water supply,**	**Tangier, Morocco**	**June 23**
July 31.	Street bonds,	Canton, O.	July 21
Aug. 1.	Macadamizing, etc.,	Suffield, Conn.	July 21
Aug. 1.	Pipe sewers,	Elizabeth, N. J.	July 21
Aug. 1.	School bonds,	Taylorsville, Ill.	July 21
Aug. 1.	Lighthouse,	New Haven, Conn.	July 21
	Advertised, Eng. News, July 21 and 28.		
Aug. 1.	Street bonds,	Berea, O.	July 21
Aug. 1.	Jail building,	Richfield, Utah	July 21
Aug. 1.	Asphalt paving,	Buffalo, N. Y.	July 21

Aug. 1. Water pipe, etc., Rock Island, Ill. ....July 14
Aug. 1. Bridge, Centralia, Wash. ....July 21
Aug. 1. Bridges (3), Chehalis, Wash. ....July 21
Aug. 1. Bridges (200 ft.), Claquato, Wash. ....July 21
Aug. 1. Electric light plant, Charleston, S. C.......June 30
Advertised, Eng. News, June 30 to July 21.
Aug. 1. Power canal, Ellensburg, Wash. ....June 30
Aug. 1. Jail building plans, Syracuse, N. Y.........July 7
Aug. 1. Steel bridge, Stockton, Mo. ....July 7
Aug. 1. Iron bridges (3), Wichita, Kan. ....July 7
Aug. 1. School building, Bloomfield, N. J...........July 14
Aug. 1. Steel bridge, Lake Belt, Minn................July 14
Aug. 1. Pile bridges (3), Red Cloud, Minn. ....July 14
Aug. 1. Boilers, heaters, etc., Concord, Mass........July 14
Advertised, Engineering News, July 14.
Aug. 1. Macadamizing, Toledo, O.......................July 14
Aug. 1. Macadam road, Proviso, Ill...................July 14
Aug. 1. Asphalt paving, Rockford, Ill..................July 28
Aug. 1. Pipe sewers, Belfast, Me. ....July 28
Aug. 1. Pipe sewers, Jersey City, N. J...............July 28
Aug. 1. Sewers, Kane, Pa. ....July 28
Aug. 1. Bridge, Martinez, Cal. ....July 28
Aug. 1. School building, London, Ont. ....July 28
Aug. 1. Fire hose, Troy, N. Y. ....July 28
Aug. 1. Stop cocks, lead, etc., Jersey City, N. J. ....July 28
Aug. 1. Brick paving, Burlington, Ia. ....July 28
Aug. 1. Cedar block paving, Chicago ....July 28
Aug. 1. Court house bonds, Paterson, N. J. ....July 28
Aug. 1. Macadam paving, Janesville, Wis...............July 28
Aug. 1. Paving, Rochester, N. Y. ....July 28
Aug. 1. School building, Heyworth, Ill...............July 28
Aug. 1. Steam heating, Danville, Ill. ....July 28
Aug. 1. School building, Spokane, Wash. ....July 28
Aug. 1. Water pipe, etc., Braddock, Pa. ....July 28
Aug. 1. Water-works, Blair, Wis. ....July 28
Aug. 1. Macadamizing, etc., White Plains, N. Y....July 28
Aug. 1. Paving, curbing, etc., Jersey City, N. J.....July 28
Aug. 1. School building, Logansport, Ind. ....July 28
Aug. 1. Road bonds, Paterson, N. J. ....July 28
Aug. 2. Cable bridge, Auburn, Cal....................July 28
Aug. 2. Sidewalks, etc., White Plains, N. Y. ......July 28
Aug. 2. Iron bridges (3), Paterson, N. J....s.........July 28
Aug. 2. Brick sewers, Springfield, Mass. ....July 28
Aug. 2. Pipe sewers, Plattsburg, N. Y. ....July 28
Aug. 2. Sewers, Bayonne, N. J. ....July 28
Aug. 2. Pipe sewers, Waverly, Ia......................July 28
Aug. 2. Addition to school, Jackson, Miss. ....July 28
Aug. 2. Brick paving, Kewanee, Ill. ....July 21
Advertised, Engineering News, July 21.
Aug. 2. Bridge work, Oregon, Mo. ....July 28
Aug. 2. Power house, Portsmouth, N. H. ....July 28
Aug. 2. Electric light plant, Lansdale, Pa. ....July 28
Aug. 2. Ladder truck, Cincinnati, O. ....July 28
Aug. 2. Water mains, etc., Albany, N. Y. ....July 28
Aug. 2. Water-works, Baldwin, Ia. ....July 28
Aug. 2. Water-works bonds, Cincinnati, O. ....July 28
Aug. 2. Steam heating, Hartwell, O. ....July 14
Aug. 2. Dredging, Lorain, O. ....July 14
Advertised, Eng. News, July 14 and 21.
Aug. 2. Bonds, Holly Springs, Miss. ....July 7
Aug. 2. Road work, Anaconda, Mont. ....July 7
Aug. 2. Arc lighting, Lebanon, Pa.....................June 30
Aug. 2. Steel rails, Ottawa, Ont. ....June 16
Aug. 2. Bridge, Lodi, Cal. ....July 21
Aug. 2. Electric light plant, Indianapolis, Ind. ......July 21
Aug. 2. City hall, Centralia, Ill. ....July 21
Aug. 2. Repairing asphalt, etc., Brooklyn, N. Y.....July 21
Aug. 2. Pipe sewer, Wallingford, Conn. ....July 21
Advertised, Eng. News, July 21 and 28.
Aug. 2. Wharf, Point Wilson, Wash. ....July 21
Aug. 2. Electric light plant, Yale, Mich. ....July 21
Advertised, Engineering News, July 7.
Aug. 2. Y. M. C. A. hall, Waterloo, Ia. ....July 21
Aug. 2. Pumping station, Albany, N. Y. ....July 21
Advertised, Engineering News, July 21.
Aug. 2. Paving cement, New York, N. Y. ....July 21
Aug. 2. Bridge, Bloomfield, Cal. ....July 21
Aug. 3. Levee work, West Memphis, Ark............June 30
Advertised, Eng. News, June 30 to July 28.
Aug. 3. Paving, etc., Cincinnati, O. ....July 14
Aug. 3. Electric light plant, London, Ont. ....July 14
Advertised, Eng. News, July 14 and 21.
Aug. 3. Hoist bridge, Sidney, O. ....July 21
Aug. 3. Dredging, Norfolk, Va. ....July 28
Aug. 3. Fire engines and boilers, Chicago, Ill. .....July 28
Aug. 3. Special castings, Chicago, Ill. ....July 28
Aug. 3. Brick paving, etc., Wilkinsburg, Pa. ....July 28
Aug. 3. Bridges (4), Arbuckle, Cal. ....July 28
Aug. 3. Bridge repairs, New Brunswick, N. J.....July 28
Aug. 3. Granite block paving, Charleston, S. C....July 28
Aug. 3. Hose wagon, Leavenworth, Kan. ....July 28
Aug. 3. Jail building, Toledo, O. ....July 28
Aug. 4. Electric railway franchise, Plainfield, N. J. .July 28
Aug. 4. Bridge, Urbana, Ill. ....July 28
Aug. 4. Paving bonds, Carlsbadt, N. J...............July 28
Aug. 4. Bridge, Goldendale, Wash. ....July 28
Aug. 4. Hospital building, Lockport, N. Y...........July 28
Aug. 4. Bridge bonds, Jersey City, N. J. ....July 28
Aug. 4. Substructure, Brooklyn, N. Y. ....July 28
Aug. 4. Dam, tunnel, etc., Ogden, Utah. ....July 21
Advertised, Engineering News, July 21.
Aug. 4. Addition to court house, York, Pa...........July 21
Aug. 4. Water pipe, Cattaraugus, N. Y. ....July 21
Aug. 5. Pier, Cleveland, O. ....July 14
Aug. 5. Engines (2), Concord, Mass. ....July 28
Advertised, Engineering News, July 28.
Aug. 5. Sewers, grading, etc., Wilmington, Del.....July 28
Aug. 5. Court house, Portland, Ore. ....July 28
Aug. 5. Arch bridge, Springfield, Tenn. ....July 28
Aug. 5. Hospital building, Zumbrota, Minn. ....July 28
Aug. 5. Levee work, Desha county, Ark. ....July 28
Aug. 5. Roadway (2,000 ft.), Ridgway, Pa. ....July 28
Advertised, Engineering News, July 28.
Aug. 6. Bridge bonds, Brattleboro, Vt. ....July 28
Aug. 6. Ditch, Kenton, O. ....July 28
Aug. 6. Drainage ditch, Arthur, Ill. ....July 28
Aug. 6. Tile and excavating, Champlaign, Ill. ......July 28
Aug. 6. Street work, Mansfield, O. ....July 14
Aug. 6. Dike, York River, Va. ....July 7
Advertised, Eng. News, July 7 to 28.
Aug. 6. Bridge work, Olympia, Wash... ....July 21
Aug. 6. Dredging, etc., Virginia. ....July 7
Advertised, Eng. News, July 7 and 14.
Aug. 8. Sewers, Toledo, O. ....July 21
Aug. 8. School building, Peterson, Utah.............July 21
Aug. 8. Street bonds, Lima, O. ....July 21
Aug. 8. Paving, Toledo, O. ....July 21
Aug. 8. Street work, Lafayette, Ind. ....July 21
Aug. 8. Water pipe, etc., Winnipeg, Man. ....June 16
Advertised, Eng. News, June 16 to 30.
Aug. 8. Brick paving, Anderson, Ind. ....July 14
Aug. 8. Repairing asphalt, Cincinnati, O. ....July 14
Aug. 8. Bridge, Salem, Mass. ....July 28
Aug. 8. Grading, etc., Salem, Mass. ....July 28
Aug. 8. Asphalt paving, New Orleans, La. ....July 28
Aug. 8. Pipe sewer, Latrobe, Pa. ....July 28
Aug. 8. Pipe sewers, Montclair, N. J. ....July 28
Aug. 8. Plans for high schools, Wilmington, Del...July 28
Aug. 8. School bonds, Anaconda, Mont. ....July 28
Aug. 9. Brick paving, Schenectady, N. Y...........July 28
Aug. 9. Iron bridges (9), Alma, Neb. ....July 28
Aug. 9. Bridge work, Jackson, Miss. ....July 28
Aug. 9. Excavation, Boston, Mass. ....July 28
Advertised, Eng. News, July 28 and Aug. 4.
Aug. 9. Pipe laying, Boston, Mass. ....July 28
Advertised, Eng. News, July 28 and Aug. 4.
Aug. 9. Street work, Orrville, O. ....July 14
Aug. 9. Torpedo boats, Washington, D. C...........July 7
Aug. 9. Furniture, Binghamton, N. Y. ....July 21
Advertised, Eng. News, July 21 and 28.
Aug. 10. Bridge, Batavia, O. ....July 21
Aug. 10. Iron truss bridge, Cincinnati, O. ....July 21
Aug. 10. Bridge masonry work, Norristown, Pa.....July 14
Aug. 10. Water-works, Pomeroy, O. ....July 14
Advertised, Engineering News, July 14.
Aug. 10. Macadamizing, Cincinnati, O. ....July 14
Aug. 10. Grading, curbing, etc., Spokane, Wash. .....July 28
Aug. 10. Bonds, Newark, N. J. ....July 28
Aug. 10. Sewers, Norfolk, Conn. ....July 28
Advertised, Eng. News, July 28 and Aug. 4.
Aug. 10. Electric light plant, Shanghai, China.......July 28
Aug. 10. Macadam paving, Rockville, Md. ....July 28
Advertised, Engineering News, July 28.
Aug. 11. Brick paving, curb, etc., Alexandria, Va. ..July 28
Advertised, Eng. News, July 28 and Aug. 4.
Aug. 11. School building, Springfield, Mass. ....July 28
Aug. 12. Bridge masonry, Butler, Pa. ....July 28
Aug. 12. Brick paving, Olean, N. Y. ....July 28
Advertised, Engineering News, July 28.
Aug. 12. Steam pump, Salem, N. J. ....July 28
Advertised, Eng. News, July 28 and Aug. 4.
Aug. 12. Water filter plant, Salem, N. J.............July 28
Advertised, Eng. News, July 28 and Aug. 4.
Aug. 12. Art building addition, Des Moines, Ia. .....July 21
Aug. 13. Pipe sewer, Ashtabula, O...................July 28
Advertised, Engineering News, July 28.
Aug. 13. Brick paving, Chillicothe, O. ....July 28
Advertised, Engineering News, July 28.
Aug. 13. Brick paving, Lancaster, O. ....July 28
Aug. 15. Bonds, Poplarville, Miss. ....July 28
Aug. 15. Drainage ditch, Ottawa, Ill..................July 28
Aug. 15. Paving bonds, Oberlin, O. ....July 28
Aug. 15. Water bonds, Barnesboro, Pa. ....July 28
Aug. 15. Paving, etc., Fremont, O. ....July 21
Aug. 15. Grading, Omaha, Neb. ....July 21
Aug. 15. Exhibition bldg. plans, Glasgow, Scotland..June 2
Aug. 16. Electric light plant, Minster, O. ....July 21
Aug. 16. Pipe sewer, Oberlin, O. ....July 28
Aug. 17. Sidewalks, St. Bernard, O. ....July 28
Aug. 17. Bridge substructures (2), Cleveland, O.....July 21
Aug. 18. Water supply, Jersey City, N. J............July 14
Aug. 18. Army supplies, Memphis, Tenn. ....July 28
Advertised, Eng. News, July 28 to Aug. 11.
Aug. 18. Grading, etc., Defiance, O. ....July 28
Aug. 19. Viaduct substructure, Cleveland, O.........July 28
Aug. 19. Administration bldg., etc., Stockton, Cal....July 28
Aug. 19. Asphalt paving, Cleveland, O. ....July 28
Aug. 20. Bridge, Cincinnati, O. ....July 28
Aug. 20. Dredging, Montgomery, Ala. ....July 28
Advertised, Eng. News, July 28 to Aug. 11.
Aug. 20. Paving bonds, Mansfield, O. ....July 28
Aug. 20. Electric lighting, Whitesboro, N. Y.........July 14
Advertised, Eng. News, July 14 and 21.
Aug. 20. Street bonds, Malta, O. ....July 21
Aug. 22. Electric light plant, Mineral Point, O. ....July 28
Advertised, Eng. News, July 28 to Aug. 11.
Aug. 22. Steel substructure, Lebanon, O. ....July 28
Aug. 22. Water-works, Mineral Point, O. ....July 28
Advertised, Eng. News, July 28 to Aug. 11.
Aug. 23. School building, Columbus, O. ....July 28
Aug. 23. Water pipe, Coolgardie, West Australia...June 2
Aug. 24. Hire dredging plant, Mobile, Ala. ....July 28
Advertised, Eng. News, July 28 to Aug. 18.
Aug. 25. Lighthouse, Baltimore, Md. ....July 28
Advertised, Engineering News, July 28.
Aug. 26. Pump engines (2), Minneapolis, Minn. ....July 21
Advertised, Eng. News, July 21 to Aug. 11.
Aug. 29. Pumping eng. (3,000,000 galls.), Marietta, O. July 28
Aug. 30. Plans for electric traveling crane, Chicago..July 21
Aug. 31. Custom house, Guayquil, Ecuador........Apr. 21
Sept. 1. Battleships (3), Washington, D. C.........June 23
Sept. 1. Drainage system, Savannah, Ga. ....June 30
Advertised, Eng. News, June 23 to Aug. 25.
Sept. 1. Electric light plant, Cullman, Ala. ....July 21
Sept. 1. Water-works, Norwood, N. Y. ....July 21
Sept. 3. Sewage pumping station, Boston, Mass.....July 7
Advertised, Eng. News, July 7 and 14.
Sept. 12. Hospital plans, San Francisco, Cal.........Mar. 24
Sept. 13. Capitol building, Helena, Mont. ....July 28
Sept. 15. Enlarging court house, Lisbon, N. Dak.....July 28
Oct. 1. Monitors (4), Washington, D. C..............July 7
Oct. 1. School building (equipment), St. Thomas, Ont. July 7
Oct. 24. Markets, etc., Belem, Brazil ....Apr. 28
Oct. 30. School building, Chehalis, Wash. ....June 16
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
No date. Pump engine, Martinsburg, W. Va. ....July 21
" . Garbage disposal plant, Newport, Ky......July 21
Advertised, Engineering News, July 21.
No date. School building, Fresno, Cal. ....July 28

RAILWAYS.

ABBEVILLE.—Chas. R. Corbett and George Forrest have been awarded the contract for the construction of four miles of railway between Abbeville, La., and the Caffrey sugar refinery, at a cost of about $12,000. Seven miles more are still to be contracted for.

ATLANTIC & DANVILLE.—S. P. Daniel, Virgilina, Va., writes us that he has been placed in charge of a field party for the purpose of making surveys for an extension of the line of this railway to the copper mines in Virginia and North Carolina, near Virgilina, Va.

BALTIMORE & OHIO.—The receivers of this road have decided to improve the grades on that portion of the third division lying between Altamont, the top of the 17-mile grade, and Terra Alta, where the Cranberry grade begins to descend. The line passes through Deer Park and Oakland, and crosses the Allegheny Mountains, where the grades are short and choppy, some being 80 to 85 ft. to the mile. Work is now in progress at No. 58 cut, the grade being reduced from 81 to 42½ ft. per mile. It is expected that the cutting down of this grade will enable the train load to be increased from 1,000 to 1,300 tons on east-bound trains. One mile of the roadway will be lowered and it is expected that the work will be completed by the middle of October. R. M. Sheats, Div. Supt., Grafton, W. Va.

BOOMER COAL & COKE CO.—It is reported that this company will build an extension to its new mines up Boomers' Branch, about 20 miles from Charleston, W. Va. Clifford Buxton, Toledo, O., Ch. Engr., Ohio Central R. R., may be addressed.

CEDAR RIVER.—Saml. Crawford, David E. Crawford and Earl H. Crawford are reported to have bought 53,000 acres of land in Delta and Menominee counties from the Spalding Lumber Co., including the mills and docks at Cedar River, Mich., for $160,000, and will build a railway from the latter place to some point on the Chicago & Northwestern Ry., about 27 miles, in order to market about 300,000,000 ft. of standing timber on these lands.

CINCINNATI NORTHERN.—This road will be extended to Jackson, Mich., according to a press report. Surveys are now being made. R. L. Read, Cincinnati, O., Ch. Engr.

CENTRAL MICHIGAN.—The bonds of this road have been sold and work on the proposed extension from Pioneer, O., to Grand Rapids, Mich., will be commenced at once, according to report. J. W. Boynton, Pres. and Treas., Grand Rapids.

CHICAGO GREAT WESTERN.—It is reported that this road will be extended to Omaha, Neb., via Mason City and Story City, and that surveys are now being made on three divisions of the proposed line. H. Fernstrom, St. Paul, Minn., Ch. Engr.

CLEARFIELD SOUTHERN.—A. W. Lee, Pres., writes us that the surveys for this road, the incorporation of which was noted in our issue of July 14, have been nearly completed, and the right of way and capital have been secured. The road will run from Belsena Mills, where it will connect with the Pennsylvania R. R., to Clearfield Bridge, a station on the Beech Creek R. R., 15 miles. Saml. Brugger, Fleming, Pa., Ch. Engr.

EAST CAROLINA.—The directors of this railway, the incorporation of which was noted in our issue of July 14, have resolved to issue $20,000 in bonds to run for 20 years, at 6%, to be secured by a first mortgage and deed of trust on the entire property. Pres. Henry Clark Bridges, Tarboro, N.C., may be addressed.

FAIRCHILD & NORTH EASTERN.—J. W. Gorman, Greenwood, Wis., has received the contract to build an extension to this road eastward, according to report. Ch. Engr., G. W. Godfroy, Fairchild, Wis.

GALVESTON, LAPORTE & HOUSTON.—This road is reported to have been bought by the Chicago, Rock Island & Texas Ry., through Geo. C. Holt, Woodstock, Ont., and will develop a through line to the Gulf. S. B. Hovey, Vice-Pres. and Gen. Supt., Fort Worth, Tex.

GUADALUPE VALLEY.—The work of grading this new road, which will run from O'Connorsport to Austin, Tex., via Victoria, Yakum, Gonzales and Bastrop, is now going forward rapidly and track laying will soon begin. A branch will be built from Gonzales to San Antonio, via Seguin. Col. Uriah Lott, Victoria, Tex., may be addressed.

HAWTHORNE & BLANCHARD.—F. Weyerbauser, Chippewa Falls, Wis., is President, and E. B. Banks, Superior, Wis., is Chief Engineer of a proposed line of steam railway, which will be built from Hawthorne to Blanchard, 13 miles. Right of way is now being secured and contracts will be let probably this week.

IDAHO.—Grading has been completed for the Idaho R. R., 17 miles long, which will run from Cupun to Ballords. Pres., D. M. White, Lewiston, Idaho; Ch. Engr., C. A. Tush, Huntington, Ore.

LEADVILLE, SOUTH EVANS & MOSQUITO PASS.—Surveys have been completed for this road, which will be 10 miles long, running to a number of important mines. Dan. Vaughn, Leadville, Colo., may be addressed.

LEHIGH VALLEY.—Chas. E. Webster, Ch. Engr., South Bethlehem, Pa., informs us that no extensions to this road are projected at present, but a third track is being constructed from Greens Bridge, near Phillipsburg, N. J., to Muse Tunnel, 9.3 miles, of which about three miles are already completed. A number of new modern steel bridges and replacing old iron bridges. Changes in some of the shops are contemplated, but the plans have not yet been prepared.

LITTLE ROCK & MEMPHIS.—It is reported that the Choctaw, Oklahoma & Gulf R. R. proposes to acquire the Little Rock & Memphis R. R. at the foreclosure sale, Oct. 25, and after reorganizing it as the Choctaw & Memphis, with $3,500,000 capital, will extend the eastern terminus to Little Rock, Ark., 130 miles. R. Fink, Little Rock, Receiver, Gen. Mgr., Ch. Engr., and Pur. Agt.

LOUISIANA & NORTH WEST.—J. D. Beardsley, Lessee and Gen. Mgr., Gibsland, La., writes us that 36 miles of the road have been finished from Bienville, La., to Homer, La., and 36 miles more from Homer to Magnolia, Ark., are under construction. It is expected that the road will begin running next month, at which time 78½ miles of the 200 miles projected, will have been completed. Pres., J. C. Case, St. Louis, Mo.; Ch. Engr., Wm. Washburn, Gibsland, La.

MEXICAN SOUTHERN.—Jas. R. Progue, C. E., Oaxaca, Mex., states that this road will be extended from Oaxaca to Minatlan, Mex. T. A. Corry, Puebla, Mex., is resident engineer.

MISSOURI PACIFIC.—It is reported that this road has acquired the Atchison & Pike's Peak R. R., 100 miles long, comprising the Central Branch of the Union Pacific Ry., extending from Atchison to Waterville, Kan. Ch. Engr., J. W. Way, St. Louis, Mo.

NELSON & BEDLINGTON.—Contracts will be let and construction begun within a short time, according to report, on the Nelson & Bedlington Ry., which is projected from Bonner's Ferry, Idaho, to Kushkonook, B. C., 50 miles. Cyrus R. Bunn, Spokane, Wash., is interested.

NEW CUMBERLAND & PITTSBURG.—This company has been incorporated, with $400,000 capital, by Jas. McCrea, Pres.; Jos. Wood, J. J. Brooks, John W. Renner and E. B. Taylor, all of Pittsburg, Pa., to build a steam railway, 16 miles long, between West Virginia and Phillipsburg, Pa.

NEW YORK, WYOMING & WESTERN.—Four field corps under Edw. L. Jenks are engaged in making surveys for this proposed road, which will carry nothing but coal, and will run from Scranton, Pa., to New York. It is estimated that the road will cost less than $10,000,000, and it is hoped to complete it this year. The officers are: Pres., E. B. Sturges; V.-Pres. and Gen. Mgr., L. A. Watres; Secy., Thos. E. Jones; Treas., Thos. H. Watkins; Ch. Engr., Edw. L. Jenks.

NORFOLK & WESTERN.—J. M. Barr, Roanoke, Va., V.-Pres. and Gen. Mgr., writes us that his company does not contemplate the construction of a line from Winston to Charlotte, N. C.

PITTSBURG & LAKE ERIE.—It is reported that this company has purchased 35 acres of land from the United States Glass Co., Glassport, Pa., and will lay tracks on it for a new yard to hold 500 coal cars. It is also said that the company contemplates an additional purchase of 25 acres, on which it will build a round-house and 24 dwellings for employes. L. H. Turner, Supt. Motive Power and Equipment McKee's Rocks, Pa., may be addressed.

RACQUETTE LAKE.—A new railway is projected from Clearwater, N. Y., to Racquette Lake, N.Y., connecting with the Adirondack Ry., at the former place. The road will be about 19 miles long. Dr. W. Seward Webb, New York, President of the St. Lawrence & Adirondack R. R., is the chief promoter.

RIO GRANDE WESTERN.—It is stated that an extension to this road is projected from Ogden to the Pacific Coast and south through California, possibly into Mexico. D. C. Dodge, V.-Pres. and Gen. Mgr., Denver, Colo.

SAN ANTONIO, LLANO & NORTHERN.—Surveys for this proposed railway from San Antonio to Llano, Strawn and Thurber, have been completed from Strawn to Llano, 140 miles, and construction will begin at once on the northern end of the line. The road will connect with the Texas & Pacific Ry., at Thurber Junction, and will be in all 330 miles long. Geo. W. Angle, Gen. Mgr., San Antonio, Tex.

SAINT JOSEPH & GRAND ISLAND.—An extension to this road will probably be built from Severance to Highland, Kan., seven miles; $200,000 in bonds have been voted by the latter town for this purpose. Gen. Mgr., W. P. Robinson, Jr., St. Joseph, Mo.

SANTANDER.—J. Ed. Buckley, of the La Compania de Ferrocarril de Santander, writes us that this company has been organized under the laws of the United States, for the purpose of building and operating a steam railway from Puerto Wilchess, on the Magdalena River, Colombia, to Bucaramanga, the departmental capital, 90 miles. The route will be from the Magdalena Terminal to Puerto Wilchess, 38 miles east, across the Magdalena Valley, to Puerto Santos, thence easterly up the River Libreja to las Bocas de Oro and Jeron (Pop. 9,000), Piedecuesta (Pop. 12,000), Florida (Pop. 5,000), terminating at Bucaramanga (Pop. 35,000). A branch 10 miles long will be built up the River de Oro, from las Bocas de Oro, to Rionegro (Pop. 12,000), the trading center of the coffee district, in which, it is stated, $12,000,000 in gold has been invested; another branch, 12 or 15 miles long, will be built due north from Bucaramanga to the gold zone, La Baja y Vetas, in which there are about 200 locations and one well developed mine. The line will be narrow gage, with a maximum grade of 2½%. A preliminary survey has been run through the country by Dr. Abelardo Ramos, but American engineers will make the final location. About 90% of the right of way is provided for. The contract price between the Colombian government and the grantee, Mr. Buckley, is $5,000,000 gold for building and equipping the road, and he receives 6% first mortgage 50-yr. gold bonds, secured by the road and its franchises. The government guarantees the interest on the bonds for 20 years, and for that purpose stipulates that 5% of the custom revenues of the nation, about $10.000,000 gold, shall constitute said guarantee fund. The present earning capacity of the road is stated to be $450,000 gold a year from the commerce and general transportation, and with the line completed to Bucaramanga the mines, it is expected, will furnish about $250,000 more. This concession gives the grantee the right to operate, in conjunction with the railway, a line of steamboats on the River Magdalena and steamships, on the ocean, between Cartagena or Puerto Savinella, with an American port on the Gulf or Atlantic coast, thus enabling the company to give through bills of lading from any American city to the interior of Colombia. The company also receives 150,000 acres of hard wood, coffee and rubber lands. J. E. Buckley, 1906 Pacific Ave., Spokane, Wash.; Dr. Ramon Guerra Azuola. Colombia, S. C., Gen. Counsel for Colombia.

SANTIAGO DE CUBA.—D. D. Vanaken & Co. have been awarded the contract to build docks and a short railway line at Santiago de Cuba, for the United States government, to be used in the handling of troops, according to report.

SIOUX CITY, CHICAGO & BALTIMORE.—The surveys for this proposed line have been completed to St. Louis, Mo. Ch. Engr., L. F. Wakefield; Pres., T. P. Gere, both of Sioux City, Ia.

SKAGWAY & LAKE BENNETT.—The narrow-gage locomotives and freight cars for this road have been shipped from Seattle, Wash., to Skagway, Alaska, according to report.

WISCONSIN & MICHIGAN.—It is reported that this road will be extended to Iron Mountain, Wis. Pres. and Treas., S. M. Fischer; Ch. Engr., A. M. Kinsman, both of Chicago.

STREET AND ELECTRIC RAILWAYS.

BERLIN, N. H.—A hearing was to be granted July 27 by the railroad commissioners on the question of the proposed electric railway from this city to Gorham, five miles. The capital stock of the company is $15,000, and the directors are: C. P. Day, L. J. Cote, A. M. Stahl, A. M. Clement, C. C. Gerrish, W. H. Paine and G. O. Holt

LACONIA, N. H.—The Laconia St. Ry. Co. will equip its road with electricity at once, taking the place of horses, and will extend the line over the new road to The Weirs in the spring. Pres., A. G. Folsom; Secy. and Treas., Edmund Little.

PORTSMOUTH, N. H.—Bids are asked until Aug. 2 by the Portsmouth & Dover Electric St. Ry. Co. for the construction of its power house at Noble's Island. Right of way has all been secured and the work of laying the rails will begin this week. Mr. Thompson, of the Boston & Maine R. R., is the engineer.

MONTPELIER, VT.—The directors of the Montpelier St. Ry. Co. have decided to build an addition to the car barn and an office for the superintendent, work on which will be commenced at once. The tracks will be extended on Main St., from College St., making a belt line. Supt. Smith may be addressed.

MONTPELIER, VT.—The local correspondent for the Burlington "Free Press" states that it is quite possible, as such a favorable report has been made on the building of the electric road between this city and Warren, that action will at once be taken by the different towns along the route so that work may be commenced as soon as possible, and it is hoped that it will be begun inside of two months, as much interest is taken in the project and the people are willing to help the matter along. Montpelier will soon be a railway center.

CLINTON, MASS.—The Clinton, Hudson, Maynard & Concord St. Ry. Co. has been granted a franchise to build an electric road in this city which must be completed within a year.

CONCORD, MASS.—The voters of this place, at a meeting July 23, decided not to require electric wires to be placed underground, in order, it is said, not to keep out of the town an overhead system of electric cars for which there has been considerable agitation.

NEW BEDFORD, MASS.—The board of public works has granted a franchise to the New Bedford, Middleboro & Brocton St. Ry. Co. to build an electric railway in this city, application for which was noted in our issue of July 14, which prohibits its doing a local business. Abbott P. Smith is interested.

HARTFORD, CONN.—The Hartford St. Ry. Co. is pushing work on its new auxiliary power house and hopes to have it completed and in running order by the middle of September. Pres., E. S. Goodrich; Secy. and Treas., Danl. R. Howe.

STAMFORD, CONN.—The electric branch line from Stamford to New Canaan, eight miles, of the Consolidated R. R., was opened July 17. The cars of the Stamford St. R. R. are being used until the arrival of the new cars and the route is the same as that of the former steam road, which is thus done away with.

ALBANY, N. Y.—A meeting of citizens was held July 22 to petition the Albany Ry. Co. to construct a trolley line on Second and Delaware Aves. to connect with the Pearl St. and Pine Hills lines. Henry F. Snyder, Robert Scott, Fred. Myer, August Whitman, John J. Lanahan, Ernest Decker, George Krank and Alderman Kapps, ex-officio, were appointed as a committee to report on a plan.

BROOKLYN, N. Y.—The railroad commissioners have granted permission to the Nassau Electric R. R. Co. of this borough to increase its capital stock from $6,000,000 to $15,000,000, for the purpose of canceling its obligations on lines leased to the company.

BUFFALO, N. Y.—The Crosstown St. Ry. Co. has made application to extend its lines.——The board of works has approved the plans reported in our issue of July 14 to have been filed by the Buffalo Ry. Co. for the enlargement of its conduits on Niagara St. Twelve ducts of brick tile will be added to the present six, which will be scraped, at a cost of $12,000, from Porter Ave. to the Square. H. H. Littell, Mgr., may be addressed for particulars.

CLINTON, N. Y.—The Sanquoit Valley Electric R. R. Co. has asked the board of trustees for a franchise to build a street railway in this village. A hearing will be granted on the application Aug. 3. The company has obtained the right of way between here and New Hartford, according to report.

FULTON, N. Y.—O. C. Breed, civil engineer, is making surveys for a proposed line of electric railway to be built from this place to Oswego Falls, according to press reports.

NEW YORK, N. Y.—Permission has been given by the railroad commissioners to the Kingsbridge Ry. Co. the North End St. Ry. Co. and the Fort George & 11th Ave. R. R. Co. to build and operate electric railways on the Boulevard and Kingsbridge Road, between Manhattan St. and Yonkers. Permission is granted on condition that but one set of tracks is laid on the Boulevard, where two routes are coincident.

SYRACUSE, N. Y.—The Syracuse, Skaneattles & Moravia R. R. Co. has asked for a franchise to build an electric railway in this city from the corner of West Fayette and Wyoming Sts. to the city line on the west. The franchise asked for by this company in Solvay, as noted in our issue of July 7, has not yet been granted, but probably will be as soon as the company has consented to the insertion of a clause requiring the road to be finished within a year. Pres., Wing T. Parker; Treas., T. W. Downing.

TROY, N. Y.—It is proposed to build an electric railway five miles long, to connect the Troy & New England R. R. with the Albany Ry. at its 3d St. terminus in Rensselaer. Surveys have been completed and work will soon begin, according to report.

ATLANTIC CITY, N. J.—The New Jersey Electric Ry. Co. has been incorporated to build an electric railway from Camden to this city. The road will be elevated in the terminal cities and the power stations will be at Port Republic and Gibbsboro. Pres., John J. Patterson, Altoona, Pa.

PATERSON, N. J.—The receivers of the Paterson Central Electric Ry. have concluded to dispose of the road as quickly as possible, according to press reports. Wm. Barbour and Charles Curie, Receivers.

PLAINFIELD, N. J.—Bids are asked until Aug. 4 by the board of chosen freeholders of Union county to construct and operate a street railway in North Ave., from Orchard St., Elizabeth, N. J., to Richmond St., in this city. S. Rusling Ryno, Clk., Elizabeth.

PITTSBURG, PA.—The car barn of the Consolidated Traction Co., located at Frankstown and Penn Aves., was completely destroyed by fire July 24, entailing a loss of about $175,000, well covered, it is stated, by insurance. Thirty-six cars were also destroyed. Pres., C. L. Magee; Secy., Jas. A. McDevitt; Treas., Geo. I. Whitney.

READING, PA.—It is stated that surveys for the proposed Boyertown & Reading Electric Ry. have reached Pleasantville, about midway of the line. Branch lines from Friedensburg to Limekiln, two and a-half miles, and from Griesemersville to Amityville, four miles, are also projected.——An electric railway is projected from this city to Bernville, 13 miles, according to report. Harrison Kalbach, Reading, may be addressed for particulars.

WILMINGTON, DEL.—The Chester Traction Co. is pushing work on the extension of its line from Chester to this city. The grading has been completed to Eagle St. and the rail laying to Flower St. on Seventh St. Supt. MacFayden may be addressed.——Edwin P. Williamson and Nicholas Spieles have been denied an injunction to restrain the Front & Union St. Ry. Co. from entering upon their land, according to report.

FREDERICK, MD.—The Frederick, Thurmont & Northern Electric Ry. has been organized to build an electric railway from this city to Gettysburg, Pa., via Lewistown, Thurmont and Emmitsburg. The road will be built as far as the latter place, 29 miles, and later will be extended to Gettysburg. Pres., L. V. Baughman; Engr., L. M. Lemley, Baltimore.

WASHINGTON, D. C.—It is reported that the City & Suburban R. R. Co., the new name of the allied lines of this city, has decided to issue $1,750,000 in bonds for the purchase of the Maryland & Washington R. R., at $700,000, and the Columbia & Maryland, at $698,000, the balance being used to retire bonds of the Eckington & Soldiers' Home R. R., absorbed by the City & Suburban. Pres., O. T. Crosby; Secy., Dana Stevens; Treas., S. C. Cooper.

WASHINGTON, D. C.—A street railway company to be known as the Washington & University Railroad Company has been authorized by Congress to build a railway from the Tenleytown road to the American University, and from there to the District line. D. D. Stone may be addressed.

FAIRMONT, W. VA.—A survey is reported to be in progress, under the charge of C. W. Fawcett for an electric street railway from Fairview to this place.

NEW ORLEANS, LA.—The New Orleans City & Lake R. R. Co. has finished and begun operating its electric line to West End, according to report.

CANTON, O.—Dr. J. B. Shank, of this city, is circulating a petition, according to report, requesting the Canton-Massillon Electric Ry. Co. to extend its line out Navarre St., from Market St. to Dueber Ave., and thence north and south to connect with the south and west lines of the road. Pres. and Treas., Wm. A. Lynch.

DAYTON, O.—The franchise of the Dayton & Troy Electric Ry. Co. has been revoked, according to report, as the company failed to begin construction within the specified time. The Dayton Northern Ry. Co. has made application for the franchise.——A press report states that the Dayton Rapid Transit Co. has been organized to construct an electric railway from this city to Xenia. J. W. Neff, Xenia, Vice-Pres.

DAYTON, O.—The Dayton & Northern Ohio R. R. Co. has been incorporated, with $10,000 capital, by Jas. Christy, Jr., H. E. Randall, W. C. Shepherd, F. J. J. Stout and C. E. Hoover, to build an electric railway from this city to Troy, via Chambersburg, Vandalia and Tippecanoe, according to report.

EATON, O.—It is stated that an electric railway is projected by Joel Steward and Dr. Satin, both of Gratis, and others, from this place to Middletown, via Gratis.

ANDERSON, IND.—The Union Traction Co., known as the Indiana Gas Belt Electric Ry., is reported to have purchased the Anderson Electric St. Ry. for $150,000 and an equal amount in notes. It is also stated that the plant of the Marion Electric Ry. will be purchased, including the line as far south as Summitville, as will be connected to the Anderson St. Ry., making a line 32 miles long, passing through Linwood, Alexandria, Jonesboro and Fairmount in addition to the other places mentioned. Pres., Treas. and Gen. Mgr., C. L. Henry.

BENTON HARBOR, MICH.—The right of way for the new electric railway from South Bend, Ind., to this place has been secured, according to report, and a water power will be developed and repair shop built at Berrien Springs. A dam 20 ft. high and 1,200 ft. long, capable of developing 8,000 to 9,000 HP. is proposed. John A. Russell, Detroit, is interested.

KALAMAZOO, MICH.—An electric railway is projected from this city to Battle Creek, according to report. It is said that Norton & Tunstall, 34 Wall St., New York, are the financial agents. Ch. Engr., Geo. S. Shafter, Philadelphia, Pa.

ALTON, ILL.—The Alton Ry. & Illuminating Co. intends extending its line from 6th and Alby Sts. to East Alton, according to report, and will also equip its Middletown line this fall with 70-lb. rails. Pres., Treas. and Gen. Mgr., J. F. Porter.

CHICAGO, ILL.—The Northern Electric Ry. Co. has asked the county board for a 50-year franchise to build an extension to its electric railway system from the western city limits to River Grove, 10 miles.——The Chicago & Fox Lake Electrical R. R. Co. has been incorporated by John W. Greene, Chas. E. Soule, Jr., Wm. A. Kawson, Stewart Spalding, Frank N. Willis and F. W. Pringle, all of Chicago, with $20,000 capital, to build an electric railway from Lake county, through McHenry county to the Wisconsin state line.

ROCKFORD, ILL.—The final survey for the Rock River Electric Ry., which will be built from this place to Oregon, Ill., via Byron, has been begun, according to report. It is hoped to have the road ready for operation this year; it will be 25 miles long. A water power will be secured at Oregon, where car barns and other buildings will be erected. Nagle, Holcomb &Co., Chicago, are said to have submitted a bid for the construction of the road, which is under consideration.

CENTERVILLE, IA.—A company is now being organized to build an electric railway between Iconium and Moravia, with extensions from the former place to Griffinsville and Confidence, and from Moravia to this place, making a system 22 miles long. It is said that the road will be operated by a storage battery system, and freight will also be carried.

KANSAS CITY, MO.—A resolution has been passed by the city council requesting the street railway companies to equip their cars with the latest and best forms of fenders. Alderman J. E. Jewell introduced the resolution. ——Permission has been granted the Metropolitan St. Ry. Co. to widen the gage of its tracks to 4 ft. 8½ ins., the standard of all the other lines in the city. The franchise of this company called for a gage under four feet. C. F. Morse, Pres. and Treas.

ST. LOUIS, MO.—An electric railway is projected from Bobringville to connect with the Southern Electric Ry., over a new 60-ft. road, which will be constructed from McGinnis Ave. to Union Road, one mile. The Southern Electric Ry. Co. is making extensive improvements to its power plant, costing about $130,000. A new 1,500-HP. engine, a 1,500-HP. dynamo and new Heine boilers will be installed, according to report. Pres., C. H. Spencer.

DALLAS, TEX.—The Dallas Consolidated Electric St. Ry. Co. has filed a mortgage for $800,000 to secure bonds which it will issue for the purpose of making extensions to its system.——J. P. Holland and Wm. H. McGrath, Vice-Pres. and Gen. Mgr., of the Dallas Electric Co., are reported to be interested in a system of electric railways which it is proposed to build in this state.

SPOKANE, WASH.—The United States Marble Co., owning quarries nine miles from Valley on the Spokane Falls & Northern Ry., has decided to build an electric railway to transport the material to the latter road. The officers of the company are: Pres., C. S. Edwards; Vice-Pres., John King; Secy., C. E. Mitchell; Treas., H. B. Allen.

REDLANDS, CAL.—Steps are being taken toward the transforming of the Redlands St. Ry., now operated by horses, into an electric road, and $50,000 in bonds will be issued for the purpose. J. H. Fisher, Gen. Mgr.

BRANTFORD, ONT.—R. L. Middleton, Ch. Engr., writes us that the construction of the Brantford & Woodstock Ry. will begin Sept. 15 and it is hoped to complete it by Nov. 30. There are 26 miles of single track connecting with the Canadian Pacific Ry., north of the town of Woodstock, and with the Toronto, Hamilton & Buffalo Ry., near the Brantford depot. The road will be equipped for both electricity and steam, and will be laid with 90-lb. steel T-rails. The only work to be let will be two miles of pile-driving along the river, a 500-ft. span steel cantilever bridge and three small steel bridges, all near the Brantford end of the line. The work in the Grand River at Brantford will be of an interesting character, owing to the treacherous nature of the river and its banks and the protection against the spring floods which devastate this part of the country. Mr. Middleton will be pleased to hear from any one who desires to furnish supplies.

PARIS, ONT.—G. H. Carroll, of this place, is reported to be projecting an electric railway from Paris to Ayr, connecting with the Canadian Pacific Ry., at the latter place. It will be operated by water power, for which purpose a dam will be built near here.

NELSON, B. C.—C. S. Drummond, representing the British Electric Traction Co., London, England, is said to have applied to the city council for a 30-year franchise to build an electric street railway in this city.

PARIS, FRANCE.—The Walker Co., Cleveland, O., is said to have received an order from this city for the equipment for 500 electric street railway cars. This includes 1,000 motors, 1,000 controllers, 500 trolleys and other details. The order will amount to over $500,000.

MILAN, ITALY.—La Societa Nazionale per Industrie ed Imprese Elettriche has been organized with $1,000,000 capital, in this city, to undertake the construction of electric railways and other electrical projects, according to report.

ROME, ITALY.—An electric street railway is reported to be projected in this city to run to Como and Lecco, 30 kilos. Prices will be asked for about Sept 15 for the necessary materials.

HONOLULU, HAWAII.—The Buffalo Ry. Co., Buffalo, N. Y., is reported to be interested in obtaining a franchise for an electric railway in this city.

ELECTRIC LIGHT AND POWER.

SANFORD, ME.—Press reports state that the Sanford Mills Co. is erecting a stone dam at the old falls of the Mousam River. The dam will be 450 ft. long, and in places 32 ft. deep. Its entire length rests on a solid ledge foundation. It is expected that the work will be completed Sept. 1. Work on the power station was begun this week. When completed, 2,500 HP. will be generated, part of which will be transmitted to the Sanford Mills, 8 miles distant, and part utilized by the Sanford & Cape Porpoise R. R. This electric road will pass within a half mile of the falls, with which it will be connected by a spur track.

WESTBROOK, ME.—Press reports state that the Westbrook Electric Light & Power Co. has made final arrangements for enlarging its power station at Lower Falls. Four 48-in. turbine water wheels and a 300-HP. two-phase Westinghouse generator have already been ordered. Supt. and Mgr., E. B. Newcomb; Engr., A. E. Winchester, South Norwalk, Conn.

SOMERSWORTH, N. H.—Mark A. Keains, Cy. Clk., writes us that this city will not establish a plant this year.

BRATTLEBORO, VT.—No information can yet be given with regard to the power plant at this place. Engrs., Butts & Crosby, 49 Pearl St., Hartford, Conn.

CONCORD, MASS.—Bids are asked until Aug. 5 for furnishing and installing two 125-HP. high-speed compound condensing engines, as stated in our advertising columns. The bids for boilers, heaters, etc., will be opened Aug. 1, as noted in these columns July 14. Stone & Webster, Engrs., 4 Post Office Square, Boston; Richard F. Barrett, Chn. Light Board.

DANVERS, MASS.—This place has voted to appropriate $5,500 for increasing the facilities of the electric light plant. Supt., T. J. Lynch.

BINGHAMTON, N. Y.—We are informed that the following bids were received July 19 for furnishing lighting fixtures. B. W. Mosher, Cy. Clk.:

D. J. Malone, Binghamton (accepted)	$2,850
Binghamton Electric Construction Co., Binghamton	2,186
Babcock Hardware Co., Binghamton	2,694
Gaylord & Gitapence, Binghamton	2,300
Cassidy & Son Mfg. Co., New York	1,865
Thos. P. Nightingale, Utica, N. Y	1,550

EAST SYRACUSE, N. Y.—M. C. Mulford is reported to have purchased the plant recently owned by Mrs. Knapp of Syracuse. Mr. Mulford has asked for a franchise to extend the lines and for permission to enlarge the plant.

SYRACUSE, N. Y.—Bids are asked until July 28 for furnishing and constructing plants for three school buildings. P. D. Cooney, Clk. Bd. Education.

CLINTON, N. J.—The electric light and steam power plant of the Clinton Electric Co. is to be sold at public auction Aug. 5. The advertisement describing this plant and announcing the sale is published on page xviii. of this paper.

WOODSTOWN, N. J.—It is reported that residents of this place are considering the question of organizing an electric light company.

DUQUESNE, PA.—Estimates, etc., for a municipal plant have been prepared by W. S. Taylor, Pittsburg. It is proposed to operate the plant in connection with the water-works.

LANSDALE, PA.—Bids are asked until Aug. 2 for furnishing and constructing a plant, to cost about $20,000. Clk., D. S. Schultz. Pres., L. M. Landis.

PHILADELPHIA, PA.—The Germantown Electric Light Co. has been granted permission to erect poles, wires, etc., for its lines in the 22d Ward.

COLUMBUS, GA.—G. Gunby Jordan, Treas. Columbus Power Co., writes us that bids will soon be asked for constructing the proposed plant; estimated cost, $200,000. The contract has already been let to the Holyoke Machine Co., Worcester, Mass., for furnishing the water-wheels and iron work. The plant will develop 10,000 HP. Des. Engr., W. C. Whitner, Columbus.

CULLMAN, ALA.—Jas. E. Clark, owner of the franchise of the Cullman Water & Lighting Co., writes us that the company is being organized. Bids for furnishing and constructing the plant will be asked about Sept. 1. The plant will have a capacity for 21 1,200 to 2,000-c. p. arc and 1,000 16-c. p. incandescent lights; estimated cost, $15,000.

NEW ORLEANS, LA.—Councilman Story has introduced an ordinance authorizing the council to receive bids for constructing a plant with a capacity of 2,000 arc, 2,000 c. p. and 5,000 16-c. p. incandescent lights. The plant is to be in operation Dec. 21, 1902, the date of the expiration of the contract with the Edison Lighting Co.

CANAL DOVER, O.—Leiser & Bowers are reported to have decided to build a light and power plant at their mills. It is said that if a sufficient number of subscribers can be secured light will be supplied to the houses and stores of the town.

McARTHUR, O.—Paris Horton, Pres. Bd. Trustees, writes us that bids will be wanted in about 30 days for furnishing and constructing a plant, to cost about $55,000. It will have a capacity for 20 2,000-c. p. arc and a large number of incandescent lights. The money has been appropriated, and is now in the hands of the trustees. Bids will be asked for furnishing machinery for a complete modern plant. Engrs., E. P. Roberts & Co., Cleveland, O.

MINERAL POINT, O.—Bids are asked until Aug. 22 for constructing an electric light and water-works plant, as stated in our advertising columns. Paul Voorhees, Engr., 1210 Guaranty Bldg., Buffalo; T. H. Edwards, Village Clk.

MINSTER, O.—Bids are asked until Aug. 16 for furnishing the materials and for constructing a plant. There will be required an 80-HP. engine, two 54-in. × 14-ft. boilers, a feed pump, three 40-K-W. dynamos, etc. Consult Engr., G. L. McKibben, Van Wert, O.; Clk., August Schunck.

BROWNSTOWN, IND.—G. B. Epperson, Anderson, Ind., has asked for a 20-year electric light franchise; estimated cost, $25,000.

EVANSVILLE, IND.—The committee has recommended that steps be taken at once to consider the advisability of building a city plant, to cost about $70,000. Mayor Akin may be addressed.

INDIANAPOLIS, IND.—Bids are asked by the board of trustees of the Indiana Institution for the Education of the Blind until Aug. 2 for furnishing and constructing a plant.

EATON RAPIDS, MICH.—A. R. Welch, Chelsea, Mich., has been granted a 5-year light franchise. It is said that 30 arc lights will be put in at once.

GRAND RAPIDS, MICH.—Nagle & Ball, New York Mutual Life Bldg., Chicago, Ill., have been directed by the council to prepare new plans for the proposed plant, after which new bids will be asked.

KALAMAZOO, MICH.—It is stated that W. A. Foote has purchased a three-fourths interest in the Kalamazoo Electric Co. from J. K. Wagner, Bush & Tate and B. A. Bush. The capital stock is $100,000. The plant will be increased and the service improved. Pres., W. A. Foote, Jackson, Mich.; Secy., S. S. Hulburt, Battle Creek; Treas., James B. Foote, Jackson. W. A. Foote is now interested in the Battle Creek, Jackson and Albion electric lighting plants. J. B. Foote writes us that no new work is contemplated.

YALE, MICH.—Bids are asked until Aug. 2 for furnishing and constructing a plant, as advertised in Engineering News, July 7. (Postponement from July 26.) E. F. Fead, Village Clk.

JOLIET, ILL.—The drainage board, Chicago, has let the contract for the power dam at Joliet, section No. 18, to Gahan & Byrne, Chicago, at $161,791. This contract includes the replacing of dam No. 1 at the present site for $17,751. The proposition of the canal commissioners is to have the dam removed 250 ft. further down the stream, in order to create more power.

DES MOINES, IA.—Local papers state as follows: A new plant will be erected at the dam, foot of Center St., at once by the Des Moines Edison Electric Light Co., which owns the water-power plant by purchase from the Fort Wayne Co. The Edison company will put up a structure 70 × 52 ft., costing about $6,500. It will be equipped with machinery made by the General Electric Co., Schenectady. N. Y. The entire plant will cost from $40,000 to $50,000. The plant is designed for water power. Three wheels which have been in the river since the mill burned six years ago will be utilized, but two new wheels, larger and better, will be put in also. The contract for building has been let to Chas. Weitz & Sons, of this city. One section of the building, 40 × 52 ft., will be erected first and equipped, then the other section. The present steam plant will be moved to the building at First and Chestnut Sts. Mgr., R. H. Fraser.

FOSSTON, MINN.—Fairbanks, Morse & Co., St. Paul, have been awarded the contract for constructing a plant and water-works, at $15,500.

AUBURN, NEB.—C. S. Hull, Cy. Clk., writes us that O. H. Kilburne will put in the proposed plant. It is probable that he has already bought the machinery.

ABILENE, KAN.—Jacob Brown is reported to have applied for permission to operate a plant for lighting the town, the power to be secured from his mills, two miles south of the town.

TISHOMINGO, IND. TER.—Press reports state that the company that has proposed to dam Pennington Creek two miles above Tishomingo has the estimates made on putting in a dam to furnish about 3,000 HP. It is likely that work will be begun soon. The dam proposed will furnish enough power for all kinds of milling machinery, a small electric light plant in the future if the town needs it, and a small system of water-works.

IDAHO FALLS, IDAHO.—Geo. Chapin, Chn., writes us that the question of issuing bonds for the purchase of the plant and water-works will be voted upon Aug. 9. Nothing further will be done until the bonds are sold.

LOS ANGELES, CAL.—The contract for street lighting has been awarded to the Los Angeles Lighting Co., at $6.50 a lamp a month. This is the bid which contemplates the maintenance of the tall mast system with 640 lamps lighting the city, each lamp to be of 2,000 c. p. This will cost the city $4,160 a month—an increase over last year's monthly payments of $16. For this price the city will get 180 more lamps than it has at present. Under the new contract, which goes into effect Jan. 1, the city will have lights all night and every night, where now it has but a half night service and no lights on moonlight nights.

BARRIE, ONT.—The question of issuing $35,000 in bonds for a plant of 65 arc lights will be voted upon Aug. 15.

LONDON, ONT.—Bids are asked until Aug. 3 for furnishing and constructing a plant, as stated in our advertising columns July 21. Samuel Stevely, Acting Chn.; Ormsby Graydon, Cy. Engr.

NIAGARA FALLS, ONT.—It is reported that J. G. White & Co., 29 Broadway, New York, and Baltimore, Md., have been awarded the contract to build the proposed power plant and station on the Canadian side of the Falls.

SEBASTOPOL, RUSSIA.—Press reports state that a company was recently formed at Ougree, Belgium, to be known as La Societe de Traction et d'Electricite de Sebastopol. The new company has a capital of $400,000, and will acquire and work the central electric lighting station and the system of electric tramway in Sebastopol, South Russia. The company is to spend $300,000 in about three months, making purchases of machinery, track material and equipment. The parties sending the advices add that there is plenty of time for American manufacturers to put in their bids.

SHANGHAI, CHINA.—Bids are asked by F. S. Blackall, of Blackall & Baldwin, 39 and 41 Cortlandt St., New York, until Aug. 10 for furnishing and constructing a plant for this municipality, to cost about $40,000. There will be required two 100-K-W. alternators, switchboard, water-tube boilers, etc.

NEW COMPANIES.—Clear Creek Power Co., Denver, Colo.; $1,000,000; to generate power for lighting and other purposes in Clear Creek county; A. R. Specht, Boston; F. Rockefeller, M. A. Bradley, J. M. Henderson, D. R. Taylor, H. P. Malone and E. K. Tilloson, Cleveland.

Union Electric Co., 106 Market St., Camden, N. J.; $6,000, with full amount paid in; H. Geo. Lewis, Oak Lane, Pa.; Chas. J. Hart, Sharon Hill, Pa.; H. G. Kepler, Philadelphia; S. H. Richards, Bridgeport, N. J.

Kinderhook Power & Light Co., Kinderhook, N. Y.; $50,000; to furnish light, heat and power by electricity to Rensselaer, Troy, North Greenbush, East Greenbush, Schodack, Nassau, Bath, Castleton and Nassau; James Purcell, Valatie, N. Y.; James R. Hughes, James Hogan, John Ritz, Stuyvesant Falls, N. Y.; William D. Barnes, Brainard, Rensselaer county, N. Y.

BRIDGES.

BRATTLEBORO, VT.—Bids are asked until Aug. 6 for the purchase of $15,000 of 4% bridge bonds. Wm. H. Vinton, Chn. Bd. Selectmen.

NORTHFIELD, MASS.—Bids are asked until July 30 for constructing a bridge over the Connecticut River. Engrs., Edward S. Shaw, 12 Pearl St., Boston, and Clapp & Abercrombie, Ponds Block, Greenfield; Lyman A. Crafts, Chn. Comrs., Greenfield.

SALEM, MASS.—Bids are asked until Aug. 8 for reconstructing and widening the Forest River bridge. Engrs., Putnam & Riker, 251 Essex St.; E. B. Bishop, Chn. County Comrs.

BROOKLYN, N. Y.—Bids are asked until Aug. 4 for furnishing material and constructing the substructure for the bridge across Newtown Creek, from Grand St. to Grand Ave. John L. Shea, Comr., Stewart Bldg., New York.

JERSEY CITY, N. J.—Bids are asked until Aug. 4 for the purchase of $26,000 of 4% bridge bonds. E. W. Wooley, Clk. Bd. Freeholders.

NEW BRUNSWICK, N. J.—Bids are asked until Aug. 3 for the repair of two bridges. R. J. Dougherty, County Engr., 113 Albany St.

PATERSON, N. J.—Bids are asked until Aug. 2 for constructing two iron bridges and abutments in Pompton township and for an iron beam bridge in West Milford township. Geo. W. Botbyle, Clk. Bd. Freeholders.

JERSEY CITY, N. J.—The Jersey City Electric Light Co. has petitioned the street and water commissioners for permission to construct a trestle from the Pennsylvania Ry. to the Railroad Ave. plant.——The following local bids were received July 7 for constructing a steel viaduct over the Erie Ry. and the West Shore Ry. tracks. N. W. Wooley, Clk. Bd. Freeholders:

	With 146-ft. through span.	Without through span.
McGuire & Hall, 26 Cortlandt St., N. Y.*	$62,025	$49,755
Michael J. Curley	54,398	16,600
M. T. Connely	64,000	52,000
Sandford & Stillman	67,552	54,681
Fagin Iron Works	69,000	57,000
Palisade Construction Co.	64,030	55,900

*Accepted.

BUTLER, PA.—Bids are asked until Aug. 2 for masonry work on one bridge. H. E. Colter, Secy.

CHAMBERSBURG, PA.—A committee consisting of Messrs. Hoffeditz, Henderson and Gilbert have been appointed to arrange with the county commissioners for the construction of a bridge over Falling Spring at Kennedy Ave.

COCALICO, PA.—The county commissioners have decided to build a bridge over the Cocalico Creek at this place. The structure is to be of steel, 75 ft. in length and 16 ft. wide.

CONNELLSVILLE, PA.—The Pittsburg Bridge Co., Pittsburg, has been awarded a contract at $60,000 for constructing a new bridge over the Youghiogheny River, for the Youghiogheny Bridge Co.

MOSGROVE, PA.—A contract has been awarded to the Keystone Bridge Co., Pittsburg, for the construction of a $150,000 bridge over the Allegheny River, for the Buffalo, Rochester & Pittsburg R. R. Co. and the Allegheny & Western R. R. Co. The structure will be 1,600 ft. long, 25 ft. wide and contain 2,000 tons of steel. E. K. Morse, Engr., Pittsburg.

PITTSBURG, PA.—John Brunner, Cy. Engr., writes us that plans are nearly ready for the reconstruction of the South 10th St. bridge, to be 40 ft. wide, having two spans of 520 ft. and 375 ft., with two new piers. As no money has yet been appropriated the work will probably not be done this year. E. M. Bigelow, Dir. Dept. Pub. Wks.

WILKES-BARRE, PA.—Reports state that the county commissioners are in favor of a proposition to purchase the eight toll bridges, crossing the Susquehanna River, at a cost of about $400,000.

JACKSON, MISS.—Bids are asked until Aug. 9 for certain bridge construction, as described in our issue of July 14. (Postponement from Aug. 2.) Walter G. Kirkpatrick, Cy. Engr.

SPRINGFIELD, TENN.—Bids are asked until Aug. 5 for constructing a stone arch bridge across Black Branch. J. W. Bell, Chn. Com.

CANTON, O.—Reports state that a 100-ft. truss bridge will be constructed on South Cherry St. Wm. A. Reed, County Audr.

CLEVELAND, O.—Bids are asked until Aug. 19 for constructing the Willet St. viaduct substructure and masonry abutments. Geo. R. Warden, Dir. Pub. Wks.

CINCINNATI, O.—Bids are asked until Aug. 20 for constructing a bridge on the Riddle Road, in Springfield township. E. L. Lewis, County Audr.

HAMILTON, O.—L. A. Dillon, Engr., has submitted plans to the county commissioners for the proposed 400-ft. bridge over the Miami River at Wood St; estimated cost, $79,000.

HAMILTON, O.—The Toledo Bridge Co., Toledo, O., has been awarded a contract by the county commissioners at $8,450 for constructing a hoist bridge.

LEBANON, O.—Bids are asked until Aug. 22 for constructing a steel substructure on Caesar's Creek, according to reports. P. O. Monfort, Engr.

NORWALK, O.—Jno. Laylin, County Surv., informs us that the following bids were received July 16 for constructing a steel bridge; length, 105 ft.; width, 16 ft.; capacity, 200 lbs. per sq. ft.:

Iron Substructure Co., Columbus, O.	$1,500
Variety Iron Works, Cleveland	1,575
King Bridge Co., Cleveland	1,498
Canton Bridge Co., Canton	1,694
Toledo Bridge Co., Toledo	*1,710
W. H. Smith, Norwalk	**1,706
Penn Bridge Co., Beaver Falls, Pa.	1,780
Wrought Iron Bridge Co., Canton, O.	$1,197 to 1,597
Brackett Bridge Co., Cincinnati	1,289
Massillon Bridge Co., Massillon, O.	1,500
Virginia Bridge Co., Roanoke, Va.	1,506
Mt. Vernon Bridge Works, Mt. Vernon	$1,250 and 1,550
Milwaukee Bridge & Iron Works, Milwaukee, Wis.	2,020

*Low truss, $1,595; awarded contract for an eight-panel bridge. **Low truss, $1,570.

SHELBY, O.—The county commissioners have decided to construct a new stone or iron bridge to cost about $5,000. Mayor Green or Engineer Weddell may be addressed.

WOODSFIELD, O.—Bids are asked until July 29 for constructing a superstructure, 130 ft. long and 16 ft. wide, having a capacity of 125 lbs. per sq. ft. W. T. Wood, County Audr.

YOUNGSTOWN, O.—The question of constructing a viaduct to connect with Steelton, at an estimated cost of $75,000, is being considered.

HART, MICH.—It has been voted to construct a new bridge at a cost of $6,000.

GRAND DETOUR, ILL.—It is reported that the county commissioners have voted to appropriate $20,000 toward the construction of a bridge over Rock River; estimated cost, $40,000.

URBANA, ILL.—Bids are asked until Aug. 4 for constructing a highway bridge on masonry. Ira O. Baker, Engr., Champaign.

ALMA, NEB.—Bids are asked until Aug. 9 for constructing nine iron bridges. S. L. Roberts, County Clk.

ATCHISON, KAN.—Geo. S. Morison, Engr., Chicago, Ill., has prepared plans for the reconstruction of the bridge over the Missouri River, to cost about $60,000, for the Chicago & Eastern Bridge Co., according to reports. W. F. Guthrie, W. W. Guthrie and N. D. Todd, Atchison, may be addressed.

OREGON, MO.—Bids are asked until Aug. 2 for the construction and repair of certain bridges. C. G. Landon, County Comr.

ST. JOSEPH, MO.—The Chicago & Great Western Ry. Co. has offered to construct a $20,000 viaduct over the tracks at Grand Ave., in North St. Joseph.

DALLAS, TEX.—We are informed that the following local bids were received by the county commissioners July 19 for constructing a 150-ft. iron bridge on the Oak Cliff

pike road. C. E. Brown, Engr.: C. R. Lane, $1,647; J. T. Carter, $1,650; Topscott, $1,800; C. W. Olcott, 182 First Ave. (accepted), $1,900; Bryant & Marshall, $1,975; Brown & Dobney, $2,000; J. W. Fuller, $2,100; Geo. E. King Bridge Co., Des Moines, Ia., $2,490.

HEARNE, TEX.—An effort has been made by the citizens to have a new bridge built across the Brazos River at Port Sullivan, but the officials do not feel able to do more than have the old bridge repaired.

GOLDENDALE, WASH.—Bids are asked by the county commissioners until Aug. 4 for constructing a bridge across the creek.

ARBUCKLE, CAL.—Bids are asked by the county supervisors until Aug. 3 for constructing four bridges.

AUBURN, CAL.—Bids are asked until Aug. 2 for constructing a cable bridge across a fork of the American River. Wm. I. May, County Clk.

MARTINEZ, CAL.—Bids are asked until Aug. 1 for constructing an 85-ft. bridge over San Pablo Creek. F. L. Glass, County Clk.

UKIAH, CAL.—Bids are asked until July 30 for repairing two bridges. C. P. Smith, Chn. Bd. Supervisors.

BRANTFORD, ONT.—Several bridges will be required on the line of the new Brantford & Woodstock Ry., on which work will be commenced in September. The work will include a 500-ft. cantilever and three smaller structures. R. L. Middleton, Cy. Engr., Brantford.

BUILDINGS.

BOSTON, MASS.—Reports state that the following local bids were received July 14 for constructing a high school building. Thos. S. Stranger, Chn. Com.:

W. H. Keyes & Co., 17 Otis St., Boston	$259,943
Kerreno Driscoll, 17 Otis St.	253,952
Connery & Wentworth, 22 Pemberton Square	237,500
John L. Jacobs & Son, Herald Bldg.	237,400
Norcross Bros., 1143 Tremont Bldg.	237,263
James Fagan, 27 School St.	229,389
Meade, Mason & Co., 13 Exchange St.	226,950
James A. Colson, 90 Monumental St.	207,905

SPRINGFIELD, MASS.—Bids are asked until Aug. 1 for erecting and plumbing the Alden St. school building. Arch., F. R. Richmond, Masonic Bldg., Springfield; Chas. E. Brown, Chn. Com.

LOCKPORT, N. Y.—Bids are asked until Aug. 4 for erecting a hospital at the Niagara County Farm. Fred H. Krull, Clk. Bd. Supervisors.

MECHANICSVILLE, N. Y.—An extension of 40 × 70 ft. will be built on to the Methodist Episcopal Church.

NEW YORK, N. Y.—Reports state that J. D. Rockefeller will give $10,000 toward the construction of a Barnard College building, to cost $100,000.——Plans have been prepared by F. R. Comstock, Arch., for the erection of a church, on Fifth Ave. and 68th St., to cost about $100,000. Mrs. Laura Lathrop and Rev. Dr. Geo. Tompkins are interested.——Plans have been filed by Linton B. Matthews, 59 West 125th St., for two 5-story brick flat buildings on 3d Ave., near 173d St.; cost $50,000. Archs., Neville & Bagge, 217 West 125th St.; by Hubert S. S. Harde, 648 Madison Ave., for a 6-story brick flat building, on 80th St., near West End Ave., to cost $75,000. Townsend & Harde, Archs.; by Francis J. Schnugg, 1 East 94th St., for a 6-story dwelling on 158th St. and Boulevard Lafayette, to cost $90,000. Louis Entzer, Arch., 78 East 96th St.; by John Westervelt, 43 East 19th St., for an 8-story brick and stone flat building on 80th St., near West End Ave., to cost $300,000. Arch., Henry Anderson, 1180 Broadway; by William Hall and T. M. Hall, 31 East 74th St., for three 5-story dwellings on Riverside Drive, near 87th St., to cost $99,000. A. M. Welch, Arch., 503 5th Ave.; by the Harrison Realty Co., Harrison, N. Y., for an 8-story brick office building at 90 Prince St., to cost $90,000. Neville & Bagge, Archs., 217 West 125th St.; by Lowen Harde and S. Harde, 307 West 85th St., for a 7-story brick flat building, 102 × 51 ft., on 80th St. and West End Ave., to cost $175,000. Archs., Townsend & Harde, 29 East 19th St.

NEW YORK, N. Y.—Plans have been filed by Patrick H. Lynch, Arch., 642 West 128th St., for six 4-story brick dwellings, 16 × 47 ft., to cost $72,000, on 141st St. and Hamilton Place; S. Guidera, 26 East 118th St., for three 5-story brick tenements, on 168th St. and Audubon Ave., to cost $54,000. Arch., J. West Wagner, 407 Nostrand Ave., Brooklyn; by J. C. Lyon, 67 East 127th St., for eight 5-story brick and stone dwellings, on 74th St., near Park Ave., to cost $178,000. Archs., Buckman & Deisler.

NORWICH, N. Y.—An offer has been made to construct a jail building, at a cost of $14,000.

SYRACUSE, N. Y.—C. T. Snavlin will erect a $65,000 dwelling on South Crouse Ave.

ROCHESTER, N. Y.—Plans have been filed by John D. Lynn and J. J. Schubert for a theater building, 70 × 165 ft., to cost $80,000. Arch., J. Foster Warner.

TROY, N. Y.—The following bids have been received for masonry work in the construction of a school building at Third and Adams Sts.: William Ellis, $29,300; Charles Crowley, $28,965; James Dollard, $29,700; Timothy Casey, $27,995; William Behan, $31,042; James H. Morrissey, $29,500; Charles P. Boland, $28,154.

PATERSON, N. J.—Bids are asked until Aug. 1 for the purchase of $100,000 of 4% court house bonds. E. G. Edwards, Chn. Com., Paterson Savings Institution Bldg.

PITTSBURG, PA.—Plans have been accepted for the erection of a Roman Catholic church, at First Ave. and Kennedy St., to cost $150,000.

WILMINGTON, DEL.—Bids are asked until Aug. 8 for furnishing plans and specifications for the erection of a high school building on Delaware Ave. Wm. Turner, Chn. Com.

BALTIMORE, MD.—Bids are asked until Aug. 25 for the construction of the Wade Point lighthouse, N. C., as stated in our advertising columns. Lt.-Col. W. A. Jones, U. S. Lighthouse Engr., Baltimore.

DANVILLE, VA.—Bids will be asked about Sept. 1 for erecting the new Masonic Temple, to cost about $50,000. Arch., Frank P. Milburn, Charlotte, N. C.

WALHALLA, N. C.—Reports state that plans have been prepared by C. M. Guest, Arch., Anderson, for a bank building, to be erected for J. D. Verner.

ATLANTA, GA.—Bids are asked until July 29 for erecting a hospital building and stewards' quarters, at Fort Morgan, Ala. John Simpson, Chief Q. M., Atlanta.

JACKSON, MISS.—Bids are asked by the board of aldermen until Aug. 2 for constructing a 2-story brick addition to the school building at Oakley and Bloom Sts.

MEMPHIS, TENN.—A. J. Welch and J. H. Sullivan, Memphis, will present a petition to the railway companies for a new station, to cost about $170,000.

NASHVILLE, TENN.—Bids were opened at the office of the Louisville & Nashville Ry. Co., at this place, on July 25, for the erection of a new union station, to cost about $1,600,000.

NEWPORT, KY.—A fire in this place July 20 destroyed a saw mill and 17 dwellings, at a reported loss of about $100,000.

BELLEFONTAINE, O.—The fire committee has recommended an issue of $10,000 in bonds to erect a new 2-story brick building, at Columbus and Mad River Sts.

COLUMBUS, O.—Plans have been prepared by Yost & Packard, Y. M. C. A. Bldg., for a new Methodist Episcopal Church, to cost $30,000.

COLUMBUS, O.—Bids are asked until Aug. 23 for furnishing the material and for erecting a school building for the Ohio Institute for the Education of the Deaf and Dumb. Archs., Richards & McCarty, Columbus; J. W. Jones, Secy.

TOLEDO, O.—Bids are asked until Aug. 3 for furnishing the material and constructing a jail building. Arch., David L. Stive; Wm. M. Godfrey, County Audr.

LOGANSPORT, IND.—Bids are asked until Aug. 1 for constructing an 8-room school building. Arch., J. F. Alexander & Son, Lafayette; James D. McNitt, Trustee.

CHICAGO, ILL.—Contracts have been let by Richard E. Schmidt for the 10-story business block which Montgomery, Ward & Co. will erect at Michigan Ave. and Madison St., at a cost of $200,000; by D. H. Burnham & Co., for the fireproof office building for the Union Trust Co., at Pittsburg, to cost $150,000, and by Frost & Granger for a passenger station at Green Bay, Wis., for the Chicago & Northwestern R. R., to cost $15,000.

DANVILLE, ILL.—Bids are asked until Aug. 1 for furnishing the material and for installing a steam heating system at the National Home for Disabled Volunteer Soldiers. J. B. Birmingham, Treas., Danville; W. B. Franklin, Pres. Bd. Mgrs., Hartford, Conn.

HEYWORTH, ILL.—Bids are asked until Aug. 1 for building a brick school house. Arch., P. O. Moratz, 103 East Front St., Bloomington, Ill.; Secy., W. Delano.

OSHKOSH, WIS.—The Chicago & Northwestern Ry. Co. will construct a freight station, 400 ft. long, according to reports.

ST. PAUL, MINN.—Plans are being prepared by Bruchner & Jacobsen, Archs., St. Paul, for the Norwegian Lutheran Seminary building, to be erected at Hamline, to cost $50,000.

ST. PAUL, MINN.—M. J. O'Neil and August Wolentine have applied for permission to erect a 4-story apartment building, to cost about $60,000.

ST. JAMES, MINN.—J. B. Nelson & Co., Mankato, Minn., are reported to have been awarded the contract, at $25,468, for constructing the Park Hotel for M. K. Armstrong. Arch., Frank Thayer, Mankato.

ZUMBROTA, MINN.—Bids are asked until Aug. 5 for constructing a 3-story hospital building for the Lutheran Hospital Association. Arch., C. L. Grover; Chn. Com., R. V. Lund.

CRESTON, IA.—The Chicago, Burlington & Quincy Ry. Co. is about to commence the construction of a new station which will cost $50,000. W. C. Brown, Gen. Mgr., Chicago.

DES MOINES, IA.—Lafayette Higgins, Engr., 352 and 353 Good Block, Des Moines, is preparing plans for a low-pressure steam heating plant to be placed in University Place Church, Des Moines; work to be let soon.

AUBURN, NEB.—Nemaha county, it is reported, will again vote on the question of issuing $40,000 in bonds for a county court house.

DEADWOOD, S. DAK.—This city voted July 14 to issue $10,000 in bonds for a new school house, according to reports.

LISBON, N. DAK.—Bids are asked until Sept. 15 for remodeling and enlarging the court house, according to reports. T. J. Harris, County Audr.

JEFFERSON CITY, MO.—Surveys have been made by the Missouri Pacific R. R. Co. for a new passenger and freight station, to be 243 ft. long and 36 ft. wide. The contract will be let soon. E. Fisher, Engr. Bridges and Buildings.

HELENA, MONT.—Bids are asked until Sept. 13 for erecting a 3-story brick, stone and iron capitol building, to cost about $300,000. Archs., Bell & Kent, Merchants' Bank Bldg., Helena; Chn. Com., Robt. B. Smith; Secy., E. B. Kennedy.

ANACONDA, MONT.—Bids are asked until Aug. 8 for the purchase of $30,000 of 6% school bonds. E. J. Nadeau, Clk. School Trustees of District No. 10.

BUTTE, MONT.—It is stated that the school board will ask for new bids for building the new school house for East Butte, to cost about $28,600. The bids were given in our last issue.

COLORADO SPRINGS, COLO.—Steps are being taken for building a new First Methodist Episcopal Church, to cost about $50,000. Dr. Allen, Pastor; Messrs. Hallett and Simmons are on the committee.

DENVER, COLO.—It is reported that a 5-story brick and stone theater building, 100 × 200 ft., to seat 3,000 persons, is to be erected on 15th and Arapahoe Sts., to cost about $300,000. The Denver Tramway Co. is interested.

SPOKANE, WASH.—Bids are asked by the board of directors of school district No. 81 until Aug. 1 for constructing a 2-room brick school building. E. A. Thomas, Secy.

PORTLAND, ORE.—Bids are asked until Aug. 5 for furnishing plans and specifications for the erection of a court house. E. Hayter, County Clk.

FRESNO, CAL.—Bids are asked for the erection of a new school building. D. C. McDougall, Trustee.

OAKLAND, CAL.—The plans of Percy & Hamilton, Archs., for the new library building for the Sanford University have been accepted; cost, $150,000.

PALO ALTO, CAL.—Bids for construction of a library building and an assembly hall to be erected on the campus have been opened, and work will be begun at once. Estimated cost of the two structures is $280,000.

STOCKTON, CAL.—Bids are asked until Aug. 19 for erecting an administration building and two cottages on the grounds of the Preston School of Industry. Secy., B. T. K. Preston. Address J. W. Oates, Salz Bldg., Stockton.

LONDON, ONT.—Bids are asked until Aug. 1 for erecting a public school building. Herbert Matthews, Arch.

WATER-WORKS.

BREWER, ME.—Plans have been prepared by H. T. Sparks, Supt. Water-Works, Public Works Co., for a filter 50 ft. long to have a capacity of about 2,000,000 gallons of water a day. Other improvements to the works are also proposed.

BOSTON, MASS.—Bids are asked by the Metropolitan Water Board until Aug. 9 for making excavations for the North Dike of the Wachusett reservoir at Clinton (290,000 cu. yds. earth excavation), and also for laying 3,060 ft. of 48-in. pipe in the Brighton district, as stated in our advertising columns. F. P. Stearns, Ch. Engr.; W. N. Davenport, Secy., 3 Mount Vernon St.

NEWBURYPORT, MASS.—Bids are asked until July 30 for building a masonry foundation for a stand-pipe to be erected on the lot occupied by the present stand-pipe. C. C. Dame, Chn. Com.

NORTH ANDOVER, MASS.—Geo. M. Cole & Co., Lawrence, Mass., have been awarded the contract for building the new pumping station at $5,312.

SEYMOUR, CONN.—C. W. Blakeslee & Sons, New Haven, Conn., have been awarded the contract for building a reservoir and dam for the Seymour Water-Works Co. The stream selected as a supply is the Pine Bridge Brook. The water company has purchased 12 acres of land and the pond will contain about 10,000,000 gallons of water. The plans contemplate the erection of a larger dam for storage reservoir later on. Total cost is estimated at $50,000.

ALBANY, N. Y.—Bids are asked until Aug. 2 for laying 6 to 12-in. water mains in several streets. Supt., Geo. I. Bailey.——It is proposed to clean and improve the Bleecker reservoir.

HORSEHEADS, N. Y.—H. N. Sciple and others, of Philadelphia, Pa., have applied for permission to build works.

FORESTPORT, N. Y.—The Forestport Water Co. has been incorporated by Howard M. Fordham, of Buffalo, and James Gallagher, Jr., Albert Herrig, Richard J. Monahan, Charles O'Connor, Francis X. Salzman, William E. Syphert, of Forestport; capital stock, $10,000.

LANSINGBURG, N. Y.—Chas. A. Roemer, Village Engr., writes us that the proposed extension to the works will consist of a storage reservoir with a pipe line about 4½ miles long, connecting with the present works.

MILLBROOK, N. Y.—Estimates, etc., for gravity works have been submitted to the board of trustees; estimated cost, $15,000. F. H. Scrip, Village Clk., writes us that there is no prospect of the works at present. Population, 850.

MOUNT VERNON, N. Y.—The question of placing water meters in the buildings and houses supplied with water from the works of the New York Suburban Water Co. is being considered.

NORWOOD, N. Y.—The Norwood Water Co. has been incorporated with a capital stock of $15,000 by Philip J. Barry and H. E. Mandeville, of Hazleton, Pa.; Dix W. Smith, of Elmira, N. Y.; W. B. Berry, Henry H. Warren, William H. Cushman and Leon C. Ball, of Massena, N. Y. Further information in regard to this improvement may be found in our issue of last week.

OGDENSBURG, N. Y.—Local papers state that a contract has been let to the Stilwell-Bierce & Smith-Vaile Co., Dayton, O., through their representative in this city, A. H. Dalzell, for two 48-in. Victor waterwheels and other apparatus for the power pumps of the water-works.

PORT JERVIS, N. Y.—The Port Jervis Water-Works Co., it is stated, is about to make extensions to its works and also to increase the water supply.

TICONDEROGA, N. Y.—The water board is making surveys for a water main to Worcester Pond, a distance of 1½ miles, for an increased water supply. Engr., D. M. Arnold.

BRIDGETON, N. J.—It is reported that the council has voted to spend about $15,000 for building a new reservoir.

HAMMONTON, N. J.—A. H. Sutton, Pres. Bd. Water Comrs., writes us that nothing has yet been done by the council with regard to works. The next council will be held July 30.

JERSEY CITY, N. J.—Bids are asked until Aug. 1 for furnishing 90 dozen ⅝-in. stop cocks; 50 dozen ¾-in. stop cocks; 25 dozen 1-in. stop cocks; 6 dozen 1½-in. stop cocks; 10,000 lbs. of lead; 500 lbs. of solder. Geo. T. Bouton, Clk. St. and Water Bd.

MONTCLAIR, N. J.—A. W. Simpson, Secy. Montclair Heights Water & Land Co., writes us that the company was incorporated to supply water to the Acquackanonk township, particularly for the development of Montclair Heights. Arrangements have been made for a reservoir. Wells and water-works are not wanted yet as the company has a hot-air system which will be used at present. Engr., W. S. Bacot, 1 Broadway, New York.

SALEM, N. J.—Bids are asked until Aug. 12 for constructing a filter plant of 500,000 gallons capacity, and also for a steam pump of 1,000,000 gallons capacity, as stated in our advertising columns. C. Hungerford, Engr., 116 West 69th St., New York; C. W. Casper, Supt. W.-W.

BARNESBORO, PA.—Bids are asked until Aug. 15 for the purchase of $9,500 of 30-year bonds for the proposed new works, according to reports.

BRADDOCK, PA.—Bids are asked until Aug. 1 for furnishing and laying 10,300 ft. of 16-in. cast-iron water pipe and 3,370 ft. of 12-in. sewer pipe. Wm. Howat, Supt.

EVANS CITY, PA.—It is reported that this place has voted to issue $40,000 in bonds for works.

LANCASTER, PA.—The council is reported to have engaged Edmund Mather, Pres. Water Comrs., Harrisburg, Pa., to submit a report for a settling basin for a better water supply for this city. Mr. Mather writes us that he is not aware of any action having been taken.

LATROBE, PA.—W. A. Johnston, Supt. Latrobe Water Co., writes us that the company will issue $100,000 in bonds for the improvements to be made to the works, the contracts for which were let recently, as noted in our last issue. The total cost will be $125,000.

NAZARETH, PA.—Frank Kunkel, Secy. Nazareth Water Co., writes us that no appropriation has been made and no steps taken for the proposed increased water supply. It is probable that steps will be taken soon.

SHENANDOAH, PA.—The committee has decided to build a 30,000,000-gallon reservoir at a cost of about $16,000. The question is being considered of either securing an increased water supply or of purchasing for $200,000 the plant of the Citizens' Water & Gas Co. and consolidating it with the city works. Councilmen Bell and Straughn may be addressed.

WILKES-BARRE, PA.—The Commings Lake Water Supply Co. has been incorporated with a capital stock of $10,000, by C. Drymond, Frederick Cross, E. E. Hoyt, Kingston, Pa.; T. F. Ryman, Wilkesbarre; Thomas Wingert, Luzerne, Pa.

GEORGETOWN, DEL.—W. T. Tunnell writes us that there is no probability of the proposed works being built this year.

CUMBERLAND, MD.—Geo. A. Kean, Mayor, writes us that nothing has been done as yet in regard to securing a better water supply. It is hoped, however, that the matter will soon be disposed of by the council. It is stated that E. A. Wilder, New York, has submitted a proposition for a new method of water filtration to cost $38,000.

HARPER'S FERRY, W. VA.—This place is reported about to engage an engineer to look over the ground and report on the proposed works.

DAVIDSON, N. C.—The trustees of Davidson College have decided to build works to supply the town and college buildings. Pres., Rev. J. B. Shearer; Chn., Rev. W. J. McKay, Maysville, S. C.

COLUMBIA, S. C.—C. C. Wilson, Cy. Engr., has submitted plans, etc., for new works and a sewerage system to cost about $450,000. The reservoir and pumping plant will cost $250,000, and the distribution system $175,000. A. R. Stewart, Chn. St. Com., writes us that definite plans have not yet been decided upon.

MILLEDGEVILLE, GA.—It is reported that the American Pipe Mfg. Co., 112 North Broad St., Philadelphia, Pa., owner of the works at this place, has purchased the Moran spring for an increased supply. Secy., H. Bayard Hodge, Philadelphia.

ROME, GA.—The question of a filtration plant at the works is reported as being considered.

BRISTOL, TENN.—It is reported that the committee will soon ask for bids for furnishing deep-well and duplex pumps, two steel tanks, one of 20,000 and one of about 500,000 gallons capacity, etc. The deep-well pump will have a capacity of 250,000 gallons. The well for the supply has been drilled 1,200 ft., at which depth a flow of 180 gallons a minute was secured. Contractor, S. B. Geiger, Chicago; Chn. Com., J. D. Mitchell.

CINCINNATI, O.—Bids are asked until Aug. 2 for the purchase of $500,000 of 3½% water-works bonds. C. G. Roth, Clk. Bd. Trustees.——Louis Drach submitted the lowest bid at $91,902 July 22 for the masonry work, grading and excavating of the property where the new works will be located at California, O.

CRIDERSVILLE, O.—The question of building works is being considered, according to reports.

MARIETTA, O.—Bids are asked until Aug. 29 for furnishing and installing a 3,000,000-gallon pumping engine for the works. Pres., J. H. McConnell.

MINERAL POINT, O.—Bids are asked until Aug. 22 for constructing works, as stated in our advertising columns. Paul Voorhees, Engr., Buffalo, N. Y.; T. H. Edwards, Village Clk.

NEWARK, O.—Press reports state that Judge Jones on July 18 confirmed the appraisement of the Newark Water-Works Co. in the case instituted against the company by the Farmers' Loan & Trust Co., and ordered the water-works sold for not less than $9,000, plus the first mortgage of $225,000.

POMEROY, O.—Bids are asked until Aug. 10 for furnishing and constructing works for the Pomeroy & Middleport Water Co., 800 Broad St., Newark, N. J., as described in our advertising columns of July 14. Pres., Geo. MacDonald, Newark, N. J.; Engr., J. W. Ledoux, 112 North Broad St., Philadelphia.

BROWNSTOWN, IND.—G. B. Epperson, Anderson, Ind., has applied for a 20-year franchise to supply this place with water.

EVANSVILLE, IND.—Bailey, Koerner & Co., Evansville, submitted the lowest bid July 19 for constructing the new building, etc., for the water-works, at $61,676. The lowest bid for constructing a steel plate smokestack on a concrete and stone foundation was submitted by the same firm, at $6,386. Engr., Chas. Hermany, Louisville.

EATON RAPIDS, MICH.—The council has been petitioned to call an election to vote again on the question of building works.

LAKE CITY, MICH.—It is reported that the plant at this place owned by D. Reeder & Co. was destroyed by fire July 15.

LAWTON, MICH.—An election was held July 26 to vote on the question of issuing $9,500 in 5% bonds for works. H. C. Lammond, Village Clk.

CHICAGO, ILL.—Bids are asked until Aug. 3 for furnishing special castings for hydrants, valves and water pipe. L. E. McGann, Comr. Pub. Wks.

McLEANSBORO, ILL.—The council of this place is reported to have voted to issue $32,000 in bonds for the proposed works.

BLAIR, WIS.—Bids are asked until Aug. 1 for furnishing and installing works, to cost about $4,000. E. L. Immell, Village Pres.

TREMPEALEAU, WIS.—The question of building works to cost about $5,000 is being considered, according to reports.

FOSSTON, MINN.—Fairbanks, Morse & Co., St. Paul, have been awarded the contract for building the works and electric plant, at $15,500.

LAKEVILLE, MINN.—It is reported that this place will vote to issue $3,500 in bonds for works.

BALDWIN, IA.—Bids are asked until Aug. 2 for furnishing a steel water-tower, tank, pipe, 4-HP. gasoline engine, pump, etc., for the proposed works, to cost $5,000. Engr., Iowa Engineering Co., Weston Block, Clinton; Clk., J. H. Summers.

OGDEN, IA.—Fairbanks, Morse & Co., St. Paul., Minn., have been awarded the contract for building the works, at $4,367.

McPHERSON, KAN.—A. Bass, Cy. Engr., writes us that the city is in litigation with the Western Water & Light Co., and if a compromise can be effected nothing towards building works will be done. If no settlement can be arranged a new company will be organized and new water-works and a gas plant will be put in.

TOPEKA, KAN.—The council has been petitioned to call an election to vote on the question of purchasing the works of the Topeka Water Co.

OSCEOLA, MO.—The Osceola Water Supply Co. has been incorporated to supply Osceola with water; capital stock, $8,000. Incorporators, Robert Craig, T. J. Alexander, E. D. Miles and others.

ST. LOUIS, MO.—The following are the lowest bids received by the board of public improvements July 15 for furnishing several miles of cast-iron water pipe, etc.: Pipe—American Pipe & Foundry Co., $14.08 a ton, total $47,168. Laying, two contracts—George P. Prendergast, $11,400 and $8,520. Valves—Michigan Brass & Iron Works, $7,965. Special Castings—Magnetite Foundry Co., $6,200. Fire Plugs, 375—Pleuger & Enger, $7,450.

BLACK HAWK, COLO.—F. A. Randolph, Cy. Clk., writes us that D. Mitchell, Denver, Colo., has been awarded the contract for furnishing and constructing the works, at $26,804, excepting the pipe. The contract for furnishing the pipe has been let to E. E. Clark, Black Hawk, at $12,500, he being the only bidder on pipe. The bids received July 18 were as follows:

[1]D. Mitchell, Denver	$26,800
[2]Holmes & Allen, Denver	36,554
[1]James H. Tierney, Central City	41,800
[3]P. E. Anderson, Central City	12,500
[4]D. J. Tirsway, Denver	37,818
[4]Quigley & Co., Central City	53,750
[5]E. E. Clark, Black Hawk	12,500
[4]R. B. MacDonald Bldg. Co., Denver	39,322

[1]Complete without pipe. [2]Complete with pipe. [3]For reservoir only. [4]Complete. [5]Pipe only.

FLORENCE, COLO.—Hiram Phillips, 306 Oriel Bldg., St. Louis, Mo., is reported to have been engaged to report on a water supply for this city. Plans and estimates will be prepared, after which the question will be voted upon by the citizens. Mayor McGuire may be addressed.

BERKELEY, CAL.—The town trustees have appropriated $2,500 for hiring experts to look over the ground and report on the feasibility of a water supply. The committee consists of Dr. Thos. Addison, J. J. Le Conte, and E. F. Niehaus. Clk., M. L. Hanscom.

PASADENA, CAL.—The question of securing a new city charter, with a view to the municipal ownership of the water-works, is being considered. P. M. Green and H. G. Reynolds may be addressed.

VISALIA, CAL.—A new committee is reported to have been appointed to investigate the advisability of building works. Councilmen Roth and Stewart may be addressed.

FLAGSTAFF, ARIZ.—The council has let the contract for constructing the works to George W. Sturtevant, Chicago, at $85,000. The springs which will furnish the water supply are 17 miles from town, and have an average flow of 500,000 gallons daily. A force of men will be put to work immediately, the terms of the contract requiring that the system be completed within five months.

MOSCOW, RUSSIA.—Nicholas Simin, Ch. Engr. Moscow Water-Works, writes us that the councils have appropriated $32,800 to make experiments with different systems of mechanical filters. The future water supply of 40,000,000 gallons for this city will be secured from the Moscow River. The tests will continue for about a year.

SEWERAGE.

BELFAST, ME.—Bids are asked until Aug. 1 for constructing 3,500 ft. of pipe sewers. C. O. Poor, Chn. Com.

CLINTON, MASS.—Local papers state that bids will soon be asked by the Metropolitan Water Board, Boston, for constructing a sewage disposal plant for this city. Ch. Engr., F. P. Stearns, Boston.

SPRINGFIELD, MASS.—Bids are asked until Aug. 2 for constructing about 2,900 ft. of eliptical brick sewer, etc. C. M. Slocum, Cy. Engr.; W. L. Dickinson, Supt. Sts.

WINTHROP, MASS.—Bids are asked until July 30 for constructing a portion of the system in Winthrop Heights; check, $500; Engrs., Whitman & Howard, 85 Devonshire St., Boston; Chn. Com., H. A. Root.

NORFOLK, CONN.—Bids are asked until Aug. 10 for constructing about six miles of the system, as described in our advertising columns. Edmund Brown, Clk.

COHOES, N. Y.—The public improvement commission has engaged Prof. Palmer C. Ricketts, Rensselaer Polytechnic Institute, Troy, N. Y., to prepare plans for a system for this city.

LANCASTER, N. Y.—The board of sewer commissioners has approved the plans prepared by O. N. Gardner, of Jamestown, N. Y., for a system and for disposal works for the village. Fifteen plans were received July 7. The board of village trustees has decided to call a special election Aug. 1 to vote on the question of raising $1,200 by special tax.

PLATTSBURG, N. Y.—Bids are asked until Aug. 2 for constructing pipe sewers in a number of streets. H. E. Barnard, Acting Clk.; S. L. Wheeler, Chn. Com.

BAYONNE, N. J.—Bids are asked until Aug. 2 for building sewers in five streets. W. C. Hamilton, Cy. Clk.

JERSEY CITY, N. J.—Bids are asked until Aug. 1 for constructing 1,300 ft. of 42 to 18-in. sewers, etc. Geo. T. Bouton, Clk. St. and Water Bd.

MONTCLAIR, N. J.—Bids are asked until Aug. 8 for constructing an 8-in. pipe sewer in Portland Place. H. Tippett, Town Clk.

WOODSTOWN, N. J.—The question of building a system is being considered, according to reports.

KANE, PA.—Bids are asked until Aug. 1 for sewers in six streets. P. B. Anderson, Secy.

LATROBE, PA.—Bids are asked until Aug. 8 for constructing a 12-in. pipe sewer in Thompson St. Engr., L. W. Fogg; Secy., H. M. Fink; Burgess, C. H. Eiseman.

READING, PA.—Bids are asked until July 28 for furnishing and laying about 38,000 ft. of pipe sewers. S. S. Hoff, Cy. Engr.

READING, PA.—Bids are asked until July 28 for constructing a by-pass or overflow at the sewage pumping station; bond, $2,500; S. S. Hoff, Cy. Engr.

WILLIAMSPORT, PA.—John Welteroth has been awarded the contract for building the West End main sewer. Mayor Mansel may be addressed.

WILMINGTON, DEL.—Bids are asked until Aug. 5 for constructing storm water drains and grading and macadamizing in the Wilmington and Brandywine Cemetery. M. M. Cleaver, Secy., 602 Market St.

CHESTERTOWN, MD.—Wm. T. Sutton, Chestertown, has been awarded the contract for constructing a sewer in Washington and Maple Aves., at $1,625.

WASHINGTON, D. C.—The district commissioners have ordered the construction of the extension of the Burleith main sewer along 37th St. to Y, and in Y St., from 37th to 38th St. Estimated cost, $7,656.

ELKINS, W. VA.—W. W. Mills, Recdr., writes us that the contract for building 2,100 ft. of 20-in. pipe sewer has been let to K. G. Lyons. Engr., I. W. Galbreath, Elkins.

COLUMBIA, S. C.—C. C. Wilson, Cy. Engr., has submitted plans and estimates for a system and water-works, to cost about $450,000; the system itself to cost about $125,000. We are informed that the matter is not in shape for any definite information.

ASHTABULA, O.—Bids are asked until Aug. 13 for constructing 1,284 lin. ft. of 8-in. pipe sewers, etc., as stated in our advertising columns. H. E. Mann, Cy. Engr.; Frank W. Wagner, Cy. Clk.

LIMA, O.—Bids are asked until July 28 for constructing sewers in several streets. C. E. Lynch, Cy. Clk.

OBERLIN, O.—Bids are asked until Aug. 15 for the purchase of $1,900 of sewer bonds and until Aug. 16 for constructing 2,500 ft. of 6-in. pipe sewer. W. B. Gerrish, Cy. Engr.

PAW PAW, MICH.—This place voted July 12 against issuing $5,000 in bonds for a system, although it voted to issue $18,000 in bonds for water-works.

WAVERLY, IA.—Bids are asked until Aug. 2 for constructing 8-in. pipe sewers in several streets. D. A. Long, Cy. Clk.

TOPEKA, KAN.—The question of building sewers in North Topeka is being considered; population, 4,000.

EMERYVILLE, CAL.—We are informed that Thos. N. Badger, Town Engr., is preparing plans and specifications for a system. There will probably be about 20,000 ft. of 14 to 6-in. pipe; average cut, 7.7 ft. It will be several weeks before bids for the work are asked. W. H. Christie, Pres. Bd. Trustees.

OAKLAND, CAL.—The Lake Merritt Sanitary Improvement Club has been organized to advocate the building of more sewers in the city around Merritt Lake, and also the cleansing of that lake. Edwin Goodall, A. Schilling and H. F. Gordon may be addressed.

POMONA, CAL.—Stoddard Jess, W. H. Sanders and J. H. Graber have been appointed a committee to gather data for an outfall sewer and a sewerage system. City Clerk Lee is to communicate with Redlands, Riverside, Santa Ana, Santa Monica, and Pasadena, with regard to a joint sewer.

SANTA ANA, CAL.—E. H. Rollins & Son, Boston, Mass., are reported to have been awarded the bonds amounting to $65,000 for the proposed system. It is stated that the trustees will soon ask for bids for building the system.

JUNEAU, ALASKA.—The "Miner" is again urging the construction of a sewerage system.

GARBAGE DISPOSAL—STREET CLEANING

UTICA, N. Y.—The council has awarded the contract to Henry Stappenbeck, at $6,500 a year, for collecting and destroying the garbage for a term of 10 years.

WHITE PLAINS, N. Y.—The following bids were received July 11 by the board of trustees for collecting and disposing of the garbage: John Jackman, dumping ground his own, $2,850; Jay F. Crawford, dumping ground, Shampnois Swamp (accepted), $1,576; Antonio Martinello, no dumping ground stated, $1,300; Thos. O'Rourke, dumping ground not stated, $1,105; P. J. Mannix, no dumping ground stated, $936.

ATLANTIC CITY, N. J.—Mayor Jos. Thompson, Councilman Leeds, Prof. Wm. P. Landenslager and H. S. Scoll have visited Reading to inspect the garbage disposal plant, with a view to putting in one soon.

PERTH AMBOY, N. J.—Press reports state as follows: The board of health on July 25 considered the question of disposing of the garbage of the city. The first year under the contract system is about to expire, and a new contract will be made at the next session of the board of aldermen. Although there is an ordinance directing that the garbage and ashes be separated, it is seldom done, and the dumping of the mixture causes a nuisance, which the board has been endeavoring all the year to abate. At a recent meeting of the board a resolution was adopted prohibiting the dumping of garbage or ashes within the city limits. It is contended that the board cannot legally do this.

MILWAUKEE, WIS.—Comptroller John R. Wolf has countersigned a resolution drafted by Chairman Graebner of the committee on health, with the approval of the committee, instructing the board of public works to advertise for bids for a municipal garbage plant, to be erected on Jones Island; the plant capable of disposing of 100 tons of garbage a day. The ordinance to issue bonds for the plant will doubtless be repealed, the amount needed for the plant to be taken from the other funds. Estimated cost, $60,000.

ST. LOUIS, MO.—The following bids were received by the board of health July 14 for collecting and disposing of the garbage for 10 years:

Edward Butler, 13 South 10th St.—$245,031, $250,160, $264,489, $275,112, $286,302, $296,682, $302,710 $321,411, $340,190, $359,875 a year; total for 10 years, $2,941,982.

Hill-O'Meara Construction Co.—$261,000, $266,000, $266,000, $266,000, $271,000, $271,000, $271,000, $271,000, $277,000, $277,000; total, $2,697,000.

Rich & Sale, Rowe Bldg.—$196,000 for each of the 10 years; total, $1,960,000.

Wade & Miller.—$200,000, $175,000, $175,000, $185,000, $190,000, $195,000, $200,000, $200,000, $205,000, $210,000; total, $1,935,000.

J. W. Thompson & Co., Wainwright Bldg.—$120,000, $123,000, $126,000, $129,000, $132,000, $135,000, $138,000, $141,000, $144,000, $147,000; total, $1,335,000.

Excelsior Hauling & Transfer Co.—$80,000, $127,200, $127,200, $127,200, $127,200, $127,200, $127,200, $127,200, $127,200, $127,400; total, $1,225,000. Awarded contract.

SANTA BARBARA, CAL.—Bids are being asked by the council for the construction of a pumping plant to supply salt water for sprinkling the first district, the cost not to exceed $3,000, according to reports.

STREETS AND ROADS.

LEWISTON, ME.—Bids are asked by the council until July 28 for furnishing and laying about 3,000 sq. yds. of granite pavement.

LACONIA, N. H.—S. C. Frye, Cy. Clk., informs us that the following bids were received July 18 for constructing the Weirs Road, as advertised in Engineering News:

	For 16-ft. roadway.	For 26-ft. roadway.
Frederic R. Page & Co., Boston, Mass.	$5,117	*$6,584
Edwin D. Bell, Roxbury, Mass.	5,520	8,013
Joseph D. Gennaro, Boston, Mass.	9,078	12,283
A. R. Smith, Plymouth, N. H.	8,355	13,200
John Walker, Newmarket, N. H.	10,049	14,437
Fred. T. Ley & Co., Springfield, Mass.	9,134	13,461
Chas. A. Bailey, Suncook, N. H.	12,887	18,234
Stone & Thurston, 220 Broadway, N. Y.	20,375	29,257

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*Awarded contract.

SALEM, MASS.—Bids are asked until Aug. 8 for widening and grading a portion of Lafayette St., in Salem, and Pleasant St., in Marblehead. Putnam & Ricker, Engrs., 251 Essex St., Salem.

SOUTH NORWALK, CONN.—The council has voted to pave South Main St. with brick, from Monroe St. to Woodward Ave.; estimated cost, $10,935. Joseph R. Taylor, Clk.

EAST AURORA, N. Y.—G. W. Partridge submitted the lowest bid July 11 for paving in Main St., at $8,000 for macadam, and at $11,000 for brick. C. H. Addington, Clk.

JAMESTOWN, N. Y.—Bids are asked until July 30 for brick paving. W. O. Benedict, Bd. Pub. Wks.

OLEAN, N. Y.—Bids are asked until Aug. 12 for constructing about 2,000 sq. yds. of brick pavement on concrete foundation, as stated in our advertising columns. E. E. Allen, Supt. of Streets.

ROCHESTER, N. Y.—Bids are asked until Aug. 5 for paving East Main St. with brick, estimated cost $74,700; Clarissa St., asphalt, $12,000; Clarissa St., retaining walls; Pierpont Ave., asphalt, $26,000; Austin St., cement walks, $2,025; Minerva Place, brick, $1,800. Edwin A. Fisher, Cy. Engr.; Chas. M. Beattie, Clk.

SCHENECTADY, N. Y.—Bids are asked by the council until Aug. 9 for brick paving in Dock St.

WHITE PLAINS, N. Y.—Bids are asked until Aug. 1 for macadamizing, etc., in Lexington Ave., between Martine and Fisher Aves., and grading East Barker Ave. and Warren St.; also until Aug. 2 for furnishing and constructing 4-ft. sidewalks, etc., on Fisher Ave. S. C. Miller, Pres.; E. G. Sutherland, Clk.

ATLANTIC CITY, N. J.—Portions of South Carolina, Tennessee and Arkansas Aves. will be paved with brick. President Southwick may be addressed.

CARLSTADT, N. J.—Bids are asked until Aug. 4 for the purchase of $30,000 of grading and macadamizing bonds. Frank Erdle, Borough Clk.

JERSEY CITY, N. J.—Bids are asked until Aug. 1 for about 689 sq. yds. of Belgian paving, 2,850 sq. yds. of asphalt paving, 3,372 lin. ft. of curbing, etc., on portions of Duncan and Highland Aves. Geo. T. Bouton, Clk. Bd. St. Comrs.

PATERSON, N. J.—Bids are asked until Aug. 1 for the purchase of $30,000 of 5% road bonds. E. G. Edwards, Chn. Bd. Freeholders.

PATERSON, N. J.—The aldermen have voted to pave portions of Colt, Hamilton, Market and other streets with asphalt block and Broadway with brick. About $97,000 has been appropriated.

RIVERTON, N. J.—Bids are asked until July 28 for about 2,100 lin. ft. of asphalt tile sidewalk and foundation 5 ft. wide. Henry S. Haines, Engr., Temple Bldg., Camden; Chas. S. Walnut, Borough Clk.

WOODBURY, N. J.—The board of freeholders has granted a petition for the construction of a stone road from Woodbury to Knight Run, a distance of 5¼ miles; estimated cost, $7,560. Messrs. [illegible]arpley, Knight, Pierson, Hendrickson and Starr have been appointed a committee to carry on this and other road improvements. Wm. M. Carter, Engr.

McKEES ROCKS, PA.—It has been voted to issue $40,000 in bonds for street improvements.

READING, PA.—The board of public works has rejected the bids received July 18 for 30,000 lin. ft. of granite curbing and 52,000 sq. yds. of sheet asphalt paving, for which $100,000 has been appropriated. The bids were too high. S. S. Hoff, Cy. Engr.

RIDGWAY, PA.—Bids are asked until Aug. 5 for paving about 2,000 lin. ft. of roadway, constructing drains, etc., as stated in our advertising columns. A. B. Little, Engr.; W. W. Barbour, Chn. St. Com.

SHARPSBURG, PA.—An ordinance will be presented to the council for issuing $60,000 in bonds for the improvement of highways. Geo. H. Ayres, Chn.; Wm. C. Tibby, Geo. D. McMarran, Geo. L. Keil, Councilmen.

WILKINSBURG, PA.—Bids are asked until Aug. 3 for grading, curbing and brick paving in portions of Clark St. and three other streets. Frease & Sperling, Engrs.

BALTIMORE, MD.—The board of public works has awarded a contract to the Southern Asphalt Paving Co., Baltimore, at $29,951, for paving Fulton Ave., and at $35,814, for paving Mount Roval Ave.

ROCKVILLE, MD.—Bids are asked until Aug. 10 for grading and macadamizing about nine miles of county roads, as stated in our advertising columns. W. W. Welsh, Clk. County Comrs.

ALEXANDRIA, VA.—Bids are asked until Aug. 11 for furnishing and constructing 500 lin. ft. of curb and 1,060 sq. yds. of brick pavement, as stated in our advertising columns. E. B. Dunn, Cy. Engr.

CHARLESTON, S. C.—Bids are asked until Aug. 3 for paving the county roadway with granite blocks. Wm. P. Cantwell, County Supv.

ROME, GA.—Broad St. will be paved with brick between the Etowah River and Second Ave. Address Chairman Denny or City Engineer Smith.

NEW ORLEANS, LA.—Bids are asked until Aug. 8 for paving, etc., in Camp St., Claiborne Ave. and Canal St., as follows: 65,250 sq. yds. of sheet or rock asphalt on 4 to 6-in. concrete foundation; 135,000 brick, 289,200 lbs. of cast iron, 6,550 lin. ft. of curb, 9,500 lin. ft. of curb to reset, 38,500 ft. B. M. of cypress lumber, 650 sq. yds. of gutter buttons, etc. A. C. Bell, Cy. Engr.; P. A. Rabouin, Comptroller.

CHILLICOTHE, O.—Bids are asked until Aug. 13 for paving certain streets with brick, as stated in our advertising columns. H. M. Redd, Cy. Engr.; W. J. Eyth, Cy. Clk.

CLEVELAND, O.—Bids are asked until Aug. 19 for grading, draining and asphalt paving on the Superior St. viaduct. Geo. R. Warden, Dir.

DEFIANCE, O.—Bids are asked until Aug. 18 for excavating and grading in North Clinton St. and Ralston Ave. J. J. Malley, Cy. Clk.

LANCASTER, O.—Bids are asked until Aug. 13 for brick paving on Main St., from Broad to Maple St. H. T. Mechling, Cy. Clk.

LORAIN, O.—A committee consisting of D. C. Fisher and others have been appointed to consider the question of paving in Second St.

MANSFIELD, O.—Bids are asked by the clerk until Aug. 20 for the purchase of $10,000 of 6% street bonds.

OBERLIN, O.—Bids are asked until Aug. 15 for the purchase of $4,000 of paving bonds and until Aug. 16 for constructing 2,000 sq. yds. of brick pavement. W. B. Gerrish, Cy. Engr.

ST. BERNARD, O.—Bids are asked until Aug. 17 for constructing sidewalks on the bridge over the canal on the Carthage pike road. E. L. Lewis, County Audr., Cincinnati.

SWANTON, O.—Thos. McKinney was awarded a contract July 11 at $6,524 for about 4,500 sq. yds. of brick paving. F. H. Aldrich, Clk.

LAPORTE, IND.—Bids are asked until July 29 for about 9,000 sq. yds. of brick paving, according to reports. Geo. Koenig, Clk.

VERNON, IND.—Walter S. Downs and Peter Van Cleve, Viewers, and W. B. Prather, Engr., have submitted a report to the county commissioners on 17 miles of proposed macadamizing, at an estimated cost of $40,342.

DETROIT, MICH.—Bids are asked until July 30 for furnishing the material and for constructing about 22,000 sq. yds. of cedar block pavement on concrete, etc., in portions of Seward Ave., Orleans St. and seven other streets. D. W. H. Moreland, Pres. Bd. Pub. Wks.

CHICAGO, ILL.—Bids are asked until Aug. 1 for grading, curbing and cedar block paving in Franklin Ave., at River Forest. Robt. E. Williams, Engr., 84 State St., Chicago; T. M. Jackson, Pres.

PEORIA, ILL.—Bids are asked until July 28 for 5,255 sq. yds. of asphalt paving, 3,208 cu. yds. of excavation, 3,346 lin. ft. of curb and gutter. M. W. Manning, Chn. Bd. Local Improvements; A. D. Thompson, Cy. Engr.

ROCKFORD, ILL.—Bids are asked until Aug. 1 for furnishing and constructing about 7,580 sq. yds. of asphalt and 2,885 sq. yds. of brick pavement in East State St. E. W. Brown, Pres. Bd. Local Improvements; Edwin Main, Cy. Engr.

JANESVILLE, WIS.—Bids are asked until Aug. 1 for grading, curbing and macadamizing South Main St., between Racine St. and Carrington St. A. E. Badger, Cy. Clk.

SHEBOYGAN, WIS.—Bids will soon be asked by the board of public works for the purchase of a road roller, to weigh about 28,000 lbs.

MINNEAPOLIS, MINN.—Bids are asked until July 29 for furnishing artificial combined curb and gutter. L. A. Lydiard, Cy. Clk.

BURLINGTON, IA.—Bids are asked until Aug. 1 for brick paving, etc., in Arch St., from Third to Fourth St. Emmet Steece, Cy. Engr.

COUNCIL BLUFFS, IA.—A resolution has been passed for the paving of portions of Ave. F, Pierce St. and five other streets, with brick.

SEDALIA, MO.—An ordinance will be presented to the council by A. P. Morey and others, for brick paving on Ohio St.

ST. LOUIS, MO.—Mayor Ziegenhein has recommended an ordinance appropriating $100,000 for paving, to be presented in the general appropriation bill.

SPOKANE, WASH.—Bids are asked until Aug. 10 for grading, curbing and guttering in Chestnut St. and Mission Ave. H. B. Fowle, Secy. Bd. Pub. Wks.

OGDEN, UTAH.—The county commissioners will spend about $2,500 for road improvements this year.

MANUFACTURING PLANTS.

BUFFALO, N. Y.—The People's Brewing Co., recently incorporated, is reported to have purchased a building on Broadway, near the Belt line. This building will be remodeled and machinery for a brewery will be put in. M. Hilburger, Buffalo, is preparing the plans and specifications. The plans for the machinery will be prepared by Emil Krampitz, of Buffalo. The brewery will have a capacity of 30,000 barrels of beer a year. Capital stock, $120,000. Jos. E. Barnard, Geo. Baltz and C. R. Rossler, of the Rossler Carriage & Buggy Co., are interested.

DUNKIRK, N. Y.—The Buffalo Bridge & Iron Works has been awarded the contract for erecting a 220 × 80 × 36-ft. addition to the plant of the Brooks Locomotive Works. It will be of steel and have two heavy overhead cranes.

TROY, N. Y.—The Troy Laundry Machinery Co., Thomas S. Wiles, Pres., is negotiating for the purchase of a portion of the plant of the Gilbert Car Works property on Green Island, and it is probable that the transfer will be made in a few days. The plant of the company on Fulton St. has become inadequate, and it was found necessary to enlarge. The present establishment will be continued in conjunction with the new one.——Additions and alterations are to be made to the Troy Paint Works, Wm. Connors, Pres.; estimated cost, $22,000. Archs., M. F. Cummings & Son, Troy.

CONNELLSVILLE, PA.—Press reports state that the plant of the Slaymaker-Barry Co., which was destroyed by fire about five weeks ago, is to be rebuilt. Plans have been prepared and the contract let for the padlock factory. The buildings will be of iron and steel, and will cost $20,000. The main building will be 70 × 400 ft. Besides this there will be a boiler room 35 × 42 ft., an engine room 36 × 40 ft., and a stock house 20 × 40 ft. The contract for the entire building, machinery included, has been let to Edward Erickson, contracting engineer, Pittsburg, Pa. Mr. Erickson has also secured the contract for putting in two new mills at the plant of the Humbert Tin Plate Co., Connellsville. An addition to the building will be made, the contract for this part of the work having been secured by W. B. Scaife & Sons, Pittsburg, while all the other work will be furnished by Mr. Erickson.

ROCKINGHAM, N. C.—Press reports state that the Pee Dee Mfg. Co. will begin at once the building of Mill No. 2. The structure will be two stories high, 317 × 100 ft., and its equipment of machinery will include 6,000 spindles, 300 looms, dyehouse equipment and the necessary engine and boilers to furnish the power. This machinery has not yet been purchased.

SALISBURY, N. C.—Geo. R. Collins has purchased the plant of the Artificial Ice Co., and, it is stated, will put in new machinery at once.

ROCK HILL, S. C.—Wm. O. Webber, Consulting Engr., 53 State St., Boston, Mass., writes us that the contracts have not yet been let by the Rock Hill Cotton Factory Co. for furnishing the machinery and for constructing its plant. There will be a 1½-story building, 100 × 230 ft., a 2-story building, 30 × 80 ft., etc., supplied with steam heating, electric lights, spindles, etc.; estimated cost, $20,000. The equipment will include a 600-HP. engine, etc.; estimated cost of equipment, $120,000.

JACKSONVILLE FLA.—It is reported that the Duval & Clay Sugar Co. will increase its capital stock, which is now $300,000, for constructing and equipping a new mill. Treas., J. F. Eldridge.

MISCELLANEOUS CONTRACTS.

FIRE HOSE.—Troy, N. Y.—Bids are asked until Aug. 1 for furnishing fire hose. C. W. Peoble, Clk. Fire Bd.

DITCH.—Lafayette, Ind.—Bids are asked until July 29 for constructing a drainage ditch. M. W. Miller, Chn. Com.

BONDS.—Poplarville, Miss.—Bids are asked until Aug. 15 for the purchase of $2,500 of bonds. R. H. Reeves, Town Clk.

LADDER TRUCK.—Cincinnati, O.—Bids are asked until Aug. 2 for furnishing one ladder truck. C. F. Lakeman, Secy. Bd. Fire Trustees, 66th St.

BONDS.—Newark, N. J.—Bids are asked until Aug. 10 for the purchase of $500,000 of 4% park improvement bonds. D. H. Johnson, Chn. Finance Com.

DITCH.—Kenton, O.—Bids are asked until Aug. 6 for constructing the Scioto River ditch improvement. W. E. Myers, Engr.; James Bastable, County Audr.

DREDGING.—Norfolk, Va.—Bids are asked until Aug. 3 for dredging the Elizabeth River from Hampton Roads to Norfolk. Capt. Thos. L. Casey, U. S. Engrs., Norfolk.

LEVEE WORK.—Desha County, Ark.—Bids are asked until Aug. 5 for levee work. Address Board of State Engineers, Cotton Exchange Bldg., New Orleans, La.

DRAINAGE DITCH.—Arthur, Ill.—Bids are asked until Aug. 6 for constructing a drainage ditch, etc., about 23,936 cu. yds. of excavation. W. M. Fleming, Town Clk.

DREDGING.—Montgomery, Ala.—Bids are asked until Aug. 20 for dredging at entrance to Pensacola Bay, Fla., as stated in our advertising columns. Maj. F. A. Mahan, U. S. Engrs.

RIVER WORK.—Buffalo, N. Y.—Bids will soon be asked by the harbor commissioners for work on section A in the Buffalo River, including a channel 230 ft. wide and 20 ft. deep.

HOSE WAGON.—Leavenworth, Kan.—Bids are asked until Aug. 3 for furnishing a combination chemical and hose wagon, to cost about $1,000. Geo. W. Kaufmann, Chn. Com.

HIRE OF DREDGING PLANT.—Mobile, Ala.—Bids are asked until Aug. 24 for the hire of dredging plant for Mobile River and Bay, as stated in our advertising columns. Maj. Wm. T. Rossell, U. S. Engrs.

LEVEE WORK.—Columbus, O.—Reports state that Julian Griggs, Cy. Engr., has submitted an estimate of $752,618 for the necessary strengthening of the west side levee.

DRY DOCKS.—New Orleans, La.—Reports state that the New Orleans & Western Ry. Co. will construct four new docks, 150, 300, 350 and 1,500 ft. long, to cost about $200,000, at Port Chalmette.

TELEPHONE SYSTEM.—Clarence, Mo.—Bids were received July 23 for the purchase of a franchise to construct and operate a telephone system. H. J. Simmons, Mayor; A. B. Irwin, Cy. Clk.

FIRE ENGINES AND BOILERS.—Chicago, Ill.—Bids are asked until Aug. 3 for furnishing one first-size and two second-size Metropolitan steam fire engines, and two extra boilers, 31 × 64 ins. D. J. Sweenie, Fire Marshal.

SUBMARINE PIPELAYING.—Philadelphia, Pa.—Lewis F. Shoemaker & Co., 417 Fidelity Building, advised us last week that they wished to engage a man for two or three months to lay pipe in about 7 ft. of water.

SUPPLIES.—Memphis, Tenn.—Bids are asked until Aug. 18 for furnishing brush, poles, riprap stone, wire, rope and other supplies, as stated in our advertising columns. Capt. Mason M. Patrick, U. S. Engr., 36 Equitable Bldg.

TILE AND EXCAVATING.—Champaign, Ill.—Bids are asked until Aug. 6 for excavating about 13,566 cu. yds. of earth and for furnishing, hauling and laying about 6,300 lin. ft. of 8 to 18-in. tile. Chas. Witt, Chn. Drainage Comn.

DRAINAGE DITCH.—Ottawa, Ill.—Bids are asked until Aug. 15 for constructing about 8 miles of drainage ditch in Wallace and Waltham. About 100,000 cu. yds. of excavation will be required. Chas. F. Wilson, Engr.; Samuel Bonnefoy, Clk., Ottawa.

FIRE ALARM SYSTEM, ETC.—Oakland, Cal.—A petition has been presented to the council by Edward J. Wolfe, David Bibber and Frederick Kahn, for permission to construct and maintain a burglar, police, fire alarm and a district telegraph messenger system. Bids will be asked for the purchase of a franchise.

HYDRAULIC DREDGE.—St. Louis, Mo.—The following bids were received July 22 for furnishing a hydraulic dredge, as advertised in Engineering News. Capt. H. E. Waterman, U. S. Engrs., Secy., Mississippi River Comn.:

	Dredge.	Refrigerating plant.
Springfield Boiler & Mfg. Co., Springfield, Ill.	$94,970	$2,981
Edw. Flad, St. Louis, Mo.	98,981	2,300
The Bucyrus Co., South Milwaukee, Wis.	129,760	2,448

INDUSTRIAL NOTES.

THE FISHER GOVERNOR CO., Marshalltown, Ia., writes us that it has recently sold 20 governors to one firm and 11 to another firm in Cleveland, O.

THE BIRMINGHAM PIPE WORKS, Birmingham, Ala., was sold July 16, at public auction by R. C. White, assignee, according to report, to the Ahrens & Ott Mfg. Co., Louisville, Ky., for $1,000 cash, and $5,000 in liens, which were assumed by the latter company.

THE PITTSBURG LOCOMOTIVE & CAR WORKS, Pittsburg, has an order from the Wheeling Bridge & Terminal Co., Wheeling, W. Va., for six 100,000-lb. switching locomotives, with Westinghouse air-brakes, to cost about $75,000 each, according to report.

THE STILWELL-BIERCE & SMITH-VAILE CO., Dayton, O., is said to have received an order, through its representative, Mr. A. H. Dalzell, Ogdensburg, N. Y., for two 48-in. Victor water wheels and other apparatus for the power pumps of the Ogdensburg city water-works.

THE FRONTIER IRON WORKS, Detroit, Mich., is adding new brass furnaces to its plant and increasing the size of its brass foundry, in order to take care of the increase in its valve business. The company states that the demand for its Frontier hot water radiator valves is beyond precedent.

THE WEBER RAILWAY JOINT MFG. CO., Cotton Exchange Bldg., New York, has elected the following officers: Emil Greeff, Pres.; Edward Y. Weber, Vice-Pres. and Treas.; George A. Weber, Secy., and Percy Holbrook, Gen. Mgr.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., has a contract from the New Haven Gas Light Co., New Haven, Conn., for its new fireproof coal shed, 60 × 500 ft., with a steel frame arranged so that the coal cars are brought into the building on a track supported by the roof trusses, thus providing the maximum storage at the least expenditure of power and room.

THE SEMI-STEEL CO., King & Andrews Co., proprietors, Chicago, reports that it has just completed its large new foundry at Chicago Heights, Ill. The following roads have tracks into the yards: Chicago & Eastern Illinois R. R., Michigan Central Ry., and Elgin, Joliet & Eastern Ry., giving the factory excellent shipping facilities to all points. The factory was recently described in our columns.

THE KEYSTONE BRIDGE CO., Pittsburg, is reported to have the contract to build the Buffalo, Rochester & Pittsburg R. R. bridge, 1,600 ft. long, 125 ft. high, and 25 ft. wide, over the Allegheny River, at Moss Grove, near Pittsburg, at a cost of $150,000. The Jutte & Foley Co., Pittsburg, has the contract for the substructure. E. K. Morse, Pittsburg, is the engineer in charge of the work.

THE PITTSBURG BRIDGE CO., Pittsburg, Pa., has received through Collins & Norton, New England agents, a contract from the Dwight Mfg. Co., Chicopee, Mass., to build a steel roof over its boiler house which was recently destroyed by fire. This will do away with all wood work in the building. The town of Brookfield, Mass., has also placed a contract with the company for a new bridge on the state highway in the town of East Brookfield, Mass.

THE AMERICAN IMPULSE WHEEL CO., 120 Liberty St., New York, states that it is making steady headway with its improved water wheel in this and foreign countries. The company has wheels installed in Japan, France, Sweden and Scotland, which are reported as giving favorable results, and among contemplated large power and transmission plants in Utah, Canada, Montana and Minnesota the wheels are also being given serious consideration. Mr. Thorburn Reid is Consulting Engineer of the company.

THE STOREY MOTOR & TOOL CO. has moved its main office and factory from Philadelphia to 464 South Broad St., Trenton, N. J., in the plant with the Trenton Iron Co. The change has been made necessary by the increased demand for its electrical machinery, particularly the multipolar, enclosed, dust and moisture-proof motors, the first of this style, it is claimed, to be placed on the market. The company, with its increased facilities, will also push the sale of its open-type machines for all classes of standard work, together with several lines of specialties which up to the present it has been unable to put upon the market.

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PERSONAL.

Mr. Val. Morrison has been appointed Manager of the water-works at Ennis, Tex.

Mr. James W. G. Walker has been appointed a Civil Engineer in the United States Navy, with rank of Lieutenant, junior grade.

Mr. Jacob L. Kuehn, for over 40 years Superintendent of the York Water Co. and of the York Gas Co., York, Pa., has resigned the former position.

Dr. David Gill, the British astronomer at the Cape of Good Hope, South Africa, has been elected a Foreign Member of the National Academy of Sciences, Washington, D. C.

Mr. James Donnelly, for many years Division Superintendent of the Easton & Amboy and the Lehigh Divisions of the Lehigh Valley R. R., with headquarters at Easton, Pa., has resigned; to take effect Sept. 1.

Mr. Alexander Rice McKim, M. Am. Soc. C. E., consulting engineer, of New York city, has accepted the position of Resident Engineer of the Pittsburg Testing Laboratory, Ltd., Pittsburg, Pa., with headquarters at 106 East 23d St.

Mr. George Schley, consulting civil and mining engineer, leaves for British Honduras Aug. 8, to be gone about eight weeks. During his absence he will be represented by Mr. George R. Olney, 27 Thames St., New York city, or 16 Willow Ave., Stamford, Conn.

Rear-Admiral John G. Walker, retired, U. S. Navy, has been appointed a member of the commission to examine the plans for a bridge across the Niagara River, at Grand Island. The plans must be approved by both the United States and the Dominion of Canada.

Mr. Theodore Belzner, Jun. Am. Soc. C. E., 111 Broadway, New York, has resigned his position as Assistant Engineer to the expert in charge of buildings of that city, which he has held for the past two years. He has also been an assistant expert on the valuation of buildings for three years.

Mr. A. J. Churchyard, formerly connected with the Excelsior Co. as Electrical Engineer, has been appointed to a position in the engineering department of the Fort Wayne Electric Corporation, Fort Wayne, Ind. He is best known for his work with single-phase alternating motors and rotary transformers.

Mr. Robert L. Gifford, civil engineer, of Chicago, Ill., has associated himself with Mr. Robert G. Dwen, architect, of the same city, in the joint practice of architecture and engineering, with offices at 187 Dearborn St. Mr. Dwen was formerly associated with Mr. Murray A. White under the firm name of Dwen & White, architects.

Mr. Charles E. Billin, Western Representative of Bement, Miles & Co., Philadelphia, has resigned and will in the future devote all his attention to the business of Chas. E. Billin & Co., Chicago, Ill., which firm is acting as engineers and purchasing agents for a number of mining properties in the western states and in Mexico.

Herr Max Buhle, Assistant Professor in the Royal Technical High School of Berlin, and a Member of the German Society of Engineers, is visiting the United States to study American practice in hoisting and conveying machinery, coal, ore and grain handling machinery, street railways and other fields of engineering work. Prof. Buhle will visit Boston, Schenectady, Niagara Falls, Buffalo, Cleveland, Chicago, Milwaukee, Minneapolis and St. Paul, Duluth and Superior, St. Louis, Washington, Philadelphia, and may possibly extend his trip to San Francisco. Prof. Buhle will be glad to receive the catalogues of American manufacturers of engineering materials, which may be sent to him in care of Thos. Prosser & Sons, 15 Gold St., New York city.

OBITUARY.

Mr. J. M. Byers, contractor, of Oskaloosa, Ia., died there July 24, aged 85.

Mr. William H. Bates, contractor, of St. Charles, Mo., died July 24, aged 75.

Mr. W. H. Holly, Superintendent of the Paducah Water Co., Paducah, Ky., died July 23, aged 48.

Mr. William P. Merrill, who built the first water-works of Milwaukee, Wis., died at Battle Creek, Mich., July 25, aged 82.

Mr. Claude W. Matson, civil engineer, of Brookville, Pa., was killed July 28 while attempting to board a train at Pittsburg. He was 27 years of age.

Mr. George Josselyn, mechanical engineer, of Cedar Rapids, Ia., died July 22, aged 77. He was born in Kingston, Jamaica, W. I. I., and was educated in Neuwiede, Germany. In 1839 he came to the United States and settled at Dayton, O. He was the Superintendent of Construction for the Josselyn & Taylor Co., Cedar Rapids, at the time of his death.

Dr. E. Lewis Sturtevant, formerly President of the Society for the Promotion of Agricultural Science, died at his home in Framingham, Mass., July 30. He was born in Boston, Jan. 23, 1842, and graduated from Bowdoin College, Brunswick, Me., in 1863. In 1866 he graduated from the medical department of Howard University and devoted himself to agricultural science. He was a Fellow of the American Association for the Advancement of Science.

Mr. Joseph Banigan, rubber manufacturer and formerly President of the United States Rubber Co., of Providence, R. I., died July 29. He was born in Carickadoncey, Ireland, June 5, 1839, and came to this country when eight years of age. He learned the jeweler's trade and then made a study of rubber, later engaging in the manufacture of rubber bottle stoppers. He soon afterwards discovered, it is said, a process for vulcanizing rubber and established the Goodyear India Rubber Bottle-Stopper Co. in Boston, Mass., and was its Manager until 1866. At that time he organized the Woonsocket Rubber Co., Woonsocket, R. I., and was its Superintendent and Manager. Three years ago he was made the President of the United States Rubber Co. at a salary of $50,000 a year. He was also President of a number of other companies and was interested in various manufacturing enterprises.

Mr. Edward Appleton, civil engineer, of Reading, Mass., died there July 31. He was born in Boston, Jan. 25, 1816, and graduated from Harvard University in 1835. After two years spent in tutoring he began the study of civil engineering in the office of James Hayward, being employed on the construction of the Boston & Maine R. R. in Haverhill, Dover and Exeter. In 1842 and 1843 he was Principal of the Beverly Academy and in 1844 returned to the Boston & Maine, in charge of the construction of the line from Wilmington to Greenwood. In 1846 he located in Reading, and spent the remainder of his life on railway work in the New England States, and also in New York, Pennsylvania, Ohio and Wisconsin. For several years he was Chief Engineer of the Boston, Hartford & Erie R. R., now the New England R. R. He was a railroad commissioner of Massachusetts in 1869 and 1870, and was also President of the Troy & Greenfield R. R. for several years. In 1890 he retired from professional work.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

THE LOUISIANA ENGINEERING SOCIETY.
Aug. 8. "Deep Bridge Foundations at the Atchafalya River, T. & P. Crossing," C. H. Chamberlin. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Aug. 9. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
MONTANA SOCIETY OF ENGINEERS.
Aug. 13. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
ENGINEERS' CLUB OF MINNEAPOLIS.
Aug. 15. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Aug. 16. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Aug. 17. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
NEW ENGLAND ROAD MASTERS' ASSOCIATION.
Aug. 17. Annual meeting, Boston, Mass. F. C. Stowell, B. & M. R. R., Ware, Mass.
SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.
Aug. 18 to 20. Annual meeting at Massachusetts Institute of Technology, Boston, Mass. Secy., Albert Kingsbury, Durham, N. H.
AMERICAN MATHEMATICAL SOCIETY.
Aug. 19-20. Annual meeting, Boston, Mass. Secy., F. N. Cole, Columbus University, New York city.
AMERICAN CHEMICAL SOCIETY.
Aug. 22-23. Annual meeting, Boston, Mass. Secy., Albert C. Hale, 551 Putnam Ave., Brooklyn, N. Y.
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Aug. 22-27. Annual meeting, Boston, Mass. Secy., F. W. Putnam, Salem, Mass.
GEOLOGICAL SOCIETY OF AMERICA.
Aug. 23. Annual meeting Boston, Mass. Secy., H. L. Fairchilds, Rochester, N. Y.
AMERICAN FORESTRY ASSOCIATION.
Aug. 23-24. Annual meeting, Boston, Mass. Pres., Francis H. Appleton, 101 Tremont St., Boston, Mass.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Sept. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Sept. 5. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
ROADMASTERS' ASSOCIATION OF AMERICA.
Sept. 13. Annual meeting, Denver, Colo. Secy., J. B. Dickson, Sterling, Ill.
CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

CENTRAL STATES WATER-WORKS ASSOCIATION.—The annual convention of this association will be held at Springfield, O., Sept. 27-29. It is expected that fully 200 delegates will attend.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.—The anuual convention of this association will be held at Sault Ste. Marie, Sept. 12-13. Arrangements are being made for a lake trip previous to the meeting, the Eastern members taking the boat, either the Northwest or North Land, at Buffalo and the Western members at Detroit.

THE WESTERN FOUNDRYMEN'S ASSOCIATION.—The regular monthly meeting of this association, held July 20, was devoted to discussing the papers read at the Cincinnati convention held June 23.

The first paper, "Trolley Systems in the Foundry," by Mr. Herbert M. Ramp was read by the secretary preparatory to its discussion. Mr. E. H. Putnam's paper, "Inspection of Castings," was then read and discussed.

NEW PUBLICATIONS.

LITERARY MAGAZINES.—Two of the great English reviews for July, the "Fortnightly" and "Nineteenth Century," give prominent place to articles discussing the new "era of good feeling" between Great Britain and America and its possible influence in International politics. Mr. Frederick Greenwood, in the last named magazine, is inclined to think that America will be glad to have England's help in her own complications, but if England wants aid in return she will get the cold shoulder. At the same time he thinks that if the United States is really setting out to become one of the great world powers, the day will come when she will need and welcome an alliance in which she can both give and get; and he esteems the fact that both nations happened to be looking for a friend at the same time and found one in each other, highly fortunate for both.

The following extract is interesting as showing how our attack of Spain is regarded by European nations:

> . . . . when the American Republic assaults a European State upon extra-legal grounds the door is opened for similar attack by Europe on the American Republic. A spell of immunity surrounded her; she reads the charm backwards and the spell is broken. For the people of the United States should remember that their justification of moral impulse is by no means unchallengeable. Its existence is openly denied by some of their own most learned and lofty minds. And if Europe were to say that here is a case where one country nurses insurrection in another, and then founds a moral right of invasion on the consequences, it could make out a very strong argument, which many commercial Americans are aware of.

An anonymous writer in the "Fortnightly" takes even stronger ground in urging that the United States will never repay the moral support which England has given in the present struggle; and thinks that England wants either an out and out alliance with this country or else no connection whatever.

In the same magazine Hon. T. A. Brassey discusses the question: "Can England Hold Her Own at Sea," and expresses the opinion that England's Navy is at present superior to that of any two powers combined, and this superiority can be maintained. He questions, however, whether the nation is strong enough to keep the fleet equal in strength to the fleets of three powers combined, and looks to the federation of England's colonies and a possible future alliance with the United States as the best means of securing the nation's safety. "The Nineteenth Century" also has a valuable statistical paper on the "Coal Supplies of the World."

In the "Pall Mall Magazine" for July the series of articles on "The Evolution of Comfort in Railway Travel" is concluded with a finely illustrated description of modern American passenger travel by Mr. Angus Sinclair, in which especial reference is made to the great improvement in the lighting of passenger cars, which has resulted from the general introduction of the Pintsch gas system. H. W. Wilson writes on current naval problems, and says that in the present war the navies opposed to each other at the outset were not unlike in their relative strength what the navies of England and France would be if brought to battle at the present time. In the August number of the same magazine Admiral Colomb writes on the lessons of the present war and makes a very readable paper, though he makes such slips as calling our own Sampson, "Admiral Hampton." Although the article was written before the battle of July 3, Admiral Colomb did not hesitate to express his wonder at Cervera's tactics and prophesied that he would not escape from Santiago.

The August "Home Magazine" has a long paper entitled "Harnessing the Earth," in which a large number of the water power and electric transmission plants erected during the last few years in this country are described. The article had better have been called "Harnessing the Rivers."

In "McClure's" for August Lieut.-Col. A. S. Rowan tells of his adventurous ride across Cuba to Gen. Garcia's headquarters in May last, and Gen. Miles describes the field manueuvers of the Russian, German and French troops last autumn.

The more popular literary magazines are giving so much of their space usually devoted to "solid matter," to articles upon the war and the new territories into which the United States arms have been carried, that they have little to spare for articles on scientific or engineering topics. "The August Century," however, has two very brief articles deserving note here, one describing the system of forest preservation which has worked such wonders in India, the other by Mark Twain, entitled "The Austrian Edison Keeping School Again." It appears that Jau Szczepanik, the inventor of the new "telectroscope," and the application of photography to pattern designing, was a poor country schoolmaster. He could not get leave of absence to go to Vienna to market his invention, so he deserted. This lost him his position but gained him a fortune. Now, however, he is obliged to do compulsory military service for three years, according to the law, to which, naturally, he is much opposed at a time when he is just setting out on an inventive career, and the government is also loath to take the young man, who has done so much for the nation's fame, away from his work. This dilemma has been solved, not by an amendment of the law, or the passage of a special act; that is not the continental way; but by allowing the inventor to nominally turn schoolmaster again. As schoolmasters are exempt from military service, once in every two months Szezepanik must return to his native village and teach school half a day.

In the "Atlantic" Prof. Simon Newcomb begins a most interesting series of articles on "The Reminiscences of an Astronomer," describing a visit to England three decades ago, and many famous scientists of that day. "Harper's" for August has an article on the "Grand Canon of the Colorado," by T. M. Prudden, the well-known bacteriologist, which will interest any of our readers who have ever had occasion to explore this wild region of the Southwest.

In the "Popular Science Monthly" for August, Prof. Israel C. Russell, of the U. S. Geological Survey, writes on "Topographical Features Due to Landslides." He explains the occurrence of many foothills and of small lakes without outlets in the lava covered region of Oregon, Washington and Idaho, on the theory that they are due to landslides from the adjacent cliffs and mountain ranges.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Aug. 4.	Electric railway franchise, Plainfield, N. J.	July 28
Aug. 4.	Bridge, Urbana, Ill.	July 28
Aug. 4.	Paving bonds, Carlsbadt, N. J.	July 28
Aug. 4.	Hospital building, Lockport, N. Y.	July 28
Aug. 4.	Bridge bonds, Jersey City, N. J.	July 28
Aug. 4.	Substructure, Brooklyn, N. Y.	July 28
Aug. 4.	Dam, tunnel, etc., Ogden, Utah. Advertised, Engineering News, July 21.	July 21
Aug. 4.	Addition to court house, York, Pa.	July 21
Aug. 4.	Water pipe, Cattaraugus, N. Y.	July 21
Aug. 4.	Macadamizing, Boston, Mass.	Aug. 4
Aug. 4.	Road work, Plymouth, Mass.	Aug. 4
Aug. 4.	Iron bridge, Easton, Pa.	Aug. 4
Aug. 4.	Dredging, Boston, Mass.	Aug. 4
Aug. 4.	Pipe sewers, Erie, Pa.	Aug. 4
Aug. 5.	Pier, Cleveland, O.	July 14
Aug. 5.	Engines (2), Concord, Mass. Advertised, Engineering News, July 28.	July 28
Aug. 5.	Sewers, grading, etc., Wilmington, Del.	July 28
Aug. 5.	Court house, Portland, Ore.	July 28
Aug. 5.	Arch bridge, Springfield, Tenn.	July 28
Aug. 5.	Hospital building, Zumbrota, Minn.	July 28
Aug. 5.	Levee work, Desha county, Ark.	July 28
Aug. 5.	Roadway (2,000 ft.), Ridgway, Pa. Advertised, Engineering News, July 28.	July 28
Aug. 5.	Brick paving, Sedalia, Mo.	Aug. 4
Aug. 5.	Gravel road, Peoria, Ill.	Aug. 4
Aug. 5.	Asphalt paving, Louisville, Ky.	Aug. 4
Aug. 5.	Altering steam dump, New York, N. Y.	Aug. 4
Aug. 5.	Dredging, New York, N. Y.	Aug. 4
Aug. 6.	Asphalt paving, Louisville, Ky.	Aug. 4
Aug. 6.	School building, Watertown, Mass.	Aug. 4
Aug. 6.	Bridge bonds, Brattleboro, Vt.	July 28
Aug. 6.	Ditch, Kenton, O.	July 28
Aug. 6.	Drainage ditch, Arthur, Ill.	July 28
Aug. 6.	Tile and excavating, Champlaign, Ill.	July 28
Aug. 6.	Street work, Mansfield, O.	July 14
Aug. 6.	**Dike, York River, Va.** Advertised, Eng. News, July 7 to 28.	**July 7**
Aug. 6.	Bridge work, Olympia, Wash.	July 21
Aug. 6.	Dredging, etc., Virginia. Advertised, Eng. News, July 7 and 14.	July 7
Aug. 8.	Sewers, Toledo, O.	July 21
Aug. 8.	School building, Peterson, Utah.	July 21
Aug. 8.	Street bonds, Lima, O.	July 21
Aug. 8.	Street work, Lafayette, Ind.	July 21
Aug. 8.	**Water pipe, etc., Winnipeg, Man.** Advertised, Eng. News, June 16 to 30.	**June 16**
Aug. 8.	Brick paving, Anderson, Ind.	July 14
Aug. 8.	Repairing asphalt, Cincinnati, O.	July 14
Aug. 8.	Bridge, Salem, Mass.	July 28
Aug. 8.	Grading, etc., Salem, Mass.	July 28
Aug. 8.	Asphalt paving, New Orleans, La.	July 28
Aug. 8.	Pipe sewer, Latrobe, Pa.	July 28
Aug. 8.	Pipe sewers, Montclair, N. J.	July 28
Aug. 8.	Plans for high schools, Wilmington, Del.	July 28
Aug. 8.	School bonds, Anaconda, Mont.	July 28
Aug. 8.	Electric plant, New Paynesville, Minn. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 8.	Harbor bonds, Montreal, Que.	Aug. 4
Aug. 8.	Bridge masonry, Cardington, Pa.	Aug. 4
Aug. 8.	Light station, New Haven, Conn. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 8.	Water-works, New Paynesville, Minn. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 8.	Brick paving, Montgomery, Ala.	Aug. 4
Aug. 8.	Macadamizing, etc., Findlay, O.	Aug. 4
Aug. 9.	Grading, Sharpsburg, Pa.	Aug. 4
Aug. 9.	School building, Brookline, Mass.	Aug. 4
Aug. 9.	Draft apparatus, Boston, Mass.	Aug. 4
Aug. 9.	Heating and ventilation, Ogdensburg, N. Y.	Aug. 4
Aug. 9.	Heating, plumbing, etc., Central Islip, N.Y.	Aug. 4
Aug. 9.	Brick paving, Schenectady, N. Y.	July 28
Aug. 9.	Iron bridges (9), Alma, Neb.	July 28
Aug. 9.	Bridge work, Jackson, Miss.	July 28
Aug. 9.	Excavation, Boston, Mass. Advertised, Eng. News, July 28 and Aug. 4.	July 28
Aug. 9.	Pipe laying, Boston, Mass. Advertised, Eng. News, July 28 and Aug. 4.	July 28
Aug. 9.	Street work, Orrville, O.	July 14
Aug. 9.	Torpedo boats, Washington, D. C.	July 7
Aug. 9.	Furniture, Binghamton, N. Y. Advertised, Eng. News, July 21 and 28.	July 21
Aug. 10.	Bridge, Batavia, O.	July 21
Aug. 10.	Iron truss bridge, Cincinnati, O.	July 21
Aug. 10.	Bridge masonry work, Norristown, Pa.	July 14
Aug. 10.	Water-works, Pomeroy, O. Advertised, Engineering News, July 14.	July 14
Aug. 10.	Macadamizing, Cincinnati, O.	July 14
Aug. 10.	Grading, curbing, etc., Spokane, Wash.	July 28
Aug. 10.	Bonds, Newark, N. J.	July 28
Aug. 10.	Sewers, Norfolk, Conn. Advertised, Eng. News, July 28 and Aug. 4.	July 28
Aug. 10.	Electric light plant, Shanghai, China.	July 28
Aug. 10.	Macadam paving, Rockville, Md. Advertised, Engineering News, July 28.	July 28
Aug. 10.	Gymnasium building, Batavia, N. Y.	Aug. 4
Aug. 10.	Asylum building, Versailles, N. Y.	Aug. 4
Aug. 10.	Asphalt paving, etc., Indianapolis, Ind.	Aug. 4
Aug. 10.	Electric light plant, Gaylord, Minn. Advertised, Engineering News, July 21.	Aug. 4
Aug. 10.	Gun forgings, Washington, D. C.	Aug. 4
Aug. 10.	Bridges (6), London, O.	Aug. 4
Aug. 11.	Paving, Ashland, Wis.	Aug. 4
Aug. 11.	Light station, Orient Point, N. Y. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 11.	Steel swing bridge, Vancouver, B. C.	Aug. 4
Aug. 11.	Iron or stone bridge, Elizabeth, N. J.	Aug. 4
Aug. 11.	Heating apparatus, Knoxville, Tenn.	Aug. 4
Aug. 11.	Brick paving, curb, etc., Alexandria, Va. Advertised, Eng. News, July 28 and Aug. 4.	July 28
Aug. 11.	School building, Springfield, Mass.	July 28
Aug. 12.	Bridge masonry, Butler, Pa.	July 28
Aug. 12.	Brick paving, Olean, N. Y. Advertised, Engineering News, July 28.	July 28
Aug. 12.	Steam pump, Salem, N. J. Advertised, Eng. News, July 28 and Aug. 4.	July 28
Aug. 12.	Water filter plant, Salem, N. J. Advertised, Eng. News, July 28 and Aug. 4.	July 28
Aug. 12.	Art building addition, Des Moines, Ia.	July 21
Aug. 12.	Electrical conductors, New York, N. Y.	Aug. 4
Aug. 12.	Culvert, Omaha, Neb.	Aug. 4
Aug. 12.	Garbage disposal plant, Milwaukee, Wis.	Aug. 4
Aug. 12.	Bank building, Passaic, N. J.	Aug. 4
Aug. 13.	Clearing, Port Wilson, Wash.	Aug. 4
Aug. 13.	Bridge, Marion, O.	Aug. 4
Aug. 13.	Pipe sewers, Kenton, O.	Aug. 4
Aug. 13.	Bridges (2), Colfax, Wash.	Aug. 4
Aug. 13.	Grading, Zanesville, O.	Aug. 4
Aug. 13.	Pipe sewer, Ashtabula, O. Advertised, Engineering News, July 28.	July 28
Aug. 13.	Brick paving, Chillicothe, O. Advertised, Engineering News, July 28.	July 28
Aug. 13.	Brick paving, Lancaster, O.	July 28
Aug. 15.	Bonds, Poplarville, Miss.	July 28
Aug. 15.	Drainage ditch, Ottawa, Ill.	July 28
Aug. 15.	Paving bonds, Oberlin, O.	July 28
Aug. 15.	Water bonds, Barnesboro, Pa.	July 28
Aug. 15.	Paving, etc., Fremont, O.	July 21
Aug. 15.	Grading, Omaha, Neb.	July 21
Aug. 15.	**Exhibition bldg. plans, Glasgow, Scotland**	**June 2**
Aug. 15.	Water pipe, pumping statn, etc., Laporte, Ind.	Aug. 4
Aug. 15.	Engine house, etc., Evansville, Ind.	Aug. 4
Aug. 15.	Water-works, Augusta, Wis.	Aug. 4
Aug. 15.	Water tower and tank, San Jose, Cal.	Aug. 4
Aug. 15.	Drainage, Cissna Park, Ill.	Aug. 4
Aug. 15.	Gas lamps, Duluth, Minn.	Aug. 4
Aug. 15.	Coal house, Springfield, O.	Aug. 4
Aug. 15.	Heating apparatus, Petersburg, Va.	Aug. 4
Aug. 15.	Church building, Petrolea, Ont.	Aug. 4
Aug. 15.	Asphalt paving, Buffalo, N. Y.	Aug. 4
Aug. 15.	Grading and draining, Toledo, O.	Aug. 4
Aug. 15.	Macadamizing, Oakland, Cal.	Aug. 4
Aug. 15.	Macadamizing, etc., Fremont, O. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 16.	Gas lamps, etc., Superior, Wis.	Aug. 4
Aug. 16.	Bonds, Salt Lake City, Utah.	Aug. 4
Aug. 16.	Steel bridge, Oshkosh, Wis. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 16.	Electric light bonds, Springville, N. Y.	Aug. 4
Aug. 16.	Street bonds, Mount Vernon, N. Y.	Aug. 4
Aug. 16.	Brick paving, Coldwater, Mich. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 16.	Electric light apparatus, Danville, Ill.	Aug. 4
Aug. 16.	Asphalt paving, New York, N. Y.	Aug. 4
Aug. 16.	Electric lighting, Superior, Wis.	Aug. 4
Aug. 16.	Electric light plant, Minster, O.	July 21
Aug. 16.	Pipe sewer, Oberlin, O.	July 28
Aug. 17.	Bridge substructure, New Haven, Conn. Advertised, Engineering News, Aug. 4.	Aug. 4
Aug. 17.	Sidewalks, St. Bernard, O.	July 28
Aug. 17.	Bridge substructures (2), Cleveland, O.	July 21
Aug. 18.	Water supply, Jersey City, N. J.	July 14
Aug. 18.	Army supplies, Memphis, Tenn. Advertised, Eng. News, July 28 to Aug. 11.	July 28
Aug. 18.	Grading, etc., Defiance, O.	July 28
Aug. 18.	Water-works, Rome, N. Y.	Aug. 4
Aug. 19.	Viaduct substructure, Cleveland, O.	July 28
Aug. 19.	Administration bldg., etc., Stockton, Cal.	July 28
Aug. 19.	Asphalt paving, Cleveland, O.	July 28
Aug. 20.	Bridge, Cincinnati, O.	July 28
Aug. 20.	Dredging, Montgomery, Ala. Advertised, Eng. News, July 28 to Aug. 11.	July 28
Aug. 20.	Paving bonds, Mansfield, O.	July 28
Aug. 20.	Electric lighting, Whitesboro, N. Y. Advertised, Eng. News, July 14 and 21.	July 14
Aug. 20.	Street bonds, Malta, O.	July 21
Aug. 20.	Pumping engines, Lancaster, O.	Aug. 4
Aug. 20.	High school building, Sharonville, O.	Aug. 4
Aug. 20.	Road bonds, Houston, Tex.	Aug. 4
Aug. 22.	Heating and ventilation, Paterson, N. J. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Aug. 22.	Bridge (400 ft.), Hamilton, O.	Aug. 4
Aug. 22.	High school building, Columbus, O.	Aug. 4
Aug. 22.	Court house, Charleston, Ill.	Aug. 4
Aug. 22.	School buildings, Ione, Cal.	Aug. 4
Aug. 22.	Electric light plant, Mineral Point, O. Advertised, Eng. News, July 28 to Aug. 11.	July 28
Aug. 22.	Steel substructure, Lebanon, O.	July 28
Aug. 22.	Water-works, Mineral Point, O. Advertised, Eng. News, July 28 to Aug. 11.	July 28
Aug. 23.	School building, Columbus, O.	July 28
Aug. 23.	**Water pipe, Coolgardie, West Australia**	**June 2**
Aug. 23.	Electric light plant, Bunker Hill, Ill.	Aug. 4
Aug. 24.	Water-works improvements, Elyria, O.	Aug. 4
Aug. 24.	Sidewalks, Cambridge City, Ind.	Aug. 4
Aug. 24.	Hire dredging plant, Mobile, Ala. Advertised, Eng. News, July 28 to Aug. 18.	July 28
Aug. 25.	Lighthouse, Baltimore, Md. Advertised, Engineering News, July 28.	July 28
Aug. 25.	Bonds ($80,000), Healdsburg, Cal.	Aug. 4
Aug. 25.	School building, Waldo, O.	Aug. 4
Aug. 26.	Pump engines (2), Minneapolis, Minn. Advertised, Eng. News, July 21 to Aug. 11.	July 21
Aug. 27.	Water pipe, Lakewood, O.	Aug. 4
Aug. 29.	Brick paving, Malta, O.	Aug. 4
Aug. 29.	Brick paving, Canton, O.	Aug. 4
Aug. 29.	Paving, etc., Toledo, O.	Aug. 4
Aug. 29.	Pumping eng. (3,000,000 galls.), Marietta, O.	July 28
Aug. 30.	Plans for electric traveling crane, Chicago.	July 21
Aug. 30.	Grading, etc., for water-wks, Cincinnati, O.	Aug. 4
Aug. 30.	Dams, etc., Mississippi River, Ill. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Aug. 30.	Gravel roads, Indianapolis, Ind.	Aug. 4
Aug. 31.	Dredging, Bridgeport, Conn. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Aug. 31.	Custom house, Guayquil, Ecuador.	Apr. 21
Sept. 1.	Battleships (3), Washington, D. C.	June 23
Sept. 1.	Drainage system, Savannah, Ga. **Advertised, Eng. News, June 23 to Aug. 25.**	June 30
Sept. 1.	Electric light plant, Cullman, Ala.	July 21
Sept. 1.	Water-works, Norwood, N. Y.	July 21
Sept. 1.	Bridges, Johnsonburg, Pa. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Sept. 1.	Water-works, Mobile, Ala. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Sept. 3.	**Sewage pumping station, Boston, Mass.** **Advertised, Eng. News, July 7 and 14.**	**July 7**
Sept. 5.	Dredging, Waukegan, Ill. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Sept. 5.	Bridge, Dillon, Mont.	Aug. 4
Sept. 7.	Bridge, Oroville, Cal.	Aug. 4
Sept. 8.	Bridge, Roseburg, Ore.	Aug. 4
Sept. 12.	**Hospital plans, San Francisco, Cal.**	**Mar. 24**
Sept. 13.	Capitol building, Helena, Mont.	July 28
Sept. 15.	Enlarging court house, Lisbon, N. Dak.	July 28
Sept. 19.	Hospital plans, San Francisco, Cal.	Aug. 4
Oct. 1.	**Monitors (4), Washington, D. C.**	**July 7**
Oct. 1.	**School building (equipment), St. Thomas, Ont.**	**July 7**
Oct. 24.	**Markets, etc., Belem, Brazil**	**Apr. 28**
Oct. 30.	**School building, Chehalis, Wash.**	**June 16**
Dec. 31.	**Plans for station, etc., Stockholm, Sweden.**	**June 23**
No date.	Water franchise, Sumpter, Ore.	Aug. 4
"	Garbage disposal plant, Newport, Ky. Advertised, Engineering News, July 21.	July 21

RAILWAYS.

ALABAMA.—Reports state that the Pioneer Mining & Mfg. Co. has completed the purchase of coal lands near North Birmingham, Ala., and that it will award contracts in about two weeks for the grading of a railway from its furnace plant at Thomas, Ala., to the new mines, about 3½ miles. Surveys have already been made; and it is proposed to build a standard gage line with heavy rail. Messrs. Thomas, of Catasaqua, Pa., are the managers of the company.

ALLEGHENY & WESTERN.—J. M. Floesch, Ch. Engr., Kittanning, Pa., writes us that this company has recently awarded contracts for bridge work along its line to the Pencoyd Bridge Co., of Philadelphia, Pa.; Jutte & Foley, of Pittsburg, Pa.; and the Keystone Bridge Co., of Pittsburg, as more fully described under Bridges.

ATLANTIC COAST LINE.—Surveys are now being made for an extension of this line from Denmark, S. C., to a connection with the Charleston & Western Carolina Ry. It is said that contracts will probably be awarded in September. F. Gardner, Ch. Engr., Wilmington, N. C.

BRANDON & SOUTHWEST.—The contract for the construction of this railway from Brandon to Turtle Mountain, and from Deloraine to Wakida, Manitoba, a distance of about 90 miles, is said to have been awarded to Robert Waddell, Trenton, Ont. The work is to be completed by Nov. 1, 1904.

CALIFORNIA.—Press reports state that work will be resumed next month on the proposed railway to be built from San Diego to the sulphur mines, about 70 miles south of Yuma, Ariz., via Tia Juana, Cal., and Yuma. An entrance will be made into San Diego over the National City & Otay Ry. at Tia Juana. A. J. Booth, of Pittsburg, Pa., is said to be one of the directors. J. A. Dubbs, Gen. Mgr. Mexican Sulphur Co., Pittsburg, Pa., informs us that nothing has yet been done towards building this line except to survey the route from mines to Southern Pacific Ry., near Yuma, 67 miles, and a route from mines to San Diego, 168 miles. It is impossible to tell when construction will begin; nothing further may be done. W. A. Hartt, Ch. Engr., Los Angeles, Cal.

CAPE FEAR & NORTHERN.—J. M. Bandy, Ch. Engr., Greensboro, N. C., informs us that Gibson & Carpenter, Holly Springs, N. C., were awarded the contract July 25 for grading 20 miles of this proposed line from Apex to Blanchards, via Holly Springs, a total distance of 60 miles. Work was to have begun July 27. The right of way has been secured for this first section of 20 miles, and the profile and longitudinal maps completed for the same. Pres., Benjamin Duke, Durham, N. C.

CHICAGO, PEORIA & WESTERN.—This company has been incorporated in Illinois, with a capital stock of $50,000, to build and operate a railway from Chicago through Cook, Will, Grundy, Livingston, Woodford, Tazewell and Peoria counties to Peoria, Ill., thence to Rock Island through the counties of Peoria, Knox, Henry and Rock Island and from Peoria to Rockford through the counties of of Peoria, Marshall, Bureau, Lee, Ogle and Winnebago. The incorporators and first board of directors are, C. H. Matthiesen, S. T. Butler, W. J. German, William Dickinson and C. L. Glass, all of Chicago.

CHINA.—Press reports state that Yung Wing, the Chinese-American, has obtained an extension of time for his concession for the Tien-Tsin-Chin-Kiang Ry., alleging that he has received the support of an English syndicate to supply the necessary capital, £5,000,000. It is also said that Hou Yu Fen, one of the directors general of the Chinese railways, in the face of Russian opposition to the loan, has broken off negotiations with the Hong Kong Bank, which proposed to supply the capital for building an extension of the Tien-Tsin-Shan-Haikwan Ry. to New-Chwang. The latter is distinct from Yung Wing's concession.

CHOCTAW, OKLAHOMA & GULF.—F. A. Molitor, Ch. Engr., South McAlester, Ind. Ter., informs us that this company has completed the location of its line from Shawnee to Stillwater, Okla., a distance of 64 miles. On the eastern extension, from Wister Junction to Howe, on the Kansas City, Pittsburg & Gulf R. R. track has been laid and the road has just been placed in operation. On the western extension track was laid to Geary and the road placed in operation on July 6; this is at a distance of 18 miles from Fort Reno, Okla. Since that time the track has been extended to the South Canadian River at Bridgeport and grading is in progress as far as Weatherford, a distance of 47 miles from Fort Reno, and it is expected that the line will be completed to Weatherford and ready for business on or about Sept. 15.

COLORADO & NORTHWESTERN.—J. S. Frankeberger, Ch. Engr., Boulder, Colo., informs us that this line will not be extended from Ward to Eldorado, Colo., this year. Pres., C. E. Thompson, Boulder, Colo.

DENVER & RIO GRANDE.—Press reports state that Orman, Crook & Co., of Pueblo, Colo., are at work on the proposed extension of this line from Leadville to Ibex, Colo. It is expected to complete the work in 90 days.

EAGLE VALLEY & BAKER CITY.—S. R. Reeves, Pres., La Grande, Ore., informs us that the preliminary survey has been made and the right of way obtained for this proposed line of railway from Baker City to the Seven Devils mining camp, via Sparta and Pine, Ore., a distance of 70 miles. The capital for construction has not yet been secured, and if it be not obtained soon, it is not likely that the road will be built. Mr. Howe, of Baker City, is chief engineer.

ELLAVILLE, WESTLAKE & JENNINGS.—This company is said to be extending its line for a distance of 13 miles. It is now in operation between Ellaville and Johnson, Fla., 20 miles, and the extension is towards Jennings. E. E. West, Pres. and Gen. Mgr., Westlake, Fla.

EMMITSBURG.—It is announced that the directors of the Emmitsburg R. R. Co., which bought the seven miles of road running from Rocky Ridge, where it connects with the Western Maryland R. R., have reorganized and elected the following officers: Pres., James A. Elder; Vice-Pres., William A. Hines, New Oxford, Pa.; Treas., William G. Blair; Secy., Dr. J. B. Brawner; Counsel, Vincent Sebold. In the near future the company contemplates extending the road on to Woodsboro, where it will connect with the Pennsylvania system and give direct communication with Frederick City, Md.

FLAT RIVER VALLEY.—This company was incorporated in Missouri, July 28, with a capital stock of $600,000, to build and operate a standard gage railway from the Mississippi River, in Perry county, opposite Chester, Ill., and through the county of Ste. Genevieve to Farmington, in St. Francis county, and thence to Irondale, on the Iron Mountain R. R., in Washington county, a distance of 60 miles. The incorporators are: C. B. Cole, C. H. Shannon, Edward Whitaker, H. J. Cantwell and Charles Hamilton.

GULF & BRAZOS VALLEY.—Reports state that tracklaying will begin on this proposed line, from Henrietta to Velasco, Tex., 400 miles, in about two months. About 20 miles have been graded and the bridges are being erected. Pres., W. A. Squires, Lakota, Tex.

INDIANOLA COAL & RY.—This company was incorporated in Texas, July 21, with a capital stock of $250,000, by C. H. Alexander, Emmett A. Ellis and R. C. Hawley. The principal place of business will be at Dallas, Tex.

KANSAS, OKLAHOMA CENTRAL & SOUTH WESTERN.—The citizens of Cherryvale and Caney, Kan., voted to issue $20,000 and $10,000 in bonds respectively at a special election July 19, to aid in the construction of this railway, which is being built from Cherryvale, Kan., to Vernon, Tex., a distance of 350 miles. Independence, Kan., was to have a special election Aug. 2 to vote $13,000 in bonds for the same road. Pres., J. H. Bartles, Bartlesville, Ind. Ter.

LEHIGH VALLEY.—This company is said to have made a contract with A. G. Morris & Co., of Tyrone, Pa., for reballasting the entire double-track roadbed from Buffalo to New York with crushed stone; the stone will be quarried at Le Roy, N. Y. C. E. Webster, Ch. Engr., South Bethlehem, Pa.

MINNESOTA, IOWA & GULF.—This company was incorporated in Iowa, June 27, with a capital of $10,000. It is proposed to construct a railway from New Ulm, Minn., to Conception, Mo. The incorporators are, J. J. Bell, A. C. Titus, J. H. Dixon, Frank T. Campbell and Samuel Compton, of Des Moines, Ia.

MORRISTOWN & CUMBERLAND GAP.—We are informed that the survey will soon be started for the proposed extension of this line, from Bristol towards Knoxville, Tenn. This line is a branch of the Knoxville & Bristol Ry., of which B. J. Woodward, of Philadelphia, is president.

MUSCATINE, NORTH & SOUTH.—E. A. Tennis, of Philadelphia, Pa., according to press reports, has been awarded a contract for the construction of 30 miles of railway for this company, from Muscatine to Elrick, via Grandview and Wapello, Ia. The work is expected to cost about $450,000, and is to be completed by Jan. 1, 1899.

NORFOLK & WESTERN.—Reports state that two corps of engineers are now at work surveying a line of railway from the Elkhorn division of the Norfolk & Western, up Dry Fork or Sandy, towards Tazewell, Va., which will develop a large area of the finest coal in all this section, and it is stated that there is no question now of its construction. It is also said that the road will run to within about twelve miles of Tazewell, which will make it an easy matter to connect with the Clinch Valley division of the Norfolk & Western. J. M. Barr, Gen. Mgr., Roanoke, Va.

NORTHERN PACIFIC.—The directors of this company have authorized the construction of an extension of its Rocky Fork branch through Carbon county, from Rockvale, Mont., in a southerly direction up the valley of Clarke's Fork River, 20 miles to the Bridger coal fields, which is to be the other terminus of the road.——Press reports state that a large force of men and teams and the work train of this company are now at the Cedar Creek side track, three miles south of Garfield, Wash., and will begin at once on the work of filling the big trestle across Cedar Creek. This is the largest and highest trestle on the Spokane & Palouse branch, and the contract of filling this with rock and earth will be a large one. It is said the estimated cost of this work is $28,000. Two large stone arches are to be erected, one for the wagon road and the other for the creek, and when this is completed the Spokane & Palouse branch will have nearly a solid roadbed the entire length of the road. Another large trestle south of Cedar Creek was filled last year, but this has settled some and more work will be done on this soon. It is hoped to have the fill at Cedar creek completed before next winter. E. H. McHenry, Ch. Engr., St. Paul, Minn.

PHILADELPHIA & EASTERN.—The charter granted to this company on January 31 was accepted by the incorporators on August 1; capital stock, $250,000. It is proposed to construct a steam railway through Philadelphia and Bucks counties, Pa., to connect with the Philadelphia, Newtown & New York R. R. below Foxchase, a suburb of Philadelphia, to a point on the Delaware River opposite Trenton, N. J., a distance of 20 miles. The incorporators are: Pres., Lamar J. Ridge; John S. Hoffman, J. T. Ridge, M. D.; Albert W. Margerum and Clarence Hampton, all of Philadelphia, Pa.

ST. FRANCOIS VALLEY.—We are informed that this line was to be open for business on Aug. 1, or as soon as the crossing over the St. Louis Southwestern Ry. was put in. The route is from Campbell to Caligoa, Mo., 10 miles. Pres., E. F. Blomeyer; Ch. Engr., Jas. F. Brooks, both of Cape Girardeau, Mo.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—W. B. Storey, Jr., Ch. Engr., 321 Market St., San Francisco, Cal., informs us that this line was opened for operation to Bakerfield, Cal., 235 miles from Stockton, on June 1. The road has been graded from Visalia to Junction, with a line south from Hanford, a distance of 24 miles. Tracklaying has just begun on this piece. Work on the Franklin tunnel is progressing satisfactorily, and grading has been well advanced for six miles on each side of the tunnel. It is also reported from San Francisco that Frank S. Boggs has been awarded a contract for grading two miles of the road on the extension west of Stockton, and that additional grading contracts will soon be let.

ST. LOUIS & OKLAHOMA.—We are informed that 95% of the grading has been completed on this new line from Sapulpa, Ind. Ter., to Oklahoma City, Okla., via Stroud, Chadler and Wellston, 103½ miles. Track has been laid on the 20 miles west of Sapulpa. J. F. Hinckley, Ch. Engr., Sapulpa.

VALLEY CONNECTING.—This company was incorporated in Pennsylvania July 29, with a capital stock of $10,000, to construct one mile of steam railway in Mercer county, Pa. The incorporators are: Pres., Samuel McClure; Charles E. Phillips, Edward W. Budd, all of Sharon, Pa.; Fayette Brown, Cleveland, O.

STREET AND ELECTRIC RAILWAYS.

BENTON, ME.—The railroad commissioners granted a hearing, July 25, at Fairfield, on the application of the Benton & Fairfield Electric R. R., according to report, for a location between Fairfield and this place. E. F. Webb, Atty., Waterville.

FITCHBURG, MASS.—The Gardiner, Westminster & Fitchburg St. Ry. Co. has asked for a change of location for its proposed electric road in this city, according to report.

MILLBURY, MASS.—It is reported that franchises for a new electric railway from Grafton to this place, 10 miles, via North Grafton and Millbury Junction, have been granted, and construction will begin at once.

NEW BEDFORD, MASS.—The New Bedford, Middleboro & Brockton St. Ry. Co. has been granted a franchise to build its line in this city, according to report. Abbott P. Smith, Frederick C. Hinds and L. Le B. Holmes are interested in the company.

NORTON, MASS.—The Norton & Taunton St. Ry. Co. is reported to have been given permission by the railroad commissioners to issue $80,000 in bonds to build a power house and equip its line with electricity.

BUFFALO, N. Y.—The railroad commissioners, July 26, granted permission to the Buffalo Valley R. R. Co. to build an electric railway from Java to this city, 26 miles, according to press reports. The road will pass through Gardenville, Elma, East Elma, Marilla, Porterville, Wales Centre, Wales and Strykersville, and will carry both passengers and freight. Pres., E. E. Felton, Harrisburg, Pa.

CHATHAM, N. Y.—The Nassau Electric Ry. Co. has made application for permission to increase its capital from $600,000 to $1,500,000, and to consolidate with several other companies.

LOCKPORT, N. Y.—Surveys have been commenced for the line of the Buffalo & Lockport Electric Ry., from this city to Olcott, on Lake Ontario, 36 miles, via Tonawanda. Mgr., Burt Van Horn, Jr.

MOUNT VERNON, N. Y.—The Westchester Electric R. R. has filed a certificate of the extensions of its lines on Fulton Ave., from the Hutchinson River to North 4th Ave. and the city line, via 3d St., Franklin Ave., 18th St., 3d Ave. and Prospect Ave.; also from 6th St. and the western city line to 6th St. and the easterly city line, via Columbus Ave., Hawkhurst Lane and Old Boston Post Road.

RYE, N. Y.—It is reported that the Portchester Electric R. R. Co. has been granted a franchise in this town.

MONTCLAIR, N. J.—It is reported that the town council has granted permission to the North Jersey St. Ry. Co. to continue the construction of its electric railway on Valley Road, and to operate its line on Bloomfield Ave.

EASTON, PA.—Groman Bros., Bethlehem, are reported to have the contract for the new power house of the Easton Transit Co., whose electric railway runs from this city to Bethlehem.

EMAUS, PA.—It is reported that Hugh E. Crilly has the contract to build the electric railway from South Allen to this place. About 120 men are at work and it is expected that the road will be completed by Sept. 15.

GERMANTOWN, PA.—It is reported that the Germantown & Fairmount Park Ry. Co. has been organized to build the Falls of Schuylkill and Fairmount Park. Petitions are being circulated requesting the Councils of Germantown, Chestnut Hill and Mount Airy to grant franchises to the company. It is stated that the line when completed will be operated by the Union Traction Co., Philadelphia. The officers of the new company are, Pres., Chas. E. Morgan, Jr.; Secy. and Treas., Wm. Selfridge.

HOKENDAUQUA, PA.—The Hokendauqua & Egypt St. Ry. Co. was incorporated July 29 with a capital stock of $20,000, to construct and operate an electric railway three miles in length. The incorporators are, Pres., John W. Eckert; Directors, John L. Schwartz, Walter J. Saeger, Edwin R. Snyder and Patrick F. Cannon, Allentown, Pa.

PITTSBURG, PA.—It is reported that the Monongahela Traction Co. will lay a complete new line of electric railway from Duquesne to this city, at a cost of about $100,000, and will also pave its line from Braddock to Homestead. L. G. Woods may be addressed.——The Pittsburg & Birmingham Traction Co. is reported to be laying 90-lb. rails and otherwise improving its roadbed from Union Depot to the foot of Castle Shannon incline, at a cost of about $50,000. Pres., Harry Moore; Vice-Pres., A. C. Wettengel; Secy. and Treas., A. S. Petrie.

STROUDSBURG, PA.—The Stroudsburg Passenger Ry. Co. has accepted the ordinance recently granted by the borough council of East Stroudsburg permitting the former to change its motive power to electricity. It is now hoped to obtain similar permission in this place. Pres., Frank Smith.

WILMINGTON, DEL.—The property-owners in Brandywine hundred are disputing in the courts the right of the Front & Union Sts. Ry. Co. to build its electric railway extension from Chester to this city, across their property, according to press reports.

HAGERSTOWN, MD.—The Harrisburg Foundry & Machine Co., Harrisburg, Pa., has been awarded the contract for two 200-HP. engines, and Robt. Wetherill & Co., Chester, Pa., has secured the contract for three vertical boilers, two of 200 HP. and one of 150 HP., for the Hagerstown Electric Ry. Co., according to report. Two condensers, an additional boiler, with feed pump and necessary piping, was also contracted for. The company has purchased ten lots at Summit Ave. and West Lee St. for $5,500, on which, it is stated, the electric light plant of the company will be built.

MYERSVILLE, MD.—Douglas Bros. have the contract for the construction of the Myersville & Catoctin Ry., to run from this place to Middletown. They have finished grading and expect to have the track laying completed by Sept. 15. We are also informed that later the road will be extended to Hagerstown, via South Mountain. Pres., Cyrus F. Flook, Frederick; Ch. Engr., C. McC. Lemley, Myersville.

ROCKVILLE, MD.—H. M. Talbott, Atty., has made application to the county commissioners for a right of way for the Washington & Rockville Electric Ry. Co. over the Georgetown turnpike, from Montrose to this place, according to report.

WASHINGTON, D. C.—The Columbia St. Ry. Co. has obtained nearly all the land required for its eastern extension to Benning, and grading will soon commence. Pres., Nath. Wilson; Secy. and Treas., Theo. J. King.——The Washington & Glen Echo R. R. Co. has applied to the War Department for permission to lay its tracks across a portion of government property near Georgetown. Maj. A. M. Miller, U. S. Engrs., will report on the question.

LYNCHBURG, VA.—The Lynchburg Electric Ry. & Light Co., successor to the Lynchburg Electric Co., has been organized by Randolph Harrison, of this place, and H. G. Runkle, H. D. McDana, W. S. Johnston, R. A. C. Smith, Thos. D. Kent and Isaac Rosenwald, of New York. It is said that over $50,000 will be spent in rehabilitating the street railway property of the old company.

BIRMINGHAM, ALA.—The Birmingham Traction Co. is engaged in transforming its North Birmingham steam dummy line into an electric railway, and hopes to have the work completed by Oct. 1, according to report.

CHAGRIN FALLS, O.—The Cleveland & Chagrin Falls Electric R. R. Co. has begun an extension to its line from this place to Burton, 18 miles, to be known as the Chagrin Falls & Eastern Ry., and will extend the line, it is said, next season to Warren, thus forming a continuous line from Youngstown to Cleveland. Pres., Vincent A. Taylor; Secy., C. F. Lowe; Treas., Wm. Prescott.

CONNEAUT, O.—It is reported that the Pennsylvania & Ohio St. Ry. Co. has applied for a franchise in this place.

LANCASTER, O.—The Fairfield Traction Co. has been incorporated with $100,000 capital, by H. B. Peters and Wm. Davidson, to build an electric railway in this city.

SANDUSKY, O.—The Sandusky & Interurban Electric Ry. Co. has been incorporated with $500,000 capital by Harry A. Everett, E. W. Moore, Barney Mahler, Chas. H. Stewart and Wm. H. Price, who were reported in our issue of July 21 to have bought the Sandusky Electric St. Ry. The company will build an extension to the latter road to Lorain, via Huron and Vermillion.

ANDERSON, IND.—S. C. Parkhurst, of the Chicago & Southeastern Ry. of Indiana, is reported to be interested in the construction of an electric railway from this city to Jacksonton, 22 miles, via Eaton, Middletown, Winchester and West Eckton.

MONTICELLO, IND.—The Tippecanoe Electric R. R. Co. has been incorporated with $50,000 capital, by Chas. C. Spencer, Emory B. Sellers, Louis G. Gustovel, Clinton L. Bader and Henry Van Voorst, to build a road from this place to Covington, 110 miles, via Fowler. Address Chas. C. Spencer for particulars.

DURAND, MICH.—It is stated that application will be made in a few days for a franchise to build an electric railway from Coranna to this place, via Vernon.

GRAND RAPIDS, MICH.—The council has under consideration a new franchise for the Consolidated St. Ry. Co. to which there is much opposition from the citizens. Pres. and Gen. Mgr., G. S. Johnson.

HOUGHTON, MICH.—It is reported that T. W. Taylor has asked the council for a franchise to build a street railway in this place.

KALAMAZOO, MICH.—It is stated that the Michigan Traction Co. will build its projected line to Battle Creek, noted in our last issue, next spring. The city council has passed a resolution requiring the company to substitute a seven-inch standard girder rail of not less than 90-lbs. weight for the rail now in use between Portage St. and the Grand Rapids & Indiana Ry. crossing. Ch. Engr., Geo. S. Shafer, Philadelphia.

PLYMOUTH, MICH.—A press report states that the Detroit, Plymouth & Northville Ry. Co. has given a mortgage to the Union Trust Co. to secure an issue of $375,000 in bonds, for the purpose of constructing an electric railway over the tracks of the Detroit, Ypsilanti & Ann Arbor Ry. Pres., C. W. Casgrain; Secy., Henry F. Wickham; Treas., John A. Russell.

SAGINAW, MICH.—Pres. Isaac Bearinger, of the Interurban Ry. of this city, has been granted a franchise to build an electric railway on Davenport St., from Michigan Ave. to the bridge.——Operations on the Saginaw Suburban Ry., which is projected from this city to Flint, have been resumed, according to report. The contract to construct the road has been given to a company in Chicago. Secy. Swarthout may be addressed.

WAUKESHA, WIS.—Wm. Powrie, C. E., writes us that the Milwaukee-Waukesha Electric Ry., since its opening, June 25, has been doing a large and constantly increasing business; the running time has been reduced to one hour between the two cities. The road has cut into the passenger business of the steam roads so much that they are now selling 10-ride tickets at 25 cents a ride, the old rate being 60 cents each way. The rate on the electric railway is 50 cents for the round trip, with transfer in Milwaukee to any part of the city. The cars are equipped with air brakes, whistles and electric headlights which show up the track for two miles. The road will be extended to Oconomowoc in a short time.

DES MOINES, IA.—It is expected that the Des Moines City Ry. Co. will have its extension to Valley Junction in operation by Sept. 15. Pres., J. S. Polk; Supt., W. G. Owens.

LAWRENCE, KAN.—A meeting of business men of this city was held July 26, at the Commercial Club, in the interest of a proposed electric street railway in this place, according to report.

LEAVENWORTH, KAN.—The Kansas City & Leavenworth Traction Co. is reported to have accepted the franchise recently granted by the county commissioners for an electric railway between Kansas City, Kan., and this place. Pres., H. G. Pert; Secy., C. H. Chapin.

HOT SPRINGS, ARK.—D. S. Ryan, 414 Central Ave., informs us that the new power plant of the Ouachita Water Power Co. is to furnish the necessary power for the operation of the street cars in this city and for the line running to the lake, 4½ miles from the city. It will also supply power to the railway between Hot Springs and Malvern, 22 miles, or to Benton, Ark., 33 miles. The company has a free right of way for the projected railway to the lake and the promise of a franchise to operate the same through the city. Estimated cost of entire plant, $250,000. Further information may be found under Electric Light and Power.

DALLAS, TEX.—The Dallas Consolidated Electric St. Ry. Co. has completed financial arrangements to secure $800,000 to be used for the improvement of the line, according to report.

DENVER, COLO.—The board of aldermen has granted a franchise over the mayor's veto to the Colfax Electric Ry. permitting it to extend its line to Montclair, a suburb of this city.

PASADENA, CAL.—A new 650-HP. Ball & Wood engine and a Westinghouse multiple dynamo are being installed in the new power house of the Pasadena & Los Angeles Electric Ry., in this city. About $12,000 worth of new copper wire has also been recently put in place. The improvement will cost over $50,000. Pres., P. M. Green.

MEXICO, MEX.—The Riter-Conley Co., Pittsburg, is reported to have the contract for the erection of a 55 × 78-ft. boiler house, a 51 × 78-ft. engine house, and a 75 × 78-ft. coal storage sheds for the City of Mexico Tramways. The Babcock & Wilcox Co., New York, has received the contract to furnish 2,000-HP. of Glasgow boilers, and McIntosh, Seymour & Co., Auburn, have the contract for the engines. A 25-ton traveling crane will be required, according to report.

ELECTRIC LIGHT AND POWER.

HANOVER, N. H.—Lamb & Rich, Archs., have prepared plans for a power plant for Dartmouth College which call for a brick and steel building 157 × 57 ft. and a brick stack.

LOWVILLE, N. Y.—The village board has granted a franchise for lighting the town to Lafayette Wetmore. A plant to cost about $40,000 will be built at Belfort, on the Beaver River. It is proposed to furnish light and power to other places. A company will probably be organized soon. The power house will be 35 × 50 ft., the dam about 200 ft. long, etc. There will be two 30-in. wheels and two 660-HP. dynamos, etc. Bids are now being received for the work, according to reports.

NEW YORK, N. Y.—Bids are asked until Aug. 12 for furnishing the police department with electrical conductors. Wm. H. Kipp, Ch. Clk., 300 Mulberry St.

SPRINGVILLE, N. Y.—Bids are asked until Aug. 16 for the purchase of $4,850 4% 5—30-year electric light bonds. Watt Smith, Village Clk.

SEA ISLE CITY, N. J.—Walter Sexton, Pemberton, N. J., is reported as making arrangements for the immediate construction of the proposed plant, for which a franchise was recently granted.

GREENCASTLE, PA.—Geo. F. Blosser has been granted a franchise for a plant in this town.

WINCHESTER, VA.—Press reports state that the proposed plant for this place, recently voted for by the town, will have 70 2,000-c. p. arc lights.

FITZGERALD, GA.—C. C. Goodnow, Mayor, writes us that the following bids were received July 18 for furnishing the materials and for constructing a plant and water-works:

J. H. Harris, Fitzgerald, Ga.	$28,999
Consolidated Engineering Co., New Orleans	27,925
Moore & McCoy, Atlanta (accepted)	26,672

JACKSON, GA.—The question of building a plant and water-works is being considered, according to reports. M. L. Hendrick may be addressed.

MOULTRIE, GA.—At the election in July this place voted to issue bonds for a municipal plant and for completing the water-works.

ELLISVILLE, MISS.—The council is reported as considering a proposition to grant a franchise for a plant.

OXFORD, MISS.—Jno. F. Brown, Mayor, writes us that at the election held July 26 this place voted against building a plant and sewerage system. It is only a question of time when the town will have the improvements, however.

KOKOMO, IND.—The plant of the Citizens' Electric Light Co. was destroyed by an explosion and fire July 28, according to reports.

PORTLAND, IND.—It is reported that a fire at this place caused $3,000 damage to the city plant. Supt., O. N. Eiler.

BAY CITY, MICH.—Bids are asked by the city clerk until Aug. 15 for furnishing a new dynamo for the city light plant.

BELLAIRE, MICH.—Edward Suffern, Village Clk., writes us that on June 20 this place voted to build a plant to cost $8,000. About $5,000 in bonds will be issued, $2,000 of which will be used for a woodenware factory, the balance for an electric light plant. It is not likely that anything in regard to securing the plant will be done this year.

JONESVILLE, MICH.—The council is reported as considering the question of building a plant and water-works.

BUNKER HILL, ILL.—Bids are asked until about Aug. 23 for furnishing and constructing a plant, according to reports. Engr., Owen Ford, Security Bldg., St. Louis, Mo.

DANVILLE, ILL.—Bids are asked by the board of trustees of the National Home for Disabled Volunteer Soldiers until Aug. 16 for furnishing and installing lighting apparatus, etc., in certain buildings here.

SUPERIOR, WIS.—Bids are asked until Aug. 16 for lighting the streets with 50 to 200 1,200 or 2,000-c. p. arc lights for one to three years, also for gasoline lighting, etc. F. J. Seguin, Cy. Clk.

GAYLORD, MINN.—Bids are asked until Aug. 10 for furnishing and constructing a plant, as advertised in Engineering News July 21. (Postponement from July 28.) C. W. Clasen, Village Recdr.; F. Mansfield, Mayor.

NEW PAYNESVILLE, MINN.—Bids are asked until Aug. 8 for furnishing and constructing a plant and water-works, as stated in our advertising columns. M. S. Elliott, Recdr.; Fairbanks, Morse & Co., Engrs., St. Paul, Minn.

WINNEBAGO CITY, MINN.—The council is reported as making arrangements for the immediate construction of the proposed plant, for which $8,000 in bonds were voted July 2.

AURORA, NEB.—O. H. Kilbourne, Osceola, Neb., writes us that he has purchased all the machinery for the proposed plant, to cost $6,000.

HASTINGS, NEB.—Bids are asked by the city clerk for lighting the streets with electricity. The council has appropriated $3,000 for this year's lighting.

LIVINGSTON, MONT.—The electric light plant of the Livingston Electric Light Co. was destroyed by fire July 24. The loss was $32,000, more than half covered by insurance. A temporary service will be established. Pres., J. R. King.

HOT SPRINGS, ARK.—D. S. Ryan, 414 Central Ave., Hot Springs, writes us as follows with regard to the proposed power plant for the Ouachita Water Power Co.: The plant is intended to supply lights and power for entire city, including 190 hotels, to operate street cars in this city and to the lake, the latter 4½ miles from city. It is to operate railway from Hot Springs to Malvern, 22 miles, or to Benton, 33 miles. To supply lights and power for Pyrites mines, 2½ miles west, and for Silver mine, 28 miles west. Cross-sections and soundings made and levels over several miles above dam site. Capital desired, any reasonable arrangements. Examinations made by engineers of Jas. Leffel & Co., Springfield, O.; by chief engineer National Co., and the surveys, soundings and cross-sectioning with original surveys and measurements by Edw. Ruger, of Janesville, Wis., and under his directions. The plant will have a capacity for 180 arc and 10,000 16-c. p. incandescent lights; estimated cost, $250.000. Des. Engr., Geo. M. French, Hot Springs.

LITTLE ROCK, ARK.—Geo. G. Harkness, Secy. Bd. of Trade, writes us that preliminary surveys have been started for a dam and turbine wheels on the Ouachita River, near Rockyford, Ark. The dam will be about 700 ft. long. It is proposed to generate electricity and transmit it to Little Rock, a distance of 45 miles. Geo. C. Strong, Little Rock, may be addressed.

SHERMAN, TEX.—C. P. Gregory, Chn. St. Com., writes us that the council is contemplating putting in a new dynamo for the plant. M. H. Andrews may be addressed.

SEATTLE, WASH.—Local papers state that Chas. H. Baker, Pres. Snoqualmie Falls Power Co., left this city July 26 for eastern cities to arrange for the purchase of machinery for the proposed plant; estimated cost, $250,000. Wm. H. Baker, ex-Pres. Chicago Board of Trade, Chicago, Ill., may be addressed.

SANTA CRUZ, CAL.—Press reports state that a contract was signed July 22 for furnishing 150 HP. by the Big Creek Water Power Co. for the operation of the machinery at the powder works. It is expected soon to increase this to 450 HP.

TUSCARORA, NEV.—The Dexter Mining Co., it is reported, is making preparations to put in a plant. Surveys have been made and the company has advertised for bids to furnish the necessary poles for the electric line. When the plant is completed the company will have 195 HP., instead of 85, as at present. Gen. Mgr., S. B. Milner; Pres., John Dern.

HAMILTON, ONT.—The council is considering the question of engaging either J. Roderick Parks, Toronto, Ont., or Percy Domville, Hamilton, to prepare estimates, etc., for a municipal plant.

SHERBROOKE, QUE.—Press reports state that the Eastern Townships Light, Power & Carbide Co., formed recently, has decided to purchase the electric plant at North Hatley formerly owned by Edgar & Roy. The reason for forming a joint stock company is to meet the demand for electric light and power from other than the villages of Waterville, Hatley, Eustis and Compton, which were supplied by Edgar & Roy. The capital stock of the company is $50,000, but only half of this has been offered to the public, and has been about all taken up. Pres., A. J. Gordon, North Hatley; Secy. and Treas., O. E. Roy, Montreal.

MONTEREY, MEX.—It is stated that E. Dysterum, Supt. Compania de Luz Electrica y Fuerza Motriz, of Monterey, Mex., is visiting electrical plants and manufacturing establishments in New York. The company is extending its business, particularly in the way of power transmission.

EDINBURGH, SCOTLAND.—Press reports state that the electric lighting committee of Edinburgh is making additions to the plant, and several American manufacturers, who are represented in England or Scotland, will be the recipients of contracts in connection with the work. It is understood that the Babcock & Wilcox Boiler Co. has already received an order for nearly $15,000 worth of material, and that the General Electric Co. has also secured a contract.

NEW COMPANIES.—Jaques Cartier Water Power Co., 243 Washington St., Jersey City; $500,000, with $1,000 paid in; to operate in Canada; Russell H. Lansdole, Ernest W. Cooke, 243 Washington St., Jersey City.

Spartanburg Gas, Electric Light & Street Ry. Co., Spartanburg, S. C.; $200,000; Elliot Norton, William E. Lown, George G. Day, Albert Leszynsky, all of New York.

BRIDGES.

NEW HAVEN, CONN.—Bids are asked until Aug. 17 for constructing the substructure, retaining walls and approaches for the new Chapel St. draw bridge, across Mill River, as stated in our advertising columns. C. W. Kelly, Cy. Engr., 17 City Hall.

ELIZABETH, N. J.—Bids are asked until Aug. 11 for constructing a 2-span bridge of iron or stone at Bridge St. Louis Quien, Engr.

ALLEGHENY, PA.—The Fort Pitt Bridge Works, Canonsburg, has been awarded a contract at $30,000 for constructing a 400-ft. bridge, having a center span of 175 ft., over Wood's Run, at Davis Ave. Gustave Kaufman, Engr., Pittsburg.

CARDINGTON, PA.—Bids are asked until Aug. 8 for the masonry work for two bridges over Naylor's Run. Wm. P. Hipple, Chn. County Comrs., Media.

EASTON, PA.—Bids are asked until Aug. 4 for constructing an iron bridge on Peach St., according to reports. H. R. Fehr, Cy. Engr.

JOHNSONBURG, PA.—Bids are asked until Sept. 1 for constructing one or two iron or steel bridges on Center St., as stated in our advertising columns. H. Little & Sons, Engrs., Ridgway, Pa.

KITTANNING, PA.—J. M. Floesch, Ch. Engr., writes us that the following contracts have recently been let by the Allegheny & Western Ry. Co.: All the steel bridge work between Lindsey and the Allegheny River, a distance of 33 miles, to the Pencoyd Bridge Co., Philadelphia. This work includes two crossings of Mahoning Creek and one steel viaduct 830 ft. long and 60 ft. high over Big Mahoning Creek, near Dayton, and one 1,025 ft. long and 150 ft. high over Little Mahoning Creek, near Dayton; also numerous smaller spans over highways and streams. The substructure for the bridge over the Allegheny River at Mosgrove has been let to Jutte & Foley, Pittsburg. The superstructure for the Allegheny River bridge has been let to the Keystone Bridge Co., Pittsburg, and consists of a channel span 450 ft. long, two spans 300 ft., one span 240 ft. and a steel viaduct 400 ft. in length. The bridge is to be a deck truss with a clear height 60 ft. above low water. The steel superstructure of the bridges between the Allegheny River and Butler has also been let to the Keystone Bridge Co., Pittsburg. This work consists of two steel viaducts 400 ft. long and several smaller span bridges.

ANNAPOLIS, MD.—A contract has been awarded to W. T. Douglas, Baltimore, at $16,594, for constructing the bridge over Curtis Bay. A. K. Starlings, County Clk.

NEWPORT NEWS, VA.—Geo. Y. Alsop, Cy. Engr., has submitted plans for two steel bridges, at 24th and 25th Sts., each to be 550 ft. long.

CARTHAGE, O.—The following bids were received by the county commissioners July 27 for constructing a bridge over Mill Creek, near this place:

Youngstown Bridge Co., Youngstown, O.	$38,950
Cincinnati Bridge Co., Cincinnati, O.	36,000
Wrought Iron Bridge Co., Canton, O.	42,000
King Bridge Co., Cleveland, O.	38,000
Brackett Bridge Co., Cincinnati, O.	32,500
Toledo Bridge Co., Toledo, O.	39,900
Lafayette Bridge Co., Lafayette, O.	37,000
Champion Bridge Co., Wilmington, Del.	35,995
Oregonia Bridge Co., Cincinnati	39,600
Massillon Bridge Co., Massillon, O.	36,500
Penn Bridge Co., Beaver Falls, Pa.	37,165

CHILLICOTHE, O.—Willard & Cornwell, Louisville, Ky., have been awarded the contract for building a $20,000 iron bridge.

HAMILTON, O.—Bids are asked until Aug. 22 for constructing a 400-ft. bridge over the Miami River at Wood St.; estimated cost, $79,000. L. A. Dillon, County Engr.

MARION, O.—Bids are asked until Aug. 13 for a 130-ft. iron superstructure over Whitestone Creek, capacity 100 lbs. per sq. ft. U. K. Guthberg, County Audr.

LONDON, O.—Bids are asked until Aug. 10 for constructing six bridges, according to reports. W. D. Wilson, County Audr.

YOUNGSTOWN, O.—A contract was awarded to the Youngstown Bridge Co., on July 25, at $78,000, for constructing the South Ave. bridge.——F. M. Lillie, Cy. Engr., informs us that a petition has been circulated for the construction of a bridge across the Mahoning River, near the Ohio Steel Works.

GRAND RAPIDS, MICH.—Geo. M. Ames, Cy. Engr., informs us that a proposition has been suggested to construct a bridge at Lyon St., for the street railway company.

OWOSSO, MICH.—The Groton Bridge & Mfg. Co., Groton, N. Y., has been awarded a contract at $10,375 for constructing the bridge across West Main St.

CHICAGO, ILL.—The following bids were received June 25 for constructing a railway bridge at Campbell Ave., advertised in Engineering News. Jas. Reddick, Clk.:

	Excluding operation.	Including operation.
C. L. Strobel, Chicago, Ill	$235,425	$337,425
Edgemoor Bdg. Wks., Wilmington, Del.	286,195	371,195
Scherzer Rolling Lift Bdg. Co., Chicago.	369,140	510,880
King Bridge Co., Cleveland, O*	373,000	454,020
J. G. Wagner Co., Milwaukee, Wis.	366,750	416,750

*Waddell arch, tubular piers. Waddell cantilever, $423,020, $505,020; Waddell arch, $395,710; $476,710, respectively.

OSHKOSH, WIS.—Bids are asked until Aug. 16 for furnishing the material and for constructing a steel bridge across Sawyer Creek, as described in our advertising columns. Oscar Sanne, Engr., Colby & Abbot Bldg., Milwaukee, Wis.; Casper Fluor, Chn. Bd. Pub. Wks.

FLEMING, KAN.—Reports state that arrangements are being made for the construction of a bridge between Sheridan and Baker townships, near this place. Address John Oertle, Township Trustee.

DILLON, MONT.—Bids are asked until Sept. 5 for constructing a 60-ft. Howe truss bridge, on Big Hole River. E. H. Mayers, Clk.

COLFAX, WASH.—Bids are asked until Aug. 13 for furnishing the material and for constructing two bridges. John Tobin, County Audr.

ROSEBURG, ORE.—Bids are asked until Sept. 8 for constructing a bridge over Elk Creek. J. Lyons, County Judge.

LOS ANGELES, CAL.—Sawyer & McArthur have been awarded a contract, at $23,000, for constructing the 600-ft. bridge across the Santa Fe River, for the Los Angeles Traction Co. W. S. Hook, Mgr.

OROVILLE, CAL.—Bids are asked until Sept. 7 for constructing a bridge over Powell Creek. Address Supervisor Cass.

VANCOUVER, B. C.—Bids are asked until Aug. 11 for constructing a steel swing for the Granville St. bridge. Thos. F. McGuigan, Cy. Clk.

BUILDINGS

HALLOWELL, ME.—William Wiley, Gardiner, Me., has been awarded the contract for installing a hot-water heating apparatus in the new industrial school building, at $933. The contract for plumbing was awarded to John B. Smith & Co., of Lewiston, at $496.——It is said that the Hallowell Granite Co. has received the contract to erect the new city hall building in this city, to cost about $20,000.

BARRE, VT.—Reports state that the contract for erecting the new city hall building has been let to Mason & Co., Concord, N. H., at $36,000.

BOSTON, MASS.—Bids are asked by the Boston City Hospital, Harrison Ave., until Aug. 9, for the installation of a mechanical draft apparatus in connection with the power plant, boiler house, at the City Hospital on Albany St.; also for three new boilers, etc. Pres., A. Shuman.

BROOKLINE, MASS.—Bids are asked until Aug. 9 for the erection of a grammar school building on Harvard St. Jas. R. Dunbar, Chn. School Com., Town Hall; Loring & Phipps, Archs., Exchange Bldg., Boston, Mass.

WATERTOWN, MASS.—Bids are asked until Aug. 6 for erecting an 8-story school building in this city. Edward F. Porter, Chn. Bldg. Com.

NEW HAVEN, CONN.—Bids are asked until Aug. 8 for erecting the New Haven Harbor breakwater light station. as stated in our advertising columns. The plans and specifications for this work are on file in the office of Engineering News, St. Paul Bldg., New York. Lt.-Col. D. P. Heap, U. S. Engr., Tompkinsville, S. I., N. Y.

BATAVIA, N. Y.—Bids are asked until Aug. 10 for erecting a gymnasium building for the State School for the Blind. Lee R. Sanborn, Pres. Bd. of Mgrs.

CENTRAL ISLIP (L. I.), N. Y.—Bids are asked by the Manhattan State Hospital, 1 Madison Ave., New York, until Aug. 9, for furnishing the materials and performing the labor required for the erection and finishing; warming and hot-water supply; plumbing and drainage, and the electric wiring and fixtures of extensions to the dining-room building of group D, at Central Islip. Geo. E. Dodge, Secy. Bd. of Mgrs.; I. G. Perry, State Arch., Albany, N. Y.

DEPEW, N. Y.—The Depew Improvement Co. will build a 5-story brick hotel to cost $40,000, and a 3-story brick business block to cost $10,000. Arch., George Palliser, 32 Park Place, New York.

NEW YORK, N. Y.—Plans have been filed by Polstein & Feinberg, 200 Henry St., for three 6-story brick flat and store buildings at 209 and 213 Eldridge St., to cost $75,000. Arch., Michael Bernstein, 145 Centre St.; by Harris Fine and David Kidansky, for three 6-story brick tenement and store buildings at 244 to 248 Broome St., to cost $70,000. Archs., Horenburger & Straub, 122 Bowery; by Ablemann & Rosenbaum, 1804 Madison Ave., for eight 4-story brick flat buildings on St. Ann's Ave., from 157th to 158th Sts., to cost $140,000. Arch., Michael Bernstein, 145 Centre St.; by Frank Harly and others, for a 3-story brick department store building at 126th St. and 3d Ave., to cost $60,000. Archs., Cleverdon & Putzel, 13 Astor Place; by Brensky & Goldstein. 1703 Lexington Ave., for three 5-story brick tenement buildings on 101st St., near Park Ave., to cost $66,000. Arch., Sol. D. Cohen, 203 Broadway.

OGDENSBURG, N. Y.—Bids are asked by the supervising architect, Washington, D. C., until Aug. 9, for the removal of the old heating and ventilating apparatus and installation of a new system in the U. S. building in this city.

ORIENT POINT, N. Y.—Bids are asked until Aug. 11 for furnishing the material and for erecting the Orient Point light station N. Y., as stated in our advertising columns. The plans and specifications are on file in the office of Engineering News, St. Paul Bldg., New York. Lt.-Col. D. P. Heap. U. S. Engr., Tompkinsville, N. Y.

ROME, N. Y.—Andrew Douglass, of Binghamton, N. Y., has been awarded the contract for the construction of a number of buildings for the Rome State Custodial Asylum, at $66,004.

TROY, N. Y.—Contracts for the extension to the Troy Times Building have been awarded to Chas. P. Boland, for mason work, and to E. W. Martin & Son for the carpentry work; estimated cost, $30,000.——The school board of Troy is to have a special meeting to adopt plans by M. F. Cummings & Son for a new high school building to be erected on 5th St., at a cost of $150,000.

ELLIS ISLAND, N.Y.H.—The following bids were received by the supervising architect, Washington, D. C., July 30, for the masonry, carpentry and structural iron work required in the construction of the main buildings of the U. S. immigrant station on Ellis Island, in New York Harbor; Archs., Boring & Tilton, 32 Broadway, N. Y.:

Bidders.	Totals.	Mason work, etc.	Carpentry work, etc.	Iron work, etc.	Time.
Brown, Ketchum & Co., Indianapolis, Ind.	......	......	......	$84,400	....
Jas. C. McGuire, New York	......	......	......	74,900	8 mos.
Post & McCord, New York	......	......	......	77,950	6 "
James Baker Smith, New York	$571,542	$398,371	$90,194	82,977	11 "
T. B. Updyke, Philadelphia, Pa.	......	......	......	86,400	11 "
D. H. Hayes, Chicago, Ill	......	345,337	83,533	......	12 "
Hopper & O'Rourke, New York	573,000	393,000	100,000	80,000	8 "
N. J. Steel & Iron Co., New York	......	......	......	85,600	4 "
Martin Walsh, Brooklyn, N. Y	551,700	376,700	100,000	75,000	12 "
Eugene Lentilhorn, New York	567,400	402,235	85,420	80,745	360 days
Mapes-Reeves Cons. Co., New York	......	425,000	......	......	8 mos.
Jno. H. Parker & Co., New York	......	380,639	......	......	11½ "
P. J. Carlin & Co., Brooklyn, N. Y	519,000	339,000	98,103	81,897	1 year
L. L. Leach & Son, Chicago, Ill	487,788	370,493	55,915	79,973	12 mos.
Geo. G. Fuller & Co., Chicago, Ill	503,000	......	......	......	12 "
Jos. J. Churchyard, Buffalo, N. Y	568,560	388,291	110,000	83,000	12 "
R. H. Hood & Co., New York	473,975	......	......	......	....
McIlvain, Unkefer & Co., New York	524,300	358,000	83,000	83,300	12 mos.
Hugh Getty, New York	599,446	......	......	......	350 days.
Jno. F. Johnson, New York	......	434,673	......	......	12 mos.
Thos. Marshall, Pittsburg, Pa	......	......	......	94,080	April, '99
Bradley & Currier Co., New York	......	......	119,988	......	....
Prescott, Buckley & Callivan, Albany, N. Y	639,000	440,254	117,000	82,000	12 mos.
Levering & Garrigues, New York	......	......	......	88,740	9 "
Norcross Bros., New York	585,739	411,984	90,525	83,230	12 "
Jno. L. Hamilton & Sons, New York	......	......	136,377	......	6 "

VERSAILLES, N. Y.—Bids are asked until Aug. 10 for erecting a dining hall for the Thomas Asylum for Orphan and Destitute Indian Children, near Versailles. Henry R. Howland, Pres. Bd. Mgrs., 367 7th St., Buffalo, N. Y.

JERSEY CITY, N. J.—The trustees of the new library building to be erected on Jersey Ave., from Montgomery to Mercer St., at a cost of about $120,000, have adopted the plans of Brite & Bacon, Constable Bldg., 111 5th Ave., New York.

NEWARK, N. J.—V. J. Hedden & Sons, 143 Liberty St., New York, are said to have been awarded the contract for erecting the new bank building for the Howard Savings Institution, at 766 Broad St. Arch., Geo. B. Post, 33 East 17th St., New York.

PASSAIC, N. J.—Bids are asked until Aug. 12 for erecting a 6-story brick and stone bank and office building for the People's Bank & Trust Co. Arch., Fred. W. Wentworth, National Bank Bldg., Paterson, N. J.

PATERSON, N. J.—Bids are asked until Aug. 22 for furnishing and installing a steam heating and ventilating apparatus for the post-office building, as stated in our advertising columns. Jos. Knox Taylor, Supervising Arch., Washington, D. C.

CARNEGIE, PA.—The contract for the erection of a new high school at this place has been awarded to Charles Rife & Bros., of Allegheny, at about $30,000.

PITTSBURG, PA.—The barns of the Consolidated Traction Co. at Frankstown and Penn Aves. were destroyed by fire July 24, causing a reported loss of $150,000. The building was valued at $125,000, and the 36 cars contained therein at $55,000. Pres., C. L. Magee.——W. H. Skivington has purchased 410 ft. of property on Highland Ave. for $90,000, on which he will erect brick and stone residences.

RANKIN, PA.—The Monongahela St. Ry. Co. has placed the order for a new street car barn at Rankin. The building will be 120 × 230 ft., and was designed by Wilkins & Lavison, Engrs., Westinghouse Bldg., Pittsburg.

BALTIMORE, MD.—The Consolidated Ry. Co. has made application for a permit to build large car sheds on the Frederick turnpike, near Irving Ave., to replace the barn burned several months ago. The building is to be of brick and iron, 1½ stories high, and will cost about $60,000 and accommodate 250 cars. John Hiltz is the builder and Baldwin & Pennington the architects. Work will begin at once.

WASHINGTON, D. C.—The following bids have been received by the supervising architect for repairs to heating and power plants, etc., of the U. S. Treasury, the Winder and the Marine Hospital (Butler) Buildings, in this city:

		Time.
G. A. Suter & Co., New York	$5,758	40 days
Bromwell, Schmidt & Co., York, Pa	3,453	Sept. 1
Edw. P. Bates, Albany, N. Y	9,833	30 days
Blake & Williams, New York	2,912	Sept. 1
Wallace & Stebbins, Baltimore, Md	2,822	Sept. 1
Zellers & Co., Washington, D. C	2,899	30 days
E. Keeler & Co., Williamsport, Pa	2,780	45 days
Phila. Lt. H. Co., Philadelphia, Pa	2,319	....

PETERSBURG, VA.—Bids are asked by the supervising architect, Washington, D. C., until Aug. 15, for a new heating apparatus for the U. S. building in this city.

KNOXVILLE, TENN.—Bids are asked by the supervising architect, Washington, D. C., until Aug. 11, for removing and constructing new heating apparatus for the U. S. building in Knoxville.

AKRON, O.—J. W. Myers & Co., Ashland, O., have been awarded the contract for the construction (except heating apparatus and electric wire conduits) of the post office building. The other bids were published in our issue of July 21.

COLUMBUS, O.—Bids are asked until Aug. 22 for the excavation and foundations of the South Side high school building; also for heating and ventilating said building by the hot air system. Arch., David E. Riebel; Chn., C. E. Morris.

SHARONVILLE, O.—Bids are asked until Aug. 20 for the erection of a new high school building. F. S. Mossteller, Pres. Bd. Education; Charles Crapsey, Arch., Race and 7th Sts., Cincinnati, O.

SPRINGFIELD, O.—Bids are asked by the water-works board, until Aug. 15, for the construction of a new brick coal house, 16 × 70 ft., after plans by Chas. E. Dowley & Bro.

WALDO, O.—Bids are asked by the board of education until Aug. 25 for the erection of a 3-room brick school building at this place. Clk., J. H. Winsor; Archs., Sloan & Ault, Marion, O.

INDIANAPOLIS, IND.—Preliminary plans have been completed, according to reports, for the 11-story Law Building to be erected on East Market St.

ESCANABA, MICH.—A fire in this city July 31 damaged the Escanaba Bank Bldg. and other buildings, causing a reported loss of $200,000.

CHARLESTON, ILL.—Bids are asked by the county supervisors until Aug. 22 for the erection of a new court house to cost about $100,000. Arch., C. W. Rapp, 1307—100 Washington St., Chicago.

CHICAGO, ILL.—Press reports state that plans have been perfected for the construction of a new amusement and convention hall, 600 × 348 ft., on the property formerly used by the Chicago Baseball Club, on the West Side.——Plans have been prepared for an apartment hotel to be erected at North State and Rush Sts. and Bellevue Place for a stock company. W. F. Mayhon & Co., Chamber of Commerce Bldg., Chicago, are said to represent the company. The structure is expected to cost about $1,500,000, and will be 12 stories in height. Robert T, Newberry, Arch., 171 La Salle St., Chicago, is interested.

FORT MADISON, IA.—It is announced that Chicago, Burlington & Kansas City Ry. Co. has decided to build a new brick and stone station at this place, 24 × 92 ft., at a cost of about $12,000. H. Zimmerman, Supt. of Bldgs., Hannibal, Mo.

MINNEAPOLIS, MINN.—The board of education has decided to erect a new school building in Prospect Park to cost about $65,000.

ST. LOUIS, MO.—The contract for the steel work for the new city hall has been awarded to E. H. Connor, 1000 Fullerton Bldg., agent for Pittsburg Bridge Co.——Plans have been prepared for a new stone and iron church building, 71 × 118 ft., to be erected in this city for the Church of the Sacred Heart, to cost about $60,000. Archs., Barnett, Haynes & Barnett, 418½ Olive St.; Pastor, J. J. McCabe.

FORT WORTH, TEX.—It is reported that plans are being prepared for a 5-story steel frame office building to be erected at 7th and Main Sts., at a cost of about $50,000, for Mrs. John R. Hoxie, of Chicago.

IONE, CAL.—Bids are asked until Aug. 22 for the erection of an annex to the administration building, and two double cottages on the grounds of the Preston School of Industry, at Ione. B. T. K. Preston, Secy. Bd. of Trustees; W. W. Oates, Arch., both of Rooms 17 to 19 Salz Bldg., Main St., Stockton, Cal.

PETROLEA, ONT.—Bids are asked by the trustees of the Petrolea Methodist Church until Aug. 15 for the construction of a church building. T. Vandelinder, Secy. Bd. of Trustees; J. Erb, Arch., Sarnia, Ont.

SAN FRANCISCO, CAL.—Plans and specifications are asked until Sept. 19, an extension of time, for erecting a new hospital building on the almshouse tract at a cost of $300,000. Clk., J. A. Russell.

WATER-WORKS.

BREWER, ME.—H. F. Sparks, Supt. Water Dept., Public Works Co., writes us that the company has contracted for a Warren filter plant for the supply of Brewer and Veazie. A brick house will be built at Veazie, where the power house is located. The building will be put up by day labor.

BERLIN, VT.—It is stated that this place is considering the question of securing a new water supply, for which purpose a company will be organized. At present the supply is secured from Montpelier. Martin W. Wheelock may be addressed.

NANTASKET, MASS.—It is reported that a company is being organized to put in new works to cost about $100,000. The Hingham Water Co. at present supplies the town.

NEWBURYPORT, MASS.—Philip H. Lunt, Secy. Water Comrs., writes us that Cashman Bros., of this city, have been awarded the contract to put in the masonry foundation for the new stand-pipe. The contract for the steel tank has been let to E. Hodge & Co., Boston. A report says that it will be 65 ft. high by 40 ft. in diameter.

FULTON, N. Y.—O. C. Breed, Cy. Engr., writes us that the water commissioners have agreed to arbitrate with the Fulton Water-Works Co. for the purchase of the works. The final results of the negotiations are at present exceedingly problematical.

PORT JERVIS, N. Y.—P. E. Farnum, Pres. Port Jervis Water-Works Co., writes us that it will be several months before final action will be taken for a new water supply.

GRANVILLE, N. Y.—The question of an increased water supply is being considered. D. D. Woodward and Jno. Gilroy may be addressed.

NYACK, N. Y.—This place voted July 28 not to purchase the Odell Water-Works for $15,000.

ROME, N. Y.—Bids are asked by J. I. Sayles, Pres. Board of Managers Rome Custodial Asylum, until Aug. 18 for constructing water-works. It will consist of a steel stand-pipe, pipe, valves, hydrants, etc.

HOBOKEN, N. J.—The water commissioners have decided to buy a number of hydrants. Bids for furnishing them will not be asked.

BEAVER, PA.—Simon Harrold, Beaver Falls, Pa., is reported to have been awarded the contract for furnishing the material and for building a new reservoir and a pumping station at about $30,000. Engr., J. P. Leaf, Rochester, Pa.

CHARLEROI, PA.—James S. McKean, Pres. Union Trust Co., sold on July 27 the Charleroi water-works to an eastern syndicate represented by W. M. Bell, for $100,000. The company will spend $150,000 in improving the plant and connecting it with adjacent towns. A contract has been closed with Cronin & O'Herron, Pittsburg, for the construction of two reservoirs at a cost of $10,000. The National Pipe & Foundry Co., Scottdale, Pa., has secured the pipe contract, amounting to $15,000.

LANCASTER, PA.—Simon Shissler, Mayor, writes us that an ordinance will be presented to councils to appropriate $250.000 for improving the stand-pipe, putting in a new pump and a filter.

PHILADELPHIA, PA.—The bureau of water received the following bids July 26 for furnishing additional steam capacity for the Belmont pumping station: Riter-Conley Co., Pittsburg, five boilers $18,287, one boiler $3,637; I. P. Morris & Co., five $19,119, one $3,735; Worden Mfg. Co., five $23,160, one $4,632; Robert Wetherill & Co., Chester Pa. (accepted), five $18,000, one $3,600. For the annex which must be built to the present boiler house the bids were as follows: R. C. Ballinger & Co., $5,649; M. McManus, $5,759; H. C. Nichols & Co., $4,876.60; Philadelphia Construction Co., $5,933; H. P. Shoemaker & Co., $5,500; S. Gourley, Jr., $6,349; John H. Jordan, $6,431; Macy, Henderson & Co. (accepted), $4,398.

PITTSBURG, PA.—Press reports state that Laughlins & Co., Ltd., are preparing to build a water-works for their blast furnaces at the Eliza furnace to cost $150,000. The capacity will be about 20,000,000 gallons of water a day. The plant has been designed by E. K. Morse, Pittsburg. The pumps are being constructed by the Wilson-Snyder Mfg. Co., Pittsburg. The improvements of various kinds being made at the furnaces will cost about $500,000.

LAUREL, MD.—It is reported that the proposed works for the Laurel Water Co. will be erected at once. The plant will have a capacity for 500,000 gallons a day. The stand-pipe will have a capacity for 50,000 gallons. Wm. H. Minch, of Minch & Eisenbrey, and Jos. M. Cone, of Baltimore, are interested.

POCOMOKE CITY, MO.—Bids will be asked at once by the mayor for the purchase of $30,000 of bonds for the proposed works and sewerage system.

FITZGERALD, GA.—C. C. Goodnow, Mayor, writes us that the contract for building works and a light plant has been let to Moore & McCrary, Atlanta, Ga., at $26,622.

BESSEMER, ALA.—Henry F. De Bardeleben has been awarded the contract for building a dam, etc., for a reservoir for the works of the Bessemer Land & Improvement Co. at $5,000.

MOBILE, ALA.—Bids are asked until Sept. 1 for furnishing the material and for constructing works for this city, as stated in our advertising columns. Engr., T. W. Nicol, Mobile; Mayor, J. C. Bush.

GADSDEN, ALA.—Wm J. Brockway, Receiver Gadsden Water-Works Co., has filed a petition asking the U. S. Circuit Court to restrain this city from building the proposed municipal works.

CAMDEN, ALA.—The question of building works is being considered, according to reports. Jno. A. Milner, Engr., Birmingham, may be addressed.

SARDIS, TENN.—This place voted July 25 to build works, according to reports. Population (1890), 106.

CANTON, O.—The water-works trustees are considering the question of at once purchasing and laying 12,000 ft. of 20-in. water pipe.

SHARONVILLE, O.—The question of works for fire protection is being discussed, according to reports.

CINCINNATI, O.—Bids are asked by the water commission until Aug. 30 for grading the grounds, roads and river banks and for revetment of slopes, etc., for the works at California, O. The lowest bid for this work was submitted July 22 by Louis Drach at $91,901. The highest bid was $163,531.——Chas. G. Roth, Secy., writes us that the following bids were received July 29 for furnishing the sluice gates, etc., for the works, as advertised in Engineering News; the Ludlow Valve Mfg. Co.'s bid is for each sluice gate:

Bidders.	Six Sluice Gates.	One Sluice Gate.	One Hand Pump.
Coffin Valve Co., Boston	$8,150	$1,505	$110
Ludlow Val. Mfg. Co., Troy, N. Y.	990	1,295	400
L. & E. Greenwald Co., Cincinnati	8,216	1,679	100
Lane & Bodley Co., Cincinnati	9,975	1,900	300
Hoeffinghoff & Lane, Detroit	7,531	1,944	1,200
Mich. Brass & Iron Wks., Detroit	1,438	1,955	105
Vulcan Iron Works, Chicago	6,704	1,349	26
A. S. Smith Mfg. Co., Newark, N.J.	7,800	2,000	100

LANCASTER, O.—Bids are asked until Aug. 20 for furnishing and erecting for the Boy's Industrial School, two compound longitudinal duplex pumping engines of 500,000 gallons each. C. D. Hilles, Secy. and Steward.

ELYRIA, O.—Bids are asked until Aug. 24 for furnishing the material and for constructing improvements to the municipal works; estimated cost, about $150,000. Engr., L. E. Chapin, O.; Cy. Clk., W. H. Park.

LAKEWOOD, O.—Bids are asked until Aug. 27 for furnishing the material and for laying a 12-in. water main in Detroit St., from Summit Ave. to Rockey River bridge. U. W. Hird, Clk.

BLOOMINGTON, IND.—Geo. Champe, Cy. Engr., writes us that the water-works was sold at receiver's sale July 28 to Jas. D. Showers, of this city for $19,000. The works will be improved. Population, 9,000.

EAST CHICAGO, IND.—The East Chicago & Northern Indiana Water Co. has been incorporated; capital stock, $17,000; incorporators, G. W. Mayer, B. O. Mayer and J. H. Brown.

EVANSVILLE, IND.—Bids are asked by the board of water trustees until Aug. 15 for constructing the engine and boiler houses for the new water-works; estimated cost, about $50,000. Engr., Chas. Hermany, Louisville, Ky.

LAPORTE, IND.—Bids are asked until Aug. 15 for furnishing and constructing about four miles of 20-in. water pipe to the source of the new water supply and a pumping station on the Little Kankakee River. Engr., W. H. Rosencrans, South Bend, Ind.; Supt., G. R. Tyrrell.

COLEMAN, MICH.—The question of building works is being considered, according to reports.

MOUNT PLEASANT, MICH.—The council proposes to extend the works. Population (1890), 2,700.

JONESVILLE, MICH.—This town is reported as considering the question of building works and a light plant.

CHICAGO, ILL.—The Pittsburg Meter Co., Pittsburg, Pa., has been awarded the contract for furnishing this city with water meters. It is said that this year 8,000 meters will be installed and that in all about 300,000 meters will be purchased at a cost of about $8,000,000. L. E. McGann, Comr. Pub. Wks.

AUGUSTA, WIS.—Bids are asked until Aug. 15 for furnishing and constructing the proposed works, to cost about $12,000. Consult. Engr., A. M. Palitz, 1102 Pabst Bldg., Milwaukee; Cy., Wm. Johnston.

APPLETON, WIS.—Press reports state that the court has appointed a receiver for the Appleton Water-Works Co.

BELOIT, WIS.—The council proposes to submit to the people at a special election the question of issuing $210,000 in bonds to purchase the proposed works, according to reports.

OSCEOLA, IA.—The people of this place have voted to build works, to cost about $20,000.

NEW PAYNESVILLE, MINN.—Bids are asked until Aug. 8 for furnishing the material and for constructing the works and electric light plant, as stated in our advertising columns. Mayor, P. C. Pilon; Recdr., M. S. Elliott.

OSAGE, IA.—It is stated that an election will be held Aug. 5 to vote on the question of issuing $10,000 in bonds for works. Chn. Com., J. W. Williams; Mayor, Chas. Kathan.

BOZEMAN, MONT.—Geo. D. Pease, Cy. Clk., writes us that this city voted July 26 to issue $165,000 in bonds to purchase the works of the Bozeman Water-Works Co. If the bonds are sold and the works purchased the city will extend the mains about a mile.

GREAT FALLS, MONT.—C. H. Clark, Cy. Clk., writes us that the council has decided to purchase the works of the Great Falls Water Co. It is not likely any improvements will be made.

TRENTON, MO.—We are informed that the American Water & Gas Corporation, 52 Broadway, New York, is contemplating the filtration of the water at the works in this city. Alex. Potter, 137 Broadway, New York, has been retained to prepare the plans. He is engaged in making analysis of the sands available for filtration purposes, and will probably recommend a system of sand filtration. Treas., Wm. F. Ross.

BRECKENRIDGE, COLO.—This place has voted to issue $25,000 of 6% 20-year bonds for new works. Fred. C. Cramer, Engr., writes us that the survey and plans will be made before long.

WARD, COLO.—We are informed that an election will be held Aug. 9 to vote on the question of issuing $12,000 of 6% bonds to build the proposed works, noted in our issue of July 21. Bids for the purchase of the bonds are wanted at once. Engr., D. J. McCanne, 1600 17th St., Denver, Colo.

GOLDFIELD, COLO.—H. King, Mayor, writes us that the proposed works will have a steel tank of 200,000 gallons capacity, seven hydrants, valves, water meters, 18,000 ft. of pipe, etc. The work will be done by the town. Bonds will be issued. Population, 5,000.

PUEBLO, COLO.—Jno. W. Hill, 35 Glenn Bldg., Cincinnati, O., has submitted a report on the proposed improvements to the works. It is recommended that high-service pumps be put in. This, with other improvements, including a 30-in. supply pipe and 10,000,000-gallon tank, will cost about $67,000.

SUMPTER, ORE.—Bids are asked by the council for the purchase of a water-works franchise. There will be required about 1¾ miles of pipe, according to reports.

LOS ANGELES, CAL.—Arbitrators have been appointed to decide the question of the sale to the city of the works of the Los Angeles City Water Co. The council recently offered the company $1,000,000 for the works but this was refused. The 30-year contract with the company is said to have expired July 21.

PETALUMA, CAL.—The question of purchasing the works of the Sonoma County Water Co. is being considered by the council. O. Jacobsen, M. Walsh and J. V. Lon are on the committee.

SAN JOSE, CAL.—The bids for the erection of a steel tower and tank at the county infirmary grounds were rejected July 26, and the clerk was directed to advertise for new bids, they to be received by the board of supervisors until Aug. 15.

SAN MATEO, CAL.—C. E. Moore, Santa Clara, Cal., has been appointed to superintend the building of the works at this place; estimated cost, about $70,000.

PRESCOTT, ONT.—An election will be held Aug. 16 to vote on the question of building works.

ASHBURN, ONT.—Jas. Lawrence, P. M., writes us that this place is not considering the question of building works, as reported in our issue of July 14.

WINNIPEG, MAN.—H. T. Ruttan, Cy. Engr., writes us that the civic board has decided to ask for new bids for building the proposed new works. The following are the bids received July 25. W. F. Lee, Winnipeg, $72,388, and The Pneumatic Engineering Co., New York, $131,886.

GLASGOW, SCOTLAND.—The municipal council is reported to have decided to ask for new bids for furnishing 1,000 tons of cast-iron water pipe. A Philadelphia firm bid $5 a ton below English manufacturers.

SEWERAGE.

WEST GARDNER, MASS.—This town has voted to appropriate $5,000 for constructing certain sewers. C. W. Conant may be addressed.

BUFFALO, N. Y.—The city engineer has been directed to prepare plans for sewers in several streets.

FULTON, N. Y.—The question of building a sewer to drain Waterhouse Creek is being considered by the council and the board of health.

WEEDSPORT, N. Y.—The question of building a trunk sewer to cost about $4,000 is being considered.

FLEMINGTON, N. J.—A. Costa, Orange, N. J., was awarded the contract July 30, at $30,102, for furnishing the materials and for constructing a system, as advertised in Engineering News. The itemized bids will be published next week. W. H. Chapman, Engr.-in-Charge.

NEWARK, N. J.—The question of building 25,000 ft. of 15 to 8-in. pipe sewer in the 10th and 12th Wards is being considered; estimated cost, $25,000. Engr., Ernest Adam.

NEWARK, N. J.—Harrison Van Duyne, Pres. Bd. Pub. Wks., writes us that so far as Newark is concerned it is now joining with South Orange, Vailsburg, Clinton, etc., to have a preliminary survey made with a view of selecting the best route and estimating the cost of an outlet sewer to tide-water. South Orange on its own account had surveys made by Engineer Crane, of East Orange. This outlet for Newark is for the benefit of only a small portion of the city sloping to the west. The city proper empties in tide water of Newark Bay, etc.

ERIE, PA.—Bids are asked until Aug. 4 for a sewer in 26th St. B. E. Briggs, Cy. Engr.

NEWCASTLE, PA.—Waring, Chapman & Farquhar, 874 Broadway, New York, have been engaged to make plans for surface drainage of a portion of this city, for extension of house sewer system, and for main sewer entension.

OAKMONT, PA.—An election will be held here Aug. 16 to vote on the question of issuing $65,000 in bonds; $41,000 of which is for a sewerage system, and $16,000 for street improvements. Borough Solicitor, J. P. Hunter.

SOUTH BETHLEHEM, PA.—This place voted July 26 to issue $100,000 in bonds for constructing a system.

STOCKTON, PA.—The council is reported as again considering the question of building sewers at a cost of about $50,000.

YORK, PA.—The committee has adopted plans for sewers for which $180,000 will be appropriated out of the proposed $500,000 loan for public improvements. City Engineer McKinnon and Mayor Brant may be addressed.

POCOMOKE CITY, MD.—It is stated that the council will ask for bids at once for the purchase of $30,000 of bonds for building the proposed system and water-works. Work will probably be begun at once.

WAYCROSS, GA.—Waring, Chapman & Farquhar, 874 Broadway, New York, have been ordered to make examination, take levels, and report on sewerage and sewage disposal, preparatory to a vote on issuing bonds for construction later on.

MOBILE, ALA.—The council has directed the sewerage committee to report on a system for the city at the meeting to be held Aug. 22. J. C. Bush, Mayor.

OXFORD, MISS.—Jno. F. Brown, Mayor, writes us that this place failed to vote July 26 in favor of building a system and light plant. It is only a question of a short time when the improvements will be put in.

CONCORD, N. C.—Surveys for the proposed system are being made; population, 7,000.

NASHVILLE, TENN.—The question of building sewers in certain streets is being considered. Mayor Dudley may be addressed.

LOUISVILLE, KY.—The question of building new sewers and of improving the old ones is being considered. Mayor Weaver, City Engineer Parsons and Mr. Grainger of the board of public works may be addressed.

HAMILTON, O.—The board of control has ordered plans for new sewers in certain streets. Mr. McMaken, of the board, may be addressed.

KENTON, O.—Bids are asked until Aug. 13 for constructing about 17,500 ft. of 24 to 10-in. pipe sewer, etc. Engr., W. E. Myers; County Audr., James Bastable.

TOLEDO, O.—Bids are asked until Aug. 29 for building a 72 to 54-in. brick sewer in Adams St. L. P. Harris, Cy. Clk.

FORT WAYNE, IND.—Plans have been ordered by the council for sewers in certain streets.

WARSAW, IND.—The question of building a system is being considered.

HIGHLAND PARK, MICH.—The question of building a system at a cost of about $60,000, to empty into the Detroit system, is being considered.

CARMI, ILL.—It is reported that the Bray Construction Co. has been organized to build a system for this place. Chas. T. Bray and F. L. Geissler, of Belleville, are interested.

MENDOTA, ILL.—The Iowa Engineering Co., Clinton, Ia., has been engaged to make plans and superintend the building of a large extension to the sewers and six intermittent sand filters at Mendota. Mr. Chase, of the company, had charge of building nine miles of sewers here two years ago.

QUINCY, ILL.—It is proposed to construct 15 to 8-in. pipe sewers in about 20 streets.

PITTSBURG, KAN.—The question of building sewers in certain streets is being considered.

KANSAS CITY, MO.—Henry A. Wise, Cy. Engr., writes us that nothing, aside from surveys, has been done in regard to the proposed Westport sewer district.

GALVESTON, TEX.—The Galveston Sewer Co. has refused to sell its system to this city for $40,000. Secy., Geo. H. Henchman.

SPOKANE, WASH.—J. C. Broad submitted the lowest bid July 21 for constructing 1,187 ft. of sewers in Front Ave., from Bernard to Division Sts., at $4,565. The lowest bid for 1,453 ft. in Front Ave., from Division to Grant Sts., was submitted by Ilse & Dishman, at $7,500.

SANTA ANA, CAL.—The city trustees have engaged H. C. Kellogg, County Surv., to superintend the construction of the system. The money from the sale of the recent bond issue is expected to be received within a few days, and work on the system will be commenced immediately; estimated cost, $65,000.

SAN LUIS OBISPO, CAL.—It is stated that an election will soon be held to vote on the question of extending the system at a cost of about $36,000; Engr., Geo. Story.

SAN RAFAEL, CAL.—This place voted July 16 to issue $26,000 in bonds for building 8,000 ft. of pipe sewer. Chn. Com., Henry Eickhoff.

MARTINEZ, CAL.—The town engineer has been directed to prepare plans and specifications for sewers in certain streets.

TUCSON, ARIZ.—Chas. T. Connell, Recdr., writes us that the bonds for the proposed system have not yet been offered for sale. Some legal objection is to be overcome.

LONDON, ONT.—W. T. Ashbridge writes us that the contract for Section B of the system was awarded July 28 to Harding & Leatham, of London, at $13,746. One other tender was received, being $14,545. City engineer's estimate, $14,985. The work will include: 3,210 ft. of 20-in. cast-iron pipe (135 lbs. per foot); 80 ft. of 16-in. cast-iron pipe; 300 ft. of 20-in. steel riveted pipe; 55 ft. of 36-in. brick sewer; 1 syphon chamber, 10-ft. drain, 17 ft. deep; 5 cedar cribs, 6 × 8 ft. × 11 ft., filled with stone; 60 oak piles; 1 concrete culvert (2 walls, each 4 × 35 ft., base, 12 × 2 ft. on top); 1,200 cu. yds. of earth filling. A. O. Graydon, Cy. Engr.

GARBAGE DISPOSAL—STREET CLEANING

NEWPORT, R.I.—The following bids were received by the council July 25 for collecting and disposing of house offal for a term of three years, from Aug. 8: Collecting, John Sullivan, $20,754; J. J. O'Hearn and R. J. Lawton, $20,700; David Goggin, $23,400; Abram A. Brown, $20,500; J. P. Sullivan, $15,300; P. H. Horgan, $18,000; Richard Dugan, $14,940 (accepted). Disposing, J. K. Sullivan, $8,800; G. B. Reynolds, $11,500; T. P. Crowley, $7,602 (accepted), and A. B. Gladding, $3,300.

NEW YORK, N. Y.—The American Street Cleaning Co. of New York, was incorporated under the laws of New Jersey July 29; capital stock, $1,000,000. The company was organized to enter into contracts for street cleaning. The incorporators are all of New York with the exception of one. They are J. F. O. Meyer, 27 West St.; R. H. Beach, 44 Broad St.; W. C. Gotschall, 5 University Place; Frank Klein, 237 Broadway; W. R. Bergholz, 15 Cortlandt St.; J. L. Pell, 214 Broadway; A. M. Dederer, 486 Broadway, and James N. Walter, Jersey City.

NEW YORK, N. Y.—Bids are asked until 12 m., Aug 5 for alterations to the steam dumper "Cinderella." James McCartney, Comr. St. Cleaning, 346 Broadway, Manhattan.

ORANGE, N. J.—The question of building a garbage cremation jointly with Bloomfield, Montclair and West Orange is being considered. Dr. G. H. Richards and Dr. T. F. Phelan are the commissioners from Orange.

ERIE, PA.—The committee has recommended that a garbage disposal plant be built in this city at a cost of about $10,000.

WARREN, PA.—The board of trustees of the state hospital are again considering the question of securing a garbage disposal plant; estimated cost, $10,000.

MILWAUKEE, WIS.—Bids are asked until Aug. 12 for furnishing and installing a garbage crematory; bond, $12,000. G. H. Benzenberg, Chn. Comrs. Pub. Wks.; J. R. Wolf, Comptroller.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked until 12 m. Aug. 4 for macadamizing in Preverell St. and Telford St. Benj. W. Wells, Supt. Sts.

MEDFORD, MASS.—The council has appropriated $45,000 for the reconstruction of Main and Salem Sts.

PLYMOUTH, MASS.—Bids are asked until 12 m. Aug. 4 for constructing about 5,000 ft. of highway. T. C. Mendenhall, Chn. Massachusetts Highway Comn., Boston.

BUFFALO, N. Y.—Bids are asked until Aug. 15 for paving Porter Ave., with asphalt, from Fourth St. to the bridge. G. H. Selkirk, Secy. Bd. Park Comrs.

CORTLAND, N. Y.—The board of trustees has awarded a contract to the Warren-Scharf Asphalt Paving Co., at $71,593, for furnishing and constructing about 22,000 sq. yds. of asphalt paving, as advertised in Engineering News. W. C. Crombie, Clk.

MOUNT VERNON, N. Y.—Bids are asked until Aug. 16 for the purchase of $40,000 of 4% street bonds. Wm. N. Hoyt, Cy. Clk.

NEWBURGH, N. Y.—The council is considering the expenditure of $26,667 for asphalt paving.

NEW YORK, N. Y.—Bids are asked until Aug. 16 for paving asphalt bicycle paths on six avenues, in the Borough of Queens. Jas. P. Keating, Comr. Highways, 150 Nassau St.

OSWEGO, N. Y.—Bids will soon be asked for about 1,800 sq. yds. of asphalt paving in West Oneida and Mohawk Sts., to cost about $3,500. Frank Ormsby, Cy. Engr.

SYRACUSE, N. Y.—The council has awarded a contract to the Columbia Construction Co., at $9,257, for paving in Park Ave., with sheet asphalt; the Asphaltina Construction Co., at $21,677, for asphaltina paving in portions of Barker Ave., Matty Ave., Wilkinson and Tracy Sts., and the Empire Contracting Co., at $40,629, for paving in Park Ave., with Alcatraz asphalt.

SHARPSBURG, PA.—Bids are asked until Aug. 9 for grading portions of Middle St. Jas. A. Robinson, Chn. Com.

WINCHESTER, VA.—C. E. Hoover & Co., Winchester, have been awarded a contract at $6,738, for constructing 4,900 sq. yds. of brick pavement, curbing, etc.

BIRMINGHAM, ALA.—F. Y. Anderson informs us that petitions have been filed with the county commissioners to build the Red Mountain Boulevard, and H. Schoel, Engr., is making an estimate of the cost. It is proposed to make the boulevard 60 ft. wide and 5½ miles long, to be located on the bench running on the north side of the mountain.

MONTGOMERY, ALA.—Bids are asked until Aug. 8 for brick paving in a portion of Holcombe St. and Lawrence St. R. H. Somerville, Treas.

LOUISVILLE, KY.—Bids are asked until 12 m. Aug. 5 for constructing asphalt pavement on portions of 26th St. and Oak St.; also until Aug. 6 for paving portions of Von Borries Ave. and Hepburn Ave. with asphalt, Chas. F. Granger, Chn. Bd. Pub. Wks.

CANTON, O.—Bids are asked until Aug. 29 for removing the old pavement and for furnishing and constructing a brick pavement on South Cherry St. L. E. Chapin, Cy. Engr.; Louis N. Levy, Cy. Clk.

FINDLAY, O.—Bids are asked until Aug. 8 for grading and macadamizing in Maple Ave., from Lima to Hancock Sts. A. W. Ray, Clk.

FREMONT, O.—Bids are asked until Aug. 15 for grading, curbing, paving and macadamizing in Hayes Ave. and Napoleon St., as stated in our advertising columns. Henry Hughes, Cy. Engr.

MALTA, O.—Bids are asked until Aug. 29 for paving portions of Front, Bell and Main Sts., with brick. Paul R. Murray, Engr.; W. S. Connor, Clk.

TOLEDO, O.—Bids are asked until Aug. 15 for furnishing the material and grading and draining in Felt St., and until Aug. 29 for furnishing the material and paving portions of Erie St., Fassett St. and Lawrence Ave., with Wassell repressed blocks, etc. L. P. Harris, Cy. Clk.

ZANESVILLE, O.—Bids are asked until Aug. 13 for grading Zane Ave. Chas. N. Bainter, Cy. Clk.

CAMBRIDGE CITY, IND.—Bids are asked until Aug. 24 for constructing cement sidewalks on several streets. Dan. E. Petro, Clk.

INDIANAPOLIS, IND.—Bids are asked until Aug. 10 for asphalt paving in Delaware St., and graveling in Barth Ave. M. A. Downing, Chn. Bd. Pub. Wks.——Bids are asked until Aug. 30 for constructing seven miles of gravel road; estimated cost, $19,608. J. R. Riggs, County Audr.

KOKOMO, IND.—The council has voted to pave North Main St. with brick for a distance of 4,076 ft.

COLDWATER, MICH.—Bids are asked until Aug. 16 for furnishing the material and for constructing brick pavement on concrete foundation on Chicago St., as stated in our advertising columns. P. H. Sweeney, Cy. Clk.

MUSKEGON, MICH.—Smith & Nelson have been awarded a contract by the county commissioners, at $9,498, for building the road to North Muskegon.

WYANDOTTE, MICH.—The council has decided to spend $3,000 in laying new crosswalks.

CHICAGO, ILL.—The board of public improvements has passed ordinances for the paving of about 20 miles of streets, with asphalt, granite, brick and macadam, to cost about $400,000.

PEORIA, ILL.—Bids are asked until 2 p. m., Aug. 5, for furnishing gravel and team work, for the construction of the Galena Road, in Richwoods township. John M. Hart, County Comr.

ASHLAND, WIS.—Bids are asked until Aug. 11 for paving a portion of 2d St. Chas. Crogster, Chn. Bd. Pub. Wks.

EAU CLAIRE, WIS.—Alderman Hammond has introduced an ordinance for brick paving on portions of South Barstow, Kelsey and four other streets.

MARYVILLE, MO.—A committee, consisting of John C. Curfman, Dr. S. C. McCluskey and A. A. Alden has been appointed to consider the question of county road improvements.

SEDALIA, MO.—Bids are asked until 5 p. m., Aug. 5, for paving on Ohio St. with brick. Jos. A. Starr, Chn. Com.

BEAUMONT, TEX.—The council has passed an ordinance to issue $13,000 of 6% street and water bonds. Mayor, D. P. Wheat.

HOUSTON, TEX.—Bids are asked until Aug. 20 for the purchase of $100,000 of street improvement bonds. I. A. Miller, Cy. Engr.; P. S. Banner, Secy.

OAKLAND, CAL.—Bids are asked until Aug. 15 for macadamizing on Fruitvale Ave. and the San Leandro Road. G. L. Nusbaumer, County Surv.

SPOKANE, WASH.—A contract has been awarded to the City Street Improvement Co., San Francisco, at $49,835, for paving Riverside Ave. with sheet asphalt, from Monroe St. to Division St. B. H. Fowle, Secy. Bd.

MANUFACTURING PLANTS.

FALL RIVER, MASS.—The Fall River Bleachery, at Fall River, Mass., has placed the contract for its new mill with the Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 65 × 200 ft., with side walls of stone and supporting framework of steel.

MIDDLETOWN, CONN.—C. E. Dustin, Hartford, Conn., is reported as again making efforts to secure capital for the construction of a plant for manufacturing electrical goods.

BEAVER FALLS, N. Y.—The strawboard pulp mill of the Jas. P. Lewis Co. has been destroyed by fire, causing a reported loss of $50,000; insurance, $18,000.

JAMESTOWN, N. Y.—The Broadhead worsted mills have been damaged by fire to the extent of $50,000; fully insured.

TROY, N. Y.—The Trojan Car Coupler Co. having purchased a portion of the Gilbert Car Co.'s works on Green Island, are to make additions and alterations and to remove its plant there. Proposed additions include blacksmith shop. 75 × 50 ft., main shop, 50 × 190 ft. Pres., A. H. Renshaw; Secy., Eugene Seitz.

HOMESTEAD, PA.—Press reports state that about $500,000 will be spent in erecting two new manufacturing plants just below Homestead. The Leechburg Foundry & Machine Co. and the Shiffler Bridge Co. will move their respective plants there before the year is ended. The property has been bought at a cost of $130,000, and plans are ready and the survey about to be made. Building will begin about September 1. The Leechburg Foundry & Machine Co. is now located at Leechburg while the Shiffler Bridge Works are at 48th St. and the Allegheny Valley R. R. George Mesta, Pres. Leechburg Foundry & Machine Co.; W. J. Walker, Pres. Shiffler Bridge Co.

LOCK HAVEN, PA.—The main building of the Farrandsville Fire Brick Works, owned by Fredericks Munroe & Co., was totally destroyed by fire July 27. The building was a frame structure 220 × 70 ft., and contained valuable machinery. It will be rebuilt at once. The loss is estimated at $40,000, with no insurance.

PHILADELPHIA, PA.—The bakery belonging to Henry Wanklin & Co., Mitchell St. and Greene Lane, Roxborough, was destroyed by fire July 22, causing a reported loss of about $30,000.——Architects Hales & Ballinger, 102 So. 12th St., are preparing plans and specifications for a 3-story brick factory and dye house to be erected for J. H. Keim, woolen manufacturer, at Fifth St. and Allegheny Ave.

PITTSBURG, PA.—The Chautauqua-Eureka Ice Co. has awarded the contract for the erection of a new ice and storage plant, to replace that destroyed by fire, to Alexander Gilleland, at $100,000. The new warehouse will be much larger that the one burned. It will be bounded by Pike and 13th Sts. and Mulberry Alley.

LYNCHBURG, VA.—It is stated that P. C. Hubbard will rebuild his machine shops, factory, etc., at once. The main building will be 40 × 100 ft.

MANCHESTER, VA.—The Richmond Cotton Mills Co., it is stated, has placed a mortgage for $30,000, which it will use for purchasing new machinery. No contracts have yet been let. Secy., C. M. Woodford.

HEILEG, N. C.—A roller flour mill is to be established here or at Rockville soon by a company of local farmers and business men. Address Calvin M. Miller, County Surveyor, Concord, N. C.

COLUMBIA, S. C.—The Granby Cotton Mills of Columbia, decided on July 27 to increase its capital stock from $200,000 to $800,000, and to quadruple the capacity of its plant. Machinery and a new power plant are yet to be bought. The Richland Cotton Mill Co., of Columbia, will also add 12,000 more spindles to its equipment. Mr. Whaley is president of both companies.

ATLANTA, GA.—A new outfit will soon be bought for the textile department of the Atlanta Technical School as the city has just appropriated $3,000 additional to the $3,000 donated by Mr. French, of Pittsburg.

CORDOVA, ALA.—Press reports state that the Ivy Coal & Coke Co. will build additional coke ovens, etc.

ENSLEY, ALA.—J. E. Lacy & Co., of Jasper, Ala., have been awarded the contract for the grading and excavating for the large steel plant to be erected here.

MOOREFIELD, ILL.—The Peoria & Eastern R. R. Co., it is said, will build new shops at Moorefield. Estimated cost, $30,000, together with turn-tables, additional tracks and other improvements. The plans have been prepared and work will begin at once.

OTTUMWA, IA.—The Janney Mfg. Co. of this place, will soon erect several new buildings, and will install therein a 100 or 125-HP. power plant.

COFFEEYVILLE, KAN.—The Coffeyville Vitrified Brick Co. informs us that it has not yet determined whether it will erect a new plant at this place or not.

LEAD, S. DAK.—The Deadwood-Terra shaft house was burned July 26, causing a loss of about $50,000. Three hundred men were employed. It is expected to rebuild at once.

MONTREAL, QUE.—The factory of the Mergenthaler Linotype Co. was damaged by fire July 29; reported loss, $50,000.

GAS PLANTS.

PITTSFIELD, MASS.—The Pittsfield Coal Gas Co. will install a new gas engine, etc., to cost about $9,000.

PHILADELPHIA, PA.—Reports state that the United Gas Improvement Co. proposes to lay about 12 miles of new mains.

ALLEGHENY, PA.—The Riter-Conley Co., Prebel Ave., Allegheny, has been awarded a contract for constructing a gas holder for the Allegheny Heating Co., at $225,000. The heating company is arranging to purchase ground adjoining the plant of the Allegheny Gas Works as a site for the holder, which will have a capacity of 5,000,000 cu. ft. of gas.

CHARLOTTE, N. C.—The Charlotte Electric Ry. Co. will construct a gas plant and system at this place, of the Lowe water gas type. About 10 miles of 4 to 10-in. pipe will be purchased.

KENOSHA, WIS.—The Kenosha Gas & Fuel Co. is constructing a new plant, to cost about $30,000.

SUPERIOR, WIS.—Bids are asked until Aug. 16 for furnishing and maintaining 500 Welsbach lamps from 80 to 100-c. p., and 4,500 16-c. p. naphtha or gasoline lamps. F. J. Sequin, Cy. Clk.

WAUKEGAN, ILL.—It is reported that Louis M. Grant, Chicago, has purchased the stock of the old gas company, and will erect new works, at a cost of about $50,000.

CHICAGO, ILL.—The Universal Gas Co. has arranged to construct a 5,000,000 cu. ft. gas holder, according to reports.

DULUTH, MINN.—Bids are asked until Aug. 15 for furnishing and maintaining 200 Welsbach lamps. H. W. Cheadle, Cy. Clk.

NEW COMPANIES.—Verna Petroleum Oil Co., Corsicana, Tex.; $15,000; to construct and operate a gas system: J. J. Culbertson, Paris; R. K. Erwin, and J. U. Singleton, Waxahachie, Tex.

Electric Gas Light Co., Baltimore, Md.; $10 000; to manufacture acetylene gas machines; Geo. C. Wedderburn, Prudencio de Murgunondo, Jas. H. Couper, John W. Kolb and Frank C. Pearre, Baltimore.

MISCELLANEOUS CONTRACTS.

DREDGING.—Stockton, Cal.—Bids will soon be asked by the board of public works for dredging the harbor channel.

GUN FORGINGS.—Washington, D. C.—Bids are asked until Aug. 10 for furnishing 8-in. gun forgings. J. D. Long, Secy. Navy Dept.

CLEARING.—Point Wilson, Wash.—Bids are asked until Aug. 13 for clearing at Point Wilson. Capt. Harry Taylor, U. S. Engr., Burke Bldg., Seattle, Wash.

CULVERT.—Omaha, Neb.—Bids are asked until Aug. 12 for furnishing the material and constructing an 8-ft. brick culvert; bond, $50,000. D. M. Haverly, County Clk.

TELEPHONES.—St. Paul, Minn.—Superintendent King, of the police patrol system, has recommended a proposition to purchase telephones for a private system.

DRAINAGE.—Cissna Park, Ill.—Bids are asked until Aug. 15 for dredging a ditch and laying about 3,550 lin. ft. of 6 to 12-in. tile. H. B. Harvey, Village Clk.

BONDS.—Montreal, Que.—Bids are asked until Aug. 8 for the purchase of $150,000 of 4% harbor improvement bonds. Jos. Woods, Secy. and Treas. Quebec Harbor Comrs.

DREDGING.—Waukegan, Ill.—Bids are asked until Sept. 5 for dredging Waukegan Harbor to a depth of 18½ ft., as stated in our advertising columns. H. Thacker, Cy. Clk.

DREDGING.—Bridgeport, Conn.—Bids are asked until Aug. 31 for dredging the harbor, as stated in our advertising columns. Maj. Smith S. Leach, U. S. Engrs., New London, Conn.

TELEPHONE EXCHANGE.—Greenfield, Ind.—Reports state that W. A. Vail, Supt., Central Union Telephone Co., Indianapolis, is making arrangements to establish a telephone exchange.

DREDGING.—Boston, Mass.—Bids are asked until 12 m. Aug. 4 for dredging a channel to a depth of 16 ft., between Congress St. and Mount Washington Ave. Wm. Jackson, Cy. Engr.

BONDS.—Healdsburg, Cal.—Bids are asked until Aug. 25 for the purchase of $80,000 of 5% bonds for waterworks, sewers and general improvements. C. H. Pond, Clk. Bd. of Trustees.

FIRE ALARM SYSTEM.—Washington, D. C.—The Gamewell Fire Alarm Co., New York, has been awarded a contract by the commissioners, at $37,500, for installing a new fire alarm system.

PIER.—Brooklyn, N. Y.—Bids will soon be asked by J. S. Cram, Comr. Docks and Ferries, Pier A, New York, for the completion of the recreation pier at North Second St., East River; estimated cost, $12,000.

ALARM SYSTEM.—Dallas, Tex.—A franchise has been granted to O. J. Gorman and others, of this city, to construct and operate a district messenger call, fire alarm system, etc. W. A. Fraser, Cy. Electrician.

DAMS AND SHORE PROTECTIONS.—Mississippi River.—Bids are asked until Aug. 30 for constructing dams and shore protections, as described in our advertising columns. Capt. C. McD. Townsend, U. S. Engrs., Rock Island, Ill.

BONDS.—Salt Lake City, Utah.—Bids are asked until Aug. 16 for the purchase of 200 20-year 4% bonds of the denomination of $500 each, and of 400 bonds of the denomination of $1,000 each. G. H. Backman, Cy. Recdr.

DREDGING.—New York, N. Y.—Bids are asked until 11 a. m. Aug. 5 for about 16,000 cu. yds. of mud dredging and 4,500 cu. yds. of crib dredging at the foot of Watts St., North River. J. Sergeant Cram, Comr. Docks, Pier A. North River.

TUNNEL.—Fort Wayne, Ind.—Plans will be prepared by F. M. Randall, Cy. Engr., according to reports, for the construction of a tunnel on Clinton St., from Holman to Murray Sts., under the railway tracks. Councilman Lennart may be addressed.

ABUTMENTS AND WING WALLS.—Boston, Mass.—A contract has been awarded to James McGrau & Co., at $42,878, for constructing three granite abutments, 119 ft. long each, and two wing walls, each 35 ft. long, on B and C Sts. William Jackson, Cy. Engr.

DITCH.—Melville, N. Y.—A ditch will be constructed from Melville to Buffalo Lake, a distance of about 17 miles, at a cost of about $20,000. Hans Gronerued, Beaver Falls; T. F. Miller, Hector; Judge Vanderburg, St. Paul, Minn., and A. M. Knight, Glencove, N. Y., are interested.

GRADING, EXCAVATION, ETC.—California, O.—Bids are asked until Aug. 30 for the grading of grounds, roads and river bank, revetment of slopes and excavation of Clear Well, near the California. The bids for this work received recently were rejected. Chas. G. Roth, Clk. Comrs. Water-Works, Cincinnati, O.

DOCK.—Cleveland, O.—Bids will soon be asked by the director of public works for constructing the new Erie St. dock. The improvement to be made at the foot of Erie St. consists of the construction of a pile and timber pier with stone filling in continuation of the present pier as now constructed, 70 ft. northerly along Erie St., and thence west parallel with the government breakwater to Seneca St.; and also for constructing piers for a slip 200 ft. wide.

IMPROVING CRUISER.—Washington, D. C.—Press reports state that the board of construction of the navy department has decided to refit and renew the "Alert," an iron third-class cruiser of the old navy, now at the Mare Island navy yard, San Francisco, Cal. The rig will be changed from ship to barkentine, a spar deck will be added, new boilers installed, and the vessel generally and thoroughly overhauled. It will be equipped with a battery of six 4-in. rapid-fire guns. The total cost of these improvements, it is expected, will be about $100,000.

LOCK WALLS, ETC.—Louisville, Ky.—The following bids were received by Capt. J. G. Warren, U. S. Engrs., July 28, for building masonry lock walls and abutments for the dams of lock No 8 on the Kentucky River: Thomas C Sheridan, Buffalo, W. Va., $188,398; J. V. Hoag, Pittsburg, Pa., $198.038; Christie, Lowe & Heyworth, Chicago, $201,523; William A. Kirk, Madison, Ind., $205,596; Mason, Hoge & Co., Frankfort, Ky., $208,560; Walter Bradley & Co., Oswego, N. Y., $230,447. The site for lock No. 8 is about four miles above Hickman, about 22 miles above High Bridge, and about 12 miles below Valley View. The work contemplated in the present contract is the construction of the stonework alone of the two lock walls and abutment, including the preparation of sites. The cofferdam and excavation at the site for the lock and abutment are to be completed during the working season of 1898. The whole work must be completed before Dec. 31, 1899.

CONTRACT PRICES.

ASPHALT PAVING.—Reading, Pa.—The following bids were received by the board of public works July 18, 1898, for about 52,000 sq. yds. of asphalt paving; the lowest bid being about $7.000 in excess of the appropriation of $100,000, all the bids were rejected: Pennsylvania Asphalt Co.—Asphalt paving, a sq. yd., $2.05; resetting 8-in. granite curbing, a ft., $1.15; 6-in., $1.05; resetting 8-in. and 6-in., 30 cts. Richardson & Ross, Philadelphia.—Asphalt paving a sq. yd., $2.24; setting 8-in. granite curbing, $1.25; 6-in., $1.12; resetting 8-in., 50 cts.; 6-in., 40 cts. Alcatraz Paving Co.—Asphalt paving, a sq. yd., $2.07; setting 8-in. granite curbing, $1.17 a ft.; 6-in. $1.04; resetting 8-in., 28 cts.; 6-in., 26 cts.

BRICK PAVING.—Rock Island, Ill.—W. A. Darling, Cy. Engr., writes us that the following bids were opened July 11 for 17,710 sq. yds. of brick paving; estimated cost, $25,636:

	Flick & Johnson.	Edwards & Walsh.
Curb	$0.46	$0.45
Paving with macadam foundation	1.23	1.23
Paving with concrete foundation	1.48	1.41

ASPHALT PAVING.—Baltimore, Md.—The following bids were received July 19, for asphalt paving in Mount Royal Ave., from Guilford Ave. to Dolphin st.; L. F. Lewis, Cy. Comr.:

Bids Received at Baltimore, Md., July 19, 1898, for Asphalt Paving.

Quantities.			‡Southern Asphalt Paving Co., Baltimore.	Jas. P. McGovern, Baltimore.	R. Parker McCormick, Baltimore.	Barber Asphalt Paving Co., New York.	J. S. Filbert, Baltimore.
Sheet asphalt paving*		18,000 sq. yds.	$1.52	.....	.....	$2.55	$2.27
Belgian block paving†		2,500 " "	2.60	$2.60	$3.20	2.75	2.65
6-in. curb	New, in place	100 lin. ft.	.70	.90	1.00	1.28	1.21
	Old, redressed and set	500 " "	.13	.15	.25	.45	.31
	Old, redressed, in place	500 " "	.13	.15	.15	.25	.25
Resetting and rejointing old curb in cross sts		100 " "	.12	.15	.15	.35	.27
4½-in. headers set		300 " "	.60	.65	...	.50	.65
3-ft. open stone gutters		150 " "	.3.30	3.50	2.50	3.85	3.85
Vitrified brick gutters and paving		800 sq. ft.	.23	.22	...	.32	.27
Cobble paving		1 000 " "	.06	.06	.06	.10	.09
Cobble repaving		6,500 " "	.03	.03	.03	.07	.07
Hauling	Old cobblestone, a mile	1,500 cu. yds.	.30	.60	.50	.12	.10
	Old curbstone, a mile	100 lin. ft.	.06	.07	.05	.10	.10
	Old flagstone	4,300 sq. ft.	.04	.04	.10	.15	.14
Total, without asphalt			$8,454	$8,985	$10,130	$9,762	$9,349
Total, with asphalt			27,360	......	......	45,900	40,860

*Including grading, a 6-in. concrete base, 1½-in. binder and 2-in. wearing surface. †Including grading, a 6-in. concrete base, 2-in. sand cushion, 10-in. gutter stones, and pouring joints with asphalt cement. ‡Awarded contract for sheet asphalt.

STEEL RAILS.—Tientsin, China.—E. G. Adams, Jr., Professor of Civil Engineering, Imperial Tientsin University, has sent us the following table from the Pekin and Tientsin "Times," of the bids received in March, 1898, by the Imperial Chinese Ry. for furnishing 7,000 tons of rails and other supplies. The bidders all do an import and export business in Tientsin. The rate of exchange of Tientsin taels at the date of receiving the bids was about 158⅝ taels to $100 U. S. currency. In our issue of June 30 we gave prices for rails received in April. The bids were as follows, the prices probably being for the long ton:

Bidder.	Price a ton. Rails, taels.	Fish-plates, taels.	Bolts, taels.	Spikes, taels.
Jardine, Matheson & Co.[1]	47.54	59.25	119.54	113.69
Wm. Forbes & Co.[2]	48.00	60.71	99.81	90.04
George Turner[3]	48.00	60.25	116.25	111.00
Louis Spitzel & Co.[4]	48.75	68.71	86.85	86.85
Birch & Co.[1]	48.88	60.62	115.36	110.47
Wm. Forbes & Co.[3]	49.56	62.27	101.37	91.60
Vander Stegen & Co.[5]	49.36	68.71	90.39	84.19
Carlowitz & Co.[1]	50.70	63.00	119.55	114.60
Wm. Forbes & Co.[3]	50.83	63.54	123.18	117.31
Buchheister & Co.[1]	51.00	64.00	122.00	117.00
Mitsui Bussan Kaisha[2]	51.05	63.40	121.40	114.15
Tientsin Trading Co.[1]	51.88	64 61	121.15	115.85
Mandl & Co.[6]	57.75	75.40	108.45	103.30

The following are the rail-makers: [1]Cammel & Co.; [2]To approval; [3]Barrow; [4]Maryland Steel Co.; [5]Cockrill & Co.; [6]Krupp.

ELECTRIC LIGHTING.—Long Beach, Cal.—The Long Beach & San Pedro Electric Co. has submitted a bid for the lighting of Long Beach. The proposition is based on the moonlight schedule, and offers to provide 16-c. p. lights, two on a standard, for $1.40 each a month, the standards to be 150 ft. apart.

ELECTRIC AND GAS LIGHTING.—Ironton, O.—We are informed that the following bids were received July 14, 1898, for electric and gas lighting: Ironton Electric Light & Ry. Co., 100 or more arc lamps, 1,200 nominal c. p., moonlight, $65 for five years and $60.50 for 10 years; all night, $75 and $70.50 for 5 and 10 years, respectively; 2,000 nominal c. p., moonlight, $85 and $80; all night, $95 and $90; 400 or more inclusive 25 c. p., moonlight, $24.50 for 10 years; 50 c. p., all night, $32.50 for 10 years.

Ironton Gas Co., 100 to 200 gas lamps, all night, $16; moonlight, $15; 200 to 300 gas lamps, all night, $15; moonlight, $14; 300 to 400 or more gas lamps, all night, $14.50; moonlight, $13.50. All the gas lighting is for 5 years.

LAYING WATER PIPE.—Boston, Mass.—The Metropolitan Water Board received the following bids July 21, for laying water pipe in Section 25; contract awarded Michael Russo:

GRADING AND PAVING.—Scottdale, Pa.—We are informed that the following contract was let July 22, 1898, for grading and paving, as advertised in Engineering News: Funkhauser & Coats, New Brighton, Pa., grading, per cu. yd., 25 cts.; curbing, per lin, ft., 45 cts.; crossing, stone, per sq. ft., 20 cts.; paving with Layton brick, per sq. yd., 90 cts. Foundation for paving brick is 8 ins. of coke cinders rolled with a 10-ton roller, and 1 in. of sharp sand.

Bids Received at Boston, Mass., July 21, 1898, for Laying Water Pipe in Section 25.

Quantities.		Michael Russo, Boston, Mass.	Jos. D Gennaro, Boston, Mass.	Bruno & Salamone, Boston, Mass.	Benj. P. Bill, Malden, Mass.	L. A. Taylor, Worcester, Mass.	John J. Falvey, Somerville, Mass.	Chas. Linnehan, Cambridge, Mass.
Laying 20-in. cast-iron pipe	25 lin. ft.	$1.00	$0.60	$1.20	$0.55	$1.25	$0.75	$1.00
" 16-in. " "	4,925 " "	.39	.47	.55	.55	.60	.65	.67
" 12-in. " "	450 " "	.30	.39	.45	.55	.40	.61	.62
" 4-in. " "	50 " "	.25	.25	.24	.25	.50	.20	.47
Excavation, rock, above grade	25 cu. yds.	.50	3.00	2.00	3.80	3.00	4.50	3.00
" " below "	10 " "	.50	3.00	.01	1.00	4.00	5.00	3.00
" earth, " "	10 " "	.50	.50	.45	.60	.60	.40	.50
Setting air valves	3 each	3.00	3.00	2.50	3.00	3.00	2.00	7.00
Chambers for valves*	12 "	35.00	25.00	28.00	33.00	26.00	25.00	37.00
Concrete masonry	10 cu. yds.	5.00	5.00	4.00	4.80	5.00	5.00	5.00
Total		$2,595	$2,987	$3,391	$3,547	$3,683	$4,027	$4,252

*Less than 20-in. diameter and air valves.

RAILWAY EMBANKMENT, ETC. Lamont, Ill.—The board of trustees of the Sanitary District of Chicago received the following bids July 20, 1898, for building a railway embankment and work collateral thereto, and for removing rock from main channel, Section 8, Lamont, as advertised in Engineering News; (1) fill railway embankment, 126,900 cu. yds.; (2) excavation and disposition of material, 19,782 cu. yds.:

	1.	2.	Total.
Mason, Hoge, King & Co., Chicago	$0.18	$0.63	$35,305
McArthur Bros. Co. and Winston & Co.	.175	.75	37,044
Griffiths & McDermott Const'n Co.	.25	.60	43,594
Hayes Bros., Janesville, Wis.	.25	.78	47,155
J. J. McCaughey, Summit, Ill.	.34	...	......

PAVING.—Cortland, N. Y.—We are informed that the following bids were received July 25 for paving, as advertised in Engineering News; Engr., Henry C. Allen, 424 Kirk Block, Syracuse, N. Y.; the contract was let July 26 to the Warren-Scharf Asphalt Paving Co., upon its proposition for paving under alternative No. 2 as follows—curb and gutter, Nelsonville block in railway strip, and Trinidad asphalt outside of railway strip, total $71,593:

SETTLING RESERVOIR.—Boston, Mass.—We are informed that the following bids were received July 2, 1898, by the Metropolitan Water Board for constructing the settling basin for the Marlborough filter beds; bid of Mignault & McGrain accepted; both bidders of South Framingham, Mass.:

Quantities.		Mignault & McGrain.	Auguste Sautier.
Earth excavation	5,700 cu. yds.	$0.18	$0.22
Split-stone masonry in mortar	70 " "	8.50	9.00
Rubble-stone masonry in mortar	25 " "	5.50	5.00
Cement-concrete masonry	36 " "	5.00	5.00
Dry paving	7 " "	1.00	1.50
Hard pine stop-planks, ft.	225 b. m.	*60.00	*60.00
Spruce sheet'g, tong'd & groov'd, ft.	2,400 "	*30.00	*30.00

*Per M. ft.

BIDS RECEIVED AT CORTLAND, N. Y., JULY 25, 1898, FOR PAVING.

Bidder.	Excavation, 10,600 cu.yds.	Sheet asphalt, 22,000 sq.yds.	Medina sandstone, 6,400 sq.yds.	Alternatives, Stone curb'g, 11,000 lin.ft.	Alternatives, Conc'te curb'g, 11,000 lin.ft.	Headers, 950 lin.ft.	Cast-iron, 40,000 lbs.	Stone Brok'n, 500 cu.yds.	Stone Gut'r, 11,000 lin.ft.	Nelsonville block, 6,400 sq.yds.	Syracuse brick, 6,400 sq.yds.	Credit, old cobbles, 500 cu.yds.	Total.	Remarks.		
Alternative No. 1:*																
Trinidad Asphalt Ref. Co., New York	$0.35	$2.22	$3.20	$0.60	$0.65	$0.40	$0.02¼	$2.00	$0.48	.....	.....	$0.50	$86,940 82,210	Stone curb and gutter. Concte " " "		Trinidad. "
Metropolitan Asp. Paving Co., New York.	.40	2.29	3.24	.52	.70	.37	.02½	1.85	.51	.....	.....	.35	88,788 85,158	Stone " " " Concte " " "		Bermud'z. "
Columbia Construction Co., Syracuse, N.Y.	.32	2.23	2.85	.55	1.00	.31	.02½	1.40	.42	.....	.....	.25	83,232 83,562	Stone " " " Concte " " "		Trinidad. "
Warren-Scharf Asp. Pav'g Co., New York.	.33	1.90	3.09	.53	.60	.45	.02	1.75	.37	.....	.....	.40	76,877 73,577	Stone " " " Concte " " "		" "
Trinidad Asphalt Paving Co., New York	.30	2.25	3.12	.58	.63	.48	.02⅛	1.65	.42	.....	.....	.45	85,554 81,484	Stone " " " Concte " " "		" "
Alternative No. 2:†														—Curb and gutter.—		
Trinidad Asphalt Refining Co., New York	.35	2.22	....	.60	.65	.40	.02¼	2.00	.48	$2.85	.....	.50	84,700 79,970	Stone. Concrete.	Trinidad. asphalt.	Nelsonville block.
Metropolitan Asp. Paving Co., New York.	.40	2.29	....	.62	.70	.37	.02½	1.85	.51	....	.....	.35	87,712 82,982	Stone. Concrete.	Bermudez asphalt.	Mack block.
Columbia Construction Co., Syracuse, N.Y.	.32	2.23	....	.55	1.00	.31	.02½	1.40	.42	2.45	$2.31	.25	80,572 80,902 79,776 80,106	Stone. Concrete. Stone. Concrete.	Trinidad asphalt. " "	Nelsonville block. Syracuse block.
Warren-Scharf Asp. Pav'g Co., New York.	.33	1.90	....	.53	.60	.45	.02	1.75	.37	2.78	2.60	.40	74,893 71,593 73,741 70,441 73,101 69,801 74,252 70,952 74,637 71,337	Stone. Concrete. Stone. Concrete. Stone. Concrete. Stone. Concrete. Stone. Concrete.	" " " " " " " " " "	Nelsonville block. Syracuse block. Hornellsvle block. Met'politan block. Harris block.
Trinidad Asphalt Paving Co., New York	.30	2.25	....	.58	.63	.48	.02⅛	1.65	.42	....	2.75	...	83,186 79,116	Stone. Concrete.	" "	Syracuse block.

*Asphalt outside street railroad strip; sandstone inside street railroad strip. †Asphalt outside street railroad strip; vitrified brick inside street railroad strip. Asphalt pavement—6-in. American natural cement concrete, 1-in. binder, 2-in. asphalt. Brick pavement—9-in. Portland cement concrete, 1-in. cushion, 4-in. brick joints filled with patent cement gravel. Brick pavement is in street railway tracks and foundation goes to bottom of cross ties.

BRIDGE MASONRY.—Milan, O.—The following bids were received July 16 by the county commissioners for the masonry work for the new bridge over the Huron River in Greenfield township: Plymouth Stone Co., Plymouth, O., 24 8-33 cts. a cu. ft.; Firley & Andrews, East Norwalk, O., 25 cts.

BRICK PAVING.—Scranton, Pa.—Jos. P. Phillips, Cy. Engr., informs us that the following bids were received July 21, for 43,708 sq. yds. of brick paving and about 22,400 sq.ft. of 6 × 18-in. curb, set in concrete; guarantee on pavement is for 10 years; George McDonald's bid is for Scranton brick or a brick equally as good; the Alcatraz Paving Co.'s bid on Mack brick is for a 5-year guarantee:

Bids Received at Scranton, Pa., July 21, 1898, for Brick Paving.

Items.	Jas. B. Reilly & Co., Philadelphia, Pa.	George McDonald, Newark, N. J.	Blair & Kennedy, Carbondale, Pa.	Alcatraz Paving Co., Philadelphia.	Abbot-Gamble Contracting Co., 620 Chestnut St., St. Louis, Mo.*	
Mack wire-cut brick, a sq. yd.	$1.65	.....	$2.10	$2.09	$2.65	$2.12
" repressed brick, a sq. yd.	1.67	.....	2.30	2.18	2.74	2.21
" wire-cut block, a sq. yd.	1.67	.....	...	2.06	2.61	2.08
" repressed block, a sq. yd.	1.69	.....	...	2.15	2.70	2.17
Syracuse brick, a sq. yd.	...	.....	...	1.98½	2.22	2.12
Guise repressed brick, a sq. yd.	...	.....	...	2.05	2.19	2.08
Guise repressed block, a sq. yd.	...	.....	...	2.06	2.18	2.09
Scranton brick, a sq. yd.	1.63	.....	1.94	1.79¾	1.96	1.85
Straight curb, a lin. ft.	.49	$0.55	.65	.60	.72	.64
Circular curb, a lin. ft.	.95	.65	.98	.96	1.24	1.05
Straight curb with tile drain, a lin. ft.	.60	.60	.80	.75	.83	.74
Circular curb, with tile drain, lin. ft.	1.06	.65	1.18	1.11	1.24	1.15
Laying 12-in. sewer pipe, lin. ft.	1.00	.29	.40	.24	.30	.30
Receivers, each	24.50	7.00	35.00	30.00	35.00	35.00

*Their first bid was for Carlucci curb stone; their second, for 5-year guarantee on pavement, and for Cleveland curb stone.

PAVING CEMENT.—New York, N. Y.—Bids for furnishing 100,000 gallons of No. 6 paving cement for use in Manhattan were received as follows Aug. 2: Jas. Lyons, 7½ cts. a gallon; Wm. B. Burke, 8 cts. a gallon.

WATER PIPE.—Atlanta, Ga.—A press report states that the following bids were received June 22 for furnishing about 250 tons 6-in. cast-iron water pipe, weighing 33 lbs. per ft., etc., as advertised in Engineering News: Pipe—H. B. Cooper, Atlanta, $16.70 a ton, f. o. b., Atlanta, freight prepaid; American Pipe Works, Chattanooga, Tenn., $16.25 a ton, same conditions; Glamorgan Pipe & Foundry Co., Lynchburg, Va., $16.25 a ton, same conditions (accepted). Special castings, ordinary standard weight—H. B. Cooper, 2¼ cts. a lb.; American Pipe Works, 2¼ cts. a lb.; Glamorgan Pipe & Foundry Co., 1⅘ cts. a lb. Supt. Water-Works, Park Woodward.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—

New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.75 cts.

Chicago—Angle bars, 1.15 cts. to 1.25 cts.; spikes, 1.50 cts. to 1.60 cts.: track bolts, hexagonal, 1.90 cts. to 2.00 cts.; square, 1.80 cts. to 1.90 cts.

RAILS, STEEL—

New York, new, $18.00 to $19.00; old iron, $11.00 to $11.50; old steel $9.00.

Chicago, new, $20.00 to $22.50; old iron, $12.25 to $12.50, steel, $10.50 to $11.00.

Pittsburg, new, $18.00; old iron, $13.50 to $13.75; steel, $10.50.

STRUCTURAL STEEL—

New York—Beams, $1.30 cts. to 1.35 cts.; channels, 1.30 cts. to 1.35 cts.; tees, 1.35 cts. to 1.40 cts.; angles, 1.20 cts. to 1.25 cts.; rivets, 1.75 cts. to 1.80 cts.

Chicago—Beams, 1.30 cts. to 1.35 cts.; channels, 1.30 cts. to 1.45 cts.; tees, 1.35 cts. to 1.40 cts.; angles, 1.20 cts. to 1.25 cts.

Pittsburg—Beams, 1.15 cts. to 1.25 cts.; channels, 1.15 cts. to 1.25 cts.; tees, 1.15 cts. to 1.20 cts.; angles, 1.05 cts. to 1.15 cts.

PLATES AND SHEETS—

New York—Universal mill plates, 1.20 cts. to 1.25 cts.; tank, 1.35 cts. to 1.40 cts.; shell, 1.35 cts. to 1.40 cts.; flange, 1.60 cts. to 1.70 cts.; firebox, 2.25 cts. to 2.50 cts.

Chicago—Universal mill plates, 1.25 cts. to 1.30 cts.; tank, 1.15 cts. to 1.25 cts.; shell, 1.50 cts. to 1.60 cts.; flange, 1.25 cts. to 1.45 cts.; firebox, 1.75 cts. to 4.00 cts.; sheets, 2 cts. to 2.05 cts.

Pittsburg—Universal mill plates, 1.00 cts. to 1.10 cts.; tank, 1.07½ cts. to 1.10 cts.; shell, 1.15 cts. to 1.20 cts.; flange, 1.10 cts. to 1.20 cts.; firebox, 2 cts. upwards; sheets, 1.85 cts. to 2 cts.

MERCHANT STEEL—

Machinery, per lb., 1.60 cts. to 1.70 cts.

Tool, per lb., 4.75 cts. to 7 cts.

IRON—

Pig Iron:

New York, No. 1, $11.00 to $11.25; No. 2, $10.00 to $10.50.

Chicago, No. 1, $11.50 to $12.00; No. 2, $11.00 to $11.50.

Pittsburg, No. 1, $10.40 to $10.50; No. 2, $10.00 to $10.25.

Bar Iron:

New York, common, $1.07½ cts. to 1.10 cts.; refined, 1.15 cts. to 1.20 cts

Chicago, common, 1.05 cts. to 1.10 cts.; refined, 1.10 cts. to 1.20 cts.

Sheets:

Common American, per lb., 1.40 cts. to 2.50 cts.

Russia, per lb., 10½ cts. to 11 cts.

LUMBER—

New York:

Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.

Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in. butts, 4½ cts. to 4¾ cts.

Spruce, special cargoes, per M, $15.00 to $17.50.

Yellow pine, random cargoes, $14.50 to $17.00.

North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.

San Francisco:

Oregon pine, per M, $15.50 to $17.50.

Redwood, per M, $17.00 to $19.00.

Redwood tank stock, up to 10 ft., $21.00 to $24.00.

GENERAL MATERIALS—

Lead, New York, 3.90 cts. to 3.95 cts.

Nails, Pittsburg, 1.40 cts.

Solder, per lb., 8¼ cts. to 11½ cts.

Spelter, per lb., 3.90 cts. to 4.00 cts.

Copper, ingots, 11.25 cts. to 11.50 cts.

Granite, rough, New York, cu. ft., 40 cts. to 50 cts.

Limestone, New York, cu. ft., 70 cts. to 80 cts.

Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.

Slate, Penn. block, per square, $4.00 to $5.00.

White lead, American, per lb., 5½ cts. to 6 cts.

Lime, common state, per bbl., 70 cts.

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PERSONAL.

Mr. George V. Lorings has been appointed City Engineer of Decatur, Ill., to succeed Mr. Dickerson, resigned.

Capt. Walter Leslie Fisk, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, stationed at Portland, Ore., has been promoted to be Major.

Mr. Edward M. Bigelow, M. Am. Soc. C. E., Director of the Department of Public Works, Pittsburg, Pa., expects to sail for Europe Aug. 13.

Prof. Aaron N. Skinner has been appointed Professor of Mathematics at the Naval Observatory, Annapolis, Md., with relative rank of Lieutenant.

Mr. W. M. Deutsch, recently Manager of the New York Filter Mfg. Co., New York, has been appointed General Manager of the Continental Filter Co., 44 Wall St., New York.

Mr. M. J. McGinty, Secretary of the Ferguson Contracting Co., railway contractors, 69 Wall St., New York city, was recently married to Miss Margaret Effinger Dean, at Harrisonburg, Va.

Mr. F. T. Chambers, Civil Engineer, United States Navy, has been detached from the New York Navy Yard and ordered to duty in connection with the coaling station at Pago Pago, Samoan Islands.

Mr. James W. G. Walker, Civil Engineer, United States Navy, whose appointment was noted in our last issue, has been ordered to duty in connection with the Nicaraguan Canal Commission.

Mr. Wm. Kent, M. Am. Soc. M. E., and one of the Associate Editors of this journal, has been appointed a member of a commission to consider the pollution of the rivers and streams of the State of New Jersey.

Mr. Creighton H. Hollingsworth, Jun. Am. Soc. C. E., of Waltham, Mass., has been appointed Assistant Engineer of the American Lake Superior Power Co. on the construction of its plant at Sault Ste. Marie, Mich.

Capt. Geo. A. Zinn, Corps of Engineers, United States Army, has been relieved from duty at Milwaukee, Wis., and ordered to Louisville, Ky., to relieve Capt. Jas. G. Warren, Corps of Engineers, who will in turn relieve him at Milwaukee.

Mr. J. W. Beardsley, civil engineer, with the Sanitary District of Chicago, has resigned his position in order to accept that of Assistant Engineer under the Board of Engineers on the Deep Waterways Commission, with headquarters at Ogdensburg, N. Y.

Major Louis Duncan, First Regiment of United States Volunteer Engineers, recently encamped at Peekskill, N. Y., has resigned. Dr. Duncan's appointment was noted in our issue of June 2. He is a Past President of the American Institute of Electrical Engineers, and is Professor of Electrical Engineering in Johns Hopkins University, Baltimore, Md.

Lieut. Francis R. Shunk, Corps of Engineers, United States Army, has been relieved from temporary duty at San Francisco, Cal., under Col. Chas. R. Suter, M. Am. Soc. C. E., Corps of Engineers, and has been ordered to duty at the United States Military Academy, West Point, N. Y. Lieut. Chester Harding, Corps of Engineers, has been relieved from duty at Newport, R. I., under Major Danl. W. Lockwood, Corps of Engineers, and has also been ordered to duty at the U. S. Military Academy.

Mr. Robert Campbell Gemmell, M. Am. Soc. C. E., civil and mining engineer, of Salt Lake City, Utah, has been appointed State Engineer by Governor Wells. He is a graduate of the University of Michigan, Ann Arbor, and has been largely engaged in railway and water supply work in the West. He is engineer of the De Lamar Mines, Mercur, Utah, and is a member of the State Board of Health. He succeeds Col. Willard Young, of the Second Regiment of United States Volunteer Engineers.

Mr. George W. Dickie, Manager of the Union Iron Works, San Francisco, Cal., and builder of the U. S. battleship "Oregon," was born at Ardroth, Scotland, about 60 years ago. He was trained in his father's shipyard; served for a time on the North British Ry., and then commenced the construction of textile machinery and hydraulic apparatus. He came to San Francisco some years ago and was Chief Constructing Engineer for the Risdon Iron Works. About 1884 he became connected with the Union Iron Works as Chief Engineer in charge of ship-building. The Superintending Engineer of the Union Iron Works is Mr. Robert Forsyth.

OBITUARY.

Mr. William Warner, architect, of Elk River, Minn., died July 26, aged 64.

Prof. William Shubert, civil engineer, of Allentown, Pa., died recently, aged 83.

Mr. John O. Deeds, mechanical engineer, of Pittsburg, Pa., died July 31, aged 34.

Mr. Daniel Boehmer, contractor, of Manitowoc, Wis., died July 29, aged 71, as the result of a fall from a building during a storm, July 19.

Mr. Andrew Nicol, for many years Superintendent of the mines of the Delaware & Hudson Canal Co., of Green Ridge, Pa., died Aug. 6, aged 81.

Mr. Arthur Hunter, Chief Engineer of the Allegheny City Light Co., Allegheny, Pa., died Aug. 4, aged 42. He was a mechanical and civil engineer.

Mr. C. W. Canfield, civil engineer, for some years past Paymaster of the Union Bridge Co., Athens, Pa., died there July 30. He had been in the employ of this company and of Kellogg & Maurice for 25 years.

Mr. H. T. Knight, for 14 years Superintendent of the Natoma Water & Mining Co., and for the past six years Chief Engineer of the Sacramento Electric, Gas & Railway Co., of Sacramento, Cal., died July 24, at Harbin Springs, Cal.

Mr. John J. Schoenleber, electrical engineer, President of the Northwestern Enginering Co., St. Paul, Minn., died Aug. 5, aged 32. He was a graduate of the Iowa State College, Ames, Ia., and of Purdue University, Lafayette, Ind.

Mr. Ichabod Jean, contractor and builder, of Baltimore, Md., died Aug. 4, aged 83. Among some of the buildings in that city which were erected by him are the City Hall and the Academy of Music. He was for a time Inspector of Buildings of Baltimore.

Mrs. Harriet S. Totten, widow of Col. George Muirson Totten, the famous civil engineer who built the Panama R. R., died Aug. 3, aged 89. Mrs. Totten assisted her husband, who died in 1884, in his engineering labors, and accompanied him on all his trips to Panama, extending over a period of 25 years. She was a frequent writer on Central American topics.

Dr. George C. Hubbard, head of the Health Department of the Borough of Richmond, New York city, died at his home in Tottenville, Aug. 3. He was appointed Assistant Sanitary Superintendent of the Health Board, Jan. 1, 1898, upon the consolidation of the cities. He was a veteran of the Civil War, in which he served in the Union Army as an Assistant Surgeon.

Mr. Adolph Heinrich Joseph Sutro, Mining Engineer, builder of the Sutro Tunnel, and late Mayor of San Francisco, Cal., died in the latter city Aug. 8. He was born about 1830, and was educated as a mining engineer and mineralogist. He went to California in 1850, and engaged in mining. In 1860 he planned the great four-mile tunnel for draining the Comstock Mines, which, after hard work in securing capital, was commenced in 1869 and finished in 1871. He made a fortune out of the tax of $2 a ton on all ore extracted, and he devoted a part of his income to collecting a library and to building the great public resort near the Cliff House on the ocean front of San Francisco. In his battle with the Southern Pacific Ry. Co. for a five-cent fare to the latter place he developed those anti-monopoly fighting qualities that made him so popular with the people of San Francisco, and which finally led to his being made Mayor. He leaves an estate that is nominally worth $10,000,000; but is heavily mortgaged.

Mr. Jean Louis Charles Garnier, architect, of Paris, France, died last week. He was born in Paris, Nov. 6, 1825, and in 1842 entered the L'Ecole des Beaux-Arts, where he spent six years, winning the Grand Prix in architecture on finishing his course. He then visited Greece and made a study of the Temple of Jupiter in the Island of Egina, from which he prepared a polychromatic design for its restoration that attracted much attention at the Salon des Beaux-Arts, in 1853, and at the Exposition Universalle, in 1855. In 1861 he won the open competition of plans for the Grand Opera House to be built in Paris and was also entrusted with the execution of the work. The building was completed in 1875 and at that time had cost nearly 50,000,000 francs. Among other notable works of M. Garnier's were the Casino at Monte Carlo, the Observatory at Nice, and the various constructions designed to illustrate "The History of Human Habitation," exhibited at the Paris Exposition of 1889. He received the cross of the Legion of Honor in 1864, later becoming an officer and commander. In 1867 he became a Corresponding Member of the Institute of British Architects, and was presented with its gold medal in 1886. He was elected a member of the Academie des Beaux-Arts in 1874.

Dr. James Hall, who has been State Geologist of New York since 1837, died at Echo Hill, Bethlehem, N. H., this week. He was born in Hingham, Mass., Sept. 12, 1811 and graudated from the Rensselaer Polytechnic Institute, Troy, N. Y., in 1832. He was Assistant Professor of Chemistry at that institution for four years and in 1836 was made Professor of Geology. In that year the Geological Survey of New York was organized and he was appointed Assistant Geologist, the following year being appointed State Geologist. In 1855 he declined to accept the position of Chief of the Department of Paleontology of the geological survey of Canada, which was offered him. He was one of the founders of the American Association of Geologists and Naturalists in 1840, which later grew into the American Association for the Advancement of Science, of which he was at one time President. He was also a founder of the National Academy of Science and the International Congress of Geologists, of which latter society he was a Vice-President when it met in Paris in 1878, in Boulogne in 1881 and in Berlin in 1885. In 1848 he was elected a Foreign Member of the Geological Society of London, receiving one of its medals in 1858. In 1884 he was elected Correspondent of the Paris Academy of Science and in 1895 he was elected a member of the Russian Academy of Sciences. He was also a member of many other scientific societies and was a frequent contributor to scientific, especially geological and paleontological literature. He was appointed State Geologist of Iowa in 1855 and of Wisconsin in 1857.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN MATHEMATICAL SOCIETY.
Aug. 19-20. Annual meeting, Boston, Mass. Secy., F. N. Cole, Columbus University, New York city.
AMERICAN CHEMICAL SOCIETY.
Aug. 22-23. Annual meeting, Boston, Mass. Secy., Albert C. Hale, 551 Putnam Ave., Brooklyn, N. Y.
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Aug. 22-27. Annual meeting, Boston, Mass. Secy., F. W. Putnam, Salem, Mass.
GEOLOGICAL SOCIETY OF AMERICA.
Aug. 23. Annual meeting Boston, Mass. Secy., H. L. Fairchilds, Rochester, N. Y.
AMERICAN FORESTRY ASSOCIATION.
Aug. 23-24. Annual meeting, Boston, Mass. Pres., Francis H. Appleton, 101 Tremont St., Boston, Mass.
NATIONAL IRRIGATION CONGRESS.
Sept. 1-3. Annual convention, Cheyenne, Wyo. Secy., J. C. Harpham.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Sept. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
GERMAN-AMERICAN TECHNICAL SOCIETY.
Sept. 3-7. Annual meeting Philadelphia Section, Reading, Pa. Secy., A. Schumann, 532 North 4th St., Philadelphia, Pa.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Sept. 5. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
AMERICAN STREET RAILWAY ASSOCIATION.
Sept. 6-9. Annual convention, Boston, Mass. Secy., T. C. Pennington, 2020 State St., Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 7. Secy., C. W. Hunt, 220 W. 57th St., New York city.
CENTRAL RAILWAY CLUB.
Sept. 9. Secy., H. D. Vought, 114 5th Ave., New York city.
MONTANA SOCIETY OF ENGINEERS.
Sept. 10. Secy., A. S. Hovey, National Bank Bldg.,Helena, Mont.
THE LOUISIANA ENGINEERING SOCIETY.
Sept. 12. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 12-13. Annual meeting, Sault Ste. Marie,Mich. Secy., Wilson S. Howell, Newark, N. J.
NORTHWEST RAILWAY CLUB.
Sept. 13. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
ROADMASTERS' ASSOCIATION OF AMERICA.
Sept. 13. Annual meeting, Denver, Colo. Secy., J. B. Dickson, Sterling, Ill.
NEW YORK STATE STREET RAILWAY ASSOCIATION.
Sept. 13-14. Annual meeting, Brooklyn, N.Y. Secy., H. A. Robinson, New York city.
BROOKLYN ENGINEERS' CLUB.
Sept. 15. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Sept. 16. Secy., D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF MINNEAPOLIS.
Sept. 19. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
burg, Pa.
Sept. 20. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Sept. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Sept. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting Buffalo, N. Y. Secy.,R. W. Raymond, P. O. Box 223, New York city.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.—The eighth annual convention of this Association will be held at Murphy's Hotel, Richmond, Va., from Oct. 18 to 20. The program is as follows: Oct. 18.—Morning—Convention called to order and the transaction of usual routine business. Afternoon—Committee reports and discussion of reports presented at the last convention. Oct. 19.—Morning—Discussion of reports of committees on investigation. Afternoon—Further discussion and answering questions propounded by members. Oct. 20.—Morning—Miscellaneous business and election of officers. Afternoon—Excursions to points of interest.

The excursion list includes visits to Newport News, Old Point Comfort, the Newport News Navy Yard, Washington, D. C., and the many points of interest in and about Richmond.

GERMAN-AMERICAN TECHNICAL SOCIETY.—The annual meeting of the Philadelphia section of this Society will be held at Reading, Pa., Sept. 4-7. The convention will begin with an informal reception by the Philadelphia Society at 532 North 4th St., Philadelphia, Pa., on the evening of Sept. 3. On Sept. 4 there will be an excursion to Reading, where the day will be spent in sight-seeing and excursions.

Monday, Sept. 5, there will be a meeting of delegates, followed by trips to Mt. Penn, Carsonia Park and Woodvale. The evening will be given up to a banquet.

Tuesday, Sept. 6, "General Engineering Day," will be given up to visiting industrial establishments. Those proposed at present are: Carpenter Steel Works, Reading Hardware Works, Repair Shops of R. R. Co., and Reading-Scott Works. During the afternoon excursions will be made to points of interest.

Wednesday, Sept. 7.—The party will take a trolley trip to Highland House. During the business session on Sept. 6, which will consist of reading of reports of delegates and minutes of meetings, Mr. Otto C. Reyman, Pittsburg, Pa., will read a paper on "Acetylene."

NATIONAL IRRIGATION CONGRESS.—The seventh annual meeting of this organization will be held at Cheyenne, Wyo., on Sept. 1 to 3. The Executive Committee states that the Congress is composed of the following: Five delegates from each state and territory, to be appointed by the Governors thereof; one delegate from each city in the United States having a population of less than 25,000, and two delegates from each city having a population of over 25,000; one delegate each from any regularly organized irrigation, agricultural and horticultural society, society of engineers, irrigation companies, agricultural colleges and commercial bodies, and duly accredited representatives of any foreign nation or colony; and members of the United States Senate and House of Representatives, and Governor of a state or territory; any member of a state or territorial irrigation commission; the chairman of each section and the permanent officers of the Congress.

NEW YORK STATE STREET RAILWAY ASSOCIATION.—It is announced that the sixteenth annual convention of this Association will be held at the Hotel St. George, Brooklyn, N. Y., on Sept. 13 and 14. It is expected that papers will be presented on the following topics:

"Points on the Care of Dynamos;" "The Use and Abuse of Transfers;" "How Can We Increase Our Receipts?" "Low Joints; How to Prevent Them;" "The Power Station from an Economic Standpoint;" "The Office; Suggestions for Record, Reports, Etc.;" "Track Bonding; How Can We Obtain the Best Results?" "Street Railroad versus the State; the Relation to Each System for Single Track Roads;" "General Track Construction; the Most Approved Method of Freight and Express Service on Suburban and Interurban Lines;" "Are Air and Power Brakes on Electric Cars Practicable?" "The Most Approved Plan of Long-Distance Power Transmission;" "The Best Method of Preventing Accidents;" "Pleasure Resorts as a Means of Stimulating Travel; Are they Profitable?" "The Effect upon Street Railroads of the Application of Electricity to Steam; Possibilities and Advantages from an Up-to-Date Street Car Service and Why the Rate of Fare Should Not be Reduced;" "Daily Inspection of Car Equipment and How Can We Accomplish the Best Results?" "Receipts from Other Sources;" "How to Obtain Best Results from Sale of Advertising Privileges, Power, Etc."

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Aug. 11.	Light station, Orient Point, N. Y.	Aug. 4
	Advertised, Engineering News, Aug. 4.	
Aug. 11.	Iron or stone bridge, Elizabeth, N. J.	Aug. 4
Aug. 11.	Heating apparatus, Knoxville, Tenn.	Aug. 4
Aug. 11.	Brick paving, curb, etc., Alexandria, Va.	July 28
	Advertised, Eng. News, July 28 and Aug. 4.	
Aug. 11.	School building, Springfield, Mass.	July 28
Aug. 11.	Grading, Reading, Pa.	Aug. 11
Aug. 11.	Bridge, Nutley, N. J.	Aug. 11
Aug. 11.	Pipe sewers, Pittston, Pa.	Aug. 11
Aug. 11.	Grading, etc., Alexandria, Va.	Aug. 11
Aug. 12.	Pike road (36 miles), Vernon, Ind.	Aug. 11
Aug. 12.	Retaining wall, Troy, N. Y.	Aug. 11
Aug. 12.	Iron superstructure, Mount Vernon, O.	Aug. 11
Aug. 12.	Steel water tank, Bridgeton, N. J.	Aug. 11
Aug. 12.	Bridge masonry, Butler, Pa.	July 28
Aug. 12.	Brick paving, Olean, N. Y.	July 28
	Advertised, Engineering News, July 28.	
Aug. 12.	Steam pump, Salem, N. J.	July 28
	Advertised, Eng. News, July 28 and Aug. 4.	
Aug. 12.	Water filter plant, Salem, N. J.	July 28
	Advertised, Eng. News, July 28 and Aug. 4.	
Aug. 12.	Art building addition, Des Moines, Ia.	July 21
Aug. 12.	Electrical conductors, New York, N. Y.	Aug. 4
Aug. 12.	Garbage disposal plant, Milwaukee, Wis.	Aug. 4
Aug. 12.	Bank building, Passaic, N. J.	Aug. 4
Aug. 13.	Bridge, Marion, O.	Aug. 4
Aug. 13.	Pipe sewers, Kenton, O.	Aug. 4
Aug. 13.	Bridges (2), Colfax, Wash.	Aug. 4
Aug. 13.	Grading, Zanesville, O.	Aug. 4
Aug. 13.	Pipe sewer, Ashtabula, O.	July 28
	Advertised, Engineering News, July 28.	
Aug. 13.	Brick paving, Chillicothe, O.	July 28
	Advertised, Engineering News, July 28.	
Aug. 13.	Brick paving, Lancaster, O.	July 28
Aug. 13.	Heating, etc., Syracuse, N. Y.	Aug. 11
Aug. 13.	Street bonds, Chillicothe, O.	Aug. 11
Aug. 13.	Grading, fill, etc., Deadwood, S. Dak.	Aug. 11
Aug. 15.	Pipe sewer, Concord, N. C.	Aug. 11
Aug. 15.	Grading, Chicago, Ill.	Aug. 11
Aug. 15.	Grading, graveling, etc., Wauwatosa, Wis.	Aug. 11
Aug. 15.	Asphalt paving, Kansas City, Mo.	Aug. 11
Aug. 15.	Pipe sewers, Owensboro, Ky.	Aug. 11
Aug. 15.	Paving, curbing, etc., Portland, Me.	Aug. 11
Aug. 15.	Addition to school building, Boston, Mass.	Aug. 11
Aug. 15.	Park bonds, Newark, N. J.	Aug. 11
Aug. 15.	Levee work, Tallulah, La.	Aug. 11
Aug. 15.	Pipe sewer, Des Moines, Ia.	Aug. 11
Aug. 15.	Water pipe, wells, etc., McKeesport, Pa.	Aug. 11
Aug. 15.	Water machinery, Chicago Junction, O.	Aug. 11
Aug. 15.	Water-works, Ashburnham, Ont.	Aug. 11
Aug. 15.	Paving, etc., Albany, N. Y.	Aug. 11
Aug. 15.	Factory buildings, etc., Ottumwa, Ia.	Aug. 11
Aug. 15.	Road machine, Helena, Mont.	Aug. 11
Aug. 15.	Bonds, Poplarville, Miss.	July 28
Aug. 15.	Drainage ditch, Ottawa, Ill.	July 28
Aug. 15.	Paving bonds, Oberlin, O.	July 28
Aug. 15.	Water bonds, Barnesboro, Pa.	July 28
Aug. 15.	Paving, etc., Fremont, O.	July 21
Aug. 15.	Grading, Omaha, Neb.	July 21
Aug. 15.	**Exhibition bldg. plans, Glasgow, Scotland.**	**June 2**
Aug. 15.	Water pipe, pumping statn, etc., Laporte, Ind.	Aug. 4
Aug. 15.	Engine house, etc., Evansville, Ind.	Aug. 4
Aug. 15.	Water-works, Augusta, Wis.	Aug. 4
Aug. 15.	Water tower and tank, San Jose, Cal.	Aug. 4
Aug. 15.	Drainage, Cissna Park, Ill.	Aug. 4
Aug. 15.	Gas lamps, Duluth, Minn.	Aug. 4
Aug. 15.	Coal house, Springfield, O.	Aug. 4
Aug. 15.	Heating apparatus, Petersburg, Va.	Aug. 4
Aug. 15.	Church building, Petrolea, Ont.	Aug. 4
Aug. 15.	Asphalt paving, Buffalo, N. Y.	Aug. 4
Aug. 15.	Grading and draining, Toledo, O.	Aug. 4
Aug. 15.	Macadamizing, Oakland, Cal.	Aug. 4
Aug. 15.	Macadamizing, etc., Fremont, O.	Aug. 4
	Advertised, Engineering News, Aug. 4.	
Aug. 16.	Gas lamps, etc., Superior, Wis.	Aug. 4
Aug. 16.	Bonds, Salt Lake City, Utah.	Aug. 4
Aug. 16.	Steel bridge, Oshkosh, Wis.	Aug. 4
	Advertised, Engineering News, Aug. 4.	
Aug. 16.	Electric light bonds, Springville, N. Y.	Aug. 4
Aug. 16.	Street bonds, Mount Vernon, N. Y.	Aug. 4
Aug. 16.	Brick paving, Coldwater, Mich.	Aug. 4
	Advertised, Engineering News, Aug. 4.	
Aug. 16.	Electric light apparatus, Danville, Ill.	Aug. 4
Aug. 16.	Asphalt paving, New York, N. Y.	Aug. 4
Aug. 16.	Electric lighting, Superior, Wis.	Aug. 4
Aug. 16.	Electric light plant, Minster, O.	July 21
Aug. 16.	Pipe sewer, Oberlin, O.	July 28
Aug. 16.	Pipe sewer, Dunkirk, N. Y.	Aug. 11
Aug. 16.	Grading, St. Joseph, Mo.	Aug. 11
Aug. 16.	Pipe sewers, Mendota, Ill.	Aug. 11
Aug. 16.	Cylinder plates, Plum Beach L'thouse, R.I.	Aug. 11
Aug. 16.	Water pipe, Billerica, Mass.	Aug. 11
Aug. 16.	Paving and sewers, Camden, N. J.	Aug. 11
Aug. 16.	Paving, etc., Pittsburg, Pa.	Aug. 11
Aug. 16.	Church building, Waseca, Minn.	Aug. 11
Aug 16.	Macadamizing, Cromwell, Conn.	Aug. 11
Aug. 16.	Brick paving, Waterbury, Conn.	Aug. 11
Aug. 16.	Macadam roads, Rockville, Md.	Aug. 11
Aug. 16.	Brick paving, Oberlin, O.	Aug. 11
Aug. 16.	Brick paving, Dallas, Tex.	Aug. 11
Aug. 16.	Paving, Denver, Colo.	Aug. 11
Aug. 17.	School building, Chicopee, Mass.	Aug. 11
Aug. 17.	Sewers, Chicago, Ill.	Aug. 11
Aug. 17.	Masonry, etc., Cleveland, O.	Aug. 11
Aug. 17.	Gas lighting, etc., Covington, Ky.	Aug. 11
Aug. 17.	Brick paving, curbing, etc, Urbana, Ill.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 17.	Electric light plant, Thorold, Ont.	Aug. 11
Aug. 17.	Electric lighting, Covington, Ky.	Aug. 11
Aug. 17.	Bridge, New Brunswick, N. J.	Aug. 11
Aug. 17.	Water-works, Paw Paw, Mich.	Aug. 11
Aug 17.	Graveling, New Brunswick, N. J.	Aug. 11
Aug. 17.	Bridge substructure, New Haven, Conn.	Aug. 4
	Advertised, Engineering News, Aug. 4.	
Aug. 17.	Sidewalks, St. Bernard, O.	July 28
Aug. 17.	Bridge substructures (2), Cleveland, O.	July 21
Aug. 18.	Water supply, Jersey City, N. J.	July 14
Aug. 18.	Army supplies, Memphis, Tenn.	July 28
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 18.	Grading, etc., Defiance, O.	July 28
Aug. 18.	Water-works, Rome, N. Y.	Aug. 4
Aug. 18.	Highway, Truro, Mass.	Aug. 11
Aug. 18.	Broken stone, etc., New York.	Aug. 11
Aug. 18.	Paving, Buffalo, N. Y.	Aug. 11
Aug. 19.	Pipe sewers, Pontiac, Mich.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 19.	Boilers (2), National Home, Wis.	Aug. 11
Aug. 19.	Steel bridge, Delaware, O.	Aug. 11
Aug. 19.	Gate house, New Bedford, Mass.	Aug. 11
Aug. 19.	Levee work, Dayton, O.	Aug. 11
Aug. 19.	Bridge bonds, Jersey City, N. J.	Aug. 11
Aug. 19.	Grading, etc., Guilford, Conn.	Aug. 11
Aug. 19.	Cement, warks, etc., Rochester, N. Y.	Aug. 11
Aug. 19.	Paving, etc., Troy, N. Y.	Aug. 11
Aug. 19.	Paving sidewalks, Dayton, O.	Aug. 11
Aug. 19.	Viaduct substructure, Cleveland, O.	July 28
Aug. 19.	Asphalt paving, Cleveland, O.	July 28
Aug. 20.	Bridge, Cincinnati, O.	July 28
Aug. 20.	Dredging, Montgomery, Ala.	July 28
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 20.	Paving bonds, Mansfield, O.	July 28
Aug. 20.	Electric lighting, Whitesboro, N. Y.	July 14
	Advertised, Eng. News, July 14 and 21.	
Aug. 20.	Street bonds, Malta, O.	July 21
Aug. 20.	Pumping engines, Lancaster, O.	Aug. 4
Aug. 20.	High school building, Sharonville, O.	Aug. 4
Aug. 20.	Road bonds, Houston, Tex.	Aug. 4
Aug. 20.	Macadam paving, Suffield, Conn.	Aug. 11
Aug. 20.	Dam, abutments, etc., Brantford, Ont.	Aug. 11
Aug. 20.	Bonds, Tiffin, O.	Aug. 11
Aug. 20.	Bridge, Brantford, Ont.	Aug. 11
Aug. 20.	Iron bridge, Cocalico, Pa.	Aug. 11
Aug. 20.	Power pump, Chambersburg, Pa.	Aug. 11
	Advertised, Eng. News, Aug. 11 and 18.	
Aug. 20.	Curbing, gutter, etc., Piqua, O.	Aug. 11
Aug. 20.	Concrete walks, Toledo, O.	Aug. 11
Aug. 21.	Church building, Winnebago City, Minn.	Aug. 11
Aug. 22.	Masonic building, Wichita, Kan.	Aug. 11
Aug. 22.	Bridge, La Moure, N. Dak.	Aug. 11
Aug. 22.	Sewerage system, Santa Ana, Cal.	Aug. 11
Aug. 22.	Addition to engine house, Washington.	Aug. 11
Aug. 22.	Heating, etc., Paterson, N. J.	Aug. 11
Aug. 22.	Wells, Washington, D. C.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 22.	Street cleaning, Oakland, Cal.	Aug. 11
Aug. 22.	Paving, etc., South Bend, Ind.	Aug. 11
Aug. 22.	Brick paving, etc., Fremont, Neb.	Aug. 11
Aug. 22.	Heating and ventilation, Paterson, N. J.	Aug. 4
	Advertised, Eng. News, Aug. 4 and 11.	
Aug. 22.	Bridge (400 ft.), Hamilton, O.	Aug. 4
Aug. 22.	High school building, Columbus, O.	Aug. 4
Aug. 22.	Court house, Charleston, Ill.	Aug. 4
Aug. 22.	School buildings, Ione, Cal.	Aug. 4
Aug. 22.	Electric light plant, Mineral Point, O.	July 28
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 22.	Steel substructure, Lebanon, O.	July 28
Aug. 22.	Water-works, Mineral Point, O.	July 28
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 23.	School building, Columbus, O.	July 28
Aug. 23.	**Water pipe, Coolgardie, West Australia.**	**June 2**
Aug. 23.	Electric light plant, Bunker Hill, Ill.	Aug. 4
Aug. 23.	Collegiate building, Iowa City, Ia.	Aug. 11
Aug. 23.	Steel projectiles, Washington, D. C.	Aug. 11
Aug. 23.	Wharf, Fort Morgan, Ala.	Aug. 11
Aug. 23.	Naval supplies, Philadelphia, Pa.	Aug. 11
Aug. 23.	School building, Roanoke, Va.	Aug. 11
Aug. 23.	Water-works, Greenville, Cal.	Aug. 11
Aug. 23.	Macadam road, Naugatuck, Conn.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 24.	Water-works improvements, Elyria, O.	Aug. 4
Aug. 24.	Sidewalks, Cambridge City, Ind.	Aug. 4
Aug. 24.	Hire dredging plant, Mobile, Ala.	July 28
	Advertised, Eng. News, July 28 to Aug. 18.	
Aug. 25.	Lighthouse, Baltimore, Md.	July 28
	Advertised, Engineering News, July 28.	
Aug. 25.	Bonds ($80,000), Healdsburg, Cal.	Aug. 4
Aug. 25.	School building, Waldo, O.	Aug. 4
Aug. 25.	School building, Passaic, N. J.	Aug. 11
Aug. 25.	Filling sewage beds, Plainfield, N. J.	Aug. 11
Aug. 25.	Bridge work, London, O.	Aug. 11
Aug. 25.	Sewers, Cleveland, O.	Aug. 11
Aug. 25.	Electric light plant, McArthur, O.	Aug. 11
Aug. 25.	Sewer, New Hampton, Ia.	Aug. 11
Aug. 26.	Barracks, National Soldiers' Home, Va.	Aug. 11
Aug. 26.	Water-works, Healdsburg, Cal.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 26.	Water and light bonds, Healdsburg, Cal.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 26.	Electric light plant, etc., Healdsburg, Cal.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 26.	**Pump engines (2), Minneapolis, Minn.**	**July 21**
	Advertised, Eng. News, July 21 to Aug. 11.	
Aug. 27.	Water pipe, Lakewood, O.	Aug. 4
Aug. 27.	Road work, Pittsburg, Pa.	Aug. 11
Aug. 29.	Brick paving, Malta, O.	Aug. 4
Aug. 29.	Brick paving, Canton, O.	Aug. 4
Aug. 29.	Paving, etc., Toledo, O.	Aug. 4
Aug. 29.	**Pumping eng. (3,000,000 galls.), Marietta, O.**	**July 28**
Aug. 30.	**Plans for electric traveling crane, Chicago.**	**July 21**
Aug. 30.	Grading, etc., for water-wks, Cincinnati, O.	Aug. 4
Aug. 30.	Dams, etc., Mississippi River, Ill.	Aug. 4
	Advertised, Eng. News, Aug. 4 to 25.	
Aug. 30.	Gravel roads, Indianapolis, Ind.	Aug. 4
Aug. 30.	Gas mains, etc., San Jose, Cal.	Aug. 11
Aug. 30.	Pipe sewers, Peru, Ind.	Aug. 11
Aug. 30.	School building, Delphos, O.	Aug. 11
Aug. 30.	Street bonds, Orrville, O.	Aug. 11
Aug. 31.	Hospital, Fort Slocum, N. Y.	Aug. 11
Aug. 31.	Coal handling plant, New London, Conn.	Aug. 11
Aug. 31.	Chapel building, Lebanon, Pa.	Aug. 11
Aug. 31.	Dredging, Bridgeport, Conn.	Aug. 4
	Advertised, Eng. News, Aug. 4 to 25.	
Aug. 31.	Custom house, Guayquil, Ecuador.	Apr. 21
Sept. 1.	**Drainage system, Savannah, Ga.**	**June 30**
	Advertised, Eng. News, June 23 to Aug. 25.	
Sept. 1.	Electric light plant, Cullman, Ala.	July 21
Sept. 1.	Water-works, Norwood, N. Y.	July 21
Sept. 1.	Bridges, Johnsonburg, Pa.	Aug. 4
	Advertised, Eng. News, Aug. 4 and 11.	
Sept. 1.	Water-works, Mobile, Ala.	Aug. 4
	Advertised, Eng. News, Aug. 4 to 25.	
Sept. 1.	Electric lighting, Paris, Tex.	Aug. 11
	Advertised, Eng. News, Aug. 11 to 25.	
Sept. 1.	Dam, power house, etc., Jackson, Mich.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Sept. 3.	Sewage pumping plant, No. Somerville, Mass.	Aug. 11
	Advertised, Eng. News, Aug. 11 and 18.	
Sept. 3.	Smokeless powder, Washington, D. C.	Aug. 11
Sept. 3.	**Sewage pumping station, Boston, Mass.**	**July 7**
	Advertised, Eng. News, July 7 and 14.	
Sept. 5.	Dredging, Waukegan, Ill.	Aug. 4
	Advertised, Eng. News, Aug. 4 and 11.	
Sept. 5.	Bridge, Dillon, Mont.	Aug. 4
Sept. 5.	Steel hull tugboat, Seattle, Wash.	Aug. 11
Sept. 5.	Construction materials, Ft. Delaware, Del.	Aug. 11
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 6.	Pumping station, etc., Winnipeg, Man.	Aug. 11
	Advertised, Eng. News, Aug. 11 to 25.	
Sept. 6.	Wells, Winnipeg, Man.	Aug. 11
	Advertised, Eng. News, Aug. 11 to 25.	
Sept. 7.	Bridge, Oroville, Cal.	Aug. 4
Sept. 8.	Bridge, Roseburg, Ore.	Aug. 4
Sept 8.	Dykes, Hudson River, N. Y.	Aug. 11
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 9.	Rubber suctions, Charleston, S. C.	Aug. 11
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 12.	Water and sewer bonds, Mobile, Ala.	Aug. 11
Sept. 12.	Grading, paving, etc., Toledo, O.	Aug. 11
Sept. 13.	**Capitol building, Helena, Mont.**	**July 28**
Sept. 15.	**Enlarging court house, Lisbon, N. Dak.**	**July 28**
Sept. 15.	Fire alarm system, Mobile, Ala.	Aug. 11
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 19.	Hospital plans, San Francisco, Cal.	Aug. 4
Oct. 1.	**Monitors (4), Washington, D. C.**	**July 7**
Oct. 1.	**School building (equipment), St. Thomas, Ont.**	**July 7**
Oct. 5.	Bridge superstructure, Chicago, Ill.	Aug. 11
Oct. 24.	**Markets, etc., Belem, Brazil**	**Apr. 28**
Oct. 30.	**School building, Chehalis, Wash.**	**June 16**
Dec. 31.	**Plans for station, etc., Stockholm, Sweden.**	**June 23**
No date.	Electric lighting, Berkeley, Cal.	Aug. 11
"	City hall, Freeport, Ill.	Aug. 11

RAILWAYS.

ALABAMA.—Reports state that Burton & Brown are building a narrow gage railway from their mills at Minooka, on the Louisville & Nashville, to their timbered lands five miles south of Calla, Ala. This line will be two or three miles long. County Surveyor A. P. R. Dahl will survey the route.

ALABAMA & FLORIDA.—R. M. Quigley & Co., St. Louis, Mo., have been awarded the contract for clearing, grading and track-laying on this new road, from Georgiana to River Falls, Ala., a distance of about 30 miles. M. H. Smith, Pres. Louisville & Nashville R. R. Co., Louisville, Ky., is said to be interested in the new line.

ATCHISON, TOPEKA & SANTA FE.—Press reports state that the block system on this line is being rapidly extended and that by the end of another year the Chicago and Eastern divisions will be equipped. It is expected to commence work soon on the installation of the block system, from Ottawa to Purcell, Kan.

ATLANTA, KNOXVILLE & NORTHERN. — This company is making extensive improvements on its line. Every trestle on the road is being filled. The work has been in progress but a short time, and to complete it will require about two years' time, as there are many trestles on the road, and the improvement is one which cannot be rushed.

ATLANTIC COAST LINE.—It is officially announced that, commencing Aug. 1, the Atlantic Coast Line R. R. Co. of South Carolina will become the legal successor by consolidation of the following five railway companies: the Wilmington, Columbia & Augusta, the North Eastern of South Carolina, the Cheraw & Darlington, the Manchester & Augusta, the Florence of South Carolina. The principal office of the company will be at Charleston, S. C. Pres., C. S. Gadsden, Charleston, S. C.; Gen. Mgr., J. R. Kenly, Wilmington, N. C.——Reports state that the Manchester & Augusta branch will be extended about 25 miles, contracts for the construction of the same to be awarded in about one month.

BURLINGAME & NORTHWESTERN.—This company was incorporated in Kansas July 29, with a capital stock of $340,000, to operate the old Manhattan, Alma & Burlingame Ry., between Alma and Burlingame, Ark., 47 miles. The directors are: E. B. Purcell, of Manhattan; Howell Jones, of Topeka, Kan.; Adiel Sherwood, of St. Louis, Mo.; W. S. McClintock, of Topeka. Adiel Sherwood recently purchased the line at receiver's sale.

CLEARFIELD SOUTHERN.—G. H. Gearhart, Clearfield, Pa., informs us that all the surveys have been made and the capital secured for the construction of this proposed railway, from Belsena Mills to Clearfield Bridge, a station on the Beach Creek R. R. Pres., A. W. Lee, Clearfield; Ch. Engr., Samuel Bruger, Unionville, Pa.

CLEVELAND & NEW CASTLE.—D. D. Streeter & Co., of Chicago, have been awarded the contract for constructing the portion of this new line between Akron and Niles, O.; and Ryan & McDonald, of New York, have the contract for that portion between Niles and New Castle, Pa. Sub-contracts are being let. Pres., J. H. McVey; Ch. Engr., J. H. Pirkey, both of Youngstown, O.

COLUMBIA & WESTERN.—Press reports state that the Canadian Pacific Ry. Co. assumed charge of the Columbia & Western Ry., the narrow-gage line between Trail and Rossland, B. C., on July 22, and is now operating it. The road is being largely relocated, and the contract for rebuilding it and widening the gage has been let to Winters, Parsons & Boomer, of Butte, Mont., who have begun grading. They expect to complete the work in three months; estimated total cost, $120,000. It is expected that the smelter will be in blast by August 1. Laborers are in great demand. E. P. Gutelius, Gen. Mgr.

DELAWARE.—Strong & Totten, 32 Liberty St., New York, have the contract for the construction of this proposed steam railway, from Delhi to Andes and Bovina Center, Delaware County, N. Y., on the New York, Ontario & Western Ry., 15 miles. Pres., Henry Davie; Ch. Engr., Thomas Murray, both of Delhi, N. Y.

FORT WAYNE, DELPHI & PEORIA.—John Vanatta, Pres., Brookston, Ind., informs us that the surveys have been completed, the profiles made and the capital stock secured for this proposed line between Brookston and Peoria, Ill., via Fowler, Ind.; Milfold and Buckley, Ill., 175 miles. This new line will be a branch of the Chicago, Indianapolis & Louisville Ry. Ferd. Hall, Ch. Engr., Chicago, Ill.

ILLINOIS CENTRAL.—Press reports state that Pres. Stuyvesant Fish, of the Illinois Central, and other western capitalists, made application in Alabama, Aug. 9, for a charter for a railway from West Point, Miss., in a northerly direction into Alabama, terminating for the present in the coal fields of the Mississippi Valley Coal Co. This line will be operated in connection with the Illinois Central, and the first 60 miles of the road are expected to be completed by Jan. 14, 1899.

KENTUCKY.—Judge B. F. Day, of Mount Sterling, Ky., has recently closed a sale of 6,000 acres of timber land on Beaver Creek, Menefee county, to John B. Fassett, Tunkhannock, Pa.; John T. Phillips, Dallas, Pa.; and John T. Halleck, Wilkes Barre, Pa. It is reported that a railway will be built across the property at once to Rothmell or to Yale.

LOUISVILLE, HENDERSON & ST. LOUIS.—It is reported that this company contemplates the extension of its road from West Point, its present terminus, to Louisville. The line now has an entrance into Louisville over the tracks of the Illinois Central R. R. The right of way has already been secured, and about two-thirds of the distance has been graded. R. N. Hudson, Ch. Engr., Cloverport, Ky.

NEW ORLEANS & WESTERN & PORT CHALMETTE TERMINAL.—C. B. Van Nostrand, Pres., 36 Wall St., New York, is said to have finally arranged with Contractor Stewart, of New Orleans, La., for the improvement work to be made at the new terminal in New Orleans.

OHIO RIVER & CHARLESTON.—Reports state that this line will be extended from Gaffney, the present terminus, to Spartanburg, S. C. A. N. Molesworth, Ch. Engr. and Supt., Johnson City, Tenn.

OREGON RAILROAD & NAVIGATION.—This company has let the contract for improving eight miles of its track in Oregon to Hale & Smith; to cost about $175,000.

RICHMOND, PETERSBURG & CAROLINA.—The W. P. Chapman Co., general contractor of this railway, Petersburg, Va., writes us that, contrary to current reports, the directors of this railway company have not voted to terminate the contract with the W. P. Chapman Co., nor has such cancellation been considered. The W. P. Chapman Co. holds its contract from the Colonial Construction Co., which is the financial end of the railway company.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—Reports state that this company is extending its yard facilities at St. Louis, Mo., to quite an extent. The block system is in use at St. Louis, and for some distance down the main line; similar extensions are proposed at Memphis, Tenn., and the introduction of the block system will follow such extensions. This matter, like the new depot, however, may be held up until the litigation of the city against the company is over.

TENNESSEE CENTRAL.—It is announced that the necessary funds have been secured for the completion of this road, from Monterey to Knoxville, Tenn., a distance of about 100 miles. About fifteen miles of grading and all the track laying remain to be done. The work is to be finished in 90 days, and then through connections from Nashville to Harriman, on a direct line will be established over the Nashville, Chattanooga & St. Louis Ry. to Lebanon, thence over Crawford's road to Monterey, and from Monterey to Harriman over the Tennessee Central. This arrangement will only be temporary, as the Tennessee Central will build its own lines from Harriman through to Nashville as soon as practicable. Then the road from Nashville to Clarkesville will also be constructed. The work is to be finished within two years. Pres., Jere Baxter, Nashville, Tenn.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—Two contracts for grading the Point Richmond extension of this railway are said to have been let to Woods Bros. and Cy. Moring, of Stockton, Cal. They will grade the roadbed across Robert's Island, from the San Joaquin River to Whisky Slough, a little over four miles of heavy grade work across reclaimed land, which is below highwater mark on the river, but is filled in. W. B. Storey, Jr., Ch. Engr., San Francisco, Cal.

SUGAR CREEK.—J. W. Davis, Pres., Coffman, W. Va., informs us that this company is getting the right of way for its projected railway as quickly as it can. The route is from McDonald to Raleigh Court House, W. Va., along Sugar Creek, to a coal region, a distance of 18 miles. The company desires to lease these coal lands on a royalty. J. M. Clarke, Ch. Engr., Kanawha Falls, W. Va.

TITUSVILLE, CAMBRIDGE & LAKE ERIE.—Wheeler & Co., Bowling Green Bldg., New York, have been awarded the contract for the construction of a 30-mile section of this railway. F. P. Brown, Gen. Supt., Titusville, Pa.

WASHINGTON & CHESAPEAKE BEACH.—The construction of this line is being rapidly pushed. The road is already in operation from Deanwood, D. C., to Marlboro, a distance of twelve miles. It is the intention to run both steam and electric trains over the line, connecting for the present with the Alexandria branch of the Baltimore & Ohio R. R., at Deanwood, thence to Hyattsville, Md., reaching Washington over the Baltimore & Ohio tracks to the station at C St. and New Jersey Ave.

WISCONSIN.—Negotiations are said to be in progress between the Wisconsin & Michigan, the Ann Arbor, the Dunbar & Wausaukee and the Holmes & Sons' railway companies, the last two exclusive logging roads, whereby the three are to have terminals at Menominee, Wis. If the deal is made the Wisconsin & Michigan will remove its eight miles of rails between Peshtigo and the harbor to a new line to be built from Bagley Junction to Menominee, a like distance. The Dunbar & Wausaukee will build from Wausaukee to a connection with the Wisconsin & Michigan at Bagley Junction, a distance of fourteen miles, and the Holmes & Sons' road will build from its present eastern terminus at Muskauna Creek to a connection with the Wisconsin & Michigan, at Kerry Gow, a distance of six miles. This new railway scheme will carry with it the erection at Menominee of a large union station, and also the construction of a new car barge slip for the Wisconsin & Michigan. The latter road is now being extended to Quinnesec and the Menominee iron range.

STREET AND ELECTRIC RAILWAYS.

MALDEN, MASS.—The aldermen of this town have granted permission to the Boston Elevated R. R. to extend its tracks on Broadway and Eastern Ave., Maplewood.

HARTFORD, CONN.—Frank Caum, Supt. Hartford St. Ry. Co., informs us that a brick and iron addition to the power station, 40 × 75 ft., is now being built and is expected to be in use by October 1. A 30 × 52 × 48-in. cross-compound engine, with a 850-K-W. General Electric generator and a Worthington independent condenser will be installed. There are no novel features except the all-concrete foundations of the building, built by the Hartford Paving & Construction Co., in which 1,200,000 lbs. of concrete were used. The iron work in the building is by the Berlin Iron Bridge Co., of East Berlin, Conn. E. S. Goodrich, Pres. Hartford St. Ry. Co.; N. McD. Crawford, Gen. Mgr., Hartford.

SUFFIELD, CONN.—The charter of the Suffield & East Granby St. Ry. Co. was sold on Aug. 1 to George W. Dunham, of Flemington, N. J., who is said to hold a controlling interest in the Springfield & Southwestern St. R. R. Co. It is now thought that the proposed electric railway for this town will now be built, as the suit pending between the two companies will probably be withdrawn.

BROOKLYN, N. Y.—A certificate of merger has been filed by the Nassau Electric Ry. Co. of Brooklyn, with the Secretary of New York State, merging these companies: Kings County Electric Ry. Co., Coney Island Ry. Co. and the Union Ry. Co. of Brooklyn.

FULTON, N. Y.—O. C. Breed, Engr., Fulton, has prepared plans for repaving the curves and turnout for the Fulton & Oswego Falls St. Ry. Co., the changes made being suitable for the use of electric motive power. The present line is operated by horses.

LAURENS, N. Y.—Reports from Oneonta, N. Y., state that Owen Phillips has completed a new survey for an extension of the electric railway from West Oneonta to Laurens. It is said that the grade is a good one, and is on much higher ground than the one laid out by Mr. Covert last fall.

MOUNT VERNON, N. Y.—It is announced that the Nassau Electric R. R. Co., of Brooklyn, has bought the privileges of the North Mount Vernon Electric R. R. Co. for $15,000. The line is about 1½ miles in length and of late has not been operated.

NEW HARTFORD, N. Y.—It is reported that the New Hartford & Clayville Electric R. R. Co. has applied to the village trustees for a franchise.

OSWEGO, N. Y.—It is reported that the Lake Ontario & Riverside Ry. Co. has purchased a quantity of rails in New York, to cost about $3,000. These rails are required for the new extension of the line in East Bridge St., and it is expected that they will be laid next month. Receiver, F. H. Tidman.

PEEKSKILL, N. Y.—The Railroad Commission has granted the application of the Peekskill Traction Co. for permission to construct an electric street railway in Peekskill and from that village to the state camp and thence to Verplank's Point.

STILLWATER, N. Y.—Work on the Mechanicsville & Stillwater Ry. is progressing rapidly. The track is laid to within about one mile of Waterford.

UTICA, N. Y.—The Railroad Commission announced Aug. 4 that it has granted the application of the Frankfort & Utica Electric R. R. Co. to be permitted to use the overhead electric trolley system. No date has yet been fixed by the commission for the adjourned hearing on the company's application to be allowed to cross the tracks of the West Shore R. R. at grade at a point near Utica. Among those interested are, Col. Clinton Beckwith, of Herkimer, N. Y.; and John V. Quackenbush, of Mohawk, N. Y.

CAMDEN, N. J.—The Camden & Suburban Ry. Co. is laying a second track on Market and Federal Sts. The extension to Beideman's station by way of River Road, Stockton, is also being pushed.

ELIZABETH, N. J.—The Union County Board of Freeholders Aug. 4 received bids for the franchise for a trolley line between Elizabeth and Plainfield. The only bid received was that of John Kean, Pres. Elizabeth City Horse R. R. Co., at $250,000. Mr. Kean previously made an offer of $100,000.

HACKENSACK, N. J.—The reorganization committee of the Union Traction Co. of New Jersey, composed of Eliot Norton, Chm.; Wm. L. Trenholm, Daniel B. Halstead, Max Milian Calm and Geo. G. Duy, of New York, contemplate the completion of the company's line into Hackensack, requiring the construction of 6½ miles of track. Secy., G. Rowland Munroe, care of Van Schaick & Norton, 100 Broadway, New York.

PLAINFIELD, N. J.—It is reported that the Plainfield St. Ry. Co. applied to the council, Aug. 8, for a franchise to operate a trolley line from East 5th St. through Richmond St. to East 2d St., and through the latter street to the city line. The company filed the required number of consents, representing all except 131 feet of the entire street, and as only one remonstrance was presented, the franchise was granted.

PETERSBURG, VA.—At a meeting of the council Aug. 1, an ordinance was passed granting a franchise to the Piedmont Traction Co. of Charlottesville, to build an electric street railway in this city. It is said that the company will begin the construction of the line at once.

SPARTANBURG, S. C.—We are informed that the Spartanburg Gas, Electric Light & St. R. R. Co. has been organized in South Carolina, with a capital stock of $250,000, to acquire property now owned by the Aetna Light & Power Co., which includes the street railway in this city, and a graded road for a freight line to Glendale and Clifton, 10 miles. It is proposed to build the street railway, freight line, etc., as more fully stated under Electric Light and Power. Eliot Norton, Vice-Pres., 100 Broadway, New York.

CLEVELAND, O.—It is reported that the Urban & Suburban Ry. Co. has been incorporated by E. W. Moore; H. A Everett, Pres. Akron, Bedford & Cleveland R. R., Garfield Bldg., and others. It is proposed to construct an electric railway between Cleveland and Toledo.

DELAWARE, O.—The Delaware Electric St. Ry. was sold by Receiver Cone, July 30, at public auction, to B. W. Brown and others, of Delaware, at $13,525.

LEETONIA, O.—The Leetonia Ry. Co. was incorporated Aug. 4 with a capital stock of $1,000, to construct a railway from Salem township, Columbiana county, to Leetonia. The incorporators are John McKeefrey, W. D. McKeefrey, N. J. McKeefrey, C. R. Shontz and Paul M. Mossman.

MONTICELLO, IND.—Chas. C. Spencer, Pres. Tippecanoe Electric R. R. Co., informs us that the proposed route for this electric railway is from Rochester to Covington and Fowler, via Winamac, Pulaski, Buffalo, Monticello and Lafayette, Ind., a distance of 150 miles. This line does not parallel any other road, and passes through a rich and thickly populated country, in which corn, wheat, etc., is raised in abundance. From 20 to 30 miles of the right of way is secured, and capitalists stand ready to take the bonds and construct the railway.

GRAND RAPIDS, MICH.—The Grand Rapids & Belding Traction Co. contemplates the construction of an electric railway in this city. The company is capitalized at $200,000. Pres., Chas. B. Judd; Vice-Pres., J. P. Creque, both of Grand Rapids.

NILES, MICH.—The Indiana Ry. Co., which proposes connecting St. Joseph, Benton Harbor, Berrien Springs, Niles and other Berrien county points with South Bend, Ind., by an electric railway, has obtained the right of way through all the townships from St. Joseph to Niles, and this latter city will soon be asked for a franchise. If it be not granted the tracks will probably be built on the outskirts, as the company has permission to use Niles township. J. A. Russell, J. S. Hardell and William Van Cleave, of Detroit, Mich., are interested. The new railway will come over the Berrien Road from Berrien Springs to Niles.

LAWRENCE, KAN.—It was formally agreed by the citizens of Lawrence at a mass meeting held July 26 to accept the proposition of Frank Kern, of Mattoon, Ill. and Col. W. D. Ewing, of Boston, for the construction of an electric street railway in this city, and work on the new system is expected to begin at once. It is agreed that five miles of road shall be in operation December 1, and other lines will be built in the spring.

ST. LOUIS, MO.—The president and trustees of Winstanley Park have passed an ordinance granting to the St. Louis, Belleville & Suburban Electric St. Ry. a right of way through the village. Pres., F. F. Espenscheid.——The stockholders of the Central Traction Co. have voted to increase the paid-up capital stock from $100,000 to $5,000,000. It is proposed to construct the line as rapidly as possible. Pres., R. M. Snyder, Kansas City, Mo.; Secy., John H. Blessing, St. Louis.

DENVER, COLO.—The supervisors have passed the Colfax electric franchise over the mayor's veto, thus providing for the operation of an electric line to Montclair.

NELSON, B. C.—It is reported that S. C. Drummond, representing the British Electric Traction Co., London, England, had applied to the council for a charter for an electric railway in this city.

TAMPICO, MEXICO.—Press reports state that an American syndicate is arranging to build an electric street railway in this city.

ELECTRIC LIGHT AND POWER.

NORTH GORHAM, ME.—Press reports state that a contract has been awarded for electrical machinery for the plant in North Gorham at Great Falls, on the Presumpscot River, for the Sebago Power Co. It calls for two 250-K-W. alternators, with marble switchboards and all the necessary fixtures. The Cumberland Illuminating Co. is installing this plant, and will, within 90 days, be supplying power and light to Deering, Westbrook and Cape Elizabeth. A large amount of power can be sold here for motor, and it is understood that the Yarmouth Railway will take power of this company when they are ready to supply it. The company is under the same management as the Belknap Motor Co. The company will expend about $40,000.

BURLINGTON, VT.—The Consolidated Electric Light Co. has been awarded the 3-year contract for lighting this city. There will be required 140 2,000-c.p. arc lights.

HINESBURG, VT.—We are informed that the proposed plant, which will be operated by water power, will have a capacity for 16 arc and 500 incandescent lights; estimated cost, $8,000. Engr., Eugene Sanctuary, Montpelier, Vt.

MONTPELIER, VT.—The Bolton Falls Power Co. has about completed arrangements preparatory to entering upon the work of constructing the dam below the falls, having secured all the rights necessary for the enterprise. About 4,000 HP. will be developed. It is understood that there will be three contracts made—one for building the dam, one for building the power house and one for equipping the power house with machinery. G. H. Almon, Montpelier, G. E. Moody, Waterbury, Vt., and C. L. McMahon, Stowe, Vt., are interested. Engr., H. W. Allen, Manchester, N. H.

AMESBURY, MASS.—It is stated that the Amesbury Electric Light, Heat & Power Co. will purchase a 1,000 incandescent light machine this year. Supt., B. H. Young.

MYSTIC, CONN.—Arrangements are being made by Thos. C. Perkins, Hartford, Conn., for furnishing and constructing the proposed plant to cost about $15,000.

TALCOTTVILLE, CONN.—Talcott Bros. are reported to have begun the construction of a plant.

BUFFALO, N. Y.—Plans have been filed with the bureau of buildings for a brick transformer house to be erected at 2290 Niagara St. by the Cataract Power & Conduit Co. It will cost $2,500.

CHARLOTTE, N. Y.—R. M. Schwartz, Clk., writes us that plans for the proposed plant and water-works have not yet been completed by the Stanwix Engineering Co., Rome, N. Y.; estimated cost of plant, $10,000.

NEWBURG, N. Y.—The Consolidated Gas, Electric Light, Heat & Power Co. has sold $29,000 in bonds for extending its plant, according to reports.

PORT CHESTER, N.Y.—W. S. Comly, Secy. Port Chester Electric Lighting Co., writes us that the company has done nothing yet in regard to building the proposed plant.

MADISON, N. J.—Daniel Burns, of this place, has been awarded the contract for erecting the addition to the electric light plant at $4,500. The council will also purchase a new dynamo and switch board. The improvements in the station and the new engines, wells, dynamo and switch board will cost about $30,000.

VINELAND, N. J.—Capitalists and business men are forming a company to dam Muddy Run, four miles from here, for the purpose of furnishing electric power for manufacturing purposes and lighting the town with electricity.

PHILADELPHIA, PA.—The Pennsylvania Mfg., Light & Power Co., which recently purchased the Hestonville Railway Co.'s power station at 25th and Callowhill Sts., is making plans for the enlargement of the old station.

POTTSTOWN, PA.—Press reports state that the Schuylkill Valley Illuminating Co. proposes to change the 2,000-c.p. lights in Rogersford and Spring City to 1,200-c.p. Supt., W. D. Jones.

DURHAM, N. C.—At the election held Aug. 1 this place voted against issuing $225,000 in bonds for a plant, water-works, etc.

SPARTANBURG, S. C.—Eliot Norton, Vice-Pres., 100 Broadway, New York, writes us that the Spartanburg Gas, Electric Light & St. R. R. Co. has been organized under the laws of South Carolina, for the purpose of acquiring the property in Spartanburg now owned by the Aetna Light & Power Co., and which comprises the gas and electric light plant, street railway and graded road for a freight line to

Glendale and Clifton, 10 miles. The capital stock of the new company is $250,000. It is proposed to erect a new 50,000-ft. gas holder, extend the mains and service, build a water power for electric service and also to build the street railway and freight line, for all of which the money has been provided. Work will be begun early in September. Ch. Engr., J. Y. McClintock, Rochester, N. Y. Communications to be addressed to the company at its New York office

ATHENS, GA,—The council is reported to have decided to purchase a new 50-arc light dynamo.

COLUMBUS, GA.—Bids were asked by the Columbus Power Co. until Aug. 10 for constructing the proposed power plant to cost complete about $250,000. The contract for the wheels and iron work has been let to the Holyoke Machine Co., Holyoke, Mass., as noted in our issue of July 28.

GALLATIN, TENN.—The council has decided to build a municipal plant, and not grant a franchise, as at first proposed.

NASHVILLE, TENN.—The board of public works is considering the question of lighting the city hospital with 100 16-c.p. and 27 32-c.p. lights.

COVINGTON, KY.—Bids are asked until Aug. 17 for lighting that portion of the city now illuminated with gasoline with either gasoline, gas or electricity. Theo. Von Heone, Cy. Clk.

McARTHUR, O.—Bids are asked until Aug. 25 for furnishing and constructing a plant, described in our issue of July 28. Engrs., F. P. Roberts & Co., 510 Osborn Bldg., Cleveland; Pres. Bd. Trustees, Paris Horton.

MOUNT GILEAD, O.—Burton J. Ashley, Old Colony Bldg., Chicago, Ill., and Wellington, O., has submitted a report and estimates for a plant and water-works to cost complete about $35,000.

RICHWOOD, O.—Edward Schambs, Mansfield, O., has been awarded the contract for furnishing this city with 27 arc lights at $65 a year.

SOUTH CHARLESTON, O.—The question of building a plant is being considered, according to reports.

WOOSTER, O.—The council is reported to have rejected the bids received July 18 for electric lighting. The question of building a city plant is being considered.

MOUNT PLEASANT, MICH.—Congress has voted an appropriation of $10,000 for a plant, water-works, etc., at the Indian School. Supt., Rodney S. Graham.

CASS CITY, MICH.—The Fort Wayne Electric Corporation, Fort Wayne, Ind., has been awarded the contract for furinshing the plant for this place, excepting the engine which will be furnished by the Ridgeway Dynamo & Automatic Engine Co., Chicago, Ill.

JACKSON, MICH.—Bids are asked until Sept. 1 for constructing a dam, power house, etc., on the Kalamazoo River, for the Allegheny Hydraulic Co., Ltd., as stated in our advertising columns. Address Wm. G. Fargo, Engr., Jackson

LAWTON, MICH.—This place is considering the question of building a plant. An election to vote on the proposition will probably soon be held. H. C. Lammond, Village Clk.

GREENUP, ILL.—Local papers state that bids will be asked at once by the village board for furnishing and constructing a plant.

MARSHFIELD, WIS.—The council is reported to have asked for bids for lighting the streets. About 30 arc lights will be required. Chas. Schmieler, Cy. Treas.

MILWAUKEE, WIS.—The council will soon vote on the question of issuing $250,000 in bonds for a municipal plant.

DULUTH, MINN.—It is reported that the city will vote Aug. 30 on the question of issuing $100,000 in bonds for electric lighting. H. W. Cheadle, Cy. Clk.

GRAND FORKS, N. DAK.—The council is reported to have voted to build a plant. Population (1897), 12,000. Jno. Dinnie, Mayor; F. A. Brown, Audr.

KANSAS CITY, MO.—Alderman H. M. Beardsley, Chn. Com., is securing information for a municipal plant. Mr. Beardsley will visit Buffalo and a number of eastern cities.——Cornelius Sweetland and R. J. Ingraham, Providence, R. I., have applied for a franchise.

FORT WORTH, TEX.—Press reports state that on Aug. 1 Dr. A. D. Thomas, of Little Rock, Ark., filed application in the federal court for a receiver of the property of the Standard Light & Power Co., of Fort Worth. A hearing will be had before United States District Judge E. R. Meek in this city. The property is valued at $75,000.

HOUSTON, TEX.—Surveys for a site for the proposed municipal plant are being made. Aldermen Tuffly, Rosenthal and Robinson compose the committtee.

PARIS, TEX.—Bids are asked until Sept. 1 for lighting the city with arc lights for one to five years, as stated in our advertising columns. Jno. C. Gibbons, Mayor; W. C. Dean, Cy. Engr.

LAFAYETTE, COLO.—It is stated that the Rocky Mountain Power Co. will build a plant at Lafayette for transmitting power about 28 miles to Black Hawk and Central City; estimated cost about $150,000. Vice-Pres., A. N. Page.

SEATTLE, WASH.—Press reports state as follows: The Snoqualamie Falls Power Co. let contracts Aug. 8 for the completion of its plant. Snoqualamie Falls is 22 miles from Seattle, and about the same distance from Tacoma in an air line, and have an unbroken vertical fall of 270 ft. The flow of the river is equal to about 30,000 HP. at low water, and the plan of installation is such that at a small additional expense for dams and reservoirs the entire drainage from the snowfields of the Snoqualamie watershed of 1,000 square miles will be available, making over 100,000 HP., whenever business of the adjacent cities may demand it. The power house is hewn out of the solid rock, 250 ft. beneath the crest of the fall, where the waterwheels connect direct with generators, from which the electricity is transmitted by wire to Seattle and Tacoma. Chas. H. Baker, Seattle, and Wm. H. Baker, ex-Pres. Chicago Bd. of Trade, Chicago, Ill., are interested. Ch. Engr., Thos. T. Johnston, Security Bldg., Chicago.

WOODLEY, ORE.—Press reports state that bids will be received for the Grande Ronde Placer Mining Co.'s electric light installation at Woodley, consisting of a 15-HP. engine; a Thomson-Houston arc dynamo, adapted for 10 2,000-c.p. arc lights; a Westinghouse incandescent dynamo, for 15 16-c.p. lights, 100 volts, about seven miles of No. 6 insulated copper wire, together with the necessary aparatus and fittings in connection with plant. Paul Berthon, Baker City, Ore., may be addressed.

BERKELEY, CAL.—The town trustees decided July 26 to ask for bids for lighting the town with electricity for two years; check, $2,000.

HEALDSBURG, CAL.—Bids are asked until Aug. 26 for constructing a plant and water-works, and also for the purchase of $80,000 of 5% bonds, as stated in our advertising columns. C. H. Pond, Cy. Clk.

RED BLUFF, CAL.—It is stated that the Tehama Electric Co. will purchase two additional dynamos for its new plant. James Cross, San Francisco, Cal., and Wm. Sanders are interested.

THOROLD, ONT.—Bids are asked by the mayor until Aug. 17 for furnishing a plant of 1,500 to 2,000 lights capacity. Engr., R. J. Parke, 310 Foresters Temple, Toronto, Ont.

NELSON, B. C.—The question of either purchasing the present plant or of building a new one at a cost of about $40,000 is being considered, according to reports.

NEW COMPANIES.—National Light & Power Co., New York, N. Y.; $5,000,000, with $1,000 paid in. E. S. Savage, Rahway, N. J.; M. D. Valentine, Woodbridge, N. J.; Albert Bruns, Bronx Borough, New York; A. L. Sherer, Manhattan Borough, New York.

Worthington Water & Light Co., Worthington, Ind.; $5,000; John H. Brown, B. O. Mayer, Fuller McClellan.

Cherubusco Water & Light Co., Cherubusco, Ind.; $5,000; J. H. Brown, B. O. Mayer, Fuller McClellan.

Central Operating & Construction Co., Fond du Lac, Wis.; to build a light plant and water-works; Maurice McKenna, C. D. Smith.

BRIDGES.

SALEM, MASS.—The county commissioners have awarded the contract for building a bridge over Forest River at this city to Thos. Fitzgibbons, Beverly, Mass., at $18,725.

MOUNT VERNON, N. Y.—The council is considering the question of building bridges on South Fulton Ave., East Lincoln Ave., East Third St. and East Sixth St. Edwin W. Fiske, Mayor.

JERSEY CITY, N. J.—Bids are asked by the board of freeholders until Aug. 19 for the purchase of $26,000 of county bridge bonds.

NEW BRUNSWICK, N. J.—Bids are asked until Aug. 17 for repairing the Cheesequake Bridge. R. J. Dougherty, Cy. Engr., 113 Albany St.——The contract for the Washington Ave. bridge has been awarded to Wm. Farrier, New York, N. Y., at $1,565.

NUTLEY, N. J.—Bids are asked until 2.30 p. m., Aug. 11 for constructing a bridge over Third River, on Harrison St., to have steel beams, brick arches and masonry abutments. James Owen, County Engr., 800 Broad St., Newark.

PATERSON, N. J.—The board of freeholders will have plans prepared for the construction of a new bridge at Main St.

COCALICO, PA.—Bids are asked until Aug. 20 for constructing an iron bridge 75 ft. long and 16 ft. wide, over Cocalico Creek. John B. Eshleman, Chn. Comrs., Lancaster, Pa.

MEHOOPANY, PA.—The Mehoopany Bridge Co. has been incorporated with a capital stock of $25,000, to construct and maintain a toll bridge over the Susquehanna River. The directors are: Elley Colby, Owego, N. Y.; F. L. Siltser, S. L. Stark, C. A. Little and John B. Fosset, Tunkhannock, Pa.

PITTSBURG, PA.—The Creighton Bridge Co., Pittsburg, with a capital stock of $100,000, has been authorized to construct a bridge over the Allegheny River. The directors are: C. G. L. Peffer, M. D. Weyman, Mark D. Weyman and J. Frank Peffer, of Tarentum, Pa.

WESTCHESTER, PA.—Bids were asked until Aug. 10 for constructing a 76-ft. iron bridge at Landenberg, and also for the removal of the old iron structure. R. T. Garrett, Chn. Comrs.

CUMBERLAND, MD.—Reports state that the West Virginia, Central & Pittsburg Ry. Co., will construct a 250-ft. plate girder bridge, on the extension to Huttonsville. J. W. Galbreath, Ch. Engr., Cumberland.

BELLAIRE, O.—Reports state that an effort is being made to have the council construct a bridge from Franklin St. to Central Ave., on Rose Hill.

CINCINNATI, O.—F. S. Krug, County Engr., has recommended that the contract for building the substructure for two bridges on the Banklick road be let to Reubel Bros., at $2,050.

DELAWARE, O.—Bids are asked until Aug. 19 for constructing a steel bridge over the Olentangy River, in Liberty township, according to reports. E. S. Mendenhall, County Surveyor.

LONDON, O.—Bids are asked until Aug. 25 for constructing an iron superstructure and for the masonry work of six bridges, according to reports. W. D. Wilson, County Audr.

MOUNT VERNON, O.—Bids are asked until 12 m., Aug. 12, for furnishing the material and constructing an iron superstructure 110 ft. × 16 ft., over the Kokosing River, at Browns ford. W. A. Wander, County Audr.

SPRINGFIELD, O.—Plans have been submitted to the board of public affairs by Wm. Bagley for a bridge of two spans, 41 ft. each; to cost about $4,500.

PLYMOUTH, IND.—N. E. Leonard, Jr., Cy. Clk., informs us that a contract has been awarded to W. P. Bassett, of the Rochester Bridge Co., Rochester, Ind., at $2,950, for constructing a bridge over Yellow River.

CARMI, ILL.—The county supervisors have awarded the St. Louis Bridge Co., St. Louis, Mo., a contract at $1,629, for building three steel bridges over French Creek.

CHICAGO, ILL.—Bids are asked until Oct. 5 for furnishing and erecting certain bridge superstructures on the line of the river diversion channel of the Desplaines River. Jas. Reddick, Clk. Bd. Sanitary Trustees, Security Bldg., Chicago.——The following are the lowest bids received by the sanitary trustees Aug. 3 for building certain bridges: Summit and Lyons Highway, C. L. Strobel, $12,620; Chicago Terminal Co., Desplaines River, Wisconsin Bridge & Iron Co., $7,318; Romeo Highway, Heldmaier & Neu, $9,659; Chicago, Madison & Northern, Kedzie Ave., McArthur Bros., $5,743; Lemont Highway, Sackley & Petersen, $4,351; Willow Springs Highway, Sackley & Petersen, $5,386; Chicago Terminal Co., Desplaines River, Heldmaier & Neu, $7,500; Summit and Lyons Highway, Section F, McArthur Bros., $18,577; C. L. Strobel, Willow Springs Highway, main channel, Lemont Highway, Romeo Highway, $14,990 each.

ELORY, WIS.—We are informed that W. G. Kirchoffer, Engr., Baraboo, Wis., is preparing plans for a bridge to be constructed across the Baraboo River.

LA MOURE, N. DAK.—Bids are asked until Aug. 22 for constructing a bridge over the James River, according to reports. Chas. Alister, County Audr.

GRASS VALLEY, CAL.—The supervisors have asked for bids for building a new bridge over the Greenhorn Creek, between You Bet and Little York.

BRANTFORD, ONT.—Bids are asked until Aug. 20 for constructing a 100-ft. span highway bridge over a part of Grand River. T. H. Jones, Cy. Engr.

BUILDINGS

BOSTON, MASS.—Bids are asked by the city school committee, Mason St., until Aug. 15, for building an addition to the Norcross school building, on D and 5th Sts., South Boston. Chn., Thos. F. Strange.

CHICOPEE, MASS.—Bids are asked until Aug. 17 for building a 4-room brick school building on Grape St.; also for heating, ventilating and plumbing of the same. Chas. M. Bixby, Chn. Comrs.

SPRINGFIELD, MASS.—The contract for the erection of the new Alden St. school buiding has been awarded to J. Shea & Sons, of Springfield, at $22,436, according to reports.

HARTFORD, CONN.—Bids are asked until Aug. 12, up to 2 p. m., for erecting additions to the Northwest school building. George Calder, Chn. Bldg. Com.; Hapgood & Hapgood, Archs., 141 Trumbull St.

NEW HAVEN, CONN.—The following bids were received Aug. 8 for the erection of a lighthouse on the outer breakwater, New Haven Harbor:

Michael J. Kennedy, 189 Montague St., Brklyn., N.Y.	$21,090
Houston Construction Co., Grand Bldg, Philadelphia.	27,746
Engineering Contract Co., 15 Broad St., New York.	32,900
Ambrose F. Dudley, 100 Broadway, New York....	33,950
F. C. Arthur & Co., 515 Girard Bldg., Phila., Pa..	36,495
Wm. H. Flaherty & Co., 80 and 82 Reade St., N. Y.	42,919

FORT SLOCUM, N. Y.—Bids are asked until Aug. 31 for the construction of a post hospital at this place. Address Wm. J. Snow, 1st Lt., 7th Art., Q. M.

NEW YORK, N. Y.—Plans have been filed by Patrick H. Lynch, Owner and Arch., 642 West 138th St., for eight 4-story dwelling houses on 142d St., near Hamilton Place, to cost $96,000; by B. L. Connolly, 309 West 77th St., for a 7-story brick flat and store building on the Boulevard near 104th St., to cost $45,000. Arch., A. O. Hoddick, 57 West 24th St.——George Vassar's Son & Co., 111 5th Ave., have been awarded the general contract for erecting a 2-story brick warehouse, 153 × 80 ft., at 52 to 60 Vandam St., for the Trinity Church Corporation. Arch., Chas. C. Haight, 111 Broadway.——The iron contract for the new 10-story loft and office building to be erected for the Lorillard Estate, 3 Mercer St., at 296 Broadway, has been let to John J. Radley & Co. Archs., Jordan & Giller, 19 Park Place.

NIAGARA UNIVERSITY, N. Y.—A fire in the chapel of the Niagara University Aug. 5 caused a reported loss of $70,000; insurance, $19,000.

SYRACUSE, N. Y.—D. P. Plaisted & Son, of Syracuse, have been awarded the contract for heating and ventilating Jefferson school building at $1,641.

SYRACUSE, N. Y.—Bids are asked until Aug. 13 at 10 a. m., for heating and ventilating the new addition to the library building. Clk., E. W. Mundy.

BLOOMFIELD, N. J.—Peter Vanderhoof & Son, Newark, N. J., have been awarded the general contract for the Essex Ave. school building, to cost about $35,000. Arch., Chas. G. Jones, 280 Broadway, New York.

EAST ORANGE, N. J.—Meeker & Lewis, 130 Broadway, New York, has received the carpentry contract, at $9,213, for a building to be erected at Main St. and Mitchell Place for Emma F. Childs, 55 Cortlandt St., New York; Wm. H. Connolly has the mason contract, at $6,962. Arch., J. C. Westervelt, 487 Fifth Ave., New York.

LONG BRANCH, N. J.—An election will be held at this place on Aug. 16 to consider the advisability of appropriating $45,000 for a new high school building.

NEWARK, N. J.—It is reported that Wm. H. Connelly has the mason contract, at $7,197, and L. C. Becker & Bro. have the carpentry contract, at $5,878, for the building to be erected on South 9th St. for the Dominican Fathers of St. Antoninus's Church. Arch., Nathan Myers, Metropolitan Bldg., Newark.

ORANGE, N. J.—The plans of Carr, Poole & Lum, of New York, are reported to have been selected for the new 5th Ward school building; estimated cost, $40,000. As all the bids for the construction of the addition to the Lincoln Ave. school building exceeded the appropriation of $15,000, they were rejected, and the special committee was instructed to have the plans modified by the architect so as to come within the limit.

PASSAIC, N. J.—Bids are asked by the board of education, 255 Main Ave., until Aug. 25, for the construction of a new school building at Bergen and 2d Sts. Arch., Wm. M. Meeker.

PATERSON, N. J.—Bids are asked by the supervising architect, Washington, D. C., until Aug. 22 for a low pressure, return circulation, steam heating and ventilating apparatus for the U. S. building in this city.

ALLEGHENY, PA.—It is reported that the Baltimore & Ohio R. R., operating the Pittsburg & Western R. R., will erect a new passenger and freight station at Federal St. and River Ave., which will be completed before winter sets in.

BRADDOCK, PA.—Plans have been prepared for a 16-room school building to be erected on Washington Ave. at a cost of about $40,000. Archs., E. J. Carlisle & Co., 700 Lewis Bldg., Pittsburg, Pa.

GREENSBURG, PA.—D. M. Fair & Son, Blairsville, Pa., have been awarded the contract for building an additional story and otherwise improving the Masonic Temple at this place, at a cost of $10,800.——Plans have been selected for the proposed new hospital building 152 × 92 ft., to be erected in Greensburg. Archs., Beezer Bros., Mateen Bldg., Altoona, Pa.

LEBANON, PA.—Bids are asked until Aug. 31 for the erection of Salem Memorial Sunday-School Chapel, for the congregation of Salem Lutheran Church of Lebanon. Address Geo. W. Hayes; Archs., Roby & Richter, 773 Cumberland St., Lebanon.

PHILADELPHIA, PA.—The contract for erecting a 3-story building for the Psi Upsilon Society of the University of Pennsylvania is said to have been let to Thos. Little & Sons, 221 Pear St., to cost about $27,000.

YORK, PA.—The erection of a new city hall building, to cost $50,000, is contemplated.

WOODVILLE, PA.—Bids are asked by the commissioners of Allegheny county until Aug. 15 for the erection of certain buildings to be erected at Woodville; bond required, $25,000. W. F. Thompson, County Controller; F. J. Osterling, Arch., 701 Times Bldg., Pittsburg, Pa. Bids were received for this work on Aug. 3, but as the lowest, that of D. P. Osterling, at $237,600, was above the appropriation, new bids had to be asked.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Aug. 22 for constructing an additional story to engine house No. 14 on 8th St., N. W.; also until Aug. 20 for constructing an addition to station house No. 8, on U St., N. W.——The following bids have been received for erecting four general passenger elevators, one private passenger elevator, one freight elevator, three mail lifts and two freight lifts for the post-office building in this city:

		Time.
Standard Elevator & Mfg. Co., Chicago, Ill.	$75,900	Specified
Otis Bros. & Co. (Pump A), New York.	72,500	Dec. 1
Otis Bros. & Co. (Pump B), New York..	74,800	"
Morse, Williams & Co., Philadelphia, Pa.	76,400	"
McAdam & Cartwright Elev. Co., N. Y.	69,500	"
Eaton & Prince Co., Chicago, Ill.......	45,000	6 mos.

WASHINGTON, D. C.—The commissioners have awarded the contract for the construction of a boiler house on the grounds of the Industrial Home School to Paverini & Greer, at $2,900.

CHATHAM, VA.—The supervisors of Pittsylvania county have awarded to the B. F. Smith Fire Proof Construction Co. the contract for remodeling the basement of the court house into a fireproof record room, at $6,900.

NATIONAL SOLDIERS' HOME, VA.—Bids are asked until Aug. 26 for constructing two wooden barrack buildings on the grounds of the National Home for Disabled Volunteer Soldiers. Treas., Wm. Thompson.

ROANOKE, VA.—Bids are asked until Aug. 23 for erecting a high school building. Secy., E. L. Slaughter.

HUNTSVILLE, ALA.—Contracts towards the erection of the Madison county jail building have been let to Jonas Dyas, of Huntsville, for 290,000 bricks; to Hutchens & Murdock, of Huntsville, for plumbing, at $3,600.

DELPHOS, O.—Bids are asked until Aug. 30 for erecting a brick school building in school district No. 9. Otto W. Moennig, Clk. Bd. of Education, Delphos.

CHICAGO, ILL.—It is reported that the Chicago City Ry. Co. intends to erect a large casino and pavilion at the northwest corner of Cottage Grove Ave. and 61st St., at a cost of $400,000.

FREEPORT, ILL.—We are informed that an issue of $35,000 of 5% has been authorized for the erection of a new city hall building; and that bids will soon be asked for constructing a building to cost about $40,000. F. C. Kruse, Chn. Bldg. Com.; Geo. H. Tandy, Cy. Clk.

WASECA, MINN.—Bids are asked until Aug. 16 for erecting a new church building for the Church of the Sacred Heart. Arch., J. M. Doherty, Rochester, Minn.

WINNEBAGO CITY, MINN.—Bids are asked until Aug. 21 for constructing a new church building and remodeling old buildings for the Presbyterian Church of this city. David Secor, Pres. Bd. of Trustees; S. J. Bowler, Arch., 3 Collom Bldg., Minneapolis, Minn.

IOWA CITY, IA.—Bids are asked by the regents of the State University of Iowa until Aug. 23 for the construction of the foundations and basement of the collegiate building. Secy., Wm. J. Haddock, Arch.; Proudfoot & Bird, 320 5th St., Des Moines, Ia.

WICHITA, KAN.—Bids are asked until Aug. 22 for erecting an addition for the Masonic Home, including heating and plumbing. Archs., J. C. Holland & Co.

BAKERSFIELD, CAL.—Frank Sharples' has the contract for erecting the Scribner opera house at $14,420.

STRATFORD, ONT.—E. A. Cawsey and J. L. Youngs, of Stratford, has been awarded the contract for erecting a new municipal building in this city, at $27,787. Archs., Geo. W. King and J. W. Siddall, of Toronto, Ont.

WATER-WORKS.

LEWISTON, ME.—The question of a purer water supply is being considered, according to local papers. The council committee has been investigating various methods of water filtration. It is estimated that a filter will cost about $35,000.

BILLERICA, MASS.—Bids are asked until Aug. 16 for furnishing and laying water pipe; check, $100. Engr., E. Worthington, Billerica.

HUNTINGTON, MASS.—R. D. Maynard, Springfield, Mass., has been awarded the contract at $6,611 for constructing the works.

MALDEN, MASS.—The aldermen have appropriated $800 for purchasing new hydrants.

NEW BEDFORD, MASS.—Bids are asked until Aug. 19 for building the Quittacas gate-houses. Engrs., Rice & Evans, 95 Milk St., Boston; Supt., R. C. P. Coggeshall.

PITTSFIELD, MASS.—The water department proposes to extend the mains to Tillotsons at a cost of about $10,000.

WATERTOWN, MASS.—Press reports state that the Watertown Water-Works Co. and the committee appointed by the town to take and manage the works have about reached an agreement. The company wanted over $450,000, while the town would give but $400,000. Both sides have agreed that the price shall be left to three referees, to consist of Moses Williams, John C. Freeman and Solomon Lincoln.

ALBANY, N. Y.—The contract for erecting a pumping station and intake for the water filtration plant has been let to Stone & Thurston, New York, at $2,977.——Wm. A. Reynolds has been awarded the contract for laying water mains in several streets, at $2,730.——The council has been asked to appropriate $22,000 for cleaning and improving the Bleecker reservoir. Geo. I. Bailey, Supt.

ALDEN, N. Y.—An election will be held Aug. 25 to vote on the question of issuing bonds to build works to cost about $16,000. Engr., J. F. Witmer, Ellicott Square, Buffalo, N. Y.

AMSTERDAM, N. Y.—It is proposed to build a new main from the distributing reservoir and also a new dam. S. E. Babcock, Cy. Engr. of Little Falls, N. Y., has furnished data to the council.

CHARLOTTE, N. Y.—R. M. Schwartz, Clk., writes us that specifications for the works are being prepared by the Stanwix Enginering Co., Rome, N. Y. The supply will be secured from Lake Ontario. Population, 1,305.

COPENHAGEN, N. Y.—The village trustees have been petitioned to take steps toward securing works.

DEPEW, N. Y.—It is reported that the residents of this place are endeavoring to have a pipe line laid from Buffalo to furnish the town with an increased water supply. Geo. Urbans, Jr., and J. J. Albright may be addressed.

GENESEO, N. Y.—An election will be held Aug. 15 to vote on the question of appropriating $8,000 for the purchase of a new pump for the station at Conesus Lake.

RHINEBECK, N. Y.—Wm. R. Hutton, 35 Broadway, New York, has submitted estimates for works to cost about $58,000 if the water is secured from Brown Pond, or about $50,000 if secured from wells, with a reservoir located on Gerger's Hill. Dr. Frank Latson, Pres. Village Bd.

ROME, N. Y.—The Stanwix Engineering Co. of this place has submitted estimates for gravity works, to cost about $150,000. It is proposed to secure the new supply of 8,000,000 gallons from Fish Creek.

TICONDEROGA, N. Y.—F. B. Richards, Pres., writes us that the proposed extension of the pipe line laid above the ground was to help out the reservoir at low water. The scheme for the present has been abandoned.

BRIDGETON, N. J.—Bids are asked until 7 p. m., Aug. 12, for furnishing and erecting a steel water tank, 100 ft. in diameter, and 33 ft. high, with steel skeleton frame for the top of the same (about 275,000 lbs.). Timothy Woodruff, Supt. Water-Works; David S. Blew, Chn. Water Com.

FORT LEE, N. J.—W. O. Allison and A. G. Sage, of Englewood Cliffs, N. J., have organized a water company to supply this place with water. The supply will be secured from artesian wells.

GLOUCESTER CITY, N. J.—The council is reported to have decided to ask for bids for furnishing a new pump of 2,500,000 gallons capacity. Supt., H. M. Hailey.

HAMMONTON, N. J.—A town meeting will soon be called to consider the question of granting a franchise to the Hammonton Water Co. A. H. Sutton, Pres. Bd.

PRINCETON, N. J.—H. B. Hooker & Son, Rochester, N. Y., are reported to have been awarded the contract for constructing 925 ft. of submerged pipe, a new well and a circular pump house for the Princeton Water Co.

BRADDOCK, PA.—Cronin & O'Herron, Pittsburg, Pa., have been awarded the contract, at about $20,600, for laying 13,630 ft. of 16 and 12-in. pipe. Supt. of Pub. Wks., Wm. Howat.

CHAMBERSBURG, PA.—Bids are asked until Aug. 20 for furnishing a 1,500,000-gallon power pump for the water-works, as stated in our advertising columns. Dr. P. B. Montgomery, Water Comr.

DUBOIS, PA.—The question of securing an increased water supply is again being considered.

FAYETTE CITY, PA.—Jno. Mullin, Cy. Clk., writes us that there are no prospects of works being put in at present, or in the near future, as has been reported. Population, 1,200.

KNOXVILLE, PA.—An election will be held Aug. 23 to vote on the question of issuing $12,000 in bonds for works, according to reports.

McKEESPORT, PA.—Bids are asked until Aug. 15 for furnishing 5,000 ft. of cast-iron water pipe, sinking five new wells, laying suction pipe, and for furnishing an iron fence at the high service station. R. A. Hutchins, Cy. Controller.

MILLVALE, PA.—The council it reported to have decided to purchase an additional pump for the water-works.

NAZARETH, PA.—Frank Kunkel, Secy. Nazareth Water Co., writes us that nothing further has been done than to appoint a committee to negotiate for the site for the additional water supply. The committee, it is expected, will report in a few days. As soon as the site is secured plans will be prepared.

PHILADELPHIA, PA.—Plans for the new reservoir on George's Hill for supplying water to West Philadelphia are about completed. Bids will probably soon be asked. The plans provide for a single basin extending to the northwest of the present reservoir. It will cover about 10 acres and will be about 30 ft. deep. The site selected is now a natural basin, with walls on the north, south and west sides, so that it will be necessary to build only one wall on the east side. The capacity of the reservoir is to be 50,000,000 gallons, at a depth of 20 ft., and 40,000,000 gallons at a depth of 15 ft. The present basin holds 40,000,000 gallons. The greatest elevation of the site is 222 ft., and, as at present contemplated, the surface of the basin will be at a height of 216 ft. above sea level. Estimated cost, $500,000.

STRASBURG, PA.—The proposition of the Strasburg Water Co. to furnish complete works for the borough has been accepted by the council, the price of the works being $19,000. Edgar B. Kay, Engr., Strasburg Water Co.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Aug. 22 for driving wells, as stated in our advertising columns.——Col. Bingham, in charge of public buildings and grounds, in his annual report to the Chief of Engineers, just submitted, says that the need of a new conduit between Great Falls and the distributing reservoir is only a matter of time. The daily consumption of water for the past year was 47,000,000 gallons, or 170 gallons per capita per day. The conduit is capable of discharging into the reservoir about 76,500,000 gallons a day. The daily consumption has increased from 35% of the conduit capacity ten years ago to 62% now. The work of raising the height of the dam at Great Falls in order to increase the water supply of Washington was completed this year at a cost of $101,373.

LAUREL, MD.—W. H. Minch, of the Laurel Water-Works Co., Baltimore, writes us that nothing has yet been done in regard to putting in the proposed works. Address Jos. M. Cone, The Severn, Baltimore, Md.

POCOMOKE CITY, MD.—R. M. Stevenson, Mayor, writes us that Pownall & Minshall, 150 Nassau St., New York, have been engaged to make surveys and plans for the proposed works and sewerage system. Bonds for the improvement will soon be issued.

RICHMOND, VA.—The council has adopted resolutions looking to the filtering of the water supply.

HARPER'S FERRY, W. VA.—J. L. Dailey, Mayor, writes us that nothing toward securing works has been done except to get the sentiment of the people on the question. An official election will probably be held soon.

WHEELING, W. VA.—L. G. Hallock, Wheeling, has been awarded the contract for building the new pumping station at $37,807. Of this amount the well and river connection will cost $27,120, and the building, $10,687. This contract does not include the pumping engine of 12,000,000 gallons capacity. This contract will be let later. A. L. White, Cy. Engr.

DURHAM, N. C.—This place voted Aug. 1 against issuing $225,000 in bonds for works, an electric plant, etc.

MOBILE, ALA.—Bids are asked until Sept. 12 for the purchase of $750,000 of 4½% water-works and sewerage bonds. John Craft, A. S. Lyons, Finance Com.

McCOMB CITY, MISS.—Bids are asked by the mayor until Sept. 21 for furnishing and building works. Engrs., Sanders & Porter, Columbia Bldg., Louisville, Ky.

SARDIS, MISS.—This place having voted July 25 to build works, has engaged Alber & Byrne, Birmingham, Ala., to prepare plans and specifications for the works. J. Q. West, Mayor.

CHICAGO JUNCTION, O.—Bids are asked until Aug. 15 for building the power station, furnishing boilers, pumping machinery, connecting wells, etc. Engr., Chas. Sturtevant, St. Louis, Mo.; Clk., Louis Simmermacher.

CINCINNATI, O.—The water-works commission has awarded the contract for furnishing the sluice gates for the new works at California, O., to the Vulcan Iron Works Co., Chicago, Ill., at $8,079.

MOUNT GILEAD, O.—Burton J. Ashley, Old Colony Bldg., Chicago, has submitted a report and estimates for works and an electric plant to cost complete about $35,000: for water-works alone the cost will be $26,800. An election will soon be held to vote on the question of issuing the necessary bonds.

CHURUBUSCO, IND.—The council is reported to have voted to grant a franchise to the Churubusco Water & Light Co. The company was incorporated last month with a capital stock of $5,000, by J. H. Brown, B. O. Mayer and Fuller McClellan.

WORTHINGTON, IND.—The Worthington Water & Light Co. has been incorporated with a capital stock of $5,000, by John H. Brown, B. O. Mayer, and Fuller McClellan.

LA PORTE, IND.—An election will probably be held Aug. 23 to vote on the question of improvements to the works and the water supply. The committee consists of Chas. G. Replogle, W. C. Weir and Jno. C. Wilhelm.

BENTON HARBOR, MICH.—The question of securing a better water supply is being considered. It is proposed to extend the intake into Lake Michigan at a cost of about $25,000.

CASS CITY, MICH.—The following have been awarded contracts for furnishing and building the works and electric plant, to cost $18,000: Pumping machinery—Dean Bros. Steam Pump Works, Indianapolis, Ind.; Boiler—McKinnon Mfg. Co., Bay City; Heater—Stilwell-Bierce & Smith-Vaile Co.; Cast-iron pipe—American Pipe & Foundry Co., Chattanooga, Tenn., and Cincinnati, O.; Hydrants—Michigan Brass & Iron Works, Detroit; Valves and boxes—Rensselaer Mfg. Co., Troy, N. Y.; Dynamos, Switchboards, etc.—Fort Wayne Electric Corporation, Fort Wayne, Ind.; Engines—Ridgeway Dynamo & Automatic Engine Co., Chicago.

HUBBARDSTON, MICH.—The village board is considering the question of putting in small works for fire protection only.

LAKE ODESSA, MICH.—This place will vote Aug. 16 on the question of issuing $11,000 in bonds for works, according to reports.

LAURIUM, MICH.—It is reported that this place will vote on the question of issuing $15,000 in bonds for works.

LAWTON, MICH.—This place voted July 26 against issuing $9,500 in 5% bonds for works.

MOUNT PLEASANT, MICH.—Congress has appropriated $10,000 for water-works, a sewerage system, etc., for the Indian school here. Supt., R. S. Graham.

PAW PAW, MICH.—Bids are asked until Aug. 17 for furnishing the material and for building the proposed works, to cost about $18,000, as stated in our advertising columns. Wm. H. Mason, Village Clk.

YALE, MICH.—Mac Walker, Fenton, Mich., has been awarded the contract for furnishing the material and for building the works, at $10,987.

GRAYVILLE, ILL.—The council is reported to have appropriated $32,000 for building a new reservoir for the water-works. It is stated that work will soon be begun.

OXFORD JUNCTION, IA.—Bids are reported as being asked by the city clerk for furnishing and constructing works.

BLAIR, WIS.—Stevens & Vincent, Chippewa Falls, Wis., are reported to have been awarded the contract for building the works at $4,154.

ARKANSAS CITY, KAN.—An election will be held Aug. 12 to vote on the question of issuing $95,000 in water bonds.

LA PLATA, MO.—Press reports state that this place will soon issue $40,000 in bonds for works.

CRIPPLE CREEK, COLO.—Press reports state that at a meeting of the council Aug. 3, the committee, consisting of N. M. Seigsred, A. E. Carlton and H. L. Shepherd, made its report and recommended the purchase of the works of the Michigan Pipe Line Co., for $292,000. The report was accepted.

DENVER, COLO.—John C. Swan, Greeley, Colo., has been awarded the contract for sinking an artesion well 1,000 ft. deep for the capitol grounds.

GRAND JUNCTION, COLO.—The council is reported to have repealed the ordinance passed in April to purchase the works of the Grand Junction Water Co. for $55,000. It is stated that the company failed to furnish title. W. P. Ela, Mayor.

BENICIA, CAL.—It is reported that the Benicia Water Co. will soon begin the construction of improvements to the works to cost about $15,000. Baker & Hamilton are interested.

GREENVILLE, CAL.—Bids are asked until Aug. 23 for furnishing and constructing works and a sewerage system for the Indian School here. Supt., Edward N. Ament.

HEALDSBURG, CAL.—Bids are asked until Aug. 26 for furnishing the material and for constructing the proposed works and light plant, and also for the purchase of $80,000 of 5% bonds for the work, as stated in our advertising columns. C. H. Pond, Cy. Clk.

LOS ANGELES, CAL.—The Consolidated City Water Co. has been incorporated with a capital stock of $2,480,000, by W. H. Perry, W. J. Broderick, S. H. Mott and H. W. Hellman.

SHERBROOKE, QUE.—The question of extending the water mains in certain streets is being considered.

PETERBORO, ONT.—Bids are asked until Aug. 15 for furnishing and building works for Ashburnham. Specifications, etc., may be seen at the office of the Peterboro Water Co. John Wood, Clk.

WINNIPEG, MAN.—Bids are asked until Sept. 6 for constructing wells and pumping station for the supply of 4,000,000 gallons of water daily, as stated in our advertising columns. H. N. Ruttan, Cy. Engr.; C. J. Brown, Cy. Clk.

SEWERAGE.

LAWRENCE, MASS.—It is probable work on sewers in certain streets will soon be begun at a cost of about $7,000.

NORTH SOMERVILLE, MASS.—Bids are asked until Sept. 3 for furnishing pumping engines, etc., for an addition to the sewage pumping plant at North Somerville, as stated in our advertising columns. Wm. M. Brown, Jr., Ch. Engr. Metropolitan Sewerage Comrs., 1 Mount Vernon St., Boston.

TAUNTON, MASS.—The council has voted to appropriate $16,000 for new sewers.

EAST HARTFORD, CONN.—The Meadow Fire District is again considering the question of building sewers in the business portion of the city.

WEST HARTFORD, CONN.—A. B. Alderson, 68 Gladden St., New Britain, Conn., is making surveys for the purpose of designing a system for West Hartford Centre.

DUNKIRK, N. Y.—Bids are asked until Aug. 16 for constructing a 12-in. pipe sewer in Fox St. W. C. Baumgartner, Cy. Clk.

LITTLE FALLS, N. Y.—The council has voted to build sewers in three streets, at a cost of about $20,000. Mayor Dasey may be addressed.

SYRACUSE, N. Y.—John W. Bustin has been awarded a contract at $50,000 for building a trunk sewer in Midland Ave.

BAYONNE, N. J.—Martin Murray has been awarded the contract for constructing a new sewer in certain streets at $17,200.

NEWARK, N. J.—The question of the sewering of the Clinton Hill annexed district of Newark was considered by the board of works Aug. 4. A delegation of property owners in the district appeared before the board and urged the building of lateral sewers. Engineer Ernest Adam submitted a report recommending the building of a trunk sewer in Clinton Ave. and another in Clinton Place and Runyon St., to cost about $59,000. Rudolph Hering, New York, made a report indorsing Engineer Adam's plans for a lateral sewer system in the Tenth and Twelfth Wards.

PLAINFIELD, N. J.—Bids are asked until Aug. 25 for filling two disposal beds at the sewage disposal farm. E. T. Barrows, Chn. Com.

RED BANK, N. J.—The council has been petitioned not to build an outlet sewer to the Shrewsbury River.

SOUTH ORANGE, N. J.—A conference was held in South Orange Aug. 3 between representatives of South Orange, Irvington, Vailsburg, Newark and West Orange in reference to the proposed sewer to carry the sewage of the different localities to tidewater. Reports state that it was decided to employ Alexander Potter, 137 Broadway, New York, to make a preliminary survey of the outlet sewer to tidewater and submit his estimate of the cost.

BELLEVUE, PA.—Harvey Sloan has been awarded the contract for building the proposed system at $58,000.——The council has asked for bids for the purchase of $48,000 of sewer bonds.

PHILADELPHIA, PA.—The bureau of surveys has decided to enlarge the 3-ft. brick sewer in Chestnut St.

PITTSTON, PA.—Bids are asked until Aug. 11 for constructing lateral sewers, etc. J. H. Mullin, Cy. Clk.

READING, PA.—The board of public works has recommended that the contract for building the house sewer in the 9th District be let to Samuel W. Frescoln, Reading, at $41,878. The next lowest bid was submitted by David Peoples, Philadelphia, at $43,375.

SOUTH BETHLEHEM, PA.—We are informed that this place voted July 26 not to build a system. Chas. E. Webster, Burgess.

POCOMOKE CITY, MD.—R. M. Stevenson, Mayor, writes us that Pownall & Minshall, 150 Nassau St., New York, have engaged to make a survey and plans for a system and water-works. Bonds for the improvements will soon be issued.

RICHMOND, VA.—The council is considering the question of building certain sewers. Councilman Allen, Chn.

CONCORD, N. C.—Bids are asked by the mayor until Aug. 15 for constructing 9,000 ft. of 15 to 8-in. pipe sewers.

OWENSBORO, KY.—Bids are asked until Aug. 15 for building sewers in certain streets. W. P. Small, Mayor.

CLEVELAND, O.—Bids are asked until Aug. 11 for constructing sewers in three streets; and until Aug. 25 for constructing sewers in three streets; checks $500 to $2,000. Geo. R. Warden, Dir. Pub. Wks.

SPRINGFIELD, O.—The council is considering the question of building sewers in several streets.

PERU, IND.—Bids are asked by the city clerk until Aug. 30 for constructing lateral sewers.

RICHMOND, IND.—The council is considering the question of building sewers next season to cost about $25,000. Mayor Ostrander may be addressed.

HIGHLAND PARK, MICH.—Jas. Hanley, Detroit, has been awarded the contract for building sewers at $51,850. The outlet will be into the Detroit system.

LAURIUM, MICH.—This place voted in July to issue $35,000 in bonds for a system, and $15,000 in bonds for extending the water works.

MOUNT PLEASANT, MICH.—Congress has appropriated $10,000 for a sewer, water-works, etc., for the Indian School. Supt., R. S. Graham.

PONTIAC, MICH.—Bids are asked until Aug. 19 for constructing 1,600 lin. ft. of 8-in. lateral sewer, as stated in our advertising columns. Wm. J. Fiske, Cy. Engr.

SAGINAW, MICH.—Bids are asked until Aug. 12 for building sewers in several streets. Alfred Davies, Clk. Bd.

BELLEVILLE, IL.—Bids are reported as having been asked by the city clerk for building pipe sewers in two streets.

CHICAGO, ILL.—Bids are asked until Aug. 17 for building sewers in a number of streets. L. E. McGann, Pres.

ELMHURST, ILL.—This place will build 640 ft. of 12-in. in Maple Ave.; average cut, 11 ft. There will be five manholes and four catchbasins with iron covers. Engr., Geo. I. Herrick, Wheaton, Ill.

MEADOTA, ILL.—Bids are asked until Aug. 16 for constructing 4,700 ft. of 12 to 10-in. pipe sewers, 11 manholes, etc. Engrs., Iowa Engineering Co., Clinton, Ia.; Geo. Holland, Cy. Clk.

MILWAUKEE, WIS.—The contract for the building of the outlet to the 30th St. tunnel was let Aug. 2 to G. E. Zimmerman at $24,994. His bid was $13.75 a foot for one section of 1,328 ft. and $16.75 a foot for a second section of 408 ft. The commissioners estimate that the work would cost $30,000. The other bidders were: August Muedling, John O. Jones of Racine, F. H. Nakielski, R. J. Hickey, E. Bowler, Crilley & Son and Charles Forrestal.

ST. PAUL, MINN.—Bids are asked until Aug. 15 for constructing a 15-in. pipe sewer in Waltham Ave. C. N. Bronson, Clk. Bd. Pub. Wks.

DES MOINES, IA.—Bids are asked until Aug. 15 for constructing a 15-in. pipe sewer in East 6th St. G. A. Eberhart, Com. Pub. Wks.

NEW HAMPTON, IA.—Bids are asked until Aug. 25 for building a sewer in this town, requiring about 445 ft. of 8-in. pipe; 660 ft. of 12-in. pipe; 2,820 ft. of 20-in. pipe; 17,000 brick in specials; 11 manhole heads; one 8-in. flusher (De La Hunt), and an outfall cistern. Engrs., Boynton & Warriner, Cedar Rapids, Ia.

GREENVILLE, CAL.—Bids are asked until Aug. 23 for constructing a system and water-works at the Indian School. Supt., E. N. Ament.

SANTA ANA, CAL.—Bids are asked by the board of city trustees until Aug. 22 for furnishing the material and for constructing the proposed system; to cost $65,000. Engr., H C Kellogg.

RAT PORTAGE, ONT.—C. W. Belyea, R. E. Dowsett and the mayor have been appointed a committtee to consider the advisability of building a system.

NELSON, B. C.—It is proposed to build about 3,000 ft. of 15 to 8-in. pipe sewers at a cost of about $4,500.

GARBAGE DISPOSAL—STREET CLEANING

MANCHESTER, N. H.—We are informed that the joint council committee on public health has called a public meeting for Aug. 12 to consider the matter of garbage crematories.

WILMINGTON, DEL.—Bids were asked until Aug. 9 for removing the ashes and rubbish for one year, from Sept. 1. H. J. Wiley, Secy. Bd. Dir. St. Dept.

FREDERICK, MD.—Bids were asked until Aug. 10 for removing the garbage, etc., from the streets, alleys, etc., for one year, from Sept. 1. E. A. Gittinger, Cy. Register.

OAKLAND, CAL.—Bids are asked until Aug. 22 for sweeping and cleaning the paved streets of this city. H. W. Thomas, Secy. Dept. Pub. Wks.

STREETS AND ROADS.

PORTLAND, ME.—Bids are asked until Aug. 15 for furnishing and constructing about 3,410 sq. yds. of granite paving, 2,010 lin. ft. of curb, and 42 cu. yds. of rubble. W. B. Allen, Chn. County Comrs.

TRURO, MASS.—Bids are asked until Aug. 18 for constructing about 6,000 ft. of highway. T. C. Mendenhall, Chn. Massachusetts Hignway Comn., Boston.

CROMWELL, CONN.—Bids are asked until Aug. 16 for grading and macadamizing a section of road between Cromwell Center and Berlin. C. S. Pease, First Selectman.

GUILFORD, CONN.—Bids are asked until Aug. 19 for grading and graveling a road between Guilford and Branford. W. E. Griswold, First Selectman.

NEW BRITAIN, CONN.—The aldermen have recommended a proposition to the council to lay six-inch macadam from Hartford Ave. to Lawlor St., to cost $2,864. G. C. Dunham, Cy. Engr.

SUFFIELD, CONN.—Bids are asked until Aug. 20 for grading and macadamizing a section of North St. Edmund Halladay, First Selectman.

WATERBURY, CONN.—Bids are asked until Aug. 16 for brick paving on North Main St., according to reports. R. A. Cairns, Cy. Engr.

NAUGATUCK, CONN.—Bids are asked until Aug. 23 for constructing about 1,900 lin. ft. of macadam road, as stated in our advertising columns. S. S. Beardsley, Borough Clk.

ALBANY, N. Y.—Bids are asked until Aug. 15 for grading, curbing and paving in Elm St., from Delaware Ave. to Grand St. Thos J. Lanahan, Clk. St. Dept.

NEW YORK, N. Y.—Bids are asked until Aug. 18 for furnishing 800 cu. yds. of trap rock screenings and 100 cu. yds. of broken stone. Geo. C. Clausen, Chn. Park Comrs., Arsenal, Central Park.

BUFFALO, N. Y.—Bids are asked until Aug. 18 for paving a portion of Babcock St. and Ferry St. R. G. Parsons, Secy. Bd. Pub. Wks.

FULTON, N. Y.—O. C. Breed, Cy. Engr., writes us that a contract for 800 sq. yds. of brick paving has been awarded to A. S. Webb, Syracuse.

ROCHESTER, N. Y.—Bids are asked until Aug. 19 for grading, to cost about $650 and cement walks; estimated cost, $1,836; also for a sewer to cost $3,000. Chas. M. Beattie, Clk.——The council is considering a proposition to pave portions of North Clinton St. with Medina block and asphalt, and has ordered a macadam pavement on Ave. B, at an estimated cost of $8,900.

ROCHESTER, N. Y.—Whitmore, Rauber & Vicinus have submitted the lowest bid for paving in Main St., with Hornellsville brick, at $56,173.

TROY, N. Y.—Bids are asked until Aug. 19 for granite paving and curbing on Broadway. E. Ogden Ross, Secy.

CAMDEN, N. J.—Bids are asked until Aug. 16 for paving in Vine and 10th Sts., with Belgian block, and for constructing certain sewers. Wm. Z. Gibson, Chn. Com.

MERCHANTVILLE, N. J.—The council has appropriated $1,000 for highways.

NEWARK, N. J.—The board of public works has awarded a contract to the Newark Asphalt Paving & Construction Co. for asphalt paving in Elm St., at $25,962; Livingston St., $11 250, and Charlton St., at $9,608; and to John F. Shanley, at $6,936, for granite paving in Pacific St.

NEW BRUNSWICK, N. J.—Bids are asked until Aug. 17 for graveling the South Amboy and South River Road. R. J. Dougherty, County Engr., 113 Albany St., informs us that a contract will be let in September for macadamizing on the South River Road; estimated cost, $2,000.

MEADVILLE, PA.—A contract has been awarded to Peter Schenck, Butler, for paving on Mead Ave. with brick. D. T. McKay, Jr., Cy. Clk.

SCRANTON, PA.—A contract has been awarded to Geo. MacDonald, at $15,000, for constructing brick paving on Providence Road and North Main Ave. J. P. Phillips, Cy. Engr.

PITTSBURG, PA.—Bids are asked until Aug. 27 for improving the Library Road. F. W. Patterson, County Road Engr.; E. N. Randolph, Clk.——Ordinances have been passed by the council for the grading and paving of portions of 26 streets. Chas. Geyer, Mayor.

PITTSBURG, PA.—Bids are asked until Aug. 16 for grading and paving Grant Boulevard, between 5th Ave. and Forbes St. E. M. Bigelow, Dir. Pub. Wks.

READING, PA.—Bids are asked until 3 p. m. Aug. 11 for grading Windsor St.; surety, $100. S. S. Hoff, Cy. Engr.

ROCKVILLE, MD.—Bids are asked until Aug. 16 for constructing about nine miles of macadam roads, according to reports. W. W. Welsh, County Clk.

ALEXANDRIA, VA.—Bids are asked until 12 m., Aug. 11, for 500 lin. ft. of curbing, grading and 1,060 sq. yds. of brick paving on King St. E. C. Dunn, Cy. Engr.; B. B. Smith, Chn. Com.

LOUISVILLE, KY.—Bids will soon be asked for constructing about $100,000 worth of asphalt pavement. Chas. F. Granger, Chn. Bd. Pub. Wks.

CHILLICOTHE, O.—Bids are asked until Aug. 13 for the purchase of $23,675 of street improvement bonds. W. J. Elyth, Cy. Clk.

HAMILTON, O.—Portions of North Second St., South Second St., South Third St. and Ross St., will soon be paved. J. J. M'Maken, Chn. Bd. Control; M. O. Burns, Cy. Clk.

DAYTON, O.—Bids are asked until Aug. 19 for paving the sidewalks on Pulaski St. with stone, cement or asphalt. J. L. Baker, Pres.; J. E. Gimperling, Comptroller.

OBERLIN, O.—Bids are asked until Aug. 16 for 2,000 sq. yds. of brick paving, according to reports. W. B. Gerrish, Cy. Engr.

PIQUA, O.—Bids are asked until Aug. 20 for furnishing the material and for curbing, guttering and constructing sidewalks. H. E. Whitlock, Cy. Engr.; Seth McCullough, Clk.

ORRVILLE, O.—Bids are asked until Aug. 30 for the purchase of $11,000 of 6% street improvement bonds. Ed. Wirth, Clk.

TOLEDO, O.—Bids are asked until Aug. 20 for furnishing material and constructing concrete walks in the court house park. Wm. M. Godfrey, County Audr.

TOLEDO, O.—Bids are asked until Sept. 12 for furnishing the material and for grading, curbing and paving portions of Knower and Rockingham Sts. L. P. Harris, Cy. Clk.

XENIA, O.—The county commissioners have awarded a contract to Harry Tavener, Clifton, for constructing about three miles of road at $1,600 a mile.

VERNON, IND.—Bids are asked until 10 a. m. Aug. 12 for constructing about 36 miles of pike road. Wm. A. Cheever, Chn. County Comrs.; Henry Hinchman, County Audr.

SOUTH BEND, IND.—Bids are asked until Aug. 22 for cement sidewalks on South Michigan St., grading on Diamond Ave. and Johnson St., and brick paving on Carroll St. L. A. Hull, Cy. Clk.——The council has recommended an issue of $110,000 of street bonds.

CHICAGO, ILL.—Bids are asked until Aug. 15 for grading North 48th Ave., between Lake St. and Chicago Ave. L. E. McGann, Comr. Pub. Wks.

URBANA, ILL.—Bids are asked by the board of local improvements until Aug. 17 for constructing about 5,300 sq. yds. of brick paving on concrete, and 3,300 lin. ft. of combination curb and gutter, as stated in our advertising columns.

MANITOWOC, WIS.—Reports state that bids are asked for the purchase of a steam roadroller.

WATERTOWN, WIS.—Henry C. Mayer, Chn. Com., informs us that bids will soon be asked for brick or macadam paving.

WAUKESHA, WIS.—Wm. Powrie informs us that the council has ordered brick paving in Madison St., Broadway, South St. and Clinton St.; estimated at 30,000 sq. yds. John Dye, Cy. Engr.; address H. E. Blair.

WAUWATOSA, WIS.—Bids are asked until Aug. 15 for furnishing material and grading, graveling, building sidewalks, etc., on Pabst Ave. Reinertsen & Vause, Engrs., 30 Builders' and Traders' Exchange.

ST. PAUL, MINN.—L. W. Rundlett, Cy. Engr., has submitted plans for paving Washington St., from Third to Seventh St., with asphalt; estimated cost, $11,250, according to reports.

DES MOINES, IA.—The council will improve East Ninth St. and eight other streets, at a cost of about $8,000.

KANSAS CITY, MO.—A contract will be let Aug. 15 for asphalt paving to cost about $60,000. John Donnelly, Cy. Engr.

ST. JOSEPH, MO.—Bids are asked until Aug. 16 for grading four sections of road. Theo. Steinacker, County Surv.

WEBSTER GROVES, MO.—Bids are asked by the board of aldermen for macadamizing certain streets.

DEADWOOD, S. DAK.—Bids are asked until 1 p. m., Aug. 13, for grading and 400 cu. yds. of filling. J. B. Welch, County Audr.

GRAND FORKS, N. DAK.—It is reported that the question of paving about four miles with cedar block is being considered; also macadamizing and brick paving. Alexander Oldham, Cy. Engr.; F. A. Brown, Cy. Audr.

HELENA, MONT.—Bids are asked until Aug. 15 for furnishing a road machine, for grading, etc. Edward Horsky, Cy. Clk.

FREMONT, NEB.—Bids are asked until Aug. 22 for furnishing the material and for brick paving, curbing, cement walks, etc. W. D. Thomas, Chn. Bd. Pub. Wks.

DALLAS, TEX.—Bids are asked until Aug. 16 for three blocks of brick paving. T. L. Lawhon, Cy. Secy.

DENVER, COLO.—Bids are asked until Aug. 16 for paving Logan Ave., from Eighth Ave. to Colfax. Donald W. Campbell, Ch. Engr. Bd. Pub. Wks.

DURHAM, ONT.—Granolithic sidewalks will be constructed in several streets, at a cost of $5,000, according to reports.

KEMPTVILLE, ONT.—Reports state that about 8,000 lin. ft. of granolithic sidewalks are to be constructed. S. H. Guest, Clk.

PETERBOROUGH, ONT.—Dolan & Sheehey, Belleville, have been awarded a contract for about 5,000 lin. ft. of sidewalk, according to reports. S. R. Armstrong, Clk.

WINDSOR, ONT.—Stephen Lusted, Cy. Clk., informs us that there has been no appropriation for asphalt paving, as stated in our issue of July 21.

NIAGARA FALLS, ONT.—We are informed that the town is about to construct 8,700 lin. ft. of 6, 8 and 10-ft. concrete and brick walks, with stone curbing and crossings. C. H. Mitchell, Cy. Engr.

MANUFACTURING PLANTS

BURNSIDE, CONN.—We are informed that plans have been completed for extensive alterations and additions to the two-machine paper mill of the Taylor Mfg. Co., at Burnside, and that the general contract has been awarded to Watson H. Bliss & Sons, of Hartford. Butts & Crosby, Archs. and Engrs., 49 Pearl St., Hartford, Conn.

ORANGE PARK, FLA.—J. F. Eldridge, Treas. Duval & Clay Sugar Co., of Orange Park, informs us that this company proposes to improve its property and build a mill on St. John's River, 10 miles south of Jacksonville. The capital stock is $300,000, of which about two-thirds is already subscribed. Mr. Eldridge desires to communicate with manufacturers of sugar mill machinery.

OTTUMWA, IA.—The Janny Mfg. Co., Ottumwa, informs us that bids will be received from Aug. 15 to 20 for the erection of three 2-story and seven 1-story buildings, each 50 × 150 ft., to be used in the manufacture of farm implements. A 100-HP. Corliss engine and a boiler will be needed, also electric power to run the entire plant. Arch., D. C. Mitchell, Ottumwa.

GAS PLANTS.

SPARTANBURG, S. C.—The Spartanburg Gas, Electric Light & St. R. R. Co., recently incorporated, will build a new 50,000-ft. gas holder, extend the mains, etc., of the old plant, as noted under Electric Light and Power. Vice-Pres., Eliot Norton, 100 Broadway, New York.

COVINGTON, KY.—Bids are asked until Aug. 17 for lighting a certain portion of the city with gas, gasoline or electricity. Theo. Von Hoene, Cy.. Clk.

SAN JOSE, CAL.—Bids are asked by the Electrical Improvement Co., 45 West Santa Clara St., until Aug. 30 for excavating and laying gas mains.

MISCELLANEOUS CONTRACTS.

BONDS.—Tiffin, O.—Bids are asked until Aug. 20 for the purchase of $25,000 of 6% bonds. J. B. Ehrenfried, Clk.

WHARF.—Fort Morgan, Ala.—Bids are asked until Aug. 23 for constructing a wharf. Address John Simpson, Depot Q. M., Atlanta, Ga.

RETAINING WALL.—Troy, N. Y.—Bids are asked until 11 a. m. Aug. 12 for building 25 lin. ft. of retaining wall. E. Ogden Ross, Secy.

STEEL HULL.—Seattle, Wash.—Bids are asked until Sept. 5 for constructing a steel hull tugboat. Capt. Harry Taylor, U. S. Engr., Burke Bldg.

SMOKELESS POWDER.—Washington, D. C.—Bids are asked until Sept. 3 for furnishing 1,000,000 lbs. of smokeless powder. John D. Long, Secy. Navy.

BONDS.—Newark, N. J.—Bids are asked until Aug. 15 for the purchase of $500,000 of 4% county park bonds. D. H. Johnson, Chn. Finance Com., Bd. Freeholders.

BOILERS.—National Home, Wis.—Bids are asked until Aug. 19 for furnishing the Home with two steam boilers of the horizontal sectional water-tube type. J. E. Armitage, Treas.

LEVEE WORK.—Dayton, O.—Bids are asked until Aug. 19 for widening and strengthening sections A and C of Mad River levee. J. L. Baker, Pres.; J. E. Gimperling, Comptroller.

FIRE ALARM SYSTEM.—Mobile, Ala.—Bids are asked until Sept. 15 for a complete fire alarm system, as stated in our advertising coumns. Cary W. Butt, Chn. Com.

STEEL PROJECTILES.—Washington, D. C.—Bids are asked by the navy department until Aug. 23 for furnishing 100,000 six-pound, 100,000 three-pound, and 100,000 one-pound steel projectiles.

DREDGING.—Boston, Mass.—Bids were received Aug. 4 from the Eastern Dredging Co., at $2,245, and the Bay State Dredging Co., at $2,500, for dredging the Fort Point Channel. Wm. Jackson, Cy. Engr.

LEVEE WORK.—Tallulah, La.—Bids are asked until Aug. 15 for raising and enlarging the East Carroll and Madison Parish levees. J. T. McClellan, Pres.; A. T. Lane, Secy. Bd. Comrs., Fifth Louisiana Dist., Tallulah.

CYLINDER PLATES.—Plum Beach Light House, R. I. —Bids are asked until Aug. 16 for furnishing seventh-course cylinder plates, for the Plum Beach light house. Lt.-Col. D. P. Heap, U. S. Engr., Tompkinsville (S. I.).

NAVAL SUPPLIES.—Philadelphia, Pa.—Bids are asked by the navy department, Washington, D. C., until Aug. 23 for furnishing planing machines, lathes, cranes, boilers, engines, machinery, etc., for the League Island navy yard at Philadelphia.

RUBBER SUCTIONS.—Charleston, S. C.—Bids are asked until Sept. 9 for furnishing rubber suctions for the dredges "Charleston" and "Winwah Bay," as stated in our advertising columns. Maj. E. H. Ruffner, U. S. Engr., Charleston.

COAL HANDLING PLANT.—New London, Conn.—Bids are asked by the navy department, Washington, D. C., until Aug. 31 for constructing a plant for the storage and handling of coal. M. T. Endicott, Chief Bureau Yards and Docks, Washington.

DAM ABUTMENTS, ETC.—Brantford, Ont.—Bids are asked until Aug. 20 for constructing stone and concrete piers and abutments, a timber sluiceway dam, excavation, embankments and rip-rap walls. Chas. Whitney, Chn. Bd. Wks.; T. H. Jones. Cy. Engr.

DIKES.—Hudson River, N. Y.—Bids are asked until Sept. 8 for constructing and repairing dikes in the Hudson River, and for furnishing paving and rubble stone, as stated in our advertising columns. Col. J. W. Barlow, U. S. Engr., Army Bldg., New York.

CONSTRUCTION MATERIALS.—Fort Delaware, Del.—Bids are asked until Sept. 5 for furnishing and delivering, at Fort Delaware, cement, broken stone, sand, steel beams, etc., as described in our advertising columns. Lt.-Col. C. W. Raymond, U. S. Engr., Philadelphia, Pa.

MASONRY, SHORE PROTECTION, ETC.—Cleveland, O.—Bids are asked until Aug. 17 for furnishing the material and for constructing a riprap protection at Gordon Park; stone masonry work in Rockefeller Park, and a shore protection at Edgewater Park. C. W. Pratt, Jr., Ch. Engr. Bd. Park Comrs., Hickox Bldg., 185 Euclid Ave.

METAL WORK.—New Haven, Conn.—The following bids were received Aug. 1 for furnishing and constructing the metal work for the New Haven Harbor breakwater light house. Lt.-Col. D. P. Heap, U. S. Engr., Tompkinsville (S. I.), N. Y.:

Russel Wheel & Foundry Co., Detroit, Mich.	$17,330
Allentown Rolling Mills, Allentown, Pa.	17,962
Atlanta Machine Works, Atlanta, Ga.	18,485
John P. McGuire, Cleveland, O.	18,500
Wiemer Machine Works, Lebanon, Pa.	21,000
Tacony Iron & Metal Co., Philadelphia, Pa.	23,874
M. L. Vander Kloot, 1 Madison Ave., New York.	39,586

CONTRACT PRICES

ASPHALT PAVING.—Spokane, Wash.—The city commissioners received the following bids July 14, 1898, for 21,000 sq. yds. of asphalt paving in Riverside Ave.:

	City St. Imp. Co.	N. W. Asphalt Co.	Alcatraz Co.	Fife & Conlan.
Concrete, cu. yd.	$7.50	$6.30	$6.95	$8.50
Wearing surface, sq. yd.	.75	....	1.03	2.00
Asphalt binder, sq. yd.	.38	....	.27	....
Granite curb, lin. ft.	1.00	....	1.10	1.09
Excavation, cu. yd.	.40	.60	.45	.31
Catch basins, etc., each.	27.50	....	32.50	25.00
Embankment, cu. yd.	.40	.75	.45	....
Maintenance, 10 years.	2,646.00	3,000.00	8,640.00	....
Lump bid	49,865.00	57,780.00	55,149.90	....

STREET LIGHTING.—Washington, D. C.—The following proposals for street lighting, opened by the district commissioners July 30, have been accepted: Washington Gas Light Co., to furnish and maintain 4,000 or more gas lamps east of Rock Creek, $20 per lamp a year; also by same company, to furnish and maintain 400 or more gas lamps west of Rock Creek, $20 a year. Potomac Electric Power Co., to furnish and maintain 50 or more incandescent lamps, $20; 106 in Eckington, $20; 132 or more arc lamps east of Rock Creek, $91.25 a light a year. U. S. Electric Light Co., to furnish and maintain 24 or more arc lamps west of Rock Creek, 24 cts. a light a night, and 442 arc lamps east of Rock Creek, 25 cts. a lamp a night.

SEWERS.—Kewanee, Ill.—We are informed that the following bids were received July 25 for constructing sewers, as advertised in Engineering News; Jno. C. Quade, Cy. Engr.:

Bids Received at Kewanee, Ill., July 25, 1898, for Construction of Sewers.

Quantities.			Peter Simon, Quincy, Ill.	Nelch, Patterson & Shiffler, Springfield, Ill.	Knowles, & Price, Jacksonville, Ill.	P. C. Murphy, Rock Island, Ill.	Greenville (O.) Const'n Co.	H. P. Hallet, Aurora, Ill.	J. H. Roche, Chicago, Ill.	Egan & Munn, Nebraska City, Neb.
Pipe sewer and Y's laid complete.	18-in.	4,800 lin. ft.	$0.40	$0.33	$0.45	$0.39	$0.31	$0.50	$0.39	$0.32
	15-in.	3,567 " "	.28	.24	.33	.25	.25	.56	.26	.23
	12-in.	6,786 " "	.18	.20	.22	.18½	.17	.25	.20	.18
	10-in.	14,404 " "	.14	.15	.19	.15	.15	.37	.18	.14
	8-in.	11,410 " "	.11	.13	.14	.11	.10	.12	.13	.10
6-in. house connections		17,540 " "	.065	.11	.12	.08	.08	.09	.09	.09
6-in. drain tile		5,000 " "	.05	.06	.05	...	.10	...	.10	.04
Trenching and backfilling.	Under 6 ft.	10,301 ft.	.14	.11	.12	.13½	.12	.15	.12	.10½
	6 ft., under 8 ft.	14,720 "	.19	.18	.13	.18½	.17	.15	.17	.14
	8 " " 10 "	17,241 "	.27	.23	.15	.32½	.23	.15	.30	.20
	10 " " 12 "	10,673 "	.40	.33	.19	.42½	.33	.15	.45	.27
	12 " " 14 "	4,342 "	.53	.38	.21	.54½	.43	.15	.65	.36
	14 " " 16 "	669 "	.65	.43	.24	.80	.75	.35	1.05	.44
	16 " " 18 "	221 "	.90	.53	.29	1.08	.87	.35	1.45	.50
	18 " " 20 "	160 "	1.35	.63	.39	1.29	1.14	.35	1.75	.55
	20 " " 22 "	180 "	1.40	.78	.54	1.66	1.50	.35	1.95	.62
Manholes, 10 ft.		105 each.	37.00	23.00	25.00	28.00	30.00	30.00	20.00	28.00
For each additional ft.			2.00	1.70	1.00	2.00	1.70	.10	1.00	2.50
Lampholes, 10 ft.		11 each.	1.50	10.00	19.50	6.25	8.00	6.00	7.50	5.00
For each additional ft.			.10	.50	.50 + .25—	.10	.20	.10	.15	.15
Temporary lampholes		100 each.	.10	2.00	.50	1.50	.30	.35	.20	.25
Flushtanks		11 "	50.00	50.00	25.00	42.00	40.00	40.00	35.00	45.00
Double flushtanks		1.	65.00	80.00	50.00	60 00	70.00	100.00	50.00	100.00
Combined flushtank and manhole.		2 each.	120.00	100.00	150.00	57.00	80.00	100.00	70.00	70.00
Brick masonry		11.5 cu. yds.	11.50	10.00	9.00	7.00	8.00	8.00	8.00	7.50
Embankment		2,000 " "	.25	.20	.25	.22	.20	.25	.25	.25
Cast-iron pipe laid		14.5 tons.	...	25.00	30.00	22.00	30.00	30.00	25.00	27.50
Total			$30,927	$27,669	$25,132	$32,271	$27,843	$28,411	$32,333	$24,894

WATER PIPE AND LAYING.—New York, N. Y.—The following bids were received July 28, by William Dalton, Comr. Water Supply, 150 Nassau St., for furnishing and laying cast-iron water pipe in Fordham Road, across the Harlem River Ship Canal, and in 209th St. and Isham St.; the bids for this work, which were rejected, were given in our issue of April 28; Peter Fruh's bid was the lowest at $53,000:

Bids Received at New York, N. Y., July 28, 1898, for Furnishing and Laying Cast-Iron Water Pipe.

Quantities.		John Conwell, Jr.	P. K. Costello.	Peter Fruh.	T. P. McQuade.	Merritt & Chapman D. Co.	Holmes & Cogan.	Frawley & Rooney.	Thielman & Smith.	Wm. H. Masterson.
Rock excavation	500 cu. yds.	$0.35	$1.00	$0.25	$2.50	$1.00	$1.50	$0.25	$0.40	$2.00
Earth excavation	20,000 " "	.35	.30	.52	.50	.30	.33	.45	.40	.50
Filling	5,000 " "	.01	.10	.01	.50	.25	.15	.01	.10	.10
Riprap	250 " "	1.50	1.00	1.50	3.00	1.00	1.00	1.00	1.00	1.50
36-in. pipe	500 lin. ft.	6.00	5.50	4.60	4.85	4.00	4.75	5.00	4.50	5.17
20-in. "	2,000 " "	2.70	2.50	2.50	2.60	2.60	2.40	2.50	2.50	2.65
12-in. "	200 " "	1.65	2.00	1.25	1.18	1.50	1.20	1.25	1.50	1.30
6-in. "	150 " "	.80	1.00	.60	.50	.75	.60	1.00	.75	.75
36-in. stop cock	1.	750.00	520.00	525.00	406.00	413.00	550.00	500.00	450.00	600.00
20-in. "	5 each.	150.00	115.00	140.00	137.00	100.00	150.00	125.00	150.00	125.00
12-in. "	4 "	75.00	28.00	50.00	48.00	25.00	50.00	50.00	30.00	50.00
6-in. "	6 "	35.00	20.00	30.00	30.00	10.00	30.00	25.00	15.00	35.00
Double nozzle hydrants.	8 "	45.00	23.00	60.00	23.00	23.75	45.00	48.00	50.00	40.00
Masonry	75 cu. yds.	8.00	9.00	15.00	12.00	10.00	10.00	9.00	10.00	10.00
36-in. pipe	1,200 lin. ft.	40.00	32.00	26.00	34.00	29.84	31.00	32.60	33.00	26.00

SEWER BRICK, ETC.—Washington, D. C.—The following contracts were let by the district commissioners July 19, 1898, for furnishing sewer brick, etc.: The Washington Brick & Terra Cotta Co., furnishing sewer brick in the city, $7.93 a 1,000; in the county west of Rock Creek, not over one mile from Georgetown, $9.23 a 1,000; at District property yards, $7.40 a 1,000; at bidders' works, $7 a 1,000; hauling sewer brick beyond the limits mentioned, 49 cts. a 1,000 for each additional mile or fraction thereof. The Washington Brick Machine Co., furnishing sewer brick in Georgetown, $8.23 a 1,000; in the county east of the Eastern Branch, $8.93 a 1,000; in the county between the Eastern Branch and Rock Creek, not over 1½ miles from the city limits, $8.23 a 1,000. Hauling beyond the limits mentioned, 47 cts. a 1,000 for each additional mile or fraction thereof.

BRICK PAVING.—Lima, O.—R. H. Gamble, Cy. Engr., informs us that the following bids were received July 22, for brick paving in South Main St., as advertised in Engineering News; the award cannot be made until Aug. 8, date of the sale of bonds, but it will likely go to Kerlin Bros., Toledo, O., on Metropolitan (Canton, O.) 4-in. block with Portland cement filler and 6 × 30-in. Berea curbing; total bid, $47,596:

Bids Received at Lima, O., July 22, 1898, for Brick Paving.

Quantities.			Henry Gantz.	Barr & O'Brien.	T. J. Mulligan.	Kerlin Bros.	D. R. McArthur.	Jac. Spyker.
Excavation		16,000 cu. yds.	$0.22	$0.28	$0.20	$0.25	$0.25	$0.25
Concrete		30,000 sq. yds.	.46	.50	.47	.42	.50	.49
6 × 20-in. straight curb,		11,000 lin. ft.	.46	.60	.54	.60	.53	.50
6 × 20-in. circular "		458 " "	.70	.75	.65	.80	1.24	.65
6 × 30-in. straight "		11,000 " "	.65	.75	.88	.60	.85	.73
6 × 30-in. circular "		458 " "	1.00	.95	...	.80	1.25	.90
Catchbasins		22 each.	15.00	25.00	15.00	15.00	15.00	14.00
Extra haul			.02	.05	.03	.05	.05	.05
Brick or block	Trimble block	30,000 sq. yds.	.76	.87	.76	.71	.70	...
	S. F. B., 5-in.		.97	...	...	...	.87	...
	Massillon, 5-in.		.97	...	...	.87	...	.91
	Canton, 5-in.		.95	...	...	...	.92	...
	Canton, 4-in.		.76	.90	...	...	...	...
	Nelsonville		.75	.89	.78	.73	.72	.75
	Middleport		.94	.87	.75	...	...	...
	Union		...	.87	.76	...	.72	.73
	Metropolitan block, 5-in.		...	1.06	...	.83	...	...
	Massillon repressed		...	1.05	.94	...	...	...
	Metropolitan block, 4-in.		...	...	...	.71	...	...
	Malvern, 5-in.		...	...	...	.87	...	...
	Harris.		...	...	...	.71	...	.68
Filler.	Bituminous grout	30,000 sq. yds.	.16	.14	.15	.16	.16	.14
	Murphy grout		.15	.15	.15	.15	.16	.16
	Portland cement		.09	.09	.10	.08	.14	.12
	Coal tar		.10	.14	.12	.13	.16	.16
	Coal tar, special		.14	...	...	...	...	...
	Sand filler		.04	.03	.01	.03	.05	.03
	Canton Met. block repressed.		...	...	...	...	.75	...

PARK LIGHTING.—Washington, D. C.—The Potomac Electric Lighting Co. has been awarded the contract for lighting Lafayette, Franklin, Judiciary and Lincoln Parks at 24 cts. a light a night. Bids recently opened for electric lighting of the grounds south of the Executive Mansion, the grounds of the Executive Mansion, and the Washington Monument grounds, were as follows: U. S. Electric Light Co., 19 cts. a light a night for grounds south of the Executive Mansion, 24 cts. for the Executive Mansion and Monument grounds. The bids of the Potomac Electric Power Co. were 20 cts. and 25 cts., respectively.

DREDGING.—Washington, D. C—The following bids were received by the bureau of yards and docks July 16, 1898, for dredging and for building a quay dock at Dry Dock No. 1: Dredging —Morris & Cumings Dredging Co., New York, 23½ cts. a cu. yd.; R. G. & J. S. Packard, 130 Pearl St., New York, 18 cts. a cu. yd.; Theron L. Smith, Smithtown, N. Y., 29½ cts.; The International Constructing Co., Syracuse, N. Y., 24¾ cts. Quay wall, coal dock—Stacy B. Opdyke, Jr., 1232 Belmont Ave., Philadelphia, $99.50 a lin. ft.; P. Sanford Ross, Jersey City, $116.10; Samuel W. Frescoln, Reading, Pa., $119; J. & F. Kelly, 62 Beard St., Brooklyn, $103.73; Frank W. McNeal, 80 Reade St., New York, $132; The Houston Construction Co., Broad and Chestnut Sts., Philadelphia, $134; Quay wall between Dry Dock No. 1 and Main St.—P. Sanford Ross, Jersey City, $105.33; J. & F. Kelly, Brooklyn, $94.67; Houston Constructing Co., Philadelphia, $126; Frank W. McNeal, New York, $127; Stacy B. Opdyke, Jr., Philadelphia, $98.

PAVING.—Sioux City, Ia.—The following bids were received July 13, 1898, for asphalt and brick paving in certain streets: Sixth St.—Barber Asphalt Paving Co., $2.24 a sq. yd.; E. J. Hanlon, $2.36 a sq. yd. Water and Fifth Sts., three blocks—J. W. Smith, sand filler, $1.69; Portland cement, $1.77; paving cement, $1.75; Murphy grouting, $1.79. E. J. Hanlon, sand, $1.71; Portland, $1.76; paving, $1.95; Murphy, $2. M. L. Flinn, sand, $1.80; Portland, $1.84; paving, $1.93; Murphy, $2. Smith, Moss & Brown, Chicago, sand, $1.82; Portland, $1.85; paving, $1.94; Murphy, $2. Hansen Bros., sand, $1.86; Portland, $1.91½; paving, $1.96; Murphy, $2. Third St., brick—Hansen Bros., sand, $1.70¾; Portland, $1.87¾; paving, $1.72¾; Murphy, $1.97¾. E. J. Hanlon, sand, $1.71; Portland, $1.76; paving, $1.85; Murphy, $2. M. L. Flinn, sand, $1.80; Portland, $1.84; paving, $1.93; Murphy, $2. Smith, Moss & Brown, sand, $1.82; Portland, $1.85; paving, $1.94; Murphy, $2. Certain alleys—J. W. Smith, $1.44½; E. J. Hanlon, $158; Hansen Bros., $1.64; M. L. Flinn, $1.67; Smith, Moss & Brown, $1.69. Each bidder made propositions for resetting old curb and laying new curbs on the streets on which he bid. Stephen Coleman offered to lay new curbing at 60 cts. a lin. ft. and to reset Third St. and Sixth St. curbing at 8 cts. a ft. and Water St. and Fifth St. curbing at 8½ cts. a ft.

WATER PIPE, ETC.—Renovo, Pa.—The following contracts have been let for furnishing 8-in. cast-iron water pipe, hydrants, etc., as advertised in Engineering News; Secy. Comrs., Wm. J. Straley: Pipe—R. D. Wood & Co., Philadelphia, Pa., $18.90 a ton; hydrants, etc.—J. O. Frost's Sons Mfg. Co., Towanda, Pa., 20 double nozzle fire hydrants, $20 each; 3 fire hydrants, with crane attachment for supplying water for sprinkling carts, $30 each; 7 8-in. gates, $14.50; 3 6-in. gates, $9.25; 3 air valves, $5; 3 valve boxes at $2. Laying pipe—James Carr, Bedford, Pa., 14½ cts. a lin. ft. Other bids for laying pipe, digging trench, back filling, setting of valves, valve boxes, gates, fire hydrants, and air valves, were as follows: J. H. Mussina, 16 cts. a ft.; D. M. May, 18 cts. a ft.; M. Fitzgerald, 17 cts. a fe.; Thos. Delaney, 18 cts.; E. H. Post, 21 cts.; H. Malone, 17 cts.; E. F. Kitzer, 18½ cts. The other bids for furnishing 8-in. pipe were as follows: Warren Foundry & Machine Co., $19.40 a ton; Chas. Millar & Son, $20.27; National Foundry & Pipe Works, $19.39; Buffalo Cast-Iron Pipe Co., $19.90; Chattanooga Foundry & Pipe Co., $18.93; R. D. Wood & Co., $18.90; Jackson & Woodin Mfg. Co., $19.25; Donaldson Iron Co., $18.94; E. K. Post, $19.54.

SUPPLIES.—Washington, D. C.—The following contracts for furnishing terra cotta sewer pipe for the fiscal year 1899 have been awarded: 6-in., 1,000 ft., 5 cts., Angus Lamond; 2,000 ft., 4¾ cts., Thomas Somerville & Sons.; 1,000 ft., 5 cts., Potomac Terra Cotta Co. 10-in., 10,000 ft., 11 cts., Potomac Terra Cotta Co. 12-in., 13,000 ft., Potomac Terra Cotta Co. 15-in., 4,600 ft., 19 cts., Thos. Somerville & Sons; 2,400 ft., 20 cts., Potomac Terra Cotta Co. 18-in., 2,000 ft., 27 cts., Thos. Somerville & Sons; 2,000 ft., 28 cts., Potomac Terra Cotta Co. 24-in., 3,000 ft., 53 cts., Thomas Somerville & Sons; 2,000 ft., 55 cts., Potomac Terra Cotta Co. The following bids were opened by the district commissioners July 23. Laying cement sidewalks: Crawford Paving Co., $1.04 a sq. yd., class A, $1.32 class B; F. M. Kemp & Sons, 98 cts. a yd., class A, $1.18 class B; Colburn Bros., 95½ cts. a yd., class A, $1.18¾ class B. Lamp posts: C. Rittenhouse, $8.75 each; M. J. Drummond & Co., $5.40; Midvale Foundry Co., Allentown, Pa., $4.46; Stewart R. Carr & Co., $4.90; James J. Lacey & Co., $5.92; Bethlehem Foundry & Machine Co., $5.19.

BRICK PAVING.—Champaign, Ill.—Ralph P. Brower, Cy. Engr., writes us that the following bids were received July 14 for certain brick paving, as advertised in Engineering News; contract was awarded to G. Maffioli for Veedersburg (Ind.) and Galesburg (Ill.) brick, and gravel concrete; the board reserving the right to substitute broken stone concrete at any time:

WATER PIPE.—Montgomery, Ala.—It is reported that Guild & Co., Chattanooga, Tenn., were awarded the following contract, July 16, for furnishing about 10 miles of cast-iron water pipe, as advertised in Engineering News: 8-in. pipe, 10,320 ft., 50½ cts. a ft.; 6-in. pipe, 35,840 ft., 39⅔ cts. a ft.; and 4-in. pipe, 28 cts. a ft. R. H. Somerville, Cy. Treas.; Engr., Nesbit Wingfield, Atlanta, Ga.

Bids Received at Champaign, Ill., July 14, 1898, for Brick Paving.

Quantities.		J. A. Foster & Co., Attica, Ind.	J. H. Palmer, Danville, Ill.	Smith, Moss & Brown, Chicago, Ill.	Nelch, Patterson & Streffler, Springfield, Ill.	G. Maffioli, Rockford, Ill.	Crews, Lough & Allison, Arcola, Ill.	J. W. Stipes, Champaign, Ill.	A. Barr, Jr., Urbana, Ill.
Green St.:									
Excavation	10,500 cu. yds.	$0.20	$0.17	$0.10	$0.22	$0.14	$0.22	...	...
Limestone curbing	....	...	.37	.35	...	.38	...	...	...
Concrete curb and gutter	9,650 lin. ft.	.50	.60	.49	.40	.39	.45	...	...
Brick masonry	40 cu. yds.	6.00	...	12.00	8.00	10.00	1.00	...	...
Brick pavement.† Clinton (Ind.) brick	17,600 sq. yds.	1.26	1.39	1.26	1.20	1.08	1.30	...	...
Brick pavement.† Veedersburg brick		1.28	1.43	1.30	1.29	1.19	1.34	...	...
Brick pavement.† Galesburg (Ill.) brick		...	...	1.33	1.28	1.19	...	...	...
Brick pavement.† Urbana brick		...	...	...	1.09	...	...	...	...
Brick pavement.‡ Clinton (Ind.) brick		1.43	1.39	1.34	1.34	1.23	...	...	...
Brick pavement.‡ Veedersburg brick		1.45	1.43	1.38	1.42	1.34	...	...	...
Brick pavement.‡ Galesburg (Ill.) brick		...	...	1.41	1.41	1.34	...	...	...
Brick pavement.‡ Urbana brick		...	...	...	1.23	...	...	...	...
Brick pavement.‡ Springfield brick		...	...	...	1.21	...	...	...	...
Walnut St.:									
Excavation	800 cu. yds.	$0.20	$0.17	$0.20	$0.22	$0.14	$0.22	$0.30	...
Limestone curbing	3,194 lin. ft.	.38	.37	.35	.39	.38	.43	.33	...
Resetting curb	....	.10	.20	.15	.10	.05	...	.08	...
Brick pavement.† Clinton (Ind.) brick	7,280 sq. yds.	1.26	...	1.29	1.20	1.08	1.30	...	...
Brick pavement.† Veedersburg brick		1.28	...	1.33	1.29	...	1.34	...	...
Brick pavement.† Galesburg (Ill.) brick		...	...	1.36	1.28	1.19	...	...	...
Brick pavement.† Urbana brick		...	...	...	1.09	...	...	1.14	...
Brick pavement.‡ Clinton (Ind.) brick		1.43	1.39	1.37	1.34	1.23	...	...	...
Brick pavement.‡ Veedersburg brick		1.45	1.43	1.41	1.42	...	...	...	...
Brick pavement.‡ Galesburg (Ill.) brick		...	...	1.44	1.41	1.34	...	...	...
Brick pavement.‡ Urbana brick		...	...	...	1.23	...	...	1.34	...
Brick pavement.‡ Springfield brick		...	...	...	1.21	...	...	...	...
Taylor St.:									
Excavation	570 cu. yds.	$0.20	$0.17	$0.20	$0.22	$0.14	$0.22	$0.30	$0.16
Limestone curbing	480 lin. ft.	.38	.37	.42	.39	.38	.43	.33	.37
Resetting curb	....	.10	.20	.15	.10	.05	...	.08	.05
Brick pavement.† Clinton (Ind.) brick	1,150 sq. yds.	1.26	...	1.40	1.20	1.08	1.31	...	...
Brick pavement.† Veedersburg brick		1.28	...	1.44	1.29	1.19	1.35	...	...
Brick pavement.† Galesburg (Ill.) brick		...	...	1.47	1.28	1.19	...	...	...
Brick pavement.† Urbana brick		...	...	...	1.09	...	...	1.14	1.15
Brick pavement.‡ Clinton (Ind.) brick		1.43	1.39	1.34	1.34	1.23	...	...	...
Brick pavement.‡ Veedersburg brick		1.45	1.43	1.38	1.42	1.34	...	...	...
Brick pavement.‡ Galesburg (Ill.) brick		...	...	1.47	1.41	1.34	...	...	...
Brick pavement.‡ Urbana brick		...	...	...	1.23	...	...	1.34	1.35
Brick pavement.‡ Springfield brick		...	...	...	1.21	...	...	...	...

†On 6-in. gravel concrete foundation. ‡On 6-in. broken stone concrete foundation.

DREDGING.—Lorain, O.—G. A. Resek, Cy. Clk., informs us that the following bids were received Aug. 2, 1898, for dredging, as advertised in Engineering News:

Bidder.	Dredging, a cu. yd. Mud.	Dredging, a cu. yd. Shale.	Logging, per hr.
John Stang, Lorain, O.	$0.07½	$0.35	$10.00
Breymann Bros., Toledo, O.	.10	.30	.....
L. P. & J. A. Smith, Cleveland.	.10	.50	10.00
Carkin, Stickney & Cram, Detroit	.13	.42	10.00

MACADAM ROAD.—Plymouth, Mass.—A. B. Fletcher, Secy. Massachusetts State Highway Comn., informs us that the following contract was let Aug. 4, 1898, to Edward D. Bell, Roxbury, Mass., for building a macadam road in Plymouth: Excavation, 750 cu. yds., at 25 cts. a cu. yd.; gravel, 500 cu. yds. at 40 cts.; shaping, 11,666 cu. yds., 2¼ cts.; broken stone in place, 2,800 tons, $1.29 a ton; finishing between limits—labor, 20 cts. an hour; double teams, 55 cts., and single teams, 30 cts.; cobblestone gutters, 100 sq. yds., 77 cts.; total, $4,339.

COMBINED GUTTER AND CURB.—Minneapolis, Minn. —The council received the following bids July 29, 1898, for furnishing an artificial combined curb and gutter, 10 ins., as may be required during this season: Stillwater Stone Sidewalk Co., 41 cts. per lin. ft.; Portland Stone Co., 34½ cts.; Standard Stone Sidewalk Co., 36½ cts.; Flour City Paving Co., 45 cts.; Star Paving Co., 39 cts., all to be made of coarse sand and cement.

PIER.—Napatree Point, Conn.—Capt. Thos. A. Scott, New London, Conn., was awarded the following contract Aug. 3, 1898, for building a pier at Napatree Point for U. S. government: Timber, $34 a 1,000 ft., B. M., in place; $35 for lumber in place, $45 for piling in place; 4 cts. a lb. for miscellaneous iron; 5 cts. a lb. for c.-i. cleats. The pier will be 400 ft. in length, about 300 ft. trestle work over shallow water, and the last 100 ft. heavier work.

SEWERAGE SYSTEM.—Flemington, N. J.—We are informed that the following bids were received July 30 for constructing a sewerage system, sewage disposal beds, etc., as advertised in Engineering News; A. Costa was awarded contract; W. H. Chapman, Engr.-in-Charge:

ASPHALT PAVING.—Baltimore, Md.—The following bids were received by L. F. Lewis, Cy. Comr., July 19, for furnishing the material and for asphalt paving in Fulton Ave., from Presstman St. to Pennsylvania Ave.; contract awarded Southern Asphalt Paving Co.:

Bids Received at Baltimore, Md., July 19, 1898, for Asphalt Paving.

Quantities.		Southern Asphalt Pvg. Co.*	J. S. Filbert, Baltimore.	Barber Asp. Pvg. Co., N. Y.	Robertson & Anderson.
Block asphalt paving, including all necessary grading, a 6-in. concrete base, 2 ins. of sand and paving blocks	12,900 sq. yds.	.....	.....	.....	$2.48
Sheet asphalt paving, including all necessary grading, 6-in. concrete base, 1½-in. binder and 1½-in. wearing surface	12,660 " "	$1.54	$2.27	$2.55	...
New 6-in. curb, including circles, set in place	4,810 lin. ft.	.95	1.21	1.25	1.03
Old 6-in. curb and circles redressed and reset	2,715 " "	.13	.31	.33	.28
New 5-in. curb, including circles set in place	2,270 " "	.95	1.19	1.21	.93
Old 5-in. curb, including circles redressed and reset	100 " "	.14	.31	.33	.25
Old 5 and 6-in. curb redressed in place	1,400 " "	.13	.25	.25	.16
Resetting old curb in cross streets	200 " "	.12	.21	.20	.15
4½-in. headers for sheet asphalt paving, set	545 " "	.65	.65	.60	...
4½-in. headers, for asphalt block paving, set	545 " "	...	...	...	.65
3-ft. open stone gutters, set	880 sq. ft.	1.13⅓	1.28⅓	1.25	1.20
Brick gutters and brick paving for asphalt blocks	1,740 " "	...	...	...	.27
Brick gutters and brick paving for sheet asphalt	3,870 " "	.27	.27	.32	...
Cobble paving	5,000 " "	.06	.09	.10	.06½
Cobble repaving	2,000 " "	.03½	.07	.04	.03¼
Hauling old cobblestones (unused) a mile	630 cu. yds.	.35	.31	.30	.60
Hauling old curb, unused, a mile	1,000 lin. ft.	.07	.10	.10	.08
Hauling old flagstones, unused, a mile	2,460 sq. ft.	.04	.01½	.03	.04
Total		$29,950	$41,975	$45,969	$44,409

STREET SPRINKLING.—Orange, Cal.—The town trustees received the following bids for sprinkling the streets: J. E. Mailes, 22 cts. a tank; Peter Schmetgen, 21 cts. a tank; G. A. Crowell, 27½ cts. a tank, if water is taken from pipe of Orange City Water Co. at plaza, and 25½ cts. if taken from the Santiago Land & Water Co.'s pipe at Cambridge St., and 20 cts. if taken from the latter company and they deliver it at the plaza.

Bids Received at Flemington, N. J., July 30, 1898, for Constructing a Sewerage System.

Quantities.		T. M. Lesher & Son, Easton, Pa.	Edw. H. Post, Wilkes Barre, Pa.	Dwyer & Kelly, NwY'rk, N. Y.	F. Kohlmeyer & Co., NwY'rk, N. Y.	B. F. Sweeten & Son, Camden, N. J.	A. Costa, Orange, N. J.	J. E. Hillpot, Bound Brook, N. J.
Sewers 8-in. pipe	16,155 lin. ft.	$0.75	$1.12	$1.80	$0.995	$1.04	$0.60	$0.70
Sewers 10-in. "	5,920 " "	.80	1.27	1.88	1.07	1.21	.70	.80
Sewers 12-in. "	2,105 " "	1.03	1.57	2.79	1.19	1.27	1.00	.90
Sewers 15-in. "	3,080 " "	.75	.85	1.50	1.07	.69	.70	.65
Sewers 8-in. iron pipe	100 " "	1.15	1.99	.70	1.00	1.46	1.00	.62
Sewers 10-in. " "	60 " "	1.31	2.44	1.00	1.25	1.85	1.02	.80
Sewers 12-in. " "	24 " "	1.49	3.12	1.00	1.50	2.10	1.50	.93
12-in. iron pipe on piers with embankment.	76 " "	1.35	3.20	1.60	4.25	1.36	3.00	1.38
15-in. iron pipe on piers with boxing.	264 " "	2.95	5.60	3.00	5.50	3.14	5.00	2.85
15-in. iron pipe sewers	536 " "	1.50	2.78	1.50	3.25	1.81	1.80	1.45
18-in. iron pipe (two carloads)	24 " "	1.75	3.58	1.50	3.00	1.53	2.00	1.50
Y-branches 8-in.	1,170 " "	.34	.38	.30	.35	.28	.30	.35
Y-branches 10-in.	435 " "	.34	.48	.45	.40	.39	.50	.45
Y-branches 12-in.	140 " "	.34	.56	.55	.45	.52	.65	.55
Y-branches 15-in.	95 " "	.96	.80	.80	.45	.75	1.00	.65
Drop connections for house drains	100 " "	3.00	2.80	2.50	3.00	.58	.25	3.00
Underdrains 3-in.	100 " "	.10	.20	.06	.20	.04	.10	.50
Underdrains 4-in.	200 " "	.12	.21	.08	.25	.05	.15	.55
Underdrains 6-in.	100 " "	.12	.25	.12	.30	.07	.20	.60
Manholes	41 each	45.00	55.00	50.00	45.00	29.00	25.00	42.00
Drop connections at manholes	6 "	7.00	10.00	2.00	15.00	8.00	10.00	3.00
Lampholes	39 "	3.50	6.82	4.50	20.00	3.46	10.00	6.00
Flushtanks	17 "	65.00	75.00	75.00	50.00	47.00	50.00	64.00
Concrete	30 cu. yds.	5.00	7.00	6.50	10.00	6.50	4.50	6.00
Sheeting and shoring	10,000 ft. B.M.	18.00	20.00	25.00	40.00	16.00	1.00	15.00
Plank foundations	1,000 " "	18.00	40.00	25.00	40.00	16.00	1.00	15.00
Excavation and back fill	100 cu. yds.	.50	1.50	.50	1.00	.20	.50	.50
Disposal field		5,379	6,193	13,405	6,000	3,900	5,875	4,891
Total		$33,234	$47,097	$71,037	$43,154	$38,196	$30,102	$31,405

INDUSTRIAL NOTES.

CHAS. F. BURNS & CO., 44 North Water St., Rochester, N. Y., electrical engineers and manufacturers of electrical supplies, have dissolved partnership by mutual consent.

MR. L. WILSON, 53 Dearborn St., Chicago, is sinking an artesion well for the Illinois Central R. R. at Gilman, Ill. It has reached a depth of 500 ft., and will be carried down to about 1,800 or 2,000 ft.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., has a contract to furnish and erect fireproof buildings, consisting of a steel framework covered with corrugated iron, for the refining plant of the Guggenheim Smelting Co., Perth Amboy, N. J.

THE WESTINGHOUSE MACHINE CO. and the Westinghouse Electric & Mfg. Co., Pittsburg, invited a number of prominent engineers to visit their works at East Pittsburg, July 30, to inspect some new engines to be shipped to England, and also to view their extensive workshops.

THE P. H. & F. M. ROOTS CO., Connersville, Ind., announce that its rotary force pump has been endorsed by the New England Factory Mutual Fire Insurance Association. The record made by this pump for durability and good work is, the company claims, fast dispelling the prejudice against the rotary form of pump.

THE WESTINGHOUSE MACHINE CO., Pittsburg, reports that it has through its New York office the initial order from Cuba since the beginning of hostilities with this country, it being for a 100-HP. Westinghouse engine and dynamo, together with boiler, boiler pump, piping, etc., for a complete steam plant to be installed in Santiago.

THE CONTINENTAL FILTER CO., 44 Wall St., New York, has issued a circular letter stating that it is now prepared to build gravity filters, with sedimentation tanks; also that it proposes to use a coagulant produced "from a certain use of the metal of aluminum." It also states that it has secured as General Manager, Mr. Wm. Deutsch, formerly Manager of the New York Filter Co.

THE E. P. ALLIS CO., Milwaukee, Wis., has a contract from the Franklin Mining Co., Houghton, Mich., for the machinery of its new mill, including a 15,000,000-gallon steam pump and five large stamp mills, with stamps 20 × 24 ins., resting on solid foundations weighing 72 tons each, according to report. The mill will also contain a 1,000-HP. surface condenser.

THE SPRINGFIELD BOILER & MFG. CO., Springfield, Ill., is reported to have a contract from the U. S. Government for a dredging boat, 192 ft. long and 70 ft. wide, to be used on the Mississippi River. It will be equipped with powerful machinery, having side wheels like a steamboat, making it, it is said, the only self-propelling suction dredge in existence and will cost about $100,000 complete.

THE BELLEFONTAINE BRIDGE & IRON CO., Bellefontaine, O., advises us that it is quite busy at present and has the following contracts, among others, on hand: Signal tower at the crossing of the Detroit & Lima Northern Ry. and the Cleveland, Cincinnati, Chicago & St. Louis Ry., Bellefontaine, O.; high truss bridge, 170 × 16 ft., with one 6-ft. sidewalk, Paulding, O.; high truss bridge, 206 × 18 ft., Vermillion county, Ind.; structural iron for school building, Waterbury, Vt.; 150 × 16-ft. bridge, Henry county, Ill.; high truss bridge, 100 × 18 ft., Johnson county, Ind.; high truss bridge, 125 × 16 ft., Miami county, Ohio; structural iron for 3-story business block, Tiffin, Ohio; high truss bridge, 150 × 14 ft., on tubular piers, Sullivan county, Ind., and also contracts for 90 other bridges and buildings throughout the Central states.

THE HAYS CONSTRUCTION CO., Troy, O., has closed contracts with the Commissioners of Miami County, Ohio, for masonry work of nine bridges to replace bridges washed out by high water. The company has also closed contracts with the Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. for the erection of masonry work approximating 1,000 yds., for two bridges west of Troy, O., on the line of the Peoria & Eastern Ry.

THE FUEL ECONOMIZER CO., Matteawan, N. Y., is busy at present and reports its business prospects as most encouraging. Among recent sales are the following: Milwaukee Electric R. R., Milwaukee, Wis., 2,000 HP.; Worcester Bleach & Dye Works, Worcester, Mass., 350 HP.; Merchants' Cotton Co., St. Henri, Que., 600 HP.; Excelsior Mills, 300 HP.; Lehigh Valley Coal Co., Wilkesbarre, Pa., 2,000 HP. (two orders); Western Cold Storage Co., Chicago, Ill., 300 HP.; Cheney Bros., South Manchester, Conn., 2,000 HP.; Blackstone Mills, Blackstone, Mass., 500 HP.; La Belle Mill Water & Power Co., Goldfield, Colo., 1,000 HP.; Dominion Cotton Mills Co., Magog, Que., 1,000 HP. (twelfth order); Frick Co., Waynesboro, Pa., 150 HP.; D. M. Bare & Co., Roaring Springs, Pa., 600 HP., and Rome Brass & Copper Co., Rome, N. Y., 350 HP.

THE MICHIGAN BRASS & IRON WORKS, Detroit, Mich., informs us that it has never been busier than now, every department being crowded to its fullest capacity, with more men on the pay rolls than ever before. Contracts lately taken include the following: One hundred 5-in. Michigan compression fire hydrants for the city of Detroit, this lot being in addition to those noted some time ago; 100 of the same type of hydrant for the village of Delray, a suburb of Detroit; 10-in., 12-in. and 20-in. St. Louis pattern gate valves, for the city of St. Louis; over a carload of 10-in. to 26-in. valves inclusive, for the city of Spokane, Wash.; a carload of hydrants for the city of Grand Rapids, Mich.; valves and hydrants for the cities of Jackson and Saginaw, Mich.; hydrants for the city of Allegheny, Pa.; 30-in. sluice gates for the Great Plains (Colo.) Water Storage Co., etc.

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PERSONAL.

Mr. George V. Lorings has been appointed City Engineer of Decatur, Ill., to succeed Mr. Dickerson, resigned.

Mr. E. Anderson has been appointed City Electrician and Chief Engineer of the water and electric light plants of Grand Forks, B. C.

Mr. Charles O. Scull, of Baltimore, Md., has been elected President of the Erie & Central New York Ry., to succeed Mr. Stewart Browne, of New York, resigned.

Mr. Luther E. Gregory, Civil Engineer, United States Navy, has been detached from the New York Navy Yard and ordered to the navy yard at Portsmouth, N. H.

Mr. Ferdinand W. Peck, Commissioner-General to the Paris Exposition, whose appointment was reported in our issue of July 28, has announced the following appointments to his staff, with the statement that no further ones will be made until his return from Paris: Director of Affairs, Mr. Paul Blackmar; Director of Mining and Mineralogy, Mr. F. J. V. Skiff; Temporary Director of Press Bureau, Mr. Robert J. Thompson; Private Secretary, Mr. J. H. McGibbons, and Secretaire Francaise, Count de Valcourt Vermont. The headquarters of the commission are in the Auditorium Bldg., Chicago.

Mr. John A. Ockerson, M. Am. Soc. C. E., Principal Assistant Engineer to the Mississippi River Commission, with headquarters in St. Louis, Mo., has been appointed by President McKinley, as a member of the above commission, to succeed Mr. Henry Flad, M. Am. Soc. C. E., whose death was announced in our issue of June 23. The position which is for life carries with it a salary of $3,500 a year. Mr. Ockerson is a graduate of the University of Illinois, Urbana and Champlain, Ill., and has been engaged on engineering work on the Mississippi River for the past 22 years, of which 17 years have been spent on the commission's engineer corps. He is also a member of the St. Louis Engineers' Club and the National Geographical Society, and is the author of "The Mississippi River from St. Louis to the Sea," and a number of important papers relating to various phases of the Mississippi River improvement work.

OBITUARY.

Mr. William Gardner, engineer for gas plants and manufacturer of fire clay materials for gas works, formerly of Pittsburg, Pa., died at his home in Colorado Springs, Colo., Aug. 5. He built the first gas works in Portland, Ore., and was one of the original members of the American Gaslight Association. In 1889, as Consulting Engineer, he reconstructed the gas works at Johnstown, Pa., and in 1893 erected the gas works in Altoona, Pa., which was his last important work.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN MATHEMATICAL SOCIETY.
Aug. 19-20. Annual meeting, Boston, Mass. Secy., F. N. Cole, Columbus University, New York city.

AMERICAN CHEMICAL SOCIETY.
Aug. 22-23. Annual meeting, Boston, Mass. Secy., Albert C. Hale, 551 Putnam Ave., Brooklyn, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
Aug. 22-27. Annual meeting, Boston, Mass. Secy., F. W. Putnam, Salem, Mass.

GEOLOGICAL SOCIETY OF AMERICA.
Aug. 23. Annual meeting, Boston, Mass. Secy., H. L. Fairchilds, Rochester, N. Y.

AMERICAN FORESTRY ASSOCIATION.
Aug. 23-24. Annual meeting, Boston, Mass. Pres., Francis H. Appleton, 101 Tremont St., Boston, Mass.

NATIONAL IRRIGATION CONGRESS.
Sept. 1-3. Annual convention, Cheyenne, Wyo. Secy., J. C. Harpham.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Sept. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

GERMAN-AMERICAN TECHNICAL SOCIETY.
Sept. 3-7. Annual meeting, Philadelphia Section, Reading, Pa. Secy., A. Schumann, 532 North 4th St., Philadelphia, Pa.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Sept. 5. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

AMERICAN STREET RAILWAY ASSOCIATION.
Sept. 6-9. Annual convention, Boston, Mass. Secy., T. C. Pennington, 2020 State St., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 7. Secy., C. W. Hunt, 220 W. 57th St., New York city.

CENTRAL RAILWAY CLUB.
Sept. 9. Secy., H. D. Vought, 114 5th Ave., New York city.

MONTANA SOCIETY OF ENGINEERS.
Sept. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

THE LOUISIANA ENGINEERING SOCIETY.
Sept. 12. Secy., J. F. Coleman, 712 Union St. New Orleans, La.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 12-13. Annual meeting, Sault Ste. Marie, Mich. Secy., Wilson S. Howell, Newark, N. J.

NORTHWEST RAILWAY CLUB.
Sept. 13. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

ROADMASTERS' ASSOCIATION OF AMERICA.
Sept. 13. Annual meeting, Denver, Colo. Secy., J. B. Dickson, Sterling, Ill.

NEW YORK STATE STREET RAILWAY ASSOCIATION.
Sept. 13-14. Annual meeting, Brooklyn, N. Y. Secy., H. A. Robinson, New York city.

DENVER SOCIETY OF CIVIL ENGINEERS.
Sept. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

THE RAILWAY SIGNALING CLUB.
Sept. 13. Secy., Earl M. Seitz, C. & N. W. Ry., Chicago, Ill.

ROADMASTERS' ASSOCIATION OF AMERICA.
Sept. 13. Annual meeting, Denver, Colo. Secy., J. B. Dickson, Sterling, Ill.

ENGINEERS' CLUB OF CINCINNATI.
Sept. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

BROOKLYN ENGINEERS' CLUB.
Sept. 15. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Sept. 16. D. W. Meeker, St. Paul, Minn.

ENGINEERS' CLUB OF MINNEAPOLIS
Sept. 19. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Sept. 20. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Sept. 21. Secy., S. E Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Sept. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT
Oct. 12. Annual meeting, Washington D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

AMERICAN INSTITUTE OF MINING ENGINEERS
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

PACIFIC COAST GAS ASSOCIATION.—The 6th annual convention of this association was held at San Francisco, Cal., on Aug. 19-20. The following officers were elected for the ensuing year: Pres., Chas. F. Adams, Portland, Ore.; Vice-Pres., J. Clements, Red Bluff, Cal.; Secy. and Treas., John A. Britton, Oakland, Cal.

THE INTERNATIONAL MINING CONGRESS.—At the recent meeting of this organization, held at Salt Lake City, Utah, July 6-9, the following resolutions were adopted:

We do unanimously petition the Congress of the United States to create a new department of mines and mining, whose purpose shall be to aid, develop and foster the mining industry of the United States by every influence within its reach.

That the president of this association is hereby directed to appoint such committees and take such action as shall bring this measure to the attention of every member of Congress, and to stand firm in its support, without compromise of any nature, until favorable action has been secured.

AMERICAN STREET RAILWAY ASSOCIATION.—The entertainment program of the meeting to be held in Boston, Sept. 6-9, includes a trip to Concord and Lexington on Tuesday afternoon, and a reception in the evening. Wednesday afternoon, excursion will be taken down the harbor, and there will be a clambake at Nantucket Beach. Thursday afternoon is scheduled for a trip to Plymouth; in the evening the usual banquet will be held; Friday evening will be given up to a trolley excursion to Norumbega Park. The indications are that the exhibition part will be particularly successful, and already 24,750 ft. has been assigned to leading street railway supply firms and manufacturers.

INTERNATIONAL ASSOCIATION FOR THE TESTING OF MATERIALS—American Section.—The first annual meeting of the American Section will be held Aug. 27 at the Engineers' Club, 1122 Girard St., Philadelphia, Pa. The program includes an afternoon session for general business and an evening session, at which the following subjects will be discussed:

"The relation of the International Association to producers and consumers," to be opened by Dr. Charles B. Dudley and Mr. William R. Webster; "In what manner will the adoption of standard specifications improve industrial methods and processes," to be opened by Prof. Rolla C. Carpenter and Mr. Gus C. Henning.

The officers of the American Section are: Chairman, Prof. Mansfield Merriman; Vice-Chairman, Prof. Henry M. Howe; Secy., Richard L. Humphrey; Treas., Paul Kreuzpointner; Members of the International Advisory Council, Dr. R. G. G. Moldenke and Prof. Henry M. Howe.

The Association's official organ is "Baumateiralienkude," and the subscription price to members is $2.50; others, $3.50; obtained from the secretary, Mr. Richard L. Humphrey, Testing Laboratory, City Hall, Philadelphia, Pa.

OHIO ELECTRIC LIGHT ASSOCIATION.—The 4th annual meeting of this association is scheduled to be held at Sandusky, O., Aug. 18-19. The following is the list of papers to be presented:

"Positive and Negative Economies in Small Central Stations," E. P. Roberts; "Some Suggestions Relative to Determining the Cost of Electrical Supply," M. E. Turner; "The Meter's Relation to the Dividend," Caryl D. Haskins; "Comparative Commercial Qualities of Old and Modern Transformers as Applied to an Exchange," J. H. Perkins; "Long-distance Transmission of Power," E. J. Berg.

In addition, the following topics will be discussed:

"What are the advantages and disadvantages of enclosed arc lamps for outside lighting?" "Can the candle power of arc lamps be accurately determined by the use of a portable photometer?" "In what way can competition of the gasoline incandescent burner be most successfully met?" "Is it advisable for a plant to change from 15,000 volts alternating single-phase to 7,200 two-phase if no question of motor business is concerned?" "What are the types and makes of engines in use in the smaller plants of the association; the time of their installation and their condition at the present time?"

ROADMASTERS' ASSOCIATION OF AMERICA.—The 16th annual meeting will be held at Denver, Colo., Sept. 13-15, at which committee reports on the following subjects will be presented:

1. Best method of preventing the creeping of rails.
2. Tie-plates; the results and benefits obtained from their use.
3. Track joints; results obtained from the use of various devices.
4. The advisability of increasing the length of rails, and the advantages to be derived from using miter cut ends for the rails.
5. At what degree of curvature should widening of the gage begin, and how much should the gage be widened for each degree?
6. Late improvements in frogs and switches.

There will also be a paper by Mr. H. W. Church on "Discipline in its Practical Application to Track Forces," and Mr. C. M. Hobbs, of the D. & R. G. R. R., will deliver an illustrated lecture on "Colorado versus Switzerland." The business proceedings will include the consideration of proposed amendments to the constitution.

The meetings will be held in the hall of the Chamber of Commerce, and the Railway and Track Supply Association will have its headquarters and exhibit near this building.

Several excursions have been arranged, and after the convention there will be a trip to Colorado Springs, Pike's Peak, Leadville and Glenwood Springs.

J. B. Dickson, Secy.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.—The 8th annual meeting of this association will be held Oct. 18-20, at Richmond, Va., as announced in our last issue. The list of subjects to be reported upon is given as follows:

Pile-rings and method of protecting pileheads in driving; Cost and manner of putting in pipe culverts; Best floors for shops and roundhouses; Roundhouse smokejacks and ventilation; Cattleguards and wingfences; Prevention of fire in railroad buildings; Storage of fuel, oil and other station supplies at way-stations; Railroad highway crossing gates; What repairs, and how can they be safely made, to metal and wooden spans without the use of falsework; Care of iron bridges after erection, including best method of protecting them from injury by salt water drippings from refrigerator cars; Turntable construction.

At a meeting of the executive committee held in Chicago on Feb. 21, the requirements for eligibility of an applicant were defined by a resolution which said in substance that the clause in the constitution referring to entrance requirements, "should, in accordance with the action of the association in the past, be construed on the basis that the applicant must be in the employ of a railroad company, either as a superior officer with general control over questions affecting the bridge and building department, or as a subordinate official having actual responsible charge of work connected with the construction or maintenance of railroad bridges or buildings, independent of the actual title, whether as superintendent, supervisor, engineer, general foreman, general inspector, master of road, master carpenter, etc., but not to include persons only in sub-charge of individual jobs or special classes of work, such as gang-foremen, inspectors, clerks, draftsmen, etc."

THE CIVIL ENGINEERS' CLUB OF CLEVELAND.—A regular meeting of this club was held Aug. 9, at which Mr. Lehman B. Hoit read a paper on "Test Meters for Boiler Plants." After describing the requisites of a water meter, as attached to a service pipe to measure the total consumption, the importance of accuracy of record in meters used to measure boiler feed water was emphasized.

The old method of testing boilers by weighing the water cannot now be applied, owing to the expense of so doing. In every day service the fuel consumption is much greater than determined by a test. An accurate meter serves the purpose of a continuous test, and is as essential in determining the efficiency of boilers and the relative value of fuels as the steam indicator is in determining the power developed by the engine. By noting the readings in a log-book, the duty performed by the boilers is known. Incidentally the test meter also indicates the relative skill of different sets of firemen and tends to prevent waste on their part.

A Worthington meter was exhibited and described. It was stated that the error in modern meters has been proved to be only a small fraction of 1%, and as the rate of error was constant, it could be easily eliminated in the general result.

By request Mr. Hoit then exhibited some blue prints of the Worthington steam acumulator, and described its construction and operation. As compared with a weight accumulator, this has several advantages. It requires no bulky weight, no heavy foundations, and produces no water hammer requiring extra strength in connections.

The water hammer of a weighted accumulator often amounts to 25%, and sometimes 50%, of the static pressure.

It is particularly adapted to the regulation of plants operated by water pressure, such as hydraulic presses and passenger elevators. A sudden demand in the service by reducing the water head causes additional steam to be supplied to the pumps, and also in certain cases to an auxiliary pump, by which means the loss of head is promptly restored. The whole action is automatic and requires no attention on the part of the engineer. In large plants, and especially where the service is very fluctuating, these machines have proved very advantageous and economical. The effect of the accumulator is somewhat analogous to that of a steam governor.

Wm. H. Searles, Secy.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News
Aug. 18.	**Water supply, Jersey City, N. J.**	**July 14**
Aug. 18.	**Army supplies, Memphis, Tenn.**	**July 28**
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 18.	Water-works, Rome, N. Y.	Aug. 4
Aug. 18.	Highway, Truro, Mass.	Aug. 11
Aug. 18.	Broken stone, etc., New York.	Aug. 11
Aug. 18.	Paving, curbing, etc., Reading, Pa.	Aug. 18
Aug. 18.	Macadam road, Williamstown, Mass.	Aug. 8
Aug. 18.	Macadam road, Lunenburg, Mass.	Aug. 18
Aug. 18.	Bonds, Taunton, Mass.	Aug. 18
Aug. 18.	Brick sewer, Carnegie, Pa.	Aug. 18
Aug. 18.	Bridge, Park Falls, Wis.	Aug. 18
Aug. 18.	Special castings, Chicago, Ill.	Aug. 1
Aug. 19.	Retaining wall, Troy, N. Y.	Aug. 18
Aug. 19.	Fire hose, St. Louis, Mo.	Aug. 18
Aug. 19.	Gravel roads, Columbus, Ind.	Aug. 1
Aug. 19.	Macadam paving, Lima, O.	Aug. 18
Aug. 19.	Macadam paving, Paterson, N. J.	Aug. 18
Aug. 19.	Granite paving, Portland, Me.	Aug. 18
Aug. 19.	Iron bridge, Ontonagon, Mich.	Aug. 18
Aug. 19.	Water department supplies, Cincinnati, O.	Aug. 18
Aug. 19.	**Pipe sewers, Pontiac, Mich.**	**Aug. 11**
	Advertised, Engineering News, Aug. 11.	
Aug. 19.	**Boilers (2), National Home, Wis.**	**Aug 11**
Aug. 19.	**Steel bridge, Delaware, O.**	**Aug. 11**
Aug. 19.	**Gate house, New Bedford, Mass.**	**Aug. 11**
Aug. 19.	**Levee work, Dayton, O.**	**Aug. 11**
Aug. 19.	**Bridge bonds, Jersey City, N. J.**	**Aug. 11**
Aug. 19.	**Grading, etc., Guilford, Conn.**	**Aug. 11**
Aug. 19.	**Paving, etc., Troy, N. Y.**	**Aug. 11**
Aug. 19.	**Paving sidewalks, Dayton, O.**	**Aug. 11**
Aug. 19.	**Viaduct substructure, Cleveland, O.**	**July 28**
Aug. 19.	**Asphalt paving, Cleveland, O.**	**July 28**
Aug. 20.	**Bridge, Cincinnati, O.**	**July 28**
Aug. 20.	**Dredging, Montgomery, Ala.**	**July 28**
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 20.	**Paving bonds, Mansfield, O.**	**July 28**
Aug. 20.	**Electric lighting, Whitesboro, N. Y.**	**July 14**
	Advertised, Eng. News, July 14 and 21.	
Aug. 20.	**Street bonds, Malta, O.**	**July 21**
Aug. 20.	**Pumping engines, Lancaster, O.**	**Aug. 4**
Aug. 20.	**High school building, Sharonville, O.**	**Aug. 4**
Aug. 20.	**Road bonds, Houston, Tex.**	**Aug. 4**
Aug. 20.	**Macadam paving, Suffield, Conn.**	**Aug. 11**
Aug. 20.	**Dam, abutments, etc., Brantford, Ont.**	**Aug. 11**
Aug. 20.	**Bonds, Tiffin, O.**	**Aug. 11**
Aug. 20.	**Bridge, Brantford, Ont.**	**Aug. 11**
Aug. 20.	**Iron bridge, Cocalico, Pa.**	**Aug. 11**
Aug. 20.	**Power pump, Chambersburg, Pa.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 and 18.	
Aug. 20.	**Curbing, gutter, etc., Piqua, O.**	**Aug. 11**
Aug. 20.	**Concrete walks, Toledo, O.**	**Aug. 11**
Aug. 20.	Electric light plant, Eaton Rapids, Mich.	Aug. 18
Aug. 20.	Grading, Los Angeles, Cal.	Aug. 18
Aug. 20.	Paving, Quincy, Ill.	Aug. 18
Aug. 20.	Bridge, Tiffin, O.	Aug. 18
Aug. 20.	Bridges (3), Chehalis, Wash.	Aug. 18
Aug. 20.	School building, Glenshaw, Pa.	Aug. 18
Aug. 20.	Church building, Marietta, Ga.	Aug. 18
Aug. 20.	Hotel reconstruction, Niagara Falls, Ont.	Aug. 18
Aug. 20.	Painting bridges, St. John, N. B.	Aug. 18
Aug. 20.	Bonds, St. Paul, Minn.	Aug. 18
Aug. 21.	**Church building, Winnebago City, Minn.**	**Aug. 11**
Aug. 22.	**Masonic building, Wichita, Kan.**	**Aug. 11**
Aug. 22.	**Bridge, La Moure, N. Dak.**	**Aug. 11**
Aug. 22.	**Sewerage system, Santa Ana, Cal.**	**Aug. 11**
Aug. 22.	**Addition to engine house, Washington.**	**Aug. 11**
Aug. 22.	**Heating, etc., Paterson, N. J.**	**Aug. 11**
Aug. 22.	**Wells, Washington, D. C.**	**Aug. 11**
	Advertised, Engineering News, Aug. 11.	
Aug. 22.	**Street cleaning, Oakland, Cal.**	**Aug. 11**
Aug. 22.	**Paving, etc., South Bend, Ind.**	**Aug. 11**
Aug. 22.	**Brick paving, etc., Fremont, Neb.**	**Aug. 11**
Aug. 22.	**Heating and ventilation, Paterson, N. J.**	**Aug. 4**
	Advertised, Eng. News, Aug. 4 and 11.	
Aug. 22.	**Bridge (400 ft.), Hamilton, O.**	**Aug. 4**
Aug. 22.	**High school building, Columbus, O.**	**Aug. 4**
Aug. 22.	**Court house, Charleston, Ill.**	**Aug. 4**
Aug. 22.	**School buildings, Ione, Cal.**	**Aug. 4**
Aug. 22.	**Electric light plant, Mineral Point, O.**	**July 28**
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 22.	**Steel substructure, Lebanon, O.**	**July 28**
Aug. 22.	**Water-works, Mineral Point, O.**	**July 28**
	Advertised, Eng. News, July 28 to Aug. 11.	
Aug. 22.	Macadam, curb, etc., Lansingburg, N. Y.	Aug. 18
Aug. 22.	Brick paving, etc., Washington, Pa.	Aug. 18
Aug. 22.	Removal of buildings, Washington, Pa.	Aug. 18
Aug. 22.	Heating apparatus, Arnprior, Ont.	Aug. 18
Aug. 22.	Pipe sewers, Schenectady, N. Y.	Aug. 18
Aug. 22.	Paving, etc., New Kensington, Pa.	Aug. 18
Aug. 22.	Sidewalks and paving, Kansas City, Mo.	Aug. 18
Aug. 22.	Paving and curb, Des Moines, Ia.	Aug. 18
Aug. 22.	Macadamizing, Oakland, Cal.	Aug. 18
Aug. 22.	Supplies, New York, N. Y.	Aug. 18
Aug 22.	School building, Boston, Mass.	Aug. 18
Aug. 22.	School building, Marion, O.	Aug. 18
Aug. 22.	Library building, Forest City, Ia.	Aug. 18
Aug. 22.	Hospital building work, Minneapolis, Minn.	Aug. 18
Aug. 22.	Grain elevator, Halifax, N. S.	Aug. 18
Aug. 22.	Grading, etc., Revere, Mass.	Aug. 18
Aug 22.	Pipe sewer, etc, Wilkinsburg, Pa.	Aug. 18
Aug. 22.	Storm sewer, Council Bluffs, Ia.	Aug. 18
Aug. 22.	Lateral sewer, Kansas City, Mo.	Aug. 18
Aug. 22.	Reservoir, Devon, Pa.	Aug. 18
	Advertised, Engineering News, Aug. 18.	
Aug. 22.	Water mains, Bay City, Mich.	Aug. 18
Aug. 22.	Pipe sewers, New Kensington, Pa.	Aug. 18
Aug. 23.	Repairing steamer, Washington, D. C.	Aug. 18
Aug. 23.	Wrought iron work, New York.	Aug. 18
Aug. 23.	Passenger elevators (2) New York, N. Y.	Aug. 18
Aug. 23.	Sewer and bonds, Crafton, Pa.	Aug. 18
Aug. 23.	Brick paving, Warren, O.	Aug. 18
Aug. 23.	Brick paving, Philadelphia, Pa.	Aug. 18
Aug. 23.	Sewage tanks, Kewanee, Ill.	Aug. 18
Aug. 23.	Laying water pipe, Harrisburg, Pa.	Aug. 18
Aug. 23.	Pipe sewers, etc., Kearney, N. J.	Aug. 18
Aug. 23.	Public building, Ingersoll, Ont.	Aug. 18
Aug. 23.	School building, Columbus, O.	July 28
Aug. 23.	**Water pipe, Coolgardie, West Australia.**	**June 2**
Aug. 23.	Electric light plant, Bunker Hill, Ill.	Aug. 4
Aug. 23.	Collegiate building, Iowa City, Ia.	Aug. 11
Aug. 23.	Steel projectiles, Washington, D. C.	Aug. 11
Aug. 23.	Wharf, Fort Morgan, Ala.	Aug. 11
Aug. 23.	Naval supplies, Philadelphia, Pa.	Aug. 11
Aug. 23.	School building, Roanoke, Va.	Aug. 11
Aug. 23.	Water-works, Greenville, Cal.	Aug. 11
Aug. 23.	Macadam road, Naugatuck, Conn.	Aug. 11
	Advertised, Engineering News, Aug. 11.	
Aug. 24.	**Water-works improvements, Elyria, O.**	**Aug. 4**
Aug. 24.	**Sidewalks, Cambridge City, Ind.**	**Aug. 4**
Aug. 24.	**Hire dredging plant, Mobile, Ala.**	**July 28**
	Advertised, Eng. News, July 28 to Aug. 18.	
Aug. 24.	Water meters, Jersey City, N. J.	Aug. 18
Aug. 24.	Sewers, Jersey City, N. J.	Aug. 18
Aug. 24.	Cylinder plates, Tompkinsville, S. I.	Aug. 18
	Advertised, Engineering News, Aug. 18.	
Aug. 24.	Slag roadways, Chicago, Ill.	Aug. 18
Aug. 24.	Macadamizing, Kansas City, Mo.	Aug. 18
Aug. 24.	Gun forgings, Washington, D. C.	Aug. 18
Aug. 24.	Extend'g elect. plant, Nat'l Military Home.	Aug. 18
Aug. 24.	Hospital building alterations, New York.	Aug. 18
Aug. 24.	Steam heating plant, St. Peter, Minn.	Aug. 18
Aug. 24.	Repairing roadway, Mount City, Ill.	Aug. 18
Aug. 24.	Brick paving, Carbondale, Pa.	Aug. 18
	Advertised, Engineering News, Aug. 18.	
Aug. 24.	Macadam, curb, etc., Jersey City, N. J.	Aug. 18
Aug. 24.	Repairing sewer, New York, N. Y.	Aug. 18
Aug. 25.	Sheet asphalt, Newark, N. J.	Aug. 18
Aug. 25.	Bonds, New Orleans, La.	Aug. 18
Aug. 25.	Coal house, Danville, Ill.	Aug. 18
Aug. 25.	Business building, Crookston, Minn.	Aug. 18
Aug. 25.	Pipe sewers, Hudson, N. Y.	Aug. 18
Aug. 25.	Storage dam, McDonald, Pa.	Aug. 18
	Advertised, Engineering News, Aug. 18.	
Aug. 25.	Sewer, Cincinnati, O.	Aug. 18
Aug. 25.	Ventilating plant, Buffalo, N. Y.	Aug. 18
Aug. 25.	City hall, Warren, O.	Aug. 18
Aug. 25.	Lighthouse, Baltimore, Md.	July 28
	Advertised, Engineering News, July 28.	
Aug. 25.	**Bonds ($80,000), Healdsburg, Cal.**	**Aug. 4**
Aug. 25.	**School building, Waldo, O.**	**Aug. 4**
Aug. 25.	**School building, Passaic, N. J.**	**Aug. 11**
Aug. 25.	**Filling sewage beds, Plainfield, N. J.**	**Aug. 11**
Aug. 25.	**Bridge work, London, O.**	**Aug. 11**
Aug. 25.	**Sewers, Cleveland, O.**	**Aug. 11**
Aug. 25.	**Electric light plant, McArthur, O.**	**Aug. 11**
Aug. 25.	**Sewer, New Hampton, Ia.**	**Aug. 11**
Aug. 26.	**Barracks, National Soldiers' Home, Va.**	**Aug. 11**
Aug. 26.	**Water-works, Healdsburg, Cal.**	**Aug. 11**
	Advertised, Engineering News. Aug. 11.	
Aug. 26.	**Water and light bonds, Healdsburg, Cal.**	**Aug. 11**
	Advertised, Engineering News. Aug. 11.	
Aug. 26.	**Electric light plant, etc., Healdsburg, Cal.**	**Aug. 11**
	Advertised, Engineering News. Aug. 11.	
Aug. 26.	**Pump engines (2), Minneapolis, Minn.**	**July 21**
	Advertised, Eng. News. July 21 to Aug. 11.	
Aug. 26.	Buildings, Buffalo, N. Y.	Aug. 18
Aug. 26.	School buildings, Chicago, Ill.	Aug. 18
Aug. 26.	Unloading scows, New York, N. Y.	Aug. 18
Aug. 27.	Grading, Washington, D. C.	Aug. 18
	Advertised, Engineering News, Aug. 18.	
Aug. 27.	School building, Chemawa, Ore.	Aug. 18
Aug. 27.	Extending power dam, Rock Island, Ill.	Aug. 18
Aug. 27.	**Water pipe, Lakewood, O.**	**Aug. 4**
Aug. 27.	**Road work, Pittsburg, Pa.**	**Aug. 11**
Aug. 29.	**Brick paving, Malta, O.**	**Aug. 4**
Aug. 29.	**Brick paving, Canton, O.**	**Aug. 4**
Aug. 29.	**Paving, etc., Toledo, O.**	**Aug. 4**
Aug. 29.	**Pumping eng. (3,000,000 galls), Marietta, O.**	**July 28**
Aug. 29.	Macadam paving, Cincinnati, O.	Aug. 18
Aug. 29.	Macadam paving, etc., Marshall, Mo.	Aug. 18
Aug. 29.	High school building, Wilmington, Del.	Aug. 18
Aug. 29.	Sewers, Toledo, O.	Aug. 18
Aug. 30.	Brick paving, etc., Mattoon, Ill.	Aug. 18
Aug. 30.	Iron bridge, Arnprior, Ont.	Aug. 18
Aug. 30.	Brewing plant, Eaton, Pa.	Aug. 18
Aug. 30.	Traveling cranes, Chicago, Ill.	Aug. 18
	Advertised, Eng. News, Aug. 18 and 25.	
Aug. 30.	**Grading, etc., for water-wks, Cincinnati, O.**	**Aug. 4**
Aug. 30.	**Dams, etc., Mississippi River, Ill.**	**Aug. 4**
	Advertised, Eng. News, Aug. 4 to 25.	
Aug. 30.	**Gravel roads, Indianapolis, Ind.**	**Aug. 4**
Aug. 30.	**Gas mains, etc., San Jose, Cal.**	**Aug. 11**
Aug. 30.	**Pipe sewers, Peru, Ind.**	**Aug. 11**
Aug. 30.	**School building, Delphos, O.**	**Aug. 11**
Aug. 30.	**Street bonds, Orrville, O.**	**Aug. 11**
Aug. 31.	**Hospital, Fort Slocum, N. Y.**	**Aug. 11**
Aug. 31.	**Coal handling plant, New London, Conn.**	**Aug. 11**
Aug. 31.	**Chapel building, Lebanon, Pa.**	**Aug. 11**
Aug. 31.	**Dredging, Bridgeport, Conn.**	**Aug. 4**
	Advertised, Eng. News, Aug. 4 to 25.	
Aug. 31.	**Custom house, Guayquil, Ecuador.**	**Apr. 21**
Aug. 31.	Lavatory building, etc., Buffalo, N. Y.	Aug. 18
Aug. 31.	Paving, etc., Cleveland, O.	Aug. 18
Aug. 31.	Grading, Omaha, Neb.	Aug. 18
Sept. 1.	Electric plant, Abilene, Kan.	Aug. 18
Sept. 1.	Water pump, Gloucester City, N. J.	Aug. 18
	Advertised, Eng. News, Aug. 18 and 25.	
Sept. 1.	Filter plant, etc., Louisville, Ky.	Aug. 18
Sept. 1.	Water pipe, Lanesboro, Minn.	Aug. 18
Sept. 1.	Electric light plant, Mystic, Conn.	Aug. 18
Sept. 1.	Heating, ventilating, etc., Lexington, Ky.	Aug. 18
	Advertised, Eng. News, Aug. 18 and 25.	
Sept. 1.	Sewerage system, Clinton, Mass.	Aug. 18
	Advertised, Engineering News, Aug. 18.	
Sept. 1.	**Drainage system, Savannah, Ga.**	**June 30**
	Advertised, Eng. News, June 23 to Aug. 25.	
Sept. 1.	**Electric light plant, Cullman, Ala.**	**July 21**
Sept. 1.	**Water-works, Norwood, N. Y.**	**July 21**
Sept. 1.	**Bridges, Johnsonburg, Pa.**	**Aug. 4**
	Advertised, Eng. News, Aug. 4 and 11.	
Sept. 1.	**Water-works, Mobile, Ala.**	**Aug. 4**
	Advertised, Eng. News, Aug. 4 to 25.	
Sept. 1.	**Electric lighting, Paris, Tex.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to 25.	
Sept. 1.	**Dam, power house, etc., Jackson, Mich.**	**Aug. 11**
	Advertised, Engineering News, Aug. 11.	
Sept. 3.	Jail, Goliad, Tex.	Aug. 18
Sept. 3.	Hospital building, Ukiah, Cal.	Aug. 18
Sept. 3.	**Sewage pumping plant, No. Somerville Mass.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 and 18.	
Sept. 3.	**Smokeless powder, Washington, D. C.**	**Aug. 11**
Sept. 3.	**Sewage pumping station, Boston, Mass.**	**July 7**
	Advertised, Eng. News, July 7 and 14.	
Sept. 5.	**Dredging, Waukegan, Ill.**	**Aug. 4**
	Advertised, Eng. News, Aug. 4 and 11.	
Sept. 5.	**Bridge, Dillon, Mont.**	**Aug. 4**
Sept. 5.	**Steel hull tugboat, Seattle, Wash.**	**Aug. 11**
Sept. 5.	**Construction materials, Ft. Delaware, Del.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 5.	Macadam road St Paul, Minn.	Aug. 18
Sept. 5.	Brick paving, Fremont, O.	Aug. 18
Sept. 5.	Brick paving, Glens Falls, N. Y.	Aug. 18
	Advertised, Eng. News, Aug. 18 and 25.	
Sept. 5.	Macadam road, St. Paul, Minn.	Aug. 18
Sept. 5.	Dynamo and engines, Dunning, Ill.	Aug. 18
Sept. 5.	Plans for market house, San Antonio, Tex.	Aug. 18
Sept. 6.	Improving road, Carthage, O.	Aug. 18
Sept. 6.	Street bonds, Hasbrouck Heights, N. J.	Aug. 18
Sept. 6.	Bridge, Chateau, Mont.	Aug. 18
Sept. 6.	Bridge, San Jose, Cal.	Aug. 18
Sept. 6.	Sewerage system, Billings, Mont.	Aug. 18
Sept. 6.	**Pumping station, etc., Winnipeg, Man.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to 25.	
Sept. 6.	**Wells, Winnipeg, Man.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to 25.	
Sept. 7.	**Bridge, Oroville, Cal.**	**Aug. 4**
Sept. 7.	Bridges (2), Pendleton, Ore.	Aug. 18
Sept. 7.	Brick paving, Cleveland, O.	Aug. 18
Sept. 7.	Heating and ventilation, So. Omaha, Neb.	Aug. 18
	Advertised, Eng. News, Aug. 18 and 25.	
Sept. 8.	Macadam paving, Shoals, Ind.	Aug. 18
Sept. 8.	**Bridge, Roseburg, Ore.**	**Aug. 4**
Sept 8.	**Dykes, Hudson River, N. Y.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 9.	**Rubber suctions, Charleston, S. C.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 9.	Sea walls, Baltimore, Md.	Aug. 18
	Advertised, Eng. News, Aug. 18 to Sept. 8.	
Sept. 10.	Improving road, Mansfield, O.	Aug. 18
Sept. 12.	Paving, etc., Toledo, O.	Aug. 18
Sept. 12.	**Water and sewer bonds, Mobile, Ala.**	**Aug. 11**
Sept. 12.	**Grading, paving, etc., Toledo, O.**	**Aug. 11**
Sept. 13.	**Capitol building, Helena, Mont.**	**July 28**
Sept. 13.	Brick sewer, etc., Kearney, N. J.	Aug. 18
	Advertised, Eng. News, Aug. 18 to Sept. 8.	
Sept. 13.	Repairing bridge, Mountain Home, Idaho.	Aug. 18
Sept. 14.	Hospital building, Los Angeles, Cal.	Aug. 18
Sept. 15.	**Enlarging court house, Lisbon, N. Dak.**	**July 28**
Sept. 15.	**Fire alarm system, Mobile, Ala.**	**Aug. 11**
	Advertised, Eng. News, Aug. 11 to Sept. 1.	
Sept. 19.	**Hospital plans, San Francisco, Cal.**	**Aug. 4**
Sept. 19.	Jail, Lovelocks, Nev.	Aug. 18
Sept. 19.	Bridge bonds, Los Angeles, Cal.	Aug. 18
Sept. 29.	Court house, Marietta, Ga.	Aug. 18
Oct. 1.	Arc lighting, Marshfield, Wis.	Aug. 18
Oct. 1.	**Monitors (4), Washington, D. C.**	**July 7**
Oct. 1.	**School building (equipment), St. Thomas, Ont.**	**July 7**
Oct. 5.	**Bridge superstructure, Chicago, Ill.**	**Aug. 11**
Oct. 24.	**Markets, etc., Belem, Brazil**	**Apr. 28**
Oct. 30.	**School building, Chehalis, Wash.**	**June 16**
Dec. 31.	**Plans for station, etc., Stockholm, Sweden.**	**June 23**
1899.		
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18

RAILWAYS.

ASHLAND & WOOSTER.—J. L. Eberhardt, Ch. Engr., Wooster, O., informs us that the surveys are completed, and the right of way obtained for the whole line, except from Apple Creek to Wooster and Austin, a distance of 12 miles. The total length of the completed line will be 50 miles, running from Ashland to Beach City, via Jeromeville, Austin, Millbrook, Wooster, Apple Creek and West Lebanon, O. The capital for construction has been secured. Contracts will not be let, but the company will do its own work. Grading is completed from Apple Creek east to West Lebanon, and steel laid for six miles, and the line is in operation for light traffic from Jeromeville to Austin and the junction with the Findlay, Fort Wayne & Western Ry. Pres., H. B. Camp, Akron, O.

BOOMER COAL & COKE.—Clifton Buxton, Ch. Engr., Ohio Central R. R., Toledo, O., informs us that if an extension is built to this company's new mines up Boomer's Branch, that it will simply be a siding about one mile in length.

DENVER & RIO GRANDE.—Orman & Crook, Contractors, Pueblo, Colo., inform us that they are now employing 400 men on the extension of this line from Leadville to the Ibex mining district, known as the Crysolite extension, 10 miles in length; and that it is expected to complete the work by Oct. 1.

GRAND MARAIS & NORTH SHORE.—Press reports state that R. W. Nichols, Surveyor of St. Louis county, Duluth, Minn., is making the surveys for this proposed line between Duluth and Port Arthur, Ont., via Grand Marais, Minn., a distance of 185 miles.

GULF, BEAUMONT & GREAT NORTHERN.—The charter of this company was filed and approved in Texas, Aug. 5; the capital stock to be $250,000, and the principal office at Beaumont, Tex. It is proposed to construct and operate a standard gage railway commencing at a point on the Gulf of Mexico, about one mile south of Sabine Pass, Tex., and run northwardly through the counties of Jefferson, Orange, Hardin, Tyler, Jasper, Newton, Sabine, St. Augustine, Angelina, Nacogdoches, Shelby, Panola, Rusk, Gregg, Harrison, Marion, Upshur, Camp, Cass, Morris, Titus, Franklin, Hopkins, Delta, Red River and Lamar to the city of Paris, a distance of about 350 miles. The incorporators are, Wm. A. Fletcher, Wm. Weiss, Wilbur S. Davidson, F. A. Holbig, Frank M. Aldridge, Wm. M. Wilson, Willard C. Averill, George C. Greer, Geo. R. Wansbrough, Mark Weiss, S. H. Van Warner, of Jefferson county; John H. Kirby, of Harris; W. T. Atkins and Sam A. McNeeley, of Marion.

HALIBURTON, WHITNEY & MATTAWA.—It is announced that an application will be made in October for the incorporation of this company, which proposes to construct a railway from Mattawa, Ont., to the Ottawa, Arnprior & Parry Sound Ry., at Whitney, and thence to Haliburton. Solicitors, Gordon & Sampson, Toronto, Ont.

HAYTI.—It is announced that the construction of the projected railway in Hayti within the next two months is assured. The government has granted to Cincinnatus Leconte, Minister of the Interior and Public Works, and Blanc Eusebe, the exclusive privilege of constructing the line, the concession to last for 60 years. The railway will be narrow gage, running from Cape Haytien to La Grande Riviere du Nord, a distance of about 18 miles to the northeast. It is said that contracts for supplying the material have not yet been let, and that it is to be bought wholly in the United States. Engr., H. Thomasseh.

MERCHANTS & MANUFACTURERS.—It is now proposed by some to make this projected railway in Detroit, Mich., an elevated system. The scheme as originally outlined was to construct a tunnel underneath Fort St. and Cadillac Square, between the Fort St. Union station and the Brush St. station, and at the same time to build a surface line between the two points along the streets near the river. Lewis Warfield, Ch. Engr., 54 Wall St., New York.

MEXICO.—Press reports state that J. P. Riverall, Gen. Mgr., Hidalgo Express Co., Mexico City, Mexico, has been granted a concession to construct a railway from Palo Herrado to San Andres, Tuxtla and side branches. The plans have been approved, and it is proposed to begin work at once. Purchases of the various kinds required will, it is said, be made in the United States, and F. E. Lee will superintend the construction of the line.

MISSOURI, KANSAS & TEXAS.—Press reports state that this company has contracted with Jones & Laughlins and the Pittsburg Locomotive & Car Works for locomotives, machinery, structural iron for bridges, steel rails, etc., valued at about $500,000. S. B. Fisher, Ch. Engr., St. Louis, Mo.

ONTARIO & RAINY RIVER.—Surveys are said to have commenced for this proposed railway from the western terminus of the Port Arthur, Duluth & Western Ry. along the north side of the boundary line. The Canadian government having granted a subsidy to the company, the construction of the line from Gunflint to Fort Frances will soon be constructed.

OREGON & MISSOURI.—Reports state that this company is about to be organized, with a capital stock of $100,000, to construct a railway from a point on the Kansas City, St. Joseph & Council Bluffs R. R. at Forest City, or Curzon Switch, to Oregon, and eventually to Fillmore, Mo., 17 miles. Irving H. Wheatcroft, Vice-Pres and Gen. Mgr. Colorado Valley Ry., Sweetwater, Tex., is said to be interested.

PHILADELPHIA & READING.—Reports state that this company will soon begin the construction of a new line at Shippensburg, Pa., on the Philadelphia, Harrisburg & Pittsburg R. R., to a connection with the Western Maryland R. R., a distance of about 1½ miles, thus doing away with the large and heavy grade the company now has to contend with to reach the Western Maryland tracks. The surveys for the new extension have been made, and bids have been asked for the construction of the road. It is also said to be the intention of the Reading and the Western Maryland Railway companies to build a large freight yard. H. K. Nichols, Ch. Engr., Philadelphia, Pa.——E. D. Smith & Co., contractors, of Philadelphia, have completed the work of filling in the trestle on this line at Yardley, Pa., which was 55 ft. high, and required the dumping of 37,764 carloads of earth.

RARITAN TERMINAL & TRANSPORTATION.—This company was incorporated in New Jersey Aug. 4, with a capital stock of $50,000, with $2,000 paid in. It is proposed to construct and operate a railway in Perth Amboy, N. J. The incorporators are, Adolph Lewisohn and Jesse Lewisohn, New York; Jas. C. McCoy and W. E. Tobey, Perth Amboy; Joseph Rechert, Hoboken, N. J.; Sidney Riddlestorffer, Upper Montclair, N. J.; Edgar Buffum, Newark, N. J. Principal office, 258 Smith St., Perth Amboy, N. J.

ROCHESTER & SODUS BAY.—This company was incorporated in New York, Aug. 15, with a capital stock of $1,000,000, to build and operate a 45-mile railway from the United States government pier at Sodus Point to Rochester, N. Y. The directors are, Walter B. Duffy, Thomas J. Nicoll, John C. Woodbury, Daniel B. Pratt, George Wilder, Nathaniel Foote, A. Masters McDonald, Joseph C. Tone, Ira M. Laddington, George Wilson, Charles Van Voorhis, of Rochester; John A. Sullivan, of New York. The stock is taken principally by Wayne and Monroe county residents.

TITUSVILLE, CAMBRIDGE & LAKE ERIE. — A. H. Steele, Pres., 43 Cedar St., New York, informs us that no contracts have yet been awarded for the construction of a 30-mile extension of this railway, as stated in our last issue. Estimates, however, are now being made for the extension referred to.

UNION, CORNUCOPIA & EASTERN.—Bids are being received for the construction of this proposed railway from Union, Ore., to the Seven Devils mines, Idaho, 122 miles, including the building of a number of bridges, etc. The line, which will be standard gage, will be laid with 70-lb. rails, and five Howe truss bridges will have to be built. Grading has already been commenced on the Union, Cove & Valley Branch line between Union and Cove, a distance of 12 miles. Materials and equipment are now being purchased for this branch, which is expected to be in operation by Jan. 1. G. E. Howe, Ch. Engr.; Joseph Johnson, Supt. of Construction, both of Union, Ore.

STREET AND ELECTRIC RAILWAYS.

NASHUA, N. H.—The Nashua St. Ry. Co. was granted a franchise Aug. 9 to extend its lines from the present terminal on Main St. to the Massachusetts state line at Tyngsboro, the gage of said track to be 56½ ins., and the motive power electricity. Pres., John A. Fisher; Gen. Mgr., P. F. Sullivan.

PORTSMOUTH, N. H.—W. H. Moore, of Portsmouth, informs us that the bids are all in for the construction of the Portsmouth & Dover R. R., from Portsmouth through Newcastle and Rye, six miles, but that the contract has not yet ben awarded. Pres., Frank Jones, Portsmouth, N. H.

DEDHAM, MASS.—The selectmen of Dedham have granted a franchise to the Norfolk Western St. Ry. Co. to place its tracks on High St. in this town, and the road must be completed by Nov. 1 or $5,000 be forfeited to the town. This line is projected to run from Medfield to Dedham, via Wellesley, Needham and Watertown, thus connecting the outlying towns of Norfolk county with the county seat in Dedham.

MILFORD, MASS.—A petition has been filed with the selectmen by Charles W. Shippee for the construction of an electric street railway connecting Milford with Hopkinton. The line asked for begins on Cedar St., Hopkinton town line, thence through Cedar to Dilla, Purchase, Pearl, Main and Franklin Sts. The petition is signed by Joseph G. Ray, Edgar K. Ray, Geo. W. Wiggin, W. S. Reed, Edward H. Rathburn, Orestus T. Doe. A hearing on the petition will be given on Sept. 1. It is the intention of the company to extend the railway from Hopkinton to Westboro via Woodville, and later to build to Woonsocket and Attleboro, thus making a continuous line of about 40 miles length. A location has already been asked for in Bellingham, and it is probable that an arrangement will be made with the Milford, Holliston & Framingham St. Ry. Co. whereby the latter's line will be used from Caryville to Milford.

EAST WINDSOR, CONN.—The East Windsor R. R. Co. has obtained a charter from the state legislature to build an electric line from the terminus of the Hartford St. Ry. at East Windsor to a connection with the Enfield, Long Meadow and Springfield line at Warehouse Point. S. D. Rockwell, of Warehouse Point, Conn., is one of the directors; Pres., Charles Woodward.

BROOKLYN, N. Y.—It is reported that the 5th Ave. and Lexington Ave. lines of the Brooklyn Elevated R. R. Co. will have their motive power changed to the Sprague electric system at an estimated cost of $800,000.

FALLSBURG, N. Y.—We are informed that Wheeler & Boody, Bowling Green Bldg., New York, have recently been awarded the contract for the construction of about 23 miles of electric railway for the Fallsburg & Monticello R. R. Co. Pres., B. Van Steenbergh, 53 Broadway, New York.

NEW HARTFORD, N. Y.—The citizens of New Hartford, Claysville and Paris have declared their sentiment at public hearings to be in favor of the proposition to grant franchises to the Sauquoit Valley Electric St. R. R. Co. for the construction of a line through these places. Pres., A. P. Seaton.

NEW YORK, N. Y.—The state railroad commission, Aug. 11, approved the application of the Metropolitan St. Ry. Co., of New York, for permission to increase its capital stock from $30,000,000 to $45,000,000. It was also announced to-day that the board had granted 18 applications of the company for leave to change its motive power on its various lines, which, with the permits granted last week to the lines of the Third Ave. R. R. Co., embraces the fulfilment of the projected new system of surface railways in the Borough of Manhattan.

SCHENECTADY, N. Y.—Press reports state that the General Electric Co. has purchased the plants of the Schenectady St. Car Co. and the Schenectady Illuminating Co., and will hereafter operate both plants with its own power, soon to be obtained from the Hudson River at Mechanicsville. The street car lines will probably be greatly improved and extended.

SOLVAY, N. Y.—The village trustees have granted a franchise to the Syracuse, Skaneateles & Moravia R. R. Co. to construct and operate a double track electric railway through this village. Pres., Wing T. Parker, Moravia, N. Y.

ELIZABETH, N. J.—The Union county board of freehodlers, Aug. 16, awarded the franchise for the construction of an electric railway between Elizabeth and Plainfield, 12 miles, to John Kean, representing the Elizabeth City Horse R. R. Co. As stated in our last issue, the company's bid was $250,000. The proposed railway will be built parallel to the Central R. R. of New Jersey on a new boulevard to be made by widening the present road from 66 ft. to 100 ft. The money paid for the franchise is expected to be used in building the boulevard. Plans and estimates for the work have been prepared by F. J. Hubbard, of Plainfield, and J. L. Bauer, Elizabeth.

WEEHAWKEN, N. J.—It is reported that the New Jersey Elevating & Transfer Co. has begun the construction of a new inclined railway from 19th St. in Weehawken to Weehawken St. and Mountain Road in West Hoboken, to be used by vehicles and pedestrians. The contract, it is stated, has not yet been let for the structural steel, nor is it definitely decided whether the motive power will be steam or electricity. The grade will be 72 ft. in 100 ft. Thos. H. McCann, Supt. of Construction, Hoboken, N. J.

BALTIMORE, MD.—It is reported that the David E. Evans Co. has been awarded the contract for the extension of the Baltimore Consolidated Ry., running south on Bond St., from Pratt to Gough St.

RICHMOND, KY.—Reports state that the Richmond, Nicholasville, Irvine & Beattyville R. R. will be put up for sale for the second time on Sept. 6, through the failure of Adolph Segal, of Philadelphia, to make his purchase good by July 23. The upset price will again be $160,000. Receiver, John McLeod.

EATON, O.—Chas. S. Parkhurst, P. O. Box 575, Anderson, Ind., informs us that the survey has been completed and the right of way is now being obtained for the proposed electric railway which the Western Ohio Traction Co. contemplates building from Eaton to Gratis, and thence to Jacksonboro and Middletown, O., a distance of 22 miles. As soon as the right of way is obtained it is expected to issue bonds for construction purposes. The Patton electric motor system will be used. The promotors of the line are Mr. Parkhurst and Walter W. Brandon, of Anderson.

SANDUSKY, O.—Chas. H. Stewart, Secy. Sandusky & Interurban Ry. Co., Cleveland, O., informs us that the right of way has been obtained and the capital secured for this proposed line from Sandusky to Lorain, via Huron and Vermillion, but that contracts for construction work will not be let until next year. Pres., H. A. Everett, Cleveland, O.; Ch. Engr., Thomas Wood, Sandusky.

DUNKIRK, IND.—The Dunkirk & Redkey Traction Co. was incorporated Aug. 12, with a capital stock of $75,000, to construct a line from Dunkirk to Redkey, Jay county. The incorporators are, H. C. Billingsley, Charles A. Hasbrouck, Elmer Bishop and W. H. Kewser.

DETROIT, MICH.—The Detroit, Utica & Rome Ry. Co. has been organized with capital stock of $300,000, to build an electric railway connecting the towns mentioned, a distance of 34 miles. It is hoped to have the line in full operation by January. The directors are, Alexander McVittie, Frank E. Kirby, Frank D. Andrus and Elliott G. Stevenson, of Detroit; Geo. B. Davis, of Utica, and Marvin I. Brabb, of Romeo.

ESCANABA, MICH.—The Escanaba Electric Ry. Co. has been reorganized and officers elected as follows: Pres. and Mgr., A. R. Moore; Vice-Pres., O. B. Fuller; Secy., I. C. Jennings; Treas., Edward Erickson. It is said that the line will be put into good condition, and inside of 90 days connection will be made at Wells with the Soo line. Aditional cars will be purchased and sheds built. Parks and resorts will be made along the Escanaba River, and it is expected that the road will later on be extended to Gladstone.

NORTHVILLE, MICH.—The township board at this place, Aug. 10, granted a franchise to the Detroit, Plymouth & Northville Electric R. R. Co. to construct its line through Northville.

SAGINAW, MICH.—It is reported that the receivers of the street railway have been authorized to issue $33,000 worth of additional certificates to be used in paying city taxes and building the track on South Michigan Ave.

EAST ST. LOUIS, ILL.—William Ortgier, of East St. Louis, one of the incorporators of the East St. Louis & Collinsville Electric Ry. Co., informs us that his company has sold the right of way which it owned to the Mississippi Valley Electric Ry. Co., of St. Louis, Mo., and of which J. H. Mehling is the president. The new company, it is said, will proceed at once to build two lines, one from East St. Louis to Edwardsville, via Collinsville and Glen Carbon, and the other from East St. Louis to Edwardsville via Brooklyn, Venice, Madison, Granite City and Alton.

QUINCY, ILL.—Press reports state that the entire electric street railway system was sold Aug. 5 to a Maine syndicate, represented by W. B. McKinley, of Chicago, and which controls the street car systems and the electric light plants in Joliet, Bay City, Champaign, Springfield, O.; Trenton, Mo., and other cities. The consideration was about $220,000. It is said that the syndicate will at once spend $100,000 for extensions and rolling stock.

MILWAUKEE, WIS.—The contracts for the construction of a new power house for the Milwaukee Electric Ry. Co. were awarded Aug. 3, as stated under Buildings; estimated cost, $600,000. It is said that the plant will be supplied with five 1,600-HP. engines, made by E. P. Allis & Co., and five boilers from the Edgemoor Iron Co.

SAN ANTONIO, TEX.—John H. Clark, of this city, was appointed receiver of the West End St. Ry. Co., by Judge Camp, Aug. 8, on application of the bondholders.

WHITTIER, CAL.—An ordinance has been passed granting a franchise to A. B. Patton to construct a cable or electric railway in this city.

ELECTRIC LIGHT AND POWER.

MONTPELIER, VT.—We are informed that bids for constructing the power plant at North Duxbury or Bolton Falls for the Consolidated Lighting Co. of Montpelier will soon be received. The company expects to light about half a dozen villages, and to lease power for electric railways and other purposes. The plans and specifications are about ready. Des. Engr., H. W. Allen, Manchester, N. H.; C. P. Pitkit, Montpelier, is in charge of the work.

FRAMINGHAM, MASS.—Frank E. Henning, Town Clk., writes us that nothing will be done at present in regard to the proposed electric light plant.

PITTSFIELD, MASS.—Wm. Dodson, W. R. Hunnewell and J. W. Mason have been appointed a committee to consider the advisability of lighting the streets by electricity.

MYSTIC, CONN.—Bids will be asked about Sept. 1 for constructing a plant to cost about $25,000 for the Mystic Electric Light & Gas Co. We are informed that the plant will have arc and incandescent lights, 150-HP. steam plant with engine, and 15,000 light alternator, line, poles, etc. No contracts have been let yet. The plant will light Mystic and Stonington. Thos. C. Perkins, Gen. Mgr. and Des. Engr., Danforth, Conn.

HYDE PARK, N. Y.—Fred. W. Vanderbilt has authorized Owen Morris, Engr., Hyde Park-on-the-Hudson, to prepare plans for a stone masonry dam across the Crum Elbow Creek for a 6,000,000-gallon storage reservoir for electric and water power purposes on the estate.

BERLIN, PA.—G. B. Hough, of the Berlin Electric Light Co., writes us that the proposed plant will be put in operation about Sept. 1. The plant will have a 75-HP. Westinghouse engine, 750-light Westinghouse dynamo, 20 arc light Brush dynamo, 75-HP. Erie boiler, etc., to cost $5,000.

NEWPORT NEWS, VA.—The Newport News & Old Point Ry. & Electric Co. has applied for a franchise to Jan. 1, 1949. W. J. Payne, Pres. Newport News Gas Co., is interested. Mayor, A. A. Moss.

CHARLESTON, S. C.—The following bids were received Aug. 1 for installing a plant at Battery Jasper, Sullivan's Island, S. C., by Maj. H. C. Ruffner, U. S. Engr., Charleston, S. C.: General Electric Co., Schenectady, N. Y., $5,700; New York Finance & Construction Co., 141 Broadway, New York, $6,698; N. J. Foundry & Machinery Co., Jersey City, N. J., $5,632. Bidders specification, $5,542.

ELLISVILLE, MISS.—J. F. Parker, Mayor, writes us that no organized effort has been made to put in a plant.

NEW ORLEANS, LA.—An ordinance has been introduced calling for bids by the City Clerk until Jan. 2 for lighting the city with electricity, gas or oil; bond, $50,000.

DICKSON, TENN.—The Business Men's League is reported as considering the question of lighting the town by electricity.

FRANKLIN, KY.—The question of building a plant here is again being considered, according to reports.

LEXINGTON, KY.—The Triumph Electric Co., 859 Hathaway St., Cincinnati, O., has been awarded the contract for furnishing the asylum in this city with a plant. Prof. Paul Anderson may be addressed.

SOUTH CHARLESTON, O.—Wm. Cherry, Mayor, writes us that nothing definite has yet been done in regard to the proposed plant, reported in our issue of last week.

KOKOMO, IND.—Press reports state that applications for receiver for the Citizens' Electric Light & Power Co. of this place were filed Aug. 12, with claims aggregating $12,800, by the American Savings Bank, of Grand Rapids, Mich., the Capital City National Bank, and by Joseph L. Cohn, of Indianapolis. The corporation is capitalized at $40,000.

EATON RAPIDS, MICH.—Bids are asked until Aug. 20 for furnishing and putting in a water power plant in this place for A. R. Welch, of Chelsea, Mich. The plant will have 60 2,000-c. p. and 1,000 16-c. p. lights. It is proposed to install a direct-current 220-volt machine. Mr. Welch wishes samples of enclosed arc lamps. He will be in the market for everything except water wheels.

GRAND RAPIDS, MICH.—It is reported that the Consolidated Water Power Co. has decided to build a dam on the Wisconsin River. It will have a 30-ft. head; will furnish 12,000 HP. and will cost about $30,000. Engr., T. W. Orbison, Appleton, Wis.

JONESVILLE, MICH.—C. F. Wade, Pres., writes us that a committee is preparing a report on the advisability of putting in a plant. The report will soon be submitted.

MOUNT PLEASANT, MICH.—Chas. M. Brooks, Mayor, writes us that the question of building a plant in connection with the improvements to the water-works is being considered. The complete improvements will cost about $28,500. Population, 4,000.

SAULT STE. MARIE, MICH.—The American Lake Superior Power Co. has been granted a franchise, according to reports. Work on the plant, which will cost about $2,000,000, will be begun in a few weeks. The bids were received July 1, and the contract will be let at once. Ch. Engr., H. von Schon.

CHICAGO, ILL.—The Chicago Edison Electric Light Co. has completed the absorption of the following companies, according to reports: The Hyde Park Thomson-Houston Light Co., Hyde Park Electric Light & Power Co., People's Light & Power Co. (Hyde Park), People's Electric Light & Motor Power Co. (town of Lake), Mutual Electric Light & Power Co. (Hyde Park), Englewood Electric Light Co., West Chicago Light & Power Co., Western Light & Power Co. (Lakeview), Edgewater Electric Light & Power Co., Chicago Sectional Electric Light Underground Co., and Commonwealth Electric Light Co. The only electric light company not included in the deal is the Cosmopolitan Company. While it has a franchise and some wires laid, it has not yet got a plant. Arrangements have been made with a local syndicate to take $2,500,000 of first mortgage bonds to be issued by the Commonwealth Company under the terms of the trust deed to the Northern Trust Company. Of the money to be obtained by the sale of these bonds, which were disposed of at par, $2,000,000 is to go to pay for the first nine companies given in the above list. Of the $500,000 remaining $350,000 is to be used in construction work and $150,000 to pay off the old indebtedness of the Commonwealth Company.

MATTOON, ILL.—The Mattoon Light, Heat & Power Co. has been granted a 20-year franchise by the council and will at once begin building a plant. From the new plant power for fulfillment of the terms of the Somerville & Marks electric light contracts will be furnished, and the company also intends to furnish steam heat in the central district of the city. J. F. Marks, secretary and treasurer, writes us that the Mattoon Heat, Light & Power Co. has purchased a hot-water heating plant. The plants are owned by Somerville & Marks, who have incorporated the above company.

ROCK ISLAND, ILL.—Bids are asked until Aug. 27 for extending the wing dam of the water power pool for about 10,000 ft., etc. Capt. S. E. Blunt, U. S. A., Rock Island.

MARSHFIELD, WIS.—Bids are asked until Oct. 1 for lighting the city with 28 2,000-c. p. lights for terms of five and ten years. Population, 6,000. Henry Horn, Mayor; J. A. Thomas, Cy. Clk.

NEW PAYNESVILLE, MINN.—M. S. Elliott, Recdr., writes us that W. I. Gray & Co., 703 Sykes Block, Minneapolis, have been awarded the contract at $9,144 for building the plant and water-works. P. C. Pilon, Pres.

WINNEBAGO CITY, MINN.—A. C. Drew, Pres. Council, writes us that the matter of a plant will be taken up very soon.

ABILENE, KAN.—Bids are asked until Sept. 1 for furnishing and installing a plant about three miles from here for Jacob Brower & Co. The plant, which will be operated by water power, will have a capacity for 25 2,000-c. p. arc and 1,000 16-c. p. incandescent lights. Work will be begun soon as possible after Sept. 1. Correspondence is solicited.

NATIONAL MILITARY HOME, KAN.—Bids are asked until Aug. 24 for extending the plant at the western branch of the National Home for Disabled Volunteer Soldiers, according to reports. W. B. Shockley.

PLEASANTON, KAN.—The question of building a plant is being considered, according to reports.

WELLINGTON, KAN.—The council is considering the question of erecting a plant in connection with the proposed water-works, the two to cost about $125,000.

REDLANDS, CAL.—The certificate of the increase of the capital stock of the Redlands Electric Light & Power Co. was filed in San Bernardino Aug. 4 by W. J. Curtis, attorney for the company. The increase is from $200,000 to $500,000, and is made in order to extend the scope of the company's operations, improve the plant, circuit lines, property, etc. Directors, H. H. Sinclair, Chn.; F. G. Feraud, Secy.; J. F. Drake, J. H. Fisher and George B. Ellis.

SAN JOSE, CAL.—The mayor has recommended that a municipal plant be built at a cost of about $40,000.

SHERBROOKE, QUE.—Councilmen Olivier, Le Baron, Cate and Guay have been appointed a committee to consider the advisability of building a municipal plant.

HAMILTON, ONT.—S. H. Kent, Acting City Clerk, writes us that an engineer (Percy Domville, Hamilton,) has been appointed to report on the cost of a municipal plant. The present contract, which is said to be for 384 2,000-c. p. arc lights expires in 1900.

LUNENBURG, N. S.—It is stated that the Lunenburg Gas Co. has decided to install a plant on Mush-a-Mush River at the head of Mahone Bay, for the purpose of supplying Mahone and Lunenburg with an all-night electric service.

BUENOS AYRES, ARGENTINE.—Press reports state that machinery is being purchased for new plants in various cities of this country. The specifications call for American machinery. Carlos Bright, Civil Engr., Buenos Ayres, may be addressed.

NEW COMPANIES.—Mason Electric Light Co., Mason, Tex.; $5,500; L. Guggenheim, V. M. Loring, John Lemberg, Otto Donoh, Richard Grosse.

Berlin Electric Light Co., Berlin, Pa.; $4,000, with $400 paid in; W. S. Matthews, Berlin; J. A. Berkey, G. B. Haugh, J. M. Bricker, H. F. Barron, Somerset.

Mexico City Light, Heat & Power Co., New York; $5,000,000, with $150 paid in; Henry C. Bush, 32 Pine St., New York; Frank Johnston, Wm. C. Foster, Frederick Giblin, New York.

Lansdowne Electric Light Co., Lansdowne, Pa.; Tamany P. Street, Henry C. Staatzell, Richardson Shoemaker, J. Milton Lutz, Muntha J. Kelly.

BRIDGES.

RUMFORD FALLS, ME.—The selectmen have awarded a contract to the New Columbus Bridge Co., Columbus, O., at $9,700, for constructing a 198-ft. single span bridge across the Androscoggin River.

NORTHFIELD, MASS.—The following bids were received by the county commissioners July 30 for constructing the superstructure of a bridge over the Connecticut River. Engrs., Edward S. Shaw, 12 Pearl St., Boston, and Clapp & Abercombie, Ponds Block, Greenfield, Mass.:

	With wooden stringers.	With steel stringers.	Abutment piers.
Berlin Iron Bridge Co.	$28,791	$30 800	....
Boston Bridge Works, Boston	25,200	26,800	$2,500
Edge Moore Bridge Co.	29,500	32,000	1,620
New England Structural Co.	23,980	25,713	....
King Bridge Co., Cleveland	26,300	28,875	2,685
N. J. Steel & Iron Co., Trenton*	23,255	24,817	....
Pennsylvania Steel Co	30,407	32,913	....
Pittsburg Bridge Co	29,600	30,791	2,325
Massillon Bridge Co	25,272	27,275	1,800
Wrought Iron Bridge Co.	29,900	32,200	....
Vermont Const'n Co., St. Albans	24,000	25,200	2,680
Youngstown Bridge Co	27,400	29,900	2,400
Groton Bridge & Mfg. Co	26,500	28,000	2,400
Canton Bridge Co., Canton, O.	....	27,587	....
Elmira Bridge Co., Elmira, N. Y.	25,120	27,089	....
Horseheads (N.Y.) Bridge Co.	26,300	27,500	....
Toledo Bridge Co., Toledo, O.	27,300	29,300	....
Variety Iron Works Co	27,000	28,500	....
L. F. Kittredge & Son, Lowell	....	....	2,350
Flint Granite Co., Monson, Mass.	....	....	3,500
H. C. Wood, Westfield, Mass.	....	....	1,948

*Awarded contract.

NEW YORK, N. Y.—John C. Rodgers has been awarded a contract, at $1,036,192, for the construction of the Willis Ave. bridge, over the Harlem River at 1st Ave. The itemized bids were in our issue of Sept. 23, 1897. Jno. L. Shea, Comr. Bridges, Stewart Bldg.

OWEGO, N. Y.—The town board has appropriated $2,500 for the construction of two bridges.

LANDENBURG, PA.—A contract has been awarded by the county commissioners to the Schuylkill Bridge Co., Phoenixville, Pa., at $1,785, for constructing a 76-ft. iron bridge over White Clay Creek.

NEWPORT NEWS, VA.—The committee has submitted a report to the council, recommending that bids be asked for furnishing plans and for constructing two bridges, one at 34th St. and one at 25th St.

CHILLICOTHE, O.—The county commissioners have awarded a contract to the King Bridge Co., Cleveland, O., at $11,500, for the superstructure of the Main St. bridge; also to the Iron Substructure Co., Columbus, O., at $1,295, for the Deer Creek bridge.

LORAIN, O.—The county commissioners, Elyria, O., have engaged F. C. Osborn, Cleveland, O., to prepare specifications for the construction of a 120-ft. span bridge at Erie Ave. Bids will soon be asked.

TIFFIN, O.—Bids are asked until Aug. 20 for building a bridge in Pleasant township. Address the county auditor.

GRAND RAPIDS, MICH.—The Toledo Bridge Co., Toledo, O., has been awarded a contract, at $8,600, for constructing two bridges, 550 and 250 ft. long respectively, on the Muskegon and North Muskegon roads.

ONTONAGON, MICH.—Bids are asked until 10 a. m., Aug. 19, for constructing an iron bridge across the Iron River, in Carp Lake township. W. N. Cunningham, Highway Comr.

CHICAGO, ILL.—Press reports state that the engineering department has prepared plans and estimates for replacing a number of bridges along the river with bascule structures, to cost about $5,000,000. Bonds will be issued.——Scherzer Rolling Lift Bridge Co., Monadnock Block, Chicago, has been awarded a contract, at $369,140, for constructing the Campbell Ave. bridge, according to reports.

PARK FALLS, WIS.—Bids are asked by the city clerk until 2 p. m., Aug. 18, for constructing a wooden and iron bridge over the Flambeau River. W. F. Turner, Chn.

CHOTEAU, MONT.—Bids are asked until Sept. 6 for constructing a steel or iron bridge over the Marias River. A. C. Warner, County Clk.

ST. JOSEPH, MO.—Bids will soon be asked by the council for the construction of the South 6th St. viaduct, according to reports.

PUEBLO, COLO.—New bids will be asked for constructing the First St. bridge. Mayor Orman may be addressed.

PENDLETON, ORE.—Bids are asked until Sept. 7 for constructing two bridges. B. S. Borroughs, County Clk.

CHEHALIS, WASH.—Bids are asked until Aug. 20 for constructing three bridges over the Chehalis River, to cost about $15,000. Allen P. Schooley, County Audr.

CHEHALIS, WASH.—Reports state that a contract has been awarded to the Columbia Bridge Co., Portland, Ore., for constructing a steel bridge at Gray's Harbor, to cost about $9,000.

NEVADA CITY, CAL.—County Supervisor Buffington has been authorized to prepare plans for a bridge over Greenhorn Creek.

LOS ANGELES, CAL.—Bids are asked until Sept. 19 for the purchase of $23,000 of 4% bridge bonds. C. H. Hance, Cy. Clk.

SAN JOSE, CAL.—Bids are asked by the county clerk until Sept. 6 for constructing a bridge over Stevens Creek.

STOCKTON, CAL.—D. Tumelty & Son have been awarded a $3,587 contract by the county supervisors, for constructing a steel bridge across Mokelume River.

MOUNTAIN HOME, IDAHO.—Bids are asked until Sept. 15 for moving and repairing the birdge over South Boise River, at Pine Grove. W. H. Manion, County Clk.

ARNPRIOR, ONT.—Bids are asked until Aug. 30 for constructing an iron bridge over the Madawaska River. Frank A. Hibbard, Engr., Ottawa, Ont.; Sam. Kedey, Chn. Com.

ST. JOHN, N. B.—Bids are asked until Aug. 20 for painting the cantilever bridge and western trestle. T. B. Robinson, Secy. St. John Bridge & Ry. Extension Co., 103 Prince William St.

BUILDINGS.

BOSTON, MASS.—Bids are asked by the city school committee, Mason St., until Aug. 22, for erecting a high-school building at South Boston; bond required, $30,000. Arch., Herbert D. Hale, 13 Exchange St.

BRIDGEPORT, CONN.—Plans are asked until about Jan. 1 for the new city hall building, to cost about $150,000. Dr. C. Lincoln Banks, Chn. Com.

BUFFALO, N. Y.—Bids are asked by the department of public works until Aug. 25 for the installation of a ventilating plant for the chemical laboratory at the Masten Park High School; also until Aug. 31 for the erection of a brick lavatory at School No. 35, etc.——Bids are asked by the park commissioners until Aug. 26 for the construction of a series of propagating houses in Delaware Park.

ELLIS ISLAND, N. Y.—The contract for erecting the five buildings on Ellis Island, in New York Harbor, for the new immigrant station, has been awarded to R. H. Hood & Co., St. Paul Bldg., 220 Broadway, New York, on slightly revised plans, at $419,298. The full list of bids received by the supervising architect on July 30 was published in our issue of Aug. 4.

NEW YORK, N. Y.—Bids are asked by the department of public buildings, lighting and supplies, at 346 Broadway, until Aug. 23, for erecting two Otis hydraulic passenger elevators in the brownstone building, City Hall Park, and for the construction and erection of wrought iron balcony, with stairs leading to same, and for new bookcases in the room known as the Library of the Supreme Court, in the County Court-House in City Hall Park, Borough of Manhattan.——Bids are asked by the department of health, at Criminal Court Bldg., until Aug. 24, for alterations to the disinfecting depot, foot of East 16th St.——Plans have been filed by Lorenz F. J. Weiher, Jr., Owner and Architect, 125th St. and Park Ave., for three 5-story brick flat buildings at Brook and Elton Aves., to cost $50,000; by Henriette K. White, 208 West 118th St., for a 10-story brick flat and store building at 80th St. and Columbus Ave., to cost $235,000. Arch., Henry F. Cook, 111 5th Ave.; by Neil Hansen, 647 Amsterdam Ave., for three 5-story brick flat and store buildings at Amsterdam Ave. and 147th St., to cost $60,000. Archs., Angell & Higginson, 108 Fulton St.; by J. W. Simpson, 34 West 20th St., for a 4-story brick and stone dwelling on 5th Ave., near 74th St., to cost $50,000, and for an adjacent building to cost $45,000. Arch., C. P. H. Gilbert, 1123 Broadway.——The contract for erecting the masonry of the new building for the St. Jerome Roman Catholic Church, at 137th St. and Alexander Ave., is said to have been let to Henry McNally, 287 4th Ave., and for the carpentry contract, to William Burns, 287 4th Ave.; estimated cost, $80,000. Archs., Delhi & Howard, 1193 Broadway.——D. C. Weeks & Son, 289 4th Ave., have the general contract for erecting a 12-story store and office building at 110 to 116 Nassau St., for Levi P. Morton. Archs., Clinton & Russell, 32 Nassau St.

OGDENSBURG, N. Y.—The following bids were received by the supervising architect, Washington, D. C., Aug. 9, for the removal of the old heating and ventilating apparatus, and for installing a new heating and ventilating apparatus in the U. S. building at Ogdensburg:

		Time.
Blake & Williams, New York	$5,281	Oct. 1
Edward Joy, Syracuse, N. Y.	5,950	2 mos.
Edward P. Bates, Syracuse, N. Y.	4,835	Oct. 1
Chas. Lavies, Ogdensburg	4,806	"
E. Rutzler, New York	5,291	"

ORIENT POINT, N. Y.—The following bids were received by Lt.-Col. D. P. Heap, U. S. Engrs., Tompkinsville (S. I.), N. Y., Aug. 11, for furnishing the material for and erecting the Orient Point light station, as advertised in Engineering News:

Allentown Rolling Mills, Allentown, Pa.	$9,912
Atlanta Machine Works, Atlanta, Ga.	10,380
Chamblin & Scott, Richmond, Va.	10,566
John P. McGuire, 51 Scranton Ave., Cleveland, O.	10,800
Tacony Iron & Metal Co., Philadelphia, Pa.	13,500
Russel Wheel & Foundry Co., Detroit, Mich.	13,970
M. H. Treadwell & Co., 120 Liberty St., New York.	14,434
Chas. L. Rowland, 102-114 Greene St., Brooklyn, N.Y	15,750

ROCHESTER, N. Y.—A. W. Van Alstyne has been awarded the contract for the carpentry work at School No. 19, at $9,885.

HAMILTON, N. J.—Bids are asked by the board of education until Aug. 18 at 3 p. m., for erecting a 4-room brick school building; deposit required, $500. Pres., John Sykes, 111 East State St. Arch., W. A. Poland, 11 West State St., both of Trenton, N. J.

WEST HOBOKEN, N. J.—A brick, stone and iron addition to the Hudson County Savings Institution will soon be erected on Spring St., at a cost of about $35,000. Arch., Herman Kreitler, 62 Broad St., New oYrk.

CORRY, PA.—J. A. Nixon, of Titusville, Pa., has been awarded the contract for erecting the high school building, at $21,555. Archs., McCollum & Ely, Washington, Pa.

GLENSHAW, PA.—Bids are asked by the directors of Shaler township until Aug. 20 for the erection of a second-story to the school building at Glenshaw. Secy., Jacob Ochsenhirt.

PACKERTON, PA.—Bids are asked, according to reports, for the erection of a 2-story brick and iron storehouse, 73 × 301 ft., for the Lehigh Valley R. R. Co. C. E. Webster, Ch. Engr., South Bethlehem, Pa.

WASHINGTON, PA.—Bids are asked by the town council of this borough until Aug. 22 for the removal of the buildings within the lines of Brownson Ave. Secy., J. N. White.

WILMINGTON, DEL.—Bids are asked until Aug. 29, extension of time from Aug. 8, for the erection of a new high school building on Delaware Ave. William Turner, Chn. Bldg. Com.

LAUREL, MD.—Jas. T. Loveless, Washington, D. C., was awarded the contract, Aug. 10, for the construction of the new high-school building, complete, at $8,345.

WASHINGTON, D. C.—Dr. G. F. Whiting will build at once an office building at No. 1331 F St., N. W. Arch., W. M. Poindexter, 806 17th St., N. W.——J. M. Dunn has been awarded the contract for constructing an addition to the station house on 5th St., N. W., at $4,649.

PETERSBURG, VA.—The Pittsburg Heating Supply Co. was the lowest bidder, Aug. 15, on the installation of a heating apparatus in the U. S. building in this city, at $1,104; time, 40 days.

MARIETTA, GA.—Bids are asked until Aug. 20 for the erection of a new Methodist Church building. T. M. Brumby, Chn. Com.; Hayden & Wheeler, Archs., Equitable Bldg., Atlanta, Ga.——Bids are asked until Sept. 29 for a 3-story brick and marble court house, 60 × 80 ft., for Cobb county. Archs., Golucke & Stewart, 24½ Whitehall St., Atlanta.

NEW ORLEANS, LA.—A fire in this city, Aug. 10, destroyed the Osborne Turkish baths, on Bourbon St., and several adjacent buildings; reported loss, $200,000.

KNOXVILLE, TENN.—The following bids were received by the supervising architect Aug. 11 for removing old and constructing new heating apparatus for the U. S. building at Knoxville: E. Rutzler, New York, $6,144, time, Oct. 1; Pittsburg Heating Supply Co., Pittsburg, Pa., $5,396, Sept. 30; Blake & Williams, New York, $6,436, Oct. 1; Chafer & Becker, Cleveland, O., $5,382, 4 mos.

LEXINGTON, KY.—Bids are asked until Sept. 1 for the installation of the lighting, heating and ventilating plants for the court house of Fayette county, as stated in our advertising columns. Address Judge Frank Bullock, Lexington; Arch., F. Paul Anderson, State College of Kentucky, Lexington.

MARION, O.—Bids are asked until Aug. 22 for erecting a 4-room brick school building. Frank E. White, Clk. Bd. of Education; Sloan & Ault, Archs.

TOLEDO, O.—M. Rabbet, of Toledo, has been awarded the contract for erecting the new county jail building, except jail iron work, at $56,673.

WARREN, O.—Bids are asked until Aug. 25 for remodeling the city hall, according to plans on file with the city engineer. A. E. Andrews, Cy. Clk.

CHICAGO, ILL.—Bids are asked by the board of education until Aug. 19 for laying cement floors in sundry school buildings; also until Aug. 26 for erecting a school building on Oakley Ave., between Division St. and Potomac Ave., and for improvements to other school buildings.

DANVILLE, ILL.—Bids are asked until Aug. 25 for the erection of a coal house at the Danville branch of the National Home for Disabled Volunteer Soldiers. Address W. C. Gunnell, C. E., Post Office Bldg., Danville.

DUNNING, ILL.—Bids are asked by the commissioners of Cook county until Sept. 5 for the labor and material for a dynamo and engine at the county poor house. E. D. Northam, Supt. of Pub. Service.

DES MOINES, IA.—Bids are asked until Sept. 1 for erecting a 2-story brick block, 67 × 133 ft., on West 7th and Locust Sts., for Mrs. C. S. Worse. Archs., Proudfoot & Bird.

FOREST CITY, IA.—Bids are asked until Aug. 22 for a brick public library building. Secy., F. J. Ward, Forest City.

CROOKSTON, MINN.—Bids are asked until Aug. 25 for erecting a 3-story brick business building. Address J. W. Wheeler, First National Bank.

MINNEAPOLIS, MINN.—Bids are asked by the board of charities until Aug. 22 for the labor and material required for the excavation, brick, terra cotta and structural iron and steel for the east ward of the city hospital. Secy., O. B. King; Archs., MacLeod & Lamoreaux, 712 Lumber Exchange.

ST. PETER, MINN.—Bids are asked until Aug. 24 for a steam heating plant for the court-house. Charles Hensel, County Audr.

MILWAUKEE, WIS.—Contracts have been let for the construction of the new power house for the Milwaukee Ry. & Light Co., to cost about $600,000. The interior steel construction work will be done by W. R. Roberts & Co., of Chicago; the brick and mason work, by the Paul Reisen Co., of this city; the sidewalks, floors, roofs, etc., by the Northwestern Tile & Cement Co.; the terra cotta trimmings, by Evans & Howard, of St. Louis.

LINCOLN, NEB.—John Roberts, of Lincoln, was the lowest bidder for a heating and ventilating apparatus for the U. S. building, at $2,399; time, 55 days.

SOUTH OMAHA, NEB.—Bids are asked by the supervising architect, Washington, D .C., until Sept. 7, for a low-pressure steam heating and ventilating apparatus for the post-office building in this city, as stated in our advertising columns.

BISMARCK, N. DAK.—It is reported that the total loss from the fire in this city on Aug. 8 will be about $600,000; insurance, $250,000. Among the losers are the First National Bank, the post-office, C. H. Phelps and Joseph Hare.

DONIPHAN, MO.—Ripley county has decided by popular vote to issue $20,000 court-house and jail bonds. Bids for the purchase of the bonds will soon be asked.

KANSAS CITY, MO.—William Harmon has been awarded the contract for the reconstruction of the Union station, at about $42,000. Archs., Van Brunt & Howe, 1214a Main St., Kansas City.

GOLIAD, TEX.—Bids are asked until Sept. 3 for reconstructing the Goilad county jail. Henry Shaper, County Judge.

SAN ANTONIO, TEX.—Plans and specifications are asked by the city council until Sept. 5 for a one-story central market house to be erected on Paschal Square at a cost of about $40,000; first prize, $500; second prize, $250. Mayor, Bryan Callaghan; Cy. Clk., Theo. Vinke.

COLORADO CITY, COLO.—Reports state that the Manitou & Pike's Peak R. R. Co. has signed a contract for a large observatory to be built on the top of Pike's Peak.

CHEMAWA, ORE.—Bids are asked until Aug. 27 for erecting one brick school and assembly building for the Indian Industrial School. Supt., Thos. W. Potter.

PORTLAND, ORE.—The supervising architect, Washington, D. C., received the following bids Aug. 8 for plaster models for the U. S. Custom House building in this city: Jas. F. Earley, Washington, D. C., $508; time 42 days; C. W. Buhler, Washington, D. C., $415, time, 48 days.

FRESNO, CAL.—A fire in this city Aug. 10, destroyed $500,000 worth of property on the Southern Pacific Co.'s reservation, from Mariposa St. to Mono St.

LOS ANGELES, CAL.—Bids are asked by the supervisors of Los Angeles county until Sept. 14 for the construction of a brick building for the county hospital. T. E. Newlin, County Clk.

UKIAH, CAL.—Bids are asked until Sept. 3 for erecting an administration building for the Mendvano State Hospital. Secy., W. W. Cunningham; Archs., Cunningham Bros. San Francisco, Cal.

WHEATLAND, CAL.—The business portion of this town was burned Aug. 12, causing an estimated loss of $185,000; insurance, about one-half of loss.

LOVELOCKS, NEV.—Bids are asked until Sept. 19 for constructing a jail building here for Humboldt county. Geo. E. Miller, County Clk., Winnemuca, Nev.

HALIFAX, N. S.—Bids are asked by the Intercolonial Ry. Co. until Aug. 22 for the erection of a grain elevator at Halifax. D. Pottinger, Gen. Mgr., Moncton, N. B.

QUEBEC, QUE.—Reports state that Joseph Gosselin, of Levis, has been awarded the contract for erecting new buildings for Judge Chauveau on the site of the old city hall; estimated cost, $75,000.

ARNPRIOR, ONT.—Bids are asked by the department of public works, at Ottawa, Ont., until Aug. 22, for the construction of a heating apparatus in the public building in Arnprior. Secy., E. F. E. Roy.

INGERSOLL, ONT.—Bids are asked by the department of public works until Aug. 23 for the construction of a building in this city. Secy., E. F. E. Roy, Ottawa, Ont.

NIAGARA FALLS, ONT.—Bids are asked until Aug. 20 for the identical reconstruction of the Clifton House, recently destroyed by fire. Darling & Pearson, Toronto Ry. Chambers, Toronto, Ont., Architects for Bush Estate.

WATER-WORKS.

AUBURN, ME.—E. S. Paul, A. M. Pulsifer and R. M. Mason have been appointed a committee to investigate the question of a pure water supply from Lake Auburn.

PITTSFIELD, MASS.—F. E. Hatch, Supt. water-works, writes us that the proposed Tillotson extension, noted last week, has not as yet been definitely decided upon.

NEW HAVEN, CONN.—A resolution has been adopted by the council authorizing the appointment of a joint committee to investigate the question of the municipal ownership of the water-works, gas plants, street railways, etc., of the city. Councilman O'Sullivan may be addressed.

ALBANY, N. Y.—Stone & Thurston, 220 Broadway, New York, have been awarded the contract for furnishing and building the pumping station and intake at the filtration plant at $22,977, instead of $2,977, as noted in our issue of last week. The prices for the various items of the work are given under Contract Prices.

CATTARAUGUS, N. Y.—W. B. Wilson, Buffalo, N. Y., has been awarded the contract for extending the works, at a cost of about $7,000.

CROWN POINT, N. Y.—The Crown Point Water-Works Co. has been incorporated with a capital stock of $5,000 by James E. Pond, Freeman C. Pond, Margaret A. Pond, Ruth D. Pond, Elbert M. Johnson, Lysander R. Berry and Edwin R. Eaton, all of Crown Point. J. E. Pond is the owner of the small works built in this place in 1895.

CROWN POINT, N. Y.—J. E. Pond, Pres. and Supt. Crown Point Water-Works Co., writes us that contracts will be let Aug. 20 for furnishing four bends, one cross, four gates, valves, etc., for the proposed improvements to the works put in three years ago.

ELLIS ISLAND, N. Y.—The following bids for water supply pipe from Jersey City to Ellis Island, N. Y. H., were received by the treasury department Aug. 8:

Bidder.		Time, days.
Merritt & Chapman D. & W. Co., New York	$16,744	60
Holmes & Cogan, Jersey City	14,045	50
Geo. B. Inman, New York	13,300	40
Jno. Cornwell, Jr., New York	32,000	58
J. T. Brown, New York	12,970	60
Jno. McNamee, Brooklyn, N. Y	15,500	60
Jno. R. Sheehan, New York	12,700	60

JOHNSTOWN, N. Y.—An election will be held Aug. 23 to vote on the question of building a reservoir, etc., for an additional water supply, to cost about $75,000. A. J. Nells, Cy. Attorney.

RHINEBECK, N. Y.—We are informed that the city has not come to any conclusion in regard to works, noted in our last issue. The question will be submitted to the voters at the next election. Population, 1,500. Frank Latson, Pres. Village Bd.

ROME, N. Y.—Chas. C. Hopkins, Cy. Engr., writes us that none of the bids recently received for an auxiliary pumping plant was accepted. The commissioners now favor submitting to a vote of the taxpayers the question of a gravity supply from Fish Creek or Mohawk River, in accordance with plans prepared in 1897 by the Stanwix Engineering Co., Rome. Estimated to cost from $110,000 to $162,000, depending upon source and capacity.

BRIDGETON, N. J.—Timothy Woodruff, Supt. water-works, informs us that the following bids were received Aug. 12 for furnishing and installing a 100-ft. steel water tank:

Tippett & Wood, Phillipsburg, N. J	$9,497
New Jersey Steel & Iron Co., Trenton, N. J	8,180
Riter-Conley Co., 29 Cortlandt St., New York	8,611
Sotter Bros., Pottstown, Pa	10,650
*J. H. & F. Ferguson, agents, Betz Bldg., Phila.	7,097
R. D. Wood & Co., 400 Chestnut St., Philadelphia.	8,120
Warren City Boiler Works, Warren, O	7,450
Cox & Sons Co., Bridgeton, N. J	11,474
Broomell, Schmidt & Co., York, Pa	8,707
Youngstown Bridge Co., 150 Nassau St., N. Y	7,242
Leighton Lea, Girard Bldg., Philadelphia	7,180
Wilkins & Kuemmerle, Betz Bldg., Philadelphia.	10,525

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*Awarded contract, agents for E. Keeler Co., Williamsport, Pa.

GLOUCESTER CITY, N. J.—Bids are asked until Sept. 1 for furnishing and erecting a 2,500,000-gallon pump at the water-works, as stated in our advertising columns. W. J. Thompson, Chn. Com.; D. F. Lane, Cy. Clk.

JERSEY CITY, N. J.—Bids are asked until Aug. 24 for furnishing a large number of ⅝ to 10-in. water meters. Geo. T. Bouton, Clk. Comrs.

ORANGE, N. J.—The city engineer is preparing plans for a pumping station at Campbell's Pond, Millburn, and for deepening and cleaning the pond; estimated cost, $25,000.

SENECA FALLS, N. Y.—The question of the municipal ownership of the works and the electric light plant is being considered.

DEVON, PA.—Bids are asked until Aug. 22 for constructing a 4,000,000-gallon reservoir at Devon for the works owned by the American Pipe Mfg. Co., as stated in our advertising columns. Ch. Engr., J. A. Ledoux, Fidelity Mutual Life Bldg., Philadelphia.

DU BOIS, PA.—D. S. Herron, Cy. Solicitor, writes us that there is no prospect of anything being done to secure an increased water supply.

EVANS CITY, PA.—Geo. Fehl, Pres. Council, writes us that plans for the proposed works are not completed. The supply will be secured from small streams. Population, 1,400. Engr., J. P. Leaf, Rochester, Pa.

GROVE CITY, PA.—Chandley Bros. & Co., Beaver Falls, Pa., have been awarded the contract at $15,000 for building the new works, according to reports.

HARRISBURG, PA.—Bids are asked until Aug. 23 for laying a 6-in. water pipe in Second St. E. Mather, Pres.

HASTINGS, PA.—The Susquehanna Water Co. has been incorporated with a capital stock of $500 by Col. J. L. Spangler, Bellefonte, Pa.; W. P. Duncan, Philipsburg; R. B. Spangler and C. F. Fraser, Hastings, and James A. McClain.

McDONALD, PA.—Bids are asked until Aug. 25 for constructing a storage dam for the Citizen's Water Co., as stated in our advertising columns. Engr., R. S. Smith, Carnegie Bldg., Pittsburg, Pa.; Secy., E. S. McWreath.

MILLVALE, PA.—At the election in November this place will vote on the question of issuing $5,000 in bonds for a new pump, $10,800 for a town hall, etc. H. I. Riley, Borough Solicitor. P. O., Bennett, Pa.

BALTIMORE, MD.—The council committee on health has decided that a filtration plant is necessary for the Lake Roland water supply. G. Stewart Johnston, Chn. Com.; Dr. H. H. Imholfe, Acting Chn. Com.

CUMBERLAND, MD.—E. A. Wilder, Fredonia, N. Y., has submitted a proposition to put in a filtration plant at this place, to cost about $38,000.

PALATINE, W. VA.—C. W. Walker, Asst. P. M., writes us that the city will complete the works this fall. The contract has not yet been let. Population, 1,600. Des. Engr., J. M. Prickett; Chn. Com., T. D. Harden.

PARKERSBURG, W. VA.—John V. Dunbar, Cy. Engr., writes us that this city will vote Aug. 30 on the question of issuing $35,000 in bonds for increasing the storage capacity of the reservoir and for extending the water mains, etc. No plans have yet been prepared.

DAVIDSON, N. C.—W. J. McKay, Mayesville, S. C., Pres. Bd. Trustees, Davidson College, writes us that the board has resolved to have works built at the college as quickly as possible. A committee has been appointed to secure plans and estimates. Address Prof. H. L. Smith, Chn. Water Com., Davidson, N. C.

ROME, GA.—H. M. Smith, Cy. Engr., writes us that the city is investigating the filter question, and will soon decide upon some plan. Mr. Smith writes that in the meantime those who have filters to place or plans to submit may take advantage of this opportunity. The daily consumption is about 1,500,000 gallons, river water.

DRY TORTUGAS, FLA.—Philadelphia papers state that the construction bureau, navy department, has awarded the contract for the construction of a distilling plant on Dry Tortugas Island to the Sugar Apparatus Mfg. Co., Philadelphia. This island is about 60 miles west of Key East, the extreme of the Florida keys, and has been used as a naval watering station for a number of years. An old fort is situated here, and a small garrison is generally kept on duty. S. Morris Lillie, President of the successful company, who prepared the plans for the new plant, states that it will cost about $35,000, and will have a capacity of 60,000 gallons of distilled water each 24 hours. The method is the same as that followed in a number of sugar refineries. At present the sole source of water supply is by cisterns for holding rain water.

MONTGOMERY, ALA.—The city engineer has been directed to prepare plans, etc., for covering the reservoirs of the water-works at the Court St. station. C. P. Hardaway, Cy. Clk.

LOUISVILLE, KY.—Bids are asked by the Louisville Water Co., 549 3d St., until Sept. 1 for the construction of a clear-water reservoir and filter house, grading and paving roads and disposing of waste material at Crescent Hill. Local papers state that the work will be a filtration plant, stand-pipe and pumping station. The new reservoir will be connected with the old one and will have a capacity of 25,000,000 gallons, or one-fourth the capacity of the old one. The water will pass from the present reservoir into the filter station and thence to the new tank from which it will be pumped into a stand-pipe. The passage between the reservoirs will lower the water 35 ft. below the present reservoir. Check, $10,000; bond, $100,000. Chas B. Long, Pres.

CHARDON, O.—H. O. Bostwick, Mayor, writes us that the subject of works to be owned by the village is being considered. No definite steps have been taken in the matter as yet.

CINCINNATI, O.—Bids are asked until Aug. 19 for furnishing such supplies as may be required by the water department for the year ending Jan. 1, 1899. A. B. Battermann, Pres. Bd. City Affairs.

AUBURN, IND.—We are informed that this place is still considering the question of works.

ALLEGAN, MICH.—The question of a new pump and pumping station, to cost about $20,000, is being considered. Trustee Priest may be addressed.

BAY CITY, MICH.—Bids are asked by the city clerk until Aug. 22 for laying new 6-in. water mains in Walnut St.

MOUNT PLEASANT, MICH.—Chas. M. Brooks, Mayor, writes us that the council is considering the question of overhauling and enlarging the works. Nothing definite has been decided upon as yet. The cost will be about $20,000 for improving the works alone or $28,500 with an electric light plant added.

CHICAGO, ILL.—Bids are asked until 11 a. m., Aug. 18, for furnishing such special castings for water pipe as may be required during the year ending July 31, 1899; check, $500. L. E. McGann, Comr. Pub. Wks.

DUBUQUE, IA.—We are informed that nothing definite has been done in regard to the city purchasing the works of the Dubuque Water Co. The city is figuring with the company with a view to buying the works. E. C. Blake, Cy. Engr. Press reports state as follows: As the outcome of the bad water recently furnished this city by the water company, the council has revoked the company's charter. The minor stockholders of the company have made a proposition to the council looking towards a permanent improvement of the plant with a cheapening of the cost to the consumers.

NEW SHARON, IA.—Jackson & Moss, Des Moines, Ia., have begun the construction of the proposed works, to cost $8,500, according to reports.

OSAGE, IA.—Chas. Kathan, Mayor, writes us that at the election held Aug. 5 this place decided to put in works by a vote of 5 to 1. The supply will be secured from deep wells. An elevated tank will probably be erected. There will be two wells with complete pumping outfit. Nearly five miles of mains will be laid and 50 hydrants set. The contract for wells has been let. It is expected to advertise for a tank and mains in a few days; estimated cost, $25,000. J. P. Williams, Chn. Com.

LANESBORO, MINN.—Bids are asked until Sept. 1 for furnishing and laying about 10,000 ft. of 4 to 8-in. water pipe, etc. Engr., Geo. Bradish, La Crosse, Wis.; Clk., O. M. Habberstad.

NEW PAYNESVILLE, MINN.—M. S. Elliott, Recdr., writes us that the following bids were received Aug. 8 for furnishing and building works and an electric light plant; P. C. Pilon, Village Pres.:

Daniel W. Mead, Rockford, Ill.	$9,790
Patrick Doherty, St. Paul	9,571
Fairbanks, Morse & Co., St. Paul, Minn.	10,149
W. I. Gray, Minneapolis (accepted)	9,144

DEADWOOD, S. DAK.—The council has accepted the proposition to secure an additional water supply from Gayville. A dam 75 ft. long and 6 ft. high will be built at once, according to reports. Mayor Star, Alderman Treber, Chn. Com., and F. C. Tucker, Cy. Engr., may be addressed.

LINCOLN, NEB.—The council has voted that water meters must be used by all consumers of water. Local papers state that about 2,000 meters will be required.

WELLINGTON, KAN.—B. F. Evans, Newton, Kan., has been awarded the contract to sink a test well for the proposed new municipal works, to cost about $125,000.

SEDALIA, MO.—Eastern parties are reported to have purchased the works of the Sedalia Water & Light Co. It is stated that the works will be improved and that a better and increased water supply will be furnished. Col. O. A. Crandall is interested in the new company.

WEBSTER GROVES, MO.—The council, it is reported, will soon ask for bids for the purchase of $5,000 of 20-year 5% bonds for the proposed works; the supply to be secured from the St. Louis works.

McKINNEY, TEX.—Press reports state that bids will soon be asked by the council for furnishing and constructing the proposed works, the bonds for which have been sold; estimated cost, $18,000. J. M. Pearson, Mayor.

GUTHRIE, OKLA.—G. M. De Groff, Cy. Clk., writes us that the two bids received July 5 for furnishing a new water supply have been rejected.

SHAWNEE, OKLA.—Another election will be held Sept. 2 to vote on the question of building works, to cost about $10,000. Benj. Diesker, Cy. Clk.

ALTMAN, COLO. — Press reports state that William Gillpatrick, formerly connected with the Altoona Light, Water & Power Co., has purchased the works from John A. Brod & Co. and will at once begin extending the water mains from Middle Beaver Creek to the towns of Goldfield and Independence.

FLORENCE, COLO.—P. M. McGuire, Mayor, writes us that Hiram Phillips, Oriel Bldg., St. Louis, Mo., is making a survey and plans for the proposed gravity works. Population, 4,500.

SEATTLE, WASH.—Capt. W. W. Robinson, Jr., Assist. Q. M. in charge of the construction of the army post, has issued a call for bids for the construction of 2,200 ft. of 6-in. water main from the east line of the army post to the site of the buildings. The main will connect with the main now being laid by the city to the post.

SEATTLE, WASH.—The council has voted to direct the judicial committee to prepare a resolution directing the board of public works to ask for new bids for constructing the Cedar River water-works addition.

WASCO, ORE.—The council is reported to have voted to build works at a cost of about $2,500.

SAN FRANCISCO, CAL.—The Spring Valley Water-Works Co. has voted to issue $4,000,000 in 4% bonds. The bonds will be issued under a third mortgage, to bear date Sept. 1, 1898, payable in eight years from date. It is said that the company proposes to use the money thus obtained for the erection of pumping works deemed now to be necessary owing to the recent drouth.

WILLOWS, CAL.—Bids are asked until Sept. 5 for furnishing and installing a water tank, etc., at the county hospital. Clk., W. H. Sale.

PHOENIX, ARIZ.—We are informed that this city contemplates the erection of municipal works. There will be 16 miles of 6 to 20-in. cast-iron water pipe, a pumping station of 4,000 gallons a minute, an elevated tank, 35 ft. in diameter and 50 ft. in height, placed on a 100-ft. steel framed base. Plans, specifications, etc., are being prepared by Ernest Abs Hagen, 338 Byrne Bldg., Los Angeles, Cal., and Hotel Adams, Phoenix. Mayor, J. C. Adams.

SUTTON, QUE.—C. A. Tartre, Secy. Treasury, writes us that the proposed works are being built by the city at a cost of about $13,000. Population, 800.

RIVER DU LOUP, QUE.—It is reported that this place will soon begin the construction of the proposed works. Engr., Walter Shanley, St. Lawrence Hall, Montreal, Que.

IRRIGATION.

CANON CITY, COLO.—A. A. Maclean and Herman H. Dunham are to construct a canal along Beaver Creek, about six miles long and 12 ft. wide, to irrigate about 22,000 acres in Tremont county.

DUPUYER, MONT.—Reports state that M. S. Darling, Fort Benton, is making surveys and estimates for an irrigation system from Birch Creek to the lower Dupuyer River. W. G. Conrad, Kyle Brice and C. E. Conrad, of Great Falls, Mont., are interested.

NEW COMPANIES.—North Loup Improvement Co., Loup City, Neb.; $3,000; J. P. Goodrich, A. T. Jones and George E. Johnson, North Platte, and C. E. Coffin, Lincoln.

SEWERAGE

BROOKLINE, MASS.—Jos. Driscoll has been awarded the contract for building a main sewer in Beacon St. at $1,855.

CLINTON, MASS.—Bids are asked until Sept. 1 for constructing sections 1 and 2 of the system, reservoir, pumping station, etc., as described in our advertising columns. Wm. N. Davenport, Secy. Metropolitan Water Bd., 3 Mt. Vernon St., Boston.

NEW BRITAIN, CONN.—M. O. Webster, Mayor, writes us that the question of sewage disposal is being investigated. No decision has been arrived at as to what changes will be made. The city has 27 miles of sewers, with outlets discharging into streams. Consult. Engr., Samuel M. Gray, Providence, R. I.; Clk., G. C. Dunham.

SOUTH NORWALK, CONN.—Jos. R. Taylor, Cy. Clk., writes us that the city will construct a 24-in. overflow storm water sewer to relieve the sewers in the lower portion of the city; estimated cost, $500.

COHOES, N. Y.—Prof. Palmer C. Ricketts, Troy, N. Y., engaged by the public improvement commission to judge the plans received for the system of sewerage, has recommended to the commission the plan signed I. X. L. By this plan most of the present sewers can be used. Those in the central part of the city run into a main along the Mohawk River and across that stream diagonally from the foot of Cedar St. to Bridge Ave., then along the east bank of the Mohawk to an outlet at the end of Locust Ave. In the future, if necessary, the city could build the sewer to an outlet at the south end of Adams Island. The sewers in the southern part of the city would empty into a main in Eagle's Nest ravine and empty at the foot of the ravine. The plan would also drain the north end of the island into the Mohawk River at a point above Buttermilk Falls, and the southern part into the Ship St. sewer. This would use some of the old sewers, including the ravine sewer. In this plan there are ten miles of new sewers in the separate system, one mile of new sewers in the combined and 5.4 miles of old sewers. Estimated cost, $127,792.

HUDSON, N. Y.—Bids are asked until Aug. 25 for constructing a 10-in. pipe sewer in Columbia St. W. S. Hallenbeck, Cy. Clk.

LANCASTER, N. Y.—This place voted against appropriating $1,200 for plans for the proposed system.

LITTLE FALLS, N. Y.—S. E. Babcock, Cy. Engr., writes us that surveys have been ordered for sewers on the south side of the Mohawk River and Erie Canal. Work cannot begin until canal navigation is closed. There will be required about three miles of 24 to 8-in. pipe sewer in rock.

LONG ISLAND CITY, N. Y.—James H. Johnson, Engr., Sewer Dept., Queens Borough, is preparing plans, etc. for relaying about 3,320 ft. of 24-in. pipe sewer in Jamaica. It is probable that bids will be asked in a few days. Other sewer work is also proposed.

NEW YORK, N. Y.—Bids are asked until Aug. 24 for repairing the wooden box sewer at 42d St., North River. M. F. Donohue, Acting Comr. of Sewers, 265 Broadway.

SCHENECTADY, N. Y.—Bids are asked until Aug. 22 for constructing about 7,100 ft. of 10 and 8-in. pipe sewers. John Allen, Chn. Com.

SYRACUSE, N. Y.—The council is arranging for the construction of a $50,000 trunk sewer in Midland Ave., to drain the southern portion of the city.

WESTFIELD, N. Y.—The question of building a system will be delayed until next year. Samuel C. Crandall, Pres. Village.

JERSEY CITY, N. J.—Bids are asked until Aug. 24 for constructing 310 ft. of 36-in. brick oval sewer and 1,050 ft. of 18-in. pipe sewer, etc. Geo. T. Bouton, Clk. Bd.

KEARNEY, N. J.—Bids are asked until Aug. 23 for building pipe sewers in one street, and also until Sept. 13 for building 5,200 ft. of brick trunk sewer in this city, as described in our advertising columns. W. S. Logan, Township Surv., Arlington, N. J.; Wm. J. Gorsuch, Chn.; J. F. Kelly, Clk.——Plans are being prepared for the sewering of a portion of the northeasterly section of the township.

STOCKTON, N. J.—The council has been petitioned to build sewers. Town Surveyor Thomson and City Clerk Abbott may be addressed.

TRENTON, N. J.—The council has voted to build sewers in certain streets. C. Edward Murray, Cy. Clk.

WOODBRIDGE, N. J.—The question of building a system is being considered, according to reports.

CARNEGIE, PA.—Bids are asked until 12 m., Aug. 18, for constructing 1,000 ft. of 5-ft. brick storm sewer. R. J. Hardy, Clk.

CRAFTON, PA.—Bids are asked until Aug. 23 for constructing about 476 ft. of 8-in. pipe sewer, etc., and for the purchase of $19,500 of 4% bonds for sewers, etc. Engr., F. A. McDonald, Penn Bldg., Pittsburg, Pa.; Clk., R. H. Thomson.

NEW KENSINGTON, PA.—Bids are asked until Aug. 22 for constructing about 13,000 ft. of 24 to 6-in. pipe sewers. Address the borough engineer, at 78 Fidelity Bldg., Pittsburg, or J. C. Reed, Chn. Com.; W. D. Snyder, Secy.

PITTSBURG, PA.—The question of building brick and pipe sewers in certain districts of the city is being considered. Wm. R. Brown, Cy. Engr.; S. T. Paisley, Supt. Dept. Highways and Sewers.

PITTSTON, PA.—J. C. Farren & Co., Wilkes-Barre, Pa., have been awarded the contract, at $3,423, for building a sewer in Broad St.

READING, PA.—Bids are asked until Aug. 18 for constructing a storm sewer in 12th St. S .S. Hoff, Cy. Engr.

SLATINGTON, PA.—The council has rejected the bids recently received for building about 1,000 ft. of 30 and 24-in. pipe sewer, and will now do the work itself at a cost of about $2,000.

SOMERSET, PA.—The question of issuing $25,000 in bonds for a system is being considered.

WILKINSBURG, PA.—Bids are asked until Aug. 22 for constructing a 24-in. pipe sewer, culverts, etc. Frease & Spearling, Borough Engrs.

WASHINGTON, D. C.—The district commissioners have authorized the following work: Construct sewer in O St., N. W., between 35th and 36th Sts.; in 36th St., between O and P, and in P between 35th and 36th; estimated cost, $3,400. On Meridian St., between Huron St. and Columbia Road; estimated cost, $2,900.

ATLANTA, GA.—The county commissioners have asked the city to co-operate with the county in the building of new sewers.

LEXINGTON, KY.—Bids will soon be asked by the city clerk and mayor for building 1,800 ft. of 27-in. pipe sewer in East Main St., at the C. & O. R. R. crossing.

CINCINNATI, O.—Bids are asked until Aug. 25 for constructing sewers in Follett St. Geo. H. Spellmire, Clk. Bd. City Affairs.

HAMILTON, O.—Reuben R. Marble, Columbus, O., is reported to have been engaged to report on the best plan for sewers in the Market St. district.

NAPOLEON, O.—James P. Rago, Mayor, writes us that plans for a system are being prepared by Riggs & Sherman, The Nasby, Toledo, O.

NILES, O.—The question of new sewers is being considered, according to reports.

SANDUSKY, O.—It is proposed to build sewers in certain streets. A. W. Miller, Cy. Clk.

TOLEDO, O.—Bids are asked until Aug. 29 for constructing 15-in. pipe and 24-in. brick sewers in certain streets. L. P. Harris, Cy. Clk.

WELLSVILLE, O.—An election will soon be held to vote on the question of building a system to cost about $75,000. Mayor Dennis and Clerk Wells may be addressed.

YOUNGSTOWN, O.—The board of health has voted to urge the council to take steps towards improving the system.——Dr. W. L. Buechner, of the board of health, has recommended that an engineer be engaged to plan a complete reconstruction of the system.

FORT WAYNE, IND.—It is probable that a sewer will soon be built in South Wayne, a suburb about to be annexed to this city.

INDIANAPOLIS, IND.—Bids are asked until Aug. 22 for constructing sewers in several streets. M. A. Downing, Pres. Bd. Pub. Wks.

KOKOMO, IND.—A. W. Smith, Cy. Engr., informs us that the council has passed a resolution to construct a 4-ft. brick sewer, about 3,500 ft. long. The ordinance will be introduced Sept. 12.

OWOSSO, MICH.—Riggs & Sherman, The Nasby, Toledo, O., have been engaged to superintend the construction of the system.

CHICAGO, ILL.—The board of local improvements proposes to build a sewer in the 95th St. district to drain about 10,800 acres; estimated cost, $1,500,000, and also for improving the pavement on Archer Ave. for three miles at a cost of about $500,000.

KEWANEE, ILL.—Bids are asked until Aug. 23 for constructing sewage disposal tanks. Jno. H. Pierce, Pres. Bd. Local Improvements. The contract for building the system has been let to Munn & Eagan, Nebraska City, Neb., at $24,894.

MONTICELLO, ILL.—The board of local improvements has voted to build a sewer in North State St. Councilman H. D. Peters and J. A. Bender may be addressed.

MURPHYSBORO, ILL.—Bids are asked until Aug. 19 for laying sewer pipe in certain streets. J. L. Ashman, Cy. Clk.

VENICE, ILL.—It is stated that the village authorities have employed two engineers to make surveys for the proposed chain of sewers, connecting Granite City, Newport, Madison and Venice, and it is estimated that the cost of building the sewers will be about $30,000.

COUNCIL BLUFFS, IA.—Bids are asked until Aug. 22 for constructing a storm sewer. N. C. Phillips, Cy. Clk.

WHITE EARTH, MINN.—It is stated that plans for sewers and water-works at the White Earth Indian school have been completed, and will be submitted to the secretary of the interior, Washington, D. C., for approval this week.

LAWRENCE, KAN.—Bids are asked until Aug. 22 for constructing lateral sewers and for curbing. A. G. Honnold, Cy. Clk.

KANSAS CITY, MO.—Bids are asked until Aug. 22 for constructing a pipe sewer in district No. 11; check, $200. ——The board of public works has approved plans for the Vine St. sewer, to cost about $5,000.——Plans for the Westport sewerage system will be completed about Oct. 1. Henry A. Wise, Cy. Engr.

JOPLIN, MO.—An election will be held Aug. 23 to vote on the question of issuing $30,000 in bonds for extending the system.

ST. JOSEPH, MO.—The council has voted to extend the Blacksnake sewer. P. J. Kirschner, Mayor.

SHERMAN, TEX.—C. P. Gregory, Chn. Com., writes us that the council has done nothing as yet in regard to the proposed sewers. It is waiting to hear from eastern contractors.

DENVER, COLO.—Plans are reported as being prepared by H. C. Lowrie, Engr. Bd. Pub. Wks., for a storm sewer to drain 2,000 acres.

PUEBLO, COLO.—Bids will probably soon be asked by the council for building a system for Ward No. 8, Bessemer. Plans prepared by City Engineer E. W. Hathaway have been accepted. The next council meeting will be held Aug. 29. Mayor Orman may be addressed.

BILLINGS, MONT.—Bids are asked by the city clerk until Sept. 6 for furnishing the material and for constructing a system, plans for which were prepared some years ago by Geo. K. Reider, Helena, Mont. Population, 12,000.

NEVADA CITY, CAL.—The trustees will soon take steps to provide the city with a system; estimated cost from $30,000 to $40,000.

POMONA, CAL.—C. P. Patterson, Pres. Bd. Trustees, writes us that an initial movement is being made for the proposed system.

SAN LUIS OBISPO, CAL.—William Shipsey, Chn. Bd. of Trustees, informs us that the city engineer has prepared plans for a system; estimated cost, $36,000. An election will be held Sept. 5 to vote on the question of issuing bonds.

PHOENIX, ARIZ.—We are informed that it is proposed to build a separate system. On account of the level country, the system will require pumping and sewage disposal works. Des. Engr., Ernest A. Hagen, Hotel Adams, Phoenix, and Byrne Bldg., Los Angeles, Cal.

STRATFORD, ONT.—W. F. Van Buskirk, Cy. Engr., has submitted a report on sewage purification, in which he recommends the adoption of a system of filtration. He estimates the cost as follows: Two tanks (90 × 30 ft.), with necessary valves, screens and discharge pipes, $7,400; sludge well, $600; seven filters (100 × 60 ft.), with pipes, valves, etc., $9,860; outlet pipe from beds, $1,215; incidentals and engineering, $1,907.

TORONTO, ONT.—The residents of Parkdale are considering the question of a sewage disposal plant, to cost about $30,000. A committee has been appointed to visit certain cities in Massachusetts to investigate methods of sewage disposal. Alderman J. J. Graham, F. W. Monteith and Mr. Saunders, of the board of works, may be addressed.

GARBAGE DISPOSAL—STREET CLEANING

NEW YORK, N. Y.—Bids are asked until Aug. 26 for the unloading of deck scows of the department at Riker's Island. Jas. McCartney, Comr. St. Cleaning, 346 Broadway.

ROCHESTER, N. Y.—Local papers state that the board of health will soon have to consider the question again of garbage disposal.

UTICA, N. Y.—The council has passed over the mayor's veto the ordinance awarding the garbage disposal contract to Henry Staffenbach, at $6,500 a year, for 10 years.

ATLANTIC CITY, N. J.—Sylvester Leeds has been awarded the contract for collecting and removing the garbage for the next five months at $4,400. The contract for removing garbage from the city wharf in scows until Jan. 1 was awarded Aug. 8 to Wallace Smith at 50 cts. per ton of 2,240 lbs.

ERIE, PA.—F. Hanlon, Cy. Clk., writes us that the city has under consideration the question of the disposal of garbage, and action has been taken to make an appropriation of $10,000 for the erection of a crematory.

WILMINGTON, DEL.—The contract for removing ashes for the year from Sept. 1 has been let to Jos. B. Stidham at $7,200.

FORT THOMAS, KY.—Major Hall, commanding, at Fort Thomas, has recommended to the war department that a crematory be built.

MILWAUKEE, WIS.—The commissioners of public works received the following bids Aug. 12 for furnishing and installing a garbage disposal plant: Engle Sanitary & Crematory Co., $52,500 and $63,500; F. C. Gross and Joseph Schaaf, $58,500; F. H. Kratzer, $53,700; Dixon Garbage Crematory Co., $58,000; Gorman Bros., $61,000; Jacob Jacobi (no bond), $79,019. Local papers state as follows: The bid of F. C. Gross and Joseph Schaaf is to sell the Wisconsin Rendering Co.'s plant at Mequon, which, it is said, can reduce 100 tons of garbage a day by the Merz system, at a cost not to exceed 22 cts. a ton. This was accompanied by an offer to enter into a contract with the city for the disposal of garbage, delivered at the plant, for $14,500 a year, or delivered on board boat or cars in the city for $22,000 a year. As the specifications call for the erection of a plant on Jones Island, it is not likely that this bid will be considered. The Engle Sanitary & Crematory Co., of Des Moines, Ia., guarantees that the cost of disposing of garbage will not exceed 32½ cts. a ton, that not over 200 lbs. of coal for each ton of garbage cremated will be used, and that it will require not more than six men to operate the plant. For $9,000 additional the company offers to furnish power for the pumping station. The bid of F. H. Kratzer, 140 Reed St., is to dispose of garbage by the Pattitz system. It sets forth that one ton of coal will be required to dispose of 10 tons of garbage, and that five employees can operate the plant. Gorman Bros., Toledo, O., propose to put in the Smead system. They say a force of nine men will be required and 300 lbs. of coal to a ton of garbage. The Dixon company, Toledo, guarantees that not more than 240 lbs. of coal will be used in the cremation of a ton of garbage, and that 16 men will be sufficient.

STREETS AND ROADS.

PORTLAND, ME.—Bids are asked until Aug. 19 for furnishing about 2,500 sq. yds. of granite paving blocks. Geo. N. Fernald, Comr. Pub. Wks.

LUNENBURG, MASS.—Bids are asked until 12 m., Aug. 18, for building 2,300 lin. ft. of state highway. T. C. Mendenhall, Chn. Massachusetts Highway Comn., Boston.

REVERE, MASS.—Bids are asked until Aug. 22 for 9,000 cu. yds. of grading, 16,000 cu. yds. of filling, 750 lin. ft. of drain, 2,600 sq. yds. of broken stone, etc., in Revere parkway. Edwin B. Haskell, Park Comr.; Wm. T. Pierce, Engr.

WILLIAMSTOWN, MASS.—Bids are asked until 12 m., Aug. 18, for constructing 3,800 lin. ft. of highway. T. C. Mendenhall, Chn. Massachusetts Highway Comn., Boston.

SOUTH NORWALK, CONN.—Jas. R. Taylor, Cy. Clk., informs us that a contract has been awarded to W. R. Johnson, at $10,000, for brick paving on South Main St.

BUFFALO, N. Y.—The board of supervisors has voted in favor of macadamizing the White Corners Road at a cost of $36,400.

GLENS FALLS, N. Y.—Bids are asked until Sept. 5 for furnishing the material and for constructing a brick pavement, as stated in our advertising columns. G. P. Slade, Cy. Engr.; W. M. Cameron, Clk.

LANSINGBURG, N. Y.—Bids are asked until Aug. 22 for about 50,854 sq. yds. of macadam pavement and 22,840 lin. ft. of curbing. Chas. A. Roemer, Village Engr.; F. M. Miter, Clk.

LE ROY, N. Y.—The board of trustees has decided to purchase a new stone crusher, according to reports.

SCHENECTADY, N. Y.—Ordinances have come before the council for brick paving in three streets and macadamizing in North St.; also a petition for grading, curbing, etc., in Hamilton St. Louis R. Sebring, Cy. Engr.

HASBROUCK HEIGHTS, N. J.—Bids are asked until Sept. 6 for the purchase of about $13,500 of 4% paving bonds, etc. G. H. Ramsden, Borough Clk.

JERSEY CITY, N. J.—Bids are asked until Aug. 24 for about 1,000 cu. yds. of excavation, 4,400 sq. yds. of macadam, 2,175 lin. ft. of curb, etc., on Pearsall Ave. Geo. T. Bouton, Clk. St. Comrs.

KEARNEY, N. J.—Contracts have been awarded for the improvement of two streets. Wm. J. Gorsuch, Chn., Arlington. Wm. S. Logan, Township Surv., 160 Midland Ave., Arlington, N. J.

NEWARK, N. J.—Bids are asked until Aug. 25 for paving and repaving in portions of Fulton St. and six other streets with 45,000 sq. yds. of sheet asphalt. M. F. McLaughlin, Gen. Supt. St. and Water Comrs.

PATERSON, N. J.—Bids are asked until 8 p. m., Aug. 19, for grading and macadamizing portions of 17 roads. Wilson M. Lawson, Chn. Com.; Geo. U. Botbyl, Clk. Bd. Freeholders.

RAHWAY, N. J.—The council will have Seminary St. macadamized at a cost of about $2,000.

VINELAND, N. J.—Bids are asked by the council for paving Landis Ave., according to reports.

WOODBURY, N. J.—Geo. S. Pierson, of the committee, informs us that the board of freeholders at a meeting held July 21 received a petition for macadamizing about three-fourths of a mile in Broad St. Wm. M. Carter has been appointed to prepare plans, etc.

CARBONDALE, PA.—Bids are asked until Aug. 24 for 6,480 sq. yds. of brick paving, as stated in our advertising columns. F. B. Clifford, Cy. Clk.

MILTON, PA.—An ordinance has been passed to pave Broadway and Front St. with brick. W. K. Wertman, Pres.; Wm. C. Miller, Clk.

EASTON, PA.—C. H. Lutzens & Sons have submitted the lowest bid for macadamizing in nine streets, at $47,932.

NEW KENSINGTON, PA.—Bids are asked until Aug. 22 for paving and curbing portions of Fifth Ave. J. C. Reed, Chn. Com.; W. D. Snyder, Secy.

PHILADELPHIA, PA.—Bids are asked until Aug. 23 for repaving certain alleys with brick. Benj. Lee, Health Officer, City Hall.

READING, PA.—Bids are asked until 3 p. m., Aug. 18, for 13,000 lin. ft. of curbing and 41,500 sq. yds. of asphalt paving. S. S. Hoff, Cy. Engr.; H. H. Hammer, Clk.

WASHINGTON, PA.—Bids are asked until Aug. 22 for grading and brick paving. J. N. White, Secy.

BALTIMORE, MD.—W. E. Reilley, Chester, Pa., has been awarded a contract for furnishing the Standard Lime & Stone Co. with 100 car loads of crushed stone for repaving Edgmont Ave.

ROCKVILLE, MD.—W. W. Welsh, County Clk., informs us that the following bids, received Aug. 10, for macadamizing, advertised in Engineering News July 28, have been rejected:

Owen Patterson & Co., 1302 John St., Baltimore	$55,500
B. D. Pierce, Jr., Co., Bridgeport, Conn.	52,000
Shea & Gunnell, Lay Hill, Md	37,700

WESTMINSTER, MD.—The council has decided to spend $3,000 for macadamizing in Main St.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Aug. 27 for grading in certain streets, as stated in our advertising columns.

MONTGOMERY, ALA.—The council has awarded a contract to the Coaldale Brick & Tile Co., Birmingham, for furnishing and laying 1,350,000 brick, at a cost of about $25,000.

CARTHAGE, O.—Bids are asked until Sept. 6 for the improvement of the Hamilton pike road. E. F. Layman, Village Engr.; L. Hall, Clk.

CINCINNATI, O.—Bids are asked until Aug. 29 for macadamizing and improving Red Bank Ave. R. P. Butterfield, Clk. Bd. Cy. Affairs.

CLEVELAND, O.—Bids are asked until Aug. 31 for seven-eighths of a mile of grading and paving, on the Ridge Road. Julius C. Dorn, Clk. County Comrs.——Bids are asked until Sept. 7 for grading, draining and brick paving in East Madison Ave. Geo. R. Warden, Dir. Pub. Wks.

FREMONT, O.—Bids are asked until Sept. 5 for brick paving, etc. R. J. Christy, Chn. Com.

LIMA, O.—Bids are asked until Aug. 19 for macadamizing in Shugar Alley. C. E. Lynch, Cy. Clk.

MANSFIELD, O.—Bids are asked until Sept. 10 for improving portions of Lexington Ave., East Johns St., Marion Ave. and West Ave. F. M. Remy, Cy. Clk.

SPRINGFIELD, O.—Resolutions have been passed to grade and gravel portions of ten streets. W. F. Bauer, Pres.; Philip Huonker, Cy. Clk.

TOLEDO, O.—Bids are asked until Sept. 12 for furnishing the material and for paving portions of Knower and Rockingham Sts. with Buckeye blocks, etc. L. P. Harris, Cy. Clk.

WARREN, O.—Bids are asked until Aug. 23 for about 1,100 sq. yds. of brick paving. E. P. Dickey, Cy. Engr.

YOUNGSTOWN, O.—F. M. Lillie, Cy. Engr., informs us that bids will be asked about the middle of September for about 7,800 sq. yds. of sheet asphalt or block pavement, on Scott St.; estimated cost, $20,000.

SHOALS, IND.—Bids are asked until Sept. 8 for constructing eight sections of macadam roads. Horation Harrymann, County Audr.

COLUMBUS, IND.—Bids are asked until Aug. 19 for constructing 6½ miles of gravel roads. H. C. Harris, Chn. County Comrs.

INDIANAPOLIS, IND.—Bids are asked until Aug. 22 for brick paving, etc., in portions of Pawnee, Arizona and Sterling Sts. M. A. Downing, Chn. Bd. Pub. Wks.

KOKOMO, IND.—A. W. Smith, Cy. Engr., informs us that 12,000 sq. yds. of brick paving will be laid. Bids will be asked later.

RICHMOND, IND.—Bids are asked until Sept. 2 for constructing a brick walk, stone curbing, etc., in Main St. Jas. H. Winder, Clk.

DETROIT, MICH.—The board of public works is considering the question of paving Second Ave. with asphalt, at a cost of about $40,000.

CHICAGO, ILL.—Bids are asked until Aug. 24 for building a slag roadway 8 ft. wide, from 114th St. to Hegewisch. L. E. McGann, Comr. Pub. Wks.

MATTOON, ILL.—Bids are asked until Aug. 30 for 10,522 sq. yds. of brick paving, 4,098 lin. ft. of curbing, catch-basins, etc. A. C. Loomis, Cy. Engr.; Jno. F. Scott, Pres.

MOUND CITY, ILL.—Bids are asked until Aug. 24 for repairing the Mound City national cemetery roadway. Maj. T. E. True, Depot Q. M., Washington, D. C.

QUINCY, ILL.—Bids are asked until Aug. 20 for paving five alleys. Address Secretary Heckle, Bd. Local Improvements.

DES MOINES, IA.—Bids are asked by the board of public works until Aug. 22 for about 15,000 sq. yds. of brick paving and curbing.

MINNEAPOLIS, MINN.—A portion of University Ave. will be paved with brick. Address Alderman Lane.

ST. PAUL, MINN.—Bids are asked until Sept. 5 for constructing a macadam road on Rice St., etc. D. M. Sullivan, County Audr.

MILWAUKEE, WIS.—The commissioners of public works have advertised for bids for the laying of asphalt pavement on several streets in the 18th Ward. The work must be completed within 30 days after the contracts are awarded.

OMAHA, NEB.—Bids are asked until Aug. 31 for about 35,000 cu. yds. of grading. D. M. Haverly, County Clk.

KANSAS CITY, MO.—Bids are asked by the park board until Aug. 24 for macadamizing the Paseo drives.

KANSAS CITY, MO.—Bids are asked until Aug. 22 for constructing stone sidewalks and paving a number of streets with brick. H. A. Wise, Cy. Engr.

MARSHALL, MO.—Bids are asked until Aug. 29 for 24,300 sq. yds. of macadam paving, 18,000 lin. ft. of curbing, etc. A. R. James, Cy. Clk.

TACOMA, WASH.—Reports state that the county commissioners have ordered surveys to be made for a wagon road, about 22 miles long.

LOS ANGELES, CAL.—Bids are asked until Aug. 20 for grading the Santa Monica and Malibu Coast Road. T. E. Newlin, County Clk.

OAKLAND, CAL.—Bids are asked until Aug. 22 for macadamizing in 20th St. and East 18th St. J. W. Tompkins, Cy. Clk.

OWEN SOUND, ONT.—Reports state that an election will be held Aug. 25 to vote on the question of borrowing $10,000 for macadamizing, and for the purchase of a steam road roller.

MANUFACTURING PLANTS.

AUBURN, ME.—E. O. Wells & Co., of Auburn, have been awarded the contract to build a 4-story factory, 136 × 80 ft., for the Turner Center Dairying Association.

BOSTON, MASS.—The New England Sanitary Product Co. is erecting at Old Harbor Point, near Boston, an absolutely fire-proof 2-story building, 120 × 130 ft., with skeleton steel framework, consisting of steel columns built in the walls, carrying heavy steel floor beams and girders and clear span roof trusses which support the roof. The structural steel work in this plant was designed and is being furnished and erected by the Berlin Iron Bridge Co., of East Berlin, Conn.

BRIDGEPORT, CONN.—It is reported that the Union Metallic Cartridge Co. will build an extension to its factory, at a cost of $50,000.

DOLGEVILLE, N. Y.—It is reported that Armour & Co. have decided to enlarge the felt works at this place, which have recently been bought by them.

NEW BRIGHTON (S. I.), N. Y.—The Kings Patent Plaster Mills, at New Brighton, Richmond Borough, was burned Aug. 6, causing damage estimated at $100,000.

DUBOIS, PA.—The contract for rebuilding the J. Mahler glass warks, which were destroyed by fire on June 25, has been awarded to a Pittsburg firm, according to reports.

EATON, PA.—Bids are asked by the Seitz Brewing Co. until Aug. 30 for erecting a new brewery on Bushkill St. Pres., John A. Seitz.

LANCASTER, PA.—It is reported that the Lancaster Board of Trade has offered a site of 14½ acres, and the necessary bricks for the building of a large steel plant, which Charles James, of Tacony, Pa., formerly connected with Disston Sons' steel plant, at Tacony, and a number of Philadelphia and New York capitalists propose locating here. It will be called the Lancaster Steel Co., and is to have a capital of $400,000, of which sum the people of Lancaster are asked to subscribe $100,000.

EDENTON, N. C.—The Edenton Cotton Mfg. Co., of Edenton, was incorporated with a paid-up capital stock of $80,000 Aug. 15, by C. S. Vann, W. D. Pruden, F. A. White, C. T. Falk and others. The company expect to build and equip at once a spinning and cotton mill at Edenton. No contracts have been let.

SKYCO, N. C.—The Consolidated Ice Co. was incorporated in this state Aug. 15 with a paid-up capital of $5,400, to establish and operate an ice plant at Skyco. The incorporators are W. S. C. Pugh, R. C. Evans, E. R. Daniels, and W. P. Lemon.

CINCINNATI, O.—Reports state that the Lodge & Shipley Tool Co. will soon erect a new plant on Colerain Ave., near Elam St., to be 300 × 100 ft., and to cost about $50,000. Pres., William Lodge.

NORWALK, O.—The plant of the Sprague Umbrella Co. was burned Aug. 9, causing a loss of about $75,000; insurance, $52,500. The building was a 2-story frame structure, 42 × 150 ft., with a wing 32 × 100 ft.

PAINESVILLE, O.—The plant of the Robison Basket Co. was destroyed by fire Aug. 7, causing a reported loss of $100,000; insurance, $55,000.

CHICAGO, ILL.—A fire in this city Aug. 12 damaged the factory of the American Cutlery Co., at 173 to 193 Mather St., causing a reported loss of $75,000.

PUEBLO, COLO.—A fire in this city damaged the plant of the Central Ore Sampling Works; estimated loss, $25,000.

FLAGSTAFF, ARIZ.—The sawmill and box factory of the Arizona Lumber & Timber Co. were destroyed by fire Aug. 2, causing a loss of about $75,000; insurance, $35,000.

MONTREAL, QUE.—The rolling mill, nail mill and lock mill of Peck, Benny & Co. were burned Aug. 3, causing a reported loss of $100,000; fully insured.

GAS PLANTS.

TORRINGTON, CONN.—It is reported that the Torrington Electric Light Co. is considering the question of installing a gas plant, and will increase the capital stock from $24,000 to $100,000.

WILLIAMSPORT, PA.—Reports state that the Williamsport Gas Co. is considering the question of extending its plant. Address Jay W. Lane.

BOONE, IA.—It has been voted to allow a company to construct a gas plant.

LITTLE ROCK, ARK.—Plans have been completed for the extension of mains through North Little Rock, according to reports. Address Manager Pullen.

SAN BERNARDINO, CAL.—The county supervisors want estimates for installing a plant to furnish gas for the court house and jail, to cost about $1,000.

MISCELLANEOUS CONTRACTS.

ENGINEER.—Berlin, Ont.—The clerk is advertising for a town engineer.

RETAINING WALL.—Troy, N. Y.—Bids are asked until 11 a. m., Aug. 19, for constructing a retaining wall on Harrison Place. E. Ogden Ross, Secy.

FIRE ENGINES.—Racine, Wis.—Reports state that the city has decided to purchase steam fire engines.

BONDS.—Los Angeles, Cal.—Bids are asked until Sept. 19 for the purchase of about $300,000 of 4% city bonds. C. H. Hance, Cy. Clk.

BONDS.—St. Paul, Minn.—Bids are asked until Aug. 20 for the purchase of $50,000 of 10-year 3½% county bonds. D. M. Sullivan, County Audr.

BONDS.—Taunton, Mass.—Bids are asked until 12 m. Aug. 18 for the purchase of $70,000 of 4% bonds. Edward Mott, Chn. County Comrs.

DRY DOCK.—West Superior, Wis.—It is reported that the American Steel Barge Co. is arranging for the construction of a new dry dock.

GUN FORGINGS.—Washington, D. C.—Bids are asked until Aug. 24 for furnishing 4-in. and 14-lb. gun forgings. J. D. Long, Secy. Navy Dept.

TELEPHONE SYSTEM.—Neepawa, Man.—Reports state that an election will be held to vote on the question of appropriating $6,000 for a telephone system.

BONDS.—New Orleans, La.—Bids are asked until Aug. 25 for the purchase of $325,000 of 5% levee bonds. T. J. Duggan, Secy. Bd. Levee Comrs., Masonic Temple.

TELEPHONE LINE.—Rockwood, Mich.—Reports state that the People's Telephone Co., of Wayne and Monroe counties, will extend its line to Monroe, via Scofield and Maybee.

REPAIRING STEAMER.—Washington, D. C.—Bids are asked until Aug. 23 for repairing the hull and machinery of the revenue cutter "Forward." O. L. Spaulding, Asst. Secy., Treasury Dept.

FIRE HOSE.—St. Louis, Mo.—Bids are asked until 12 m., Aug. 19, for furnishing 3,250 ft. of 2½-in. rubber-lined cotton hose, 2,000 ft. of 2½-in. 5-ply rubber hose, etc. Jas. Richardson, Comr. of Supplies.

SEA WALLS.—Baltimore, Md.—Bids are asked until Sept. 9 for constructing sea walls, etc., at North and Hawkins Points, as stated in our advertising columns. Lieut. Chas. W. Kutz, U. S. Engr., 9 Pleasant St.

SUPPLIES.—New York, N. Y.—Bids are asked until Aug. 22 for furnishing oils, plumbing material, tools, iron fittings, belting and packing, etc. Adolph Simis, Jr., Comr. Dept. Pub. Charities, East 26th St.

TELEPHONE SYSTEM.—Springboro, Pa.—A franchise has been granted to the Conneautville Telephone & Light Co. to construct and operate a telephone system throughout the borough of Spring. A. R. Seeley, Burgess.

BONDS.—Los Angeles, Cal.—The council has passed an ordinance to issue $160,000 in bonds for the construction of certain tunnels, and $10,000 in bonds for the purchase and improvement of certain lands. C. H. Hance, Cy. Clk.

TRAVELING CRANES.—Chicago, Ill.—Bids are asked until Aug. 30 for furnishing plans, etc., and for erecting electric traveling cranes for the new water pumping stations, as stated in our advertising columns. L. E. McGann, Comr.

LEVEE WORK.—Brownsville, Tenn.—Messrs. J. N. E. Moore, W. Halliburton, J. Anthony and W. W. Dupree have been appointed a committee to prepare specifications and to award contracts for the proposed levee work along the Hatchie River.

CYLINDER PLATES.—Tompkinsville (S. I.), N. Y.—Bids are asked until Aug. 24 for furnishing seventh-course cylinder plates for the Plum Beach Light-House, R. I., as stated in our advertising columns. Lieut.-Col. D. P. Heap, U. S. Engr., Tompkinsville.

DOCKS AND SLIPS.—Seattle, Wash.—Local papers state that Jas. J. Hill, Pres., Great Northern Ry. Co., is in the city in regard to the construction of docks and slips and a grain warehouse, between Harrison and Newark Sts. F. H. Britton, Asst. Gen. Supt., Spokane.

STEEL COAL SHEDS, ETC.—Pago Pago, Samoa.—Plans are being prepared at the bureaus of yards and docks, navy department, Washington, D. C., for the construction of steel coal sheds and piers, at this place, to cost about $250,000. Bids for the work have been asked, according to reports.

LEVEE WORK.—Vincennes, Ind.—The county commissioners have granted a petition by Chas. Pinkstaff, for an appropriation of $30,000 for strengthening about 18 miles of the Wabash levee, which will require about 183,381 cu. yds. of material. Bonds will be issued.

DREDGING.—Norfolk, Va.—A contract has been awarded to the American Dredging Co., Philadelphia, Pa., for dredging a channel 28 ft. deep and 450 ft. wide, in the Elizabeth River, from Hampton Roads to the Norfolk Navy Yard, to cost about $360,000. Capt. Thos. L. Casey, U. S. Engr.

LEVEE WORK.—West Memphis, Ark.—The bids received Aug. 3 by the St. Francis Levee Board, for constructing about 24 miles of levee, containing about 2,193 cu. yds. of material, have been rejected on account of being too high. Harry N. Pharr, Ch. Engr., informs us that new bids will not be asked this season. John B. Driver, Pres. Bd., West Memphis.

MINING MACHINERY. — Pittsburg, Pa. — Local papers state that Messrs. K. T. Fukius, T. Dan, T. Matsubarba and T. Maketa, Mining Engrs. and owners of numerous coal mines in Southern Japan, are in Pittsburg to purchase mining and pumping machinery and the material to sink a shaft over 2,000 ft. deep.

SHIP CANAL.—Chicago, Ill.—Press reports state that surveys for a ship canal through the Calumet to connect with Wolf Lake and Lake George, are now being made, and a contract will be let about Oct. 1 for the employment of about 2,000 men. A. F. Knotts, Secy. Wolf Lake Harbor Com., is said to be interested.

CONTRACT PRICES.

BY-PASS.—Chicago, Ill.—The drainage trustees received the following bids June 29 for constructing a by-pass for Section 18 of the drainage channel, as advertised in Engineering News; projects 2 and 3:

Bids Received at Chicago, Ill., June 29, 1898, for Construction of a By-Pass.

Bidder.	Project No. 2. Construction of wall, 1,810 cu.yds.	Pine stringers, 8,550 ft. B.M.	Oak flooring, 22,500 ft. B.M.	Beams, bed plates, etc., 9,450 lbs.	Excavation, 5,100 cu.yds.	Total.	Project No. 3. Construction of wall, 400 cu.yds.	Cast-iron pipe and water gate.*	Excavation, 15 cu.yds.	Total.
Griffiths & McDermott, Chicago..	$4.60	$32.00	$34.00	$0.03	$0 65	$12,963	$3.75	$1,800	$0.65	$3,310
Mason, Hoge, King & Co., Chicago	4.00	35.00	35 00	.05	1.00	13,899	3.75	2,325	1.00	3,840
Heldmaier & Neu, Chicago	5.65	20.00	28.50	.025	.90	15,960	4.90	2,425	.90	4,399
Gahan & Byrne, Chicago	4.30	21.00	25.00	.04	1.40	16,043	4.05	3,250	1.40	4,891
Geo. M. Campbell & Co., Joliet...	6.00	22.00	23.00	.025	.90	16,392	3.50	2,100	.90	3,514

*Lump sum for furnishing and placing.

PIER.—Philadelphia, Pa.—It is reported that contractor Chas. McCaul wants estimates for the construction of a wooden pier 150 ft. wide, for the Philadelphia & Reading Ry.

DAM.—Chicago, Ill.—The following bids were received by the trustees of the sanitary district June 29 for furnishing the materials and for constructing a concrete dam, Section 18, main channel, as advertised in Engineering News:

Bids Received at Chicago, Ill., June 29, 1898, for Furnishing Material and Construction of Concrete Dam.

Quantities.		Gahan & Byrne, Chicago.	Griffiths & McDermott, Chicago.	Geo. M. Campbell & Co., Joliet.	Mason, Hoge, King & Co., Chicago.	Heldmaier & Neu, Chicago.
Excavation and disposition of material..	175,500 cu. yds.	$0.452	$0.57	$0.65	$0.68	$0.675
	7,670 " "	.58	1.00	.50	.75	1.10
	55,400 " "	.22	.25	.25	.20	.33
Removal of dams Nos. 1 and 2, and Adams dam, lump sum		4,000.00	3,500.00	1,500.00	6,766.00	5,300.00
Construction of new dam above—59.0, lump sum		17,751.00	12,000.00	11,425.00	12,225.00	14,193 00
Construction of new dam below—59 0.....	150 cu. yds.	1.50	7.00	6.00	5.75	7.80
Excavation and disposition of material....	2,000 " "	.36	.85	.75	.75	.60
Construction of retaining walls..........	6,300 " "	4.05	3.75	3 50	3.75	4.90
Excav. and disposition material lock walls	50 " "	1.50	7.00	1.25	3.00	5.00
Portland cement, concrete lock walls......	250 " "	6.00	7.00	6.00	7.00	10.60
Total		$145,749	$165,530	$170,698	$183,051	$200,815

FILTRATION PLANT.—Albany, N.Y.—The following bids were received by the water commissioners Aug. 2, 1898, for the water filtration plant, contract No. 7, for the pumping station and intake; Stone & Thurston awarded contract; Supt., Geo. I. Bailey:

Quantities.		Stone & Thurston, New York.	C. Hughes. Syracuse, N. Y.
Cast-iron intake, complete		$3,800.00	$4,350.00
Pumping station, complete		12,167.00	12,700.00
Chimney stack, complete		1,540.00	1,800.00
Sluice gates and screens		825.00	1,000.00
Shallow excavation ...	600 cu. yds.	.30	.50
Deep excavation	600 " "	.50	1.20
Concrete (1—3—6)	700 " "	4.95	5.50
Concrete (1—2—4)	100 " "	6.00	6.50
Paving	100 sq. yds.	1.00	1.50
Total		$22,977.00	$25,520.00

LAYING WATER PIPE.—Albany, N. Y.—The water commissioners received the following bids Aug. 2, 1898, for laying water pipe; contract awarded Wm. R. Reynolds; Geo. I. Bailey, Supt.:

Quantities.		W. R. Reynolds.	F. Pidgeon.	John Doyle.	Dollard & Holler.	Robt. M. Strong.
Laying water pipe:						
4-in. ...	85 lin. ft..	$0.23	$0.40	$0.25	$0.25	$0.23
6-in. ...	3,610 " "	.23	.27	.25	.27	.23
8-in. ...	820 " "	.41	.34	.30	.31	.34
12-in. ...	3,900 " "	.38	.34	.40	.41	.45
Hydrants*	5 each...	2.63	10.00	4.00	3.00	2.87
Valves and boxes, complete:						
4-in. ...	1.........	3.00	6.00	2.00	2.00	1.90
6-in. ...	7 each...	2.12	8.00	2.00	3.00	2.75
8-in. ...	1.........	2.50	10.00	3.00	3.00	3.00
12-in. ...	3 each...	3.00	12.00	3.00	3.00	3.75
House cons	20.........	.75	1.50	2.00	.75	.90
AA l'd pipe	100 lbs.....	.04	.06	.05	.06	.043
Total		$2,730	$2,808	$2,823	$2,820	$2,956

*Setting fire hydrants complete.

UNDERGROUND CROSSING.—Kingston, N. Y.—The following bids were received July 9 for constructing an underground crossing for the Colonial City Traction Co., as advertised in Engineering News; contract awarded S. W. Frescoln; Pres., C. M. Preston; Engr. and Supt., C. Gordon Reel; ground will be broken this week:

SLUICE GATES, ETC.—Boston, Mass.—The metropolitan water board received the following bids Aug. 9, 1898, for furnishing sluice gates and an iron floor at the Middlesex Fells reservoir; contract awarded Coffin Valve Co.:

Quantities.		Coffin Valve Co., Neponset, Mass.	Camden Iron Wks., Camden, N. J.	I. P. Morris Co., Philadelphia, Pa.
36-in. sluice gates.	8 each...	$297.50	$515.00	$618.00
12-in. slice gates ..	2 " ...	132.00	309.00	400.00
Steam b'ms & c. i. floor plates		776.00	1,010.00	1,495.00
Total		$3,420.00	$5,748.00	$7,239.00

BRICK SEWERS.—Springfield, Mass.—Chas. M. Slocum, Cy. Engr., informs us that the following bids were received Aug. 2 for building brick sewers in Clinton, Fulton and Sargeant Sts.:

EXCAVATION.—Boston, Mass.—The following bids were received by the metropolitan water board Aug. 9, 1898, for excavating, etc., for the easterly portion of north dike, Wachusett reservoir:

Bidder.	Excavation, 290,000 cu. yds.	Haul of 100 ft., 90,000 cu. yds.	Total.
J. D. Gennaro, Boston (accepted).	$0.14⅞	$0.00¾	$43,813
Auguste Saucier, S. Framingham	.17	.00¾	49,975
Moulton & O'Mahoney, Boston..	.18	.01	53,100
H. P. Nawn, Boston...........	.18	.01	53,100
T. W. Kinser & Sons, Boston....	.22	.00¾	64,475
Martin & T. Murphy, Clinton...	.22	.01	64,700
Kirk, Driscoll & Co., Syracuse..	.23⅞	.01	70,138
Long & Little, Leominster......	.25½	.00½	74,400
Newell & Snowling Const'n Co.	.26	.01	76,300

Bids Received at Springfield, Mass., Aug. 2, 1898, for Brick Sewers in Clinton, Fulton and Sargeant Sts.

Bidder.	Earth excavation, 19,160 cu.yds.	Masonry. Brick. Portl'nd cement mortar, 175 cu.yds.	Am'rican cement mortar, 1,342 cu.yds.	Conc'te, Portl'd cement mortar, 135 cu.yds.	24-in.* outlet pipe and specials, 39½ lin. ft.	24-in.† outlet pipe, 175½ lin.ft.	8-in. underdrain, 2,950 lin.ft.	Total.	No. of work'g days.
C. E. Trumbull & Co., Boston, Mass.........	$1.25	$8.50	$7.05	$6.50	$10.00	$5.00	$0.20	$37,639	100
F. T. Ley & Co., Springfield, Mass.........	.69	9.80	7.85	8.00	14.00	12.00	.25	29,947	45
F. E. Shaw, Providence, R. I.	.80	10.00	8.00	6.50	8.00	8.00	.20	31,002	99
John Walker, New Market, N. H............	.85	10.00	8.00	7.00	5.00	5.00	.25	31,530	50
D. W. Mellen and G. M. Atkin, Springfield..	.80	10.00	8.60	6.50	16.00	11.00	.20	32,649	100
Geo. N. Vaughan, Springfield, Mass.........	.75	10.00	8.00	8.00	20.60	11.65	.15	31,237	90
Wm. D. McKenzie, Springfield, Mass........	.73	10.25	8.00	8.00	20.00	13.00	.20	31,258	95
Robert D. Maynard, Springfield, Mass.....	.60	10.00	8.00	7.00	15.00	15.00	.15	28.595	100
Maloney & Peterson, Springfield, Mass.....	.715	10.00	8.00	8.00	22.00	14.00	.20	31,181	85
Clapp & Shipman, New York, N. Y.........	.50	10.00	8.00	8.00	9.60	9.60	.15	25,653	90

*Cast-iron. †Cypress wood.

PAVING.—Rockford, Ill.—We are informed that the Barber Asphalt Paving Co., North Exchange Bldg., Chicago, has been awarded the contract for asphalt paving at $1.73 a sq. yd.; concrete foundation 6 ins. deep, 43 cts. a sq. yd.; excavation, 1 ct. a cu. yd.; guarantee, 7 years. G. Maffioli, Rockford, has been awarded the contract at 90 cts. a sq. yd. for brick paving. There will be a foundation with 6 ins. of concrete and 1-in. of sand.

TRUNK SEWER.—Wallingford, Conn.—Baker, Banker & Co., Gloversville, N. Y., submitted the following lowest bids Aug. 2, 1898, for constructing the brick sewer, as advertised in Engineering News: 24-in. pipe, $1.30 a ft.; 30-in. pipe, $2.00 a ft.; manholes, $40.00 each; 6-in. pipe, 20 cts. a ft.; rock excavating, $3.00 a cu. yd.; iron pipe, $3.90 a ft.; masonry, $13.00 a cu. yd.; dirt filling, 30 cts. a cu. yd.; rubble masonry, $4.00 a cu. yd.

Bids Received at Kingston, N. Y., July 9, 1898, for Constructing an Underground Crossing.

Bidder.	Time limit.	Excavation. Earth, 11,000 cu.yds.	Loose rock, 1 cu. yd.	Solid rock, 1 cu. yd.	Concrete, 600 cu.yds.	Masonry. Bridge, 1,000 cu.yds.	Rub'le, 700 cu.yds.	Brick, 20 cu.yds.	White glazed brick, 85 sq.yds.	Bluestone coping, 145 lin.ft.	12-in.* t. c. pipe, 1,300 lin.ft.	Laying. 12-in. t. c. pipe,† 650 lin. ft.	12-in. t. c. pipe,§ 650 lin. ft.	Steps, complete in place.	Brass hand rail, in place.	Structural steel, 92 tons, cts.	Asphalt filling, 15 cu.yds.	Total.
S. W. Frescoln, Reading, Pa...	60 days......	$0.60	$1.00	$2.00	$3.00	$5.00	$3.50	$7.00	$4.25	$2.00	$0.21	$0.26	$0.90	$170.00	$50.00	2.6	$8.00	$22,795
E. M. Haines & Co., Rhinebeck.	100 wrkg days.	.50	.60	2.45	3.00	7 50	4.00	7.00	7.95	2.35	.17	.37	.95	225.00	80 00	3.0	4.00	25,724
McHale & Co., 258 B'way, N.Y.	3 months....	.50	.55	1.00	4.05	8.00	4.50	7.15	4.95	2.15	.18	.25	1.35	185.00	135.00	2.7	14.00	26,729
Houston Const'n Co., Phila, Pa.	80 wrkg days.	.45	1.20	1.50	3.00	9.35	4.50	7.50	6.00	3.18	.22	.12	1.08	240.00	160.00	3.0	16.50	27,607
Owego Bridge Co., Owego, N.Y.	90 " "	.375	1.00	3.00	4.50	8.50	4.00	15.00	10.00	3.00	.20	1.25	2.25	400.00	60.00	3.0	15.00	27,718
Frank Pidgeon, Saugerties,N.Y.	60 " "	.45	2.00	3.00	5.00	9.00	4.00	10.00	7.25	3.00	.30	.30	.80	325.00	130.00	3.0	3.00	28,131
Campbell-Dempsey & Mitchell..	100 " "	.50	.25	.10	4.50	8.00	4.50	6.00	7.50	2.60	.20	.40	3.00	250.00	150.00	2.75	13.50	28,617
A. S. Traub, 146 W. 126th St...	50 " "	.65	1.00	2.00	4.00	8.00	4 00	12.00	7.00	2.75	.17	.30	2.50	250.00	50.00	2.6	6.00	28,802
Monty, Higley & Co.,Sandy Hill	70 " "	.50	2.00	4.00	4.50	8.75	4.55	7.50	5.00	2.25	.20	.50	5.00	200.00	90.00	2.3	10.00	29,549
D. O'Connell & Son, Holyoke...	90 " "	.57	2.00	5.00	4.00	9.00	4.50	7.00	7.56	3.00	.15	.25	3.75	250.00	100.00	2.5	8.00	29,510
Assurance Const'n Co., N. Y...	70 " "	.75	2.00	4.00	4.05	8.00	3.75	9.50	6.00	2.25	.25	.195	1.70	200.00	100.00	2.8	15.00	29,571
Drake & Stratton Co.,New York	80 " "	.60	1.00	3.50	4.50	8.00	6.00	10.00	6.00	3.00	.30	.50	.75	275.00	100.00	3.0	2.00	29,777
P. F. Curran, 48 Dey St., N. Y.	110 " "	.60	1.50	3.00	4.80	7.50	6.50	15.00	7.00	2 50	.15	.25	1.68	200.00	162.50	3.0	14.00	30,324
M. J. Kennedy, Brooklyn, N. Y.	50 " "	.92	2.00	2.50	4.75	7.50	5.50	10.00	5.00	.80	.20	.25	1.00	188.00	140.00	2.5	7.00	31,171
P. H. Harrison & Co., N. Y.....	40 " "	.55	1.00	1.50	5.00	10.00	5 50	8.00	5.06	1.40	.20	.75	2.00	200.00	200.00	3.5	3.00	32,629
H. M. Dowd, Orange, N. J.....	90 " "	.75	3.00	8.00	4.50	10.00	5.00	15.00	2.50	2.00	.20	.60	5.00	300.00	75.00	3.0	10.00	35,359
Avrezzana & Kolmeyer, N. Y...	45 days......	.38	10.00	10.00	5.00	11.50	5.50	10.00	20.00	4.00	2.50	.01	.01	400.00	85.00	4.0	5.00	36,213

*Furnishing. †Shallow trench. §Deep trench.

BRICK PAVING.—Detroit, Mich.—James Grant has been awarded the contract for brick in Congress St., at 87 cts. a sq. yd.; total, $4.473. The brick will be furnished by the city.

IMPROVING STREET.—Cincinnati, O.—We are informed that the following bids were received Aug. 2 for improving Western Ave., from Hopple St. to the north corporation line; contract awarded M. T. Flynn; A. B. Rattermann, Pres. Bd. City Affairs; T. B. Punshon, Ch. Engr.; John D. Harris, Asst. Clk.:

BRICK PAVING—Meadville, Pa.—We are informed that Peter Schenck, Butler, Pa., has been awarded the following contract for paving with Park fire clay brick, wire cut and Meadville sandstone, as advertised in Engineering News: Paving, $1.25 a sq. yd.; flagging, natural or sandstone and curbing, 2,170 ft., 5 and 6 ins. × 22 ins., 40 cts. a ft.; edgestone, 100 ft., 4 × 18 and 2½ × 12 ft., 33 and 25 cts., respectively; cast-iron gutter plates, 750 lbs., 1¾ cts. a lb.; two standard catch basins, $3,000 each; 12-in. storm sewer, 120 ft., 40 cts. a ft.; 100 ft. of 10-in. sewer, 35 cts. a ft.; total, $4,958.

Bids Received at Cincinnati, O., Aug. 2, 1898, for Improving Western Ave.

Quantities.		A. J. Henkel & Bro., 621 Main St.	M. T. Flynn, 1252 Chase Ave.	G. P. Walker, 621 Main St.	D. Folz Asphalt Paving Co., 8th & Plum.	W. Fogarty, 3550 Burnet Ave.	F. Folz, 8th and Plum.	H. Dieckomeier, 209 15th St	Delaney & Broerman, 1139 W. 6th.	Van Sandt & Meeds, 60 Atlas Bnk Bldg.	O. E. Robinson, 4647 Hamilton Ave.	J. M. Quill, 1052 Pine St.
Broken stone.	3,800 cu. yds.	$1.85	$0.95	$1.35	$1.15	$1.25	$1.25	$1.19	$1.15	$1.15	$1.25	$1 40
Concrete	50 " "	2.75	2.50	3.00	3.00	3.00	3.00	4.00	3.00	.01	2.00	3.00
Coping	90 lin. ft..	.75	.75	.70	.65	.75	.60	.70	.60	.85	.50	.60
Crossings ...	475 " "	.40	.40	.50	.52	.50	.45	.40	.45	.80	.50	.45
Curbs	5,662 " "	.50	.47	.55	.50	.50	.50	.50	.50	.60	.50	.52
Circular ..	95 " "	.75	.75	.80	.75	.75	.60	.90	.75	.90	1.00	.52
Drain pipe...	200 " "	1.00	1.24	1.00	1.30	.75	1.00	1.25	1.00	1.10	1.00	1.00
Drain pipe ..	240 " "	.40	.40	.50	.60	.25	.30	.60	.50	.60	.25	.40
Gutters*	780 " "	.70	.60	.75	.80	.65	.80	.70	.60	.75	.80	.70
Flag'g gutt'rs	4,882 " "	.45	.40	.50	.50	.50	.50	.42	.45	.55	.50	.49
Grading	17,000 cu. yds.	.01	.14	.20	.20	.15	.12	.23	.16	.21	.25	.17
Masonry:												
Brick	102 " "	7.00	7.00	8.00	7.23	10.00	5.50	8.00	7.00	7.00	5.00	7.00
Vit. brick..	31 " "	10.00	9.00	12.00	11.60	15.00	9.00	12.00	9.00	12.00	7.00	9.00
Uncoursed .	230 " "	3.00	2.50	3.00	3.00	2.25	3.00	3.50	2.50	2.75	3.00	3.50
Limestne pvg	50 sq. yds.	.60	.50	.80	.68	.25	.60	.30	.50	.65	1.00	1.00
Rolling	19,100 " "	.02	.025	.03	.03	.03	.02	.03	.03	.025	.05	.03
Gravel	543 cu. yds.	1.00	.60	1.25	.85	1.10	.97	1.25	.50	1.00	1.25	.95
Well plates..	4,000 lbs.....	.025	.03	.02	.025	.05	.02	.04	.02	.035	.04	.03
Total		$16,305	$14,386	$18,766	$17,552	$17,201	$15,981	$18,212	$15,912	$18,805	$18,894	$17,912

*Flagging and laying gutters.

ASPHALT PAVING.—Cincinnati, O.—The following bids were received Aug. 4, 1898, for asphalt paving in Bates Ave., from Colerain to Spring Grove Ave.; bid of Southwestern Alcatraz Asphalt Paving & Construction Co. accepted:

Quantities.		Warren-Scharf Asphalt Pav'g Co., New York.	Southwestern Alcatraz Asp.Pvg. & Const'n Co.	David Folz Asphalt Paving Co.
Curbs	1,650 lin. ft..	$0.65	$0.88	$1.05
Resetting. ..	24 " "	.25	.05	.20
Grading	7,000 cu. yds.	.36	.25	.35
Repaving ...	40 sq. yds.	1.00	.50	.80
Asphalt	2,735 sq. yds.	2.28	1.67	2.30
Total		$9,874	$7,791	$10,510

ARC LIGHTING.—Parsons, Pa.—Thos. M. Thomas, Clk., writes us that the Keystone Electric Construction Co., Tunkhannock, Pa., has been awarded the contract for furnishing this city with 20 2,000-c.p. arc lights for five years, at $77 a light a year.

LAYING WATER PIPE.—Boston, Mass.—The metropolitan water board awarded the following contract Aug. 9, 1898, to Bruno & Salamone, East Boston, for laying water pipe in a portion of Section 9: Laying 3,060 lin. ft. of 48-in. cast-iron pipe, at $1.79 a lin. ft.; 5 ft. of 16-in. cast-iron pipe, $1.00; 5 cu. yds. rock excavation above grade, 1 ct. a cu. yd.; 1 cu. yd. of rock excavation below grade, 1 ct.; 10 cu. yds. earth excavation below grade, $1.00; setting 2 air valves, at $3.00 each; 2 chambers for air valves, $45.00 each; 10 cu. yds. of concrete masonry, $4.00 a cu. yd.; total, $5,628.

INDUSTRIAL NOTES.

THE EASTERN PAVING BRICK CO., Catskill, N. Y., has a contract from the city of Paterson, N. J., for 1,500,000 vitrified paving bricks. The company, it is said, has a large amount of work on hand.

THE HAZARD MFG. CO., Wilkes-Barre, Pa., and 50 Dey St., New York, reports that it is now manufacturing all sizes of hard and soft drawn copper wire, and also round "figure 8" trolley wire, and can furnish any size promptly.

THE HOLYOKE MACHINE CO., Holyoke, Mass., has the contract for water wheels and iron work for the new 10,000-HP. power plant of the Columbus Power Co., Columbus, Ga. Mr. W. C. Whitner, of Columbus, is the designing engineer.

THE A. S. ALOE CO., St. Louis, Mo., advises our representative that in addition to manufacturing its own transits, levels and general engineering instruments, it also makes a specialty of buying and selling all kinds of second-hand instruments and carries in stock standard makes of engineering supplies of all descriptions.

THE PLUEGER & HENGER MFG. CO., St. Louis, Mo., has a contract from that city for 400 fire hydrants. It has also opened a Tinning Department, making a specialty of tinning on grey iron, something that, it claims, has not been accomplished successfully there before, and has met with the best results, having secured already some large contracts for this department.

THE SARGENT CO., Chicago, states that it has been running its open-hearth steel plant for the past few months at its full capacity on several large contracts, among which is one for the castings of 10-in. gun carriages for the U. S. government. The company claims to have been very successful in this class of work, readily meeting the physical tests prescribed by the government, as well as the short delivery, which is demanded in most cases.

THE FRONTIER IRON WORKS, Detroit, Mich., reports the following among recent shipments of Frontier tandem and gasoline engines: One 60-HP., for a 600-light village electric light plant, Norway, Mich.; one 40-HP., Bay City, Mich.; one 40-HP., Ogdensburg, N. Y.; one 40-HP., and several 20 and 25-HP. engines, the same type, Wichita Falls, Kan. The company claim for this engine a regulation equal to that of a steam engine, adapting it to electric lighting and similar duty at a decided economy of fuel and attendance.

THE CHICAGO PORTLAND CEMENT CO., Chicago, is said to be building a new plant for the manufacture of cement, at Oglesby, Ill., to replace the works at Hawthorne, Ill., which were destroyed by fire last February. The buildings are reported as to cost over $60,000, and the new machinery $100,000. The main building of steel and concrete will be 300 × 125 ft. and three stories high. A 70 × 250-ft. stock house, a 60 × 70-ft. boiler house, a 60 × 70-ft. engine house and a 50 × 80-ft. office building, three stories in height, will also be built, in addition to several smaller buildings. The officers of the company are: Pres., Norman Fraser; Vice-Pres., David R. Fraser; Secy. and Treas., Ralph Gates.

Contract Work Should Always be Advertised in a Paper Read by Contractors.

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies in North America Reads Engineering News.

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PERSONAL.

Dr. W. F. Blunt, of Lockhart, Tex., has been appointed a member of the State Board of Health of Texas, to succeed Dr. R. M. Swearingen, deceased.

Mr. Charles H. West has been elected Chief Enginner of the Mississippi Levee District, Greenville, Miss., to succeed Mr. William Starling, M. Am. Soc. C. E.

Mr. John D. King, for several years Superintendent of the New Brighton Water Co., New Brighton, Pa., has resigned. Mr. Bonbright Kennedy has been appointed to succeed him.

Mr. William E. McClintock, M. Am. Soc. C. E., formerly of the firm of McClintock & Field, civil engineers, of Brockton, Mass., has begun the practice of law at 644 Tremont Building, Boston, Mass.

Mr. J. F. Coleman, civil engineer, of New Orleans, La., expects to leave for Cuba and Porto Rico about Sept. 15 on a prospecting tour to investigate the outlook for civil engineers and contractors in those islands. He intends spending about 30 days on the trip.

Mr. William Forsyth, M. Am. Soc. M. E., Mechanical Engineer, of the Chicago, Burlington & Quincy R. R., with headquarters at Aurora, Ill., has accepted the position of Superintendent of Motive Power of the Northern Pacific Ry., with headquarters at St. Paul, Minn., to succeed Mr. E. M. Herr, resigned.

Mr. Thomas G. Long, M. Am. Soc. C. E., formerly of the Union Bridge Co., New York, is now Second Vice-President of the R. P. & J. H. Staats Co., lately reorganized and incorporated, with offices at 29 Broadway, New York. The company's work, as engineer and contractor, covers docks, bridges, buildings, foundations, masonry, etc.

Mr. L. N. Case, General Superintendent of the water department of Detroit, Mich., has ceased to hold that position, owing to its abolition by the Board of Water Commissioners, and has instead been appointed Acting Secretary during the absence of the Secretary. Mr. Case has been connected officially with the water department for over 30 years.

Mr. A. G. Menocal, M. Am. Soc. C. E., formerly Civil Engineer, U. S. Navy, whose "suspension from duty on furlough pay for three years" as a result of his trial in consequence of the failure of Dry Dock No. 3 at the New York Navy Yard, was noted in our issue of June 9, has been pardoned by President McKinley, who restores him to his former status in the navy. Mr. Menocal will be retired from active service Sept. 1 on account of the age limit.

OBITUARY.

Mr. Jacob Guest Jones, contractor, of Washington, D. C., died Aug. 16, aged 62.

Mr. Joseph A. Barstow, contractor, of Atlantic City, N. J., died Aug. 15, aged 71.

Mr. Joseph Clark, contractor, died at his home in Hazel Green, Ky., last week, aged 77.

Mr. David M. Smith, builder and contractor, of Brooklyn, N. Y., died Aug. 21, aged 80.

Mr. William Reed, contractor, of Allegheny, Pa., died in Wilkinsburg, Pa., Aug. 13, aged 85.

Mr. Edward H. Moore, Water Commissioner, of Stoneham, Mass., died Aug. 18, aged 47.

Mr. C. J. Gardner, President of the Utica Cement Co., Utica, N. Y., died at Colorado Springs, Colo., Aug. 18, aged 53.

Mr. Albert A. Pancoast, President of the Philadelphia & Reading Coal & Iron Co., Philadelphia, died at Elberon, N. J., Aug. 19, aged 58.

Mr. Robert A. Stranahan, formerly well known in the South as a constructor of gas works, died at his home in Boston, Mass., Aug. 9.

Mr. William E. Davis, Superintendent of the Clinton Bridge Co., Clinton, Ia., accidentally shot and killed himself Aug. 18 in that city. He was born at Athens, Pa., in 1872, and was educated at Cornell University, Ithaca, N. Y. Since then he has been connected with the Elmira Bridge Co., Elmira, N. Y., the Adirondack & St. Lawrence R. R., the Phoenix Iron Co., Phoenixville, Pa., R. W. Hildreth & Co., New York, and the Union Bridge Co., Athens, Pa. He was a son of Mr. George E. Davis, Superintendent of the last-named company.

Mrs. Sophia Braeunlich, Business Manager of the Scientific Publishing Co., New York, publishers of "The Engineering and Mining Journal" and "The Mineral Industry," died at Sault Ste. Marie, Mich., Aug. 11. She was born on Long Island, July 2, 1854, and was the first woman graduate of Packard's Business College, New York. She entered the service of the above company Dec. 11, 1879, and in 1888 she became Secretary and Treasurer of the same. She was appointed Business Manager Jan. 1, 1890. Mrs. Braeunlich was the first American woman elected a Fellow of the Imperial Institute of London.

Mr. Edward Dexter Brown, M. Am. Inst. E. E., died in the military hospital at Fort Meyer, near Washington, D. C., July 16, aged 30. He was born in Reading, Mass., and graduated from the Massachusetts Institute of Technology, Boston, Mass., in 1890. Since 1891 he had been with the American Telephone & Telegraph Co., with offices at 18 Cortlandt St., New York city, and since 1895 was the General Inspector, having risen through the lower engineering grades. On April 30, last, he resigned this position in order to go to the front with Troop C, New York Volunteer Cavalry, of which he had been a member for two years, holding the post of Corporal. He was taken sick with typhoid fever while at Camp Alger, Va.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

NATIONAL IRRIGATION CONGRESS.
Sept. 1-3. Annual convention, Cheyenne, Wyo. Secy., J. C. Harpham.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Sept. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

GERMAN-AMERICAN TECHNICAL SOCIETY.
Sept. 3-7. Annual meeting, Philadelphia Section, Reading, Pa. Secy., A. Schumann, 532 North 4th St., Philadelphia, Pa.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Sept. 5. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

AMERICAN STREET RAILWAY ASSOCIATION.
Sept. 6-9. Annual convention, Boston, Mass. Secy., T. C. Pennington, 2020 State St., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 7. Secy., C. W. Hunt, 220 W. 57th St., New York city.

CENTRAL RAILWAY CLUB.
Sept. 9. Secy., H. D. Vought, 114 5th Ave., New York city.

MONTANA SOCIETY OF ENGINEERS.
Sept. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

THE LOUISIANA ENGINEERING SOCIETY.
Sept. 12. "Evolution of Structural Design," F. T. Llewllyn. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 12-13. Annual meeting, Sault Ste. Marie, Mich. Secy., Wilson S. Howell, Newark, N. J.

NORTHWEST RAILWAY CLUB.
Sept. 13. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

NEW YORK STATE STREET RAILWAY ASSOCIATION.
Sept. 13-14. Annual meeting, Brooklyn, N. Y. Secy., H. A. Robinson, New York city.

DENVER SOCIETY OF CIVIL ENGINEERS.
Sept. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

THE RAILWAY SIGNALING CLUB.
Sept. 13. Secy., Earl M. Seitz, C. & N. W. Ry., Chicago, Ill.

ENGINEERS' CLUB OF CINCINNATI.
Sept. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

BROOKLYN ENGINEERS' CLUB.
Sept. 15. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Sept. 16. D. W. Meeker, St. Paul, Minn.

ENGINEERS' CLUB OF PHILADELPHIA.
Sept. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Sept. 17. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' CLUB OF MINNEAPOLIS.
Sept. 19. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Sept. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Sept. 20. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Sept. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Sept. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

ENGINEERS' CLUB OF ST. LOUIS.
Sept. 21. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 12. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

NEW ENGLAND ROADMASTERS' ASSOCIATION.—The 16th annual meeting of this association was held at Boston, Mass., Aug. 17-18, and the program was carried out as announced in Engineering News of July 28.

THE LOUISIANA ENGINEERING SOCIETY.—A regular meeting of this society was held Aug. 8. Mr. C. H. Chamberlain, Assistant Engineer, T. & P. R. R., read an interesting paper on "Deep Bridge Foundations on the Atchafalaya River."

The society decided to apply for membership in the Association of Engineering Societies, and the Secretary was instructed to file the necessary application. An outing will be taken in September consisting of a tour of inspection of the drainage stations and canals now being constructed in and about New Orleans.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.—The Committee on Turntable Construction recently issued a list of questions, with the request that they be answered and returned as early as possible to Mr. Onward Bates, 1100 Old Colony Bldg., Chicago, Ill. The following are the questions:

1. How many turntables are under your care?
2. Description of your turntable? (Style and name of maker.)
3. Diameter of turntable pits?
4. Depth of pits at center?
5. Depth of pits at perimeter?
6. Diameter of circular track for balancing table?
7. Kind of foundation for center of table?
8. Kind of foundation for circular track?
9. Kind of pit walls?
10. Kind of curbing on pit walls?
11. Kind of paving in pit?
12. Method of draining pit?
13. Are any of your pits covered, and in what manner?
14. What is the length of your longest engine from center of forward truck wheel to center of rear tender wheel?
15. What is the weight of your heaviest engine including tender, in running order, with coal and water?
16. How long a table is required to balance these engines?
17. What is the distance from center of table to end of turning lever?
18. How many men does it take to turn your heaviest engine?
19. Give following particulars of turntables:
    (a) Deck or through girders or gallows frame?
    (b) Kind of centers (wheels, conical rollers, balls or pins)?
    (c) Method of balancing and adjusting height of center?
    (d) Number and diameter of balance wheels?
    (e) Method of adjustment at ends?
    (f) Kind of floor?
    (g) Kind of latch?
    (h) Kind of supports for rails at ends of table and on pit walls?
20. Do you have trouble with steel or iron tables rusting?
21. What kind of paint do you use on metal tables?
22. Are engines allowed to blow off steam while standing on tables?
23. Are you troubled with snow in pits?
24. Are you required to keep the tables locked when not in use, so that they cannot be turned by trespassers?
25. If you have tables turned by power, describe its application?
26. Please state your opinion as to the durability and wearing qualities of the turntables that have come under your observation?

NEW PUBLICATIONS.

STATE BOARD OF HEALTH OF MICHIGAN.—Report for the Year Ending June 30, 1896. Henry B. Baker, Lansing, Mich., Secretary. Cloth; 6 × 9 ins.; pp. CC. + 523; tables.

This report contains a vast mass of statistical information relating to meteorology, sickness and death in Michigan for the year 1895. Besides this an account is given of the detailed work of the board during 1896 and a number of papers on health matters are included.

STATE BOARD OF HEALTH OF NEW YORK.—Report for 1896. Baxter T. Smelzer, M. D., Secretary, Albany, N. Y. Cloth; 6 × 9 ins.; pp. 620; many tables and folding maps, 32 of the latter being in a separate case.

Under the laws of New York all plans for sewerage and sewage disposal systems must be presented to the State Board of Health for approval. A large part of the report before us is made up of plans and descriptions of such proposed work. Besides this there are some special reports on sewerage, water supply, garbage disposal and other subjects, and copies of the rules and regulations established by the board for the sanitary protection of certain water supplies. Most of the tables are composed of detailed mortality statistics for the state and its subdivisions.

COMMISSIONER OF EDUCATION.—Report for the Year 1896-97. Vol. I., Part I. Wm. T. Harris, Commissioner. Washington, D. C.: Pub. Doc. Cloth; pp. 1,136; tables and illustrations.

This thick volume treats of a wide range of subjects, including such diverse ones as Sunday schools and nitrifying organisms. It is a review of educational work in a variety of phases both in this country and abroad. Some of the chapter headings indicating the matter in the volume most likely to be of interest to our readers are as follows: "The Curriculum of the Land Grant Colleges;" "Requirements for Admission to the Freshman Class in Colleges, Universities and Schools of Technology;" "Entrance Requirements for Engineering Colleges;" "Some Recent Contributions of Biology, Sociology and Metallurgy to the Curriculum of Colleges Endowed by the Federal Government for the Benefit of Agriculture and the Mechanic Arts;" "Educational Directory."

EXPERIMENTAL TREE PLANTING IN THE PLAINS.—By Charles A. Keffer, Assistant Chief of the Forestry Division. Pub. Doc. Bulletin No. 18, Division of Forestry, U. S. Department of Agriculture, Washington, D. C. Paper, 8vo.; pp. 94; illustrated.

The experiments have been made to test the adaptability of various species in different regions, to develop methods of cultivation and to demonstrate forestry methods. Most of the plantations are in the Western plains, and the author discusses the advantage of such plantations as well as the conditions affecting tree growth. Reports are given of the several plantations in South Dakota, Nebraska, Kansas, Colorado, Utah and Minnesota, some of which are under the care of the state agricultural colleges.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

DUMPING WAGONS.—Wm. Beckert, 340 Ohio St., Allegheny, Pa. Paper; 6 × 9 ins.; pp. 10; illustrated.

This catalogue contains illustrated descriptions of dumping wagons for hauling garbage, brick, stone, gravel, dirt and other materials.

ELECTRIC GENERATORS AND MOTORS.—The Crescent Electric Machine Co., 643-647 Kent Ave., Brooklyn, N. Y. Pamph.; 9½ × 5¾ ins.; pp. 29.

This is an illustrated pamphlet describing the types of generators and motors manufactured for special service by this company. Tables of sizes and letters from users of the "Crescent" apparatus are also included.

FIRE-PROOF AND RUST-PROOF PAINTS.—Chicago Fireproof Covering Co., Chicago, Ill. Paper, 5 × 6¾ ins.; pp. 8.

This pamphlet describes the results of tests made by coating iron plates with various compositions and immersing them in water for 48 and 160 days. The company's specialties are a galvanic varnish for ironwork that is submerged or exposed to acids or gases, and "asbesto-clad," which is a fireproof paint for woodwork.

FIREPROOF CONSTRUCTION.—John A Roebling's Sons Co., New York, N. Y. Pamph.; 9 × 6 ins.; pp. 73; illustrated.

This is a very neatly gotten up pamphlet, illustrating and describing in considerable detail the different forms of fireproof floor systems, ceilings, partitions and column protections in cinder concrete and wire lath, which the John A. Roebling's Co. manufacture and erect. Tables of weights, detail specifications and other information useful to designers accompany the description of each type of construction.

RECENT BALDWIN LOCOMOTIVES.—Baldwin Locomotive Works, Philadelphia, Pa. Pamph.; 9 × 6 ins.; pp. 32; illustrated.

This is No. 6 of the series of pamphlets, which the Baldwin Locomotive Works is publishing, illustrating and desribing the locomotives recently built to fill its American and foreign orders. The locomotives illustrated in this number comprise, besides several ten-wheel simple and compound engines, a four-wheeled electric mining locomotive, a six-wheeled coupled mining locomotive, a rack locomotive built for the Leopoldina Ry. of Brazil, a six-wheeled suburban locomotive, and a number of American type engines.

STEEL FREIGHT CARS.—Schoen Pressed Steel Co., Pittsburg, Pa. Cloth; 9 × 12 ins. Not paged. Numerous full-page illustrations.

This book, which is a fine specimen of the printer's and engraver's art, contains half-tone cuts of the company's extensive shops, which cover 24 acres of ground, and of the bolsters, trucks and complete cars of different styles, made entirely of pressed steel. One of the photographs is an instantaneous view of a train in motion with 35 cars loaded with iron ore, the average load in each car being 108,000 lbs. The Schoen Pressed Steel Co. began ten years ago in a small way the manufacture of pressed steel articles, to take the place of cast iron in car construction. By degrees every piece entering into a car was designed, made and perfected, and after this work was complete the manufacture of entire cars was undertaken. Already some 4,000 of these steel cars are in use, of from 80,000 to 110,000 lbs. capacity.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Aug. 25.	Sheet asphalt, Newark, N. J.	Aug. 18
Aug. 25.	Coal house, Danville, Ill.	Aug. 18
Aug. 25.	Business building, Crookston, Minn.	Aug. 18
Aug. 25.	Pipe sewers, Hudson, N. Y.	Aug. 18
Aug. 25.	Storage dam, McDonald, Pa. Advertised, Engineering News, Aug. 18.	Aug. 18
Aug. 25.	Ventilating plant, Buffalo, N. Y.	Aug. 18
Aug. 25.	City hall, Warren, O.	Aug. 18
Aug. 25.	Lighthouse, Baltimore, Md. Advertised, Engineering News, July 28.	July 28
Aug. 25.	School building, Waldo, O.	Aug. 4
Aug. 25.	School building, Passaic, N. J.	Aug. 11
Aug. 25.	Filling sewage beds, Plainfield, N. J.	Aug. 11
Aug. 25.	Bridge work, London, O.	Aug. 11
Aug. 25.	Sewers, Cleveland, O.	Aug. 11
Aug. 25.	Electric light plant, McArthur, O.	Aug. 11
Aug. 25.	Cofferdam, Pittsburg, Pa.	Aug. 25
Aug. 26.	Sheet metal work, Chicago, Ill.	Aug. 25
Aug. 26.	Rebuilding sewer, St. Louis, Mo.	Aug. 25
Aug. 26.	Pavements, Frankfort, Ky.	Aug. 25
Aug. 26.	Barracks, National Soldiers' Home, Va.	Aug. 11
Aug. 26.	Water-works, Healdsburg, Cal. Advertised, Engineering News, Aug. 11.	Aug. 11
Aug. 26.	Water and light bonds, Healdsburg, Cal. Advertised, Engineering News, Aug. 11.	Aug. 11
Aug. 26.	Electric light plant, etc., Healdsburg, Cal. Advertised, Engineering News, Aug. 11.	Aug. 11
Aug. 26.	Pump engines (2), Minneapolis, Minn. Advertised, Eng. News, July 21 to Aug. 11.	July 21
Aug. 26.	Buildings, Buffalo, N. Y.	Aug. 18
Aug. 26.	School buildings, Chicago, Ill.	Aug. 18
Aug. 26.	Unloading scows, New York, N. Y.	Aug. 18
Aug. 27.	Grading, Washington, D. C. Advertised, Engineering News, Aug. 18.	Aug. 18
Aug. 27.	School building, Chemawa, Ore.	Aug. 18
Aug. 27.	Extending power dam, Rock Island, Ill.	Aug. 18
Aug. 27.	Water pipe, Lakewood, O.	Aug. 4
Aug. 27.	Road work, Pittsburg, Pa.	Aug. 11
Aug. 27.	Bridge, Willowdale, Ont.	Aug. 25
Aug. 29.	Grading, etc., Somerville, Mass.	Aug. 25
Aug. 29.	Paving, etc., Dayton, O.	Aug. 25
Aug. 29.	Cement sidewalks, etc., Indianapolis, Ind.	Aug. 25
Aug. 29.	Cedar block paving, Sedalia, Mo.	Aug. 25
Aug. 29.	Asphalt paving, New Orleans, La.	Aug. 25
Aug. 29.	Buildings (2), Seattle, Wash.	Aug. 25
Aug. 29.	Water-works, Evans, City, Pa.	Aug. 25
Aug. 29.	Cemetery, La Crew, Ia.	Aug. 25
Aug. 29.	Brick paving, Malta, O.	Aug. 4
Aug. 29.	Brick paving, Canton, O.	Aug. 4
Aug. 29.	Paving, etc., Toledo, O.	Aug. 4
Aug. 29.	Pumping eng. (3,000,000 galls.), Marietta, O.	July 28
Aug. 29.	Macadam paving, Cincinnati, O.	Aug. 18
Aug. 29.	Macadam paving, etc., Marshall, Mo.	Aug. 18
Aug. 29.	High school building, Wilmington, Del.	Aug. 18
Aug. 29.	Sewers, Toledo, O.	Aug. 18
Aug. 30.	Brick paving, etc., Mattoon, Ill.	Aug. 18
Aug. 30.	Iron bridge, Arnprior, Ont.	Aug. 18
Aug. 30.	Brewing plant, Eaton, Pa.	Aug. 18
Aug. 30.	Traveling cranes, Chicago, Ill. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Aug. 30.	Grading, etc., for water-wks, Cincinnati, O.	Aug. 4
Aug. 30.	Dams, etc., Mississippi River, Ill. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Aug. 30.	Gravel roads, Indianapolis, Ind.	Aug. 4
Aug. 30.	Gas mains, etc., San Jose, Cal.	Aug. 11
Aug. 30.	Pipe sewers, Peru, Ind.	Aug. 11
Aug. 30.	School building, Delphos, O.	Aug. 11
Aug. 30.	Street bonds, Orrville, O.	Aug. 11
Aug. 31.	Hospital, Fort Slocum, N. Y.	Aug. 11
Aug. 31.	Coal handling plant, New London, Conn.	Aug. 11
Aug. 31.	Chapel building, Lebanon, Pa.	Aug. 11
Aug. 31.	Dredging, Bridgeport, Conn. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Aug. 31.	Custom house, Guayquil, Ecuador	Apr. 21
Aug. 31.	Lavatory building, etc., Buffalo, N. Y.	Aug. 18
Aug. 31.	Paving, etc., Cleveland, O.	Aug. 18
Aug. 31.	Grading, Omaha, Neb.	Aug. 18
Aug. 30.	School building, Camden, N. J.	Aug. 25
Aug. 30.	Brick paving, etc., Troy, N. Y.	Aug. 25
Aug. 30.	Charity building, New York	Aug. 25
Aug. 30.	Paving, grading, etc., Philadelphia, Pa.	Aug. 25
Aug. 31.	Additions to pumping station, Buffalo, N. Y.	Aug. 25
Aug. 31.	Paving, etc., Chicago, Ill.	Aug. 25
Aug. 31.	Levee work, St. Joseph, La.	Aug. 25
Aug. 31.	Grading, etc., Bristol, Conn.	Aug. 25
Aug. 31.	Grading, etc., Haddam, Conn.	Aug. 25
Aug. 31.	Pavements, North Brantford, Conn.	Aug. 25
Aug. 31.	Bonds, Tarentum, Pa.	Aug. 25
Sept. 1.	Electric plant, Abilene, Kan.	Aug. 18
Sept. 1.	Water pump, Gloucester City, N. J. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 1.	Filter plant, etc., Louisville, Ky.	Aug. 18
Sept. 1.	Heating, ventilating, etc., Lexington, Ky. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 1.	Sewerage system, Clinton, Mass. Advertised Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 1.	Drainage system, Savannah, Ga. Advertised, Eng. News, June 23 to Aug. 25.	June 30
Sept. 1.	Electric light plant, Cullman, Ala.	July 21
Sept. 1.	Water-works, Norwood, N. Y.	July 21
Sept. 1.	Bridges, Johnsonburg, Pa. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Sept. 1.	Water-works, Mobile, Ala. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Sept. 1.	Electric lighting, Paris, Tex. Advertised, Eng. News, Aug. 11 to 25.	Aug. 11
Sept. 1.	Dam, power house, etc., Jackson, Mich. Advertised, Engineering News, Aug. 11.	Aug. 11
Sept. 1.	Wooden bridge, Lexington, Ky.	Aug. 25
Sept. 1.	Water gate (7 ft.), Chicago, Ill.	Aug. 25
Sept. 1.	State road (2 miles), Schenectady, N. Y.	Aug. 25
Sept. 1.	Brick paving, Coldwater, Mich.	Aug. 25
Sept. 1.	Heating apparatus, Chicago, Ill.	Aug. 25
Sept. 1.	Sewers, Coldwater, Mich.	Aug. 25
Sept. 2.	Electric lighting, Lansdowne, Pa.	Aug. 25
Sept. 2.	Brick sewer, Buffalo, N. Y.	Aug. 25
Sept. 2.	Pipe sewers, Waukesha, Wis.	Aug. 25
Sept. 2.	Repaving, etc., Omaha, Neb.	Aug. 25
Sept. 2.	Pier, New York, N. Y.	Aug. 25
Sept. 2.	Street work, Buffalo, N. Y.	Aug. 25
Sept. 3.	Gas lighting, Delaware, O.	Aug. 25
Sept. 3.	Jail, Goliad, Tex.	Aug. 18
Sept. 3.	Hospital building, Ukiah, Cal.	Aug. 18
Sept. 3.	Sewage pumping plant, No. Somerville, Mass. Advertised, Eng. News, Aug. 11 and 18.	Aug. 11
Sept. 3.	Smokeless powder, Washington, D. C.	Aug. 11
Sept. 5.	Dredging, Waukegan, Ill. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Sept. 5.	Bridge, Dillon, Mont.	Aug. 4
Sept. 5.	Steel hull tugboat, Seattle, Wash.	Aug. 11
Sept. 5.	Construction materials, Ft. Delaware, Del. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 5.	Macadam road, St. Paul, Minn.	Aug. 18
Sept. 5.	Brick paving, Fremont, O.	Aug. 18
Sept. 5.	Brick paving, Glens Falls, N. Y. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 5.	Dynamo and engines, Dunning, Ill.	Aug. 18
Sept. 5.	Plans for market house, San Antonio, Tex.	Aug. 18
Sept. 5.	Grading and paving, Litchfield, Conn.	Aug. 25
Sept. 5.	Water dept. supplies, Cumberland, Md.	Aug. 25
Sept. 5.	Brick paving, etc., Albany, N. Y.	Aug. 25
Sept. 5.	Paving brick, stone, etc., Cumberland, Md.	Aug. 25
Sept. 5.	Street bonds, Coshocton, O.	Aug. 25
Sept. 5.	Gravel road, Lost Creek Township, Ind.	Aug. 25
Sept. 5.	Paving, Keokuk, Ia.	Aug. 25
Sept. 5.	Water supply, Anaconda, Mont.	Aug. 25
Sept. 5.	Water-works, Lanesboro, Minn.	Aug. 25
Sept. 6.	Macadamizing, Hasbrouck Heights, N. J. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 6.	Electric light plant, Decatur, Mich.	Aug. 25
Sept. 6.	Bridge, Oshkosh, Wis.	Aug. 25
Sept. 6.	Bridge and repairs, Colusa, Cal.	Aug. 25
Sept. 6.	Heating, etc., New York, N. Y.	Aug. 25
Sept. 6.	Bonds, Buffalo, N. Y.	Aug. 25
Sept. 6.	Pipe sewer, Dunkirk, N. Y.	Aug. 25
Sept. 6.	Street work, Portchester, N. Y.	Aug. 25
Sept. 6.	Bridge bonds, Newport News, Va.	Aug. 25
Sept. 6.	Improving road, Carthage, O.	Aug. 18
Sept. 6.	Street bonds, Hasbrouck Heights, N. J.	Aug. 18
Sept. 6.	Bridge, Chateau, Mont.	Aug. 18
Sept. 6.	Bridge, San Jose, Cal.	Aug. 18
Sept. 6.	Sewerage system, Billings, Mont.	Aug. 18
Sept. 7.	Bridge, Oroville, Cal.	Aug. 4
Sept. 7.	Bridges (2), Pendleton, Ore.	Aug. 18
Sept. 7.	Brick paving, Cleveland, O.	Aug. 18
Sept. 7.	Heating and ventilation, So. Omaha, Neb. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 7.	Water-works, Pocomoke City, Md. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 7.	Bridge, Prineville, Ore.	Aug. 25
Sept. 7.	Bridge, Portland, O.	Aug. 25
Sept. 7.	Water tanks, Chicago, Ill.	Aug. 25
Sept. 7.	Sewer system, Pocomoke City, Md. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 7.	Brick dormitory, Morris, Minn.	Aug. 25
Sept. 7.	Court house, St. Thomas, Ont.	Aug. 25
Sept. 8.	Plumbing, and heating, Manitowoc, Wis.	Aug. 25
Sept. 8.	Brick paving, Monroe, La.	Aug. 25
Sept. 8.	Granitoid walks, St. Louis, Mo.	Aug. 25
Sept. 8.	Macadam paving, Shoals, Ind.	Aug. 18
Sept. 8.	Bridge, Roseburg, Ore.	Aug. 4
Sept 8.	Dykes, Hudson River, N. Y. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 9.	Rubber suctions, Charleston, S. C. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 9.	Sea walls, Baltimore, Md. Advertised, Eng. News, Aug. 18 to Sept. 8.	Aug. 18
Sept. 9.	Water bonds, Sparta, Minn.	Aug. 25
Sept. 9.	School building, Laharpe, Ill.	Aug. 25
Sept. 10.	Bridges (3), Wichita, Kan.	Aug. 25
Sept. 10.	Brick paving, Coshocton, O.	Aug. 25
Sept. 10.	Street improvements, Nelsonville, O.	Aug. 25
Sept. 10.	Highways, Rockville, Ind.	Aug. 25
Sept. 10.	Improving road, Mansfield, O.	Aug. 18
Sept. 12.	Paving, etc., Toledo, O.	Aug. 18
Sept. 12.	Water and sewer bonds, Mobile, Ala.	Aug. 11
Sept. 12.	Grading, paving, etc., Toledo, O.	Aug. 11
Sept. 12.	Lake outlet, Lake Manitoba, Can.	Aug. 25
Sept. 12.	Bridge, Warren, Pa.	Aug. 25
Sept. 12.	Bonds, Mansfield, O.	Aug. 25
Sept. 12.	Bridge, Lima, O.	Aug. 25
Sept. 12.	Paving, Youngstown, O.	Aug. 25
Sept. 13.	Aqueduct (17¼ miles), Birmingham, Eng.	Aug. 25
Sept. 13.	Bridge, Edmonton, N. W. Ter.	Aug. 25
Sept. 13.	Bridge work, Columbus, O.	Aug. 25
Sept. 13.	Crushed limestone, Toledo, O.	Aug. 25
Sept. 13.	Capitol building, Helena, Mont.	July 28
Sept. 13.	Brick sewer, etc., Kearney, N. J. Advertised, Eng. News, Aug. 18 to Sept. 8.	Aug. 18
Sept. 13.	Repairing bridge, Mountain Home, Idaho.	Aug. 18
Sept. 14.	Hospital building, Los Angeles, Cal.	Aug. 18
Sept. 15.	Enlarging court house, Lisbon, N. Dak.	July 28
Sept. 15.	Fire alarm system, Mobile, Ala. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 15.	Light-house, Tompkinsville (S. I.), N. Y. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 15.	Engine (150-HP.), New Orleans, La.	Aug. 25
Sept. 15.	Iron bridge, Natchitoches, La.	Aug. 25
Sept. 16.	Brick and pipe sewer, Richmond, Ind.	Aug. 25
Sept. 16.	Supplies, Norfolk, Va. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 16.	Cement, broken stone, etc., Ft. Monroe, Va.	Aug. 25
Sept. 17.	Storm sewer, Mansfield; O.	Aug. 25
Sept. 17.	Headstones, (10,000), Boston, Mass.	Aug. 25
Sept. 19.	Heating and ventilating, St. Albans, Vt. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 19.	Hospital plans, San Francisco, Cal.	Aug. 4
Sept. 19.	Jail, Lovelocks, Nev.	Aug. 18
Sept. 19.	Bridge bonds, Los Angeles, Cal.	Aug. 18
Sept. 20.	Viaduct, Cincinnati, O.	Aug. 25
Sept. 21.	Canal, Chicago, Ill. Advertised, Aug. 25 to Sept. 15.	Aug. 25
Sept. 23.	Supplies, Watervliet, N. Y.	Aug. 25
Sept. 26.	Bonds, Dayton, O.	Aug. 25
Sept. 29.	Court house, Marietta, Ga.	Aug. 18
Oct. 1.	Arc lighting, Marshfield, Wis.	Aug. 18
Oct. 1.	Monitors (4), Washington, D. C.	July 7
Oct. 1.	School building (equipment), St. Thomas, Ont.	July 7
Oct. 4.	Coal conveyors, etc., Chicago, Ill. Advertised, Eng. News, Aug. 25 to Sept. 29.	Aug. 25
Oct. 5.	Bridge superstructure, Chicago, Ill.	Aug. 11
Oct. 24.	Markets, etc., Belem, Brazil.	Apr. 28
Oct. 25.	Jetties, Portland, Ore. Advertised, Eng. News, Aug. 25 to Sept. 15.	Aug. 25
Oct. 30.	School building, Chehalis, Wash.	June 16
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18

RAILWAYS.

BALTIMORE & OHIO.—Press reports state that this company contemplates tunneling through the heavy grade at Mt. Airy. The grade is the heaviest between Harper's Ferry and Baltimore, Md., and to make the tunnel would necessitate the expenditure of about $1,000,000. W. T. Manning, Ch. Engr., Baltimore.

CHICAGO & WABASH VALLEY.—Benj. J. Gifford, Pres., Kankakee, Ind., informs us that the right of way has been obtained and the ties and rails secured for this proposed railway from his farm lands, mostly in Jasper county, to a connection with the Eastern Illinois Ry., a distance of about ten miles. No towns will be passed through. S. B. Hodges, Kniman, Ind.

COLUMBIA SOUTHERN.—E. E. Cooper, Ch. Engr., Wasco, Ore., informs us that the grading has been completed on this proposed railway from Wasco to Moro, Ore., 17 miles, and that five miles of track on the same has been laid. Pres., E. E. Lytle, Wasco.

EAST CAROLINA.—Work has been completed on this new line from Tarboro to Davison, N. C., and is being further extended seven miles south from Davison to Crisp. Pres., Henry Clark Bridges; Engr., W. J. Burnett, both of Tarboro, N. C.

GOLDSBORO, SNOW HILL & EASTERN.—This company was incorporated in North Carolina Aug. 15, with a capital stock of $300,000, to construct a railway from Snow Hill, Green county, to Pantego, Beaufort county, N. C., through Greene and Pitt counties, a distance of about 60 miles. The officers are, J. W. Lynch, Pres., of Suffolk; Colonel Alexander S. Bacon, Vice-Pres., of New York; Colonel J. H. Macleary, Gen. Mgr., of Suffolk; Dr. J. T. McCormick, Treas., of New York; Director, George W. Sugg, of Snow Hill, N. C.

DELAWARE.—We are informed that this company has been organized to build a 15-mile line of railway from Delhi to Andes, N. Y., and that arrangements have been made with a strong New York corporation to handle the bonds. A contract has been made with Thomas Murray, of Plainfield, N. J., to construct the road. Strong & Totten, 123 Liberty St., New York, are associated with him in the contract, and the grading, tracklaying and bridges have been sublet to Richardson & Reed, of Owego, N. Y. E. F. Musson, 4 Sheldon St., Norwich, N. Y., is chief engineer. Construction will begin at once, and the contract calls for completion before Jan. 1, 1899. Pres., Henry Davie, Delhi, N.Y.

HAWTHORNE, NEBAGAMON & SUPERIOR.—F. Weyerhauser, Chippewa Falls. Wis., informs us that this is a proposed logging railway to be built in Wisconsin for a distance of 35 miles. Grading has just been begun. No officers have yet been elected.

IOWA, MINNESOTA & NORTHERN.—This company was incorporated in Iowa Aug. 17, with a capital stock of $200,000, with headquarters at Mason City, Ia. The officers are, Pres., A. C. Frost, Chicago; Vice-Pres., David Secor, Winnebago City, Minn.; Treas., W. E. Brice, Mason City; Secy., J. S. Lindon, Clear Lake, Minn.

KANSAS, OKLAHOMA CENTRAL & SOUTHWESTERN.—J. H. Bartels, Pres., Bartlesville, Ind. Ter., informs us that 60 miles of this new line have been located and cross-sectioned, and the right of way for the same obtained. The Toledo Construction Co. has 30 miles of the route graded and now has 270 teams at work; 60 miles will be graded by Oct. 1. It is proposed to construct the whole 350 miles of railway, from Cherryvale, Kan., to Verona, Tex., before quitting work, after which preparations will be made towards the further extension from Vernon to San Antonio, Tex.

KEARNEY & BLACK HILLS.—This railway property was sold under foreclosure at Kearney, Neb., Aug. 18, to the Union Pacific R. R. Co., at $150,000. The length of the line is 65.4 miles.

LEAD BELT.—This company was incorporated in Missouri Aug. 9, with a capital stock of $4,000, to construct and operate a standard gage railway from the Mississippi River & Bonne Terre Ry. at Central Station to the Central Lead Co.'s plant, a distance of four miles, all in St. Francois county. The incorporators are, J. H. Bethune, Arthur Thatcher, W. E. Guy, F. H. Ludington, H. J. Cantwell, W. T. Gould and C. S. Rodgers, all of St. Louis, Mo.

LOUISVILLE, HENDERSON & ST. LOUIS.—R. N. Hudson, Ch. Engr., Cloverport, Ky., informs us that there is no immediate intention of completing the extension of this line from West Point, the present terminus, to Louisville. Ky. The grading between these points was done in 1893.

MASSACHUSETTS.—Philip D. Borden, Cy. Engr., Fall River, Mass., writes us that the railway company and the city have agreed upon a general plan for abolishing the grade-crossings in this city, and are now at work upon the details. It is not likely that any more street work will be begun before 1899.

MINNESOTA TRANSFER.—Reports state that McLeod & Co. have been awarded a contract for the construction of two miles of track, an office building, etc., to cost about $26,000. Improvements are also contemplated at the Twin City stock yards. Pres., John R. Hastings, St. Paul, Minn.

MUSCATINE NORTH & SOUTH.—Stirling Birmingham, Vice-Pres. and Secy., 120 Broadway, New York, informs us that the surveys have been made, most of the right of way obtained and the capital secured for the construction of this railway from Muscatine to Elrick via Grandview and Wapello, Ia., a distance of about 30 miles. Contracts have been sublet to Balch, Peppard & Johnson, of Minneapolis, Minn., by the Tennis Construction Co., Pres., Edgar A. Tennis, of Philadelphia, Pa., which is building and equipping the line under contract with the railway company. About five miles have already been graded, and a connection made with the Iowa Central at Elrick. Pres., Wm. R. Stewart, 11 Broadway, New York; Ch. Engr., W. L. Willis, Wapello, Ia.

NEW YORK, NEW HAVEN & HARTFORD.—Patrick Fitzgerald, New London, Conn., is said to have received the contract for building the Groton extension of the Norwich division of the Consolidated road from the New London Navy Yard to a point 1½ miles from the Thames River drawbridge.

OHIO SOUTHERN.—Reports from Lima, O., state that the sale of this railway has been postponed from Aug. 20 until Sept. 20.

OKLAHOMA CENTRAL. — This company was incorporated in Oklahoma Aug. 15, with a capital stock of $15,000,000. The road will run from Oklahoma City northwest through Canadian, Kingfisher, Blaine and Wood counties. It is reported that eight grading outfits, which have finished contracts on the St. Louis & Oklahoma City Ry., in Lincoln county, have gone north to Pawhuska, where they were to have begun, on Aug. 20, grading on the Kansas & Oklahoma Central from Coffeyville, Kan., to Guthrie. The incorporators are, O. P. Hamilton, Saline, Kan.; Herman Bruen, New York; Paul Cooke, Kansas City; S. C. Burrell and Phillip Koch, Watonga, Okla.; Thomas H. Davis, Saline, Kan., and McGregor Douglas, Oklahoma City.

ONTARIO & RAINY RIVER.—McKenzie & Mann, Toronto, Ont., are reported to have been awarded the contract for the construction of the first 25 miles of this proposed railway in the south central portion of Canada, near Lake Superior.

OREGON SHORT LINE.—Reports state that the construction of an extension of this railway, from Milford, Utah, to the Nevada state line, is assured. J. C. O'Melveney, Ch. Engr., Salt Lake City, Utah.

ST. ANTHONY & NATIONAL PARK.—This company was incorporated in Idaho Aug. 12, with a capital stock of $350,000, to build a railway to St. Anthony, Fremont county, a distance of 30 miles. The directors are, C. H. Moon, Pres.; S. R. Finley, Secy.; M. E. Jamison, Treas.; G. C. Baker, C. P. Bartlett and R. J. Costlett, of St. Anthony, Idaho; M. J. Kerr, of Ora, Idaho.

TEMPLE & SALADO.—C. J. Grainger, Pres., Palestine, Tex., informs us that the survey has been made and the right of way obtained for this proposed railway from Temple to Salado, Tex., 16 miles. One-half of the capital, or $50,000, has still to be secured by the sale of 3% 20-year guarantee bonds. The company expects to begin construction work as soon as these bonds are disposed of. T. Cronin, Supt. of Construction, Palestine.

VERA CRUZ & PACIFIC.—It is announced that this company will soon be in the market for a quantity of material, as it expects to begin work about Oct. 1 on the construction of the proposed railway from Cordoba, on the Mexican Ry., southeasterly to a connection with the Tehuantepec National Ry., 200 miles. Principal offices, Calle Medinas, No. 6, Mexico City, Mexico.

WESTMORELAND JUNCTION.—This company was incorporated in Pennsylvania Aug. 22 with a capital stock of $60,000, to construct a steam railway from North Irwin, Pa., to or near Griffiths Station on the Baltimore & Ohio R. R., a distance of five miles. The incorporators are A. Frank, Pres.; J. D. Brown, T. P. Herron, D. A. Kelley and J. Arthur Jones, all of Irwin, Pa.

STREET AND ELECTRIC RAILWAYS.

LACONIA, N. H.—At a meeting of the directors of the Laconia & Lakeport St. Ry. the following officers were elected: Harry L. Pierce, Pres.; Chas. T. Foster, Treas., both of Leominster, Mass.; Edmund Little, Clerk, of Laconia; Lewis S. Pierce, Supt., Leominster. It was also voted to proceed at once with the construction of the electric system and to raise the roof of the car house six ft., that being necessary in order to admit of the housing of the new electric cars.

MONTPELIER, VT.—F. C. Kennedy, Pres. Mad River Valley Electric R. R. Co., Burlington, Vt., informs us that the capital is now being secured for the construction of the proposed electric railway from Montpelier to Warren, via Middlesex, Moretown and Waitsfield, a distance of about 26 miles. The route is through the valley of the Mad River, with a connection with the Central Vermont R. R. at Middlesex and Montpelier, and it is expected to carry a large amount of produce to these places. The line will be built by the Burlington Construction Co., of which Mr. Kennedy is president. V. K. Nash, Ch. Engr., Woonsocket, R. I.

DEDHAM, MASS.—David Neal, Chn. of Selectmen, Dedham, informs us that the location of the Norfolk Western St. Ry. through this place, has been granted by the town and accepted by the company, and a bond of $5,000 deposited. The proposed route is from Dedham to Medfield, via Westwood, a distance of nine miles. Pres., W. W. Metcher, Medfield, Mass.; Ch. Engrs., Hodges & Harrington, Boston, Mass.

CATSKILL, N. Y.—The Catskill Electric Ry. Co. has been granted permission by the railroad commissioners to increase its capital stock from $30,000 to $400,000. The line was originally built to be operated only for a distance of two miles through the streets of Catskill Village, but it is now proposed to extend to Windham and Cairo, making a line 16 miles in length.

ROCHESTER, N. Y.—The Rochester & Sodus Bay Ry. Co. was incorporated in New York, with a capital stock of $1,000,000, as stated in our last issue under Railways, to construct a railway to be operated by other power than steam. Thos. J. Nicholl, Pres., 267 State St., Rochester, informs us that this will be an electric line running from Webster to Sodus Point, via Sea Breeze, Ontario, Union Hill, Williamson and Sodus, a distance of about 42 miles. The preliminary survey has been made, and most of the right of way obtained. Le Grand Brown, Ch. Engr., 267 State St., Rochester.

CRANFORD, N. J.—The township committee has postponed the public hearing on the petition of the Elizabeth & Westfield St. Ry. Co. for a franchise to build a trolley line through the township, until Sept. 12. Pres., A. A. Gaddis, Westfield, N. J.

ELIZABETH, N. J.—F. J. Hubbard, County Engr., Plainfield, N. J., informs us that the preliminary survey has been made and the right of way is now being obtained for the proposed electric railway to be built by the Elizabeth City Horse R. R. Co. between this city and Plainfield, via Cranford, Westfield and Fanwood, 12 miles, as noted in our last issue. Union county receives $250,000 for the franchise, which sum is to be expended in the construction of a boulevard, 100 ft. wide, and work upon which is expected to begin this fall. Contracts for building the railway will be let as soon as the necessary consents are secured. John Kean, Pres., Elizabeth.

DOYLESTOWN, PA.—The Newtown Electric St. Ry. Co. was granted a franchise, Aug. 15, to construct a line through the borough on Green St. to Main St. This company proposes to extend its line from Newtown to Doylestown, via Wightstown, Penn's Park, Wycomb, Forestville and Furlong, 13¾ miles. Pres., Thos. P. Chambers, Newtown, Pa.

HATBORO, PA.—The Hatboro & Horsham Electric Ry. Co. was incorporated, Aug. 18, to construct a trolley line between the towns named, a distance of 1¼ miles. The directors are: James Crawford, Alfred R. Gandy and Magnus Hellstrom, Pres., all of Philadelphia; S. Edward Hagar, Doylestown; John B. Peddle, Woodbury, N. J.

PHILADELPHIA, PA.—It is reported that the Southwestern Passenger Ry Co., which received a franchise in April to construct a line through that portion of Philadelphia lying between Moyamensing Ave. and the county line, has begun the work of track laying. The road will start at Otsego and Mifflin Sts. to Jackson and 5th Sts., to Moyamensing Ave., to Penrose Ferry Road, to Schuylkill Bridge, thence across the bridge to State Island Road and Bow Creek, to the county line. It is said that the road will be constructed on the most approved plan. Pres., Edgar A. Tennis.

STROUDSBURG, PA.—Frank H. Smith, Pres., Stroudsburg, informs us that the Stroudsburg Passenger Ry. Co. expects to change the motive power on its 2½ miles of railway between Stroudsburg and East Stroudsburg from steam to electricity. An extension, two miles in length, is contemplated. No contracts will be let, but the work will be done by the company.

WASHINGTON, D. C.—The Ferguson Contracting Co., 69 Wall St., New York, has been awarded the contract for constructing the remaining section of the Washington & Chesapeake Beach R. R., 15 miles in length. Work will begin at once and be completed by Jan. 1.

ELLICOTT CITY, MD.—Reports state that the final arrangements for the completion of the electric railway between Ellicott City and Baltimore, which have been so long interfered with by financial troubles, have now reached a point that gives assurance of the success of the enterprise. Mr. Yakel, the president of the Columbia & Maryland Ry. before its purchase by the Consolidated Ry. Co., is interested.

HAGERSTOWN, MD.—We are informed that the Hagerstown Electric Ry. Co. is building a large engine and boiler house, the structural steel work for which will be erected by the North Penn Iron Co., North Penn Junction, Philadelphia, Pa.

ERLANGER, KY.—L. Morelli, A. Victor and D. Riggs have been appointed a committee by Erlanger to solicit $12,000 in subscriptions for the electric line which it is proposed to build from Erlanger to Ludlow.

CLEVELAND, O.—The county commissioners, Aug. 17, granted a five-year franchise to the Cleveland Electric Ry. Co. to extend the Cedar Ave. line on the Coventry Road.

DUNKIRK, IND.—It is reported that the contract for building an electric railway between Redkey and Dunkirk for the Dunkirk & Redkey Traction Co., whose incorporation was noted in our last issue, has been awarded to the Electrical Installation Co., of New York and Chicago, and that the work is to be commenced at once and completed by Nov. 15. The line will probably be extended to Pennville.

MICHIGAN CITY, IND.—The Northern Traction Co. was incorporated in Indiana Aug. 19, with a capital stock of $150,000, to build an electric railway from Michigan City to Laporte. The incorporators are: John W. Lovett, W. W. Huffman, W. E. and C. W. Hooven and George Nichol.

DURAND, MICH.—The council granted a franchise to the Long Lake, Durand & Corunna Electric St. Ry. Co., Aug. 12, for the construction of a line from Corunna through Durand to Long Lake, and thence to Detroit. The power house and car barns are to be located here. Wm. E. Avery, of Detroit, is at the head of the company.

JACKSON, MICH.—Reports state that a decree has been entered in the circuit court ordering the sale of the street railway, naming the time after Aug. 31, to satisfy the mortgage held by the Fidelity Loan & Trust Co., amounting to $171,830. The property has been in the hands of a receiver for the past year.

SAGINAW, MICH.—The Saginaw & Frankenmuth Ry. Co. has been incorporated, with a capital stock of $50,000, to build an electric line between Saginaw and Frankenmuth, a distance of 14 miles. The officers are: James B. Peter, Pres.; H. C. Potter, Jr., Treas.; S. G. Higgins, Secy., all of Saginaw.

OREGON CITY, ORE.—Reports state that W. R. Burghardt, representing capitalists who desire to build an electric railway from Oregon City to a point on the Highland Road 8 miles east of the Willamette River, has petitioned the county court for a franchise to build the line. The court is said to be in favor of granting the franchise, but has postponed action until next month.

MONTEREY, CAL.—The Monterey & Pacific Grove St. Ry. Co. is contemplating the project of running its cars by an improved system that will greatly lessen the time of trip between the two towns. The line is now operated by horse-power. Mgr., Juan Malarin.

ELECTRIC LIGHT AND POWER.

WATERVILLE, ME.—The Union Gas & Electric Co. has commenced work upon its water power of the Messelonskee River where Bushey & Son will put in a stone dam which will furnish about 1,600 HP., for which it is reported a manufacturing concern doing a large business and giving employment to 1,000 men is negotiating.

MYSTIC, CONN.—Bids will be asked about Sept. 1 for constructing a plant to cost about $25,000 for the Mystic Electric Light & Gas Co. We are informed that the plant will have arc and incandescent lights, 150-HP. steam plant with engine, and 15,000 light alternator, line, poles, etc. No contracts have been let yet. The plant will light Mystic and Stonington. Thos. C. Perkins, Gen. Mgr. and Des. Engr., Hartford (not Danforth), Conn., as stated last week.

ATLANTIC CITY, N. J.—The council is reported to have adopted an ordinance giving to John H. Rothermel & Co., Reading, Pa., the franchise for constructing and operating an electric light plant in this city. The Rothermel Company was recently awarded a 5-year contract for furnishing the electric lights for the entire city at $105 a year.

COLUMBIA, PA.—It is stated that the engineer of the Martic Water & Power Co., which intends rebuilding the dam, is making surveys at the foot of Walnut St. It is probable that the power house for generating electricity will be located on the Wrightsville side of the river.

LANSDOWNE, PA.—Bids are asked until Sept. 2 for lighting the streets with electricity for one or five years from Oct. 1. H. L. Warren, Secy., P. O. Box 275.

NORRISTOWN, PA.—Local papers state that a proposition is being considered to build a plant near the dams of the John Hancock Ice Co., one of them at Greenlane, the other three-fourths of a mile higher up the stream, covering 40 acres, the latter having been constructed a year ago. At a cost of about $12,000, a plant could be erected, which would furnish light to Greenlane, East Greenville, Pennsburg, Red Hill and Sumneytown.

ROYERSFORD, PA.—The council is reported to have awarded the contract for lighting the borough to the Schuylkill Valley Electric Lighting Co., of Phoenixville, the present contractors. The committee will place additional arc lights in the borough.

HAGERSTOWN, MD.—Press reports state that the contract for the erection of a new power house in Hagerstown has been let to the Conococheague Brick Co., Williamsport, Md., operated by Victor Cushwa & Sons.

OAKLAND, MD.—It is reported that arrangements are being made for the proposed municipal plant to cost $14,000.

NEWPORT NEWS, VA.—Local papers state that W. J. Payne, Richmond, Va., who has just purchased the plant of the Chesapeake Light & Power Co., will soon begin to make a number of improvements to it. Gen. Mgr. and Secy., Segar Whiting.

WINCHESTER, VA.—Bids will probably soon be asked for building a plant of two 50-light arc dynamos of 2,000 c. p.; 71 arc lights of 2,000 c. p. The foundations for the dynamos are to be erected by the city. Wm. R. Willis, Secy. Com.

CHARLESTON, W. VA.—It is reported that the Wilson Aluminum Co., which was chartered some years ago, and which purchased the land on each side of the Kanawha River at Kanawha Falls, began Aug. 22 to construct a water power plant to generate electricity for manufacturing plants in the Kanawha Valley.

EDENTON, N. C.—W. D. Pruden, R. F. Cheshire and others, of the Edenton Cotton Mills Co., organized recently, are in the market for a plant as part of the equipment of the new cotton mill to be erected at this place at once.

BENNETTSVILLE, S. C.—D. D. McCall, C. S. McCall and others, of the new cotton mill company organized recently to build a manufacturing plant, will soon purchase a light plant for the mill.

COLUMBUS, GA.—The Columbus Power Co. has awarded the contract for building the power plant to Hathaway, Jones & Co., Baltimore, Md., at about $115,000.

TALLAHASSEE, FLA.—The council is considering the question of building a plant, according to reports.

FULTON, KY.—The plant of the Fulton Electric Light & Power Co., it is reported, will be extended. Supt., F. Carden.

MINSTER, O.—August Schunds, Village Clk., writes us that the following contracts were let Aug. 16 for furnishing and erecting the plant: Boiler and engine, Minster Machine Co., Minster, $2,495; dynamos, switchboard, etc., F. Bissell & Co., Toledo, O., $1,485; poles, wire, etc., Ambos Construction Co., Cleveland, O., $3,250.

CHURUBUSCO, IND.—The Seckner Contracting Co., The Rookery, Chicago, has been awarded the contract for building a plant and water-works at $18,500. Secy. and Treas., J. H. Brown, Chicago.

EVANSVILLE, IND.—The council has decided to levy a tax for the proposed municipal plant. W. M. Akin, Jr., Mayor.

MIDDLETOWN, IND.—A franchise has been granted for a plant to cost about $5,000.

VEEDERSBURG, IND.—The contract for building a plant and water-works at Veedersburg has been let to the Seckner Contracting Co., 351 The Rookery, Chicago, Ill., at $26,950. J. H. Brown, Secy. and Treas.

DECATUR, MICH.—Bids are asked until Sept. 6 for furnishing and building a plant. Engr., Geo. S. Pierson, Kalamazoo, Mich.; Clk., E. J. Rawson.

MOUNT PLEASANT, MICH.—R. S. Graham, Supt. Indian School, writes us that the specifications for the proposed plant, with a capacity of 8 arc and 350 incandescent lights, have not yet been issued.

SAULT STE. MARIE, MICH.—The American Lake Superior Power Co. has let the following contracts for furnishing the materials and for building the proposed power plant, as advertised in Engineering News: E. D. Smith & Co., Philadelphia, all the rock and earth excavation, known as sections 1, 2 and 3; total, about $1,000,000; Mason, Hoge & Co., Chicago, power house and forebay section; total, about $500,000; H. W. Hubbell & Co., Saginaw, intake section, dredging, $80,000. There are other contracts connected with the enterprise that will make the total cost of construction $2,000,000 in round numbers, and may exceed that sum. The turbines for the power house will alone cost about $300,000. Ch. Engr., H. von Schon, Sault Ste. Marie.

GRAND RAPIDS, WIS.—F. W. Orbison, Des. Engr., Appleton, Wis., writes us that bids for the proposed plant for the Consolidated Water Power Co., noted last week under Grand Rapids, Mich., will be received in the early spring. The land along the Wisconsin River for a distance of three miles has been secured by the company. The dam will cost about $80,000, and will furnish 6,000 HP. The power will be used for various purposes. N. Johnson and J. D. Walter, Grand Rapids, Wis., are in charge of the contemplated work.

GAYLORD, MINN.—We are informed that Triumph Electric Co., Chicago, has been awarded the contract for furnishing the dynamos, etc., and that A. I. Ide & Son, Fort Wayne, Ind., has been awarded the contract for the engine and steam plant. The other bidders were the General Electric Co., Schenectady, N. Y.; Fort Wayne Electric Corporation, Fort Wayne, Ind.; W. I. Gray & Co., Minneapolis; Twin City Iron Works, Minneapolis; Westinghouse Electric Mfg. Co., Chicago.

PERHAM, MINN.—This place is reported to have voted to issue bonds for a plant.

WATERTOWN, S. DAK.—O. M. Kislin & Co. have been awarded a franchise for lighting this city with electricity.

MASON, TEX.—L. Gugenheim, president of the new electric light company, writes us that the contract for the plant has been let to W. G. Schuwirth & Co., San Antonio, Tex.

OAKLAND, CAL.—H. S. Bullock has been granted a franchise for a plant on Sutter Creek and a line into Alameda county and Oakland.

SAN FRANCISCO, CAL.—The Merchants' Association of San Francisco is considering the question of a municipal plant. The sum of $250 has been set aside for the committee on public affairs to employ experts and devise means whereby the city can acquire its own lighting plant.

IDAHO FALLS, IDAHO.—This place voted Aug. 9 not to issue $5,000 in bonds for a plant.

QUEBEC, QUE.—Press reports state that the American company which is going to develop the water power of the Jacques Cartier River for electric light and power purposes for the benefit of this city in opposition to the Montmorency company, has acquired the chartered rights as regards Quebec of the Standard Light & Power Co., Montreal. It has a capital of $500,000. Pres., Emerson McMillan, of the banking firm of Emerson McMillan & Co., Wall St., New York.

BARRIE, ONT.—This place voted Aug. 16 to build a municipal plant at a cost of about $35,000. E. Downell, Town Clk. and Treas.

ROCHDALE, ENGLAND.—Bids are asked until Sept. 6 for furnishing and building a plant. Jas. Leach, Town Clk.

BRIDGES.

HERKIMER, N.Y.—The town board has annulled the contract made with the Owego Bridge Co., Owego, N. Y., to build the bridge over West Canada Creek in this place for $7,300, according to reports. New bids will be called for shortly. Commissioner Cress may be addressed.

MOUNT VERNON, N. Y.—M. J. Donlon, Highway Comr. of Pelham, N.Y., has been appointed a committee to procure estimates for the construction of the proposed new bridge between this city and Pelham, according to report.

UTICA, N. Y.—The Half-Way bridge has been declared unsafe for the passing over of the Belt Line Co.'s electric cars, and will probably be replaced by a new one, according to report.

JERSEY CITY, N. J.—Work has been begun in tearing down the old Pacific Ave. bridge. W. G. Triest, 39 Cortlandt St., New York, has the contract to build the new one.

NEW BRUNSWICK, N. J.—Permission has been granted the Brunswick Traction Co. to erect an additional bridge 10 ft. wide at its own expense adjoining the Green Brook bridge. Edward H. Radel, Secy. Brunswick Traction Co.

PATERSON, N. J.—A new stone arch or steel arch bridge is projected to replace the present one at Main St. over the Passaic River. It will be 40 ft. wide, including 7-ft. sidewalks, and plans are asked for until Aug. 25 by the freeholders.

CONNELLSVILLE, PA.—Permission has been granted to the Youghiogheny Bridge Co. to erect a bridge in Main St., according to report.

HARRISBURG, PA.—It is reported that a new bridge will be erected over the Conscocheague, between St. Thomas and Antrim townships.

NORRISTOWN, PA.—The following contracts have been awarded by the county commissioner: Sparks & Evans, stone bridge over Saw Mill Run, $6,995; Philadelphia Bridge Works, iron bridge over Manatawney Creek, at Pottstown, $3,092; Patton & Evans, masonry of same, $3,516; Schuylkill Bridge Works, iron bridge over Perkiomen Creek, at Godshall's Mill, $1,875; Willoughby H. Smith, masonry of same, $1,435; Schuylkill Bridge Works, iron bridge over Perkiomen Creek, at Yerkes, $3,375; Patton & Evans, masonry of same, at $4.77 per cu. yd.; W. H. Smith, masonry of bridge over the same creek at Palm Station, $1,442.

PHILADELPHIA, PA.—Chas. Nolan received the contract Aug. 19 for the masonry and the Phoenix Bridge Co. for the iron superstructure of the new bridges over Cedar and Richmond branch of the Philadelphia & Reading Ry. H. K. Nichols, Ch. Engr.——Sparks & Evans have received the contract, according to report, for the erection of the Vankirk St. bridge on the New York division of the Pennsylvania R. R. W. A. Pratt, Engr. of Bridges.

PITTSBURG, PA.—The Schultz Bridge & Iron Co., McKee's Rocks, Pa., was given the contract, Aug. 16, according to report, to remove the Schenley Park bridge, at $60 and the material of the structure.

WARREN, PA.—Bids are asked until Sept. 12 for the construction of a bridge across the mill-race on Pennsylvania Ave. Plans are also desired for the same until Sept. 7. L. T. Borchers, Chn. Bridge Comrs.; A. Rogers, Engr.

ANNAPOLIS, MD.—The Structural Iron Co., Baltimore, has been given the contract at $2,700, to construct the draw of the Severn River bridge, according to report. W. J. Sauer, Secy. and Treas.

BALTIMORE, MD.—The Wrought Iron Bridge Co., Canton, O., was awarded the contract Aug. 17, to build two bridges over Charles Run, at Monkton Mills, at a cost of $724 and $748. The contract for the masonry work on both bridges was given to John T. Diven for $692. W. H. Mays, Supt. of Bridges.

NEWPORT NEWS, VA.—Bids are asked until Sept. 6 for the purchase of $40,000 bridge bonds; check, $1,000. J. A. Massie, Cy. Clk.

CHARLESTON, S.C.—Maj. E. H. Ruffner, Corps of Engrs., U. S. A., will give a public hearing Aug. 25, on the application of the Wappoo Bridge Co. to build a bridge across Wappoo Cut.

WHITE SPRINGS, FLA.—Bids are desired on the construction of a 125-ft. bridge of wood or iron, on tubular abutments 32 ft. high. Address, C. F. Cone, White Springs.

JACKSON, MISS.—A. A. Falkes has been awarded the contract at $13,961 to build a brick arch bridge on Capitol St., according to report.

NATCHITOCHES, LA.—Bids are asked until Sept. 15 by the police jury for the construction of an iron bridge across Johnson Chute. Geo. W. Kline, Pres. Police Jury.

DAYTON, TENN.—The county commissioners are reported to be preparing to let the contract for a steel bridge over Little Richland Creek, at Allen's Mill, according to report.

LEXINGTON, KY.—Bids are asked until Sept. 1 for the construction of a 50-ft. wooden bridge. J. K. Gray, Comr.

CHILLICOTHE, O.—The county commissioners have decided to readvertise for bids for the construction of the iron bridge over the Scioto River, the contract for which had been let to the King Bridge Co., Cleveland.

COLUMBUS, O.—Bids are asked until Sept. 13 for 15,000 cu. yds. of fill and embankment and 1,815 cu. yds. of gravel top dressing on the approaches of the Clickenger bridge. Also for 260 perch of limestone masonry, 48 lin. ft. new limestone wheelcourses, 375 cu. yds. of excavation, 700 cu. yds. of fill and back fill, 2,260 ft. B. M. white oak lumber, 8,232 lbs. steel I beams, etc., for the rebuilding of a bridge over a run on the Amity pike. W. H. Halliday, Clk. County Comrs.

CINCINNATI, O.—Separate bids are asked until Sept. 20 for the construction of masonry and of the superstructure of a steel railway viaduct across the valley of Lick Run, east of the Little Miami River; bond, $500, with each bid. Aug. Herrmann, Pres. Water-Wks. Comrs.

LIMA, O.—Bids are asked until Sept. 12 for the construction of a bridge over the Ottawa River in Sugar Creek township. J. C. Cronley, County Engr.

GRAND RAPIDS, MICH. — E. H. Barnes, Res. Engr., writes us that the contract for the masonry of the new 105-ft. plate girder bridge to be built over the Muskegon River, near Upper Big Rapids, at a cost of $21,000, has been given to H. W. Tapp, Fort Wayne, Ind., and the contract for the superstructure to the Detroit Bridge & Iron Works, Detroit, Mich.

BARABOO, WIS.—W. G. Kirchhoffer, Cy. Engr., is reported to have made a survey and to be at work upon plans for a large iron bridge to be constructed across the Baraboo River at Elroy.

OSHKOSH, WIS.—Oscar Sanne, Engr., Milwaukee, writes us that the contracts for the steel bridge to be erected at this place were not let, as the bids were too high and not in conformity with the engineer's estimate. Bids are again asked until Sept. 6.

ALMA, NEB.—The following bids were received Aug. 9 for constructing nine county bridges: Canton Bridge Co., Canton (accepted), $3,365; Missouri Valley Bridge Co., Leavenworth, Kan., $3,500; Elizabeth Bridge Co., Elizabeth, Ill., $3,450; Geo. E. King, Des Moines, Ia., $3,400; Wrought Iron Bridge Co., Canton, O., $3,415; A. McLouth, McLouth, Kas., $3,600; Sheely Bridge Co., Lincoln, Neb., $3,440; Marsh Bridge Co., Lincoln, Neb., $3,560; Parks Bridge Co., Cedar Rapids, Ia., $3,440; St. Louis Iron & Bridge Works, St. Louis, Mo., $3,412; Dildine Bridge Co., St. Louis, $3,606; Kansas City Bridge Co., Kansas City, Mo., $3,520; and the Stark Bridge Co., Kansas City, $3,475. S. L. Roberts, County Clk.

WICHITA, KAN.—Bids are asked until Sept. 10 for building three steel bridges. A. M. Denny, County Clk.

MISSOULA, MONT.—O. E. Peppard, of this place, has been awarded the contract to build a 200-ft. steel bridge at Grantsdale, at a cost of $4,025, according to report.

PRINEVILLE, ORE.—Bids are asked until Sept. 7 for the construction of a 125-ft. bridge over Grand Ronde River at Island City. G. W. Benson, Clk. County Comrs.

CALUSA, CAL.—Bids are asked until Sept. 6 for building a new bridge on Princeton road, for removing a bridge and for repairing a bridge. Geo. K. Ford, Clk. of Bd.

PLACERVILLE, CAL.—Bids are asked until Sept. 6 for the construction of a combination deck bridge over the North Fork of Cosmunes River at Wisconsin Bar. A. S. Bosquit, Clk. of Bd. of Supervisors.

WILLOWDALE, ONT.—Bids are asked until Aug. 27 for the construction of the steel superstructure of a bridge over River Rouge, consisting of two 54-ft. span, 14 ft. wide. Peter S. Gibson & Son, Willowdale, Engrs.

EDMONTON, N. W. TER.—Bids are asked until Sept. 13 for the construction of the superstructure of a railway and general traffic bridge at Edmonton; check, $7,000. Address, E. F. E. Roy, Secy. Dept. of Pub. Wks., Ottawa.

BUILDINGS.

ST. ALBANS, VT.—Bids are asked by the supervising architect, Washington, until Sept. 19, for the steam heating and ventilating apparatus for the U. S. building in this city, as stated in our advertising columns.

BEVERLY, MASS.—The contract for the construction of a school bulding in this town is reported to have been let to S. R. Dexter, of Beverly, at $39,701. Bolger & Regan received the heating contract at $4,250.

BOSTON, MASS.—Plans are being prepared, according to reports, for a brick and stone dwelling to be erected at Beacon and Hereford Sts., for E. C. Swift, 46 Ames Bldg., at a cost of about $75,000. Archs., McKim, Mead & White, 160 5th Ave., New York.

NORTH ADAMS, MASS.—It is reported that Porter & Harnum, of North Adams, has been awarded the contract for the erection of a $125,000 hotel building on State St. for P. J. Boland.

ITHACA, N. Y.—Plans are stated to have been completed for the new chemical laboratory to be erected for Cornell University, to cost about $45,000. Work is expected to begin at once, and to be completed by June, 1899.

NEW YORK, N. Y.—Bids are asked by the department of public charities, foot of East 26th St., until Aug. 30, for the materials and work required for alterations to the old building on the pier of the department, foot of East 26th St. Archs., Horgan & Slattery, 1 Madison Ave.——Plans have been filed by Levi P. Morton, for a 12-story brick office building at 110 to 116 Nassau St., to cost $250,000. Archs., Clinton & Russell, 32 Nassau St.; by Peter Wagner, 215 West 106th St., for four 4-story brick dwellings on 95th St., west of Central Park, to cost $80,000. Arch., G. Fred. Pelham, 503 5th Ave.; by Wm. H. Lake, Yonkers, N. Y., for five 3-story brick dwellings at 154th St. and St. Nicholas Ave., to cost $75,000. Arch., Henri Fouchaux, 11th Ave. and 162d St.; by Bell & Groth, 81 East 125th St., for three 5 and 6-story brick flat buildings, at 3d and Boston Aves., to cost $125,000. Arch., C. A. Millner, 81 East 125th St.; by M. L. Fane, 239 East 22d St., for a 5-story and basement brick store and loft building at 8th Ave. and 36th St., to cost $75,000. Arch., F. P. Dinkelberg, 3 Union Square West; by Stewart & Smith, 459 Boulevard, for seven 5-story brick dwellings at 106th St. and Riverside Drive, to cost $140,000. Arch., Clarence True; by E. B. Grigsby, for a 5-story brick and stone dwelling at 59 East 67th St., to cost $50,000. Archs., Cable & Lucas, 1183 Broadway.——Thos. J. Reilly, 170 5th Ave., is reported to have been awarded the contract for the construction of a 11-story fireproof hotel building at 5th Ave. and 45th St., for the Matthew Byrnes Estate, to cost about $750,000. Archs., J. O'Rourke & Sons, 7 Clinton St., Newark, N. J.

NEW YORK, N. Y.—Bids are asked by the department of charities, foot of East 26th St., until Sept. 6, for the removal of old chimney and three old boilers, erection of self-supporting steel stack, four new down-draft boilers, erection of derrick and coal yard, and certain repairs, additions and alterations to steam-heating apparatus at Almshouse, Blackwell's Island; two bonds required, $8,000 each.——Press reports state that a 17-story brick and stone hotel building will soon be erected for a syndicate at southwest corner of Park Ave. and 42d St., to cost about $1,000,000. Plans are now being finished. Arch., Bruce Price, 1133 Broadway.

TOMPKINSVILLE (S. I.), N. Y.—Bids are asked until Sept. 15 for erecting the Plum Beach light-house, R. I., as stated in our advertising columns. Lt.-Col. D. P. Heap, U. S. Engrs.

CAMDEN, N. J.—Plans will be received by the commissioners of public instruction, at Broadway and Clinton Sts., until Aug. 30, for a new high school building, to be erected at Haddon and Newton Aves. Chn., Cornelius Sheperkotter.

ELIZABETH, N. J.—It is reported that plans are being prepared for a new gothic church building, 130 × 70 ft., to be erected for the Central Baptist Church on Jersey Ave. Pastor, Dr. E. T. Tomlinson; Archs., A. F. Leicht and F. T. Camp, 97 Cedar St., New York.

LONG BRANCH, N. J.—At the election held in this city Aug. 16 it was voted to appropriate $45,000 for the erection of a new high school building.

PATERSON, N. J.—The following bids were received by the supervising architect, Washington, D. C., Aug. 22, for a low pressure, return circulation, steam heating and ventilating apparatus for the post-office building at Paterson:

Edward Joy, Syracuse, N. Y.	$6,500	3 mos.
Frank Dobson, New York	7,395	*50 days.
Evans, Almiral & Co., New York	6,723	90 days.
Borges Bros. & Co., Columbus, O.	5,344	*75 days.
D. R. Burns, Philadelphia, Pa.	5,980	80 days.
Jno. F. Dalton, Savannah, Ga.	6,187	90 days.
McIlvain, Unkerfer & Co., Pittsburg, Pa.	5,335	60 days.
Gaylord & Eitapence, Binghamton, N. Y.	5,999	60 days.
Blake & Williams, New York	6,596	90 days.
Phila. Heating & Vent. Co., Phila., Pa.	7,939	8 weeks.
E. Rutzler, New York	7,345	75 days.
A. A. Sanborn, Boston, Mass.	6,672	....

*Working days.

LANCASTER, PA.—McLaughlin & Gersell, 220 East Walnut St., Lancaster, have received the contract for the construction of a building for the Lancaster Insane Asylum, at $71,956, according to reports.

PITTSBURG, PA.—The Central Methodist Episcopal Church, of which Dr. C. E. Moyg is pastor, contemplates the erection of a new church building at Academy and Franklin Sts., on property recently purchased.

VILLA NOVA, PA.—It is reported that the preliminary work for the erection of new monastery and college buildings at this place will begin next month; total estimated cost, $250,000 to $300,000.

WOODVILLE, PA.—The following bids were received by the commissioners of Allegheny county Aug. 16 for the construction of the new insane asylum building at the county home: John H. Trimble & Bros., $241,600; William Kerr & Sons, $240,000; H. L. Kreusler, $239,990; George A. Cochrane, $238,814; W. F. Trimble & Son, $238,068; Deeds Bros., $237,000; Rose & Fisher, $236,000; Kerr & Fox, $235,971; Murphy & Hamilton, $234,950; D. P. Osterling, $231,000; Jackson & Fulton, $228,450; A. & S. Wilson, $225,877; McIlvain, Unkefer & Co., $223,700. On the former set of bids received Aug. 3, D. P. Osterling was the lowest bidder, at $237,600. The contract was let to A. & S. Wilson, of Pittsburg, Pa.

WASHINGTON, D. C.—The following bids have been received by the district commissioners for the construction of an additional story to police station No. 8 U St., between 9th and 10th Sts, N. W.: George W. Corbett, $5,411; N. H. Thomas & Son, $5,370; Pavarini & Greer, $5,190; J. M. Dunn, $4,900.

BALTIMORE, MD.—The following bids were received by the supervising architect, Aug. 22, for modifications and repairs to the heating and ventilating apparatus, etc., of the U. S. building at Baltimore: Wells & Newton Co., Baltimore, Md., $2,475, 6 days; Crookhorner & Co., Baltimore, Md., $1,727, Sept. 15; Thos. C. Basshor & Co., Baltimore, Md., $1,874, 30 days; Philadelphia Heating & Ventilating Co., Philadelphia, Pa., $1,957, Sept. 25.

RALEIGH, N. C.—J. D. Elliott, Hickory, N. C., was awarded the contract, Aug. 20, by the trustees of the North Carolina Institution for the Blind, for erecting a new brick dormitory at the negro department, to cost $11,500; and also for the erection of a power house, the machinery for which is to be bought later, and a new dormitory at the white department, to cost $45,000.

GROVE HILL, ALA.—The commissioners of Clarke county have decided to erect a $15,000 court house.

CHAMPAIGN, ILL.—It is reported that the Illinois Central R. R. Co. has awarded the contract for building a new station at Champaign to Swift & Co., who are now erecting the Big Four shops in Urbana. The structure is to be patterned after the Illinois Central station at Kankakee, but will be 50 feet longer.

CHICAGO, ILL.—The Northwestern Terminal Elevator, at Market St. and the Chicago River, was destroyed by fire Aug. 20, causing a total loss of $350,000. Of this amount $30,000 fell upon the Chicago & Northwestern Ry. Co., whose freight yards are nearby.——The Falkenau Construction Co., 1116 Chicago Stock Exchange, has been awarded the contract for the construction of a 6-story fireproof building, 40 × 100 ft., to be erected at 282 and 284 5th Ave., for Charles Yondorf, at a cost of about $55,000. Arch., Dankmar Adler, 27 Auditorium Bldg.——A permit has been granted to the Illinois Central R. R. Co. for a 2-story brick roundhouse, 64 × 80 ft., and a 2-story machine shop to be erected at the foot of 27th St.; cost, $50,000.

CHICAGO, ILL.—Bids are asked by the department of public works until Sept. 1 for the steam heating apparatus, including boiler, for the 47th St. police station, now being erected at 47th and Paulina Sts. Comr., L. E. M'Gann.——Bids are asked by the board of education, Schiller Bldg., until Aug. 26, for the sheet metal work at workshop at 161 West Monroe St.

LAHARPE, ILL.—Bids are asked until Sept. 9, according to reports, for erecting a 2-story brick school building, 77 × 75 ft., at this place, to cost about $12,000. Archs., Geo. W. Payne & Son, Carthage, Ill.

MANITOWOC, WIS.—Bids are asked until Sept. 8 for the plumbing and steam heating in the building of St. Francis Hospital.

SPRING VALLEY, WIS.—Bids are asked by the school board until Aug. 26 for the erection of a 4-room brick school building. Address W. G. Spence, Spring Valley.

MORRIS, MINN.—Bids are asked until Sept. 7 for the erection of a brick dormitory building for the Morris Indian Industrial School. Supt., W. H. Johnson.

DES MOINES, IA.—The Capitol City Brick & Pipe Co., of Des Moines, has been awarded the contract for the construction of the west wing of the Iowa State Memorial Historical & Art building, according to reports, at $47,651.

OMAHA, NEB.—The following bids were received by the supervising architect, Washington, D. C., Aug. 16, for two hydraulic passenger elevators, one hydraulic mail lift and one hydraulic ash lift for the U. S. Building at Omaha: Crane Elevator Co., Chicago, Ill., $10,000, 90 days; Otis Bros. & Co., New York, $13,150, 90 days; Eaton & Prince Co., Chicago, Ill., $10,100, 120 days.

HOT SPRINGS, ARK.—A fire in this city, Aug. 20, destroyed the National and Windsor Hotel buildings, causing a reported loss of $75,000.

SEATTLE, WASH.—Bids are asked until Aug. 29 for constructing two houses at Point Wilson. Harry Taylor, Capt. Engrs., Burke Bldg., Seattle.

MONTREAL, QUE.—It is reported that plans are being prepared for Wm. J. McDermott, of Craig St., for a building to replace the old Irish National Hall, to cost about $80,000.

ST. THOMAS, ONT.—Bids are asked until Sept. 7 for remodeling and enlarging the court house of Elgin county in this city. Clk., K. W. McKay; Arch., N. R. Darragh, St. Thomas.

WATER-WORKS.

AUBURN, ME.—E. S. Paul, Pres. Water Com., writes us that all the work for a better water supply is being done by the day, under the management of the superintendent of water-works.

ALEXANDRIA BAY, N. Y.—Col. O. G. Staples writes us that a special meeting to consider the question of works has been called.

AMSTERDAM, N. Y.—J. R. Snell, Supt., informs us that the city is getting bids for the following iron and vitrified pipe. The plans and specifications for dams and laying pipe, etc., are not quite ready. The quantities of pipe are as follows: 270 lengths of 24-in. iron pipe, 2,120 lbs. to length; 280 lengths of 24-in. iron pipe, 2,349 lbs. to length; 280 lengths of 24-in. iron pipe, 2,580 lbs. to length; 197 lengths of 36-in. iron pipe, 4,070 lbs. to length; 10 lengths of 16-in. iron pipe, 1,152 lbs. to length; 100 lengths of 20-in. iron pipe, 1,924 lbs. to length; 25 tons specials. All pipe to be cast bell ends down, coated by Smith process, to be good, sound castings, tested to 300 lbs. pressure; weight in total to average as above, but a limit of variation in individual pipe of 4%. All f. o. b. Amsterdam. 20% limit of variation in reducing or enlarging order. Note price for delivery beginning Sept. 1 and ending April 1, 1899; 50% to be delivered before Dec. 1. Also price for winter delivery to begin April 1 and end July 1, 1899.

BUFFALO, N. Y.—The residents of Kenmore have asked this city to supply the suburb with water.

BUFFALO, N. Y.—Bids are asked until Aug. 31 for making repairs and additions to the pumping station, to cost about $10,000. R. G. Parsons, Secy. Bd. Pub. Wks.

DEERFIELD, N. Y.—The town board has accepted the proposition of the West Canada Creek Water Co. to supply this place with water. Secy., E. D. Mathews; Clk., P. D. Condon.

WHITESBORO, N. Y.—This place will probably soon vote on the question of building gravity works.

CALDWELL, N. J.—The Caldwell Water Co., incorporated Aug. 8 to supply this section with water, has asked the borough council for a franchise to establish works. Capital stock, $50,000, with $2,000 paid in. It is proposed to get a supply from driven wells, which would be at least 500 ft. in depth. The promoters of the company will meet a committee appointed by Mayor Jacobus. Pres., James Bowers; Secy. and Counsel, Walter Lindsley. M. B. Lindsley, Treas., writes us that the company proposes to supply Caldwell, township of Caldwell, North Caldwell, townships of Verona and Livingston; population, 5,000.

FLEMINGTON, N. J.—The council proposes to build city works, at a cost of about $40,000, according to reports. Edward B. Allen, Furman Williamson and Geo. H. Large are interested.

HIGHBRIDGE, N. J.—This place is considering the question of building works.

JERSEY CITY, N. J.—The street and water board received but one bid Aug. 18 for furnishing a new water supply. It was from Patrick H. Flynn, Brooklyn. He offered to furnish water by any one of three plans. The first names as the source of supply the Rockaway River, at Old Boonton, with one reservoir. The price of a million gallons varies from $36 for 25,000,000 gallons to $20 for 70,000,000 gallons. The price named for the completed works is $7,595,000 for a 50,000,000 gallon pipe line, or $8,745,000 for a 70,000,000 gallon pipe line. The second plan is the same except that it contemplates three reservoirs. The water is to be furnished by gravity at a pressure of 210 ft. above mean tide. The third bid was informal and was not considered.

SALEM, N. J.—Joseph H. Young and C. J. Young, 4618 Chester Ave., Philadelphia, have been awarded the contract for building the filtration plant of 500,000 gallons capacity at Salem, as advertised in Engineering News. Engr., C. Hungerford, 116 West 69th St., New York.

BEAVER FALLS, PA.—The People's Water Co., it is reported, will proceed with the construction of its proposed works, which was prevented during the summer by the supreme court; estimated cost, $100,000.

EVANS CITY, PA.—Bids are asked until Aug. 29 for furnishing and laying 13,600 ft. of 4 to 8-in. water pipe, a pumping station, reservoir, a 200,000-gallon pump, a gas engine, etc. Engrs., J. P. Leaf, Rochester, Pa.; Pres. Council, Geo. Fehl.

HARRISVILLE, PA.—This place voted Aug. 23 on the question of issuing $7,000 in bonds for works.

MILLHALL, PA.—A charter and franchise have been granted to the Millhall Water Co. The company will issue 5% bonds and start with enough takers to pay interest on bonds and running expenses. Capital wishing an investment with proper bonus can address Jas. P. Hardic, Williamsport, Pa., or Thomas Harmon, Lock Haven, Pa.

PATTON, PA.—The Patton Water Co. has asked for bids for furnishing and laying a 6-in. main in several streets. Supt., E. C. Brown.

PORT GRIFFITH, PA.—James P. Hardic, Williamsport, Pa., water-works contractor and builder, has just completed the laying of 1,150 ft. of 6-in. cast-iron pipe across the Susquehanna River, and several hundred feet on land, connecting with mains leading to the Pennsylvania Coal Co.'s braker at Port Griffith, Pa. The river pipe was laid in four days' time with a gang of five men; average depth of water, 3½ ft. Fred. Dittmar, of Williamsport, Pa., did the calking.

CUMBERLAND, MD.—Bids are asked until Sept. 5 for furnishing 9 dozen ¼-in. corporation cocks; 9 dozen 1-in. stops; 2 dozen 1-in. cocks; 2 dozen 1-in. stop-cocks; 5,500 ft. of pipe, valves, boxes, packing, etc. H. M. Fuller, Clk.

POCOMOKE CITY, MD.—Bids are asked until Sept. 7 for furnishing and constructing works and a sewerage system, as stated in our advertising columns. Engrs., Pownall & Minshall, 150 Nassau St., New York; Mayor, R. M. Stevenson.

LURAY, VA.—The question of building works is being considered.

MARION, N. C.—J. A. McDonald, Mayor, writes us that a private company is making estimates for works; population, 5,200. J. D. Burgin, Old Fort, N. C., may be addressed.

ARLINGTON, GA.—The question of issuing bonds for works and a light plant will probably soon be voted on.

COLUMBUS, GA.—L. H. Chappell, Mayor, writes us that no plans or appropriation has yet been made for artesian wells for a new water supply. The mayor wishes to secure the services of a party who will sink the well at his own risk.

GREENSBORO, GA.—This place is reported to have voted Aug. 9 to issue $22,000 in bonds for works. J. B. Williams, Mayor.

BESSEMER, ALA.—Councilman W. J. Long writes us that the contract for increasing the supply, enlarging reservoirs, etc., of the works of the Bessemer Water-Works Co. was recently let to Henry F. De Bardeleben at $5,000.

DICKSON, TENN.—The question of securing a water supply from Pain Spring is being considered by the Dickson Business League.

MOUNT STERLING, KY.—The council is reported as arranging for the construction of the proposed works. Mayor, Geo. W. Baird; Chn. Com., R. M. Burbridge.

CHURUBUSCO, IND.—The Seckner Contracting Co., The Rookery, Chicago, has been awarded the contract for building works and a light plant at $18,500.

CLARKSVILLE, IND.—Press reports state that the aldermen are making arrangements to put in a filtration plant and to improve the works at a cost of about $25,000.

EAST CHICAGO, IND.—The contract for extending the works has been let to the Seckner Contracting Co., Chicago, at $36,960.

EVANSVILLE, IND.—H. A. Mansfield, Indianapolis, Ind., submitted the lowest bid Aug. 15 for building the boiler house, engine house and stack at $43,600.

LAKE ODESSA, MICH.—This place voted Aug. 16 to issue $11,000 in bonds for works.

PAW PAW, MICH.—Wm. H. Mason, Clk., informs us that the following bids were received Aug. 17 for building works:

James W. Pearl, Boston Harbor, Mich..........	$16,300
T. C. Brooks & Sons, Jackson, Mich.............	16,396
Alexander & Shaw, Chicago, Ill.................	17,900
Kalamazoo (Mich.) Supply & Construction Co.	17,500

CHICAGO, ILL.—Bids are asked until Sept. 1 for constructing a 7-ft. cast-iron water gate, etc., for the Chicago Ave. tunnel connection. L. E. McGann, Comr. Pub. Wks. ——Bids are asked until Sept. 7 for installing water tanks at the Chicago Public Library. W. B. Wickersham, Secy.

GALFSVILLE, WIS.—This place is reported to have voted to build new works, to cost $5,000.

KAUKAUNA, WIS.—C. W. Weeks & Co., Chicago, and Luther Lindauer, Kaukauna, have been awarded the contract for building the works for the Kaukauna Water-Works Co., to cost about $75,000. The work is to be completed by Jan. 1.

OSCEOLA, IA.—J. W. Brown, Mayor, writes us that a committee has been appointed to decide upon plans for works. L. W. London, Chn. Com.

LANESBORO, MINN.—Bids are asked until Sept. 5 for furnishing and building complete works. O. M. Halberstad, Village Clk.

SPARTA, MINN.—Bids are asked until Sept. 9 for the purchase of $1,750 6% water bonds. E. McHale, Pres.

SPARTA, MINN.—The Virginia Iron Works, Virginia, Minn., and Jas. Dowling, Eveleth, Minn., submitted the only bids for building works at $7,992, and $5,450, respectively. Clyde Bender, Recdr.

WALNUT GROVE, MINN.—This place has voted to build works to cost about $3,500.

WAMEGO, KAN.—H. V. Hinckley, Topeka, Kan., has been engaged to prepare plans and specifications for works, and to superintend the construction.

WELLINGTON, KAN.—S. N. Brooks, Mayor, writes us that nothing definite has yet been decided upon in regard to works. The city is yet figuring on works. Population, 3,600.

TEHAMAH, NEB.—An election will soon be held to vote on the question of issuing $2,000 in bonds for extending the works.

SIOUX FALLS, S. DAK.—It is estimated that municipal works can be built for about $90,000.

ANACONDA, MONT.—Bids are asked until Sept. 5 for furnishing this city with a water supply for five years. About 50 hydrants are now used, but this number will be increased. T. O'Leary, Cy. Clk.

ST. JOSEPH, MO.—J. R. Rackliffe, Cy. Engr., writes us that the city is ready to make a contract for the construction of the proposed new works, under either private or municipal ownership. The works will include two low-service pumps of 8,000,000 gallons each; three high-pressure of 5, 8 and 10,000,000 gallons capacity; a stand-pipe, three settling basins, a filter with a capacity of 15,000,000 gallons, 11,000 tons of iron pipe, 600 hydrants, 225 tons of special castings, 500 valves, and a number of meters; estimated cost, $800,000.

WICHITA FALLS, TEX.—Chas. Carrol, Sedalia, Mo., has applied for a franchise for works and a light plant.

FLORENCE, COLO.—Hiram Philips, Oriel Bldg., St. Louis, Mo., has been engaged to prepare plans for works. The source of supply is Newton Creek Canon, about 11 miles distant, and 2,500 ft. above the city. The plans will be completed about Oct. 1, and the proposition to issue bonds will then be voted on. Estimated cost, $100,000.

FOSSIL, ORE.—The council will probably soon begin the construction of the proposed works, to cost about $6,000.

MEDFORD, ORE.—A committee has been appointed to consider the advisability of building a reservoir and of enlarging the works.

PORTLAND, ORE.—Residents of Woodstock and Ivanhoe are circulating petitions to have the Bull Run main tapped. It is estimated that a 4-in. pipe would supply the present demands, and it is proposed to bring the line from the main connected with the upper reservoir along the Milwaukee Road for a distance of two miles. From this line the Ivanhoe and Woodstock pipe systems may be connected and residents supplied.

STENT, CAL.—The question of securing a water supply from one of the nearby cities is being considered.

WHITTIER, CAL.—The question of issuing $40,000 in bonds for new city works is being considered.

FARMINGTON, UTAH.—E. A. Vail writes us that this village is having plans prepared for works which it is expected to build this year. There will be required about 6,500 ft. of 16-in. pipe and 2½ miles of smaller pipe.

IDAHO FALLS, IDAHO.—At the election held Aug. 9 this place voted a tie on the question of issuing $20,000 in bonds for works.

ATWOOD, ONT.—The "Bee" is urging the construction of works for fire protection.

PRESCOTT, ONT.—This place voted Aug. 18 to build works.

WINNIPEG, MAN.—Owing to arrangements not being completed, bids will not be opened Sept. 6 for a system of wells and pumping plant, as advertised in our issues of Aug. 11 and 18. H. N. Ruttan, Cy. Engr.; C. J. Brown, Cy. Clk.

BIRMINGHAM, ENGLAND.—Bids are asked until Sept. 13 for building 17¼ miles of the aqueduct from Cleobury Mortimer to Hagley. The contract consists principally of providing and laying two lines of cast-iron pipe and laying only two lines of steel pipe, 41 ins. in diameter. Engr., Jas. Mansergh, 5 Victoria St., Westminster, London; Town Clk., Edward Orford Smith.

SEWERAGE.

BOSTON, MASS.—The following bids were received Aug. 18 for building brick and pipe surface drain in Selden St passageway and Capen St., Dorchester. T. H. Connolly, $8,531; J. P. O'Connell, $10,501; Collins & Ham, $11,358; T. H. & G. W. Byrne, $12,117; J. J. Falvey, $12,317; D. E. Lynch, $12,933; Jones & Meehan, $13,570; H. P. Nawn, $14,457.

CLINTON, MASS.—Bids are asked by the Metropolitan Water Board, 3 Mount Vernon St., Boston, until Sept. 1 for constructing sections one and two of the system, as stated in our advertising columns. Wm. N. Davenport, Secy.

EVERETT, MASS.—The council has appropriated $10,000 for a sewer in Hendersonville.

SPRINGFIELD, MASS.—The council is arranging to construct a sewer in Worthington St., at a cost of about $15,000.

BUFFALO, N. Y.—Bids are asked until Sept. 2 for constructing 63 to 44-in. brick sewers in Hampshire St., and for a 12-in. pipe sewer in Kenmore Ave. R. G. Parsons, Secy. Bd. Pub. Wks.

DUNKIRK, N. Y.—Bids are asked until Sept. 6 for building a 15-in. pipe sewer in Railroad Ave. W. C. Baugartner, Cy. Clk.

OSWEGO, N. Y.—The board of health has asked the city engineer to prepare plans for a sewer in East Bridge St., to cost about $1,200.

NEWARK, N. J.—The board of works has published notices of intention to build the proposed brick and pipe main sewer in Clinton Ave., from Chadwick Ave. to Clinton Place, with laterals in a number of streets, and for 10 and 8-in. sewers in about 20 streets to connect with the East Branch intercepting sewer.

WOODBRIDGE, N. J.—Press reports state that bids will be asked by the township committee at once for building a portion of the proposed system. Des. Engr., C. C. Hommann.

MANSFIELD, PA.—Councils are reported to have voted to begin at once the construction of 15 to 10-in. pipe sewers for the proposed system.

McKEE'S ROCKS, PA.—E. F. Hughes has been awarded the contract at $5,000 for building certain sewers.

OAKMONT, PA.—This place has voted to issue $37,000 in bonds for local improvements; of this amount $21,000 will be for sewers and $16,000 for streets.

PHILADELPHIA, PA.—The residents of the 17th, 18th and 20th Wards are agitating the question of larger sewers in that section of the city.

SHERADEN (ALLEGHENY COUNTY), PA.—This place has voted to spend $8,000 for sewers and $8,000 for streets.

POCOMOKE CITY, MD.—Bids are asked until Sept. 7 for furnishing the materials and for constructing a system and water-works, as stated in our advertising columns. Engrs., Pownall & Minshall, 150 Nassau St., New York; Mayor, R. M. Stevenson.

RICHMOND, VA.—W. E. Cutshaw, Cy. Engr., writes us that the committee on streets will hear allegations for the construction of certain sewers, after which its recommendations will be submitted to the council for action. It is probable that bids will be asked about the middle of September.

GAINESVILLE, GA.—Survey and estimates for a system, it is reported, will soon be made.

NASHVILLE, TENN.—The city engineer has asked for bids for building a 10-in. pipe sewer in Public Square.

HENDERSON, KY.—Bids are asked until Sept. 6 for constructing a sewer in Washington St. W. I. Thompson, Mayor.

MANSFIELD, O.—Bids are asked until Sept. 17 for building a 30 and 27-in. storm water sewer in certain streets J. C. Burns, Chn. Com.

TIFFIN, O.—Bids are asked until Sept. 5 for changing the main sewer in the 4th ward. J. B. Ehrenfield, Cy. Clk.

YOUNGSTOWN, O.—Bids are asked until Sept. 5 for the purchase of sewer bonds. F. C. Brown, Clk.

CICERO, IND.—Bids are asked until Aug. 27 for constructing a sewer in Spring St. G. J. Holl, Town Clk.

KOKOMO, IND.—The council is reported by local papers to have voted to build a 4-ft. brick sewer in Union St.

RICHMOND, IND.—Bids are asked until Sept. 16 for building the North E St. brick and pipe trunk sewer to be 2,500 ft. long; bond, $10,000. J. H. Winder, Clk.; H. L. Weber, Cy. Engr.

COLDWATER, MICH.—Bids are asked until Sept. 1 for building 18 to 10-in. pipe sewer, etc., in certain streets, to cost about $900, and for paving to cost about $9,000. We are informed that the bids received for this work Aug. 16 were rejected. P. H. Sweeney, Clk.

LAURIUM, MICH.—This place, which voted July 23 to issue $35,000 in bonds for a system, will probably ask for bids in December for the construction. Des. Engr., Chas. F. Loweth, 94 E. 4th Ave., Minneapolis, Minn.; Clk., Jos. R. Murphy.

OWOSSO, MICH.—The city engineer writes us that it is proposed to build a mile of 24 to 8-in. pipe sewer at a cost of $5,500. Des. Engr., H. E. Riggs, The Nasby, Toledo.

KENOSHA, WIS.—Bids are asked by the city clerk for constructing 50 catchbasins.

RACINE, WIS.—It has been decided to build a sewer in 16th St. at a cost of about $4,000.

WAUKESHA, WIS.—Bids are asked until Sept. 2 for furnishing the material and constructing pipe sewers in certain streets. H. E. Blair, Cy. Comptroller.

SOUTH OMAHA, NEB.—It is proposed to build sewers in certain streets in South Omaha.

ANACONDA, MONT.—Patrick Walsh has been awarded the contract for building sewers in Districts 7, 8, 10 and 11, at $4,636.

DENTON, TEX.—This place is reported as considering the question of building a system.

SAN SABA, TEX.—Bids are asked until Sept. 1 for constructing a sewer to the river; check, $500. Jno. Seiders, County Judge.

INDEPENDENCE, MO.—Andrew Rosewater, Bee Bldg., Omaha, is reported to have recommended a system which will collect the sewage of the city at two or more points and dispose of it in air-tight tanks and by filtration. Estimated cost of two stations, $35,000; estimated cost of main sewers inside the city limits, $40,000. Mr. Rosewater's plan is for the city to issue $75,000 in bonds, build the plant for disposing of sewage and all the sewers necessary in the city. The council will take the report under consideration and probably call a special election.

ST. LOUIS, MO.—Bids are asked until Aug. 26 for reconstructing about 1,025 ft. of the bottom of the Mill Creek main sewer. B. H. Colby, Sewer Comr., 311 New City Hall.

GRASS VALLEY, CAL.—The city trustees will probably soon call an election to vote on the question of building a system.

CHARLOTTETOWN, P .E. I.—The council is reported as arranging for the construction of the proposed system, for which $50,000 in bonds will be issued at once. Two sewage pumping stations will be built.

MONTREAL, QUE.—The aldermen are considering the question of the better disposal of the sewage. T. J. O'Neill, Secy. Road Com., and Aldermen Dupre and Wilson may be addressed.

GARBAGE DISPOSAL—STREET CLEANING

PORTCHESTER, N. Y.—The question of a better method for the disposal of the garbage, waste, etc., is being considered, according to reports.

HAZLETON, PA.—The council is considering the question of garbage collection, etc. Councilman Ferry may be addressed.

KNOXVILLE, TENN.—The question of building a plant is being considered, according to reports.

BAY CITY, MICH.—The question of securing a garbage disposal plant is being considered.

LOS ANGELES, CAL.—The council will ask for bids at once for sweeping the streets. Bids will be asked under three specifications. The first provides for the sweeping of the business section by machines; the second for the sweeping of the business district by hand, and the third provides for sweeping of that portion of the city outside the given business area by machines.

STREETS AND ROADS.

PORTLAND, ME.—The county commissioners received the following bids Aug. 15 for paving the approach of Portland bridge, as noted in our issue of Aug. 11: W. L. White labor, $6,811; material, $4,521; Maine & New Hampshire Granite Co., labor, $2,136, material, $4,279; T. F. Griffin & Bro., labor, $2,362; material, $3,888; Geo. S. Staples, labor, $5,528; Fernald Bros. & Higgins, material, $4,467. The contract has been awarded to the Maine & New Hampshire Granite Co. for the labor and to T. F. Griffin & Bro. for material. An arrangement is said to have been made between the latter two concerns by which the work will all be done by T. F. Griffin & Bro., at the rate bid, $6,024. W. B. Allen, Chn. County Comrs.; Geo. N. Fernald, Comr. Pub. Wks.

BOSTON, MASS.—The street commissioners have decided to lay out and pave Rockford and Nottingham Sts., at Dorchester and will grant a public hearing Sept. 1.

SOMERVILLE, MASS.—Bids are asked until Aug. 29 by the Metropolitan Park Commission for 1,000 cu. yds. of earth grading, 2,000 sq. yds. of gravel walk surfacing and 4,200 sq. yds. of roadway foundation and broken stone surfacing on Middlesex Ave. Wm. T. Pierce, Engr., 13 Exchange St., Boston.

BRISTOL, CONN.—Bids are asked until Aug. 31 by the board of selectmen for grading and graveling a section of road between this place and Plymouth; check, $500. Hobart A. Warner, Fred. N. Manross and Anson Q. Perkins, Selectmen.

HADDAM, CONN.—Bids are asked until Aug. 31 by the board of selectmen for constructing and grading about 1,500 ft. of highway; bond, $1,000. Eph. P. Arnold, Willis A. Bonfoey and Chas. B. Northam, Selectmen.

LITCHFIELD, CONN.—Bids are asked until Sept. 5, by the board of selectmen for grading and telfordizing a section of road from this place to Morris. Chas. Merriman, Pat. C. Burke, Newton G. Tyler, Edgar D. Beach and Jerome D. Wheeler, Selectmen.

NORTH BRANFORD, CONN.—Bids are asked until Aug. 31 by the selectmen for constructing pavements; bond, $1,000. A. B. Hill, Engr., 82 Church St., New Haven.

ALBANY, N. Y.—Bids are asked until Sept. 5 by the board of contract and apportionment for 11,000 sq. yds. of vitrified brick paving; 6,530 lin. ft. of 6-in. granite curbing; 270 lin. ft. of circular granite curbing; 60,000 sq. ft. of new brick sidewalk; 10,000 sq. ft. of new 4-ft. flag sidewalk and six receiving basins, for Elm St., from Grand St. to Delaware Ave. Horace Andrews Cy. Engr.

BUFFALO, N. Y.—The commissioners of public works Aug. 18 received the following lowest bids: For surfacing Ferry St., from Niagara to Massachusetts Sts., Barber Asphalt Paving Co., New York, $14,533; for repaving Babcock St. with brick, L. H. Gipp, $20,000, with asphalt, Henry P. Burgard, $23,000. R. G. Parsons, Secy. Bd.

BUFFALO, N. Y.—Bids are asked until Sept. 2 for street work in Niagara Square. Address G. H. Selkirk, Secy. Park Comn.

LITTLE FALLS, N. Y.—Halliman Bros. have been awarded the contract to construct Ray St., and construct pipe, sewer and grade Loomis St., at $14,430. The only other bid was that of Jas. Creagh, $15,369. S. E. Babcock, Cy. Engr.

NEW ROCHELLE, N. Y.—The board of trade held a special meeting Aug. 11 to consider the proposition to bond the town for highway purposes. Action was deferred. C. W. S. Wilson, Village Engr.; G. R. Olney, Supt. Pub. Wks.

PORTCHESTER, N. Y.—Bids are asked until Sept. 6 by the village trustees for 19,850 sq. yds. of brick paving in three streets. J. A. Kirby, Engr.

ROCHESTER, N. Y.—The council is preparing to improve portions of Maple St., Post St., Front St., Center St., Chili Ave., Immel Place and Hudson Ave., by grading, paving, curbing and sidewalk.——The Warren-Scharf Asphalt Paving Co., New York, has been awarded the contract to construct an asphalt pavement on Clarissa St., from the river to Plymouth Ave., at $11,565, according to report. Edwin A. Fisher, Cy. Engr.

SCHENECTADY, N. Y.—Bids are asked until Sept. 1 for the improvement of the two miles of the Troy and Schenectady Turnpike, from the city line of Schenectady, easterly. C. W. Adams, State Engr., Albany, N. Y.

TROY, N. Y.—Bids are asked until Aug. 30 for brick paving on Harrison St., etc. E. Ogden Ross, Secy. Contracting Bd.

ATLANTIC CITY, N. J.—A paving ordinance is under consideration by the city council which provides for the macadamizing of all the cross avenues between Connecticut and Missouri Aves., twenty in number. Before amendment the ordinance provided for vitrified brick paving on certain streets. John P. Ashmead, Cy. Engr.

HASBROUCK HEIGHTS, N. J.—Bids are asked until Sept. 6 for macadam paving, etc., as stated in our advertising columns. Engr., Lemuel Lozier, Hackensack, N. J.; Clk., G. H. Ramsden.

CONSHOHOCKEN, PA.—The town council has passed an ordinance requiring owners of real estate on Cherry St. between Elm St. and the Pennsylvania R. R. to pave, curb and gutter in front of their property. Jos. W. Cavanagh, Pres.; Harry B. Heywood, Clk.

LANSDOWNE, PA.—The citizens will soon vote on a proposition to borrow $15,000 for the purpose of improving the streets. Thos. G. Janier, Borough Surv.

MAUCH CHUNK, PA.—The town council has voted to spend $1,500 in the construction of about 700 yds. of macadamized streets, according to report.

PHILADELPHIA, PA.—Bids are asked by the department of public works until Aug. 30 for sundry paving, grading, etc., in this city. Director, Thos. M. Thompson.

PHILLIPSBURG, PA.—Hugh E. Crilly, Allentown, has been given the contract to pave 1¾ miles of streets with brick at $30,000, according to report.

PITTSBURG, PA.—Bids are asked until Aug. 27 by the county commissioners for the improvement of the Beaver road, the Library road and the Sharpsburg and Kintanning road in Allegheny county; bond, $60,000 for each of the three contracts. F. W. Patterson, County Road Engr., 29 Court House, Pittsburg.

READING, PA.—The board of public works received bids Aug. 18 for 13,000 lin. ft. of curbing and 41,500 sq. yds. of asphalt paving, as noted in our last issue. The bidders were: Pennsylvania Asphalt Paving Co., Philadelphia; Alcatraz Co., New York; Richardson & Ross, and the Barber Asphalt Paving Co., New York.

WILMINGTON, DEL.—John Jacoby has been awarded the contract by the board of health to pave Lord St., between Poplar and Lombard Sts. with brick. Simmons & Bro. were the only other bidders.

ANNAPOLIS, MD.—Jos. Jewell was awarded Aug. 16 the contract to pave Prince George, Bladen and Compromise Sts. and Market Space, around the City Park. His bid was: Prince George St., $2,710; Compromise St., $460; Market Space, $745, and Bladen St., $393. Geo. Jewell, Cy. Comr.

CUMBERLAND, MD.—Bids are asked until Sept. 5 for furnishing vitrified paving brick, sand for street work, curbing and crossing stone and resetting curbing now in use, terra cotta pipe and oak and pine lumber. Howard M. Fuller, Clk.

ROCKVILLE, MD.—The county commissioners decided Aug. 19 to readvertise for bids for macadamizing 8 miles of the Rockville Pike. The appropriation is $25,000.

MONROE, LA.—Bids are asked until Sept. 8 for 7,788 sq. yds. of vitrified brick paving on 6 ins. of concrete. A. A. Forsythe, Mayor.

NEW ORLEANS, LA.—Bids are asked until Aug. 29 for asphalt paving in Rampart St. P. A. Rabouin, Comptroller.

FRANKFORT, KY.—Bids are asked until Aug. 26 for the construction of an artificial stone or cement pavement at the corner of Main or Montgomery and St. Clair Sts. W. S. Dehoney, Mayor; Ben. Marshall, Cy. Clk.

HENDERSON, KY.—Bids are asked until Sept. 6 for 2,000 cu. yds. of conglomerate gravel. Mayor, W. I. Thompson.

LOUISVILLE, KY.—The Assyrian Asphalt Co., Chicago, was awarded the contract Aug. 10 to pave three squares of Hepburn Ave. and one square of Von Borries Ave., with asphalt at about $21,000. Louis A. Mehler has been awarded the contract to reconstruct and pave 28th St., from Chestnut St. to Broadway and Magazine St., from 26th to 28th Sts., with vitrified brick. G. W. Gosnell received the contract to reconstruct several alleys and Frank Saffran the contract to lay the sidewalks on 9th St., from Grayson to Walnut Sts. Chas. F. Granger, Chn. Bd. Pub. Wks.

BOWLING GREEN, O.—A. Graham was awarded the contract Aug. 9 for paving North Grove St. at $4,732. The other bids were: J. C. Carland, Toledo, $4,976; W. C. Blystone, $4,980, or $4,866, according to which block was selected.

COSHOCTON, O.—Bids are asked until Sept. 5 for the purchase of 15 street bonds aggregating $22,500, which are issued for the purpose of paving Main St. with vitrified brick. Bids are also asked until Sept. 10 for 11,000 cu. yds. of excavation; 21,000 sq. yds. of brick paving; 6,900 lin. ft. of curbing. F. F. Wagner, Village Clk.

DAYTON, O.—Bids are asked until Aug. 29 for grading, graveling and paving with boulders, the alley south of Germantown St., from Summit to Greencastle Sts. J. L. Baker, Pres.; J. E. Gimperling, Cy. Comptroller.

NELSONVILLE, O.—Bids are asked until Sept. 10 for improving Chestnut St., as stated in our advertising columns. Asher Buckly, Mayor; Jas. Sharp, Village Clk.

TOLEDO, O.—Bids are asked by the commissioners of Lucas county, until Sept. 13 for 1,225 cords of crushed limestone. Wm. M. Godfrey, County Audr.

YOUNGSTOWN, O.—Bids are asked until Sept. 12 for the paving of Scott St., between Wuck and Belmont Avenues. H. W. Calvin, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until Aug. 29 for grading and laying cement sidewalks on 13th St., from Illinois St. to Capital Ave., and for grading and brick paving the first alley east of New Jersey St., from St. Clair to Pratt Sts. M. A. Downing, Chn. Bd. Pub. Wks.

LAFAYETTE, IND.—The Indiana Construction Co., Don M. Roberts, Mgr., Terra Haute, has been awarded a contract for nine miles of cement sidewalk at $22,000, according to report. W. K. Eldridge, Cy. Engr.

LOST CREEK, IND.—Bids are asked until Sept. 5, according to report, by the county commissioners for the construction of new gravel roads in Lost Creek township.

ROCKVILLE, IND.—Bids are asked until Sept. 10 for the improvement of six highways in Parke county, aggregating a total length of 16 miles, including grading, draining, bridging and graveling. E. H. Owen, Auditor.

COLDWATER, MICH.—The council has rejected the bids received Aug. 16 for furnishing the material and constructing a brick pavement on concrete foundation on Chicago St., as advertised in Engineering News. New bids are asked until Sept. 1. The bidders were: J. J. Granville, Saginaw; John McLoughlin, Detroit; and W. McLane, Coldwater. P. H. Sweeney, Cy. Clk.

CHICAGO, ILL.—Bids are asked until Aug. 31 for grading, curbing, and paving in a number of streets. L. E. McGann, Pres. Bd. Local Improvements.

MANSFIELD, O.—Bids are asked until Sept. 12 for $13,600 six per cent. street improvement bonds, according to report; deposit, 10%. F. M. Remy, Cy. Clk.

MILWAUKEE, WIS.—Theo. C. Froemming has been awarded the contract for macadamizing Galena St., from 4th to 7th Sts, $3,914, according to report.——The park board is planning to extend the Highland Boulevard, thus uniting West Park with the present boulevard. G. H. Benzenberg, Cy. Engr.

CEDAR FALLS, IA.—The Likes Improvement Co., Des Moines, has received the paving contract amounting to $32,315, according to report.

KEOKUK, IA.—Bids are asked until Sept. 5 for 5,761 sq. yds. of brick, and 5,338 sq. yds. of macadam paving, etc. G. M. Walker, Cy. Engr.

OMAHA, NEB.—Bids are asked until Sept. 2 for repaving and resetting curbs on Poppleton Ave., from 29th Ave. to 32d St. John H. Butler, Chn. Bd. Pub. Wks.; Wm. Coburn, Secy.

KANSAS CITY, MO.—Contracts were awarded Aug. 11 by the public improvements committee of the council as follows: Walter Hickman, paving two alleys, $1,133; A. L. West, grading on Victor St., $801; G. K. White, grading on 29th St., $1,772; Wm. Trehey, grading on Lockridge St., $428; Jos. Gastl, curbing on Walnut St., $1,647; M. Schoonmaker, brick sidewalks, $504; Kansas City Cement Sidewalk Co., granitoid sidewalks, $929; Parker-Washington Co. granitoid sidewalks, $1,028; Bandera Co., natural stone sidewalks, $1,440. R. W. Godfrey, Secy. Bd.

ST. LOUIS, MO.—Bids are asked until Sept. 8 for constructing a granitoid walk in Hyde Park; deposit, $150. Also for constructing a granitoid walk in Benton Park; deposit, $120. M. L. Holman, Pres. pro tem.; Emory S. Foster, Secy.

SEDALIA, MO.—Bids are asked until Aug. 29 for paving Ohio Ave. with cedar blocks. Jos. Starr, W. L. Jones, T. J. Brown, Com. on Sts. and Alleys.

SPOKANE, WASH.—Geo. Latham was awarded the contract Aug. 10 for grading Mission Ave., from Division to Standard St., at $1,147, and Fife & Conlan the contract for grading Chestnut St., from 2d to 4th Aves., at $457.

SAN FRANCISCO, CAL.—The City Street Improvement Co. has been awarded the contract to asphalt Market St., from 2d to 6th St., at $13,776. Thos. Ashworth, Supt.

ANACONDA, MONT.—Arnold Mickels has been awarded the contract, at $2,150, to construct 12 miles of wagon road between Lincoln gulch and Helmville, along the Little Blackfoot River, according to report.

OWEN SOUND, ONT.—It is reported that the ratepayers will vote Aug. 25 on the proposition to borrow $10,000 for the purpose of macadam roads, for repairs and to buy a steam road roller.

MANUFACTURING PLANTS

PYRITES, N. Y.—The plant of the High Falls Sulphite Pulp & Mining Co., at Pyrites, was destroyed by fire Aug. 21. The loss is placed at $300,000; insurance, $50,000.

LODI, N. J.—John W. Ferguson is said to have been awarded the contract for the erection of a new silk mill for Boetager Bros., to cost between $75,000 and $100,000.

CHESTER, PA.—It is reported that Robert Wetherill & Co., engine builders, will erect a large foundry in this city in the fall. It will be built on Seventh St., and will be 145 × 65 ft.

SIEGFRIED, PA.—We are informed that the Lawrence Cement Co. expects to erect a number of fireproof mill buildings and stock houses at this place for a new plant to have a daily capacity of 2,000 bbls. of Portland and common cements. Plans are now being prepared by Lathbury & Spackman, 1619 Filbert St., Philadelphia. No contracts have yet been let.

BENNETTSVILLE, S. C.—A company composed of C. S. McCall, D. D. McColl, C. M. Weatherly, M. A. J. Moore and others, has been organized with a capital stock of $100,000, to operate a cotton mill. It is said that 20% of the capital stock will be subscribed in order to begin at once the erection of a new mill.

LEXINGTON, MISS.—The Lexington Compress & Oil Mill Co. will soon erect a cotton compress at this place, to cost about $30,000. Pres., R. E. Wilburn; Secy., W. H. Durden.

CINCINNATI, O.—The Lodge & Shipley Machine Tool Co. informs us that bids were to be received until Aug. 24 for the erection of a brick and steel building, 300 × 90 ft., to cost $18,000. A 100-HP. engine and a 125-HP. boiler will be installed. Arch., Bert Baldwin, Race and 5th Sts.

DAYTON, O.—A fire in this city, Aug. 14, damaged the plant of the Pasteur-Chamberlain Filter Co., causing a loss of about $50,000.

LORAIN, O.—Bids are asked until Aug. 27 for the erection of a new factory building for F. C. Whitmore. Arch., H. O. Wurmser, of Lorain.

NORWALK, O.—The Sprague Umbrella Co., whose plant was burned Aug. 9, causing a loss of about $60,000, writes us that it is not yet ready to consider bids for the reconstruction of the plant.

PAINESVILLE, O.—The Robison Basket Co., of Painesville, informs us that bids are now being received for the construction of a new basket plant to replace the one totally destroyed by fire Aug. 7, and valued at $72,000. It is expected to erect three 2-story iron covered buildings, 40 × 200 ft., and one 1-story structural iron building, 100 × 100 ft. Bids will also be received in 30 days on the necessary equipment, including a 150-HP. Corliss engine, an electric light plant and general equipment for wood working machinery.

WELLSTON, O.—Lathbury & Spackman, Consulting Engrs., 1619 Filbert St., Philadelphia, have been retained by the Alma Portland Cement Co., of Wellston, as engineers to design and furnish specifications and to superintend the erection of a plant to have an ultimate capacity of 1,000 bbls. a day. Construction is now under way and most of the contracts for machinery awarded.

MISCELLANEOUS CONTRACTS.

WHARF.—Chester, Pa.—The New Chester Wharf Co. proposes to build a wharf in this city this fall.

BONDS.—Buffalo, N. Y.—Bids are asked until Sept. 6 for the purchase of $466,004 of 3½% tax loan bonds. E. C. Knight, Comptroller.

ENGINE.—New Orleans, La.—Bids are asked until Sept. 15 for furnishing a 150-HP. engine for the mint. C. W. Boothby, Supt. Mint.

BONDS.—Tarentum, Pa.—Bids are asked until Aug. 31 for the purchase of about $25,000 of 30-year 5% improvement bonds. F. A. Ready, Clk.

LEVEE.—St. Joseph, La.—Bids are asked until Aug. 31 for building the Kempe levee, below St. Joseph. Maj. J. H. Willard, U. S. Engr., 3232 Prytania St.

SUPPLIES.—Watervliet, N. Y.—Bids are asked until Sept. 23 for furnishing iron, steel, hardware, etc. Col. A. Mordecai, Ordinance Dept., Watervliet.

BONDS.—Dayton, O.—Bids are asked until Sept. 26 for the purchase of $150,000 of levee and $50,000 of 4% water bonds. J. E. Gimperling, Cy. Comptroller.

PIER.—New York, N. Y.—Bids are asked until Sept. 2 for building a new pier at the foot of Watts St., North River, Manhattan. J. S. Cram, Comr., Pier A.

COAL CONVEYORS AND TANKS.—Chicago, Ill.—Bids are asked until Oct. 4 for furnishing and erecting coal conveyors, etc., at certain pumping stations, as described in our advertising columns. L. E. McGann, Comr. Pub. Wks.

DREDGING.—Oakland, Cal.—The council is considering the ordinance for dredging Lake Merritt, at a cost of about $80,000. Councilman Brosnahan may be addressed.

HEADSTONES.—Boston, Mass.—Bids are asked until Sept. 17 for purchasing 10,000 American white marble headstones in slabs. J. McE. Hyde, Q.-M., 195 Summer St., Boston.

JETTIES.—Portland, Ore.—Bids are asked until Oct. 25 for constructing jetties for improving Saquina Bay, Ore., as stated in our advertising columns. Maj. W. L. Fisk, U. S. Engrs.

DAM.—Pittsburg, Pa.—Bids are asked until Aug. 25 for constructing a coffer dam, at Heers Island, Allegheny River, according to reports. Maj. Chas. F. Powell, U. S. Engr., Federal Bldg.

SUPPLIES.—Fortress Monroe, Va.—Bids are asked until Sept. 16 for furnishing cement, broken stone, yellow pine lumber, steel beams, etc. Capt. Thos. L. Casey, U. S. Engr., 166 Cranby St., Norfolk, Va.

DOCKS.—Conneaut, O.—Reports state that the Pittsburg, Bessemer & Lake Erie R. R. Co. has purchased about 200 acres of land at Conneaut Harbor, for dockage purposes, to cost about $350,000. J. H. Reed, Pres., Pittsburg, Pa.

SUPPLIES.—Norfolk, Va.—Bids are asked until Sept. 16 for furnishing and delivering cement, broken stone, lumber, steel beams, etc., at Fort Monroe, as stated in our advertising columns. Capt. Thos. L. Casey, U. S. Engrs.

LAKE OUTLET.—Lake Manitoba, Can.—Bids are asked until Sept. 12 for excavating for a supplementary outlet for increasing and regulating the overflow at Lake Manitoba; check, $4,000. Res. Engr., W. F. Gouin, Winnipeg; Secy. Pub. Wks., E. F. E. Roy, Ottawa, Ont.

CANAL.—Chicago, Ill.—Bids are asked until Sept. 21 for constructing about eight miles of feeder of the Illinois & Mississippi Canal, as stated in our advertising columns. L. L. Wheeler, Asst. Engr., Sterling, Ill.; Maj. W. L. Marshall, U. S. Engrs., 1636 Indiana Ave., Chicago.

CEMETERY.—La Crew, Ia.—Bids are asked until Aug. 29 for preparing and enclosing a cemetery about three miles from this town. It will be 529 × 567 ft. There will be required about 3,100 ft. of 6 and 4-in. drain tile, a 3-rail iron fence 2½ ft .high, etc. Address W. B. Seeley, La Crew, Ia.

FIRE ALARM SYSTEM, ETC.—Dallas, Tex.—The District Messenger & Fire Alarm Co., granted a franchise for 35 years, and want to install a complete messenger service, fire and police call system, desires bids on boxes, indicators and registers, wire and construction material. O. G. Gorman, in charge of construction, is receiving bids on material. R. H. Gamble, Secy.

DRY DOCK, ETC.—Vancouver, B. C.—Press reports state that arrangements are now being made for a marine railway and dry dock. Reports have been received here that the British government intends to send a regiment of infantry to be stationed at Vancouver, and that it will build a dry dock here and place the harbor in a defensive condition.

DRY DOCK.—West Superior, Wis.—The American Steel Barge Co. has decided to build another dry dock at the plant in this city. Several months ago the company projected the dock, but owing to the fact that there was not sufficient channel room for vessels to reach the site selected, construction could not be commenced until the council voted to extend the lines. After a bitter fight in the council between the conflicting property interests, the aldermen voted last night to make the necessary alterations and secure the dry dock for this city. A meeting of the company's officials will be held Aug. 27 to approve the plans.

CONTRACT PRICES.

ASPHALT PAVING.—New Orleans, La.—The following bids were received Aug. 8 for asphalt paving in certain streets; the Barber Asphalt Paving Co.'s bid was for Trinidad Lake Asphalt, while that of the Southwestern Alcatraz Asphalt & Construction Co. was for Santa Barbara, Cal., asphalt, and the General Asphalt Co. will use rock asphalt; A. C. Bell, Cy. Engr.:

Bids Received at New Orleans, La., Aug. 8, 1898, for Asphalt Paving.—Canal St. from Delta to Liberty.

Items.			Barber Asphalt Paving Co.	Southwestern Alcatraz Asphalt & Construction Co.	Ayers Asphalt Paving Co.	Belden & Seely.
Asphalt pavement	On square blocks	42,000 sq. yds.	$2.38	$2.63	$2.65	$2.28
	On 6-in. concrete (regulation construct'n)	42,000 " "	2.81	2.90	2.73	2.65
	On 4-in. concrete	22,000 " "	2.16	2.45	2.22	2.49
Concrete gutter bottoms		100 " "	1.26	1.35	1.75	1.60
Old curbstones relined and reset		7,000 lin. ft.	.12	.15	.14	.10
Cypress lumber		25,000 ft. B.M.	15.00	15.00	17.00	18.00
Brick per thousand		60,000	16.00	16.50	16.00	20.00
Cast iron		50,000 lbs.	.02	.03	.02	.025
Sewer pipe	12-in. glazed	2,300 lin. ft.	.64	.84	.50	.365
	18-in. "	1,000 " "	.99	1.00	.74	.615
	20-in. "	1,000 " "	1.15	1.45	1.27	.765
	24-in. "	900 " "	1.41	1.71	1.49	.975
	30-in. "	1,600 " "	2.56	2.86	2.60	1.77
	36-in. "	500 " "	3.75	4.05	4.10	2.73
Total on square blocks			$161,633	$180,932	$174,391	$161,594
Total on regulation construction			179,693	192,272	177,751	177,134

Camp St., Between Callipoe and St. Mary Sts.

Quantities.		Barber Asphalt Paving Co.	Southwestern Alcatraz Asphalt & Const'n Co.	Ayers Asphalt Paving Co.	Belden & Seely.	General Asphalt Co.
Asphalt pavement on concrete	12,450 sq. yds.	$2.72	$2.60	$2 52	$2.65	$2.83
Concrete gutter bottoms	500 " "	1.62	1.30	1.75	1.60	1.17
New stone wings, bonds and curbing	1,900 " "	.46	.42	.45	.45	.41
Old curb stones relined and reset	1,500 lin. ft.	.15	.10	.14	.10	.09
Cypress lumber	10,000 ft. B.M.	16.00	14.00	17.00	18.00	18.68
Brick, a thousand	65,000	17.00	15.00	16.00	20.00	16.23
Cast iron	225,000 lbs.	.02¾	.02	.02	.02½	.02¼
Wheel guards.	20 each	10.50	8.00	7.50	9.40	9.85
Total		$43,435	$39,743	$39,174	$42,091	$43,234

The bids for the work on Claiborne Ave., between Canal and Toulouse Sts., were the same as those for Camp St., except that of the General Asphalt Co., whose bid for rock asphalt pavement on concrete was $2.43 a sq. yd.; bids were submitted for 800 ft. of 18-in. glazed sewer pipe as follows, with totals for the whole work: Barber company, $1 a ft., $27,284; Alcatraz company, 80 cts., $25,588; Ayers company, 74 cts.,$25,163; Belden & Seely, 61½ cts.,$26,267; General Asp. Co.,$1.36, $24,687. The quantities are as follows: Asphalt pavement on concrete, 8,600 sq. yds.; concrete gutter bottoms, 50 sq. yds.; new stone wings, bonds and curbing, 4,650 sq. ft.; old curbing relined and reset, 1,000 lin. ft.; cypress lumber, 3,500 ft. B. M.; brick, 10,000; cast iron, 14,200 lbs.; wheel guards, 10.

ARTESIAN WELL.—Frostburg, Md.—The council has awarded the contract to the Curry-West Co., Cumberland, Md., to drill a 5⅝-in. well about 600 ft., at $2 a ft.

IRON WORK.—Portland, Me.—The following bids were received by Maj. R. L. Hoxie, U. S. Engr., 537 Congress St., for the iron work, etc., for batteries; G. M. Stanwood & Co. bid 3.7 cts. a lb. for ammunition cranes complete; Scaife Foundry & Machine Co., Pittsburg, Pa., bid $1.20 a lin. ft. for 5-in. I-beams for trolley rail, etc., or $30.00 for each trolley complete; Union Foundry & Machine Co., bid $1.25 a lb. for ammunition cranes complete, $35.70 for Yale & Weston blocks for ammunition cranes, each, and $26.25 for same make of triplex blocks of ½-ton capacity each, and 1.6 cts. a lb. for roof beams, connection angles, etc.; Thomas Marshall bid 1.9 cts. a lb. for roof beams, connection angles, anchor bolts, and wall plates:

Bids Received at Portland, Me., for Iron Work for Batteries.

Items.	Portland Co.	Megquier & Jones Co.	T. Carlins & Sons, Allegheny, Pa.	New Jersey Foundry & Mach. Co., New York.	T. Loughlin Co., Pittsburg, Pa.
Ammunition cranes complete, a lb.	$0.05½	.....	$0.066	$0.07½	$0.05⅛
Yale & Weston blocks for ammunition cranes, each	...	.....	36.00	29.00	...
Posts, for railings, a lb.	.06	$0.06	.....	.04½	.07
Pipe, for railing, a ft.	.08	.06	.....	.06	.07
Fittings, for railing, a lb.	.22	.12	.....	.06	.13
Iron ladders, long, a ladder, complete	13.00	6.00	.....	15.00	6.50
Iron ladders, short, a ladder, complete	7.00	3.50	.....	10.00	4.25
Ammunition lifts, each double lift complete with winch	650.00	....	639.00	525.00	725.00
Doors, 6 × 8 ft. complete with locks and sliding bolts, a pr.	39.00	16.56	.....	45.00	19.00
4 ft. 6 ins. × 8 ft. complete with locks & sliding bolts, a pr.	36.00	15.90	.....	42.00	18.90
3 " 4 " × 8 " single, complete with lock, a door	20.00	9.00	.....	35.00	10.50
3 " 4 " × 7 " 6 ins. single, complete with lock, a door	19.50	8.90	.....	30.00	10.40
3 " 4 " × 6 " 6 " " " " " "	19.00	8.75	.....	29.50	10.25
2 "10 " × 6 " 6 " " " " " "	18.00	8.50	.....	29.00	10.00
3 " 8 " × 5 " " " " " "	18.00	8.25	.....	28.00	9.90
Z-bars and anchor bolts for door frames, a lb.	.03¼	.02¾	.....		.04
Angles and splice pieces, including rivets for door frames, lb.	.02¾	.03½	.....	.....	.05
*5-in. I-beams for trolley rail, including fastenings to roof and splice pieces, a lin. ft.	.40	.35	.65	.48	.50
Trolleys, complete, each	7.00	6.60	10.00	9.50	7.00
Yale & Weston triplex blocks, ½-ton capacity, each	...	37.00	27.00	27.50	...
Bronze hinges, complete with bolts, nuts and washers, each	1.50	1.99	.....	...	2.50
Bronze gudgeons, complete with rivets, each	1.15	2.50	.....	...	3.00
Roof beams, connection angles, anchor bolts, wall plates, lb.	...	.019	.019	.02¼	.02
1-in. diameter brass tubing, a ft.	.20	.20	.....	.15	.25
Galvanized iron pipe, 1-in. diameter, a ft.	.08	.05	.....	.04	.06
Cast-iron door sills, complete with bolts, etc., a sill.	3.50	3.00	.....	3.00	3.40
Anchor bolts, complete, with nuts and anchor plates, a bolt.	3.40	...	.....	4.75	.04¼ †
‡Drain covers, 2 ft. diameter, cast-iron, a cover	7.00	...	7.50	8.50	...
Drain covers, 8-in. diameter, cast-iron, a cover	1.50	...	.85	2.25	...

*8-in. deck beams for double trolley rails, including cast-iron hangers every 16 ft. for fastening to roof, and splice-pieces per lin.ft. of double track, per drawing accompanying. ‡City pattern manhole, per print. †Price a lb.

BRICK PAVING.—Olean, N. Y.—E. E. Allen, Supt. Sts., informs us that the following bids were received Aug. 12, 1898, for brick paving, as advertised in Engineering News; B. U. Taylor & Co. was awarded contract:

Quantities.			Sheehan & McGhan, Bradford, Pa.	J. McCloud & Co., Williamsport, Pa.	J. K. Van Campen, Olean, N. Y.	W. H. Simpson, Olean, N. Y.	B. U. Taylor & Co., Olean, N. Y.
Excavation		1,000 cu. yds.	$0.28	$0.24	$0 30	$0.28	$0.20
Brick pavm't*		2,000 " "	1.49	1.45	1.36	1.38	1.29
Curb	4-in.	1,270 lin. ft.	.44	.40	.36	.33	.35
	Reset	30 " "	.12	.10	.10	.10	.15
	4-in. cir	10 " "	.60	.60	.42	.40	.53
Drain tile		10 " "	.10	.07	.15	.02	.04
Total			$3,829	$3,658	$3,486	$3,466	$3,235

*Concrete foundation.

REPAIRING ASPHALT PAVEMENT.—Brooklyn, N. Y.—The commissioners of highways received bids Aug. 2 for repairing and maintaining about 16 miles of asphalt streets from Cranford & Co.,the Brooklyn Alcatraz Asphalt Co. and the Eastern Bermudez Asphalt Paving Co.,as follows: For Class No. 1—13 cts. a sq. yd., 11½ cts. and 13 cts., respectively; new bridge stones, 40 cts. a sq. ft., 47 cts. and 50 cts., respectively; new curb stones, 75 cts. a lin. ft., 78 cts. and 80 cts., respectively; restoring opening made in pavement, $3.00 a sq. yd., $3.15 and $3.28. Class No. 2—Repairing, etc., 13 cts., 15 cts. and 14½ cts.; Class No. 3—20 cts., 26 cts. and 23 cts.; Class No. 4—18 cts., 20 cts. and 21½ cts.

DIKE, DREDGING, ETC.—Virginia.—The following bids were received by Lt.-Col. Chas. J. Allen, U. S. Engr., Washington,D.C.,Aug.6,1898,for constructing a dike and for dredging, etc., as advertised in Engineering News: Dike in York River, Va., W. B. Bradley, Manchester, Va., $6 a lin. ft.; B. F. Sweeton & Son, Camden, N. J., $6.54; A. M. Clegg, Washington, $8.28; The Degnon-McLean Construction Co., 1 Broadway, New York, $6.50; Sanford & Brooks Co., 21 S. Gay St., Baltimore, $6.73; Justin McCarthy, Norfolk, Va., $5.85. Dredging and rock excavation: Item 1, Rappahanock River, dredging; 2, the same river, rock excavation; 3, Urbanna Creek dredging, a cu. yd.: A. M. Clegg and M. A. Dugan, Washington, item 1, 29¾ cts.; 2, $3; 3, 18 cts.; John Miller, Washington, item 1, 27 cts.; 2, $4.90; 3, 19 cts.; Chas. W. Johnson, Lewes, Del., item 1, 29 cts.; 2, $6.45.

HIGHWAY.—Truro, Mass.—The following contract was let Aug. 18, 1898, to C. W. Snow, Taunton, Mass., for building a road in Truro; A. B. Fletcher, Secy. Massachusetts State Highway Commission, Boston: 600 cu. yds. of excavation at 20 cts. a cu. yd.; clay, 600 cu. yds., $1.29; broken stone in place, 800 tons, $2.00; total, $2,494.

PROJECTILES.—Washington, D. C.—The following bids were received last week by the navy chief of ordinance for furnishing the following projectiles: Cast Steel—1,000 13-in., 1,000 12-in., and 600 10-in. Forged Steel—3,000 8-in., 5,000 6-in., 5,000 5-in., and 5,000 4-in. The Midvale Steel Co., Philadelphia, 13-in., $101; 12-in., $84.50; 10-in., $52.50; 8-in., $26.14; 6-in., $10.25; 5-in., $5.38; 4-in., $3.99. Alternate, all of cast steel and part of forged steel, as follows: 13-in., $97.89; 12-in., $82.10; 10-in., $50.89; 8-in., $26.14; 6-in., $10.25; 5-in., $5.38; 4-in., $3.99. If awarded the entire contract, the prices will be as follows: 13-in., $88.90; 12-in., $78.19; 10-in., $47.89; 8-in., $25.77; 6-in., $10; 5-in., $5.30; 4-in., $3.93; time, begin in 45 days and deliver 130 8-in. steel a week or the equivalent in weight of any size. Isaac G. Johnson & Co., Spuyten Duyvil (P. O., New York), N. Y., 13-in., $99; 12-in., $81; 10-in., $49; commence in 60 days and 12 each a week thereafter. American Ordnance Co., Bridgeport, Conn., 4-in., $4.05, 300 a week after 60 days; 5-in., $5.20, 300 a week after 90 days; 6-in., $10, 250 a week after 60 days; 8-in., $22.50, 200 a week after 90 days. Taylor Iron & Steel Co., High Bridge, N. J., 13-in., $102.82; 12-in., $78.96; 10-in., $46.56; commence in three weeks and deliver 100 a week and 200 if necessary. Cumberland Steel & Tin Plate Co., Cumberland, Md., 13-in., $95.40; 12-in., $79.35; 10-in., $49.20; commence in 90 days and 20 a week thereafter or 60 a week of any one size. Driggs-Seabury Gun & Ammunition Co., New York, 13-in., $106, 100 in 80 days, 30 a week; 12-in., $85, 100 in 80 days, 30 a week; 10-in., $55.20, 100 in 75 days, and 40 a week. Mannesman Tube Co., 6 Dupont Circle, Washington, 13-in., $106; 12-in., $89.50; 10-in., $57.60; 8-in., $27.50; commence in 70 days and 120 a week. United States Projectile Co., New York, 8-in., $22.50, 150 to 200 a week after 9 to 10 months; 6-in., $9.75, 175 to 250 after 7 to 8 months; 5-in., $5, 250 to 300 after 9 to 10 months; 4-in., $3, 300 to 400 after 6 to 7 months.

MACADAM ROAD.—Lunenburg, Mass.—The Massachusetts State Highway Commission, Boston, received the following bids Aug. 18, 1898, for building a macadam road in Lunenburg; contract was awarded C. H. Kelleher; A. B. Fletcher, Secy.:

Quantities.			C. H. Kelleher, Newburyport.	A. J. Wellington, Boston.	F. E. Ellis, Melrose.	Asa Goddard, Worcester.
Excavation		900 cu. yds.	$0.25	$0.50	$0.50	$0.50
Borrow		800 " "	.35	.50	.50	.50
Rubble masonry:						
Laid dry		92 " "	3.00	4.00	3.50	2.50
Laid cem't.		110 " "	6.00	8.00	6.50	5.00
Gravel		200 " "	.55	.60	.55	.50
Shaping		5,309 sq. yds.	.02	.02	.02	.02
Broken stone		615 tons	1.30	1.20	1.20	1.40
Trap rock		700 tons	1.75	2.00	2.10	2.00
12-in. pipe		30 lin. ft.	.60	.75	.60	.60
18-in. "		30 " "	.90	1.00	1.50	1.00
Guard rail		250 " "	.15	.20	.20	.20
Finishing	Labor, pr hr.		.175	.20	.20	.20
	Double teams		.50	.50	.50	.50
	Single teams.		.30	.30	.35	.35
Stone mons.		12 each	1.50	2.00	2.00	1.50
Totals			$3,782	$4,589	$4,448	$4,213

ELECTRIC LIGHTING.—Brooklyn, N. Y.—The following bid was received from the Edison Electric Illuminating Co. for lighting the Borough of Brooklyn, for the ensuing year: For each 1,200-c. p., 34 cts., and 17 cts. for each 600-c. p.—this is for 3,500 lights or more; for any less number, 35 cts. for each 1,200-c. p., and 18 cts. for each 600-c. p.; for all electric current required for lighting offices in public buildings, 16½ cts. a K-W. power of current. The price of 34 cts. a 1,200-c. p. is the same as that of old contracts under which this company has been lighting Brooklyn. There are at the present time about 3,500 electric lights in Brooklyn, and Deputy Commissioner Walton has 500 Welsbach lights which he is intending to substitute for the electric lights in the residential streets, in which event the price of 35 cts. will prevail. This will make a difference of about $12,000 a year to the city.

BRIDGE MASONRY.—Greenfield, Mass.—The following bids were received recently by the county commissioners for the masonry work for the Northfield bridge; Engr., E. S. Shaw, Boston:

Bidder.	Masonry piers, complete.	Filling, grading, etc., a cu. yd.	Bank protect'n, etc., a sq. yd.
*Ellis & Buswell, Woburn	$7,000	.....	.....
L. F. Kittredge & Son, Lowell	9,443	$0.40	$1.35
A. H. Wright & Son, Springfield	9,044	.30	3.00
Vt. Const'n Co., St. Albans, Vt.	7,670	2,200‡	1,780‡
Wm. H. Ward, Lowell	9,226	...	...
Ward & Douglas, Barre, Vt.	12,675	...	...
Wall & Quinlan, Northfield	.....	1,558‡	695‡
R. S. Wilcox, Greenfield	.....	.24	.37
W. F. Flint Granite Co., Monson	7,500	.30	1.00
H. C. Wood, Westfield	6,013	.50	...
†Cordner Bros., Chicopee	.....	.25	.30

*Awarded contract for masonry piers and cylinder piers for abutments; total, $9,200. †Awarded contract for grading, filling, bank protection, etc., total $1,496. The N. J. Steel & Iron Co., Trenton, has been awarded the contract for the substructure at $23,255. ‡Totals.

CURBING, CROSSING, ETC.—La Porte, Ind.—The following bids were received by the council Aug. 4, 1898, for curbing, stone closing slabs and gutter stone for crossings sets; the price for the stone closings and gutter stone is for a lin. ft.:

Bidder.	Curbing, —inches, a lin ft.— 18 cts.	20 cts.	22 cts.	24 cts.	26 cts.	Stone closings, cts.	Gutter stones cts.
C. E. Moellering, Fort Wayne	34	37	39	41	43	31	34
W. W. Hatch, Goshen	29	30	32	33	33	20	40
C. L. Kinney, Elkhart	26	28	30	32	34	20	27
Rachor & Struss, La Porte	28	30	32	34	36	24	36
A. Schneider & Co., Mich. City	31	33	35	37	..	27	31

SEWERS.—Kansas City, Mo.—The following bids were received by Henry A. Wise, Cy. Engr., Aug. 11, for building brick and pipe sewers in District No. 175: M. Walsh's bid was accepted; M. Kinlin's bid was declared informal:

Bids Received at Kansas City, Mo., Aug. 11, 1898, for Building Brick and Pipe Sewers in District No. 175.

Quantities.		Cotter, McDonnell & Co.	M. Walsh.	R. J. Boyd Pvg. Const'n Co.	Adam Armstrong Cont. Co.	M. Kinlin.
Pipe sewer 27-in.	1,044 lin. ft.	$2.58	$2.10	$2.50	$1.98	$2.10
Pipe sewer 24-in.	1,493 " "	2.17	1.85	1.95	1.76	1.80
Pipe sewer 18-in.	788 " "	1.30	1.05	1.00	1.08	.95
Pipe sewer 12-in.	1,391 " "	.75	.70	.71	.77	.67
Pipe sewer 10-in.	1,166 " "	.68	.46	.50	.44	.49
Pipe sewer 8-in.	4,322 " "	.60	.55	.60	.46	.49
12-in. pipe catchbasin connections	1,750 " "	.50	.40	.60	.44	.40
39-in. brick sewer	394 " "	3.67	2.30	2.70	2.38	2.59
Manholes	23 each	38.00	25.00	38.00	23.00	30.00
Special manhole	1	75.00	40.00	50.00	45.00	.....
Flushtanks	10 each	90.00	50.00	70.00	65.00	.....
Catchbasins	25 "	18.00	18.00	33.00	25.00	18.00
Rock excavation	200 cu. yds.	2.50	2.25	3.00	3.50	3.00
Lumber	10,000 ft. B.M.	.02	.02	.03	.03	.02
Concrete	10 cu. yds.	4.00	3.00	5.00	4.50	4.00
½-in. water pipe	1,400 lin. ft.	.25	.20	.40	.10	...
Total		$17.097	$13,800	$16,546	$13,860	....

SAND, CONCRETE, ETC.—Washington, D. C.—The bid of the Columbia National Sand Dredging Co. to furnish the city 2,250 cu. yds. of paving sand at 45 cts. a cu, yd., and that of John B. Lord to furnish the city with 4,000 cu. yds. of concrete sand at 59 cts. a cu. yd.; 1,000 cu. yds. of building sand at 65 cts. a cu. yd., and 4,000 cu. yds. of screened gravel at 69 cts. a cu. yd., have been accepted by the commissioners.

DREDGING.—Norfolk, Va.—It is stated that the secretary of war has awarded the contract for dredging the channel from the sea to the Norfolk navy yard to the American Dredging Co., Philadelphia, Pa., at 14½ cts. a cu. yd. The appropriation for the work amounts to $360,000, and provides for a channel 28 ft. deep and 450 ft. wide, a width of 150 ft. to be obtained first. This work is to be completed by Dec. 1. The department was authorized to let the contract without advertising, and received an offer to do the work at 16 cts. a yd. By advertising and extending the time for the completion of the work until December a lower bid was obtained.

RAILWAY SUPPLIES.—China.—It is reported by Consul-General Goodnow that A. S. Forbes & Co., Tientsin, has been awarded the contract for furnishing 7,000 tons of railway supplies: Rails, $29.20 a ton; fish plates, $43,80; bolts, $65.70, and spikes, $58.40 a ton. In our issues of June 30 and Aug. 4, were published the bids for the various supplies.

ASPHALT STRIPS.—Brooklyn, N. Y.—Wm. N. Shannon, Deputy Comr. of Highways, received the following bids Aug. 16 for laying asphalt strips from 34th St. and Astoria ferries in Long Island City, to connect with the good roads in Queens leading out on Long Island: (1) being for the roadway of Fulton Ave., Boulevard, Broadway and Newtown Road, from the southerly side of Mills St. to Jackson Ave., Borough of Queens; and (2) for the roadway of Borden Ave., Jackson Ave., and Thomson Ave., from the coutherly side of Front St. to Woodside Ave., Queens, the foundation, stone block and wooden leaders being the same for both roadways excepting that of the Warren-Scharf Co.: Warren-Scharf Asphalt Paving Co.—Asphalt a sq. yd., (1) $1.85, (2) $1.80; concrete foundation, a sq. yd., (1) $4.50, (2) $4.25; stone block, a sq. yd., (1) 38 cts., (2) 35 cts.; wooden leaders, 1,000 ft., (1) $22.00, (2) $22.00. Barber Asphalt Paving Co.—Asphalt, a sq. yd., (1) $1.78, (2) $1.84; $4.50, 35 cts., $22.00, these bids being alike for both operations. Atlantic Alcatraz Asphalt Co.—Asphalt, a sq. yd., (1) $1.96, (2) $1.98; $4.44, 38 cts., $22.00, respectively, bids same both operations. T. U. Bowman.—Asphalt a sq. yd., (1) $1.95, (2) $1.80; $4.20, 30 cts., $16.00, respectively, bids same both operations.

LEVEE WORK.—Memphis, Tenn.—Local papers state that the following contracts for levee work were let Aug. 11, 1898, by Capt. Mason M. Patrick, U. S. Engrs.: Lower St. Francis Levee District—T. Mike, section 16, 16,000 cu. yds., 10½ cts.; sections 26-31, 30,000 cu. yds., 11 cts., and sections 41-47, 50,000 cu. yds., 14 cts. J. D. Montgomery, section 52, 18,000 cu. yds., 12½ cts., and sections 96-101, 50,000 cu. yds., 17 cts. W. H. Grider, sections 81-87, 20,000 cu. yds., 16 cts. White River Levee District—P. Cassidy, sections 4-14, 120,000 cu. yds., 11¼ cts. Upper Yazoo Levee District—Anderholdt & Lawrance, sections 81-82, 325,000 cu. yds., 14.9 cts a cu. yd.

MACADAM ROAD.—Ashfield, Mass.—Tuttle & Edgerly, Swampscott, Mass., were awarded the following contract Aug. 11, 1898, for constructing a macadam road in Ashfield for the Massachusetts State Highway Commission: Excavation, 1,500 cu. yds., 20 cts. a cu. yd.; excavation, borrow, 1,600 cu. yds., 20 cts.; ledge excavation, 400 cu. yds., 80 cts.; rubble masonry laid dry, 100 cu. yds., $6.00; rubble masonry laid in cement, 400 cu. yds., $6.75; 24-in., dry vitrified clay pipe, 40 lin ft., $2.00; Fencing used as guard rail, 1,400 lin. ft., 16 cts.; side drains, 500 lin. ft., 30 cts.; finishing between limits—labor, per hr., 20 cts.; double teams, 50 cts.; single teams, 35 cts.; stone monuments, 7, each, $1.50; 24-in. vitrified clay pipe, laid in cement, 40 lin. ft., $2.00; total, $4,785.

WATER-WORKS.—Huntington, Mass.—R. D. Maynard, Springfield, Mass., has been awarded the contract for constructing the works: Rubble masonry, a cu. yd., $3.25; puddled earth, a cu. yd., 40 cts.; dry earth filling, a yd., 40 cts.; clearing and grubbing, a yd., $3.00; laying 10-in. pipe, 5½ ft. deep., 16⅗ cts. a ft.; 8-in. pipe., 15⅗ cts.; 6-in. pipe, 14.7 cts.; 4-in. pipe, 14 cts.; rock excavation, a cu. yd., $2.50; building gate-house, $150; total, $6,611.

SIDEWALKS, CURBING, ETC.—Kansas City, Mo.—The council recently let the following contracts for laying sidewalks, curbs, etc.: Natural stone sidewalks, Baltimore Ave., from 16th to 17th St., 18¾ cts. a sq. ft.; 6th St,, from Forest to Tracy, 18½ cts.; 7th St., from Woodland to Brooklyn, 18 cts.; Bandera Flag Stone Co. Pressed brick sidewalks, McGee, from 18th to 20th St., 8⅞ cts., White & Redmond; Southwest Boulevard, from Summit to Madison, 8½ cts., C. Vincent; 9th St., from Cherry to Locust St., 8¾ cts., White & Redmond. Granitoid sidewalks, Perry Ave., Bellefontaine to Indiana, 14.95 cts., 7th St., Chestnut to Gladstone, 14.98 cts., Trestral Paving Co.; 36th St., Holmes to Jansen Pl., 19¾ cts., M. Schoonmaker; 36th St., McGee to Cherry, 15.99 cts., Trestrail Paving Co.; 36th St., Locust to Jansen Pl., 19¾ cts., M. Schoonmaker. Curbing, 8th St., from Wabash to Prospect, 9 cts a lin. ft., G. Kirn; Locust, 28th to 29th St., 10 cts., Joe Gastl; Grading, 23d St., from Wabash to Prospect, $2.90 a cu. yd., J. J. Armstrong; grading alleys between Brooklyn and Park, 13th and 14th Sts., 43 cts., P. Sullivan; Garfield, Brooklyn, 11th and 12th Sts., 39 cts., Wm. Trehav; Harrison, Campbell, 13th and 14th Sts., 45 cts., A. L. West; Wyandotte, Central, 10th and 11th, 46 cts., A. L. Smith.

MACADAM ROAD.—Warren, Mass.—A. B. Fletcher, Secy. State Highway Comn., Boston, informs us that the following contract was let Aug. 11, 1898, to John S. Lane & Son, of Springfield, Mass., for building a macadam road: Excavation, 300 cu. yds., 35 cts.; excavation, borrow, 600 cu. yds., 40 cts.; ledge excavation, 10 sq. yds., $2.00; rubble masonry laid in cement, 60 cu. yds., $4.00; gravel, 200 cu. yds., 50 cts.; telford, 100 sq. yds., 25 cts.; shaping, 4,445 sq. yds., 2 cts.; broken stone in place, 1,085 tons, $1.80; vitrified clay pipe, 12-in., 45 lin. ft., 50 cts.; fencing used as guard rail, 100 ft., 15 cts.; finishing between limits—labor per hr., 20 cts.; double teams, 50 cts.; single teams, 35 cts.; stone monuments, 10, each, $1.25; total, $2,822.

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INDUSTRIAL NOTES.

THE GILLETTE-HERZOG MFG. CO., Minneapolis, Minn., has opened a new branch office at Spokane, Wash.

THE JACKSON & WOODIN MFG. CO., Berwick, Pa., is reported to have an order from the Buffalo, Rochester & Pittsburg Ry. for 200 gondola cars.

TIPPETT & WOOD, Phillipsburg, N. J., have just completed a smoke stack, 140 ft. high, and a large water tower for the public buildings at Collins, N. Y.

H. K. PORTER & CO., Pittsburg, are reported to have the contract for a complete compressed air haulage and power plant for the Pennsylvania Coal Co., Pittston, Pa.

THE RICHMOND LOCOMOTIVE & MACHINE WORKS, Richmond, Va., is reported to have a contract for 12 locomotives for the Plant System, and for four locomotives from the Georgia & Alabama Ry.

THE NORTH PENN IRON CO., North Penn Junction, Philadelphia, has the contract for the structural steel work of the new engine and boiler house of the Hagerstown Electric Ry. Co., Hagerstown, Md.

THE LEECHBURG FOUNDRY & MACHINE CO., Leechburg, Pa., will, it is stated, move its plant from that place to Homestead, Pa., before the end of the year. Mr. Geo. Mesta is President of the company.

THE GROTON BRIDGE & MFG. CO., Groton, N. Y., is about to open an office in Porto Rico, and is desirous of handling a line of first-class sugar and coffee machinery. The company will be glad to correspond with manufacturers.

THE CARNEGIE STEEL CO., Homestead, Pa., is reported to have a contract from England for 30,000 tons of 2½-in. steel billets, to be used in the manufacture of bolts; also an order for 10,000 tons of plates for the city water-works, Sidney, Australia.

THE BETHLEHEM IRON CO., South Bethlehem, Pa., reports that it has been asked to bid on the forgings for the engine and shafting of a torpedo boat to be built in Japan for the Imperial Japanese Navy. The line of shafts, including the thrust and crank shafts are to be hollow. The company states that it is the only American concern that has been asked to bid on this work.

THE PHILADELPHIA ENGINEERING WORKS, Philadelphia, is reported to have orders for a 300-HP. cross-compound condensing Corliss engine, with two 100-HP. vertical water-tube boilers for shipment to Yokohama, Japan; two 300-HP. horizontal cross-compound Corliss engines for shipment to China, and one 450-HP. vertical cross-compound Corliss engine for Honolulu, Hawaii.

THE DAIMLER MFG. CO., 54 Wall St., New York, and 937 to 945 Steinway Ave., Long Island City, N. Y., has acquired all the real estate, plants, machinery, patents, etc., of the Daimler Motor Co. and will continue the business with enlarged facilities. The officers of the new company are: Pres., Frederick Kuebler; Vice-Pres., Horace Bacon; Treas. and Secy., Otto G. Nestle; Asst. Treas. and Asst. Secy., Adolph O. Krieger. The capital stock of the company is $500,000, of which $400,000 is said to be paid in.

THE THACKERAY INCINERATING & FERTILIZING Co., San Francisco, Cal., has established a subsidiary corporation at Cincinnati, O., for the states of Ohio, Kentucky and Indiana and has also just formed another for the New England States, with offices in Boston, which will begin operations Sept. 1. Mr. Charles J. Okell, Secy. and Treas., is now in New York for the purpose of establishing a branch office of the parent company. The company announces that it has in San Francisco the largest incinerator in the United States, and that the cost of incinerating garbage in that city is only 10 cts. a ton, owing to the fact that no fuel is required, the only expense being the cost of labor and repairs.

LATHBURY & SPACKMAN, 1619 Filbert St., Philadelphia, consulting engineers, have been retained by the Alma Portland Cement Co., Wellston, O., as engineers to design and furnish specifications and to superintend the erection of a plant in that place to have an ultimate capacity of 1,000 bbls. a day. Construction is now under way, and the contracts for machinery nearly all let. They have also been engaged by the Lawrence Cement Co., of Pennsylvania, as engineers for the erection of its new plant at Siegfried, Pa., which will have a capacity of about 2,000 bbls. a day of Portland and common cements. Large fireproof mill buildings and stock houses will be erected and the latest improved machinery installed. No contracts have yet been let. The firm has also finished plans and specifications for the enlargement and reconstruction of the plant of the Portland Cement Co., Salt Lake City, Utah, which was totally destroyed by fire last June. Contracts for steel buildings and all machinery have been let, and the construction is well under way. Plans and specifications for the introduction of the rotary system of burning cement at the large works of the Aalborg Portland Cement Co., Copenhagen, Denmark, have also been finished. The machinery is being constructed in this country, and will be shipped in the course of a month. In all of the above plants the system of burning in rotary kilns using pulverized coal as a fuel will be introduced.

THE GENERAL ELECTRIC CO., Schenectady, N. Y., has begun work on its new machine shop, to cost $175,000, which will form an important addition to the manufacturing facilities of the company. Contracts have been let to the Pencord Iron Works, Philadelphia, for the steel construction, and to J. J. Turner, of Amsterdam, N. Y., for the masonry, etc. The building will face on the central avenue, opposite Building No. 15, and will be 653 × 166 ft., divided into three aisles, the central one having a width of 65 ft. and the side ones each being about 50 ft. wide. The total floor space, it is claimed, will be at least 144,250 sq. ft., and the building will contain the machinery necessary to handle large apparatus. It is expected that the shop will be completed before the end of 1898. The machinery will be driven by current transmitted from Mechanicsville, 17 miles distant. In addition to the shop, several important extensions to other buildings are being made. The foundry, recently begun, is ready to receive the iron work, as the support for the large traveling crane has been erected. This building when finished will contain, it is claimed, the largest foundry under one roof in the world. The government of Victoria, Australia, has placed an order with the company for six Thomson recording Watt meters of 100 volts and varying capacities. which will be placed in the Electrical Bureau of the home office, Victoria, to be used, it is claimed, as the official standards by which all meters used in the colony will be tested.

NEW COMPANIES.—R. P. & J. H. Staats, Hoboken, N.J.; $100,000, with all paid in; to construct bridges, piers, tunnels, railways and canals; Robt. P. Staats, 149 West 85th St., New York; John H. Staats, Morristown, N. J.; Thos. J. Long, 7 West 43d St., New York; Dickinson W. Richards, 190 Park Ave., Orange, N. J.; Walter E. Castle, Fordham, New York.

Gordan Battery Co., Portland, Me.; $350,000, commencing with $250; to generate and deal in electricity; Pres., Arthur S. Pinkham; Treas., Charles E. Lockwood, both of New York.

Eberle Construction Co., New York, N. Y.; $24,000; to construct and equip railways to be operated by electricity and steam; David Longecker, Charles R. Eberle, Philadelphia; Edwin C. Stout, Alva Oatman, Thomas A. Matthews, New York.

International Electric Co., Cleveland, O.; $10,000; to manufacture and deal in electrical appliances; A. W. Mayers, E. H. Shaw, W. R. Studebaker, W. S. Hale and Charles Seaton.

Fulling Springs Quarry & Construction Co., East St. Louis, Ill.; $5,000; F. W. Hackman, Sr., Francis Kirsch and Fred Brandt.

Pasadena Construction Co., Pasadena, Cal.; $50,000; to construct roadways for motor vehicles; J. H. Campbell, J. E. Smythe, T. Lowe.

Richmond Construction Co., New York; $25,000; to do a general contracting business; John B. Newhall, Ernst Crossman, James McQuigham, Guy A. Hubbard, and Chas. J. Worth, New York.

National Iron Co., 525 Main St., East Orange, N.J.; $100,000, with $1,000 paid in; to manufacture architectural and structural iron work; Alfred O. Dunk, James D. Mattison and Geo. W. Carnrick, all of 525 Main St., East Orange, N.J.

Gardner Mfg. Co., Baltimore, Md.; $5,000; to manufacture gas machines for generating gas; Joshua G. Gardner, Andrew G. Stielman, James Russell, Laurence O. Wright Ward and Edw. L. Ward.

Payne Mfg. & Engineering Co., Elmira, N. Y.; $600,000, with $140,000 paid in; to manufacture engines, boilers, army and navy supplies.

Sanford & Brooks Co., Baltimore, Md.; $200,000; to build bridges, piers, etc.; Jos. B. Sanford, Newark, N. J.; Walter B. Brooks, Jr., Wm. H. Taylor, J. Frank Sinton and William H. Dorsey, Baltimore.

Angleton Telephone Co., Alvin, Tex.; $2,000; A. W. Wilkinson, W. A. Leonard and F. J. Bush.

Hoosier Telephone Co., Salem, Ind.; Dr. H. C. Hoggs, Pres., Salem; Frank Brewer, Vice-Pres., Smedley; Dr. G. M. Morris, Secy., Comton; and W. A. Denny, Treas., Martinsburg.

Rivesville & Montana Telephone Co., Rivesville, W. Va.; $50,000; to construct and operate a telephone from Fairmont to Rivesville; C. E. Gaskill, J. C. Gaskill, F. B. Clayton, J. P. Coogle, of Fairmont; J. D. Arnett, F. F. Pickett, A. S. Prichard, T. S. Cox, and J. G. Floyd, of Morgantown.

Siloam Springs Telephone Co., Clayton, Ill.; $1,500; G. L. Thompson, John Padgett, John W. Butz.

Edward Falls Land Co., Syracuse, N. Y.; $35,000; to deal in real estate; E. Powell, Philadelphia; A. Cady Palmer, Fayetteville; Daniel C. Gridley, Arthur Jenkins, John L. King, Thomas Hogan, Elbert F. Allen, and Gillis H. Stillwell, Syracuse.

Shenandoah Valley Car Works, Philadelphia, Pa.; $250,000, commencing with $500; to manufacture wood and metal railway ties, rails, cars, etc.; G. A. Hamilton, Chas. P. Poole, Chas. J. Hepburn and J. B. Rettew, all of Philadelphia; S. M. Hepburn, Carlisle, Pa.

London-Glasgow Mfg. & Colonization Co., Philadelphia, Pa.; $5,000,000, commencing with $500; to manufacture railway ties, rails and other railway equipment; G. A. Hamilton, Chas. P. Poole and others, of Philadelphia.

The Circulation of ENGINEERING NEWS among Prominent Contractors Probably EXCEEDS that of any other FIVE PAPERS.

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PERSONAL.

Mr. Charles H. Schenck, President pro tem. of the New Orleans Levee Board, New Orleans, La., has resigned.

Mr. Frank J. Illig has been appointed Superintendent of the Water Bureau, of Buffalo, N. Y., to succeed Col. Francis G. Ward.

Mr. E. J. Roberts, Chief Engineer of the Spokane Falls & Northern Ry., with headquarters at Spokane, Wash., has resigned.

Prof. Edward Orton, State Geologist of Ohio, has been elected President of the American Association for the Advancement of Science.

Mr. H. R. Hobart, who has been for 23 years a member of the editorial staff of the "Railway Age," of Chicago, has resigned his position.

Mr. George F. Becker, of the U. S. Geological Survey, has been sent to the Philippine Islands as an expert on geological formation for the purpose of studying the mineral deposits.

Prof. Mark V. Slingerland, Assistant Entomologist of the College of Agriculture, Cornell University, Ithaca, N. Y., has been appointed State Entomologist of New York, to succeed Dr. J. A. Lintner.

Mr. Charles A. Hague, M. Am. Soc. C. E., consulting engineer, 39 Cortlandt St., New York, has been selected by the City Council of Camden, N. J., to make a test of the water-works of Camden.

Mr. C. C. Riley, Superintendent of Car Service of the Baltimore & Ohio Southwestern Ry., with headquarters at Cincinnati, O., has been promoted to the newly created position of Superintendent of Transportation, and his former position has been abolished.

Mr. David E. McComb, M. Am. Soc. C. E., Superintendent of Sewers, Washington, D. C., has been ordered to visit Boston, Mass.; Montreal, Que.; Chicago, Ill., and Milwaukee, Wis., to examine works in connection with the preparation of plans for the pumping station for the sewage disposal system of his city.

Mr. F. E. Drake, Assistant Manager of the Walker Co., Cleveland, O., has been appointed Special Mechanical and Electrical Adviser to Mr. Ferdinand W. Peck, Commissioner-General to the Paris Exposition of 1900. His duties will be to secure an adequate representation of American manufactures in both the mechanical and electrical fields, with a view to the development and increase of American export trade. He will sail from New York for France in company with Mr. Peck and staff on the steamer "La Touraine," Sept. 3, and expects to return to this country about the middle of October, when he will resume his duties with the Walker Co.

OBITUARY.

Mr. Philip A. Jackson, City Engineer, of Dorchester, Mass., died last week.

Mr. Frank W. Brown, of the firm of Brown Brothers, bridge and railway contractors, of Elizabeth, N. J., died Aug. 27, aged 80.

Mr. Martin L. Saulsbury, Civil Engineer, of Ridgley, Md., died Aug. 22, aged 26. He was a graduate of Lehigh University, South Bethlehem, Pa., in the class of 1893.

Mr. John Coon, junior member of the firm of Hammond & Coon, proprietors of the Lake Erie Boiler Works, Buffalo, N. Y., died Aug. 23, aged 53. He was also the Secretary of the Lake Erie Engineering Works.

Mr. Henry Mason, formerly Superintendent of the Quintard Iron Works, New York, died at his home in Brooklyn Aug. 27, aged 69. He was born in Newcastle-on-Tyne, England, and came to this country when 10 years of age. He entered the engineering department of the Quintard Iron Works in 1858, and was Superintendent for many years, being in charge of the installation of the engines and boilers of the ill-fated U. S. battleship "Maine."

Mr. James McCloskey, Manager of the firm of L. J. McCloskey & Co., Philadelphia, Pa., varnish manufacturers, died at Belmar, N. J., July 28, aged 68. He was one of the earliest pioneers in the mineral paint industry in this country, and in 1868 established a large paint factory in Philadelphia. In 1877 he organized a branch in that city of Berry Bros., Detroit, varnish makers, and was the manager of it for 19 years, resigning to take the position which he held at the time of his death.

Dr. John Hopkinson, the well-known English electrical engineer, and his son and two daughters were killed last week while ascending, without guides, a mountain in the canton of Valais, Switzerland. Dr. Hopkinson had intended starting for New York on Sept. 28 on business in connection with a syndicate which he was forming for the purpose of developing some of his recent inventions. Besides receiving the degrees of M. A. and D. Sc., Dr. Hopkinson was a Fellow of the Royal Society, a member of the Institute of Civil Engineers and a member of the Institute of Electrical Engineers. At different times he received the Telford Medal and Telford Premium of the Institute of Civil Engineers for valuable contributions to science. He was also a contributor to the Proceedings of the other societies, and the author of "Papers on Dynamo Electric Machinery." To electrical engineers he is perhaps best known as the author of the "Hopkinson Method" of dynamo testing.

Col. Sir Casimir Stanislaus Gzowski, M. Am. Soc. C. E., of Toronto, Ont., died at his residence, The Hall, in that city, Aug. 24. He was born in St. Petersburg, Russia, March 5, 1813, and his father was Count Gzowski, a Polish nobleman, an officer in the Imperial Guard. Sir Casimir was placed in the military college at Kremnitz at the age of nine, and remained there until 1830, when he received a commission in the engineering branch of the Imperial service. When the Polish rebellion against the Emperor Constantine broke out in 1831 he resigned his commission and joined the insurgents. The rebellion failed, and he, with many other officers, was exiled. He came to the United States, reaching New York in 1833 with but $40 in money and an entire ignorance of the English language. He began the study of it at once, however, supporting himself meanwhile by teaching French, Italian and German. Afterwards he went to Pittsfield, Mass., where he studied law, thinking that he would thus master the English most essential to the practice of engineering. In 1837 he was admitted to the bar in Pennsylvania. After four years in the practice of law he went to Toronto, Ont., and was engaged as an engineer by the Department of Public Works. For six years he held the position of Superintending Engineer of Roads and Harbors in Western Ontario. From 1850 to 1853 he was engineer of the harbor works at Montreal, Que., and Consulting Engineer of the ship canal improvement between that city and Quebec. He next became Chief Engineer of the St. Lawrence & Atlantic Ry., now part of the Grand Trunk system. He resigned this position to enter into partnership with Sir A. T. Galt, the late Hon. Luther H. Holton and the late Sir David Macpherson for the construction of the Grand Trunk Ry. from Toronto to Sarnia. In 1857 Sir Casimir and Sir David established the Toronto Rolling Mills for the manufacture of rails and other railway material. In 1870 he was appointed a member of a commission to inquire into the water communications of the Dominion, and in 1871 the firm of Gzowski & Macpherson constructed the international suspension bridge over the Niagara River. Sir Casimir was the engineer in charge of this work, and the same year was called upon to report on the enlargement of the Welland Canal, and also upon the Baie Verte canal scheme. He was the first President of the Canadian Society of Civil Engineers, of which he was elected a member Jan. 20, 1887, and was also the first Chairman of the Niagara Falls Park Commission. He was President of the Corporation of Wycliffe College. In 1872 he was made a Lieutenant-Colonel, in 1879 a Colonel and in the same year an honorary Aide-de-camp to the Queen. In 1890, in recognition of valuable services rendered to the Dominion of Canada, he was created a Knight Commander of St. Michael and St. George. He was elected a member of the American Society of Civil Engineers Dec. 2, 1868.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

GERMAN-AMERICAN TECHNICAL SOCIETY.
Sept. 3-7. Annual meeting, Philadelphia Section, Reading, Pa. Secy., A. Schumann, 532 North 4th St., Philadelphia, Pa.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Sept. 5. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

AMERICAN STREET RAILWAY ASSOCIATION.
Sept. 6-9. Annual convention, Boston, Mass. Secy., T. C. Pennington, 2020 State St., Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 7. Secy., C. W. Hunt, 220 W. 57th St., New York city.

CENTRAL RAILWAY CLUB.
Sept. 9. Secy., H. D. Vought, 114 5th Ave., New York city.

MONTANA SOCIETY OF ENGINEERS.
Sept. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

THE LOUISIANA ENGINEERING SOCIETY.
Sept. 12. "Evolution of Structural Design," F. T. Llewllyn. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 12-13. Annual meeting, Sault Ste. Marie, Mich. Secy., Wilson S. Howell, Newark, N. J.

NORTHWEST RAILWAY CLUB.
Sept. 13. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

NEW YORK STATE STREET RAILWAY ASSOCIATION.
Sept. 13-14. Annual meeting, Brooklyn, N. Y. Secy., H. A. Robinson, New York city.

DENVER SOCIETY OF CIVIL ENGINEERS.
Sept. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

THE RAILWAY SIGNALING CLUB.
Sept. 13. Secy., Earl M. Seitz, C. & N. W. Ry., Chicago, Ill.

ENGINEERS' CLUB OF CINCINNATI.
Sept. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

BROOKLYN ENGINEERS' CLUB.
Sept. 15. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Sept. 16. D. W. Meeker, St. Paul, Minn.

ENGINEERS' CLUB OF PHILADELPHIA.
Sept. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Sept. 17. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' CLUB OF MINNEAPOLIS.
Sept. 19. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Sept. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Sept. 20. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Sept. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Sept. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

ENGINEERS' CLUB OF ST. LOUIS.
Sept. 21. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 3. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.

CHICAGO ELECTRICAL ASSOCIATION.
Oct. 7. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 12. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.

MASTER CAR BUILDERS' ASSOCIATION.—In accordance with the recommendations of the Committee on Prices, approved by the Association at the convention held June, 1898, Secretary Jno. W. Cloud has just issued a circular giving the weights of M. C. B. couplers and coupler parts, as reported by manufacturers.

ILLINOIS TELEPHONE ASSOCIATION.—A meeting of this association will be held Sept. 28-29 at Du Quoin. Among the papers to be presented the following are of general interest: "Past, Present and Future Apparatus," P. J. Hertz; "The Evolution of the Telephone Signal," H. P. Clausen; "Growth and Development of the Telephone Business in the State of Illinois Within the Last Three Years," A. M. Howell; "Progress of the Independent Telephone Business in the West Outside of the State of Illinois," James S. Cuming.

INTERNATIONAL ACETYLENE ASSOCIATION.—At a recent meeting of manufacturers of generators of acetylene gas a society was formed to unite the manufacturers of acetylene apparatus and calcium carbide. A constitution was adopted and officers elected. It was decided that the principal office should be in Chicago and that meetings should be held in January and July of each year. The following were selected for 1898: Pres., George Landis Wilson, Chicago; Vice-President, J. W. Earl, Minneapolis, Minn.; Secy., J. B. Carroll, Chicago; Treas., C. D. Moody, Louisville, Ky.; Directors, George F. Owen, Grand Rapids, Mich.; I. R. Barton, Batavia, N. Y.; Charles J. Wangler, St. Louis, Mo.

THE LAKE SUPERIOR MINING INSTITUTE.—The 5th annual meeting of this society was held at Ironwood, Mich., Aug. 16-18. Much of the time was devoted to visiting points of engineering interest in the vicinity. During the business sessions several papers of special interest to mining engineers were read.

Officers for the ensuing year were elected as follows: Pres., Wm. Kelly, Vulcan, Mich.; Vice-Presidents, J. B. Cooper, Lake Linden, Mich.; W. Fitch, Beacon, Mich.; E. F. Brown, Iron Mountain, Mich.; Geo. H. Abeel, Hurley, Wis.; Edwin Ball, Soudan, Minn.; Treas., A. J. Youngbluth, Ishpeming, Mich.; Secy., F. W. Denton, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION.—The 4th annual convention of this association was held on Aug. 18-19 at Sandusky, Ohio. The usual routine business was transacted, after which President H. K. Wood read his address. In this he advised that the companies use all their influence to oppose the growth of municipal ownership. At the afternoon session a paper entitled "Positive and Negative Economies in the Operation of Small Electric Light Plants" was presented by Mr. E. P. Roberts, Cleveland, Ohio. In this the question was considered from the standpoint of an existing plant and it was claimed that many plants could reduce operating expenses from 10 to 20% by considering such details as tightness of belts, pulleys out of line, leakage of engine valves and poor adjustment. The keeping of accurate records was advised.

Mr. M. E. Turner, Cleveland, O., also presented a paper on "Some Suggestions Relative to Determining the Cost of Electrical Supply," which was a discussion of the Weight Demand System and a consideration of what made up the cost of current production.

The following morning's session was devoted to two papers and their discussion. The first, by Mr. Caryl D. Hastin, entitled "The Meters' Relation to the Dividend," which considered the selection and installation of meters and such points as testing, cleaning, inspecting, etc.; the second, by Mr. J. H. Perkins, on "Comparative Commercial Qualities of Old and Modern Transformers as Applied to an Exchange." This paper was a discussion of the various losses in a transformer and its regulation, and it was pointed out that a marked saving resulted from the replacing of a number of small transformers by a few larger ones.

Mr. E. J. Berg presented at the afternoon session a paper on "Long Distance Transmission of Power," which argued against the use of multiphase systems of transmission, except for cases where the distance between generating and consuming stations was large enough to demand the highest voltages at present possible. The single phase and monocyclic systems were considered by him preferable, generally speaking. Regarding periodicity he favored 60 or 125-cycle for lighting distribution, although for motor service or rotary converters lower periodicity gave good results.

In response to questions it was stated by Mr. Scovil that the advantages of the enclosed arc over the open were a saving of labor and carbon besides a steadier light. He understood that the Boston Electric Light Co. saved about $10 per year per lamp by their use.

The candle-power of an arc lamp could, according to Mr. E. P. Roberts, be accurately determined by a portable photometer, but the method was too inconvenient for practice.

Other questions were briefly considered, after which Cleveland was announced as the meeting place for next year. Officers for the ensuing year were elected at the morning session as follows: Pres., Emil C. Schmidt, Sandusky; Vice-Pres., B. P. Holmes, Youngstown; Secy. and Treas., Samuel Scovil, Cleveland.

NEW PUBLICATIONS.

ADDRESSES ON RAILWAY SUBJECTS AT PURDUE UNIVERSITY.—Published by the University, Lafayette, Ind. Nine pamphlets, 5¼ × 7½ ins.; paper.

These pamphlets contain nine of the eleven addresses or railway subjects delivered before the students of the university during the school year, 1896-97. The following is a list of the subjects: "Problems in the Management of a Railway System," John T. Brooks, Pennsylvania Lines; "The Past, Present and Future of American Railways," Melville E. Ingalls, C., C. C. & St. L. Ry.; "The Mutual Obligations of Railway Corporations and the Public," John W. Noble; "Relation of Railways to the State," Addison C. Harris; "Railways and Their Servants," Addison C. Harris; "Business Problems of the Motive Power Department," Robert Quayle, C. & N. W. Ry.; "Railway Signaling," Frederic A. Delano, C., B. & Q. Ry.; "Car Designing and Construction," Arthur M. Waitt, L. S. & M. S. Ry.

REVIEW OF WORLD'S COMMERCE.—Introductory to Commercial Relations of the United States with Foreign Countries During the Years 1896-1897. Department of State, Washington. Paper; 9 × 5¾ ins.; pp. 284.

This is a compilation of the annual reports of U. S. Consular officers on the industries and commerce of their respective districts. It includes special reports upon trade conditions in these countries, noting those conditions favorable to an extension of our own trade, or pointing out disadvantages and hindrance to such trade. While the general statistics are given for all countries with which we have dealings, the commerce of Asia and that of the Pacific Islands is especially discussed.

BEESON'S MARINE DIRECTORY.—By Harvey C. Beeson, Royal Insurance Building, Chicago, Ill. Cloth, 8vo.; pp. 258.

This is the eleventh annual edition of this directory of the shipping interests of the Great Lakes. It contains lists of all the sailing and steam vessels on the lakes, with particulars of their dimensions, engines, builders and owners, and also lists of U. S. courts and marshals, vessel owners, vessels lost during the year, and particulars as to lake commerce, steamship inspection, pilot rules, canal rates and regulations, etc. There is also a lengthy classified directory of ship and engine builders, manufacturers and dealers in supplies, contractors for dredging and pier work, etc., etc. About 28 pages are devoted to an alphabetical descriptive list of the lake ports, giving the population, principal industries, traffic, transportation lines, etc. A number of half-tone illustrations of ships, engines, harbor views, etc., are distributed through the volume, and the advertising pages include numerous and varied industries.

TRADE OF PUERTO RICO.—By Frank H. Hitchcock, Chief, Section of Foreign Markets, U. S. Department of Agriculture. Bulletin No. 13. Government Printing Office, Washington, D. C. Pamph.; 6 × 9 ins.; pp. 84.

The probability that Puerto Rico (why not Porto Rico?) will soon be part of the territory of the United States makes the publication of this pamphlet a timely one. For the years 1887-91 the average annual imports were $14,412,345, and exports $10,548,872. For the years 1892-96 the annual average imports were $17,480,494, and exports $16.390,041. In the first of these periods, of the combined import and export trade, the United States obtained 25.78%, and Spain 25.58%. In the second Spain obtained 28.80%, and the United States only 19.45%. It is safe to predict that these figures will be greatly changed in the next five years. Of the imports in 1895 42.6% were agricultural, and 57.4% non-agricultural. Of the exports 96% were agricultural. The agricultural imports are chiefly rice, wheat flour and hog products. Of the exports, coffee and sugar form the great bulk, coffee amounting to over $9,000,000 in 1895.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

ELECTRICITY FOR MACHINE DRIVING.—Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Pamph.; 6 × 9 ins.; illustrated.

This brochure is intended to point out a few of the advantages secured by the use of motors directly connected to various machines.

HOW TO SELECT A DYNAMO.—Walker Co., Cleveland, O. Circular.

This is circular No. 1,079 of the regular Walker series, and supersedes No. 1,049. As the title implies, it outlines the salient features of a good dynamo. The manner in which the Walker generators fit these requirements is pointed out.

ELECTRIC POWER MACHINERY. — Crocker-Wheeler Electric Co., Ampere, N. J. Pamph.; 7½ × 10 ins.; illustrated.

This is a remarkably well illustrated circular, in which the various types of generators and motors manufactured by the Crocker-Wheeler Co. are shown. The illustrations are accompanied by suitable descriptive paragraphs.

POWER PUMPS.—The Goulds Mfg. Co., 16 Murray St., New York city. Pamph.; 8 × 7¼ ins.; pp. 36; illustrated.

This pamphlet makes no attempt to describe in detail any of the machinery manufactured by the company, and is simply a series of illustrations of pumping plants installed throughout the country, accompanied in each case by a brief description.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Sept. 1.	Electric plant, Abilene, Kan.	Aug. 18
Sept. 1.	Water pump, Gloucester City, N. J. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 1.	Filter plant, etc., Louisville, Ky.	Aug. 18
Sept. 1.	Heating, ventilating, etc., Lexington, Ky. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 1.	Sewerage system, Clinton, Mass. Advertised Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 1.	Drainage system, Savannah, Ga. Advertised, Eng. News, June 23 to Aug. 25.	June 30
Sept. 1.	Electric light plant, Cullman, Ala.	July 21
Sept. 1.	Water-works, Norwood, N. Y.	July 21
Sept. 1.	Bridges, Johnsonburg, Pa. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Sept. 1.	Water-works, Mobile, Ala. Advertised, Eng. News, Aug. 4 to 25.	Aug. 4
Sept. 1.	Electric lighting, Paris, Tex. Advertised, Eng. News, Aug. 11 to 25.	Aug. 11
Sept. 1.	Dam, power house, etc., Jackson, Mich. Advertised, Engineering News, Aug. 11.	Aug. 11
Sept. 1.	Water gate (7 ft.), Chicago, Ill.	Aug. 25
Sept. 1.	State road (2 miles), Schenectady, N. Y.	Aug. 25
Sept. 1.	Brick paving, Coldwater, Mich.	Aug. 25
Sept. 1.	Paving, Gloucester City, N. J.	Sept. 1
Sept. 1.	Asphalt paving, Scranton, Pa.	Sept. 1
Sept. 2.	Electric lighting, Prospect Park, Pa.	Sept. 1
Sept. 2.	Highway, Pepperell, Mass.	Sept. 1
Sept. 2.	Sewers, Providence, R. I.	Sept. 1
Sept. 2.	Pipe sewers, Mercer, Pa.	Sept. 1
Sept. 2.	Asphalt paving, Lowell, Mass.	Sept. 1
Sept. 2.	Bicycle path, Buffalo, N. Y.	Sept. 1
Sept. 2.	School building, Rosedale, Kan.	Sept. 1
Sept. 2.	Street work, Cincinnati, O.	Sept. 1
Sept. 2.	Street impvmts (two contracts) Leipsic, O.	Sept. 1
Sept. 2.	Brick sidewalks, etc., Richmond, Ind.	Sept. 1
Sept. 2.	Electric lighting, Lansdowne, Pa.	Aug. 25
Sept. 2.	Brick sewer, Buffalo, N. Y.	Aug. 25
Sept. 2.	Pipe sewers, Waukesha, Wis.	Aug. 25
Sept. 2.	Repaving, etc., Omaha, Neb.	Aug. 25
Sept. 2.	Pier, New York, N. Y.	Aug. 25
Sept. 2.	Street work, Buffalo, N. Y.	Aug. 25
Sept. 3.	Gas lighting, Delaware, O.	Aug. 25
Sept. 3.	Jail, Goliad, Tex.	Aug. 18
Sept. 3.	Hospital building, Ukiah, Cal.	Aug. 18
Sept. 3.	Sewage pumping plant, No. Somerville, Mass. Advertised, Eng. News, Aug. 11 and 18.	Aug. 11
Sept. 3.	Smokeless powder, Washington, D. C.	Aug. 11
Sept. 3.	Granolithic walks, Cornwall, Ont.	Sept. 1
Sept. 5.	Water-works, Maynard, Minn.	Sept. 1
Sept. 5.	Wooden bridge, Dillon, Mont.	Sept. 1
Sept. 5.	Brick paving, Des Moines, Ia.	Sept. 1
Sept. 5.	Street work, Allegheny, Pa.	Sept. 1
Sept. 5.	Asphalt paving, Chester, Pa.	Sept. 1
Sept. 5.	Cement sidewalks, Lake Forest, N. Dak.	Sept. 1
Sept. 5.	Heating plant, Valley City, N. Dak.	Sept. 1
Sept. 5.	Sewers, Callender, Ia.	Sept. 1
Sept. 5.	Tramways (13 miles), London, England.	Sept. 1
Sept. 5.	Dredging, Waukegan, Ill. Advertised, Eng. News, Aug. 4 and 11.	Aug. 4
Sept. 5.	Bridge, Dillon, Mont.	Aug. 4
Sept. 5.	Steel hull tugboat, Seattle, Wash.	Aug. 11
Sept. 5.	Construction materials, Ft. Delaware, Del. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 5.	Macadam road, St. Paul, Minn.	Aug. 18
Sept. 5.	Brick paving, Fremont, O.	Aug. 18
Sept. 5.	Brick paving, Glens Falls, N. Y. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 5.	Dynamo and engines, Dunning, Ill.	Aug. 18
Sept. 5.	Plans for market house, San Antonio, Tex.	Aug. 18
Sept. 5.	Grading and paving, Litchfield, Conn.	Aug. 25
Sept. 5.	Water dept. supplies, Cumberland, Md.	Aug. 25
Sept. 5.	Brick paving, etc., Albany, N. Y.	Aug. 25
Sept. 5.	Paving brick, stone, etc., Cumberland, Md.	Aug. 25
Sept. 5.	Street bonds, Coshocton, O.	Aug. 25
Sept. 5.	Paving, Keokuk, Ia.	Aug. 25
Sept. 5.	Water supply, Anaconda, Mont.	Aug. 25
Sept. 5.	Water-works, Lanesboro, Minn.	Aug. 25
Sept. 6.	Macadamizing, Hasbrouck Heights, N. J. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 6.	Electric light plant, Decatur, Mich.	Aug. 25
Sept. 6.	Bridge, Oshkosh, Wis.	Aug. 25
Sept. 6.	Bridge and repairs, Colusa, Cal.	Aug. 25
Sept. 6.	Heating, etc., New York, N. Y.	Aug. 25
Sept. 6.	Pipe sewer, Dunkirk, N. Y.	Aug. 25
Sept. 6.	Street work, Portchester, N. Y.	Aug. 25
Sept. 6.	Bridge bonds, Newport News, Va.	Aug. 25
Sept. 6.	Improving road, Carthage, O.	Aug. 18
Sept. 6.	Street bonds, Hasbrouck Heights, N. J.	Aug. 18
Sept. 6.	Bridge, Chateau, Mont.	Aug. 18
Sept. 6.	Bridge, San Jose, Cal.	Aug. 18
Sept. 6.	Sewerage system, Billings, Mont.	Aug. 18
Sept. 6.	Stop-cocks, etc., Jersey City, N. J.	Sept. 1
Sept. 6.	Recreation pier, Brooklyn, N. Y.	Sept. 1
Sept. 6.	Pipe sewers, etc., Newton, N. J.	Sept. 1
Sept. 6.	Sewer, Henderson, Ky.	Sept. 1
Sept. 6.	Street sweeper, Hamilton, O.	Sept. 1
Sept. 6.	Sewers, Columbus, O.	Sept. 1
Sept. 6.	Brick paving, Bay City, Mich.	Sept. 1
Sept. 6.	Recreation building, Brooklyn, N. Y.	Sept. 1
Sept. 6.	Water supply, Philadelphia, Pa.	Sept. 1
Sept. 6.	Water-works, Walker, Minn.	Sept. 1
Sept. 6.	Engine houses (4), Toledo, O.	Sept. 1
Sept. 6.	Brick paving, Albany, N. Y.	Sept. 1
Sept. 6.	Paving (2 contracts), Binghamton, N. Y.	Sept. 1
Sept. 6.	Brick pvg. (2 contracts), Schenectady, N.Y.	Sept. 1
Sept. 6.	Sewers, etc, Philadelphia, Pa	Sept. 1
Sept. 7.	Paving bonds, Spokane, Wash.	Sept. 1
Sept. 7.	Library bonds, Jersey City, N. J.	Sept. 1
Sept. 7.	Fire hose nozzles, New York, N. Y.	Sept. 1.
Sept. 7.	Bridge, Oroville, Cal.	Aug. 4
Sept. 7.	Bridges (2), Pendleton, Ore.	Aug. 18
Sept. 7.	Brick paving, Cleveland, O.	Aug. 18
Sept. 7.	Heating and ventilation, So. Omaha, Neb. Advertised, Eng. News, Aug. 18 and 25.	Aug. 18
Sept. 7.	Bridge, Prineville, Ore.	Aug. 25
Sept. 7.	Bridge, Portland, O.	Aug. 25
Sept. 7.	Water tanks, Chicago, Ill.	Aug. 25
Sept. 7.	Brick dormitory, Morris, Minn.	Aug. 25
Sept. 7.	Court house, St. Thomas, Ont.	Aug. 25
Sept. 8.	Plumbing, and heating, Manitowoc, Wis.	Aug. 25
Sept. 8.	Brick paving, Monroe, La.	Aug. 25
Sept. 8.	Granitoid walks, St. Louis, Mo.	Aug. 25
Sept. 8.	Macadam paving, Shoals, Ind.	Aug. 18
Sept. 8.	Bridge, Roseburg, Ore.	Aug. 4
Sept. 8.	Dykes, Hudson River, N. Y. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 8.	Court house, Dallas, Ore.	Sept. 1
Sept. 8.	Brick sewer, Hammond, Ind.	Sept. 1
Sept. 8.	Buildings, Danville, Ill.	Sept. 1
Sept. 9.	Brick paving, Shamokin, Pa.	Sept. 1
Sept. 9.	School buildings, Mandan, N. Dak.	Sept. 1
Sept. 9.	Paving, Omaha, Neb.	Sept. 1
Sept. 9.	Condenser, etc., for electric plant, Chicago.	Sept. 1
Sept. 9.	Electric plant, St. Louis, Mich.	Sept. 1
Sept. 9.	Abutments, Woodsfield, O.	Sept. 1
Sept. 9.	Rubber suctions, Charleston, S. C. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 9.	Sea walls, Baltimore, Md. Advertised, Eng. News, Aug. 18 to Sept. 8.	Aug. 18
Sept. 9.	Water bonds, Sparta, Minn.	Aug. 25
Sept. 9.	School building, Laharpe, Ill.	Aug. 25
Sept. 10.	Bridges (3), Wichita, Kan.	Aug. 25
Sept. 10.	Brick paving, Coshocton, O.	Aug. 25
Sept. 10.	Street improvements, Nelsonville, O.	Aug. 25
Sept. 10.	Highways, Rockville, Ind.	Aug. 25
Sept. 10.	Improving road, Mansfield, O.	Aug. 18
Sept. 10.	School buildings (2), St. Louis, Mo.	Sept. 1
Sept. 10.	Lodge building, Fort Worth, Tex.	Sept. 1
Sept. 10.	Electric plant bonds, Lancaster, Pa.	Sept. 1
Sept. 10.	Electric plant, Greenup, Ill.	Sept. 1
Sept. 10.	Brick paving, Alexandria, Ind.	Sept. 1
Sept. 10.	Dredging, Philadelphia, Pa.	Sept. 1
Sept. 10.	Dam foundation, Columbus, O. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 12.	Brick sewer, Houston, Tex.	Sept. 1
Sept. 12.	Pipe sewers, etc., Faribault, Minn.	Sept. 1
Sept. 12.	Road work, Houston, Tex.	Sept. 1
Sept. 12.	Bridge, Manning's Ford, Va.	Sept. 1
Sept. 12.	Repairing steamer, New York, N. Y.	Sept. 1
Sept. 12.	Paving, etc., Toledo, O.	Aug. 18
Sept. 12.	Water and sewer bonds, Mobile, Ala.	Aug. 11
Sept. 12.	Grading, paving, etc., Toledo, O.	Aug. 11
Sept. 12.	Lake outlet, Lake Manitoba, Can.	Aug. 25
Sept. 12.	Bridge, Warren, Pa.	Aug. 25
Sept. 12.	Bonds, Mansfield, O.	Aug. 25
Sept. 12.	Bridge, Lima, O.	Aug. 25
Sept. 12.	Paving, Youngstown, O.	Aug. 25
Sept. 13.	Aqueduct (17¼ miles), Birmingham, Eng.	Aug. 25
Sept. 13.	Bridge, Edmonton, N. W. Ter.	Aug. 25
Sept. 13.	Bridge work, Columbus, O.	Aug. 25
Sept. 13.	Crushed limestone, Toledo, O.	Aug. 25
Sept. 13.	Capitol building, Helena, Mont.	July 28
Sept. 13.	Brick sewer, etc., Kearney, N. J. Advertised, Eng. News, Aug. 18 to Sept. 8.	Aug. 18
Sept. 13.	Repairing bridge, Mountain Home, Idaho.	Aug. 18
Sept. 13.	Building, etc., Oxford, O.	Sept. 1
Sept. 13.	Paving, Vineland, N. J.	Sept. 1
Sept. 13.	Pipe sewers, etc., Parkersburg, W. Va.	Sept. 1
Sept. 13.	Sandstone, etc., Pt. Wilson, Wash.	Sept. 1
Sept. 13.	Electrical apparatus, Norfolk, Va.	Sept. 1
Sept. 14.	Sewer system, Pocomoke City, Md. Advertised, Eng. News, Aug. 25 and Sept. 1.	Sept. 1
Sept. 14.	Water-works, Pocomoke City, Md. Advertised, Eng. News, Aug. 25 and Sept. 1.	Sept. 1
Sept. 14.	School building, Pittsburg, Pa.	Sept. 1
Sept. 14.	City hall bonds, Brooklyn, O.	Sept. 1
Sept. 14.	Brick paving, Alexandria, Ind.	Sept. 1
Sept. 14.	Hospital building, Los Angeles, Cal.	Aug. 18
Sept. 15.	Enlarging court house, Lisbon, N. Dak.	July 28
Sept. 15.	Fire alarm system, Mobile, Ala. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 15.	Light-house, Tompkinsville (S. I.), N. Y. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 15.	Engine (150-HP.), New Orleans, La.	Aug. 25
Sept. 15.	Iron bridge, Natchitoches, La.	Aug. 25
Sept. 15.	Pipe sewers, etc., Santa Ana, Cal.	Sept. 1
Sept. 16.	Pipe sewers (6 miles), Shelby, O.	Sept. 1
Sept. 16.	Brick and pipe sewer, Richmond, Ind.	Aug. 25
Sept. 16.	Supplies, Norfolk, Va. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 17.	Storm sewer, Mansfield, O.	Aug. 25
Sept. 17.	Headstones, (10,000), Boston, Mass.	Aug. 25
Sept. 17.	Brick paving, Watertown, Wis. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 17.	Sewers, Washington, D. C. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 17.	Removing wreck, St. Joseph, Mo.	Sept. 1
Sept. 19.	Electric lighting, Portland, Ore.	Sept. 1
Sept. 19.	Jail building, Newport News, Va.	Sept. 1
Sept. 19.	Bridges (2), Newport News, Va.	Sept. 1
Sept. 19.	Heating and ventilating, St. Albans, Vt. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 19.	Hospital plans, San Francisco, Cal.	Aug. 4
Sept. 19.	Jail, Lovelocks, Nev.	Aug. 18
Sept. 19.	Bridge bonds, Los Angeles, Cal.	Aug. 18
Sept. 20.	Viaduct, Cincinnati, O.	Aug. 25
Sept. 20.	Electric light plant, Grand Rapids, Mich. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 21.	Water-works, Bristol, Va.	Sept. 1
Sept. 21.	Canal, Chicago, Ill. Advertised, Aug. 25 to Sept. 15.	Aug. 25
Sept. 22.	Hospital buildings, etc., Central Islip, N.Y.	Sept. 1
Sept. 22.	Electrical apparatus, Central Islip, N.Y.	Sept. 1
Sept. 23.	Supplies, Watervliet, N. Y.	Aug. 25
Sept. 24.	Capitol building, Columbus, O.	Sept. 1
Sept. 24.	Electric plant, Pensacola, Fla.	Sept. 1
Sept. 24.	Quay wall, San Francisco, Cal.	Sept. 1
Sept. 26.	Bonds, Dayton, O.	Aug. 25
Sept. 26.	Electric plant bonds, St. Louis, Mich.	Sept. 1

Sept. 28. U. S. building, Brockton, Mass. .... Sept. 1
Advertised, Eng. News, Sept. 1 and 8.
Sept. 29. Water-works, Wivenhoe, England .... Sept. 1
Sept. 29. Court house, Marietta, Ga. .... Aug. 18
Oct. 1. Arc lighting, Marshfield, Wis. .... Aug. 18
Oct. 1. Monitors (4), Washington, D. C. .... July 7
Oct. 1. School building (equipment), St. Thomas, Ont. July 7
Oct. 1. Road roller, Sheboygan, Wis. .... Sept. 1
Advertised, Engineering News, Sept. 1.
Oct. 1. Head-race (power plant), Montreal, Que. .... Sept. 1
Advertised, Eng. News, Sept. 1 to 15.
Oct. 3. Street work, Toledo, O. .... Sept. 1
Oct. 4. Coal conveyors, etc., Chicago, Ill. .... Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 29.
Oct. 5. Bridge superstructure, Chicago, Ill. .... Aug. 11
Oct. 12. Park bonds, Spokane, Wash. .... Sept. 1
Oct. 17. Gasholder, etc., Edinburgh, Scotland ...... Sept. 1
Oct. 24. Markets, etc., Belem, Brazil. .... Apr. 28
Oct. 25. Jetties, Portland, Ore. .... Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 15.
Oct. 30. School building, Chehalis, Wash. .... June 16
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn. .... Aug. 18
No date. Fireproofing, Petersburg, Va. .... Sept. 1

RAILWAYS.

ALABAMA & FLORIDA.—We are informed that the surveys of this proposed line have been completed, the capital for construction secured and the contract awarded to R. M. Quigley & Co., St. Louis, Mo. The route is from Georgiana to River Falls, Ala., 30 miles, as previously stated, and it is expected to finish the work before Jan. 1. Pres., E. L. Moore, Georgiana, Ala.; Ch. Engr., Charles Seymour, Madisonville, Ky.

ATCHISON, TOPEKA & SANTA FE.—Reports state that Barney Lantry & Sons, of Strong City, Kan., have a contract to furnish this company with 50 carloads of crushed-stone a day, to be used on the main line west of Kansas City, Mo. The ballasting work is expected to be finished by next spring.

ATLANTIC, VALDOSTA & WESTERN.—It is announced that construction work has been completed on this line from Haylow, Ga., to Crawford, Fla., and that it is now being further extended from Haylow to Valdosta. A number of contracts for work along the line have still to be awarded.

BRANDON & SOUTHWEST.—Reports state that the preliminary surveys have been completed for this proposed railway into Brandon, Man., to be about 90 miles in length. It is said that Robert Waddell, Trenton, Ont., has the contract, and that he will begin work at Deloraine in about one month.

CANTON, ABERDEEN & NASHVILLE.—This company intends to build a line from Winfield, Ala., to be about nine miles in length. The company applied for a charter in Alabama, Aug. 9, with a proposed capital stock of $1,000,000. A number of Illinois Central R. R. officials are interested.

CLEARFIELD SOUTHERN.—P. E. McGovern, of Punxsutawney, Pa., is reported to have been awarded the contract for the construction of this railway from Belsena Mills, Pa., to Clearfield Bridge, a station on the Bridge Creek R. R., a distance of about 15 miles. It is expected to employ about 200 men on the work at first.

COOS BAY, ROSEBURG & EASTERN.—Work is in progress on a 3-mile extension of this railway in Coos county, Ore., now in operation from Marshfield, on Coos Bay, to Myrtle Point, a distance of about 26 miles. A further extension from Myrtle to Roseburg, 60 miles, is projected. Pres., T. R. Sheridan, Roseburg, Ore.

DETROIT & LIMA NORTHERN.—C. W. Haskell, First Vice-Pres., 30 Broad St., New York, informs us that this company does not intend to extend its line from Waponeta, O., direct to Chicago, as currently reported.

DURANGO, WESTERN & PACIFIC.—Press reports state that this company will soon advertise for bids for iron bridges, section houses, stations, round-houses, rolling stock, etc., and that an English syndicate, headed by W. A. Moffat, is back of the project. A subsidy of $12,000 a kilometer (.621 mile) for mountain road, and $7,000 a kilometer across the table land is said to have been granted by the Mexican government. The line will be 300 miles long, and the provisions of the subsidy require its completion in three years.

GRAND MARAIS & NORTH SHORE.—R. W. Nichols, Ch. Engr., Duluth, Minn., informs us that the terminus has been located for this proposed railway from Grand Marais to Two Harbors, Minn., a distance of 90 miles, and that the right of way has been secured and the preliminary surveys are in progress. It is expected to let contracts for the construction of the line as soon as the survey is completed. Pres., E. K. Lewis, Duluth, Minn.

KOOTENAY RY. & NAVIGATION.—Press reports state that this company has been organized in London, Eng., with a capital stock of $500,000, for the purpose of consolidating the Kalso & Slocan Ry. Co., and the International Navigation & Trading Co., and to connect these directly with the Great Northern and Northern Pacific Rys.

LEHIGH VALLEY.—We are informed that H. O. Duerr, Contracting Engr., South Bethlehem, Pa., has made a contract with the Lehigh Valley R. R. Co., extending over several years, to furnish it with stone ballast on the main line of the road. The contract consists in furnishing the stone from two points: the Eastern point is Redington, Pa., from which a dark blue limestone is furnished that is almost as hard as trap rock. Mr. Duerr has agreed to supply 500 yds. a day at each point, and has purchased from the Rodger Ballast Car Co. forty 80,000-lb. patent ballast cars and two plows for that purpose. It is the intention of the railway company to ballast the entire line with stone ballast instead of cinder and gravel, as has been done heretofore. The western point from which a delivery is made is at a place known as Flint Hill, near North LeRoy, N. Y. From this latter place a flint rock ballast is obtained. C. E. Webster, Ch. Engr., South Bethlehem, Pa.

LITTLE COAL RIVER RY. & MINING.—Henry S. Hopkins, Jr., Secy., St. Louis, Mo., informs us that the location is now being made for this proposed railway from St. Albans to Madison, W. Va., a distance of 50 miles. The capital for construction has been negotiated for, and the contract for constructing the entire line has been awarded to the Hopkins Bridge & Construction Co., of St. Louis. The line enters 35,000 acres of valuable coal lands, and the company's principal revenue will be derived from its coal business. Pres., Allan R. Sheffer, 160 and 164 Broadway, N. Y; Ch. Engr., N. M. Leete, Huntington, W. Va.

LITTLE ROCK, HOT SPRINGS & TEXAS.—Press reports state that Receiver Lonsdale has been authorized to receive private bids, until Oct. 1, for the purchase of this line. The railway is projected to run from Little Rock, Ark., to Wister, Ind. Ter., 155 miles, with branches, and was graded from Benton to Hot Springs, Ark., in 1895, and four miles of track laid from Benton to the Saline River.

MISSOURI, KANSAS & TEXAS.—S. B. Fisher, Ch. Engr., St. Louis, Mo., informs us that no improvements of consequence are at present projected on this line of railway. Pres., H. C. Rouse, 45 Wall St., New York.

MONTGOMERY, HAINESVILLE & CAMDEN.—P. S. Milner, Principal Asst. Engr., Birmingham, Ala., informs us that this company has just completed a 45-mile survey from Camden to Suggsville, Ala., the latter town being on the Mobile & Birmingham R. R. The line crosses the Alabama River, requiring a bridge 600 ft. in length, and is intended to give the Montgomery, Hainesville & Camden an outlet to the Gulf. Pres., Sol. D. Bloch, Montgomery, Ala.; Ch. Engr., J. A. Milner, Birmingham, Ala.

RICHMOND NICHOLASVILLE, IRVINE & BEATTYVILLE.—It is announced that this railway will be offered at public sale at Versailles, Ky., Sept. 6, under foreclosure. The line at present extends from Versailles to Irvine, Ky., a distance of 61 miles, and has been in operation since 1890. After grading the road from Irvine nearly to Beattyville and building a number of costly trestles the money gave out and the rails have never been laid. In 1893 the company was forced into the hands of a receiver. This will be the fourth time within two years that the property has been put up at auction.

SANDY HUFF.—This company was incorporated in West Virginia, Aug. 29, with a capital stock of $500, to construct a steam railway from Sandy Huff Creek, on the Norfolk & Western R. R., to Guyandotte River, at the mouth of Huff Creek, W. Va. The incorporators are: F. S. Hamlin, W. R. Leathers, Jas. F. Strother and John Effler, McDonald county, W. Va.; W. D. Janney, Wayne county, W. Va.

SIERRA OF CALIFORNIA.—Reports state that this company has decided to extend its line immediately to the sugar pine belt, 20 miles from Jamestown, Cal.; work to begin this fall. The Crockers own about 30,000 acres of timber lands in this country, and it is said to be their intention to erect mills where the timber will be cut and dressed. It is thought that the road will be extended over the mountains into Nevada next season. Pres., Prince A. Poniatowski; Vice-Pres., H. J. Crocker, both of San Francisco, Cal.

STOCKTON & TUOLUMNE.—We are informed that about 12 miles of the earthwork on the roadbed for this proposed railway has been completed in detached portions where the right of way could most easily be obtained. All work is now suspended, pending an issue of bonds which has been authorized. If bonds are sold soon work may be again resumed. The work done is between Stockton, Cal., and the foot-hills 25 miles to the east. Pres., Mrs. Annie Kline Rikert, Grand Hotel, San Francisco, Cal.

WESTMORELAND JUNCTION.—J. Arthur Jones, Secy., Irwin, Pa., informs us that this company, whose incorporation was noted in our last issue, expects to build a steam railway from Irwin, on the Pennsylvania R. R., to Guffeys, on the Baltimore & Ohio R. R., a distance of six miles. Surveys are rapidly progressing, and most of the capital for construction secured. Pres., A. Frank, Irwin.

STREET AND ELECTRIC RAILWAYS.

BENTON, ME.—Samuel Ferguson, of Waterville, Me., has been awarded the contract for building the Benton & Fairfield Electric Ry., to be about three miles in length and to cost $30,000. Heavy rails will be laid so as to permit the hauling of freight cars from the Maine Central to the pulp mill at Benton Falls.

CLINTON, MASS.—A franchise was granted to the Clinton, Hudson, Maynard & Clinton St. Ry. Co. Aug. 23 to build from Clinton to Hudson. The company has 18 months in which to build the line.

HYDE PARK, MASS.—It is reported that the Norfolk Suburban St. Ry. Co. contemplates the extension of its line in the Readville district to the grounds of the New England Horse Breeders' Association. Pres., Jas. D. McAvoy, Readville, Hyde Park.

MERIDEN, CONN.—We are informed that Sanderson & Porter, 31 Nassau St., New York, contractors for the proposed Meriden & Compounce Electric Ry., have awarded to the Berlin Iron Bridge Co., of East Berlin, Conn., the contract for furnishing seven steel bridge spans; a steel frame car barn, 50 × 100 ft., and a power-house, 45 × 75 ft. Francis Atwater, of Meriden, is one of the promotors of the project.

BUFFALO, N. Y.—Reports state that the Buffalo, Kenmore & Tonawanda Electric Ry. was sold at a referee's sale in Buffalo, Aug. 23, to Morris Cohn, of Niagara Falls, N. Y., a stockholder of the Buffalo & Lockport Ry. Co., at about $92,000.

COXSACKIE, N. Y.—We are informed that work has been suspended for the present by the Greene County Traction Co. on its electric railway to connect Coxsackie, Greenville, Middleburgh and other places. The road will be 42 miles in length, and is to be completed by 1900. J. V. W. O'Connor, of Coxsackie, is interested. G. W. Raines, Pres., New York.

HILTON, N. Y.—An extension of the Rochester, Charlotte & Manitou R. R. is said to be contemplated from the present terminus at Manitou to Hilton, a distance of four miles. If built, the line would probably consist of only a single track at first, and would accommodate both passengers and freight.

HUDSON, N. Y.—It is announced that a number of Brooklyn street railway promoters have purchased the Kinderhook & Hudson Ry., now operated from Hudson to Niverville, N. Y., a distance of 18 miles, and that it will be converted into a trolley line. Power will be supplied from Stuyvesant Falls. An extension to Philmont will probably be built next year. S. R. Raines, Pres. Kinderhook & Hudson Ry. Co., Hudson.

NEW PALTZ, N. Y.—It is reported that Jas. G. Graham, of Newburgh, N. Y., has been appointed temporary receiver for the New Paltz & Wallkill Valley Ry. Co., on the application of the directors for a voluntary dissolution of the corporation. The company was incorporated Jan. 16, 1897, with a capital stock of $150,000, by Henry M. Brundage, Portchester, N. Y.; Hugh H. Douglass, of Boston; Paul Shaffer, 801 3d Ave., New York, and others. This electric line extended from the West Shore R. R., at Highland, N. Y., to New Paltz, Ulster county.

NEW YORK, N. Y.—The franchise of the Fulton, Wall & Cortlandt Street Ferries R. R. Co. was sold at auction Aug. 25 by L. J. Phillips & Co., in pursuance of a judgment in foreclosure obtained by the Central Trust Co., of New York, to Joseph D. Donald, 81 Fulton St., at $621,276. The franchise provides for a street railway from the foot of Fulton St. to the Cortlandt St. ferry, and from the Wall St. ferry to the Cortlandt St. ferry. Edward Selleck, 45 William St., New York, is interested.——The Wall & Cortlandt St. Ferries Ry. Co. was incorporated Aug. 25, with a capital stock of $1,000,000, to operate under the franchise formerly owned by the Fulton, Wall & Cortlandt St. Ferries R. R. Co., and which was sold at auction Aug 25. The directors are, F. D. Moffat, 81 Fulton St.; Charles Buse, K. S. Hogg, E. L. Conant, H. W. Bean, M. E. Gill and J. P. Sheffield, all of New York.

SYRACUSE, N. Y.—Belden & Seeley are now at work on the new line of the Syracuse & Suburban R. R. Co. on East Fayette and Montgomery Sts. The work will probably be completed the latter part of this month.

WATERTOWN, N. Y.—The Watertown & Sacketts Harbor Rapid Transit Co. has been organized, with a capital stock of $100,000, to construct and operate an electric street railway from Arcade and Arsenal Sts., in Watertown, to Sacketts Harbor, on Lake Ontario, a distance of ten miles. It is proposed to carry freight and passengers. The incorporators are, William P. Casey, James J. Luddington, James H. Kinney and H. D. Barto, of Syracuse; G. Harrison Smith, Joseph Marrian, Wilbur F. Porter, Amelia E. Barron, D'Esting Moore, John E. Bergevin, Ora E. Riordan, Norris M. Van Brunt and Edward Cuff, of Watertown; S. Harland Wetmore, Leyden, N. Y.; William H. Reese, Evans Mills, N. Y.

ATLANTIC CITY, N. J.—The Atlantic City St. Ry. Co. has applied for a franchise to construct an electric railway from South Carolina Ave. and the beach to Arctic Ave., and thence on Rhode Island Ave. to Caspian Ave. Among the petitioners are: C. J. Adams, John J. Gardner and Levi C. Albertson.

COPLAY, PA.—We are informed that surveys have been completed and rights of way obtained for the electric railway of the Coplay, Egypt & Ironton St. Ry. Co. It will be six miles in length, connecting the three places named. Contracts for the construction will probably be awarded this week. J. G. Meyle, Coplay, is interested. Dr. H. Y. Horn, Pres., Coplay; Chas. Weirbach, Ch. Engr., Allentown, Pa. The incorporation of the company was noted in our issue of May 26.

EDGEWOOD PARK, PA.—The Edgewood St. Ry. Co. was incorporated Aug. 26 with a capital stock of $5,000, to construct a railway eight-tenths of a mile in length. The incorporators are, W. E. Guy, Pres.; J. C. Burkhard, William Porter and Edward Williams, all of Pittsburg, Pa.; Harry Fisher, Allegheny City, Pa.

RANKIN STATION, PA.—The Rankin & Hawkins St. Ry. Co. was incorporated Aug. 26 with a capital of $6,000, to construct an electric street railway one mile in length in the borough of Rankin. Pres., W. E. Guy, Pittsburg.

SWISSVALE, PA.—The Swissvale St. Ry. Co. was incorporated Aug. 26 with a capital stock of $5,000, to construct one mile of electric street railway in Swissvale. Pres., W. E. Guy, Pittsburg.

WILKINSBURG, PA.—The Wilkinsburg Connecting St. Ry. Co. was incorporated Aug. 26 with a capital stock of $5,000, to construct an electric street railway six-tenths of a mile in length. Pres., W. E. Guy, Pittsburg; Directors, J. C. Burkhard and others.

WASHINGTON, D. C.—The Siemens & Halske Electric Co., of Chicago, is reported to have been awarded a contract to furnish the Capital Ry. Co. with an electric power plant, consisting of a 100-K-W., 550-volt dynamo and other machinery, at $2,355. Pres., A. E. Randle.

ROANOKE, VA.—D. W. Flickwir, Recr., Roanoke, informs us that the Roanoke St. Ry. Co. is making no improvements or changes to its system, other than the regular repair work.

CLEVELAND, O.—It is reported that work has begun on the Cleveland & Eastern electric railway, and that contracts have been let for 15 miles of grading in Gauga county. Contracts are expected to be let within a few days for the power house, the running stock and the electrical equipment. The officers are, Pres., H. P. McIntosh; Vice-Pres., H. A. Sherwin; Secy. and Treas., E. G. Tillotson.

EATON, O.—Jas A. Gilmore, of Eaton, in behalf of the Western Ohio Traction Co., has applied to this town for a franchise over the roads leading to Middletown, a distance of 22 miles. The promoters of the project, as stated in our issue of Aug. 18, are Chas. S. Parkhurst and Walter W. Brandon, of Anderson, Ind.

MICHIGAN CITY, IND.—We are informed that John W. Lovett is president and W. W. Huffman chief engineer, both of Anderson, Ind., of the Northern Traction Co., which was incorporated Aug. 19 to build an electric street railway from Michigan City to Laporte.

DURAND, MICH.—H. Hutchinson, of Durand, writes us that right of way has been obtained in this village, but no surveys have yet been made for the projected road of the Long Lake, Durand & Corunna Electric Ry. Co., noted last week. Particulars can be obtained by addressing Wm. E. Avery, 88 Post St., Detroit.

HOUGHTON, MICH.—It is reported that the Houghton County St. Ry. Co. is being organized by business men from Calumet, Laurium, Hancock, Lake Linden and Houghton, to construct an electric street railway in Houghton county. A preliminary survey has been made from East Houghton to West Hancock.

SAUGATUCK, MICH.—The township boards of Laketown and Saugatuck have granted franchises to the Saugatuck, Douglas & Lake Shore Electric Ry. Co., to construct an electric railway. It is said that work will begin in the middle of October.

EAST ST. LOUIS, ILL.—The Illinois Central R. R. Co. has decided to install an electric system on the old St. Louis, Belleville & Southern Ry., between East St. Louis and Belleville, a distance of about 14 miles, according to reports.

KANSAS CITY, KAN.—At a meeting of the city council, Aug. 16, an ordinance was passed providing for the changing of the Fifth St. cable line into an electric road. Local papers state that the work of changing the system will be resumed at once and pushed to completion.

LAWRENCE, KAN.—A franchise was granted to the Lawrence Electric Ry. Co., Aug. 24, to replace its present street car system by an electric system. It provides that work shall commence within 60 days, and that five miles shall be completed by March 1, and the entire system, eight miles, by July 1.

KANSAS CITY, MO.—The Jackson County Electric Ry. Co. has applied to the county court for franchises for two new lines of electric railway, one to follow Independence Ave. from Kansas City to Independence; the other from the south city limits to Dobson. Pres., F. W. Sears.

GAINESVILE, TEX.—The Gainesville Park St. Ry. Co. was incorporated Aug. 23; capital stock, $100,000. Incorporators, J. M. Lindsay, Lewis Lindsay, Henry Lindsay, Geo. Lindsay, H. E. Eldridge.

LOS ANGELES, CAL.—A meeting of the citizens of San Gabriel and Alhambra has been held to raise a bonus of $20,000 to be paid the Los Angeles Terminal Ry. Co., to secure the construction of an electric line four miles long from South Pasadena to San Gabriel Sanitarium, passing the San Gabriel Mission and Alhambra. It is believed the money will be raised within a few weeks.

OAKLAND, CAL.—Local papers announce that the Southern Pacific Co. will soon adopt electric motors on all its lines in Alameda county, the San Pablo Ave. cable road to be the first line to be changed.——Also that the Oakland, San Leandro & Haywards Electric Ry. Co. has commenced the work of raising its tracks on East Twelfth St. to the official grade, and that the Oakland Transit Co. will improve its tracks on the thoroughfare as soon as new rails arrive from the East.

HONOLULU, HAWAII.—Press reports state that August Drieir, manager of Elell plantation, has given an order to Theodore Hoffman, Mgr. of the Hawaiian Electric Co., for the equipment of two miles of electric railway, including one 50-HP. electric locomotive. This will be the first electric line in the islands.

LONDON, ENGLAND.—Bids are asked until Sept. 5 for the materials and construction of the track and permanent way of about 13 miles of tramways (in sections) in the Potteries district of North Staffordshire, for the British Electric Traction Co., Ltd. For information, address Permanent Way Engr's. Office, Donington House, Norfolk St., Strand, W. C.

ELECTRIC LIGHT AND POWER.

CHESTER, MASS.—The question of building a plant is being considered.

MEDWAY, MASS.—The committee has decided to award the 5-year lighting contract to the Medway Electric Light Co. The plant is to be in operation Oct. 1. The company is endeavoring to secure business in Millis. Pres., John McGuinnis; Secy., C. P. Harding.

ALBANY, N. Y.—Jacob V. Jacobs, Deputy Supt. of Public Buildings, has submitted a report for a plant for the capitol building and grounds, according to reports. There are at present in use about 10,600 incandescent and 60 arc lights, costing $42,000 a year.

ALBION, N. Y.—Press reports state that the plant and franchise of the Albion Electric Light Co., the stock of which is owned principally by the estate of E. K. Hart and Wm. G. Swan, are to be sold to the new company, the Albion Power & Light Co. The old company was organized eight years ago. Its contract with the trustees for lighting the streets terminated last April, and was not renewed, as better terms were offered by Mr. Lum, the promoter of the new company. A large number of improvements will be made, including a new power house. Engr. and Gen. Mgr., Wallace G. Johnson; Secy., Sanford T. Church.

AUBURN, N. Y.—The contract for furnishing a plant for the state prison has been let to Barnes & Payton, Troy, N. Y., at $6,189. The plant will be installed by the convicts.

CENTRAL ISLIP, N. Y.—Bids are asked until Sept. 22 for furnishing the materials and for erecting a power plant, warming, ventilation and hot-water supply; water supply and distribution; plumbing and drainage; engines and generators; and the electric wiring and fixtures, of a new colony of hospital and accessory buildings at Central Islip, for Manhattan State Hospital. State Arch., I. G. Perry, Albany; Pres. Bd. Mgrs., Henry E. Howland, 1 Madison Ave., New York.

CENTERTON, N. J.—It is stated that the Parvin Mill at Centerton has been sold to Philadelphia parties for $10,000. It is understood that an electric light plant will be put in to light the nearby towns.

COHOES, N. Y.—The Cohoes Electric Light Co. is reported as considering the question of extending its plant.

CHESTER, PA.—Bids are asked until Sept. 2 for lighting the borough of Prospect Park with electricity. Chn. Com., F. McGinnis.

JOHNSTOWN, PA.—The 3-year lighting contract with the Johnstown Electric Light Co. expires Oct. 1. There is some discussion of the question of the city building a plant.

LANCASTER, PA.—Bids are asked until about Sept. 10 for the purchase of $100,000 of 30-year first mortgage bonds for extending the incandescent system, etc., of the plant of the Lancaster Electric Light, Heat & Power Co Pres., W. F. Beyer, 33 North Duke St.

OAKLAND, MD.—It is stated that the council has authorized R. S. Jamison, Mayor, to make D. E. Offutt an offer of $13,000 for his electric plant. The town now pays Mr. Offutt $170 a month for arc lights on the streets. Should Mr. Offutt accept the offer, the authorities will provide for an issue of bonds and improvements will then be made.

TRAPPE, MD.—J. I. Chaplain, M. D., writes us that it is proposed to construct a plant, but the plans are not sufficiently matured to ask for bids at present.

FREDERICKSBURG, VA.—T. McCracken, Chn. Com., writes us that this city is getting data as to cost of wiring, dynamos, engines, etc., for a plant. Mr. McCracken wishes to correspond with electric companies about building a plant. It is likely that the town will be ready to secure bids in about 10 or 15 days. The plant will cost about $9,000.

NORFOLK, VA.—Bids are asked until Sept. 13 for furnishing the navy yard with two direct-connected electric generating sets, one switchboard and 30 lightning arresters. Edwin Stewart, Paymaster-Gen., U. S. Navy, Washington,

ORANGEBURG, S. C.—The council is reported as arranging for the construction of a plant and water-works.

ARLINGTON, GA.—An election will probably soon be held to vote on the question of issuing bonds for a plant and water-works.

PENSACOLA, FLA.—Bids are asked until Sept. 24 for installing a plant at the navy yard. The appropriation for this work is $10,000. M. T. Endicott, Chn. Bureau Yards and Docks, Washington, D. C.

TUSCUMBIA, ALA.—The question of building a plant in connection with the proposed water-works is being considered, according to reports.

LAKE PROVIDENCE, LA.—R. L. Hill is reported as wishing to receive estimates for materials for a plant and water-works.

FRANKFORT, KY.—Arrangements are reported as being made for the proposed plant for the capitol building.

MOUNT GILEAD, O.—Geo. J. Young, Clk., writes us that at election held Aug. 27 this place voted against issuing $33,000 in bonds for a plant and water-works. On account of the light vote another election will probably soon be held.

NEW RICHMOND, O.—It is stated that an election will be held Sept. 6 to vote on the question of issuing $30,000 in bonds for a plant and water-works. Engr., E. F. Layman, 32 East 3d St., Cincinnati, O.

TOLEDO, O.—T. R. Cook, Supt. water-works, writes us that no steps have yet been taken towards establishing a plant at the pumping station. There has been considerable preliminary discussion.

WESTERVILLE, O.—The Westerville Electric Co. has secured a 10-year franchise and a 5-year contract to light the village. A plant will be built at once. A 40 K-W. 220-volt dynamo, a 60-HP. engine, etc., will be put in. E. S. Aldrich, 11 Wesley Block, Columbus, O., engineer in charge, wishes prices on the generator, on 10 220-volt enclosed arc lamps, 6,000 lbs. W. P. wire, 200 poles and all necessary supplies.

GRAND RAPIDS, MICH.—Bids are asked until Sept. 20 for furnishing buildings, machinery, etc., for a complete plant, as stated in our advertising columns. Pres. Bd. Pub. Wks., Wm. T. Johnston; Secy., Fred. A. Twamley.

CLINTON, MICH.—It is stated that the municipal plant will be extended. F. Ellis may be addressed.

ST. LOUIS, MICH.—Bids are asked until Sept. 9 for constructing a dam, power house, installing machinery, etc., and until Sept. 26 for the purchase of $20,000 of 4% bonds for the proposed plant, etc. Engr., E. Z. Burns; Cy. Clk., Jno. R. Wilson; Mayor, Parker Merrill.

CHICAGO, ILL.—Bids are asked until Sept. 9 for furnishing steam piping and a condenser for the electric light plant at Rice and Lincoln Sts. Edward B. Ellicott, Cy. Electrician.

GREENUP, ILL.—Bids are asked until Sept. 10 for furnishing and building a plant to be operated in connection with the water-works. Gasoline engines will be used. It will have a capacity for 17 arc and 200 20-c. p. incandescent lights; estimated cost, $2,000. Engr., J. C. Riper, Indianapolis; Clk., W. H. Cuningham.

SHELBYVILLE, ILL.—It is stated that the Trout Bros.' electric light plant, which has been in the hands of a receiver, was sold Aug. 23 to the Shelbyville Water & Light Co. for $9,300. The purchase gives the latter company a monopoly of the water supply and lighting of the town.

EAU CLAIRE, WIS.—It is stated that this city is securing data regarding municipal plants.

LONEROCK, WIS.—The question of building a plant is being considered, according to reports.

DULUTH, MINN.—Press reports state that a deal for the Jay Cooke property on the St. Louis River, owned by the St. Louis River Water Power Co., is in progress. An English syndicate is said to be negotiating for it and the price at which it is held is $1,500,000. About 10 miles of the river is included in the property. J. M. Butler, Philadelphia, Pa., represents the Cooke interests.

REDLAKE FALLS, MINN.—The council is reported as considering a proposition from Marcus Johnson for putting in a plant.

PLEASANTON, KAN.—J. P. Holmes, Cy. Clk., writes us that this place will not have electric lights, as was recently reported.

WATERTOWN, S. DAK.—O. M. Kirlin writes us that the equipment for the proposed plant has not yet been purchased, but will be very soon.

FARGO, N. DAK.—E. A. Hughes and Gen. Hughes, Bismarck, N. Dak., will let the contract at once for the proposed plant, according to reports.

LOS ANIMAS, COLO.—This place voted Aug. 23 against granting a 20-year franchise to J. B. Downing, Pueblo, Colo. It is stated that the opponents are in favor of the municipal ownership of the plant.

TACOMA, WASH.—The council has refused to grant a franchise to the Snoqualmie Falls Power Co. The Westinghouse Electric & Mfg. Co., Pittsburg, Pa., has been awarded the contract for 2,000-HP. generators, motors, etc., for the plant. Pres., C. H. Baker, Seattle, Wash.

PORTLAND, ORE.—Bids are asked until Sept. 19 for lighting the streets for a term of two years with arc and incandescent lights; check, $30,000. The present contract expires April 1, 1899. Chn. Com. J. C. Luckel.

DUNDAS, ONT.—It is stated that the council will grant a 15-year franchise to the Dundas Electric Light Co. The town will use 150 incandescent and four arc lights. Geo. H. Harper, Mgr.

MONTREAL, QUE.—Bids are asked until Oct. 1 for constructing a head-race complete for the power plant of the Shawinigan Water & Power Co., as described in our advertising columns. We are informed that the company has prepared plans to utilize Shawinigan Falls on the St. Lawrence River, 17 miles from Three Rivers, or about 100 miles from Montreal. There is a fall of 165 ft., with a water supply which will develop 200,000 HP. The company has decided to install at once a plant capable of developing 100,000 HP., and is now calling for bids for the construction of the head-race. It is understood that the company will be in a position to sell power at Three Rivers cheaper than it can be obtained at any other port in the world reached by ocean-going vessels, and at the falls at a proportionally low figure. Engrs., T. Pringle & Son, Imperial Bldg., Montreal; Secy., B. Shepherd.

NEW COMPANIES.—H. W. & M. Electric Co., New York; $25,000; Charles Hagedorn, 227 13th St., Brooklyn.

Keystone Electric Construction Co., Tunkhannock, Pa.; $10,000.

Standard Electric Co., Parsons, Pa.; $40,000.

Loveland Power & Electric Light Co., Loveland, O.; $10,000; I. W. Newcomer, C. C. Strickleman, W. H. Stubbs, H. A. Cayne, R. B. Corwin.

Keeseville Electric Co., of Chesterfield, N. Y.; $30,000; Orville S. Morse, Henry M. Prime, A. W. Boynton, Keeseville; George F. Morse, Peru, N. Y.; Henry E. Barnard, Plattsburg, N. Y.

Morrow Power & Electric Light Co., Morrow, O.; $10,000; W. H. Stubbs, R. R. Corwin.

Wetmore Electric Co., Lowville, N. Y.; $40,000; to light Lowville, Croghan and New Bremen; George W. Pulver, Syracuse; Jacob Strife, Oliver P. Hedden, Lowville; Thomas Glenn, Croghan.

Dunmore Electric Light Co.; $50,000, with $5,000 paid in; James E. Watkins, Taylor, Pa.; Deputy Recorder Anthony T. Irwin, Dunmore; ex-County Surveyor Abraham Dunning, ex-Mayor John H. Fellows; State Senator James C. Vaughn, Scranton.

Perry Electric Light, Heat & Power Co., Newport, Pa.; $13,000, with $1,300 paid in; Treas., Samuel S. Leiby, Marysville, Pa.; Jas. R. Van Dyke, Philadelphia; J. S. Leiby, Newport.

Consumers' Electric Co., Cleveland, O.; to light the west side of Cleveland; Pres. and Treas., A. W. Offerman; Secy., Chas., P. Salen.

Sonoma Water & Power Co., Genoa, Nev.; $10,000.

BRIDGES.

WESTFIELD, MASS.—The county commissioners have ordered the construction of a new 115-ft. iron or steel highway bridge, with a 22-ft. roadway and one sidewalk, over Little River, according to report.

YONKERS, N. Y.—The council is reported to have approved the plans for a bridge over the Nepperhan River, on Nepperhan St., prepared by S. L. Cooper, Comr. of Pub. Wks. Bids for the same will soon be asked.——Pennell & O'Hern have the contract for the masonry abutments of the Hastings Ravine bridge on Warburton Ave. extension, and Dougherty & Berrigan have the contract for the stone bridge over Rowley Brook.

HOBOKEN, N. J.—The Erie R. R. and the West Shore R. R. have agreed jointly to pay $15,000 of the cost of the proposed Park Ave. viaduct, to be erected by the freeholders, the total cost of which will be about $72,000. E. W. Harrison, Ch. Engr.

COCALICO, PA.—The Massillon Bridge Co., Massillon, O., was awarded the contract Aug. 20 for the superstructure of the new iron bridge over Cocalico Creek, as noted in our issue of Aug. 11. Its bid was $1,450. Kaufman & Kramer were awarded the contract for the masonry substructure at $2.50 a cu. yd. John B. Eshleman, Chn. Comrs., Lancaster, Pa.

EMAUS, PA.—The Passaic Bridge Co., Passaic, N. J., is reported to have been awarded the contract to build two iron bridges across the tracks of the street railway company on Perkiomen and 4th Sts.

LANDENBURG, PA.—William Founds has been awarded the contract for the masonry of an iron bridge at this place, according to report.

STROUDSBURG, PA.—The bridge over the Delaware River to the island at this place was washed away, Aug. 25, as the result of a cloudburst above Port Jervis.

MANNING'S FORD, VA.—Bids are asked until Sept. 12 for constructing a 69-ft. iron highway bridge over Broad Run at this place. P. W. Carper, E. F. Burch and Geo. M. Ellmore, Comrs., Leesburg, Va.

NEWPORT NEWS, VA.—Bids are asked until Sept. 19 for the construction of two iron bridges and approaches. J. A. Massie, Cy. Clk.

NEWPORT NEWS, VA.—Bids are asked until Sept. 6 for the purchase of $40,000 4½% bridge bonds; check, $1,000. J. A. Massie, Cy. Clk.

CINCINNATI, O.—The injunction granted the Cincinnati & Wooster Turnpike Co. restraining the county commissioners from constructing an approach to the Indian Hill bridge at the pike crossing has been dissolved, according to report.——The Brockett Bridge Co. has been awarded the contract to build the Mill Creek Bridge on Riddle Road, at $2,900.——A. J. Wellman has secured the contract for the superstructure of the bridge over Mill Creek, at $3,456, according to report.——The Cincinnati Bridge Co. was awarded the contract Aug. 13 for an iron bridge to cost $1,750 over the Miami Canal on Township Ave., according to report. The contract for the approaches was given to A. J. Henkel & Co., for $2,269. Guy M. Gest was awarded the contract for the substructure and approaches of the Mill Creek bridge on the Springfield pike at $35,155. F. S. Krug, Cy. Engr.

HAMILTON, O.—The following bids were received Aug. 22 by the county commissioners for the construction of the new Columbian Bridge: King Bridge Co., Cleveland, O., $55,221; Bellefontaine Bridge & Iron Co., Bellefontaine, O., $61,500; Rogers Iron Co., Springfield, O., $56,000; Variety Iron Works Co., Cleveland, O., $57,200 and $58,200; Youngstown Bridge Co., Youngstown, O., $50,648, and $50,900; Iron Substructure Co., Columbus, O., $59,000; Lafayette Bridge Co., Lafayette, Ind., $49,000, $35,000, $40,000, $23,000, $71,000, $57,300, $68,000 and $51,000; Oregonia Bridge Co., Oregonia, O., $49,500, $36,000, $41,000 and $23,500; Toledo Bridge Co., Toledo, O., $48,850 and $43,000; Penn Bridge Co., Beaver Falls, Pa., $55,195; Mt. Vernon Bridge Co., Mt. Vernon, O., $56,334; Champion Bridge Co., Wilmington, O., $56,975; Brockett Bridge Co., Cincinnati, O., $55,487; J. T. Guillaume, $69,500, $68,500 and $62,000, superstructure only, $42,000; New Columbus Bridge Co., Columbus, O., $57,365; Milwaukee Bridge & Iron Works, Milwaukee, Wis., $50,000; Wrought Iron Bridge Co., Canton, O., $51,100; Massillon Bridge Co., Massillon, O., $56,000 and $55,000; Cincinnati Bridge Co., Cincinnati, O., $55,550; Pittsburg Bridge Co., Pittsburg, Pa., $57,309; Peter E. Schwab, 38 different bids, varying in price from $31,000 to $79,000. L. A. Dillon, Cy. Engr.

LORAIN, O.—The Osborn Co., Cleveland, O., has been appointed engineer in charge of the new bridge over Black River at Erie Ave., the estimated cost of which is $175,000.

TIFFIN, O.—The Canton Iron Bridge Co., Canton, O., has received a contract to build an iron bridge at Tiffin.

WOODSFIELD, O.—Bids are asked until Sept. 9 for the erection of stone abutments for the Buschy Ford bridge. W. T. Wood, County Auditor.

ANDERSON, IND.—Thos. P. Kelly has been awarded the contract to build the stone viaduct at 11th and John Sts., at $2,900, according to report. H. H. Rogers, Cy. Engr.

BIG RAPIDS, MICH.—The Detroit Bridge & Iron Works, Detroit, is reported to have a contract for an $18,000 steel bridge for the Grand Rapids & Indiana Ry. Co. at Upper Big Rapids, over the Muskegon River.

MUSKEGON, MICH.—The council has passed a resolution, according to report, condemning the Biedler St. bridge and ordering it torn down. Clifford Gamble, Cy. Engr.

EAU CLAIRE, WIS.—It is reported that an election will be held Sept. 6 to vote on the question of issuing bonds for a new bridge to cost about $50,000. C. A. Alderman, Cy. Engr.

BRAINERD, MINN.—Bids are asked until Sept. 9 for the construction of a steel bridge over a ravine from Kingwood St. to Kindred St. F. A. Farrar, Cy. Clk.

MINNEAPOLIS, MINN.—The Sherwood-Sutherland Co. has been awarded a contract for repairing and paving the Wabash St. bridge, at $6,603, according to report.——The council is reported to have approved the recommendations of the ways and means committee that $30,000 be appropriated for widening the Central Ave. bridge over the East River. F. W. Cappelen, Cy. Engr.

BURLINGTON, IA.—High water is reported to have damaged or destroyed the following bridges: Rolling Mill road, 120-ft., destroyed; Dry Branch on Walker road, 100-ft., destroyed; Flint River, 100-ft., washed away; Honey Creek on Iowa City road, 38-ft. steel, badly damaged; Augusta township, 100-ft., badly damaged; Flint River on Bottom road, 24-ft., steel, destroyed; Mediapolis bridge on Iowa City road, 30-ft., destroyed; Yellow Springs branch, 90-ft., steel, destroyed; North Bottom bridge over Yellow Springs branch, 130-ft., destroyed; Howard branch, 30-ft., steel, washed away, and Washington road bridge, 90-ft., destroyed. Address County Bridge Commissioners.

OMAHA, NEB.—The county clerk has been instructed to call for bids for a 150-ft. steel bridge over the Elkhorn River, according to report.——The Canton Bridge Co., Canton, O., has received the contract to construct the 75-ft. steel bridge across a ravine on the Millard road for $1,675. R. W. Howell, Cy. Engr.; Geo. F. Monroe, Chn. Bd. Pub. Wks.

DILLON, MONT.—Bids are asked until Sept. 5 for constructing a 60-ft. wooden bridge at the Montgomery crossing on Big Hole River. E. H. Mayers, Clk.

HOUSTON, TEX.—About 200 citizens have petitioned the council to replace the present Franklin St. bridge by a new one, according to report. L. A. Gueringer, Cy. Engr.

CHEHALIS, WASH.—Peter Summersett and William Young were awarded the contracts for the Alpha and Salmon Creek wooden bridges, Aug. 5.——The San Francisco Bridge Co., San Francisco, Cal., was awarded the contract Aug. 20 for the Lincoln Creek bridge at $8,965. Savage & Schofield were awarded the contract for the Boistfort bridge at $2,500. Tweeden & Mills, Tacoma, Wash., received the contract for the Claquito bridge at $5,590. The original bids received Aug. 5 were rejected.

MONTESANO, WASH.—The Columbia Bridge Co. has been awarded the contract, according to report, for the construction of the 80-ft. steel draw span and the approaches of the South Bay bridge, at $9,236.

BUILDINGS.

ST. ALBANS, VT.—Bids are asked by the supervising architect, Washington, D. C., until Sept. 19, for the low-pressure, return circulation steam heating and ventilating apparatus for the U. S. building in this city.

BOSTON, MASS.—The following bids were received by the school-house committee Aug. 22 for the erection of a new high school building at South Boston: John S. Jacobson & Son, Boston, $242,971; W. L. Clarke & Co., $264,000; W. H. Keyes & Co., Boston, $265,187; Mead, Mason & Co., Boston, $266,600; James Fagan, $273,535; W. S. Sampson & Son, Boston, $281,000; Woodbury & Leighton, Boston, $282,000; Connery & Wentworth, $290,000; Chas. H. Dodge & Co., $328,323.——Reports state that the contracts for erecting the Dorchester high school and the Brighton school buildings have been awarded to Frank G. Coburn & Co., Melrose, Mass., at $217,900 and $34,900, respectively.

BROCKTON, MASS.—Bids are asked by the supervising architect until Sept. 28 for the construction (except heating apparatus and electric wire conduits) of the post-office building in Brockton, as stated in our advertising columns.

BROOKLYN, N. Y.—Bids are asked by the department of docks and ferries, Pier A, North River, New York, until Sept. 6 for preparing for and completing the recreation building at the foot of North 2d St., East River, in the Borough of Brooklyn. It is estimated that the following material will be required: 188,000 lbs. of structural steel; 2,050 lbs. of screw bolts; 3,100 sq. ft. of corrugated iron; 14,000 sq. ft. of tin roofing; 6,150 sq. ft. of exterior and interior metal work, etc.——Bids are asked by the bureau of yards and docks, navy department, Washington, D. C., until Sept. 17, for the erection of a storehouse for steel, the appropriation for which is $17,500. Mordecai T. Endicott, Ch. of Bureau.——Plans have been filed by Rev. James Duffy, Pastor of St. Agnes's Catholic Church, at Sackett and Hoyt Sts., for a new church building to be erected in Degraw St., near Hoyt St., at a cost of about $60,000. Arch., Thos. J. Houghton, 213 Montague St., Brooklyn.

CENTRAL ISLIP (L. I.), N. Y.—Bids are asked until Sept. 22 for the erection and finishing, power plant, warming, ventilation and hot-water supply; water supply and distribution; plumbing and drainage; engines and generators; and the electric wiring and fixtures of a new colony of hospital and accessory buildings at Central Islip for the Manhattan State Hospital. Henry E. Howland, Pres. Bd. of Mgrs., 1 Madison Ave., New York.

NEW YORK, N. Y.—Plans are being prepared, according to reports, for six 6-story stone store and apartment buildings, to be erected on 116th St., near 8th Ave., at a cost of about $200,000, for Thomas Martin, of Brooklyn, N. Y. Arch., F. T. Camp, 97 Cedar St., New York.——Plans have been filed by W. H. Gildersleeve, 213 West 4th St., for two 6-story brick warehouses and stable, at 244 to 248 West 27th St., to cost $70,000. Arch., G. A. Edelsvard; by the Church of the Holy Rosary, for a 1-story brick church building on 119th St., west of Pleasant Ave., to cost $90,000. Arch., T. F. Houghton, 213 Montague St., Brooklyn, N.Y.; Builder, John T. Brady; by Charles Thorley for a 9-story brick office and store building at Broadway and 42d St., to cost $60,000. Arch., H. F. Kilburn, 150 5th Ave.; by Arthur Gorsch, 1444 3d Ave., for four 5-story brick flats and store buildings on 125th St., west of Amsterdam Ave., to cost $80,000. Arch., S. Sass, 25 Chambers St.; by Eva Steinmetz, 579 West 146th St., for five 3-story brick dwellings on 149th St., west of Amsterdam Ave., to cost $70,000. Arch., C. Steinmetz; by George Brown for four 5-story brick flat and store buildings, at 148th St and 8th Ave., to cost $88,000. Arch., Jas. W. Cole, 403 West 51st St.; by Hyman & Oppenheim, 103 4th Ave., for four 6-story brick flat buildings at 323 to 331 East 16th St., to cost $114,000. Archs., Schneider & Herter, Bible House; by Jacob Jung, 31 West 117th St., for a 5-story brick flat and store buildings at 83d St. and Lexington Ave., to cost $50,000. Arch., Charles Stegmayer, 306 East 82d St.; by Louis Lese, 231 East 6th St., for four 6-story brick flat and store buildings at 105th St. and 1st Ave., to cost $113,000. Arch., G. F. Pelham, 503 5th Ave.; by Geo. A. Fisher, 695 East 141st St., for three 5-story brick dwellings on 90th St., west of Central Park West, to cost $54,000. Arch., G. F. Pelham.

ELIZABETH, N. J.—A. F. Leicht and F. T. Camp, Archs., 97 Cedar St., New York, inform us that they have prepared plans for a new stone church building, with a Sunday-school room, to be one and two stories high, for the Central Baptist Church of this city. It will have a slate roof and will be heated by steam. Bids will be received for erecting the building about Sept. 1.

JERSEY CITY, N. J.—Bids are asked by the clerk of finance committee until Sept. 7 for the purchase of $150,000 of 4% gold public library bonds.

WEST HOBOKEN, N. J.—We are informed that a 2-story brick extension to the building occupied by the Hudson Trust & Savings Institution will be erected by John Larkin, contractor, West Hoboken, to cost about $10,000. All contracts have been let, and no new heating plant will be required. Arch., H. Kreitler, 62 Broad St., New York.

WOODBURY, N. J.—Wm. M. Carter, Cy. Engr., writes us that the contract for building the new fire engine house has been let to John R. R. Fowler at $6,125.

CHESTER, PA.—Plans are being prepared for a new high school building to be erected in Chester at a cost of about $100,000. Arch., Seymour Davis, 907 Walnut St., Philadelphia.

NEW KENSINGTON, PA.—It is stated that the Opera House, Harmer's block, Jacobin's block and dwellings were destroyed by fire last week; loss, $50,000.

PENNSBURG, PA.—P. J. Guthrie, Philadelphia, has been awarded the contract for erecting the new Lutheran Church building at $11,000.

PHILADELPHIA, PA.—Chas. McCaul, 10 North 11th St., is reported to have been awarded the contract for erecting the new 14-story office building for the West End Trust & Safe Deposit Co.

PITTSBURG, PA.—Bids are asked until Sept. 14 for erecting a school building in the 20th ward. Arch., C. M. Bartberger, Westinghouse Bldg.; Secy. Bd. Education, C. M. Sheaffer.

BALTIMORE, MD.—Bids were received by Lieut.-Col. W. A. Jones, U. S. Light-House Engr., Baltimore, Aug. 25, for the construction of the Wade Point Light-House, N. C., as advertised in Engineering News, as follows:

John L. Grim, Philadelphia, Pa.	$16,300
Wilkins & Kuemmerle, Philadelphia, Pa.	10,000
Houston Construction Co., Philadelphia, Pa.	9,150
W. R. Taylor, Norfolk, Va.	9,140
F. C. Artur, Philadephia, Pa.	9,600

WASHINGTON, D. C.—The following bids have been received for the construction of an addition to engine house No. 14 on 8th St., between D and E Sts., N. W.; N. H. Thomas & Co., $5,447; Gleason & Humphreys, $5,701; P. J. Bresnehan, $5,750.

NEWPORT NEWS, VA.—Bids are asked until Sept. 19 for the construction of a brick jail and hospital building. J. A. Massie, Cy. Clk.

PETERSBURG, VA.—Bids are asked for the fireproofing and fitting up with metallic furniture of the clerk's office of this city. Chn. Com., John D. Watkins.

NASHVILLE, TENN.—A fire in this city Aug. 30 is reported to have destroyed $500,000 worth of property. The Phillips-Buttorff Mfg. Co. and A. J. Warren suffered the greatest loss.

COLUMBUS, O.—Bids are asked until Sept. 24 for constructing the new state capitol building. Archs., Hannaford & Sons, 6th and Vine Sts., Cincinnati; Chn. Com., A. S. Bushnell, Columbus; Clk., Opha Moore.

OXFORD, O.—Bids are asked until Sept. 13 for additions to the Miami University, and for a steam heating apparatus. W. O. Thompson, Chn. Bldg. Com.

SOUTH BROOKLYN, O.—Bids are asked until Sept. 14 for the purchase of $2,500 of 6% bonds for a city hall. Clk., W. T. Pupikofer.

TOLEDO, O.—Bids are asked until Sept. 6 for the construction of four fire engine houses to be located in this city. Cy. Clk., L. P. Harris.

LOGANSPORT, IND.—A fire in this town, Aug. 23, destroyed all the business buildings, including that of the Chicago Lumber & Coal Co; reported loss, $90,000.

DETROIT, MICH.—Bids were asked until Aug. 30 for furnishing the materials and for constructing a market building at Winder and Russell Sts.; check, $1,000. Pres. Bd. Pub. Wks., D. W. H. Moreland.

CARTERVILLE, ILL.—A fire at this place, Aug. 23, destroyed a number of buildings in the business portion of the town: estimated loss, $75,000.

CHICAGO, ILL.—Frederick Ayer, 213 Wabash Ave., has been granted a permit to build a 9-story business block to cost $200,000.——The elevator of the Northwestern Terminal Elevator Co., at Orleans St. and the river front, was destroyed by fire Aug. 22, causing a loss of $150,000, mostly on the building. Secy., E. W. Thompson.

DANVILLE, ILL.—Bids are asked by the National Home for Disabled Volunteer Soldiers, until Sept. 8, for erecting a building for the governor's residence at the Danville branch: also for erecting a guard-house. Address W. C. Gunnell, C. E., 4 Post-Office Bldg., Danville.——The Prox & Brinkman Mfg. Co., Terre Haute, Ind., were the lowest bidders, Aug. 16, for a heating and ventilating apparatus for a mess hall and kitchen buildings for this Home, at $5.390.

CHARLESTON, ILL.—The contract for building the Coles county court house has been let to A. G. Campfield, Richmond, Ind., at $74,500.

WEST SUPERIOR, WIS.—Bids were asked until Aug. 30 for erecting a 9-story theatre and office building for W. H. Miller, according to reports; estimated cost, $110,000. Arch., Geo. O. Garnsey, 185 Dearborn St., Chicago, Ill.

MINNEAPOLIS, MINN.—Pike & Cook, 220 South 4th St., Minneapolis, has been awarded the general contract for rebuilding the Andrus Bldg. at 5th St. and Nicollet Ave., to cost about $100,000. Arch., F. B. Long.

DES MOINES, IA.—S. T. Roberts was the lowest bidder for the erection of a building for the Nichols & Shepard Co., at $16,662.

ROSEDALE, KAN.—Bids are asked until Sept. 2 for constructing an 8-room brick and stone school building. Arch., L. G. Middaugh, Massachusetts Bldg., Kansas City, Mo.; Clk., W. E. Harvey.

TOPEKA, KAN.—The Hope Ventilator Co., 1633 West Prospect Place, Kansas City, Mo., is reported to have been awarded the contract for furnishing and installing the heating and ventilating apparatus at the insane asylum building at $8,549, and that for the Winfield asylum at $5,755.

ST. LOUIS, MO.—Bids are asked by the board of education until Sept. 10 for the erection of two school buildings in this city. Comr., Wm. B. Ittner.

MANDAN, N. DAK.—Bids are asked until Sept. 9 for building two school houses. Clk., J. T. Nelson.

VALLEY CITY, N. DAK.—Bids are asked until Sept. 5 for furnishing the steam heating plant for the court house, according to reports. Chn. County Comrs., E. K. Myhre.

FORT WORTH, TEX.—Bids are asked until Sept. 10 for the construction of the building for a Masonic Widows' and Orphans' Home for the Grand Lodge of Texas, near Fort Worth. Address A. M. Carter, Scott-Harrold Bldg.; Arch., S. B. Haggart, 703 Main St., Fort Worth.

DALLAS, ORE.—Bids are asked until Sept. 8 for the erection of a county court house in this city. E. Hayter, Clk. of County Comrs.; D. D. Neer, Arch., Portland, Ore.

TORONTO, ONT.—The board of control has accepted the bid of the Sprague Co. of New York, for erecting three electric elevators, with a plant for five, in the municipal building, at $26,475.

WATER-WORKS.

OAKLAND, ME.—The Maine Water Co., it is stated, will put in the proposed works in this place at once. The company was recently granted a franchise. W. T. Haines and Geo. Learned, Waterville, Me., are interested.

BOSTON, MASS.—Norcross Bros., Worcester, Mass., have been awarded the contract for building the new low service reservoir at Chestnut Hill, at $182,660. The bids will probably be given in our issue of next week.

SPRINGFIELD, MASS.—Local papers state that the commissioners expect to recommend to the next city government measures for improvements to the works and water supply, to cost from $100,000 to $300,000. F A. Holden, Clk.

ALDEN, N. Y.—This place has voted to issue $18,000 in bonds for works.

BAINBRIDGE, N. Y.—C. E. Clark writes us that the corporation has not decided the question of new works. There is a plant in operation owned by the Bainbridge Water-Works Co. It is said to be not entirely satisfactory. Population (1890), 1,050.

COPENHAGEN, N. Y.—Surveys for works are being made. It is proposed to secure a water supply from a lake in Pinckney, about five miles distant.

ELLIS ISLAND, N. Y.—Holmes & Cogan, Jersey City, were awarded a contract, Aug. 29, by the United States Government to lay a water pipe from the foot of Phillip St., Jersey City, to Ellis Island. The pipe line will be 2,000 ft. long, and the contract price is $14,045. The city will receive $100 a 1,000,000 gallons for all water furnished, but the quantity that will be needed will not be known until the supply is turned on. It is stated that it was for this reason that Jersey City insisted that the Government should pay for the laying of the pipe.

ROME, N. Y.—Morton & Hill, Attica, N. Y., have been awarded the contract at $10,290, for furnishing and erecting the water tower at the Rome State Custodial Asylum.

WHITESBORO, N. Y.—This place voted Aug. 26 against building works.

CAMDEN, N. J.—Chas. A. Hague, 39 Cortlandt St., New York, has been selected to test the water-works.

HIGHBRIDGE, N. J.—H. Satimer, Borough Clk., writes us that the proposed gravity works will cost about $12,000. The question of making the improvement has not yet been voted upon. Population, 1,300.

JERSEY CITY, N. J.—Bids are asked until Sept. 6 for furnishing 90 dozen ⅝-in. stop cocks, 50 dozen ¾-in., 25 dozen 1-in., and 6 dozen 1½-in. stop cocks, about 10,000 lbs. of lead, etc. Geo. T. Bouton, Clk. Bd. St. and Water Comrs.

MILFORD, N. J.—The council is considering propositions for building works.

SALEM, N. J.—We are informed that the contract for furnishing the pump for the filter plant at the water-works has been let to Henry R. Worthington, 86 Liberty St., New York, at $387; that for the filter basin was let to C. J. Young and Jos. H. Young, 4618 Chester Ave., Philadelphia, at $3,100.

SPRING LAKE, N. J.—It is stated that the council has appropriated $70,000 for new works.

BRADDOCK, PA.—This place voted, Aug. 23, to issue $81,000 in bonds to complete the works.

LEBANON, PA.—At the last meeting of councils ordinances were passed extending the water mains from Willow St. through Pheasant alley to Spring alley; and also for laying 8-in. water mains in Church St., from Sixth St. to Fifth St. An ordinance has been passed providing for 25 additional fire hydrants. J. D. Kerr, Secy. Water Board; Geo. W. Hayes, City Engr.

PHOENIXVILLE, PA.—M. P. Quinn, Pottsville, Pa., has been awarded the contract for laying water pipe in this city, according to reports.

PHILADELPHIA, PA.—Bids are asked until Sept. 6 for furnishing a permanent water supply in connection with the Pennsylvania Ave. subway and tunnels. Thos. M. Thompson, Dir. Pub. Wks.

DELAWARE CITY, DEL.—It is reported that the contractors have begun the construction of the proposed works. C. Taylor Leland, Quakertown, Pa., may be addressed.

MIDLAND, MD.—The question of building works to cost about $8,000 is being considered. It is proposed to secure the water supply from Mathes Run, about three miles distant.

POCOMOKE CITY, MD.—Bids are asked until Sept. 14 for constructing works and a sewerage system, as stated in our advertising columns. (Postponement from Sept. 7.) Engrs., Pownall & Minshall, 150 Nassau St., New York; Mayor, R. M. Stevenson.

WASHINGTON, D. C.—Bids for driving deep wells have been received from the following: Rust Well Machinery Co, Ithaca, N. Y.; J. E. Thomas & Son, Lyons, Pa.; Lebanon Valley Artesian Well Co., Lebanon, Pa.; C. Gruver, Alliance, Va.; Wm. C. Miller, Anacostia, D. C.; W. E. Dewitt and Prather & Niemyer, Washington, D. C.

BRISTOL, VA.—Bids are asked until Sept. 21 for furnishing the materials and constructing the proposed works, according to reports. It is proposed to secure a supply of 250,000 gallons of water a day from artesian wells, which have already been driven. Population (1890), 3,000. J. D. Mitchel, Chn. Com.

MOUNT PLEASANT, S. C.—The council is considering the question of securing a water supply. It has not been decided whether to use a standpipe or artesian wells. Intendant, R. V. Royall.

ELBERTON, GA.—An election will be held Sept. 20 to vote on the question of awarding a contract to Geo. J. Baldwin, Savannah, Ga., and 39 Cotton Exchange Bldg., New York; estimated cost of works, $25,000.

SYLVANIA, GA.—The question of issuing bonds for an artesian well for a water supply will probably soon be voted upon.

TUSCUMBIA, ALA.—The question of building works to cost about $25,000 is being considered, according to reports. It is proposed to secure the water supply from Big Spring.

LAKE PROVIDENCE, LA.—It is stated that R. L. Hill wishes to secure prices for machinery for works and a light plant.

JACKSON, O.—The question of building works will be voted upon Sept. 19.

NEW RICHMOND, O.—This place will vote, Sept. 6, on the question of issuing $30,000 in bonds for works and a light plant. Engr., E. F. Layman, 32 East 3d St., Cincinnati.

McCONNELSVILLE, O.—An election will be held Sept. 19 to vote on the question of issuing $20,000 in bonds for works.

MOUNT GILEAD, O.—Geo. J. Young, Clk., writes us that this place voted Aug. 27 against issuing $33,000 in bonds for works and a light plant. It is probable that another election will be held.

ATTICA, IND.—Work on the new reservoir has been begun and it will be completed this fall; its capacity will be 500,000 gallons, and it will be covered with masonry arches. J. A. Foster & Co. are the contractors, and Alvord & Shields, Chicago, Ill., the designing and constructing engineers.

DELPHI, IND.—The report made to the council by Alvord & Shields, The Rookery, Chicago, has been adopted and the changes in the works are being carried out under their direction. Bids for a new 1,000,000-gallon pump have been received. A 100,000-gallon reservoir is being built.

LA PORTE, IND.—We are informed that this city voted Aug. 23 to secure a new water supply. The new supply will probably be secured from Little Kankakee River, requiring an extension of four miles of 20-in. pipe; but the question of the source is still under discussion; estimated cost, $70,000. Population, 10,000. W. C. Weir and Milton J. Henoch, Cy. Engr., may be addressed.

MARION, IND.—Bids are asked by the city clerk until Sept. 3 for laying water pipe in a number of streets.

NEW ALBANY, IND.—Local papers state that the new water company has applied for a franchise.

LAKE ODESSA, MICH.—Wm. H. McCartney, Village Pres., writes us that this place will put in works this fall to cost about $10,000. The contract will probably be let in about two weeks.

LESLIE, MICH.—The question of issuing bonds for works is being considered.

MOUNT PLEASANT, MICH.—Riggs & Sherman, Toledo, O., have been engaged to prepare plans for works and a sewer system for the U. S. Indian School here. Supt., R. S. Graham.

ALEXIS, ILL.—Bids are asked by the city clerk until Sept. 1 for the purchase of $3,000 of 6% water-works improvement bonds.

DUBUQUE, IA.—E. C. Blake, Cy. Engr., writes us that the city has served notice on the Dubuque Water Co. of its intention to buy the works. The company will have six months' time in which to prepare for the sale, according to its charter. The works will be remodeled and put in first-class condition. The plant contains about 44 miles of mains varying in size from 4 to 16 ins.; 353 hydrants, standpipes, pumps, reservoir, etc. It is probable that the city will no more than get the purchase question settled before some time next year. It is hoped, however, to have everything in shape for next season.

EARLING, IA.—This place is reported to have voted to build works.

MAYNARD, MINN.—Bids are asked until Sept. 5 for building the proposed works, according to reports. K. H. Hollan, Recdr.

MINNEAPOLIS, MINN.—We are informed that the following bids were received Aug. 26 for furnishing one or two 10,000,000-gallon pumping engine, as advertised in Engineering News; F. W. Cappelen, Cy. Engr.:

Bidder.	—Engines— One.	Two.
The Holly Mfg. Co., Lockport, N. Y.	$41,000	$80,500
Lake Erie Eng. Works, Buffalo, N.Y.	57,250	109,500
Wilson-Snyder Mfg. Co., Pittsburg, Pa.	47,500	92,000
Henry R. Worthington, New York, N. Y.	42,300	82,300
Edw. P. Allis Co., Milwaukee, Wis.	48,000	94,000

WALKER, MINN.—Bids are asked until Sept. 6 for furnishing the materials and for building works; estimated cost, $6,000. Pres., Chas. Kinkele; Recdr., M. J. Quam.

DEADWOOD, S. DAK.—Francis C. Tucker, Cy. Engr., writes us that the contract has been let for the excavation to bed rock at the dam site for the extensions to the works. The water collected there will be brought in an 8 or 10-in. pipe about 1½ miles, and then pumped about 100 ft., so as to be added to the present supply. The addition will be about 500,000 gallons a day. This supply will be used as an auxiliary in case of the shortness of the present supply. D. A. McPherson, Chn. Com.

SIOUX FALLS, S. DAK.—Local papers state that W. R. Coates, Ypsilanti, Mich., will make a proposition for building new city works. S. B. Howe, Cy. Engr., writes us that nothing has yet been done toward the proposed new works.

JAMESTOWN, N. DAK.—The question of sinking a second and larger artesian well is being considered. The present well is 2 to 4 ins. in diameter and 1,467 ft. deep.

GREAT FALLS, MONT.—This city voted Aug. 20 to purchase the works of the Great Falls Water Co. for $375,000.

GOLDFIELD, COLO.—This place voted Aug. 24 to build works. It is stated that the water supply will be secured from Victor.

PUEBLO, COLO.—A new main will be built to Dundee. Trustees Davis and Mattice may be addressed. Consult. Engr., Jno. W. Hill, Cincinnati, O.

SEDALIA, MO.—L. P. Andrews, Secy. and Treas. Sedalia Water & Light Co., writes us that the works will have a general overhauling. The machinery will be repaired, the pumping station remodeled, a new reservoir, nine miles from the pumping station completed, and a conduit laid to connect the same. Part of the work will be let, the balance will probably be done by the company.

SEATTLE, WASH.—Local papers state that the commission will ask for bids about Sept. 10 for furnishing the materials and for constructing the Cedar River water-works addition. Plans and specifications are about completed, having been prepared under the direction of G. N. Miller, Asst. Engr. The improvements will cost about $1,000,000. Geo. Cotterill, Acting Cy. Engr.

OAKLAND, CAL.—The Contracosta Water Co. proposes to lay about 12 miles of water pipe from the artesian belt for an increased water supply.

SAN MATEO, CAL.—Geo. A. Kertell, Chn. Water Com., writes us that the city contemplates the construction of city works. The question of issuing $80,000 in bonds for the improvement will be voted upon Oct. 22. Chas. E. Moore, Santa Clara, Cal., has prepared preliminary plans and estimates. Population, $1,500. Pres., Bd. Trustees, A. B. Ford; Cy. Clk., R. H. Jury.

SAUSALITO, CAL.—M. M. O'Shaughnessy, 191 Crocker Bldg., San Francisco, is reported to have been engaged to make a report for an increased water supply.

VALLEJO, CAL.—The city trustees have made a survey for an increased water supply from Dugroad Creek, according to reports. Trustees Cooper and Rounds may be addressed.

TEMPE, ARIZ.—It is stated that the council wishes to receive proposals until October for a franchise for supplying this place with water.

MANTI, UTAH.—The question of securing an increased water supply from Funks Lake is being considered. The lake is six miles distant. Population (1890), 2,000.

ALMONTE, ONT.—The question of building works to cost about $50,000 is being considered. Town Clk., L. Coulter.

FRASERVILLE, ONT.—Thos. Crocket, Supt. Temisconata Ry. Co., Riviere du Loup, Que., has been granted a franchise for the proposed works. Engr., C. E. Hoare.

HINTONBURG, ONT.—E. J. Rainboth, Ottawa, is stated to have been granted a franchise for works, the construction to be begun at once.

PETERBORO, ONT.—It is reported that McQuillan & Co., Toronto, submitted the lowest bid at $6,295 for construction of the works at Ashburnham.

WIVENHOE, ENGLAND.—Bids, plans, etc., are asked until Sept. 29 for the proposed water supply for this place. Clk., C. W. Denton, 8 East Stockwell St., Colchester.

HONOLULU, HAWAIIAN ISLANDS.—Gear, Lansing & Co. propose to build works at the Diamond Head addition, according to reports. It is said that a 4,000,000-gallon pump will be purchased from Henry R. Worthington, New York. Supt., Andrew Brown.

IRRIGATION.

LONG CREEK, ORE.—It is reported that Godfrey & Tabor intend to run a ditch to tap Olive Lake. It will be 9 miles long and will cost about $15,000.

WOODBRIDGE, CAL.—The plant of the Woodbridge Canal & Irrigation Co. was sold at auction by Judge Morrow, Aug. 10, to G. Howard Thompson, at $21,000, according to reports.

SALT LAKE CITY, UTAH.—The Davis & Weber Counties Canal Co. has decided to let the contract for the building of the East Canyon dam to Parker, Ferrin Bros. and the Andrews Bridge Co. on a combination bid. The dam is for a reservoir in East Canyon back of Weber Canyon, from which to draw the late water supply for the Davis and Weber counties canal. The work will cost about $35,000.——Press reports state that H. B. Windsor, Pres. Utah Irrigation Co., Salt Lake City, is buying the necessary material for the extension of the company's pipe lines in the southwestern part of Utah, 250 miles south of Salt Lake City.

NEW COMPANIES.—Summer Lake Irrigation Co., Ana River, Township 30, Lake county; $10,000; W. H. Butts, D. S. Dufur, C. C. Hutchinson.

McPherson Irrigating Ditch Co., Gate, Okla., and Englewood, Kan.; to use the water in the Cimarron for irrigation purposes; Benj. F. McPherson, Blair F. Ruth and Ira M. Hewins, of Englewood, Kan.

West Fork Ditch Co.; $5,000; to build ditches in Choteau county, near Chinook; A. J. Davidson, Helena, Mont.; F. D. Parker and Winfield S. Reinbolt, of Chinook, Mont.

Spring Lake Irrigation & Improvement Co., Klamath Falls, Ore.; $10,000; James W. Jory and Charles F. Jory.

Lower Lathan Reservoir Co., Greeley, Colo.; $20,000; to build a reservoir covering 702½ acres east of La Salle, and to have a capacity of about 150,000,000 gallons; Pres., Asa Sterling; Vice-Pres., H. A. Irons; Secy., J. B. Phillips; Treas., A. J. Park.

Full Creek Ditch & Reservoir Co., Denver, Colo.; $64,000; to operate in San Miguel and Montrose counties; L. G. Gray, L. F. Watts and Sadie M. Gray.

SEWERAGE.

DANVERS, MASS.—It is stated that work has been begun on the new system for the Danvers hospital. The contract was recently awarded to F. C. Trumbull & Co., Boston, at $8,300. Snow & Barber, Boston, are the engineers who have the work in charge. The plant is on the west side of Dayton St., Danvers Center, and there are to be 10 filter beds, with 6 and 8-in. pipes leading from Asylum Hill. The largest beds are to be about 100 ft. square.

FALL RIVER, MASS.—Estimates are being prepared for sewers in a number of streets.

HOLYOKE, MASS.—The plans prepared by the city engineer for the new sewer for the Highlands have been approved by the state board of health.

PALMER, MASS.—C. T. Brainerd has been awarded the contract for building the sewers in Depot village, according to reports.

PROVIDENCE, R. I.—Bids are asked until 11 a. m. Sept. 2, for constructing about 2,000 ft. of 34 to 20-in. brick and 3,500 ft. of 18 to 8-in. pipe sewers, etc. Robt. E. Smith, Comr. Pub. Wks.

COHOES, N. Y.—Local papers state that the plans for a system marked "I X L," prepared by Hunter & Fernald, Melrose, Mass., have been adopted by the commission. These plans were described in our issue of Aug. 18. Estimated cost, $127,792.

PHILLIPSBURG, N. J.—Jas. E. Smith, Town Surv., writes us that T. S. Pursell has been awarded the contract for building 5,400 ft. of 24 to 12-in. pipe sewer, at about $6,000. S. P. Stone, Chn. Com.

TRENTON, N. J.—Bids are asked until Sept. 6 for constructing pipe sewers in certain streets, brick paving, etc. C. Edward Murray, Cy. Clk.

WOODBRIDGE, N. J.—An election will be held Sept. 20 to vote on the question of building sewers.

GETTYSBURG, PA.—The question of improving the system is being considered, according to reports. J. L. Kendlehart, Clk. Council.

HAZLETON, PA.—The question of building sewers in certain streets is being considered.

MERCER, PA.—This place voted Aug. 23 to issue bonds for a sewer in the east side.

MERCER, PA.—Bids are asked until 12 m., Sept. 2, for constructing 12,565 ft. of 10 to 6-in. pipe sewers. Engr., Geo. Zahnises, New Castle, Pa.; Clk., J. M. Campbell.

PHILADELPHIA, PA.—Bids are asked until Sept. 6 for constructing branch and main sewers, etc. Thos. M. Thompson, Dir. Pub. Wks.

RANKIN, PA.—This place has voted not to issue $25,908 in bonds for continuing the construction of the system.

WASHINGTON, D.C.—Bids are asked by the District Commissioners until Sept. 17 for constructing sewers, as stated in our advertising columns.

POCOMOKE CITY, MD.—Bids are asked until Sept. 14 for building a system and water-works, as stated in our advertising columns. (Postponement from Sept. 7.) Engrs., Pownall & Minshall, 150 Nassau St., New York; Mayor, R. M. Stevenson.

PARKERSBURG, W. VA.—Bids are asked until Sept. 13 for furnishing the material and for laying 1,400 ft. of 8-in. pipe sewer and brick pavement in two streets. W. T. Rittenhouse, Clk.

HENDERSON, KY.—Bids are asked until Sept. 6 for constructing a sewer in a certain street. W. I. Thompson, Mayor.

CLEVELAND, O.—Bids are asked until Sept. 8 and 15 for constructing sewers. Geo. R. Warden, Dir. Pub. Wks.

CLEVELAND, O.—Plans have been adopted for the reconstruction of the 5-ft. Taylor St. brick sewer.

COLUMBUS, O.—Bids are asked until Sept. 6 for constructing sewers in district 1. Jas. A. Fanning, Clk. Bd.

NILES, O.—Wm. Wilson, Cy. Engr., writes us that it is proposed to build about two miles of 40 to 8-in. brick and pipe sewers; average cut, 10 ft.

SHELBY, O.—Bids are asked until Sept. 19 for constructing six miles of lateral sewers. W. F. Sonnastine, Clk.

WELLSVILLE, O.—A. P. Dennis, Mayor, writes us that there has been no definite action taken in regard to a system, noted in our issue of Aug. 18. The question is being considered and will probably be voted on at the election in November.

HAMMOND, IND.—Bids are asked until Sept. 8 for constructing 860 ft. of two-ring 3½ ft., 1,290 ft. of two-ring 4 ft. and 250 ft. of three-ring 4-ft. brick sewer in West Hammond. Clk., Martin H. Finneran.

HARBOR SPRINGS, MICH.—Geo. S. Pierson, Kalamazoo, Mich., is preparing plans for sewers for Harbor Point summer resort.

LAURIUM, MICH.—Jos. R. Murphy, Clk., writes us that this place voted July 23 to issue $35,000 in bonds for the proposed system. Bids for the construction will probably be asked in January or February. Engr., C. F. Loweth, 94 East 3d St., St. Paul, Minn.

MOUNT PLEASANT, MICH.—Riggs & Sherman, The Nasby, Toledo, O., have been selected to prepare plans and specifications for water-works and sewers for the United States Indian School at Mount Pleasant. R. S. Graham, Supt.

CHICAGO, ILL.—The trustees of the Illinois & Michigan Canal have employed Alvord & Shields, The Rookery, Chicago, to report upon the proposed plans of the sanitary district of Chicago for changes in the canal between Lockport and Joliet. The question involves power as well as navigation interests, and arises from the increased flow of water which will be caused by the operation of the Drainage Canal.

SYCAMORE, ILL.—The council has decided to adopt the separate system of sewers, with sewage disposal works. It has engaged Alvord & Shields, 1140 The Rookery, Chicago, to prepare plans and to superintend the construction of the main outlet sewer, which will be built this fall.

MONMOUTH, ILL.—It is proposed to construct sewers in several streets.

BURLINGTON, IA.—The council has appropriated $6,000 to arch the Hawkeye sewer.

CALLENDER, IA.—Bids are asked until Sept. 5 for constructing certain sewers, according to reports. N. C. Rasmussen, Chn. Com.

SIOUX CITY, IA.—The question of additional sewers in Fourth and Water Sts. is being considered.

FARIBAULT, MINN.—Bids are asked until Sept. 12 for constructing 2,525 ft. of sand-rock tunnel, about 8,300 ft. of 15 to 8-in. pipe sewer, 27 manholes, etc. Engr., C. F. Loweth, 94 E. 4th St., St. Paul, Minn., and Davenport, Ia.; Mayor, P. F. Ruge.

FARGO, N. DAK.—S. F. Crabbe, Cy. Engr., writes us that it is proposed to build 3,200 ft. of 12-in. pipe sewers in 2d and 4th Sts.

GRAND FORKS, N. DAK.—Bids will soon be asked for sewers in certain streets. John Dinnie, Mayor.

COLUMBIA, MO.—This place will vote Sept. 27 on the question of building a system to cost $28,000.

JOPLIN, MO.—This place voted Aug. 23 to raise $30,000 by direct taxation for additional sewers.

SEDALIA, MO.—The council has voted to build sewers in two new districts. Mayor Overstreet may be addressed.

HOUSTON, TEX.—Bids are asked until Sept. 12 for constructing a brick sewer in the Riverside and Washington Road. County Judge W. N. Shaw.

SANTA ANA, CAL.—Bids are asked until Sept. 15 for furnishing the materials and for constructing 10,000 ft. of pipe sewer, a sewage disposal plant, etc., according to reports. Edward Telford, Cy. Clk.

SAN LUIS OBISPO, CAL.—An election will be held Sept. 5 to vote on the question of issuing $36,000 in bonds for a system. Cy. Clk., J. A. Goodrich.

OTTAWA, ONT.—Alderman Davis, Chn. Com., is urging the council to adopt plans for the disposal of sewage into the Ottawa River, the outlet sewers to be built to the middle of the stream.

TORONTO, ONT.—Dr. Sheard, of the board of health, and Alderman Crane have secured information, etc., for the disposal of sewage by precipitation and by filtration.

GARBAGE DISPOSAL—STREET CLEANING

CHESTER, PA.—B. R. Myers, of the councils, has recommended that steps be taken at once for building a plant to cost about $5,000.

LANCASTER, PA.—The council received the following bids Aug. 24 for cleaning and sweeping the streets from Sept. 1 to April 1: Adam M. Diller, $1,800; Frank B. Kendig, $1,840; Vincent Pfau, $2.25 a sq. a week—cleaning twice a week; I. M. Bernard & Bro., $1,600; A. Steinwandel, $3,433 a year; H. N. Herr, $1,675; Andrew Mehaffy and August Nutto, $1.25 a sq. a week; Jacob Workman, $1,750; F. H. Wilhelm, $2 a sq. a week, if city furnishes sweepers, and $3 if bidder furnishes sweepers.

CUMBERLAND, MD.—The question of a better method of garbage collection and disposal is being urged by the newspapers.

HAGERSTOWN, MD.—The council, it is stated, will soon consider the question of a garbage disposal plant.

HAMILTON, O.—Bids are asked until Sept. 6 for furnishing a street sweeper. M. O. Burns, Cy. Clk.

DETROIT, MICH.—Local papers state that Nettleton & Kahn, 1117 Union Trust Bldg., have prepared plans for a garbage crematory, office, stables, etc., for the Detroit Sanitary Co., at French's Landing. Mgr., M. H. Chamberlain, 51 Woodward Ave.

STREETS AND ROADS.

BOSTON, MASS.—The street commissioners have ordered the construction of 15 streets in various parts of the city. Benj. W. Wells, Supt. of Sts.

LOWELL, MASS.—Bids are asked until Sept. 2 for about 5,800 sq. yds. of asphalt for paving Aiken St., from Cheever St. to the Aiken St. bridge, over the Merrimack River; check, $500. Cleveland J. Cheney, Supt. of Sts.

MELROSE, MASS.—At a town meeting, Aug. 18, it was voted to borrow $3,500 for highway purposes. W. De Haven Jones, Town Clk., pro tem.

PEPPERELL, MASS.—Bids are asked until Sept. 2 for building 6,270 ft. of highway; check, $250. Geo. Jenks, Chas. H. Miller and Chas. B. Taft, Selectmen.

ROSLINDALE, MASS.—J. McGraw & Co. have been awarded the contract, at $14,510, to construct a macadam road near here.

ALBANY, N. Y.—Bids are asked until Sept. 6 for excavating, filling and vitrified brick paving Elm St. from Delaware Ave. to Grand St. Bond, $5,000. Thos. J Lanahan, Clk.

BINGHAMTON, N. Y.—Bids are asked until Sept. 6 for paving Collier St. and Academy St. with vitrified brick (two contracts). Burr W. Mosher, Cy. Clk.

BUFFALO, N. Y.—Bids are asked until Sept. 2 for constructing a bicycle path along Scajaquada Creek. G. H. Selkirk, Secy. Park Comrs.

NEW ROCHELLE, N. Y.—The board of trade has issued an appeal to the taxpayers to vote in favor of appropriating $150,000 for street improvements. J. Hollwegs, Frank J. New and Jas. D. Foot, Com.; H. S. Clarke, Village Pres.

ROCHESTER, N. Y.—Bids are asked by the executive board, City Hall Bldg., until Sept. 6 for paving North Clinton St. with asphalt, to cost about $78,000, and for a plank walk on North Joiner St., estimated to cost $2,200.

SCHENECTADY, N. Y.—Bids are asked until Sept. 6 for 6,000 sq. yds. of Catskill shale brick paving or other brick equally good for Front St. Also until Sept. 6 bids for paving Steuben St; quantities not stated. L. B. Sebring, Cy. Engr.

ATLANTIC CITY, N. J.—The council has passed an ordinance authorizing the construction of a public walk, 40 ft. wide, between Massachusetts and Texas Aves., an elevated walk, 40 ft. wide of iron or seel and wood, between Massachusetts and Vermont Aves., an elevated walk, 20 ft. wide, between Texas and Albany Aves., and an elevated walk, 20 ft. wide, between Vermont and Atlantic Aves. Emery D. Irelan, Cy. Clk.; John P. Ashmead, Cy. Engr.

GLOUCESTER CITY, N. J.—Bids are asked until Sept. 1 for paving Broadway, between Salem and Market Sts., with rubble, asphalt or Belgian blocks; check, $100. Edw. J. O'Hara, Chn. St. Com.; Danl. F. Lane, Cy. Clk.

VINELAND, N. J.—Bids are asked until Sept. 13 for paving Landis Ave., from the Boulevard to 6th St. Wm. E. Allen, David W. Sigafoo and John A. Ackley, Com.

ALLEGHENY, PA.—Bids are asked until Sept. 5 for regrading and repaving Pennsylvania Ave., from Allegheny Ave to Beaver Ave. Robt. McAfee, Dir. Pub. Wks.

CHESTER, PA.—Bids are asked until Sept. 5 for paving Market St. with asphalt, from Market Sq. to 6th St.; check, $1,000. W. T. Cullis, Chn. Com. on Sts.; Frank W. Harrison, Cy. Clk.

EASTON, PA.—Hugh E. Crilly, Allentown, has been awarded the contract for paving Main St. with vitrified brick. About 400 carloads of 20 tons each will be required, it is stated. C. J. Lutjen & Son, Long Island City, N. Y., have received a contract for macadam paving which will require over 8,000 tons of trap rock. H. R. Fehr, Cy. Engr.

HAZLETON, PA.—The council has passed an ordinance authorizing the city engineer to receive bids for 10 trapped inlets with catchbasins, etc. A. Brooks Celiax, Cy. Engr.

LANSDOWNE, PA.—An election will be held Sept. 20 to vote on the question of issuing $5,000 in bonds for street improvements, according to report. Thos. G. Janier, Borough Surv.

OAKMONT, PA.—It has been voted to issue $65,000 in bonds, of which $16,000 will be for improving the streets, according to report.

READING, PA.—The Pennsylvania Asphalt Paving Co. was awarded the contract, Aug. 18, for asphalt paving, at $72,210. The other bids received were: Barber Asphalt Paving Co., $96,280; Alcatraz Co., $74,285, and Richardson & Ross, $81,755. Other contracts have been awarded as follows: For grading Wunder St., W. T. Snyder, $846; for Paving Elm St., Court St. and Peach St., Saml. Bobst, $1,650; for paving Weimer St., Fred. Barth and Henry K. Noll, $544.

SCRANTON, PA.—Bids are asked until Sept. 1 for paving Quincy Ave. with asphalt, from Pine St. to Gibson St.; check, $100. M. T. Lavelle, Cy. Clk.

SHAMOKIN, PA.—Bids are asked until Sept. 9 for 12,000 sq. yds. of brick paving; estimated cost, $19,500. O. J. Reed, Pres. of Council; Chas. H. Douty, Engr.; M. C. Farrow, Ch. Burgess.

YORK, PA.—C. W. Brant, Mayor, writes us that the council has under discussion a popular loan of $500,000 for street improvements, which has not yet assumed definite shape. R. J. McKinnon, Cy. Engr.

HAGERSTOWN, MD.—E. G. Buck has been awarded the contract for vitrified brick paving two blocks on Franklin St., at $1.22 a sq. yd., according to report. Jacob Zeigler, Supt. of Sts.

WASHINGTON, D. C.—The following contracts are reported to have been awarded for vitrified paving bricks: Camden Clay Co., 100,000; J. H. Guise, 200,000; McMahon, Porter & Co., 900,000.——The district commissioners have ordered the following streets to be resurfaced: 20th St., from Pennsylvania Ave. to F St.; G St., between 17th and 19th Sts.; G St., from 21st to 22d St.; roadway around Scott Circle; 14th St. and Massachusetts Ave.; estimated cost of the work, $26,000.

PARKERSBURG, W. VA.—The Camden Clay Co. has been awarded the contract to pave the Northwestern Turnpike with brick, from the city limits to Park Ave. John V. Dunbar, Cy. Engr.

BIRMINGHAM, ALA.—C. M. Burkhalter & Co. have been given the contract for grading and macadamizing 8th Ave., between 24th and 25th Sts., and Dunn & Lallande have secured the contract for grading and macadamizing 11th Ave. South, between 19th and 20th Sts. Julian Kendrick, Cy. Engr.

LOUISVILLE, KY.—It is reported that the board of public works will advertise for bids for improving alleys, streets and sidewalks in a few days. Chas. F. Granger, Chn. Bd. Pub. Wks.

BARNESVILLE, O.—The following bids were received Aug. 22 for road improvements: H. E. Alexander, St. Clairville, O., $5,126 (accepted); First National Bank, Barnesville, $5,109; Huhn & Sons, Cincinnati, $5,084; Seasongood & Mayer, Cincinnati, $5,076; Lamprecht Bros. & Co., Cleveland, $5,063; Hays & Son, Cleveland, $5,053, and Briggs, Smith & Co., Cincinnati, $5,042. S. B. Pipe, Township Clk.; Geo. H. Buchanan, Cy. Engr.

CINCINNATI, O.—Bids are asked until Sept. 2 for the improvement of Guy St. from Warner St. 357 ft. north. A. B. Ratterman, Pres. Bd. of Cy. Affairs; Geo. H. Spellmire, Clk.

CLEVELAND, O.—C. H. Strong & Son have been given the contract for the Edgewater Park shore improvement, which has been advertised five times. The contract price is $38,836. Contracts were also let Aug. 24 to Burnett & Ross for stone masonry, near Euclid Ave. in Rockefeller Park, at $15,730, and to the same firm for shore protection of Gordon Park, at $2,700. C. W. Pratt, Jr., Ch. Engr.

COLUMBUS, O.—The following contracts were awarded Aug. 22 for street improvements: West Park Ave., N. B. Abbott, $9,280; Harris Ave., N. B. Abbott, $2,567; State St., N. B. Abbott, $3,952; Gay St., John B. Crowe, $339; Second Ave., John Minton, $379.——Bids are asked until Sept. 6 for grading and macadamizing 4th Ave. from 4th St. to its eastern terminus; check, $100. Jas. A. Fanning, Clk. Bd. Pub. Wks.

LEIPSIC, O.—Bids are asked until Sept. 2 for constructing the Easton, Pearl and Belmore St. improvement; check, $1,000. Also bids are asked until Sept. 2 for constructing the East Defiance St. extension improvement; check, $500. Andrew A. Kober, Clk.

TOLEDO, O.—Bids are asked until Oct. 3 for improving Ontario St., from Stickney Ave. to Ash St. Lem P. Harris, Cy. Clk.

ALEXANDRIA, IND.—Bids are asked until Sept. 10 for improving John St. by grading, curbing and paving the sidewalks and gutters with brick; check, $500. Bids are also asked until Sept. 14 for improving Canal St. from Water St. to Broadway by grading, curbing and paving the roadway and sidewalks with vitrified brick; check, $500. G. A. Gessner, Jr., Cy. Engr.

RICHMOND, IND.—Bids are asked until Sept. 2 for vitrified brick sidewalks, gutters, sewer, etc., on Main St. from Ft. Wayne Ave. to 2d St.; check, $500. Jos. H. Winder, Clk. of Bd.

BAY CITY, MICH.—Bids are asked until Sept. 6 for paving South Union St. from Henry St. to Washington St. with brick. John Kelly, County Engr.

DETROIT, MICH.—J. M. O'Rourke has been awarded the contract for paving Logan Ave. with disintegrated granite, at $19,791. The Colorado Paving Co. bid $24,096, and Chas. Conner, $20,142. D. W. H. Moreland, Comr. Pub. Wks.; H. D. Ludden, Cy. Engr.——Bids will soon be asked for paving Second Ave. with asphalt. Robt. Y. Ogg, Secy. Bd. Pub. Wks.

BELLEVILLE, ILL.—The Myers Construction Co., St. Louis, Mo., has been given the contract for paving East Main St. with Wabash brick, at $16,125. Louis Graner, Cy. Engr.

LAKE FOREST, ILL.—Bids are asked until Sept. 5 for 716 lin. ft. of cement curbing and 7,800 sq. ft. of cement sidewalk; check, $100. Jas. Anderson, Jr., Cy. Engr.

MILWAUKEE, WIS.—The Western Paving & Supply Co. has been given the contract to asphalt Newberry Boulevard, at $42,245. The Warren-Scharf Asphalt Paving Co., New York, was given the contract to construct the asphalt pavement on 5th St., from Wells to Cedar Sts., at $5,709; Shepard Ave., from Burleigh St. to Hartford Ave., at $6,433, and Franklin Place, from Prospect Ave. to Knapp St., at $863. G. H. Benzenberg, Cy. Engr.

SHEBOYGAN, WIS.—Bids are asked until Oct. 1 for furnishing a steam road roller, f. o. b. Sheboygan, as stated in our advertising columns. Pres. Bd. Pub. Wks., A. J. Mallmann; Comptroller, Jno. Schmidt.

WATERTOWN, WIS.—Bids are advertised until Sept. 17 for furnishing the material and for brick paving, as stated in our advertising columns. Pres. Bd. Pub. Wks., Harlow Pease.

CEDAR RAPIDS, IA.—G. H. Merridith, Cy. Engr., writes us that he has been directed by the council to prepare plans and specifications for asphalt paving on 1st Ave., from 10th to 13th Sts.

DES MOINES, IA.—Bids are asked until Sept. 5 for about 4,700 sq. yds. of vitrified brick paving on 11th St., from Forest Ave. to College Ave.; bond $1,000. G. A. Eberhart and C. E. Campbell, Bd. Pub. Wks.; Geo. M. King, Cy. Engr.

OMAHA, NEB.—Bids are asked until Sept. 9 for improving 24th Ave., from Harney St. to St. Mary's Ave., with asphalt, brick or stone paving, curbing, etc.; check, 2% of bid. Andrew Rosewater, Chn. Bd. Pub. Wks.; Wm. Coburn, Secy.

FARGO, N. DAK.—S. F. Crabbe, Cy. Engr., writes us that the council has created seven improvement districts and will ask for bids for paving the same with cedar blocks; about four miles of paving in all.

GRAND FORKS, N. DAK.—Correspondence from contractors is solicited in regard to paving about four miles of streets with cedar blocks; also for macadamizing, brick paving, curbing, etc. Alex. Oldham, Cy. Engr.; F. A. Brown, Cy. Audr.

JEFFERSON CITY, MO.—The council has voted to pave Madison St., between High and Main Sts., with vitrified brick. E. F. C. Harding, Cy. Engr.

ST. LOUIS, MO.—The county court has ordered 14 miles of telford paving, according to report. A. N. Milner, St. Comr.

SPRINGFIELD, MO.—Williams Bros. were awarded the contract Aug. 22 for the construction of sidewalks on Sherman, Clay, Calhoun, Court, Lynn, South and Smith Sts., and on Washington Ave. T. A. White, Cy. Engr.

GALVESTON, TEX.—J. M. Griswold has been awarded the contract, according to report, to shell the main land roads. R. H. Peek, Cy. Engr.

HOUSTON, TEX.—Bids are asked until Sept. 12 for work on Riverside and Washington and San Felipe Road; check, $200. W. N. Shaw, County Judge, Harris county.

DENVER, COLO.—J. P. O'Rourke has been awarded the contract to grade, curb and drain Logan Ave., at $19,791. Wm. T. Davoren, Comr. of Highways.

SPOKANE, WASH.—The City Street Improvement Co. has been awarded the contract, it is stated, at $2,300, to pave Monroe St. W. H. Wiscombe, Comr. of Sts.

SPOKANE, WASH—Bids are asked until Sept. 7 for $49,865 in 8% paving bonds for the purpose of improving Riverside Ave. Geo. A. Liebes, Secy. Sinking Fund Comrs.

OAKLAND, CAL.—E. B. Stone has been awarded the contract to improve the San Leandro Road, at $7,108, and Gottlieb Schumacher has the contract to macadamize Fruitvale Ave., for $8,000, according to report. M. K. Miller, Supt. of Sts.

SAN FRANCISCO, CAL.—It is reported that San Bruno Ave. is to be graded and macadamized from the county line to Baden, three miles, at a cost of about $25,000. Thos. Ashworth, Supt. of Sts.

CORNWALL, ONT.—Bids are asked until Sept. 3 for constructing granolithic walks on four streets, about 29,000 sq. ft. Geo. S. Jarvis, Town Clk.

MANUFACTURING PLANTS.

WINSLOW, ME.—It is reported that the Hollingsworth & Whitney Co. expects to increase the capacity of its plant by the erection of a large pulp mill to cost about $250,000.

BROOKLYN, N. Y.—Plans are stated to have been completed for a 2-story brick and stone glass furnace and tinstamping plant, 200 × 400 ft. Arch., H. L. Spicer, 326 56th St., Brooklyn.

NIAGARA FALLS, N. Y.—The entire plant of the Niagara Engineering Works was destroyed by fire Aug. 27, causing a loss of about $25,000. The plant was owned and operated by A. W. & F. R. French.

CHESTER, PA.—The Standard Plaster Board Co., of Philadelphia, is said to have purchased the plant of the Marsden Co. in Chester. A number of improvements are contemplated to cost from $10,000 to $15,000, including the construction of a new wharf and the installation of new machinery.

AKRON, O.—The plant of the Collins Buggy Co. was burned Aug. 27, causing a loss of about $15,000; fully insured.

LORAIN, O.—Reports state that the Frank-Kneeland Machine Co., of Pittsburg, has been awarded the contract by the Lorain Steel Co. for building a 38-inch blooming mill with tables and manipulator. It will weigh about 1,000,000 lbs., and is to be completed in 100 days.

PORTSMOUTH, O.—B. F. Vincent, Secy. Burgess Steel & Iron Works, Portsmouth, informs us that the Riter-Conley, of Allegheny, Pa., and the Portsmouth Structural Steel & Iron Co., of Portsmouth, have been awarded contracts for the erection of the proposed addition to his company's plant.

DECATUR, ILL.—We are informed that contracts have all been let for the erection of a 4-story brick building to be used for a power plant by Suffern, Hunt & Co. A 350-HP. engine will be installed.

ABERDEEN, WASH.—Reports state that the Western Cooperage Co. will rebuild its plant recently destroyed by fire, including a mill building, 100 × 38 ft., a warehouse and dry house, 50 × 100 ft., and a boiler house, 30 × 120 ft.

LOS ANGELES, CAL.—The Los Angeles Soap Co.'s plant was burned Aug. 29, causing a loss of about $80,000.

VICTORIA, B. C.—The Victoria Chemical Works were partly destroyed by fire Aug. 16, causing a reported loss of $25,000.

GAS PLANTS.

HOPE VALLEY, R. I.—It is reported that the erection of an acetylene gas plant in this town is contemplated.

SYRACUSE, N. Y.—The Syracuse Gas Co. has begun to lay natural gas mains in this city, and it is said that a connection will be made with the Baldwinsville main if the natural gas wells in that village prove to be of sufficient size.

PHILADELPHIA, PA.—The United Gas Improvement Co., Drexel Bldg., is taking bids on a boiler and pump house building, to be erected at the Point Breeze works, according to reports.

DELAWARE, O.—Bids are asked until Sept. 3 for lighting this city with gas or electricity. Address the mayor.

SAULT STE. MARIE, MICH.—Peter Primeau, of Marquette, Mich., has asked for a 30-year franchise for the operation of a gas plant to be erected in this city; estimated cost, $50,000.

MASON CITY, IA.—Reports state that a gas plant will be constructed at Mason City, and that Mrs. M. I. Clark is the head of the enterprise.

AINSWORTH, NEB.—A company is said to have been formed in this city to finance the erection of an acetylene gas plant by H. O. Mead, of Omaha, Neb. Pres., S. Backey; Secy., R. S. Rising.

SAN BERNANDINO, CAL.—B. C. Roos is reported to be contemplating the erection of an electric and gas plant in this city.

EDINBURGH, SCOTLAND.—Bids are asked by the Edinburgh and Leith corporations' gas commissioners, until Oct. 17, for the excavation, concretor, bricklayer and mason's work in connection with the construction of a brick and puddle gasholder tank, 252 ft. 6 in. diameter by 37 ft. deep, at their new works at Granton, near Edinburgh. W. R. Herring, Edinburgh.

NEW COMPANIES.—Enterprise Gas Co., McKean county, Pa.; $40,000, with $4,000 paid in; to operate in Hamlin and Sergeant townships; Edwin E. Tait, Frank P. Hazelton, Frank Fessenmeyer, Bradford, Pa.; J. D. Westcott, Union City, Pa.; M. D. Carmody, Limestone, N. Y.

Oxygen Gas Co., Chicago, Ill.; $5,000,000, with $50 paid in; to manufacture oxygen and illuminating gas, machinery, etc.; J. D. Springer, Wm. Garrett, Jr., H. I. Keck, H. S. Backus, Wm. H. Clark, Chicago, Ill.

Dewey Oil & Gas Co., St. Marys, O.; $50,000, with $1,000 paid in; to bore for oil and gas; Frank Konley, C. J. Macomber, John Salmon, Edgar Botkin and H. H. Fenton, all of St. Marys, O.

Breckenridge Natural Gas Co., Natrona, Pa.; $1,500, with $150 paid in; to operate in Harrison township, Allegheny county, Pa.; G. B. Findlay, Treas.; J. R. Taylor, both of Freeport, Pa.; H. M. Breckenridge, W. B. Ekas and C. M. Maurhoff, of Natrona.

MISCELLANEOUS CONTRACTS.

DREDGING.—Oakland, Cal.—Bids will be asked at once by the board of public works for dredging Lake Merritt at a cost of about $80,000, according to reports.

PARK BONDS.—Spokane, Wash.—Bids are asked until Oct. 12 for the purchase of $10,000 of brick bonds. Geo. A. Liebes, Secy. Comn.

FIRE ALARM SYSTEM.—Poughkeepsie, N. Y.—It is said that the Gamewell fire alarm system is to be installed in Poughkeepsie with 30 boxes at a cost of $6,000.

DOCK, ETC.—Brockville, Ont.—It is stated that the Canadian Pacific Ry. Co. will build a new dock here besides making other improvements to its property; estimated cost, $50,000.

FIRE HOSE NOZZLES.—New York, N. Y.—Bids are asked until Sept. 7 for furnishing the fire department with two 5-in. and one 8-in. rotary nozzles. J. J. Scannell, Comr., 157 East 67th St.

REPAIRING STEAMER.—New York, N. Y.—Bids are asked until Sept. 12 for repairing the steamer "Minnahannock;" two sureties of $3,500 each. F. J. Lantry, Comr. Correction, 148 East 20th St.

DREDGING.—Philadelphia, Pa.—Bids are asked until Sept. 10 for dredging and filling at the League Island navy yard, Philadelphia. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

SAND, STONE, ETC.—Point Wilson, Wash.—Bids are asked until Sept. 13 for furnishing sand and gravel or broken stone at Point Wilson. Capt. Harry Taylor, U. S. Engr., Burke Bldg., Seattle, Wash.

QUAY WALL.—San Francisco, Cal.—Bids are asked until Sept. 24 for extending the quay wall at the Mare Island navy yard, San Francisco. Mordecai T. Endicott, Chn. Bureau Yards & Docks, Washington.

DREDGING.—Buffalo, N. Y.—The mayor and the board of public works are considering plans prepared by City Engineer Bardol for dredging the Buffalo River at South Buffalo in order to prevent the spring floods.

REMOVING WRECK.—St. Joseph, Mich.—Bids are asked until Sept. 17 for removing the wreck of the steamer "City of Duluth" lying in the entrance to the harbor. Lt.-Col. G. J. Lydecker, U. S. Engr., Detroit, Mich.

DREDGING.—Troy, N. Y.—Local papers state that the Delaware & Hudson R. R. Co. contemplates dredging the river from the 23d St. Ferry slip to the Delaware & Hudson bridge and between Centre Island and the company's docks.

PILES, PIER, ETC.—Philadelphia, Pa.—Bids are asked until Sept. 6 for furnishing a guard rail for permanent track, sinking test piles for a canal sewer, constructing superstructure on Arch St. pier, etc. T. M. Thompson, Dir. Pub. Wks.

MASONRY DAM FOUNDATION.—Columbus, O.—Bids are asked until Sept. 10 for furnishing the labor and materials and for constructing the foundation and lower portion of the concrete masonry dam, as described in our advertising columns. Dir. Pub. Wks., F. A. Jacobs; Clk., Jas. A. Fanning.

RECREATION PIER.—Brooklyn, N. Y.—Bids are asked by the commissioners of docks and ferries, Pier A, North River, Manhattan, until Sept. 6 for completing the recreation pier at the foot of North 2d St., Brooklyn. About 188,000 lbs. of structural steel will be required; estimated cost, $12,000.

DAM.—West Superior, Wis.—Press reports state that Judge Vinje has decided the case of the Brule River Improvement Co. against the Mills & Le Claire Lumber Co. in favor of the defendant. The plaintiff asked the court to permanently restrain the defendant from building a dam across the Brule River for logging purposes. The judge allowed the construction of a dam of 7½ ft. head, with proper sluices.

JETTY WORK.—Ocean City, Md.—Press reports state that the council has accepted plans for a jetty north of the Atlantic Hotel to low-water mark, a distance of 150 ft. from the board walk. Piles will be driven to form the jetty, which is an experiment to find out exactly how the surf will affect the beach at that point. If the venture is successful in building up the beach, it is proposed to put in a series of jetties along the whole front of the town.

CABLE.—Sydney, N. S. W.—Press reports state that Sir Hugh Muir Nelson, Premier of Queensland; Sir George H. Reid, Premier of New South Wales, and Sir George Turner, Premier of Victoria, met in conference on Aug. 20, and discussed plans for a Pacific cable. They decided to make the definite offer that if Great Britain and Canada, collectively, would guarantee five-ninths of the cost of laying the new cable they would recommend to their respective legislatures to contribute one-ninth each, asking New Zealand to contribute the remaining one-ninth.

DRAINAGE CANAL, ETC.—Florida.—Press reports state that a company with $2,000,000 capital has been formed to reclaim the Florida Everglades. It proposes to construct a canal system 144 miles long which will drain 800,000 acres of land in southeastern Florida, which it has secured from the state. Among the directors of the company are J. R. Parrott, Vice-Pres. Flagler Ry. System, and James A. Ingraham, Land Comr. Flagler Ry. System. It is understood that the company is to begin operations immediately, under the title of the Florida Coast Drainage & Sugar Co.

COFFERDAM.—Pittsburg, Pa.—The following bids were received by Maj. Chas. F. Powell, U. S. Engr., Aug. 25 for the construction of a coffer and the building of a part of the chanoine dam at the Herrs Island lock in the Allegheny River: W. W. Hegeman & Co., New York, $57,735; W. Bradley & Co., Oswego, N. Y., $62,510; I. V. Hoag, Jr., Allegheny, $74,455; McIlvain & Unkefer, Pittsburg, $75,526; James Jackson, Pittsburg, $78,105; C. W. Friend, Pittsburg, $78,923; Jutte & Foley, Pittsburg, $80,339; Keeling & Ridge, Pittsburg, $81,647; A. W. McDonald Pittsburg, $89,560.

CONTRACT PRICES.

BRICK PAVING.—Chillicothe, O.—The following bids were received Aug. 13 for brick paving, as advertised in Engineering News; contract awarded Pfaff, Ringwald & Smith; Wm. H. Luchtenberg put in a bid of 12 cts. for tar filler:

Bids Received at Chilicothe, O., Aug. 13, 1898, for Brick Paving.

Quantities.			D. E. Sullivan, Columbus.	Pfaff, Ringwald & Smith, Chillicothe.	J. A. Kelley, Portsmouth.	E. M. Costello, Cincinnati.	Monroe & Bryan, Portsmouth.	Wm. H. Luchtenberg, Columbus.
	Redressing	1,000 lin. ft.	$0.20	$0.20	$0.15	$0.15	$0.14	$0.10
Curb..	Dayton limestone	3,370 lin. ft.	.62	.58	.55	.60	...	...
	Osgood limestone		...	...	.61	...	.69	.55
	Berea stone		.42	.44	...	...	.54	.45
	Cement		.27	.26	.40	.26	...	.45
	Cement circular	243 lin. ft.	.37	...	.70	.37	...	.65
	Dayton limestone circular		1.10	1.14	.98	.78	...	...
	Osgood limestone circular		...	...	1.09	...	...	1.20
	Berea stone circular		.53	.88	...	...	.68	.65
Excavation		6,200 cu. yds.	.26	.27	.25	.30	.24	.30
Concrete foundation		2,350 " "	1.90	1.39	3.10	2.37	2.94	2.00
Screened gravel foundation		3,166 " "	.75	.47	.70	.76	.58	.42
Athens brick or block		14,120 sq. yds.	.87	...	...	...	...	.75
Kinds of block..	Harris		.88	...	...	...	.78	.75
	Sciotoville and Union		.89	.77	.68	...	.78	...
	Portsmouth		.92	...	.67	...	.77	.78
	Middleport		.89	...	.67	.74	...	...
Repairing pavement, a sq. yd.		14,120 sq. yds.	.04	.50	1.25	.50	.09	3.00
Bituminous pont. filler, a sq. yd.			.16	.14	.15	.11	.145	.14
Cement filler, a sq. yd.			.11	.07	.14	.13	.12	.08
Sand filler, a sq. yd.			.04	.03	.05	.08	.02	.03
Total, limestone curb, concrete foundation, cement filler			$22,496	$19,268	$22,660	$22,065	$23,583	$20,696

BRICK PAVING.—Urbana, Ill.—We are informed that the following bids were received Aug. 17, 1898, for brick paving, curbing, etc.:

Bidder.	Excavation, 3,000 cu. yds.	Concrete curb and gutter, 3,320 lin.ft.	Brick pavement,* 5,350 sq. yds.	Total.
J. A. Foster & Co., Attica, Ind.	$0.20	$0.48	$1.21	$8,747
Ebert & Shanahan, Quincy, Ill.	.25	.50	1.29	9,241
J. W. Stipes, Urbana, Ill.	.22	.48	1.20	8,762
E. J. Hastings, Crawfordsville, Ind.	.225	.525	...	2,418
P. E. Taintor, Springfield, Ill.	.25	.48	...	2,344

*On concrete.

LEVEE WORK.—Memphis, Tenn.—J. P. Parker, Pres. Tensas Levee District, awarded the contract Aug. 17, 1898, for enlarging the Arkansas City Loop Levee to J. B. Lewis at 14⅞ cts. a cu. ft.

BRICK PAVING.—Kewanee, Ill.—The following bids were received Aug. 2 for brick paving in Tremont St.:

Bids Received at Kewanee, Ill., Aug. 2, 1898, for Brick Paving.

Quantities.			A. E. Rutledge, Rockford, Ill.	J. A. Foster & Co., Attica, Ind.	Flick & Johnson, Davenport, Ia.	Edwards & Walsh Con. Co., Davenport, Ia.	J. B. McAuley, Galesburg, Ill.	Smith, Moss & Brown, Chicago, Ill.
Excavation		9,000 cu. yds.	$0.16	$0.27	$0.15	$0.18	$0.24	$0.21
Filling (borrowed material)		500 " "	.10	.27	.15	.18	.24	.30
Curbing	Berea sandstone set in place	8,266 lin. ft.	.44*	.47	.44*	.45*	.42	.46*
	Limestone set in place		.37†	...	.37†	.39†	...	.39†
	Concrete		.40	.43	.41	.41	.47	.42
Concrete combined curb and gutter		8,266 " "	.48	.59	.48	.49	.55	.50
Brick pavement		20,240 sq. yds.	1.54	1.64	1.52	1.525	1.59	1.55
Total, using combined curb and gutter			$36,627	$40,470	$36,157	$36,626	$39,008	$38,945

*Curbing 5 × 24 ins. †Berea curbing 4 × 24 ins.

DREDGING.—Montgomery, Ala.—Maj. F. A. Mahan, U. S. Engr., informs us that the following bids were received Aug. 20 for dredging: National Dredging Co., Wilmington, Del., 17.9 cts. a cu. yd. for 2,300 cu. yds. of dredging, etc., a day; Rittenhouse-Moore Dredging Co., Mobile, Ala., 19.5 cts. a yd. for 3,000 yds. a day.

MACADAM PAVING.—Lansingburg, N. Y.—The following bids were recently received by the village trustees for macadam paving in Fifth Ave.: Henry Dumary, Albany—Excavating, $3 a cu. yd.; granite curb, $2.25 a lin. ft.; kosmocrete curb, $1.50 a lin. ft.; bluestone curb, $2.50 a lin. ft.; 8-in. macadam pavement, complete, 76 cts. a sq. yd. Thos. H. Karr, Troy—Excavating, 10 cts; granite curb, $1.40; kosmocrete curb, $1.50; bluestone curb, $1; macadam paving, 75 cts. a yd (awarded contract). Troy Public Works Co.—Excavation, $4; granite curb, $1.40; kosmocrete curb, $1.50; bluestone curb, $1.40; macadam paving, 85 cts. Crutchley & Murray, Lansingburg.—Excavation, $2; granite curb, $1.19; kosmocrete curb, $1.45; bluestone curb, $1.13; macadam paving, 79 cts. Donnovan Bros., Staten Island.—Excavation, $5; granite curb, $2; kosmocrete curb, $1.75; bluestone curb, $2; macadam paving, $1.35.

PIPE SEWER.—Schenectady, N. Y.—Henry Furman has been awarded the contract at 38 cts. a ft. for laying 3,000 ft. of 8-in. sewer pipe. S. B. Sebring, Cy. Engr.

LEVEE WORK.—West Memphis, Tenn.—Harry N. Pharr, Ch. Engr. St. Francis Levee District, informs us that the bids received Aug. 3, 1898, for levee work, were rejected, and will not be readvertised this season; the work was to be paid in certificates of levee board bearing 6%, and payable $40,000 a year, beginning with 1902. The bids are as follows: Keeney & Bailey, Cairo, Ill., Miles 141 to 144, 188,116 cu. yds., 14 cts. a cu. yd.; Miles 147 to 149, 168,666 cu. yds., 15 cts.; W. J. Bentley & Co., New Orleans, La., Miles 141 to 144, 14 cts.; 130 to 136, 455,008 cu. yds., 17.6 cts.; 136 to 141, 529,350 cu. yds., 22.9 cts.; 144 to 147, 373,800 cu. yds., 21.9 cts.; 147 to 151, 348,800 cu. yds., 18.9 cts.; not less than one nor more than two divisions to be awarded; R. M. Quigley & Co., St. Louis, Mo., Miles 127½ to 151½, 2,093,521 cu. yds., 17.93 cts.

BRICK SIDEWALK.—Baltimore, Md.—The following bids were received Aug. 3, 1898, for constructing a brick sidewalk around Collington Square, about 28,000 sq. ft., being covered; all bidders of Baltimore: C. A. Hook, 7.3 cts.; W. H. Doe (accepted), 6⅞ cts.; W. E. Morris, 8¼ cts.; C. W. Kraft, 9¼ cts.

SEWER MATERIAL.—Baltimore, Md.—The following contracts were let Aug. 3, 1898, for furnishing materials for the proposed Harris Creek sewer, all contractors of Baltimore: American Portland cement, 1,375 bbls., National Building Supply Co., $1.85 a bbl. Rubble stone, 900 cu. yds., I. H. Peddicord & Son, $1.60 a cu. yd. Sand, 395 cu. yds., B. Noha, 65 cts. a yd. Hand-made brick, 91,000, Smith & Schwarz Brick Co., $6.22 a M.; vitrified brick, 15,000, B. Wallis & Co., $19 a M.; machine-made brick, 120,000, J. R. Busey & Son, $6.90 a M.

PIPE SEWER.—Nanticoke, Pa.—The council recently received the following bids for trenching, backfilling, laying and cementing about 2,500 ft. of sewer pipe in West Church St.: Rebesher & Edmunds, 6 ft. and under, 18 cts.; 6 ft. to 7 ft., 19 cts.; 7 ft. to 9 ft., 25 cts.; laying and cementing, 6 cts.; rock, 97 cts. a cu. yd. G. S. Post & Co., Wilkes-Barre, 6 ft. and under, 36 cts.; 6 to 7½ ft., 40 cts.; 7½ to 9 ft., 54 cts.; 9 to 11 ft., 65 cts.; 11 to 14 ft., 79 cts.; rock, $1.25 a cu. yd.; shale rock, 68 cts. a cu. yd. Lyman E. Carle, Ashley, 6½ ft. and under, 27 cts.; 6½ to 7½ ft., 49 cts.; 7½ to 9 ft., 55 cts.; rock, 80 cts. a cu. yd.; hard pan, 70 cts. a cu. yd. Coon & Co., Wilkes-Barre, 6 ft. and under, 27 cts.; 6 to 8 ft., 33 cts.; 8 to 10 ft., 45 cts.; 10 to 12 ft., 70 cts.; rock, 80 cts. a cu. yd. Philpin & Lueder, 6 ft. and under, 16 cts.; 6 to 7½ ft., 20 cts.; 7½ to 9 ft., 25 cts.; 9 to 11 ft., 40 cts.; 11 to 14 ft., 74 cts.; 14 to 18 ft., $1; rock, shale and slate, $1.05 a cu. yd.

LEVEE WORK.—New Orleans, La.—The following are the lowest bids recently received by the board of state engineers for 2,500 cu. yds. of work on the Cairo levee, 10,000 cu. yds. on the Taylor levee and 145,000 yds. on the Choctaw Bayou levee: J. Thomas, 9 cts., 8.25 cts. and 9.33⅓ cts. for the Cairo, Taylor and Choctaw Bayou levees, respectively, and W. M. Rushing, 7.90 cts. on the Taylor levee.

ASPHALT REPAIRING.—Macon, Ga.—Local papers state that the council will award a contract to the Southern Asphalt Paving Co., at 6 cts. a sq. yd., for repairing the asphalt pavement of the city as may be required.

WATER PIPE.—Seattle, Wash.—A. E. Kirk has been awarded the contract for furnishing 1,000 ft. of 20-in. cast-iron water pipe, at $23.75 a ton. The other bids were as follows: W. D. Hofius & Co., $26; Caldwell Bros., Tacoma, $26.75; E. A. Hanbach Co., $26.50.

BRICK PAVING.—Binghamton, N. Y.—Jerome De Witt, Mayor, writes us that the contract for brick paving in Court St. has been let to Eugene Fee, at $1.72 a sq. yd.

BRICK SEWER.—Dallas, Tex.—We are informed that the following bids were received Aug. 18 for building a 7-ft. brick sewer through block 338: J. C. McCord, $7.75 a lin. ft.; concrete, $4.50 a cu. yd.; J. C. McCord, Jr., $6.75; concrete, $4; C. W. Olcott, 182 First Ave. (awarded contract), $5.91; concrete, $4.25.

ASPHALT BLOCK PAVING.—Sing Sing, N. Y.—The Hastings Pavement Co., New York, has been awarded the contract for paving Spring St., from Main St. to Waller Ave., at $2.25 a sq. yd., according to reports.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—
- **New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.75 cts.**
- Chicago—Angle bars, 1.10 cts. to 1.15 cts.; spikes, 1.50 cts. to 1.60 cts.; **track bolts, hexagonal, 1.90 cts. to 2.00 cts.;** square, 1.80 cts. to 1.90 cts.

RAILS, STEEL—
- New York, new, $18.00 to $19.00; old iron, $11.00 to $11.50; old steel $9.00.
- Chicago, new, $20.00 to $22.50; old iron, $12.00 to $12.50, steel, $10.00 to $11.00.
- Pittsburg, new $18.00 to $19.00; old iron, $13.50 to $13.75; steel, $10.00.

STRUCTURAL STEEL—
- New York—Beams, 1.40 cts. to 1.45 cts.; channels, 1.40 cts. to 1.45 cts.; tees, 1.45 cts. to 1.50 cts.; angles, 1.20 cts. to 1.25 cts.; rivets, 1.75 cts. to 1.85 cts.
- Chicago—Beams, 1.35 cts. to 1.45 cts.; channels, 1.35 cts. to 1.45 cts.; tees, 1.40 cts. to 1.50 cts.; angles, 1.25 cts. to 1.35 cts.
- Pittsburg—Beams, 1.15 cts. to 1.25 cts.; channels, 1.15 cts. to 1.25 cts.; tees, 1.15 cts. to 1.20 cts.; angles, 1.05 cts. to 1.15 cts.

PLATES AND SHEETS—
- New York—Universal mill plates, 1.25 cts. to 1.30 cts.; tank, 1.35 cts. to 1.40 cts.; shell, 1.35 cts. to 1.40 cts.; flange, 1.60 cts. to 1.70 cts.; firebox, 2.25 cts. to 2.50 cts.
- Chicago—Universal mill plates, 1.25 cts. to 1.30 cts.; tank, 1.25 cts. to 1.30 cts.; shell, 1.55 cts. to 1.65 cts.; flange, 1.30 cts. to 1.50 cts.; firebox, 1.75 cts. to 4.00 cts.; sheets, 2 cts. to 2.05 cts.
- Pittsburg—Universal mill plates, 1.00 cts. to 1.10 cts.; tank, 1.10 cts. to 1.15 cts.; shell, 1.25 cts. to 1.35 cts.; flange, 1.10 cts. to 1.25 cts.; firebox, 2 cts. upwards; sheets 1.85 cts. to 2 cts.

MERCHANT STEEL—
- **Machinery, per lb., 1.60 cts. to 1.70 cts.**
- Tool, per lb., 5.50 cts. to 7 cts.

IRON—
- **Pig Iron:**
  - New York—No. 1, $11.00 to $11.25; No. 2, $10.25 to $10.50.
  - Chicago—No. 1, $11.50 to $12.50; No. 2, $11.00 to $12.00.
  - Pittsburg—No. 1, $10.00 to $10.50; No. 2, $9.75 to $10.00.
- **Bar Iron:**
  - New York, common, $1.07½ cts. to 1.10 cts.; refined, **1.15 cts. to 1.20 cts.**
  - Chicago, common, 1.05 cts. to 1.07½ cts.; refined, 1.10 **cts. to 1.20 cts.**
- **Sheets:**
  - Common American, per lb., 1.40 cts. to 2.50 cts.
  - Russia, per lb., 10½ cts. to 11 cts.

LUMBER—
- **New York:**
  - **Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.**
  - **Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in.** butts, 4½ cts. to 4¾ cts.
  - **Spruce, special cargoes, per M, $15.00 to $17.50.**
  - **Yellow pine, random cargoes, $14.50 to $17.00.**
  - **North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.**
- **San Francisco:**
  - **Oregon pine, per M, $15.50 to $17.50.**
  - **Redwood, per M, $17.00 to $19.00.**
  - **Redwood tank stock, up to 10 ft., $21.00 to $24.00.**

GENERAL MATERIALS—
- Lead, New York, 3.90 cts. to 3.95 cts.
- Nails, Pittsburg, 1.40 cts.
- Solder, per lb., 8¼ cts. to 11½ cts.
- Spelter, per lb., 3.90 cts. to 4.00 cts.
- Copper ingots, 11⅞ cts. to 12.00 cts.
- **Granite, rough, New York, cu. ft., 40 cts. to 50 cts.**
- **Limestone, New York, cu. ft., 70 cts. to 80 cts.**
- **Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.**
- **Slate, Penn. block, per square, $4.00 to $5.00.**
- **White lead, American, per lb., 5½ cts. to 6 cts.**
- **Lime, common state, per bbl., 70 cts.**

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INDUSTRIAL NOTES.

J. C. RODGERS & SON, contractors, have removed their offices from 8 Solingen Bldg., 138th St. and Mott Ave., to 340 East 125th St., New York.

THE PORTSMOUTH STRUCTURAL STEEL & IRON CO., Portsmouth, O., reports it is very busy at present, and that the number of orders on hand render additional help necessary.

TIPPETT & WOOD, Phillipsburg, N. J., has a contract to furnish to Silver Spring, Md., a suburb of Washington, D. C., Saratoga, N. Y., and Media, Pa., additional stand-pipes to the present water systems.

THE PITTSBURG BRIDGE CO., Pittsburg, of which Mr. Albert Price is Superintendent, has added to its shop equipment a No. 5 Hills & Jones combined machine for heavy punching, coping and framing beams and channels. The company has received a contract, through Mr. E. H. Connor, Fullerton Bldg., St. Louis, western agent, to build for the Central Lead Co. a steel head frame and tipple for its Theodora Shaft, at Flat River, Mo.

THE BETHLEHEM IRON CO., South Bethlehem, Pa., will make the forgings of the engine for the Boston Elevated Railway Co. The shaft is to be 27 ft. 10 ins. long, and 37 ins. in diameter, having a hole 17½ ins. in diameter throughout its length, and when completed will weigh, together with cranks and fly-wheel hub, upwards of 150,000 lbs. This will be assembled at the works of the Bethlehem Iron Co., and transported in its entirety by rail to Boston.

THE W. E. CALDWELL CO., 200 E. Main St., Louisville, Ky., reports a decided activity in its line at present. It manufactures water tanks and steel towers for their support, and is one of the oldest firms engaged in this business. It makes a specialty of furnishing outfits for fire protection to mills and manufactories, and also puts in water-works systems for private grounds and for small towns. Some of its recent water-works contracts are for the towns of Odell, Ill.; Minden, Ia.; Hyattsville, Md.; Middletown, R. I.; Clark's Summit, Pa.; Sea Side Park, N. J.; Jasper, Fla.; Ensley, Ala.; Theological Seminary, Va., etc. The tanks used for these outfits range from 25,000 to 100,000-gallons capacity, and the towers from 50 to 90 ft. in height. The company announces that its new catalogue contains many useful tables of information.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., has a contract to build a fire-proof boiler house for the estate of C. M. Robertson, Montville, Conn., which recently lost its former one by fire. It will consist of a steel frame work, brick side walls, and a roof of corrugated iron covering, laid on patent anti-condensation roof lining. The building will be 50 ft. square, divided by a corrugated iron partition through the center, forming boiler room and pump room, and ventilation will be obtained by monitors on the ridge of the roof, each having a sash on the side.——The Berlin Iron Bridge Co. has also received a contract from Sanderson & Porter, contractors for the Meriden & Compounce Electric R. R., to furnish several bridges and buildings on the line of this road, consisting of seven spans, varying in length from 10 to 65 ft.; a car barn, 50 × 100 ft., and a power house, 45 × 75 ft. The bridges will be of steel, and the buildings will have steel frames, brick side walls, and fire-proof roofs, the roof of the power house being covered with corrugated iron and lined with patent anti-condensation roof lining.

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PERSONAL.

Lieut.-Commander Franklin C. Prindle, Civil Engineer, U. S. Navy, M. Am. Soc. C. E., has been promoted to the relative rank of Commander.

Prof. Henry M. Paul, Professor of Mathematics at the Naval Observatory, Washington, D. C., has been ordered to the Navy Yard, Mare Island, Cal.

Mr. D. C. Holly, Chief Engineer of the water-works, at Paducah, Ky., has resigned. Mr. Asa Williams, of Owensboro, has been appointed to succeed him.

Mr. E. C. Oliver, civil engineer, of Alpeña, Mich., has accepted the position of Assistant Professor of Civil Engineering in the University of Illinois, Champaign, Ill.

Lieut. Frank O. Maxson, Civil Engineers, U. S. Navy, with headquarters at Puget Sound Naval Station, has been promoted to the relative rank of Lieutenant-Commander.

Lieut. Adolfo J. Menocal, Civil Engineer, U. S. Navy, on duty at the naval station at Key West, Fla., has been promoted from the junior grade to the full grade of Lieutenant.

Mr. A. C. Menocal, M. Am. Soc. C. E., Civil Engineer, U. S. Navy, was retired from active service Sept. 1, on account of age, and has been assigned to special duty with the Nicaragua Canal Commission.

Prof. Benjamin D. Woodward, Professor of the Romance Languages and Literature, of Columbia University, New York, has been appointed Assistant Commissioner-General to the Paris Exposition of 1900.

Mr. C. E. Van Bergen, Manager of the Duluth Gas & Water Co., Duluth, Minn., has been appointed Secretary and Manager of the Board of Water and Light Commissioners, in charge of the city plant.

Lieut. Charles Keller, Corps of Engineers, U. S. Army, has been relieved from duty at Beaufort, S. C., and has been ordered to Rock Island, Ill., for duty under Capt. Curtis McD. Townsend, M. Am. Soc. C. E., Corps of Engineers.

Capt. William L. Sibert, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, has been relieved from duty at Little Rock, Ark., and has been ordered to Willet's Point, N. Y., for duty under Major John G. D. Knight, Corps of Engineers.

Major William Starling M. Am. Soc. C. E., formerly Chief Engineer of the Mississippi Levee District, at Greenville, Miss., has lately been apppointed Chief Engineer of the Lower Yazoo Mississippi District, to succeed Capt. William J. Hardee, M. Am. Soc. C E.

Col. Jared A. Smith, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, of Cleveland, O., has been detailed to succeed Major Thomas W. Simons, Corps of Engineers, as a member of the board to examine the locality of a proposed bridge across the Niagara River.

Mr. Charles H. Nichols, Jun. Am. Soc. C. E., of the firm of Nichols & Potter, consulting engineers, 42 Church St., New Haven, Conn., has opened an office in the Hosley Block, Branford, Conn., in which place he has charge of the construction of the new water-works for the Branford Electric Co.

Mr. Ira G. Rawn, General Superintendent of the Baltimore & Ohio Southwestern Ry., with headquarters at Cincinnati, O., has been promoted to succeed Mr. W. W. Peabody as General Manager. The latter will retain his position of Vice-President, which office has been separated from that of General Manager and the office of General Superintendent has been abolished.

Prof. Arthur Beardsley, M. Am. Soc. C. E., who has had charge of the Department of Engineering and the Mechanic Arts, in Swarthmore College, Swarthmore, Pa., for the past 26 years, has resigned his professorship on account of impaired sight. In appreciation of his services he has been made Professor Emeritus. His successor is Mr. W. H. Stine, late Professor of Electrical Engineering in the Armour Institute, Chicago.

OBITUARY.

Mr. Oscar Wright, Superintendent of the Rockville Electric Light Co., Rockville, Ind., died Aug. 29.

Mr. Henry G. Humber, Inspector of the Sewers, of Denver, Colo., since 1887, died in that city Aug. 26, aged 53.

Mr. John B. Dyar, formerly President of the Michigan Radiator & Mfg. Co., of Detroit, Mich., died at Grosse Point, Mich., last week.

Major William Vance McCracken, railway contractor, of New York city, died Aug. 30, aged 62. He was born in Bucyrus, O., and served in the Union Army during the Civil War.

Mr. William Frederick Bender, mechanical engineer, proprietor of the firm of William Oliver & Son, stone contractors, of Baltimore, Md., died Aug. 27, aged 72. He was a native of Germany.

Mr. Henry M. Myers, President of the H. M. Myers Co., Beaver Falls, Pa., shovel manufacturer, died of heart failure Aug. 30, aged 67. He was born in Georgetown, O., and learned the blacksmithing trade in Cohoes Falls, N. Y. He became the manager of the axe and shovel works of Newmyer & Graff, Allegheny City, Pa., and in 1869 organized the shovel works of Myers & Arnold, Beaver Falls. He is said to have taken out over 50 patents in this country, Canada and Europe.

Mr. Wilson Eddy, for 30 years Master Mechanic of the Boston & Albany R. R., died at his home in Springfield, Mass., Sept. 2. He was born in Chelsea, Vt., Feb. 24, 1813, and at 19 went to Lowell where he was employed on the canal. In 1840 he entered the service of the Boston & Albany R. R. as a mechanic, and was soon promoted to be Foreman of the local shops at Springfield. He was appointed Master Mechanic of the road in 1850, and during the years he held that position he built 135 locomotives, among them the "Addison Gilmore," which, it is said, was the fastest locomotive in the world at that time, and which won a gold medal and diploma at a tournament in Worcester, Mass., Oct. 1 and 2, 1851, making nine miles in 11 min. 20 sec. He resigned his position in 1881, and was succeeded by his son, Mr. Horace Eddy.

Mr. James Samuel Thomas Stranahan, President of the Park Commission of Brooklyn, N. Y., from 1860 to 1882, and formerly President of the Board of Trustees of the Brooklyn Bridge, died of apoplexy, at Saratoga, N. Y., Sept. 3. He was born at Peterboro, N. Y., April 25, 1808, and studied civil engineering, abandoning it however to engage in Indian trading. He founded the town of Florence, N. Y., in 1832, and represented that section in the Assembly in 1838. In 1840 he went to Newark, N. J., and became interested in the construction of railways. He removed to Brooklyn in 1845 and was elected an alderman of that city in 1848. In 1854 he was elected to Congress and remained in Washington until 1857, when he was appointed a member of the Metropolitan Police Commission of Brooklyn. During the Civil War he was President of the War Fund Committee and established "The Brooklyn Union," now "The Standard-Union." He was appointed President of the Park Commission in 1860 and held that office until 1882. In recognition of his services on this commission his statue was erected at the entrance to Prospect Park in 1891. Mr. Stranahan was also President of the Union Ferry Co. of Brooklyn in 1888, and was a director for 35 years. He was the oldest member of the Chamber of Commerce of New York city and was long a trustee and director of the New York and Brooklyn Bridge.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

CENTRAL RAILWAY CLUB.
Sept. 9. Secy., H. D. Vought, 114 5th Ave., New York city.
MONTANA SOCIETY OF ENGINEERS.
Sept. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
THE LOUISIANA ENGINEERING SOCIETY.
Sept. 12. "Evolution of Structural Design," F. T. Llewllyn. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
ASSOCIATION OF EDISON ILLUMINATING COMPANIES.
Sept. 12-13. Annual meeting, Sault Ste. Marie, Mich. Secy., Wilson S. Howell, Newark, N. J.
NORTHWEST RAILWAY CLUB.
Sept. 13. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
DENVER SOCIETY OF CIVIL ENGINEERS.
Sept. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.
THE RAILWAY SIGNALING CLUB.
Sept. 13. Secy., Earl M. Seitz, C. & N. W. Ry., Chicago, Ill.
ROADMASTERS' ASSOCIATION OF AMERICA.
Sept. 13. Annual meeting, Denver, Colo. Secy., J. B. Dickson, Sterling, Ill.
NEW YORK STATE STREET RAILWAY ASSOCIATION.
Sept. 13-14. Annual meeting, Manhattan Beach, Brooklyn, N. Y. Secy., H. A. Robinson, New York city.
MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOCIATION.
Sept. 13-15. Annual meeting, St. Paul, Minn. Secy., Robert McKeon, Kent, O.
NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 14-16. Annual meeting, Portsmouth, N. H. Secy., J. C. Whitney, Newton, Mass.
ENGINEERS' CLUB OF CINCINNATI.
Sept. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
BROOKLYN ENGINEERS' CLUB.
Sept. 15. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Sept. 16. D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF PHILADELPHIA.
Sept. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
ENGINEERS' CLUB OF COLUMBUS.
Sept. 17. Secy., H. M. Gates, 12½ North High St., Columbus, O.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Sept. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
ENGINEERS' CLUB OF MINNEAPOLIS.
Sept. 19. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Sept. 20. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Sept. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Sept. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 28. Secy., R. W. Pope, 26 Cortlandt St., New York city.
ENGINEERS' CLUB OF ST. LOUIS.
Sept. 21. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 28. Secy., R. W. Pope, 26 Cortland St., New York city.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 3. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Oct. 3. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
CHICAGO ELECTRICAL ASSOCIATION.
Oct. 7. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 12-16. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.
AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 18-20. Annual meeting, Richmond, Va. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.
PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.

NEW ENGLAND RAILROAD CLUB.—This club will take its annual outing on Sept. 13. The program includes music and dinner at Crescent Park, Narragansett Bay, and arrangements have been made for a special train which will leave Boston at 9.05 a. m.

MASTER CAR & LOCOMOTIVE PAINTERS' ASSOCIATION.—The 29th annual meeting of this association will be held at St. Paul, Minn., Sept. 13-16. The following subjects will be reported upon by the various committees: "Quick Drying Colors for Passenger Cars and Locomotives;" "The Railway Paint Shop Stock Room;" "Classification of Painting Repairs on the Outside and Inside Body of Passenger Cars;" "Painters and Painting as Compared with and Related to Other Mechanical Departments of Railway Work;" "The Difficulties and Environments of the Master Car Painter;" "A Historical Sketch of Railway Equipment Painters and Their Work in the Early Days;" "Do Railway Companies Give Proper Consideration to the Painting of Freight Cars?" "The Advantages Derived from Having a Suitable Shop for Painting of Locomotives Instead of Doing the Work in Round Houses and Machine Shops;" "Are the Railway Companies Justified in Surfacing and Varnishing Passenger Equipment, Cars and Locomotives?" "What Progress, If Any, Has Been Made in the Past Year in Paint Spraying?"

There will also be discussions on the following questions: "Do you paint roofing tin on both sides?" "What is the best filler for hardwood?" "What is the best varnish remover?" "Is there any advantage in the use of the gilding wheel?" "Which is the best for general purposes, grain alcohol, wood alcohol or alkaline?"

NEW ENGLAND WATER-WORKS ASSOCIATION.—The 17th annual convention will be held at Portsmouth, N. H., Sept. 14 to 16. Headquarters will be at the Hotel Wentworth and an exhibit of water-works appliances will be made. Exhibitors should address Mr. Henry F. Jenks, Pawtucket, R. I., for information concerning this. The following is the list of papers:

"Method for Determination of Color and the Relations of the Color to the Character of the Water." Frederick S. Hollis, Biologist, Metropolitan Water Board, Boston, Mass.
"Some Things that Should be Done in Constructing a Distributing System of Water-Works." William R. Hill, C. E., Chief Engineer and Superintendent, Syracuse, N. Y.
An informal talk on "Recent Sanitary Development in Certain Water Supplies." William T. Sedgwick, professor of Biology, Mass. Institute of Technology.
"Stand Pipes for Street Watering." F. F. Forbes, Supt., Brookline, Mass.
"Triple Expansion Pumping Engines." J. M. Betton, M. E., Brooklyn, N. Y.
"The Occurrence of Cristatella in the Storage Reservoir at Henderson, N. C." Robert S. Weston, C. E., Brockton, Mass.
"Description of the Monson, Mass., Water-Works." Frank L. Fuller, C.E., Boston, Mass.
"Man's Imitation of Nature in Purification of Water." Dr. Gardner T. Swarts, Secretary Rhode Island State Board of Health, Providence, R. I.
"Result of Tube Well Experiments in Lowell, Mass." George Bowers, C. E., City Engineer, Lowell, Mass.
"Surface Water Supplies." John C. Haskell, C. E., Supt., Lynn, Mass.
"Description of the Separate High Pressure Fire Service System of Providence, R. I." Edmund B. Weston, C. E., Consulting Engineer, Providence, R. I.

J. C. Whitney, Secy., Newton, Mass.

NATIONAL IRRIGATION CONGRESS.—The resolutions adopted at the annual convention held at Cheyenne, Wyo., Sept. 1, 2 and 3 favor an appropriation of not less than $100,000 for hydrographic surveys, for the measurement of streams and the survey of reservoir sites; strongly commend the care of forests begun by the Secretary of the Interior, and urge the formation of a Forestry Bureau and an appropriation by Congress sufficient for its support and management; urge upon the states legislation to prevent forest fires; favor the suggestion of Professor

Sargent, of Harvard University, that instruction in forestry be given at West Point, to prepare army officers for an intelligent understanding of forestry administration; commend the action of Cornell University in starting a school of forestry; favor the creation in the Department of Agriculture of a bureau of irrigation and a liberal appropriation for its support; express cordial appreciation of the value of irrigation investigations already made by agricultural experiment stations, and recommend that they give increased attention to the arid states; request Congress to make sufficient appropriations to construct the reservoir surveyed at Butte, Ariz., and to construct a water-shed reserve near Butte, Mont.; provide that a committee of five be appointed to present a bill to this Congress regulating and establishing uniform methods for appropriation and control of the waters of interstate streams; reaffirm the resolutions of the Phoenix congress on reservoirs, of the Lincoln congress on the public ownership of water, and of the Phoenix congress on the cession of public lands to the states under strict conditions insuring settlement, and indorse the Chittenden report favoring the construction of reservoirs and the recommendation of Elwood Mead favoring the leasing of the grazing lands.

WESTERN SOCIETY OF ENGINEERS.—The first fall meeting of this Society was held Sept. 7, at Chicago, Ill., and the following papers were presented: The "Equilibristat" (for railroad track inspection), D. J. Whittemore; "Mechanics of Suction and Suction Pipes," D. W. Mead; "Cableway Construction," Robt. D. Seymour; "Concrete Facing on a Sandstone Bluff at St. Paul," Onward Bates. The advance program for the year ending February, 1899, is given as follows: Sept. 21, "The Soudan and Recent British Campaigns There," H. G. Prout; Sept. 28, "The Foundations for the U. S. Government Post Office and Custom House Building at Chicago," William Sooy Smith; Oct. 5, "Track Elevation of the Chicago & Northwestern Ry.," Louis H. Evans. In discussion of this paper notes will be presented on the track elevation of Ill. Central Ry., H. W. Parkhurst; C., M. & St. P. Ry., Messrs. Wade, Rogers and Reichmann; C., B. & Q. R. R., G. H. Bremner; L. S. & M. S. Ry. and C. R. I. & P. Ry., L. H. Clarke; P., F. W. & C. Ry., W. H. Coverdale; P., C. C. & St. L. Ry., Thos. H. Johnson; 16th St. Crossing, G. W. Vaughn; (Title to be announced later), Robert B. Owens; Oct. 19, "Masonry" (illustrated), George S. Morison; Nov. 2, "Construction of Retaining Walls for the Sanitary District of Chicago," James W. Beardsley; "Berthier Method of Coal Calorimetry," Charles V. Kerr; "Brakes for Electrical Cars," William G. Price; Nov. 16, "The Manchester Ship Canal" (illustrated), Elmer L. Corthell; "Tables of Excessive Precipitations of Rain at Chicago," Edwin Duryea, Jr.; Dec. 7, "Electrolytic Corrosion of Underground Metallic Structures," Prof. D. C. Jackson; "Mechanical Plants of Large Buildings" (Part II.), Dankmar Adler; Dec. 21, "Foundations for Railroad Bridge Across the St. Lawrence River at Cornwall, Ont.," George E. Thomas; "Drawbridges on Chicago & Northwestern Ry.," William H. Finley; "Notes on Engineering Work," John S. Prell; Jan. 3, Annual Meeting; Jan. 18, "Establishment of Street Grades," Charles P. Chase; Feb. 8, "Measurement of the Discharge of the Niagara River," Clinton B. Stewart; "The Effect of Speed and Radii of Curves on the Inclination of Bicycle Tracks," John C. Quade.

NEW PUBLICATIONS.

LITERARY MAGAZINES.—In "Harper's" for September, Mr. W. C. Ford discusses the new revenue policy of the United States and points out the reasons why the stamp and other taxes which have recently been adopted are likely to be a permanent feature of our fiscal system. He emphasizes especially the fact that a protective tariff (as distinguished from a tariff for revenue) can no longer be expected to yield large returns to the treasury. "Days in the Arctic" is the title of an entertaining and well illustrated paper by Mr. F. G. Jackson, describing his experiences in Franz Josef Land. Hon. James Bryce discusses the policy which the United States had best pursue toward the former Spanish possessions, and considers the question from a broad standpoint. If we regard purely our material interests, he thinks that we will take none of these over-sea possessions as colonies; but he recognizes the feelings of national pride that will prompt an opposite course.

The September "Century" has two articles on the same topic, one by Carl Schurz, in which the dangers that beset us in acquiring these new territories are set forth, and the other by Hon. Whitelaw Reid, entitled "The Territory with Which We Are Threatened." Mr. Reid recognizes the arguments of those who foresee trouble from a policy of "colonial expansion;" but he shows that it is rather a matter of what we are obliged to do to fulfil our international obligations than what we want to do as a matter of self-interest. Emile Ollivier, the eminent French statesman, writes on "America, Spain and France," and emphatically declares that America has fought a just war and that to be relieved of her colonies will really be a blessing to Spain. "The Malay Pirates of the Philippines" are described by Prof. Worcester of the University of Michigan, and we commend the article to any of our readers who think that the task of governing the Philippines is likely to prove an easy one.

In "Scribner's" for September, Edgar R. Dawson, M. E., writes of the Jungfrau Railway, work on which is now in progress and which will be one of the highest railways in the world, reaching an altitude of 13,720 ft., if one counts as a part of the railway the 240 ft. elevated, which makes the last stage of the trip. The September "Cosmopolitan" has a paper on "Horseless Carriages in Paris," written from the popular point of view. Two other articles deserving mention here are "A Study of the Modern Battleship," and a description of the methods by which the great newspapers have given their readers the news of the war, at an expense for which their added returns do not begin to compensate. In the "Atlantic" for September, Mr. Worthington C. Ford writes on "New Opportunities for American Commerce." He thinks that there is little prospect of our building up any large market for American goods in China or the Philippines; but believes that Cuba and Porto Rico will prove very valuable possessions. "Fifty Years of American Science" is the title of a paper which was inserted at this time, we presume, because of the current semi-centennial meeting of the American Association for the Advancement of Science in Boston.

"Appleton's Popular Science Monthly" for September opens with a paper entitled "Geological Waterways Across Central America," in which various depressions are described which were once the beds of straits connecting the Atlantic and Pacific oceans. Some of these, we believe, are known to few engineers, and the article should have interest for all students of the Isthmian canal problem. The same magazine contains the fullest account we have seen in any American periodical of the purchase of the Swiss railways by the Government, which was ordered by an overwhelming popular vote on Feb. 20 last. The experiment Switzerland is making is one of great interest and its results will be attentively watched. It may be said that all the railways will not probably come into possession of the state for a half-dozen years yet, one after the other being taken, according to the dates fixed in their original charters.

The "North American Review" is devoted chiefly to current political problems, those in connection with the East and West Indies receiving, of course, greatest prominence. We may note that Hon. John B. Barrett, late U. S. Minister to Siam, urges that the Philippines will be a highly valuable acquisition for this country, and his article was written, curiously enough, before the declaration of war last spring.

The "Review of Reviews" has its usual critical discussion of current events, and we note especially an article on the cost and finances of the war, in which it is computed from official figures that the total cost of our war with Spain, including the garrisoning of our new possessions till Jan. 1 next, will reach $250,000,000. The pension bill is not included in this; and from the condition of many of the returning troops, it looks as if the typhoid-inoculated water, which the soldiers had to drink would in the end prove more costly than smokeless powder.

In the August "Fortnightly Review" we notice two articles worth mention here. One is "The Dynastic Crisis in Spain," by a Spaniard, explaining some of the reasons why the present occupant of the Spanish throne has felt great insecurity during the past few months, and the other is an article on the prevention of consumption.

LOSSES FROM CANALS FROM FILTRATION AND SEEPAGE.—Bulletin No. 48, Colorado Agricultural Experiment Station, Fort Collins, Colo. By L. G. Carpenter, Meteorologist and Irrigation Engineer. Paper; 6 × 9 ins.; pp. 36; tables and one illustration. Address, Director Experimental Station.

The conclusions drawn by the professor on this subject are given elsewhere in this issue. They are founded principally on actual measurements, made mostly in Colorado.

VEREIN DEUTSCHER INGENIEURE.—Membership list for 1898. Published by Geschäftsfühbrung und Redaktion der Vereinsschriften, Berlin, N. W. Charlotten Str., 43. Pamph.; 5¼ × 7½ ins.; pp. 285.

This is a list of members of the Society of German Engineers, giving their addresses. The names are arranged according to districts, but a complete alphabetical list of names is given with cross references to the district lists. The total membership of the Society is nearly 3,000.

REPORT ON THE WATER-WORKS SYSTEM OF MEMPHIS, TENN.—By John Lundie, Consulting Engineer, Chicago. Paper; 5¾ × 8½ ins.; pp. 46; illustrated.

In February, 1898, Mr. Lundie was directed to examine and report upon the water-works system, and to present an estimate of the cost of a similar plant. The report outlines the history of the water supply, and describes the present works, in which a 5-ft. tunnel ¾ mile long and 80 ft. below the surface, forms an underground reservoir fed by 60 artesian wells. The water is pumped by three Worthington vertical engines of 10,000,000 gallons capacity, taking water from a 10-ft. pump well to the tunnel. The supply is reported to be inexhaustible, and the cost of duplication of the plant, including land, is estimated at $1,283,938. To the report is appended the text of the present contract between the city and the Artesian Water Co.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

GAS AND GASOLINE ENGINES AND HOISTS.—The Weber Gas & Gasoline Engine Co., Kansas City., Mo. Pamph.; 9¼ × 6 ins.; pp. 64.

This is an illustrated description of the Weber gas engines and several special applications, such as agricultural engines for farmers, irrigators and dairymen. Illustrations and brief descriptions of hoisting engines are also given and a number of letters from users of Weber machinery are included.

ODORLESS SEWAGE DISPOSAL FOR TOWN AND COUNTRY HOUSES.—Edson Manufacturing Co., 132 Commercial St., Boston, Mass. Paper; 6½ × 3 ins.; pp. 20; illustrated.

This pamphlet describes a pump and fittings for lifting the contents of cesspools to tank wagons.

SPECIAL RIVETED PIPE.—Abendroth & Root Mfg. Co., 28 Cliff St., New York city. Paper; 8 × 7 ins.; pp. 32.

This catalogue describes the well-known spiral riveted pipe which is a specialty of this firm, and illustrates its use in many different fields. Special forms of joints, elbows, tees, etc., are also shown.

SNOW PLOWS FOR STREET RAILWAYS.—J. G. Brill Co., Philadelphia, Pa. Pamph.; 9 × 6 ins.; pp. 16; illustrated.

This pamphlet illustrates and describes briefly the standard snow plows, snow sweepers, and track scrapers manufactured by the above named company for street railway use.

STEAM PUMPS.—Dean Bros. Steam Pump Works, Indianapolis, Ind. Pamph.; 3½ × 6 ins.; pp. 16; illustrated.

This pamphlet illustrates and describes briefly a number of the standard boiler feed and pressure pumps manufactured by the above firm. A diagram and list of parts is also given for those who wish to order parts for repairing pumps of this firm's manufacture.

RECENT BALDWIN LOCOMOTIVES.—Bethlehem Locomotive Works, Philadelphia, Pa. Pamph.; 9 × 6 ins.; pp. 32; illustrated.

This is No.7 of the series of monthly descriptive pamphlets published by the above firm and it contains illustrations of a number of locomotives recently built to American and foreign orders, the latter mostly from Brazil and Mexico.

PUMPS AND GOVERNORS.—Gardner Governor Co., Quincy, Ill. Paper; 7¾ × 5¼ ins.; pp. 52.

The specialties included in this catalogue are various forms of steam pumps, pump and engine governors, speed and pressure governors for air compressors, balanced lever valves, and globe valves for steam engines. Price lists and tables of dimensions are given, and there are some pages of "useful information."

RESISTANCE METAL.—Herman Boker & Co., New York City. Pamph; 3½ × 7 ins.

This pamphlet contains a series of tablets in which the weights, sizes and resistances of various kinds of nickel and special resistance wires are given. The same data is given for resistance tape made of the same alloys. These tapes have a maximum length of about 300 ft., a maximum width of ¾-in. and a least thickness of between .003 and .002.

THE "NORTHWESTERN LIMITED" TRAIN: Passenger Department, Chicago & Northwestern Ry., Chicago., Ill. Pamph.; 6½ × 6 ins.; pp. 24; illustrated.

This little pamphlet contains a number of handsome half-tone views showing the interior fittings and equipment of the luxurious special passenger train recently put in operation between Chicago and St. Paul by the Chicago & Northwestern Ry. A brief description accompanies each of the engravings.

THE GRAND ARMY OF CINCINNATI. — Issued by the passenger departments of the Chicago, Indianapolis & Louisville Ry. and the Cincinnati, Hamilton & Dayton Ry. Paper; 5 × 7 ins.; pp. 24.

This is a handsome pamphlet, containing views of and information regarding Cincinnati and its surroundings, and its historic relation to the Civil War, in connection with the coming "encampment" meeting of the Grand Army of the Republic. Incidentally the advantages afforded by the two railways for transportation facilities are put forward.

ONE QUARTER OF A MILLION HORSE-POWER.—Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Pamph.; 9 × 6 ins.; pp. 24; illustrated.

This pamphlet is a collection of especially good half-tones of Westinghouse polyphase apparatus, with brief descriptions and a list of 185 plants in this and foreign countries using such machinery. In this list are given the number and capacity of generators, motors, rotary transformers, and the transmission voltage, all of which are valuable for reference. It is unfortunate that the method of driving and rated power of engine or water wheel are omitted.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News
Sept. 8.	Plumbing, and heating,	Manitowoc, Wis.	Aug. 25
Sept. 8.	Brick paving,	Monroe, La.	Aug. 25
Sept. 8.	Macadam paving.	Shoals, Ind.	Aug. 18
Sept. 8.	Dykes,	Hudson River, N. Y.	Aug. 11
	Advertised, Eng. News, Aug. 11 to Sept. 1.		
Sept. 8.	Brick sewer,	Hammond, Ind.	Sept. 1
Sept. 8.	Buildings,	Danville, Ill.	Sept. 1
Sept. 8.	Bank protection,	New Orleans, La.	Sept. 8
Sept. 8.	Highway (2 contracts),	Boston, Mass.	Sept. 8
Sept. 8.	Pipe sewers,	Avalon, Pa.	Sept. 8
Sept. 9.	Concrete sidewalks,	Oshawa, Ont.	Sept. 8
Sept. 9.	Asylum buildings,	Buffalo, N. Y.	Sept. 8
Sept. 9.	Brick paving,	Shamokin, Pa.	Sept. 1
Sept. 9.	School buildings,	Mandan, N. Dak.	Sept. 1
Sept. 9.	Paving,	Omaha, Neb.	Sept. 1
Sept. 9.	Condenser, etc., for electric plant,	Chicago.	Sept. 1
Sept. 9.	Electric plant,	St. Louis, Mich.	Sept. 1
Sept. 9.	Abutments,	Woodsfield, O.	Sept. 1
Sept. 9.	Rubber suctions,	Charleston, S. C.	Aug. 11
	Advertised, Eng. News, Aug. 11 to Sept. 1.		
Sept. 9.	Sea walls,	Baltimore, Md.	Aug. 18
	Advertised, Eng. News, Aug. 18 to Sept. 8.		
Sept. 9.	Water bonds,	Sparta, Minn.	Aug. 25
Sept. 9.	School building,	Laharpe, Ill.	Aug. 25
Sept. 10.	Bridges (3),	Wichita, Kan.	Aug. 25
Sept. 10.	Brick paving,	Coshocton, O.	Aug. 25
Sept. 10.	Street improvements,	Nelsonville, O.	Aug. 25
Sept. 10.	Highways,	Rockville, Ind.	Aug. 25

Sept. 10. Improving road, Mansfield, O. .... Aug. 18
Sept. 10. School buildings (2), St. Louis, Mo. ...... Sept. 1
Sept. 10. Lodge building, Fort Worth, Tex. .... Sept. 1
Sept. 10. Electric plant bonds, Lancaster, Pa. ...... Sept. 1
Sept. 10. Electric plant, Greenup, Ill. .... Sept. 1
Sept. 10. Brick paving, Alexandria, Ind. .... Sept. 1
Sept. 10. Dredging, Philadelphia, Pa. .... Sept. 1
Sept. 10. Dam foundation, Columbus, O. .... Sept. 1
Advertised, Engineering News, Sept. 1.
Sept. 10. Sewer bonds, New Britain, Conn. .... Sept. 8
Sept. 10. Sewerage system, Oakmont, Pa. .... Sept. 8
Sept. 10. Engine house, Lancaster, O. .... Sept. 8
Sept. 10. Water-works, Elbow Lake, Minn. .... Sept. 8
Sept. 10. Bridge abutments, Willowdale, Ont. ...... Sept. 8
Sept. 12. Wooden sidewalks, Wichita, Kan. .... Sept. 8
Sept. 12. Sewers, etc., Indianapolis, Ind. .... Sept. 8
Sept. 12. Improving alleys, Louisville, Ky. .... Sept. 8
Sept. 12. Grading, St. Joseph, Mo. .... Sept. 8
Sept. 12. Iron platform, Chicago, Ill. .... Sept. 8
Sept. 12. Bridge work, St. Joseph, Mo. .... Sept. 8
Sept. 12. Sewers, Sycamore, Ill. .... Sept. 8
Sept. 12. Grading, etc. (5 contracts), Kansas City, Mo. Sept. 8
Sept. 12. Garbage boat, New Orleans, La. .... Sept. 8
Sept. 12. Sidewalks (11 contracts), Kansas City, Mo. Sept. 8
Sept. 12. Paving, etc., Indianapolis, Ind. .... Sept. 8
Sept. 12. Brick sewer, Houston, Tex. .... Sept. 1
Sept. 12. Pipe sewers, etc., Faribault, Minn. .... Sept. 1
Sept. 12. Road work, Houston, Tex. .... Sept. 1
Sept. 12. Bridge, Manning's Ford, Va. .... Sept. 1
Sept. 12. Repairing steamer, New York, N. Y. ...... Sept. 1
Sept. 12. Paving, etc., Toledo, O. .... Aug. 18
Sept. 12. Water and sewer bonds, Mobile, Ala. ...... Aug. 11
Sept. 12. Grading, paving, etc., Toledo, O. .... Aug. 11
Sept. 12. Lake outlet, Lake Manitoba, Can. .... Aug. 25
Sept. 12. Bridge, Warren, Pa. .... Aug. 25
Sept. 12. Bonds, Mansfield, O. .... Aug. 25
Sept. 12. Bridge, Lima, O. .... Aug. 25
Sept. 12. Paving, Youngstown, O. .... Aug. 25
Sept. 13. Aqueduct (17¼ miles), Birmingham, Eng. .. Aug. 25
Sept. 13. Bridge, Edmonton, N. W. Ter. .... Aug. 25
Sept. 13. Bridge work, Columbus, O. .... Aug. 25
Sept. 13. Crushed limestone, Toledo, O. .... Aug. 25
Sept. 13. Capitol building, Helena, Mont. .... July 28
Sept. 13. Brick sewer, etc., Kearney, N. J. .... Aug. 18
Advertised, Eng. News, Aug. 18 to Sept. 8.
Sept. 13. Repairing bridge, Mountain Home, Idaho ... Aug. 18
Sept. 13. Building, etc., Oxford, O. .... Sept. 1
Sept. 13. Paving, Vineland, N. J. .... Sept. 1
Sept. 13. Pipe sewers, etc., Parkersburg, W. Va. .... Sept. 1
Sept. 13. Sandstone, etc., Pt. Wilson, Wash. .... Sept. 1
Sept. 13. Electrical apparatus, Norfolk, Va. .... Sept. 1
Sept. 13. Pavement, New Haven, Conn. .... Sept. 8
Sept. 13. Concrete walk, New Haven, Conn. .... Sept. 8
Sept. 13. Macadamizing, Cincinnati, O. .... Sept. 8
Sept. 13. Asphalt paving, etc., Chicago, Ill. .... Sept. 8
Sept. 13. Buildings, National Military Home, Kan. ... Sept. 8
Sept. 13. Bonds, Sheridanville, Pa. .... Sept. 8
Sept. 13. Extending water-works, Manilla, Ia. ...... Sept. 8
Sept. 13. Paving and curbing, Crafton, Pa. .... Sept. 8
Sept. 14. Macadamizing, Marshall, Tex. .... Sept. 8
Sept. 14. Electric light plant, Winchester, Va. ...... Sept. 8
Sept. 14. School building, Pittsburg, Pa. .... Sept. 8
Sept. 14. Removing offal, etc., New York, N. Y. ..... Sept. 8
Sept. 14. Brick paving, Meadville, Pa. .... Sept. 8
Advertised, Engineering News, Sept. 8.
Sept. 14. Water pump, Covington, Ky. .... Sept. 8
Sept. 14. Sewer system, Pocomoke City, Md. .... Sept. 1
Advertised, Eng. News, Aug. 25 and Sept. 1.
Sept. 14. Water-works, Pocomoke City, Md. .... Sept. 1
Advertised, Eng. News, Aug. 25 and Sept. 1.
Sept. 14. School building, Pittsburg, Pa. .... Sept. 1
Sept. 14. City hall bonds, Brooklyn, O. .... Sept. 1
Sept. 14. Brick paving, Alexandria, Ind. .... Sept. 1
Sept. 14. Hospital building, Los Angeles, Cal. ...... Aug. 18
Sept. 15. Enlarging court house, Lisbon, N. Dak. .... July 28
Sept. 15. Fire alarm system, Mobile, Ala. .... Aug. 11
Advertised, Eng. News, Aug. 11 to Sept. 1.
Sept. 15. Light-house, Tompkinsville (S. I.), N. Y. .. Aug. 25
Advertised Eng. News, Aug. 25 and Sept. 1.
Sept. 15. Engine (150-HP.), New Orleans, La. ..... Aug. 25
Sept. 15. Iron bridge, Natchitoches, La. .... Aug. 25
Sept. 15. Pipe sewers, etc., Santa Ana, Cal. .... Sept. 1
Sept. 15. Asphalt paving, Bloomington, Ill. .... Sept. 8
Sept. 15. Sidewalks, Louisville, Ky. .... Sept. 8
Sept. 15. Stone, cement, etc., New York, N. Y. ...... Sept. 8
Sept. 15. Laying water pipe, Boston, Mass. .... Sept. 8
Advertised, Engineering News, Sept. 8.
Sept. 15. Stone and screenings, New York, N. Y. .. Sept. 8
Sept. 15. Sewers, Cleveland, O. .... Sept. 8
Sept. 16. Sewer, Omaha, Neb. .... Sept. 8
Sept. 16. Asphalt paving, (2 contracts), Omaha, Neb. . Sept. 8
Sept. 16. Railway grading (10 miles), Petersburg, Va. Sept. 8
Advertised, Engineering News, Sept. 8.
Sept. 16. Pipe sewers (6 miles), Shelby, O. .... Sept. 1
Sept. 16. Brick and pipe sewer, Richmond, Ind. .... Aug. 25
Sept. 16. Supplies, Norfolk, Va. .... Aug. 25
Advertised Eng. News, Aug. 25 and Sept. 1.
Sept. 17. Storm sewer, Mansfield, O. .... Aug. 25
Sept. 17. Headstones, (10,000), Boston, Mass. ...... Aug. 25
Sept. 17. Brick paving, Watertown, Wis. .... Sept. 1
Advertised, Engineering News, Sept. 1.
Sept. 17. Sewers, Washington, D. C. .... Sept. 1
Advertised, Engineering News, Sept. 1.
Sept. 17. Removing wreck, St. Joseph, Mo. .... Sept. 1
Sept. 17. Electric plant, Duncannon, Pa. .... Sept. 8
Sept. 17. Pig lead, Cleveland, O. .... Sept. 8
Sept. 17. Heating and ventilation, Danville, Ill. ... Sept. 8
Sept. 19. Paving bonds, Youngstown, O. .... Sept. 8
Sept. 19. School building repairs, Rochester, N. Y. .. Sept. 8
Sept. 19. Pipe sewers, Toledo, O. .... Sept. 8
Sept. 19. Heating, Windsor, N. S. .... Sept. 8
Sept. 19. Water refunding bonds, Canton, O. .... Sept. 8
Sept. 19. Electric lighting, Portland, Ore. .... Sept. 1
Sept. 19. Jail building, Newport News, Va. .... Sept. 1
Sept. 19. Bridges (2), Newport News, Va. .... Sept. 1
Sept. 19. Heating and ventilating, St. Albans, Vt. ... Aug. 25
Advertised Eng. News, Aug. 25 and Sept. 1.
Sept. 19. Hospital plans, San Francisco, Cal. ...... Aug. 4
Sept. 19. Jail, Lovelocks, Nev. .... Aug. 18
Sept. 19. Bridge bonds, Los Angeles, Cal. .... Aug. 18
Sept. 20. Viaduct, Cincinnati, O. .... Aug. 25
Sept. 20. Electric light plant, Grand Rapids, Mich. .. Sept. 1
Advertised, Engineering News, Sept. 1.
Sept. 20. Highway, Rockville, Md. .... Sept. 8
Sept. 20. Hospital building, Binghamton, N. Y. .... Sept. 8
Sept. 21. School building, New Brunswick, N. J. .. Sept. 8
Sept. 21. Water-works, Bristol, Va. .... Sept. 1
Sept. 21. Canal, Chicago, Ill. .... Aug. 25
Advertised, Aug. 25 to Sept. 15.
Sept. 22. Hospital buildings, etc., Central Islip, N.Y. . Sept. 1
Sept. 22. Electrical apparatus, Central Islip, N.Y. ... Sept. 1
Sept. 22. Power plant, Wrightsville, Pa. .... Sept. 8
Advertised, Eng. News, Sept. 8 and 15.
Sept. 22. Bridge bonds, Elyria, O. .... Sept. 8
Sept. 22. Levee work, New Orleans, La. .... Sept. 8
Sept. 22. Stone jetties, Green Harbor, Mass. .... Sept. 8
Advertised, Eng. News, Sept. 8 and 15.
Sept. 23. High-school building, Camden, N. J. ...... Sept. 8
Sept. 23. Supplies, Watervliet, N. Y. .... Aug. 25
Sept. 24. Capitol building, Columbus, O. .... Sept. 1
Sept. 24. Electric plant, Pensacola, Fla. .... Sept. 1
Sept. 24. Quay wall, San Francisco, Cal. .... Sept. 1
Sept. 24. School building, Shreveport, La. .... Sept. 8
Sept. 24. Building material, Pine Ridge, S. Dak. .... Sept. 8
Sept. 26. Bonds, Dayton, O. .... Aug. 25
Sept. 26. Electric plant bonds, St. Louis, Mich. .... Sept. 1
Sept. 28. U. S. building, Brockton, Mass. .... Sept. 1
Advertised, Eng. News, Sept. 1 and 8.
Sept. 29. Water-works, Wivenhoe, England .... Sept. 1
Sept. 29. Court house, Marietta, Ga. .... Aug. 18
Sept. 30. Improving reservoir, Albany, N. Y. ...... Sept. 8
Advertised, Engineering News, Sept. 8.
Sept. 30. Coal shaft, Latrobe, Pa. .... Sept. 8
Oct. 1. Towboat, St. Louis, Mo. .... Sept. 8
Oct. 1. Arc lighting, Marshfield, Wis. .... Aug. 18
Oct. 1. Monitors (4), Washington, D. C. .... July 7
Oct. 1. School building (equipment), St. Thomas, Ont. July 7
Oct. 1. Road roller, Sheboygan, Wis. .... Sept. 1
Advertised, Engineering News, Sept. 1.
Oct. 1. Head-race (power plant), Montreal, Que. .... Sept. 1
Advertised, Eng. News, Sept. 1 to 15.
Oct. 3. Street work, Toledo, O. .... Sept. 1
Oct. 3. Building plans, Liverpool, England .... Sept. 8
Oct. 3. Building superstructure, Philadelphia, Pa. .. Sept. 8
Advertised, Eng. News, Sept. 8 and 15.
Oct. 3. Bridge, Flandreau, S. Dak. .... Sept. 8
Oct. 4. Coal conveyors, etc., Chicago, Ill. .... Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 29.
Oct. 5. Bridge superstructure, Chicago, Ill. .... Aug. 11
Oct. 5. Dredging, Oakland, Cal. .... Sept. 8
Oct. 5. Shore protection, Fort Morgan, Ala. .... Sept. 8
Advertised, Eng. News, Sept. 8 to 29.
Oct. 10. Turbine wheels (24), Wrightsville, Pa. ..... Sept. 8
Advertised, Eng. News, Sept. 8 and 15.
Oct. 10. Trestle, Chehalis, Wash. .... Sept. 8
Oct. 12. Park bonds, Spokane, Wash. .... Sept. 1
Oct. 17. Gasholder, etc., Edinburgh, Scotland ...... Sept. 1
Oct. 21. Dry dock, Algiers, La. .... Sept. 8
Oct. 24. Markets, etc., Belem, Brazil. .... Apr. 28
Oct. 25. Jetties, Portland, Ore. .... Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 15.
Oct. 30. School building, Chehalis, Wash. .... June 16
Oct. 31. Water supply, Cobourg, Ont. .... Sept. 8
Advertised, Eng. News, Sept. 8 to Oct. 27.
Oct. 31. Electric lighting, Cobourg, Ont. .... Sept. 8
Advertised, Eng. News, Sept. 8 to Oct. 27.
Nov. 1. Court house, Garner, Ia. .... Sept. 8
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn. .... Aug. 18
No date. Sewer & water systems, White Earth, Minn. Sept. 8

RAILWAYS.

CALIFORNIA.—J. A. Dubbs, Mgr. Mexican Sulphur Co., Pittsburg, Pa., informs us that nothing further has yet been done towards the construction of the proposed railway to the sulphur mines, about 70 miles south of Yuma, Ariz., other than the completion of two surveys, one 67 miles in length to Yuma, and the other to San Diego, Cal., on the Pacific coast, 168 miles.

CHICAGO, PEORIA & WESTERN.—This company was incorporated in Iowa, Aug. 19, with a capital stock of $50,000. It is proposed to construct and operate a railway from a point on the Mississippi River, near the glucose works, thence northwesterly through the counties of Scott, Cedar, Linn, Benton, Tama and Marshall to Marshalltown. The officers, who are all connected to the Davenport Glucose Co., are: Pres., Lee S. Harrison; Vice-Pres., Louis H. Brandt; Secy. and Treas., Carl J. Langfeldt, all of Davenport. Reference was made to this company in our issue of Aug. 4.

CLEARFIELD SOUTHERN.—P. E. McGovern writes us from Clearfield, Pa., that he has been awarded the contract for the construction of this proposed railway from Belsena Mills, Pa., to Clearfield Bridge, a distance of about 16 miles, as reported in our last issue. The new line will penetrate large timber and coal districts. Construction work has already commenced, and the work will be pushed forward rapidly. Pres., A. W. Lee, Clearfield; Ch. Engr., Samuel Bruger, Fleming, Pa.

ELDON & ST. LOUIS.—The citizens of Shelbyville, Ill., expect to raise $7,500 towards the construction of this railway and also to grant the right of way, station grounds and switchyards in Black Creek township. The company contemplates building from Milton, Ia., to Mexico, Mo., a distance of 272 miles. C. J. Du Bois, Ch. Engr., Macon, Mo., has previously informed us that no contracts will be let until all of the right of way is obtained. Pres., S. H. Sawyer, Eldon, Ia.

EL PASO & NORTHEASTERN.—It is announced that George S. Good & Co., Lock Haven, Pa., has about completed the grading on the main line from Alafogorda Junction to Toboggan Gulch. Track-laying, under the direct supervision of the company, is now in progress near La Luz, N. Mex. Pres., C. D. Simpson, Scranton, Pa.

HAMPTON & BRANCHVILLE.—Reports state that this line will probably be extended from Mauldinton to Georges, S. C., on the South Carolina & Georgia R. R., a distance of 17 miles. The company now operates about 23 miles of railway. W. H. Mauldin, Pres. and Treas., Hampton, S. C.

LOWELL & HASTINGS.—Reports state that the Lowell & Hastings R. R. will be extended north from Lowell to Belding and south from Freeport to Hastings, Mich., by a Boston syndicate; also that operations will begin soon and the road completed in three months from that time. M. L. Sweet, Gen. Mgr., Grand Rapids, Mich.

MEXICO & SAN RAFAEL.—Reports state that surveys have been commenced for a line of railway from Chalco to Rio Frio, to form part of the line projected under the charter of the Xico & San Rafael Ry. Co. Robert Gayol, Ch. Engr.

MICHIGAN.—Balch & Peppard, of Minneapolis, Minn., are stated to have been awarded the contract for the construction of a railway to connect the Franklin, Jr., and Arcadian mines with the mill sites at Grosse Point. The proposed line, including terminals and sidings, will contain about 12 miles of track. The road will be of standard gage, and is expected to be completed and ready for use by next spring.

MINNEAPOLIS & ANOKA SUBURBAN.—Reports from Minneapolis, Minn., state that trains are expected to be running to Anoka, a distance of 20 miles, over this new line, by Oct. 1. Mr. Fisher, of St. Paul, is the contractor, and the grading is being done by Page Bros. and F. H. Eddy, of Anoka, Minn. The entire system, as contemplated, will be built by two companies, and will have a total length of 185 miles, from Minneapolis to Rainy Lake. From Camden Place to Champlin it will run on along the river, and there will cross to Anoka over a new bridge. From that point it will be known as the Minneapolis, Anoka & Rainy Lake Ry., and will run 70 miles to Mille Lacs, and thence 100 miles farther to Rainy Lake.

MOBILE & BAY SHORE.—This company has been incorporated in Alabama to build a railway from Mertz station, on the Duncan branch, down to or near Portersville and Alabama Port, a distance of about 27 miles. All the rights of way for the new line have been secured. The incorporators are: W. Butler Duncan and Adrian Iselin, Jr., of New York; A. J. Russell, of Meridian, Miss.; J. C. Clarke, J. H. Mason, C. S. Clarke and E. L. Russell, of Mobile, O.

OREGON R. R. & NAVIGATION.—W. H. Kennedy, Ch. Engr., Portland, Ore., informs us that a contract was let to Hale & Smith, of Portland, July 15, for rectifying the alinement for a distance of three miles between Cascade Locks and Viento. Estimated cost of improvements, about $60,000. Pres., A. L. Mohler, Portland.

PETERSBURG.—Bids are asked by this company, a part of the Atlantic Coast Line, Until Sept. 16, for the graduation of a line about ten miles in length, beginning about two miles south of Petersburg, Va., and running southeasterly in proximity to the existing railway, as stated in our advertising columns. E. T. D. Myers, Ch. Engr., Richmond, Va.

PHILADELPHIA & READING.—It is announced that preliminary plans have been prepared for the proposed elevation of this company's tracks along 9th St., from Wallace to Huntindon St., in order to avoid all grade crossings without materially disturbing the grade of any street; estimated cost, $2,200,000. Geo. S. Webster, Ch. of Bureau of Surveys.

PORTLAND, VANCOUVER & YAKIMA.—Press reports state that this line will soon be extended from its present terminus at Brush Prairie towards the Yacolt Prairie, for a distance of 15 miles. The company was incorporated in Washington last December to operate the old Vancouver, Klickitat & Yakima Ry., a 15-mile logging road, which it purchased with the intention of extending and improving the line. Pres., L. Gerlinger, Vancouver, B. C.; Vice-Pres., J. H. Hubbard, Portland, Ore.

SUGAR CREEK.—J. M. Clark, Ch. Engr., Kanawha Falls, W. Va., informs us that this company proposes to build a line from McDonald, W. Va., to coal property several miles distant. The right of way will probably be secured soon. Not all of the capital for construction has yet been obtained, and it is not definitely known when the contracts will be let. Pres., Col. J. M. Davis, Coffman, W. Va.

SOUTHERN.—Press reports from Birmingham, Ala., state that surveys have been completed for a branch line to the mines of the Ivy Coal & Coke Co., in Walker county, and that contracts would be let as soon as possible. The new line will leave the main road at a point 28 miles west of Birmingham, and run north along Horse Creek. The extension will be only for freight service.

UTAH.—J. H. McEwen, Agent for Jesse Knight, of Provo City, Utah, informs us that he is at present making a preliminary survey in Hobble Creek canyon only in order to establish a grade and to secure the right of way for a railway projected to connect Salt Lake and Denver.

UTAH & PACIFIC.—We are informed that this company proposes to construct 75 miles of railway from Milford, Utah, south to the Utah and Nevada state line on the old grade built by the Oregon Short Line R. R. Co. Bids were to be received for this work until Sept. 5. A chief engineer has not yet been appointed. Pres., A. W. M'Cune, Salt Lake City, Utah.

WASHINGTON COUNTY.—William Kenefick, Ellsworth, Me., informs us that his section of the work on this new railway, or that part extending from Ellsworth to East Machias, Me., a distance of about 60 miles, will be completed by Sept. 15. The other contractor at work on the line is R. F. Rivinac, Calais, Me. The completed line will extend from Calais to Ellsworth, 116 miles. G. M. Rushing, Ch. Engr., Machias, Me.

WESTMORELAND JUNCTION.—A. Frank, Pres., Irwin, Pa., informs us that the surveys have now been completed and most of the right of way promised for this proposed steam line from Irwin Junction to Guffeys, Pa., a distance of five miles. The capital has been arranged for, and contracts will be awarded as soon as the stock and bonds are placed. S. A. Taylor, Ch. Engr., Pittsburg, Pa.

WISCONSIN & MICHIGAN.—Press reports from Green Bay, Wis., state that T. J. McGrath has secured the contract for constructing eight miles of railway for this company from Fairthorn Junction to Vulcan, Wis.

WILKES-BARRE & NORTHERN.—Reports state that this company's property has been purchased by J. W. Hollenbeck, E. Troxell, John Graham, John A. Schmitt, George R. Bedford, Pierce Butler and Thomas S. Barber. The railway, extending from Luzerne to Harvey's Lake, Pa., a distance of 12 miles, will probably be improved at once. The new owners will meet for reorganization purposes on Sept. 10.

WYOMING & MISSOURI RIVER.—Work will be resumed, according to reports, on this proposed line between Belle Fourche, S. D., and Aladdin, Wyo., a distance of about 18 miles. Pres., George M. Nix, Dubuque, Ia.

STREET AND ELECTRIC RAILWAYS.

PORTSMOUTH, N. H.—George W. Killoren, of Wakefield, Mass., who has the contract for making the road bed and laying the rails for the proposed electric railway in this city, commenced work on New Vaughan St., Sept. 1. It is also said that Joseph Herbert, North Hampton, Mass., is preparing to commence work on the power house.

WAITSFIELD, VT.—This town has guaranteed $50,000 towards the construction of the proposed electric railway of the Mad River Valley Electric R. R. Co., noted in our issue of Aug. 25. The proposed line will run from Montpelier to Warren, via Middlesex, Moretown and Waitsfield, a distance of about 26 miles. Pres., F. C. Kennedy, Burlington, Vt.; Ch. Engr., V. K. Nash, Woonsocket, R. I.

FITCHBURG, MASS.—The Fitchburg & Ashby Ry. Co., which was incorporated by this year's legislature, has petitioned this city for a franchise to construct a street railway. The petitioners are, Francis W. Wright, Wm. O. Loveland, E. A. Hubbard, Albert M. Wilder, Harry F. Bingham and Alonzo A. Carr.

GRAFTON, MASS.—Reports state that work was begun Sept. 1 on the proposed electric line from Grafton to Worcester, via North Grafton and Millbury Junction, a distance of about seven miles. Operation is expected to commence on Nov. 1.

MEDFORD, MASS.—The aldermen of this town have granted the Boston Elevated R. R. Co. permission to build double track lines on Main and Salem Sts.

NEEDHAM, MASS.—The Needham & Boston St. Ry. Co. is being formed in Needham, according to reports, for the construction of a street railway between Needham and Spring St. in West Roxbury. The capital stock is $10,000, and the temporary directors are, C. Atherton Hicks, Frederick G. Tuttle, Edward F. Howe, Victor M. Berthold, Francis de M. Dunn, William W. Carter, of Needham; Edwin L. Booth, of Boston.

WORCESTER, MASS.—W. H. Tylee, of Worcester, who holds the contract for building and equipping the Worcester & Clinton St. Ry., informs us that the new line is completed except that part where the state is constructing a new highway. Operations could have commenced on Aug. 1 had this road been built. The route is from Worcester to Clinton, via Boylston, a distance of 12 miles. Pres., A. S. Paton, Leominster, Mass.; Ch. Engr., O. W. Rugg, Worcester.

BROOKLYN, N. Y.—It is reported that a plan has been agreed upon whereby the railway companies running cars over the New York and Brooklyn Bridge will, with the assent of the bridge commissioners, build two additional loops on the Brooklyn approach to the Bridge, at an estimated cost of $10,000. C. C. Martin, Ch. Engr. of the Bridge.

BUFFALO, N. Y.—The Buffalo, Tonawanda & Niagara Falls Electric R. R. Co. was incorporated Aug. 26 with a capital stock of $1,250,000, being a reorganization of the Tonawanda St. R. R. Co. It is said that the line running to Tonawanda from Niagara and Tonawanda Sts., Buffalo, which is known as the Smith Road, will be part of the new line; and that to finish the projected railway, 40 miles of new track must be laid. The new company has a franchise to operate between Tonawanda and Niagara Falls, and an application has been made in Niagara Falls for a franchise to build through that city. The directors are: Henry B. Smith, Bay City, Mich.; H. M. Gillett, Bay City, Mich.; Timothy E. Ellsworth, Lockport, N. Y.; James A. Roberts, George Sandrock and Clarence M. Howard, of Buffalo; James Low, Niagara Falls; John A. Read and Benjamin L. Rand of North Tonawanda.

NEW PALTZ, N. Y.—Jas. G. Graham, Receiver of New Paltz & Wallkill Valley R. R. Co., Newburgh, N. Y., informs us that nothing, except necessary repairs, will be done by him towards the extension and improvement of this line. As stated in our last issue, Mr. Graham has been appointed temporary receiver of this company, incorporated Jan. 16, 1897, and operating an electric railway from the West Shore R. R. at Highland, N. Y., to New Paltz.

BLOOMFIELD, N. J.—It is reported that the township committee has given permission to the Orange & Passaic Valley Ry. Co. to rebuild its line through Bloomfield and to narrow the gage. Work is expected to begin at once.

BRIDGETON, N. J.—The Fairfield township committee passed an ordinance Aug. 31, granting the South Jersey Traction Co. a franchise to build through the township.

CRAFTON, PA.—The Crafton & Chartiers Valley Traction Co. was incorporated in Pennsylvania Sept. 6 with a capital stock of $6,000, to construct one mile of electric street railway. The incorporators are, Frank Thornburg, Pres., Clifton, Ia.; William J. Scully, Edgewood, Pa.; David C. Thornburg, Pittsburg, Pa.; Florence C. Biggert, Idlewood, Pa.; Jas. E. Duncan, Washington, Pa.

WASHINGTON, D. C.—The district commissioners have granted the Capital Ry. Co. an extension of 60 days in order to further test its underground system. This system, known as the Brown, Westinghouse, or electro-magnetic, is laid from the Navy Yard to the Navy Yard bridge, a distance of about one-half mile, and has been down for several months. Pres., A. E. Randle.——The directors of the Washington & University R. R. Co. have elected the following officers: Pres., F. C. Kennedy, of Burlington, Vt.; Vice-Pres., J. D. Croissant; Secy., D. D. Stone.——A deed has been recorded transferring the entire property, including franchises, of the Washington & Maryland Ry. Co. to the City & Suburban Ry. Co., formerly the Eckington & Soldiers' Home Ry. Co. Pres., J. T. Crosby, of the City & Suburban Co.

NORFOLK, VA.—It is reported that the Port Norfolk Electric Ry. has decided to build a 25-mile extension of its line from Norfolk to Smithfield, Va. Work is to begin as soon as possible. M. W. Mason, Gen. Mgr. and Purchasing Agt.

NATCHEZ, MISS.—Abraham Moses, Secy. and Treas. Natchez Light, Power & Transit Co., Natchez, informs us that this company will not construct the proposed six miles of electric railway until after next March, at which time the light plant is expected to be started. A perpetual and exclusive state and city franchise has been obtained, as well as the right of way in the city of Natchez and the whole county of Adams. Pres., Maurice Moses, Natchez; Ch. Engr., Erle S. Roos, 484 42d Place, Chicago, Ill.

CINCINNATI, O.—It is reported that the Mill Creek Valley St. R. R. Co. has certified an increase of its capital stock from $500,000 to $1,750,000. Pres., L. C. Weir; Secy., O. B. Brown.

CONNEAUT, O.—The council has granted the Pennsylvania & Ohio Ry. Co. a franchise to build a street car line through this city. The new line will be part of a system to connect Conneaut, Ashtabula, Geneva, Painesville and Cleveland.

SAGINAW, MICH.—Jas. B. Peter, Pres., Saginaw, informs us that the surveys for the proposed Saginaw & Frankenmuth Ry. and the preliminary work of obtaining the right of way are now in progress. The capital for construction will be provided when needed, and it is expected to award the contracts in the early part of next year. The route as projected is from Saginaw to Frankenmuth, via Bridgeport, a distance of 14 miles, and the motive power will be electricity. The chief engineer has not yet been appointed.

MILWAUKEE, WIS.—Reports state that an agreement has been made between the city and the Milwaukee Electric Ry. & Light Co. whereby the latter is to raise its tracks on Island Ave. and the city is to grade and macadamize between the tracks. Manager Beggs will supervise the improvement.

SEDALIA, MO.—The Sedalia Electric Ry. and the Sedalia & Brown Springs Electric Ry., including 15 miles of track, with their lighting plant, was sold to Stewart & Co., of New York, Aug. 26, at $400,000. It is said that the new company will be known as the Sedalia Electric Co., with officers as follows: Pres., S. H. G. Stewart, New York; Vice-Pres., John D. Crawford, Sedalia; Secy. and Treas., Carlton H. Reeve, New York.

COLORADO SPRINGS, COLO.—It is again reported that the owners of the famous cog road running up Pike's Peak have decided to change the motive power from steam to electricity. It is estimated that the cost of making the change will be about $50,000.

HULL, ENGLAND.—Bids are asked until Sept. 30 for the supply of 45 electric motor cars, 20 trail cars, two sprinkler cars, two traversing platforms, for the corporation. A. E. White, Cy. Engr., Town Hall., Hull. Thos. G. Milner, Cy. Treas.

ELECTRIC LIGHT AND POWER.

CHESTER, MASS.—E. LeRoy Gardner writes us that it has not been decided definitely to construct a plant, but it is very likely to be built. The apparatus will be contracted for separately, and the plant will be installed under the supervision of an engineer, yet to be selected. Estimated cost, $3,500. The plant will be operated by water power, and will have capacity to furnish 500 16-c. p. lights.

CAZENOVIA, N. Y.—Mr. O'Connell, Cortland, N. Y., is reported to have applied for a franchise.

GENEVA, N. Y.—L. L. Moses, of Clyde, N. Y., and Frank G. Brown, Jr., of Syracuse, N. Y., have applied for a 50-year franchise, and a contract for furnishing this town with 100 2,000-c. p. arc lights.

PORT CHESTER, N. Y.—The Port Chester Electric Lighting Co. has been granted a 99-year franchise. The company has submitted a proposition to light the city with arc and incandescent lights at $95 and $20 a year. Wm. L. Ward, of the company, may be addressed.

BENNETT, PA.—An election will be held Nov. 8 to vote on the question of issuing $25,000 in bonds for additional machinery for the plant and water-works.

DUNCANNON, PA.—Bids are asked until Sept. 17 for constructing a plant. Engr., Robt. R. Jones, Harrisburg, Pa.; Clk., A. C. Lackey.

WRIGHTSVILLE, PA.—Bids are asked by the Martic Water & Power Co. until Sept. 22 for furnishing the materials and for constructing the proposed power plant, and until Oct. 10 for furnishing 24 turbine water wheels, etc., as stated in our advertising columns. Ch. Engr., Jas. H. Harlow, Wrightsville.

HAGERSTOWN, MD.—Press reports state that the council is arranging for the construction of the proposed municipal plant to cost about $60,000. The lighting contract with the Hagerstown St. Ry. Co. expires in about two years.

WINCHESTER, VA.—Bids are asked until about Sept. 15 for furnishing the materials and for building a plant in connection with the water-works, according to reports. Chn. Com., Henry Schneider.

ATLANTA, GA.—The question of the municipal ownership of the electric plant is being considered. Judge Geo. Hillyer may be addressed.

FORSYTH, GA.—The question of building a plant is being considered, according to reports. John H. Andrews, Chn.

NEW IBERIA, LA.—Press reports state that this place will probably vote on the question of issuing $80,000 in bonds for a plant and water-works. Secy., A. J. Cammack.

NATCHEZ, MISS.—Arrangements are being made for buying machinery for the plant for A. & M. Moses, recently awarded a 10-year contract.

WINONA, MISS.—It is stated that the Blackston Mercantile Co. wants bids for furnishing and installing a plant to cost about $8,000.

LYNCHBURG, TENN.—It is stated that this place is to be supplied with electric lights.

SOMERVILLE, TENN.—This place voted Aug. 29 to issue $10,000 in bonds for a plant and water-works.

COVINGTON, KY.—Bids are asked until Sept. 6 for lighting that portion of the city now lighted by gasoline. Clk., Theo. von Hoene.

FOSTORIA, O.—Press reports state that Samuel R. Bullock, of Philadelphia, has purchased the plants of the Fostoria Light & Power Co. and the Northwestern Ohio Natural Gas Co. He proposes to erect a plant in the southern part of the city for the manufacture of fuel and illuminating gas and electric light, removing the plants already purchased to that location on completion of the new plant, which will be about Nov. 1.

McARTHUR, O.—Paris Horton, Pres. Trustees, writes us that the following submitted bids Aug. 25 for furnishing and installing a plant: Ambos Construction & Electric Co., Cleveland, O., awarded the entire construction at $4,677, except for power-house which went to local parties; J. A. Erner & Co., Columbus; Westinghouse Electric & Mfg. Co., Pittsburg; Crocker-Wheeler Electric Co., Chicago; The Triumph Electric Co., Cincinnati; Craighead Co., Dayton, O.; General Electric Co., Schenectady, N. Y.; Fort Wayne Electric Corporation, Fort Wayne, Ind. The plant is to be completed by Oct. 15.

MINERAL POINT, O.—We are informed that the following bids were received Aug. 22 for furnishing and constructing a plant, as advertised in Engineering News: Generator, switchboards, etc.—Westinghouse Electric & Mfg. Co., Pittsburg, Pa., $1,025; Fort Wayne Electric Corporation, Fort Wayne, Ind., $1,155. Poles, wiring, lamps, etc.—Goughmour Electric Co., Canton O., $1,475; Fort Wayne Electric Corporation, $1,625. Engine—Russell & Co., Massillon, O., $577 and $508. Boiler—Russell & Co., $815 and $775. Plant complete—Ambos Construction Co., Cleveland, O., $4,172 (accepted); King & Wentz, Canal Dover, O., $4,998. Complete machinery, without building—Ambos Construction Co., $3,854 and $3,745. Building—C. S. Rodgers, Mineral Point, $919. Building and brick smokestack—Irvinweiler & Winger, Mineral Point, $490.

XENIA, O.—The council has awarded a contract for lighting the city to the Xenia Electric Light Co.

WILLIAMSPORT, IND.—It is reported that the council has let a contract to a Chicago company for furnishing and installing a plant and water-works to cost about $37,000.

CARO, MICH.—J. H. Harris, Mgr. J. H. Harris & Co., writes us that a new plant will be built here within a year or two. Both water and steam will be used. The plant will have a capacity for 40 2,000-c. p. arc and 2,000 16-c. p. incandescent lights.

MOLINE, ILL.—Press reports state that Major Blunt, commandant of the arsenal, has awarded the contract for a 2½-miles extension of the old wing dam, to the Moline Water Power Co., at $40,000. The improvement, for which a special appropriation was made by Congress before adjournment, is expected to give 3½ ft. more head at the government water power bulkhead, and will incidentally give Moline a harbor. The work will be completed this fall.

QUINCY, ILL.—Press reports state as follows: W. B. McKinley, of Chicago, representing an eastern syndicate composed of J. M. Haynes, Geo. E. Macomber and Dr. Hill, of Vickery, Hill & Co., Augusta, Me., and Senator Wallace, Rochester, N. H., on Aug. 27 purchased the Thomson-Houston electric light plant and the gas plant owned by the same company. The purchase price was $460,000 for both. The new owners will spend $100,000 in repairs. This is the same syndicate which recently purchased the street railway here. A Chicago syndicate has offered $72,000 for the Empire electric light plant, and will probably get it.

BOSCOBEL, WIS.—The city clerk writes us that no steps have yet been taken in regard to putting in a plant and water-works. The question so far has only been under discussion.

LITTLE FALLS, MINN.—The question of building a plant and water-works is being considered, according to reports. Mayor Vasaly may be addressed.

DICKINSON, N. DAK.—The council is reported as arranging for the construction of a plant and water-works.

HELENA, MONT.—C. W. Whitley, Mgr. Helena Water & Electric Power Co., writes us the present work is completing the water power plant, increasing same to 10,000 HP. from 3,200 HP. This work will probably be completed in December. Bids for the additional water-wheels and electric generators will be considered soon. Supt., M. H. Gerry, Jr.

HAMBURG, ARK.—The question of building a plant and water-works is being considered by the Arkansas Improvement Co., according to reports.

LAKE CITY, COLO.—A. E. Reynolds, Denver, Colo., is reported to have located a reservoir site at Lake San Cristobal for the proposed power plant. The transmission station will be built at Agenta Falls, about one-third of a mile below the dam. The plant will be used mainly for furnishing power to mines, factories, etc.

SANTA ANA, CAL.—A. G. Croswell, Elec. Engr., San Francisco, Cal., is reported as interested in a company being organized to build a plant in this town; estimated cost, $8,000 to $15,000. The machinery is to consist of a compound condensing engine of 125-H.P., three 40-HP. boilers, one 60-arc-light dynamo, one 500-incandescent-light dynamo, and two 400-light dynamos for a three-wire Edison system.

COBOURG, ONT.—Bids are asked until Oct. 31 for street lighting and water supply, as stated in our advertising columns. Town Clk., D. H. Minaker.

LONDON, ONT.—It is stated that the plant of the London General Electric Co. was destroyed Aug. 30.

NEW COMPANIES.—Standard Electric Co., Parsons, Pa.; $40,000, with $4,000 paid in; Treas., A. H. Squire, Tunkhannock, Pa.; J. H. Kenney, Parsons.

Jefferson Electric Light Co., Chicago, Ill.; $50,000; M. A. Fort, Harry Ferguson, William M. Copeland.

Worthington Light & Water Co.; $4,500; Worthington, Ind.; H. C. Knight, W. C. Knight, C. S. Knight, Thomas Duncan, M. S. Polhamus.

Southern Electric Co., Charlotte, N. C.; $10,000; Pres., S. B. Alexander, Jr.

City Heat & Light Co., Fostoria, O.; $250,000; George A. Snyder.

Georgia Lighting & Heating Co., Atlanta, Ga.; $100,000; to build and lease lighting plants and to furnish light; R. H. Wilhoyte, R. J. Thurmond, Jr., of Alabama; J. F. Burke, Atlanta; W. T. Glasgow, of Tennessee.

Mitchell Electric Co., Portland, Me.; $150,000, with $2,500 paid in; to manufacture and deal in electric car brakes, car controllers and other electric devices; Pres., Thos. H. McDonnell, of Quincy, Mass.; Treas., Wm. E. Pearson, Boston.

BRIDGES.

HERKIMER, N. Y.—The town board has awarded a contract to Patten & Munson, at $4,126, for the abutments for a bridge across West Canada Creek.

NEWPORT, N. Y.—Reports state that the town board is awarding contracts for the construction of 15 iron highway bridges to replace the stone arch bridges which have been recently destroyed.

WHITE SPRINGS, FLA.—Bids are asked by C. F. Cone, White Springs, for constructing a 125-ft. wooden or iron bridge, on tubular abutments, according to reports.

CLEVELAND, O.—The county commissioners have awarded a contract to the King Bridge Co., at $5,950, for constructing the South Park bridge, and the Variety Iron Works, at $6,450, for the Four Mile Lock bridge.

ELYRIA, O.—Bids are asked until Sept. 22 for the purchase of $175,000 of 4% bridge bonds. A. B. Hayes, County Comr.

ELROY, WIS.—W. G. Kirchoffer, Engr., Baraboo, Wis., informs us that bids will be asked about Sept. 8 for a substructure, to cost about $550, and until Sept. 20 for a superstructure of one span, 64 ft. long and 16 ft. wide, on masonry. Address L. E. Dixon, Elroy.

EAU CLAIRE, WIS.—S. S. Kepler, Mayor, writes us that a contract will be let about Oct. 1 for the abutments and piers for the proposed steel bridge. Plans have been completed. T. P. Cochrane, Clk.

BURLINGTON, IA.—The county commissioners are considering the question of replacing a number of bridges which have been destroyed at a loss of about $10,000.

BLUE EARTH CITY, MINN.—T. R. Coughlin, Mankato, Minn., has been awarded a contract, at $1,200, for a bridge over the Blue Earth River, according to reports.

ST. PAUL, MINN.—Press reports state that negotiations are being made with the railway companies for the repair of the bridges at Western Ave., Westminster St., Robert St., and University Ave.

NIOBRARA, NEB.—The Canton Bridge Co., Canton, O., has been awarded a contract at $6,000 for constructing 10 county bridges.

FLANDREAU, S. DAK.—Bids are asked until Oct. 3 for constructing an iron or steel bridge, 100 ft. long and 16 ft. wide. H. W. B. Souther, County Audr.

ST. JOSEPH, MO.—Bids are asked until Sept. 12 for certain bridge work. Theo. Steinacker, County Surveyor. ——Bids will soon be asked by the Chicago Great Western Ry. Co. for the construction of a steel viaduct at Grand Ave. H. Fernstrom, Ch. Engr., St. Paul, Minn.

PUEBLO, COLO.—The council has awarded a contract to the Pueblo Bridge Co., at $10,000, for constructing a bridge across the Mountain River at First St.

CHEHALIS, WASH.—Bids are asked until Oct. 10 for constructing a trestle, 1,500 ft. long, over the Chehalis River, on the Lincoln Road. Albert Schooley, County Auditor.

PORTLAND, ORE.—The Oregon R. R. & Navigation Co. will let contracts about Sept. 30 for the construction of 14 steel trestles, according to reports. A. L. Mohler, Pres. and Gen. Mgr., Portland.

SANTA BARBARA, CAL.—City Engineer Flournoy is preparing plans for a new bridge over Mission Creek, on West Ortega St.

SANTA CRUZ, CAL.—E. Mosher has been awarded a contract, at $4,000, for building a bridge over Salsipuedes Creek.

WILLOWDALE, ONT.—Bids are asked until Sept. 10 for constructing two stone abutments for a steel bridge over the west branch of the Humber River, according to reports. P. S. Gibson & Sons, Engrs.

BUILDINGS.

AMHERST, MASS.—Henry Mellen & Son, Worcester, Mass., was the lowest bidder for the erection of a veterinary laboratory and hospital stable for the Massachusetts Agricultural College at Amherst, at $17,985. H. C. Wood, of Westfield, was the next lowest bidder at $19,157.

BINGHAMTON, N. Y.—Bids are asked until Sept. 20 for the erection of a building to be used for a boiler house and laundry, and a building to be used for an isolation ward in connection with the city hospital, and for new heating apparatus. Burr W. Mosher, Cy. Clk.

BROOKLYN, N. Y.—It is reported that plans are being prepared for erecting two limestone dwelling houses at Carroll St. and Prospect Park West for Samuel Goldstein, of this city, to cost about $48,000. Arch., Montrose W. Morris, 45 Exchange Place, New York.

BUFFALO, N. Y.—Bids are asked by Henry R. Howland, Pres. Bd. of Mgrs. of the Thomas Asylum for Orphan and Destitute Indian Children, at 367 7th St., Buffalo, N. Y., until Sept. 9, for the erection of a dining hall and connecting corridor, on the asylum grounds, at Iroquois, N. Y., on the Cattaraugus Indian Reservation.

NEW YORK, N. Y.—The laboratory building of R. H. Macy & Co., at Greenwich and 12th Sts., was partially damaged by fire, Aug. 30, causing an estimated loss of $100,000.——Plans have been filed by Matthew Byrnes for a 13-story terra cotta, brick and stone hotel building, at 45th St. and 5th Ave., to cost $750,000. Archs., J. O'Rourke & Son, 203 Lexington Ave.; by Louis Lese, 231 East 60th St., for three 5-story brick flat buildings, on 105th St., near 1st Ave., to cost $75,000. Archs., G. F. Pelham, 503 5th Ave.; by Charles Gahren, 9 Mount Morris Place, for two 6-story brick flat buildings on 84th St., near West End Ave., to cost $150,000. Archs., Neville & Bagge, 217 West 125th St.; by Polstein & Cohen, 181 East 2d St., for two 6-story brick flat buildings at 332 to 336 East 8th St., to cost $60,000. Arch., M. Bernstein, 145 Centre St.; by Jas. J. Barry, 1149 Boston Ave., for five 4-story brick flat buildings at Franklin Ave. and 168th St., to cost $105,000. Arch., Edward Wenz., 1491 3d Ave.; by Louis Perlstein, 96 Monroe St., for a 6-story brick flat and store building at Oak and Oliver Sts., to cost $50,000. Arch., Chas. E. Reid, 217 West 125th St.; by M. B. Healy, 412 3d Ave., for three 5-story brick flat buildings on 96th St., near 3d Ave., to cost $90,000. Archs, Neville & Bagge; by the Globe Realty Co., 141 Broadway, for an 8-story brick flat building at 94th st. and Central Park West, to cost $275,000. Archs., J. Ware & Son and H. S. Harde, 315 West 29th St.

ORIENT POINT, N. Y.—The following bids were received by Lt.-Col. D. P. Heap, at Tompkinsville (S. I)., N. Y., for the erection of a light-house at Orient Point, N. Y.:

L. A. Guerber, 171 Broadway, New York......	$16,975
F. C. Arthur & Co., 315 Girard Bldg., Phila....	19,800
Wm. H. Flaherty Co., 80-82 Reade st., New York..	20,400
Houston Construction Co., Girard Bldg., Phila..	22,440
Wilkins & Kuemnerle, Betz Bldg, Philadelphia....	23,500
Engineering Contract Co., 15 Broad st, N. Y....	23,500
Toomey Brothers & Co., Guilford, Conn...........	17,400
A. F. Dudley, 100 Broadway, New York...........	13,975

ROCHESTER, N. Y.—Bids are asked by the board of education until Sept. 19 for improvements to School Building No. 18. W. K. Gillette, Chn. Com.

WATERVLIET, N. Y.—The contract for mason, cut stone and iron work on new high school building to be erected at Watervliet has been awarvded to Chas. P. Boland, Troy, N. Y., to cost $30,000. Arch., John F. Gunson, Albany, N. Y.

CAMDEN, N. J.—We are informed that bids will be asked about Sept. 23 for erecting the new Camden high school building, for which working plans are now being prepared. The total cost of the building will approximate $95,000. It will be heated and ventilated by the hot blast system, and will have twenty class rooms, large assembly, wood and metal working rooms, locker rooms, boiler, engine, dynamo, etc. The construction will be that known as the slow burning construction, the style of architecture will be "Colonial," the exterior material will be red brick laid up in Flemish bond with black headers, all trimmings will be of white marble, the steps of granite and the roof of slate; sanitary arrangements will be the most improved. Arch., Thomas Stephen, 302 Masonic Temple, Camden.

NEW BRUNSWICK, N. J.—Bids are asked by the board of education until Sept. 21 for erecting the new French St. school building, to cost about $30,000. The contract for furnishing fire escapes has already been awarded to the Champion Iron Co., Canton, O., at $825. Arch., Geo. K. Parsell, New Brunswick.

OIL CITY, PA.—Plans are being prepared by Architect Perry, of Oil City, for a new high school building, to be erected in this city at a cost of about $40,000.

PHILADELPHIA, PA.—Bids are asked by the supervising architect, Washington, D. C., until Oct. 3, for the construction of the superstructure (except interior finish) of the U. S. mint building at Philadelphia.——Estimates are being received, according to report, for the erection of a brick, stone and iron power house for the Philadelphia Commercial Museum, at University and Vintage Aves., and Blockley Lane. Archs., Wilson Bros. & Co.——Plans are said to have been completed for the new 10-story brick, stone and terra cotta apartment building for the Singerly Apartment House Co., of Philadelphia, to cost about $600,000. Archs., Henry E. Cregier & Co., Boston, Mass.

PHILADELPHIA, PA.—The following bids were received by the supervising architect, Washington, D. C., Sept. 2, for removing the building adjacent to the U. S. post office and court house building in this city: Wilkins Kuemmerle, Philadelphia, $1,200, $400, 30 days; James Porter, Philadelphia, $725, $225, 20 days.

PHOENIXVILLE, PA.—The contract for the erection of the building for the Phoenixville Hospital is reported to have been let to George Lowry & Son, of Phoenixville, at $18,520.

PITTSBURG, PA.—The Henderson-Johnson Co., grain dealers, has been granted a permit to erect a 3-story fireproof cold storage warehouse and a 3-story storage house on Carson St., near the foot of Castle Shannon incline at South 1st St.

PITTSBURG, PA.—Bids are asked until Sept. 14 for erecting a school building for the Liberty sub-school district; deposit, $1,000. Address C. M. Bartberger, Arch., Westinghouse Bldg.; Chas. M. Sheaffer, Clk. of School Bd.

DENBIGH, VA.—Plans and specifications will soon be asked, according to reports, for a new jail building for Warwick county, to cost about $8,000. D. G. Smith, County Clk.

SHREVEPORT, LA.—Bids are asked until Sept. 24 for the erection of a school building, to cost about $30,000. W. T. Dalzell, Pres. School Bd.; J. W. Gaddis, Arch., Vincennes, Ind.

LOUISVILLE, KY.—Henry Wolters, Arch., Columbia Bldg., Louisville, has prepared plans for a steel elevator for Callahan & Sons, 13th and Lexington Sts., and has awarded the contract for the steel work to H. M. Knapp, agent for the Pittsburg Bridge Co.

CINCINNATI, O.—John J. Regan and Joseph Stein, members of the board of legislation, have united in presenting a petition to the board of city affairs, which provides for a new market house for the Court St. market, to cost $50,000.

LANCASTER, O.—Bids are asked by the city clerk until Sept. 10 for erecting a new fire engine house in this city. H. T. Mechling, Cy. Clk.

LANSING, MICH.—It is reported that the board of state auditors has decided to replace the present elevator by an electric elevator to have a speed of 300 ft. a minute.

CHARLESTON, ILL.—The contract for the erection of the new court house in this city is reported to have been let to A. G. Campfield, Richmond, Ind., at $74,500.

CHICAGO, ILL.—Frederick Ayer has been granted a permit to erect a 9-story building, to cost $200,000, at 213 and 215 Wabash Ave.——Contracts have been awarded, according to reports, for an apartment building to be erected on Drexel Boulevard, near 40th St., for Julian Blain, to cost about $40,000. Arch., Arthur Foster, 4310 Cottage Grove Ave.

CHICAGO, ILL.—Bids are asked by the Cook County commissioners until Sept. 12 for an iron platform and filing cases for the vault of the clerk of the Superior Court. D. D. Healy, Acting Supt.

DANVILLE, ILL.—Bids are asked by the National Home for Disabled Volunteer Soldiers at Danville, until Sept. 17, for the installation of a heating and ventilating apparatus in barrack buildings. For information address W. C. Gunnell, C. E., Room 4, Post Office Bldg., Danville.

GARNER, IA.—Bids will be received about Nov. 1, it is stated, for the erection of a new 2-story stone county court house, to cost about $30,000. Arch., F. W. Kinney.

MINNEAPOLIS, MINN.—The contract for the erection of one wing of the new city hospital was let Aug. 29 to J. & W. A. Elliott, at $14,690, and for structural iron to the Wisconsin Brick & Iron Company at $5,120. The completed building will cost about $55,000.

ST. PAUL, MINN.—The following bids were received by a special committee, Aug. 25, for erecting two new elevators in court house: Crane Elevator Co., Chicago, $9,500; Angus McLeod Elevator Co., Minneapolis, $8,500; Eaton-Prince Elevator Co., W. H. Craig, Agent, Minneapolis (accepted), $7,123.

RED WING, MINN.—Bids are asked until Sept. 9 for building a new vault in the Goodhue county court house. Carl N. Lien, County Audr.

PINE RIDGE, S. DAK.—Bids are asked by the Pine Ridge Indian Agency, until Sept. 24, for furnishing a quantity of building material, consisting of assorted lumber, lime, cement, etc. Major W. H. Clapp, Aacting Agent.

FARGO, N. DAK.—Watterworth & Fee have received the contract for erecting the new Catholic cathedral in this city, at $24,000. Archs., Bassford & Donahue, St. Paul, Minn.

COLUMBIA, MO.—Senator H. H. Hohenschield, of Rolla, is said to have been chosen by the Boone county court to prepare plans for a new country poorhouse, to cost $12,000.

NATIONAL MILITARY HOME, KAN.—Bids are asked until Sept. 13 for the construction of a quartermaster and commissary building at western branch of the National Home, D. V. S. Treas., W. B. Shockley.

KANSAS CITY, MO.—Plans are being prepared for a new opera house to be built at 10th and Baltimore Sts., at a cost of about $90,000. Arch., J. C. Wililams, 561 Scheidley Bldg.

AUSTIN, TEX.—The dry-goods store of Philip Hatzfeld was destroyed by fire, Aug. 30, causing a reported loss of $125,000; insurance, $80,000.

BAKERSFIELD, CAL.—Contracts have been let for the erection of the new Scribner opera house at Wall and Chester Sts., for W. H. Scribner, to cost about $20,000. Arch., Philip Schwerdt.

WINDSOR, N. S.—Bids are asked until Sept. 19 for a heating apparatus for the public building. E. E. Roy, Secy. Bd. of Pub. Wks., Ottawa, Ont.

LIVERPOOL, ENGLAND.—Designs are asked until Oct. 3, extension of time, for new buildings for the Royal Institution. Secy., Harold Waterhouse, 3 Cook St., Liverpool.

WATER-WORKS.

CONTOOCOOK. N. H.—G. A. Curtice, Secy. Water Bd., writes us that the contract for building works has been let to John Walker, New Market, N. H. The water supply will be secured from Bear Pond. The plans and specifications were prepared by Geo. P. Hadley, Goffstown, N. H.

ENFIELD, N. H.—Ira Copeland is reported as arranging for the construction of works.

HAMPTON, N. H.—Chas. M. Lamprey, Dir. and Clk. Hampton Water-Works Co., writes us that the directors will meet next month to decide upon plans for completing the works next spring. After the meeting surveys will be made.

BOSTON, MASS.—Bids are asked until Sept. 15 for laying 34,200 ft. of 12 and 16-in. water pipe, as stated in our advertising columns. Wm. N. Davenport, Secy. Metropolitan Water Bd., 3 Mount Vernon St., Boston.

HOLYOKE, MASS.—It is stated that the water commissioners are considering methods of water filtration with a view to putting in a plant this year. It is estimated that a plant of 1,500,000 gallons can be put in for $20,000.

NATICK, MASS.—Jas. McManus, Town Clk., writes us that a proposition to change the location of the pumping station was brought before the last annual town meeting. It would involve a new method of furnishing and a new source of supply to Lake Cochituate. The matter was deferred for the present in order that it may be further investigated. The question will probably be considered next year.

NORTHFIELD, MASS.—C. H. Webster, Secy. Northfield Water Co., writes us that the contract has not yet been let for furnishing and laying about 13,000 ft. of 4 and 6-in. water pipe for the extension to Minot Brook.

TURNER'S FALLS, MASS.—Willard E. Everett, of the committee, writes us that proposals have been sent out for building an extension to the works at a cost of about $13,000.

CROMWELL, CONN.—We are informed that the Cromwell Water Co., Waterbury, Conn., is in the market for the purchase of first-class pumps of 100,000 gallons capacity. F. W. Seibert, Jr., Waterbury, may be addressed.

ALBANY, N. Y.—Bids are asked until Sept. 30 for improving Bleecker reservoir, as stated in our advertising columns. Supt., Geo. I. Bailey.

BOLIVAR, N. Y.—The Bolivar Water Co. has been incorporated with a capital stock of $16,000 by S. F. Booth, J. B. Bradley and W. P. Cook, of Bolivar.

BUFFALO, N. Y.—B. I. Crooker, Buffalo, submitted the lowest bid Aug. 31 for repairing the water-works pumping station at $9,750.

JOHNSTOWN, N. Y.—W. W. Crouse, Clk., writes us that the city has voted to sell bonds to pay for the diversion of water land damages, etc. The bonds will be sold within a few weeks.

NIAGARA FALLS, N. Y.—Walter Jones, Cy. Engr., writes us that it is proposed to extend the 12-in water main to the city line, about 7,500 ft.; estimated cost, $10,000.

RHINEBECK, N. Y.—J. M. Johnson, Millersburg, Pa., is reported to have submitted a proposition to put in works.

CAMDEN, N. J.—The National Meter Co., 86 New Chambers St., New York, is reported to have been awarded the contract for furnishing a 36-in. meter, at $3,100.

FLEMINGTON, N. J.—We are informed that the proposed works will require about seven miles of 6-in. cast-iron water pipe and three miles of 8-in. pipe, 30 hydrants, standpipe, 20 × 100 ft., valves, etc. Capt. John J. Shields, Furman Williamson, E. B. Allen and Geo. H. Large have a franchise as individuals. It is expected that they will incorporate.

NEWARK, N. J.—The Pomeroy & Middleport Water Co. has been incorporated, with a capital stock of $100,000, with $30,000 paid in, by Geo. S. Wentz, Dufton, Pa.; Jno. L. Wentz, Scranton, Pa., and Geo. MacDonald, 800 Broad St., Newark.

BEAVER FALLS, PA.—Jno. Warren, Secy. People's Water Co., writes us that the company has let all contracts for furnishing materials and for constructing the proposed works.

BENNETT, PA.—At the election Nov. 8 this place will vote on the question of issuing $25,000 in bonds for an additional pump and machinery for the works and the electric light plant.

CONNEAUTVILLE, PA.—The council is considering a report on the proposed works; estimated cost, $10,000. The water supply will probably be secured from the Nicolls Springs.

DEVON, PA.—Skelly & Weaver, Norristown, Pa., have been awarded the contract by the American Pipe Mfg. Co., 112 North Broad St., Philadelphia, for building the new reservoir. The American Pipe Mfg. Co. is now building a sand filtration plant of 1,500,000 gallons capacity at its Pickering Creek pumping station. Ch. Engr., J. W. Ledoux, Philadelphia.

MILLHEIM, PA.—An election will be held Sept. 12 to vote on the question of issuing $7,000 in bonds for works. The water supply will be secured from Philips Creek, a mile north of the town.

PITTSBURG, PA.—We are informed that the experiments of the filtration committee, which have been conducted at the Brilliant pumping station since July, 1897, were concluded Aug. 31. Work on the tabulation of the data and on the preparation of the final report is now being pushed as rapidly as possible, but this work will probably not be completed for about two months. The report will be in the nature of a recommendation to councils and the question of building will remain with them. Consult. Engr., Allen Hazen, St. Paul Bldg., New York; Res. Engr., Morris Knowles; Chn., Robt. Pitcairn.

READING, PA.—The clerk of the select council writes us that the councils have passed an ordinance providing for holding an election in November to vote on the question of a loan of $225,000 to erect a land filtration plant for the water supply.

LAUREL, MD.—We are informed that a company will be formed to build the proposed works. D. G. Adelsberger, 722 Pennsylvania Ave., Baltimore, Md., is preparing plans, etc. Wm. H. Minch, J. Stuart MacDonald and Jos. M. Cone, Baltimore, are interested.

MIDLAND, MD.—G. T. Long, Midland, writes us that a company will be organized to put in works in the spring. The water supply will be secured from a source about 1½ miles distant. Mr. Long wishes to secure prices of pipe, etc.

PARKERSBURG, W. VA.—W. I. Rittenhouse, Cy. Clk., writes us that this city voted Aug. 30 against issuing $35,000 in bonds for improving the works. The vote was 266 for and 460 against the proposition.

WHEELING, W. VA.—A. L. White, Cy. Engr., writes us that the water board has awarded the contract for furnishing a 12,000,000-gallon pumping engine to the Holly Mfg. Co., Lockport, N. Y., at $56,000. It is to be installed by May 1. The contract for the well and building has been let to L. G. Hallock, Wheeling, at $37,807.

ELBERTON, GA.—W. B. Henry, Clk. Council, writes us that the contract for furnishing the materials and for building the works has been let to Geo. J. Baldwin, Savannah, Ga. The contract is subject to the approval of the people Sept. 20 by a two-thirds vote.

MACON, GA.—The Macon Gas Light & Water Co. proposes to furnish Vineville with water. The company has petitioned the court for permission to build a stand-pipe and reservoir.

SYLVANIA, GA.—The mayor writes us that it is proposed to have an artesian well and to build water-works. Population, 800.

HUNTSVILLE, ALA.—S. Meyers is reported to have been awarded the contract for erecting a new pumping station at about $15,000. There will be three pumps with a capacity of 9,000,000 gallons a day.

NEW IBERIA, LA.—Press reports state that this place will soon vote on the question of building works and a light plant to cost about $80,000. Population, 4,000. Secy., A. J. Cammack.

CLARKSVILLE, TENN.—The question of either sinking wells for a purer water supply or of building a filter plant is being considered, according to reports.

FAYETTEVILLE, TENN.—R. A. Conger, Cy. Clk., writes us that the question of issuing $30,000 in bonds for gravity works will probably be voted upon soon. Engrs., Guild & Co., Chattanooga, Tenn.

SOMERVILLE, TENN.—This place voted Aug. 30 to issue $10,000 in bonds for works and a light plant.

COVINGTON, KY.—Bids are asked by the South Covington & Cincinnati St. Ry. Co. until Sept. 14 for furnishing a 4,000,000 gallon pumping engine, etc. Engr., A. C. Harrington, Newport Power Station, Newport, Ky.

LOUISVILLE, KY.—The following bids were received Sept. 1 by the Louisville Water Co. for erecting a filtration plant, all local bidders: Fred. Hoertz & Co., $297,764; Edward Hely, $299,716; Myer & Coyne, $337,870. Ch. Engr., Chas. Hermany.

MT. STERLING, KY.—Geo. W. Baird, Mayor, writes us that the town will vote in November on the question of issuing $80,000 in bonds for works. The supply will be secured from a creek 4½ miles distant.

CANTON, O.—Bids are asked until Sept. 19 for the purchase of $15,000 of 5% water-works refunding bonds. Cy. Clk., L. N. Ley.

CLEVELAND, O.—Bids are asked until Sept. 17 for furnishing 100 tons of pig lead for the water-works department. Dir. Pub. Wks., Geo. R. Warden.

ELYRIA, O.—W. J. Hayes & Son, Cleveland, O., have been awarded the purchase of $150,000 of water-works extension bonds and $45,000 of water-works purchase bonds. It is probable that the contract for the improvements to the works will be let at once; the bids having been received Aug. 24. Cy. Clk., W. H. Park.

TROTWOOD, O.—The Water-Works Supply Co., it is stated, will begin the construction of its proposed works at once. Capital stock, $5,000. M. G. Pfoutz, T. M. Wagner and Dr. W. C. Mendenhall may be addressed.

WILLIAMSPORT, O.—Press reports state that this place has let a contract for building works and a light plant at $37,000.

NEW BOSTON, O.—Levi D. York, Portsmouth, O., it is stated, will build works at once for this place.

BLOOMINGTON, IND.—The City Water-Works Co. has been incorporated with a capital stock of $25,000 by Jos. D. Showers, H. F. Perry and W. J. Allen.

EVANSVILLE, IND.—Geo. F. Weikel has been awarded the contract for erecting the new water-works buildings and smokestack at $57,500.

NEW ALBANY, IND.—Press reports state as follows: Frank Scheffold, ex-Supt. New Albany Water Co., is at the head of a movement to organize a new company, said to be composed of Louisville and New Albany capitalists, and it is claimed that a franchise will be asked for from the council at a meeting of that body next month. It is said that the proposed company can put in complete works for $125,000. The old water company is making an effort to have its charter extended.

HOUGHTON, MICH.—The question of building an addition to the works for an increased water supply at a cost of about $20,000 is being considered.

LAKE FOREST, ILL.—The water-works company has had Alvord & Shields, The Rookery, Chicago, report upon the economical operation of the Lake Forest Water-Works. Extensions will probably be made in the course of another year to the inlet pipe and pumping station.

STREATOR, ILL.—The city council has engaged Alvord & Shields, Chicago, to make a report on the sufficiency of the fire protection afforded by the water company, under the terms of its franchise.

BOSCOBEL, WIS.—The city clerk writes us that no steps have yet been taken with regard to building new works and a light plant.

DES MOINES, IA.—This city voted Aug. 29 against the proposition to buy the water-works for $850,000.

MANILLA, IA.—Bids are asked until Sept. 13 for extending the present small city works, according to reports. Population (1890), 526. Mayor, C. O. Campbell.

PELLA, IA.—Bids were asked by the city clerk until Sept. 7 for constructing works, according to reports.

CLARA CITY, MINN.—Press reports state that K. H. Holian, Recdr., wants bids for constructing works.

ELBOW LAKE, MINN.—Bids are asked until Sept. 10 for constructing works. Recdr., W. E. Landeene; Pres., J. S. Jacobson.

LITTLE FALLS, MINN.—Estimates for works and a light plant are being secured, according to reports.

WHITE EARTH, MINN.—Bids are asked by J. H. Sutherland, U. S. Indian Agent, for constructing works and sewers for the White Earth reservation.

DICKINSON, N. DAK.—It is stated that this place is considering the question of works and a light plant.

ARKANSAS CITY, KAN.—The council has authorized the mayor to issue $95,000 in bonds for the purchase of the works of the Arkansas City Water Co.

PLATTE CITY, MO.—The question of building works is being considered.

COLORADO, TEX.—The Colorado Water-Works Co. has been incorporated with a capital stock of $5,000, by Benj. S. Van Tuyl and R. M. Webb.

WICHITA FALLS, TEX.—J. B. Quigley, of Sedalia, Mo., and Chas. Carrol have applied for a franchise for works and a light plant.

CRIPPLE CREEK, COLO.—J. Stanley Jones, as chairman of the mass meeting Aug. 15 to discuss the water question, has appointed a committee to further investigate the subject of municipal works.

TACOMA, WASH.—The residents of the north end have asked the council to furnish that portion of the city with more water.

CONDON, ORE.—H. Orchard has submitted a proposition to put in works to cost about $3,000.

HEALDSBURG, CAL.—The San Francisco Bridge Co., San Francisco, Cal., is reported to have been awarded the contract for building the works at $31,700. The Oakland Bank of Savings has purchased $82,650 of bonds for the works and the electric plant.

PASADENA, CAL.—The committee is reported to have recommended the construction of new municipal works to cost about $250,000.

MONTREAL, QUE.—Walter E. Wood has been awarded the contract, at $1,800, for digging a ditch across the Ogilvie dam on the Lower Lachine Road in connection with the water-works.

COBOURG, ONT.—Bids are asked until Oct. 31 for furnishing this city with a water supply and street lighting, as stated in our advertising columns. Town Clk., D. H. Minaker.

OSHAWA, ONT.—John Galt, Canada Life Bldg., Toronto, Ont., is making surveys and plans for the proposed works and a sewerage system.

IRRIGATION.

DENVER, COLO.—Reports state that the South Platte Land, Reservoir & Irrigation Co. will repair its canal and build three miles additional, making a total length of 33 miles. Water will be taken from the Platte River and stored in reservoirs.

DINUBA, CAL.—The Alta Irrigation District received bids Sept. 6 for the enlargement of the district system. W. P. Boon, Secy.

NILES, CAL.—Press reports state that Joseph Tyson, Henry Tyson, E. A. Ellsworth, Joseph Shinn, C. B. Overacker, Wm. Brier and George Lowery have started to sink wells from which water will be pumped for irrigating purposes.

SAN RAFAEL, CAL.—Press reports state that W. Bradbury, of San Francisco, has made known his intention to purchase a water site on the property of the American Land & Trust Co., near Larkspur. This is a natural gorge near the base of Mount Tamalpais with a living stream. A dam will be constructed which will make a lake covering more than 25 acres. Mr. Bradbury calculates that the lower end of the county can be supplied with water from this source.

NEW COMPANIES.—Rawlins Reservoir Co., Cheyenne, Wyo.; $5,000; to sell water for canals, reservoirs, etc.; E. Dickinson, John B. Berry and Erastus Young.

Dry Creek Irrigation Co., Monroe, Utah; $6,000; Moroni Hunt, Pres.; Abraham Sorensen, Secy; William Norgren, Treas.; F. W. Hunt, M. L. McNamara.

SEWERAGE.

HARTFORD, CONN.—Jos. C. Smith has been awarded the contract for building sewers in four streets, at $4,917.

NEW BRITAIN, CONN.—Bids are asked until Sept. 10 for the purchase of $50,000 of 4% 30-year sewer bonds. A portion of this amount will be used for new sewers and a portion to pay the expenses of a committee to investigate the question of sewage disposal. Chn. Com., S. H. Stearns.

WESTERLY, R. I.—The council is considering plans for a system, to cost about $193,000. The outlet, it is proposed, will empty into the Pawcatuck River, near the Rock. Consult, Engrs., Shedd, Sarle & Shedd, Providence, R. I.

BALLSTON SPA, N. Y.—The question of appropriating $4,000 for repairing and extending the Gordon Creek sewer will be voted upon.

AVALON, PA.—Bids are asked until 4 p. m. Sept. 8 for building 10 and 8-in. pipe sewers in a number of streets; check, $500. Engr., Jno. McBride, 341 Fourth Ave., Pittsburg; Treas., J. C. McDowell.

GETTYSBURG, PA.—I. L. Kendlehart, Secy. Town Council, writes us that nothing definite has been done about extending the sewers. It will probably be necessary to secure advice from an expert before anything is done.

NEW KENSINGTON, PA.—W. D. Snyder, Secy., writes us that the contract for building certain sewers has been let to Ott Bros., Allegheny, Pa.

OAKMONT, PA.—Bids are asked until Sept. 10 for constructing 58,350 ft. of 30 to 8-in. pipe sewers, 80 manholes, 25 flush tanks, etc. Engrs., Edeburn, Cooper & Co., 410 Grant St., Pittsburg, Pa.

PHILADELPHIA, PA.—The board of surveyors has approved plans for a 9-ft. brick sewer in 55th St.; estimated cost, $20,000.

PITTSBURG, PA.—The question of building a 4-ft. main sewer to drain a portion of the East End is being considered. Dir. Pub. Wks., E. M. Bigelow.

CONCORD, N. C.—W. F. Dowd, Charlotte, N. C., has been awarded the contract for furnishing the materials and for building a system. There will be required 9,000 ft. of 15 to 8-in. pipe.

AIKEN, S. C.—This place voted Aug. 25 to issue $10,000 in bonds, in addition to the $15,000 voted some time ago, for the proposed system. The council will probably ask for bids at once.

BIRMINGHAM, ALA.—Jas. L. Sandefer has petitioned the Chancery Court for an injunction restraining the city from emptying its sewage into Valley Creek.

MEMPHIS, TENN.—The Nashville, Chattanooga & St. Louis R. R. Co. has agreed to build a culvert 800 ft. long from Main and Georgia Sts. to Clay St., in order to drain a portion of the city, etc. It will be 6 or 8 ft. in diameter. City Engineer Bell is preparing plans.

CLEVELAND, O.—Bids are asked until Sept. 15 for building sewers in three streets. Dir. Pub. Wks., Geo. R. Warden.

EAST LIVERPOOL, O.—This place has voted to issue $15,000 in bonds for sewers and paving, according to reports.

TOLEDO, O.—Bids are asked until Sept. 19 for building a 15-in. pipe sewer in Greenwood Ave. Cy. Clk., L. P. Harris.——J. T. McKinney will be awarded the contract for building a 5-ft. sewer in Adams St. at $33,911.

INDIANAPOLIS, IND.—Bids are asked until Sept. 12 for pipe sewers, etc., in certain streets. Pres. Bd. Pub. Wks., M. A. Downing.

SYCAMORE, ILL.—Bids are asked until Sept. 12 for building sewers to cost $5,000. Au outlet for the present for the proposed system will be into the Kishwanken River. It is proposed to defer the construction of the disposal works until the main sewer and some of the branches are complete. Engrs., Alvord & Shields, The Rookery, Chicago; Cy. Clk., J. D. Berkler.

MILWAUKEE, WIS.—Bids were asked by the board of public works until Sept. 6 for constructing Section No. 6 of the 30th St. tunnel sewer. This section will cost about $75,000.

WHITE EARTH, MINN.—Bids are asked by Jno. H. Sutherland, U. S. Indian Agent, White Earth Agency, for building sewers and water-works for the reservation school.

OMAHA, NEB.—Bids are asked until Sept. 16 for building a sewer in district No. 231. Secy. Bd. Pub. Wks., Wm. Coburn.

JOPLIN, MO.—E. C. H. Squire, Cy. Clk., writes us that the city voted Aug. 23 to build, by a direct tax, 18,000 ft. of 20 and 10-in. pipe sewers; average cut, 9 ft. The work will not be started until the spring. There will be let in about 30 days a contract for 5,100 sq. yds. of brick paving. Cy. Engr., S. J. McKee.

VICTOR, COLO.—Andrew Rosewater, Bee Bldg., Omaha, Neb., has submitted plans for a system to cost about $57,980. Michael Donavan has applied for a 10-year franchise to build and operate the system. Mayor Doyle is opposed to granting a franchise.

OSHAWA, ONT.—John Galt, Canada Life Bldg., Toronto, Ont., is making plans for a system and water-works.

GARBAGE DISPOSAL—STREET CLEANING

BRIDGEPORT, CONN.—Local papers state that the Connecticut Reduction Co. has given up its contract for destroying the garbage of this city, for which it was awarded the contract three years ago. The board of health is said to be undecided how to destroy the garbage. Pres. Connecticut Reduction Co., Frank E. Clark.

WEST HAVEN, CONN.—Reports state that Swift & Co. will construct a crematory for the disposal of refuse at the slaughter house in Allingtown. Health Officer Bevan may be addressed.

BINGHAMTON, N. Y.—A. H. Abbott, Secy. Bd. of Health, writes us that the board has laid the matter of garbage disposal before the council. It has promised to have an amendment to the charter so as to appropriate a sufficient sum to build a crematory in 1899.

NEW YORK, N. Y.—Bids are asked until Sept. 14 for removing the night soil, offal and dead animals from the Boroughs of Queens and Richmond. M. C. Murphy, Pres. Dept. of Health, Centre and White sts.

UTICA, N. Y.—T. E. Kinney, Mayor, is urging the council to bury the city garbage. The mayor has appointed E. Prentiss Bailey and Geo. E. Dunham to confer with the board of health regarding the matter.

MONTCLAIR, N. J.—We are informed that a conference has been arranged between committees from several boards with regard to a garbage disposal plant. The question is undecided and nothing may be done for some time. W. O. Leighton, Health Inspector.

CHESTER, PA.—The board of health is reported to have recommended to the council the construction of a plant to cost about $2,000 or $4,000.

READING, PA.—The committee will consider the question of increasing the capacity of the garbage plant, from 25 to 80 tons per day. H. L. Boas may be addressed.

HAGERSTOWN, MD.—M. L. Byers, Cy. Clk., writes us that no definite action has been taken with regard to a garbage disposal plant.

WHEELING, W. VA.—A. L. White, Cy. Engr., will visit eastern cities this week to investigate methods of garbage reduction, disposal, etc., and will make a report on the subject.

NEW ORLEANS, LA.—Bids are asked until Sept. 12 for constructing a new garbage boat. Jno. F. Butts, Comptroller.

CHATTANOOGA, TENN.—A crematory will be built at Camp Thomas at once, according to reports. Capt. H. P. Young has charge of the sanitary department. J. J. Fisher, of Chattanooga, is said to have prepared the plans.

MILWAUKEE, WIS.—The committee is reported to have decided to recommmend for adoption by the council the plans of the Dixon Garbage Cremation Co., Toledo, O. This company proposes to build a plant for $58,000.

STREETS AND ROADS.

REVERE, MASS.—The following bids were received Aug. 22 for grading, etc., on the Revere Beach Parkway, between Eliot Circle and Campbell Ave., as noted in our issue of Aug. 18: Walter R. Brown, Lowell, $25,055; Thos. H. Gill, Somerville, $23,334; Mirick & Wentworth, Malden, $22,715; Richard Falvey, Somerville, $21,465; Martin Gill & Co., Somerville, $20,723; Joseph D. Gennaro, Boston, $18,896; B. D. Pierce Co., Bridgeport, Conn., $18,384; McCusker Bros., Waltham, $17,842; George A. Lancaster, Revere, $17,542; Cogan Bros. & Forschner, Atlantic, $16,943; Owen Cunningham & Son, Somerville, $16,150; Jas. J. Welch & Co., Salem, $15,636; Thos. Hurley, Lynn, $15,605; Johnston, Haines & Letteney, Boston, $14,877; J. A. Whittemore's Sons, Boston, $14,472. Edwin B. Haskell, Park Comr.; Wm. T. Pierce, Engr.

BOSTON, MASS.—Bids are asked until Sept. 8 for building two sections of the State Highway, 2,600 and 2,900 lin. ft., respectively (two contracts); check for each, $250. T. C. Mendenhall, Pres. Massachusetts State Highway Comn.

PITTSFIELD, MASS.—The aldermen have made appropriations for draining and repairing Allen Ave., between Dunham and School Sts.; for grading a portion of Appleton Ave., and for repairing North John St., according to report. A. A. Fobes, Cy. Engr.

SOMERVILLE, MASS.—Martin Gill & Co. have been awarded the contract for surfacing a portion of Middlesex Ave., consisting of 1,000 cu. yds. of earth grading, 2,000 sq. yds. of gravel surfacing and 4,200 sq. yds. of foundation and broken stone surfacing. E. M. Bailey, Cy. Engr.

WORCESTER, MASS.—The Boston Paving Co. has been awarded the contract to lay 25,000 sq. ft. of granolithic sidewalk, curbing and gutter paving at Richmond Heights, on Pleasant, Lenox and Beeching Sts., according to report. Lucien B. Stone, Comr. of Sts.

CROMWELL, CONN.—The B. D. Pierce, Jr., Co., Bridgeport, has received the contract to construct 4,100 lin. ft. of macadam roadway, at a cost of $3,010, according to report. C. S. Pease, Selectman.

HARTFORD, CONN.—The following bids were received for grading a roadway in Pope Park: Fred. T. Ley & Co., $1,175; H. J. Mullen, $835; R. F. Hudson, $1,258; R. W. Sherman, $1,067; A. H. McElwain, $786; Peter Suzio, $888. The bids were referred to C. H. Bunce, Cy. Engr., to ascertain the responsibility of the lowest bidder.

NEW HAVEN, CONN.—Bids are asked until Sept. 13 for constructing a broken stone pavement on Dixwell Ave., from Division St. to the city limits. Bids are also asked until Sept. 13 for laying a concrete walk and curbing on the easterly causeway of Tomlinson Bridge. C. W. Kelly, Cy. Engr.

ALBANY, N. Y.—The Callahan Road Improvement Co., 51 State St., received the contract, Sept. 2, to improve two miles of the Troy and Schenectady Turnpike, at $14,590, according to report. Campbell W. Adams, State Engr., Utica.

BROOKLYN, N. Y.—It is reported that bids will soon be asked for grading and paving a number of streets, among them portions of Regent Place, Pacific St., Park Place, Himrod St., 84th St., Ave. B. and Ocean Ave. N. P. Lewis, Engr. of Highways.

NEW ROCHELLE, N. Y.—At a special election, Aug. 30, the resolution to issue $150,000 for street improvements was defeated by a very small majority. H. S. Clarke, Village Pres.; G. R. Olney, Supt. Pub. Wks.

NEW YORK, N. Y.—Bids are asked until Sept. 15 for furnishing broken stone and screening of trap rock and gravel and delivering the same along certain streets in the borough of Queens. Jas. P. Keating, Comr. of Highways.

ROCHESTER, N. Y.—H. B. Hooker was awarded the contract Aug. 29 to macadamize Ave. B for $6,152; also to construct cement walks on Chili Ave. for $2,555. Chambers & Casey received the contract to improve Post St. for $1,684. Edwin A. Fisher, Cy. Engr.

ATLANTIC CITY, N. J.—It is reported that Mayor Jos. Thompson has approved the street paving ordinance noted in our last isue; the estimated cost of the work is $150,000. John P. Ashmead, Cy. Engr.

ELIZABETH, N. J.—It is stated that bids will be asked next week by the county board of freeholders for widening the road from Elizabeth to Plainfield, a distance of 12 miles. An issue of $75,000 of bonds will probably be authorized in addition to $250,000 received from John Kean for a franchise for an electric railway between these cities.

GLOUCESTER CITY, N. J.—The council has postponed the opening of bids for the paving of Broadway, between Salem and Market Sts., as noted in our last issue, until Sept. 15, according to report. Edw. J. O'Hara, Chn.

NEWARK, N. J.—G. W. Sharp & Son have been awarded the contract to lay the cement pavement in and about the new City Hospital at $940. Dr. Herold, Pres. Bd. of Health.——The following contracts were awarded Aug. 25 for paving, as noted in our issue of Aug. 18: New Jersey Asphalt Co., 736 Broad St., Newark, part of North 7th St., brick, $5,541; North 7th St., asphalt, $3,890; Fulton St., asphalt, $6,114; South 7th St., asphalt, $43,720. Barber Asphalt Paving Co., New York, Lincoln Park, from Washington St. to Clinton Ave., asphalt, $1,789. Atlantic Alcatraz Asphalt Co., New York, Sidney Place, asphalt, $1,953; Broome St., asphalt, $6,791; Ninth Ave., asphalt, $11,415. M. F. McLaughlin, Gen. Supt. St. and Water Comrs.

CRAFTON, PA.—Bids are asked until Sept. 13 for paving and curbing White Ave., between Noble Ave. and Station St. F. A. McDonald, Borough Engr., 811 Penn Bldg., Pittsburg; R. H. Thomson, Borough Clk.

ERIE, PA.—M. Whitman has been awarded the contract to gravel Ash St., at 35 cts. a sq. yd., according to report. Benj. E. Briggs, Cy. Engr.

MEADVILLE, PA.—Bids are asked until Sept. 14 for 1,480 sq. yds. of brick paving, etc., as described in our advertising columns. D. T. McKay, Jr., Cy. Clk.; W. A. Doane, Cy. Engr.

NEW KENSINGTON, PA.—W. D. Snyder, Secy., writes us that the bids received Aug. 31 for paving were all too high and were rejected. The council will readvertise at once for new bids.

PITTSBURG, PA.—Contracts were awarded Aug. 30 for the improvement of portions of three roads, as follows: Beaver Road, Booth & Flinn, $43,064; Kittanning Road, Keeling & Ridge, $29,161; Library Road, Booth & Flinn, $40,901. W. W. Murray and J. A. Clark, County Comrs.; Fred. W. Patterson, County Engr.

SHARPSBURG, PA.—E. C. Hulbert, Cy. Engr., writes us that the borough has decided to issue $60,000 bonds for the purpose of repaving all the cobble streets with modern pavement. There are about 45,000 sq. yds. of paving to be done, and the work will be pushed at once.

ROCKVILLE, MD.—Bids are asked until Sept. 20 for grading, masonry and macadam paving necessary in constructing a highway from Rockville, Md., to Washington, D. C. W. W. Welsh, Clk. County Comrs.; Taylor Gleaves, Constr. Engr., Lynchburg, Va.

LOUISVILLE, KY.—Bids are asked until Sept. 12 for improving portions of six alleys by grading, curbing and vitrified brick or block paving. Bids are also asked until Sept. 15 for improving the sidewalks on nine streets by regrading, recurbing, supplying metal gutters and brick paving. Thos. P. Craig, Secy. Bd. Pub. Wks.——The council has refused to approve the awarding of the contracts for asphalt paving to the Assyrian Asphalt Paving Co., according to report.

CINCINNATI, O.—Bids are asked until Sept. 13 for improving Bell Place, from Locust St. to 267 ft. south, by grading, curbing and macadamizing. A. B. Rattermann, Pres. Bd. of Cy. Affairs; Geo. H. Spellmire, Clk.——Ruebel Bros. have been given the contract at $6,108, to improve Red Bank Ave.

CLEVELAND, O.—The council has passed an ordinance to grade, curb and pave Hayward St. from Cedar to Central Aves. Geo. H. Billman, Pres.; Howard H. Burgess, Cy. Clk.

YOUNGSTOWN, O.—Bids are asked until Sept. 19 for the purchase of $20,000 bonds for paving Scott St., between Wick and Belmont Aves., $1,500 bonds for grading and improving Seneca St., between Oakland and Delaware Aves., and $400 bonds for constructing a sewer on Hogue St. F. C. Brown, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until Sept. 12 for grading, curbing, gravel paving and building cement sidewalks on Tacoma Ave., from 10th St. to the south bank of Pogue's Run; check, $1,000. M. A. Downing, W. Scott Moore and T. J. Montgomery, Bd. Pub. Wks.

DETROIT, MICH.—It is reported that the board of works will call for bids for paving Cass St. from Lafayette to Michigan Sts., with asphalt. D. W. H. Morelands, Comr. Pub. Wks.

BLOOMINGTON, ILL.—Bids are asked until Sept. 15 for 480 ft. of stone curbing and about 1,100 sq. yds. asphalt paving on Centre St. C. F. Koch, Pres. Bd. of Local Improvement.

CHICAGO, ILL.—Bids are asked until Sept. 13 for 4,750 sq. yds. of asphalt paving, 2,245 lin. ft. of granite concrete curb, two new catch basins with connections, seven wooden catch basin covers replaced by iron covers and set, two wooden manhole covers replaced by iron covers and set, 390 cu. yds. of common filling, 170 cu. yds. of black soil, 1,300 sq. yds. of sodding and 25 elm trees, all for the West Chicago Park Commissioners; check, 10% of bid. Anton Peterson, Pres. Bd. of Local Improvements of the West Chicago Park Comrs.; Ernest G. Schubert, Secy.

EAU CLAIRE, WIS.—S. S. Kepler, Mayor, writes us that an ordinance has been passed providing for the laying of new vitrified brick pavements on certain streets and the removal of the old cedar blocks; also for the purchase of a 12-ton steam road roller. It is not expected, however, to contract for paving before 1899. T. P. Cochrane, Cy. Clk.

RACINE, WIS.—The board of public works rejected all bids for the grading of Kewaunee St., Aug. 27. Fred. Nelson was awarded the contract for the filling of La Salle St. at 11 cts. a cu. yd. O. Burlingame, Cy. Engr.

ST. PAUL, MINN.—L. W. Rundlett, Cy. Engr., has prepared plans and estimates for paving 10th St. from St. Peters St. to Rice St., and Rice St. from that point to the Great Northern Ry. tracks. The estimated cost is $20,000 for asphalt, $19,000 for sandstone and $17,000 for brick.——The board of public works is reported to be contemplating the construction of 25 miles of cement sidewalks.

WICHITA, KAN.—Bids are asked until Sept. 12 for the completion of three 5-ft. unfinished wooden sidewalks; check, $10. H. T. Kramer, Cy. Clk.

OMAHA, NEB.—Bids are asked until Sept. 16 for grading Fowler Ave. from Florence Boulevard to 24th St. Bids are also asked until Sept. 16 for curbing and paving 32d Ave., from Lincoln Ave. to Dorcas St., with asphalt, brick or stone; check, 2% of bid. Andrew Rosewater, Chn. Bd. Pub. Wks.; Wm. Coburn, Secy.

JOPLIN, MO.—E. C. H. Squire, Cy. Clk., writes us that the contracts for street paving will be let this month. S. J. McKee, Engr.

KANSAS CITY, MO.—Adam Armstrong was awarded the contract, Aug 24, for macadamizing the roadways and constructing artificial stone crosswalks on the Paseo drives at a cost of $46,000 for the former, and $800 for the latter. A contract was also awarded to the Dugan Cut Stone Co. to construct the South Paceo Park fountain at $9,382, according to report. R. W. Godfrey, Secy.

KANSAS CITY, MO.—Bids are asked until Sept. 12 for constructing a natural stone sidewalk on the west side of Troost Ave., between 8th St. and 9th St.; also for constructing granitoid sidewalks on 10 streets (separate bids for each); check with each bid, $200. Bids are also asked until the same date for grading 25th St., between Cherry and Holmes St.; for 136 lin. ft. of curbing on Bank St., for paving Central St. with vitrified brick, for paving Amarette St. with the same, and for paving the alley between Grand Ave. and McGee St. with the same (five contracts; check, $200 each). Henry A. Wise, Cy. Engr.

MARSHALL, MO.—The city council rejected all the bids received Aug. 29 for macadam paving and curbing, as noted in our issue of Aug. 18, on account of the bids being above the estimate of the street commissioners. Bids are again asked for until Sept. 14 for the same work. A. R. James, Cy. Clk.

ST. JOSEPH, MO.—Bids are asked until Sept. 12 for grading St. Joseph and De Kalb Road; check, $15. Theo. Steinacker, County Surv.

OREGON CITY, ORE.—J. Henry Smith, C. E., writes us that the contracts recently awarded to Danl. Lyons amounted to about 900 lin. ft. of roadway on the side of a bluff at a cost of about $2,400. More extensive work is promised for the near future.

WESTMOUNT, QUE.—At a council meeting Sept. 6, a resolution was to be introduced to open the Boulevard from its present terminus westerly to Glencoe Ave. Wm. Mints, Secy. and Treas.

OSHAWA, ONT.—Bids are asked until Sept. 9 for the construction of 500 lin. ft. of 8-ft. concrete sidewalks. John Bailes, Chn. Bd. of Wks.; Thomas Morris, Acting Clk.

MANUFACTURING PLANTS.

NEW MILFORD, CONN.—The factory of the New Milford Hat Co. was destroyed by fire Sept. 5, causing a loss of about $40,000.

NEW YORK, N. Y.—A fire in this city, Sept. 3, destroyed the works of the East Side Rubber, Bone & Ivory Works, 2220 to 2228 1st Ave., and 401 and 403 East 124th St., causing a reported loss of $60,000.——The drug and chemical factory at 3d Ave. and 18th St., occupied by Elmer & Amend, was damaged by fire, Sept. 5, causing an estimated loss of $125,000.

TROY, N. Y.—It is reported that Cluett, Coon & Co., shirt and collar manufacturers, will soon erect a new 6-story addition to their plant on River St.——Also that Searle, Gardner & Co., collar manufacturers, will erect a new factory building at River and Middleburgh St.

NEWARK, N. J.—A third fire occurred in the works of the Celluloid Mfg. Co., Sept. 4, causing a reported loss of over $100,000.

CHESTER, PA.—It is reported that Robert Wetherill & Co., boiler and engine builders, have awarded the contract to build a new foundry, 146 × 65 ft., on East 7th St., to Alva R. Kerr & Co., of Eddystone, Pa.

MAUCH CHUNK, PA.—The Keystone Construction Co., of Easton, is said to have been awarded the contract for furnishing and erecting the structural iron for the new plant to be built at Hazards by the Lehigh Zinc & Iron Co. Fourteen large buildings are expected to be built.

STATESVILLE, S. C.—Reports state that the Statesville Cotton Mills will purchase additional machinery to increase its capacity by one-third, at a cost of $14,580. The present equipment is 6,000 spindles and 180 looms.

DETROIT, MICH.—Plans have been prepared, according to reports, for a new plant and bottling works for the Union Brewing Co.; estimated cost, $50,000. Mgr., Joseph Aipel, 837 Leland St.; Arch., Gustav A. Mueller, Union Trust Bldg.

OWOSSO, MICH.—A fire in this city Sept. 3 destroyed Woodward's furniture factory, the plant of the Owosso Brewing Co. and other buildings. Reported loss, $175,000; insurance, about $90,000.

KENOSHA, WIS.—Reports state that the Laflin & Rand Powder Co. has bought a tract of land near Pleasant Prairie and will remove its plant at Plattville, Ia., to this place; estimated cost, $50,000.

TOLEDO, O.—The Bertram shipyards were destroyed by fire, Sept. 2, causing a loss to the shops and machinery of about $70,000.

GAS PLANTS.

BUFFALO, N. Y.—Alderman Geo. S. Potter has introduced a resolution to have the council ask bids for the construction of a municipal gas and electric lighting plant, to cost about $5,000,000.

PORTSMOUTH, VA.—The Portsmouth Gas Co. will extend its works for an additional capacity of 100,000 cu. ft.

ATLANTA, GA.—J. T. Burke, of the Georgia Lighting & Heating Co., writes us that the matter of lighting has been before the council committee. Mr. Burke has offered to light the city with a new gas lamp.

NEW COMPANIES.—Pittsburg Refining Co., Pittsburg, Pa.; $5,000,000, commencing with $100; to bore for oil and natural gas; Amos Steelsmith and Ferd Reiber, Butler, Pa.; E. H. Anderson, Wilkinsburg, Pa.; A. R. MacConnell and John J. McConnell, of Pittsburg.

Columbia Drilling Co., Pittsburg, Pa.; $100,000, commencing with $1,000; to drill for oil and gas; C. C. Beggs, W. J. Ruan, H. C. Beggs, J. H. Richardson and J. P. Beggs, all of Pittsburg.

Sheford Oil Co., Cleveland, O.; $5,000,000, with $10,000 paid in; to bore for oil and gas; J. S. Riddle, Chas. A. Post, E. T. Holmes, R. C. White, J. R. Post, all of Cleveland, O.

MISCELLANEOUS CONTRACTS.

TELEPHONE SYSTEM.—Le Mars, Ia.—The town has voted to grant a franchise to a telephone company. Address W. H. Hout.

BONDS.—Sheridanville, Pa.—Bids are asked until Sept. 13 for the purchase of $30,000 of 4% bonds. Chas. L. Criss, Borough Clk.

TUNNEL.—Boston, Mass.—Hearings are being given by the Boston Rapid Transit Commissioners on the question of building a tunnel to East Boston.

RETAINING WALLS.—Oakland, Cal.—The question of constructing retaining walls on 12th and 8th Sts. will be decided by the board of public works on Oct. 5.

TOWBOAT.—St. Louis, Mo.—Bids are asked until Oct. 1 for furnishing a steel hulled towboat. Maj. Thos. H. Handbury, U. S. Engr., Custom House, St. Louis.

DREDGING.—Oakland, Cal.—Bids are asked by the board of public works until Oct. 5 for dredging Lake Merritt, for which $80,000 has been appropriated.

COAL SHAFT.—Latrobe, Pa.—Bids are asked by the Latrobe Coal Co., Latrobe, until Sept. 30, for sinking and timbering a shaft at St. Vincent's monastery. D. N. Jones, Supt.

BANK PROTECTION.—New Orleans, La.—Bids are asked until Sept. 8 for pile bank protection work in the Third District, check, $2,500. Secy, Orleans Levee Bd., T. J. Duggan.

DRAINAGE CANAL.—Spokane, Wash.—Bids will probably soon be asked by Oskar Hubar, Civil Engr., Spokane, for constructing a canal seven miles long, to drain the Colville Valley.

LEVEE WORK.—New Orleans, La.—Bids are asked until Sept. 22 for about 461,000 cu. yds. of embankment for the Atchafalaya and Lafourche levees. Maj. J. H. Willard, U. S. Engr., New Orleans.

STONE JETTIES.—Green Harbor, Mass.—Bids are asked until Sept. 22 for constructing stone jetties, as stated in our advertising columns. Woodward & Emery, Chn. Comrs., 131 State House, Boston.

SHORE PROTECTION.—Fort Morgan, Ala.—Bids are asked until Oct. 5 for the construction of shore protection at Fort Morgan, as stated in our advertising columns. Address Major W. T. Rossell, U. S. Engrs., Mobile, Ala.

DRY DOCK.—Algiers, La.—Bids are asked until Oct. 21 for constructing a combined floating and graving steel dry dock, etc., at the naval reservation, Algiers. Estimated cost, $850,000. Mordecai T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

STONE, CEMENT, ETC.—New York, N. Y.—Bids are asked by the park board, the Arsenal, Central Park, Manhattan, until Sept. 15 for furnishing 400 bbls. of Portland cement, about 2,700 cu. yds. of ½ to 2½ in. crushed stone, 10,000 ft., B. M., of timber, etc.

TIMBER FENDER.—Pittsburg, Pa.—Jotte, Foley & Co., Pittsburg, and Jas. Omslaer & Co., Park Bldg., Pittsburg, submitted the only bids received by Maj. C. F. Powell, U. S. Engr., for building a pile and timber fender at Lock No. 2, Turtle Creek, at $2,740 and $2,330 respectively.

SHORE PROTECTION.—Cleveland, O.—The following bids were received by the park board, Aug. 17, for constructing a shore protection in Edgewater Park. C. A. Strong & Son, $38,836; L. P. & J. A. Smith, $39,050; Engel & Ettner, $39,530; William Robinson, $46,321.

TELEPHONE SYSTEM.—Sandusky, O.—Press reports state that the Union Suburban Telephone & Telegraph Co., recently incorporated with a capital stock of $1,000,000, will soon begin the construction of its proposed lines. Pres., H. A. Everett, Cleveland, O.; Engr., C. W. Mason.

LEVEE.—Hanford, Cal.—The Buena Vista Reclamation District has resolved to construct 13 miles of levee to reclaim 30,000 acres, south of Lake Tulare, estimated cost $7,000. The work will be let either by contract or day labor. N. W. Motheral, L. D. Combs, T. O. Robinson, J. D. Hefton, E. O. Miller, R. Rey, L. G. Vragizan and J. F. Pryor compose the committee.

PIER.—New York, N. Y.—The dock and ferry board awarded the contract to Henry D. Steers, Bowling Green, for building a new pier at Watts St. The bids were in three classes: first, for the building of the main pier; second, for extra piles for a Pennsylvania ferry rack to be hereafter built, and third, for riprap stone to hold the pier in place at the outer end. Mr. Steer's bid for the work was $38,820 for the first class, $2,050 for the second, and 38 cts. a ft. for the third. Other bidders were W. H. Jenks, Gildersleeve & Ralf, R. P. & J. H. Staats, B. S. Cronin and P. S. Ross.

COALING STATION.—Pago Pago, Samoa.—Press reports state as follows: Bids for the erection of a coaling station at Pago Pago have been asked by Commander Z. L. Tanner, who is in charge of the work. He will not state the amount to be expended, but says the work will be of a substantial character, and at least a year will be required for its completion. Lieut. F. T. Chambers, of the Engineering Department of the Navy, will supervise the construction of the wharf and coalsheds. He will also provide for a water supply and make a complete topographical survey of the land belonging to the United States surrounding the harbor. Commander Tanner says that no fortifications are to be erected.

COAL HANDLING PLANT.—New London, Conn.—We are informed that the Bureau of Yards and Docks, Navy Department, Washington, D. C., received the following bids Aug. 31 for constructing coal sheds, coal handling machinery, etc., at New London:

Bidder.		Time, days.
Riter-Conley Co., Pittsburg	$185,700 and $155,000	..
J. W. Hoffman & Co., Philadelphia	137,500	..
F. W. McNeal Co., New York	174,999	150
Manhattan Supply Co., 160 Duane St., N. Y.	323,400	..
C. W. Blakesley & Son*	$192 000 and 171,000	4 mos.
J. A. Mead & Co., New York	$81,043 and 105,602	..
Engineering Contract Co., New York	160,000†	165
R. P. & J. H. Staats, 29 B'way, New York	166,000	..
Berlin Iron Bridge Co., East Berlin, Conn.	159,900	6 mos.
R. H. Hood & Co., 220 B'way, New York	173,975	6 mos.
McGuire & Hall, 26 Cortlandt St., N. Y.	164,980	..
Wm. Seaver Engineering Co.§	$206,677 and 361,777	8 mos.
Union Bridge Co., 1 B'way, New York	125,370‡	6 mos.

*New Haven. †Enlarged plant, $185,000. §Cleveland, O. ‡Alternate bids of $155,880, $155,360, $192,000 and $191,570.

CONTRACT PRICES.

VALVES.—Boston, Mass.—The Metropolitan Water Board received the following bids Aug. 25 for furnishing water valves:

Bidder.	Valves			
	20-in., 6 each.	16-in., 8 each.	12-in., 8 each.	Total.
Camden (N. J.) Iron Works*	$172	$110	$75	$2,512
Coffin Valve Co., Neponset, Mass	178	119	88	2,724
Atlantic Works, Boston, Mass.	298	214	148	4.684

*Awarded contract.

ELECTRIC LIGHTING.—West Superior, Wis.—Press reports state that the council voted Aug. 24 to accept the following proposition of William Burgess for street lighting for five years; 150 arc lights 1,200-c. p., $75 a year; 200 arc lights, 1,200-c. p., $75; 300 arc lights, 1,200-c. p., $72.50; all lights over 300, $70; 150 arc, 2,000 c. p., $80; 200 arc, 2,000 c. p., $80; all lights over 200-300, $77.50; over 300, $75. The above proposition on being accepted, Mr. Burgess will furnish commercial lighting as follows: Arc lights, 7 o'clock, a month, first, $5; additional, $5; 10 o'clock, a month, six nights a week, first, $6; additional, $5.50; 12 o'clock, a month, seven nights a week, first, $7; additional, $6.50; all night, seven nights a week, $8; additional, $7.50. Incandescent lights: Meter rates, 5-10 cts. a light hour or 10 cts. a 1,000 watts. Contract rates: Running later than 10 o'clock, $50; not later than 12 o'clock, $55; all night, $65, 16 c. p.

BRIDGE MASONRY.—Fort Wayne, Ind.—Chas. E. Moellering & Co. were awarded the contract, Aug. 19, for the abutments of the Walton Ave. bridge over the Maumee River, at $5.98 a cu. yd. for stone, $4.25 a cu. yd. for concrete, 16 cts. a cu. yd. for excavation, and 40 cts. a cu. yd. for wet excavation. Stringer & Wright were awarded the contract for the abutments of the Clinton St. bridge over Spy Run and the bridge over Black Creek, in Maumee Township, at $7.78 a cu. yd. for stone. Their bids are $592 and $354, respectively. Wm. H. Boshorn, County Engr.

SAND.—Washington, D. C.—The district commissioners have accepted the following proposals: Columbia National Land Dredging Co., to furnish the city with 2,250 cu. yds. of paving sand at 45 cts.; John B. Lord, to furnish the city with 4,000 cu. yds. of concrete sand at 59 cts., 1,000 cu. yds. of building sand at 65 cts., and 4,000 cu. yds. of screened gravel at 69 cts.

SEWER WORK.—St. Louis, Mo.—L. H. Meyer, 108½ North 8th St., St. Louis, was awarded the contract at $11.00 a lin. ft. Sept. 1, 1898, for taking out 928 ft. of wooden bottom in the Mill Creek sewer and replacing the same with concrete. The highest bid was $21.50 a ft. B. H. Colby, Sewer Comr.

ASPHALT PAVING.—Scranton, Pa.—The following bid was received Sept. 1, 1898, for paving Quincy Ave., between Pine and Gibson Sts.: Barber Asphalt Paving Co., asphalt pavement, $2.37 a sq. yd.; 4 × 12-in. curb, 46 cts. a lin. ft.; 6 × 12-in. curb, 53 cts. a lin. ft.; 6 × 12-in. curb with tile drain, 60 cts. a lin. ft.; circular curb with tile drain, 98 cts. lin. ft.; dressing and resetting old curb, 27 cts. a lin. ft. The curb is to be set in concrete. Joseph P. Phillips, City Engr.

ASPHALT PAVING.—Paterson, N. J.—The Paterson Construction Co., Pres., Chas. M. King, has been awarded the contract at $1.98 a sq. yd. for 29,500 sq. yds. of asphalt paving and at 40 cts. a lin. ft. for 300 ft. of crosswalk.

BRICK PAVING. — Hagerstown, Md.—E. G. Buck has been awarded the contract at $1.22 a sq. yd. for paving two blocks of Franklin St. with Clearfield brick; cement filler to be used.

ASPHALT WALK.—Toledo, O.—The county commissioners received the following bids last month for constructing 19,000 ft. of 18-ft. asphalt walk around the court house park: Schillinger Bros., $1.15 a lin. ft.; Frank Hill, $1.33; Warren-Scharf Asphalt Paving Co., $1.69; M. F. Sullivan, $1.97.

PUMPING STATION.—Boston, Mass.—The Metropolitan Water Board received the following bids Aug. 25 for building the low-service pumping station at the Chestnut Hill reservoir, as advertised in Engineering News; Norcross Bros.'s bid was accepted; all local bidders:

Bids Received at Boston, Mass., Aug. 25, 1898, for the Construction of a Low-Service Pumping Station.

Quantities.		Norcross Bros.	Woodbury & Leighton.	McNeil Bros.	C. A. Dodge & Co.	Connery & Wentworth.	L. P. Soule & Son.	C. E. Clark & Co.	L. D. Willcutt & Son.	Whidden & Co.
Excavation	15,000 cu. yds.	$0.33	$0.35	$0.65	$0.70	$0.75	$0.87	$0.80	$0.64	$1.25
Cement conc. mas'ry*	1,300 " "	4.14	5.50	6.50	4.55	4.65	4.44	6.21	5.09	7.50
Cement conc. mas'ry†	2,800 " "	5.43	6.20	7.50	6.70	7.50	5.74	7.83	8.32	8.75
Concrete floor	1,600 sq. yds.	1.39	2.00	1.00	1.60	3.00	2.35	1.72	1.64	1.75
Rubble stone masonry	28 cu. yds.	5.75	5.00	6.00	5.04	7.00	4.70	7.50	8.00	7.50
Brick masonry (fndtns)	30 " "	12.00	15.00	9.00	11.17	15.00	20.00	9.75	13.50	13.50
Cut granite stone	150 " "	53.19	50.00	40.00	40.50	37.00	41.75	41.20	38.30	50.00
Superstructure, complete		146,400	152,000	146,000	150,791	149,900	155,996	151,480	158,689	168,534
Total		$182,660	$193,050	$193,238	$195,077	$199,191	$201,644	$202,912	$207,200	$232,449

*Foundations, made with natural cement. †Foundations, made with Portland cement.

PIPE SEWERS.—Palmer, Mass.—C. W. Johnson has been awarded the following contracts for constructing certain sewers: 15-in. main sewer, 38 cts. a ft.; 10-in. laterals, 38 cts. a ft.; manholes, $32 each; catchbasins, $16 each.

BRICK PAVING.—Schenectady, N. Y.—We are informed that the following contract has been let to John Twomey, Schenectady, for brick paving, curbing, etc., in Dock St.: All paving, vitrified brick, a sq. yd., $1.80; granite block, $2.65; cobblestone, 18 cts.; 4-in. curbing, a lin. ft., 60 cts.; 8-in. curbing, $1.15; catchbasins, complete, each, $90; retaining wall, a cu. yd., $4.10; iron rail for retaining wall, a ft., $1; water taps, each, $8; sewer connections, a lin. ft., 70 cts.; lead pipe, AAA ¾-in., a lin. ft., 80 cts.; 15-in. sewer, laid, a ft., 80 cts.; 10-in. sewer, laid, a ft., 60 cts., and filling, a cu.yd., 20 cts.

MACADAMIZING.—Paterson, N. J.—The county board of freeholders received the following bids Aug. 19, 1898, for building portions of 17 macadam roads: F. J. Marley, three roads, bid ranged from 26 cts. to 31½ cts. a sq. yd.; Edward Dowling, three roads, 18 cts., 21 cts. and 28 cts.; Bunn & Daniels, three roads, 22 to 25 cts.; McKiesnan & Bergen, five roads, 23 to 33½ cts.; Wright & Lindsey, five roads, 28 to 35 cts.; Daniels & Stanley, four roads, 22 to 30 cts.; R. M. Torbet, four roads, 24 to 33 cts.; Wolf & Bergen, two roads, 26 and 29 cts.; Francisco Bros., three roads, 20, 24 and 27 cts.; Colfax & Steele, one road, 30 cts.; Nelson Cassidy, three roads, 23 and 28 cts.; John Grish, one road, 24 cts.

IMPROVING RIVER.—Rock Island, Ill.—Capt. C. McD. Townsend, U. S. Engr., Rock Island, received the following bids Aug. 30 for constructing dams and shore protection between Dubuque and Le Craire, Ia., for continuing the improvement from the mouth of the Missouri River to St. Paul, Minn., as advertised in Engineering News; John Pickley's bid was recommended for acceptance:

Bidder.	In place		
	Rock, 30,000 cu. yds.	Brush, 37,000 cu. yds.	Total.
John Tibey, Dubuque, Ia.	$0.96	$0.40	$43,600
A. B. Teasdale, Cassville, Wis.	.95	.35	41,450
John Pickley, Dubuque, Ia.	.76	.25¼	32,143
Jacob Richtman, Elsberry, Mo.	.90	.30	38,100
A. Kirchner, Fountain City	.96	.30	39,900
Fetter & Crosby, La Crosse	1.00	.26	39,620
A.J. Whitney, Rock Island, Ill.	1.00	.30	41,100

The following additional bids were recommended for acceptance for improving the Mississippi River from the mouth of the Ohio River to St. Paul, Minn., and for continuing the improvement of the river from the mouth of Missouri River to St. Paul: Dams and shore protections between Rock Island and New Boston, Ill.—Fetter & Crosby, La Crosse, Wis., 32,000 cu. yds. of rock in place, $1.00 a cu. yd.; 32,000 cu. yds. of brush in place, 28 cts. a cu. yd.; dams and shore protections between Reed's Landing and Winona, Minn., and Winona and La Crosse—Jacob Richtman, Elsberry, Mo., 25,000 cu. yds. rock, 90 cts.; 50,000 cu. yds. brush, 30 cts.; between New Boston, Ill., and Burlington, Ia.—Albert Kirchner, Fountain City, Wis., 28,000 cu. yds. rock, $1.00; 25,000 cu. yds. brush, 29 cts.; between Burlington and Montrose, Ia.—Albert Kirchner, 37,000 cu. yds. rock, 91 cts.; 46,000 cu. yds. brush, 26 cts; between Keokuk, Ia., and Quincy, Ill.—Albert Kirchner, 21,000 cu. yds. rock, 95 cts.; 28,000 cu. yds. brush, 27 cts.; between Hamburg, Ill., and Cap au Gris, Mo., and between Cap au Gris and mouth of the Illinois River—James Short, St. Charles, Mo., 30,000 cu. yds. rock, 73 cts.; 60,000 cu. yds. brush, 37 cts.

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INDUSTRIAL NOTES.

THE MAYBERRY & WATSON CO., Birmingham, Ala., is reported to have sold 20,000 bbls. of cement to the Alabama Steel & Shipbuilding Co., of the same city, for the construction of its new plant at Ensley, Ala.

THE SHIFFLER BRIDGE CO., Pittsburg, through its eastern office, 45 Broadway, New York, is erecting the steel frame work for the tank house of the Raritan Copper Works, Perth Amboy, N. J. The building is 212 × 307 ft., and will be used for the electrolytic refining of copper. The plant will be the largest in the East, it is claimed.

MR. GEORGE W. KNOPF, Carnegie Bldg., Pittsburg, consulting and contracting engineer, is erecting a steel boiler house, 133 ft. long, and a steel power house, 82 ft. long, for the Pittsburg Plate Glass Co., to be used in connection with its recent extensive additions at Ford City, Pa. Both buildings have side walls of brick and are roofed with slate. He is also erecting the structural steel in a five-story store building for Rosenbaum Bros., Cumberland, Md., the material for which was manufactured by Jones & Laughlins, Ltd.

ABENDROTH & ROOT MFG. CO., 28 Cliff St., New York, has sold 35 carloads of its Root's spiral riveted pipe to the city of Paris, Tex., at a cost of about $40,000. The company reports that recent contracts have also been received from Kewanna, Ind.; Mokena, Ill.; Augusta and Blair, Wis.; Alden, Buffalo Centre, Colfax, Minden, New Sharon and Oxford Junction, Iowa; Herman, Neb.; Siloam Springs, Ark.; Milan and Slater, Mo. The pipe is made from 4-in. to 24-in. diameter and will stand pressures from 500 to 1,200 lbs. a sq. in. It has been in use for ten years at Eagle River, Wis.; for 18 years at Lexington, Mo.; and for 26 years at Rochester, N. Y.

THE VULCAN IRON WORKS CO., Toledo, O., reports that it has recently sold two more large "Giant" B, Special 75-ton steam shovels to be used on the Massena Canal, at Massena, N. Y. Also a 55-ton "Giant" B steam shovel to go to Sweden. This shovel is bolted instead of being riveted, in order that it may be transported and is to be used in iron mines, the purchaser having seen the shovels at work in the Messabe country, Michigan. The company further states that it has had an immense business this year, and that had it not been that previous indications caused a stocking up it would have been unable to fill the orders received. Good business during the entire year is indicated by present conditions.

THE ASSOCIATED EXPANDED METAL COMPANIES of the United States held their semi-annual meeting in Boston Aug. 30 and 31. There were representatives present from 11 companies, in addition to those from the Canadian company. Mr. John F. Golding, the inventor, who was also present, is interested in the English company, which controls the business throughout Europe by means of six distinct companies in France, Belgium, Germany, Austria, Russia and Italy. The proceedings of the Boston meeting were largely routine, and a special committee, which is to compile and issue a revised and enlarged catalogue, was appointed. All the companies reported satisfactory conditions in all branches, notwithstanding the dull period of the last six months. The delegates were entertained by the Eastern Expanded Metal Co., of Boston, including a lecture and entertainment at the Exchange Club on Aug. 30, followed by a collation, at which there were present nearly 100 architects and engineers of Boston and New England. Mr. Merrill Watson is Secretary of the associated companies.

THE AMERICAN WOOD PRESERVING CO., Philadelphia, Pa., has recently received an order for about 1,100 gallons of its preservative Woodiline from the New York Central & Hudson River R. R. Co In November, 1897, a small quantity of the compound was used by the latter company for the treatment of wooden signal boxes as an experiment. The Queen & Crescent Co. placed an order in July, 1896, for 800 gallons of Woodiline for use on white oak ties and bridge timbers over the Cumberland River, at Burnside, Ky. This company has also just placed another larger order for the preservative. An important eastern railway company, we are informed, has had since Jan. 1, 1898, over 7,500 gallons of Woodiline. The Boston Elevated R.R.Co.has placed an order for over 2,000 galls. in the same time. The Bangor & Aroostook R. R. has recently duplicated its order of two years ago and the Richmond, Fredericksburg & Potomac R. R., the Cumberland Valley R. R., the Northern Central Ry. and others, having been early experimenters with Woodiline, are now regular users of the compound, which seems able to demonstrate its value as an inexpensive wood preservative wherever it is used. The officers of the company are, Mr. Frederick S. Hovey, Pres., and Mr. J. J. Hovey, Secy. and Treas.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, has the contract to build the plant of the Snoqualmie Falls, Wash., involving the tranmission of 10,000 HP. a distance of 45 miles, without other than normal losses in the dynamos, transformers and over the line. The power station is to be located at Snoqualmie Falls, 45 miles from Tacoma, and 31 miles from Seattle, to which places the current is to be transmitted and there utilized by Westinghouse motors. The contract involves the installation at the above points, of four three-phase rotary-armature dynamos, having a normal aggregate capacity of 6,000 K-W., and which are to be direct-connected to water-wheels; two 75-K-W. exciter dynamos also to be direct connected to water-wheels; high and low potential switchboards for the main power station and sub-stations at Seattle and Tacoma, involving 76 marble panels with all necessary instruments, switches, etc.; high tension oil insulated static transformers having an aggregate capacity of 10,875 K-W.; rotary transformers with a total output of 2,700 K-W. and 6 type "C" motors developing 1,600 HP., with adequate lightning protection at both ends of the line. These machines when installed will make available for industrial, railway and lighting purposes the power of Snoqualmie Falls. The line potential will be 25,000 volts, and its current will be carried over bare aluminum wires to sub-stations where lowering transformers will sufficiently reduce the voltage for safe transmission within the limits of the cities.

NEW COMPANIES. — City Refuse Utilization Co., 60 Grand St., Jersey City, N. J.; to remove and utilize refuse; $50,000, with $1,000 paid in; Herbert Tate, 60 Grand St., William W. Gooch, Henry W. Meen.

National Motor Co., St. Louis, Mo.; $100,000; H. H. Henigen, O. D. Harris, L. A. Allard and William P. Larew.

Turbine Motor Co., 24 Morris St., Jersey City, N. J.; $100,000, commencing with $1,000; to manufacture all kinds of engines, boilers, machines, etc.; Louis J. Auerbacher, 157 Grand St.; J. C. Stines, 24 Morris St.; Orville R. Van Vechten, 24 Morris St., all of Jersey City.

Standard Drop-Forging Co., Boonton, N. J.; $10,000, commencing with $1,000; to conduct a general business of drop-forging, etc.; Dickinson W. Richards, Orange, N. J.; Frank O. Affeld, Jr., Brooklyn, N. Y.; Thos. G. Boone, Boonton.

Chicago Vapor Light Co., Chicago, Ill.; $1,000,000, commencing with $100; to manufacture incandescent gas machines and apparatuses; T. M. Moe, R. P. Benedict, W .R. Hanze, W. H. Woodron and G. H. Powell, all of Chicago.

Atlas Elevator Co., Minneapolis, Minn.; $500,000, commencing with $5,000; to operate grain elevators, warehouses, etc.; A. G. Moritz, C. M. Harrington, F. C. Van Dusen, Gustav F. Ewe and Frank M. Mann, all of Winona, Minn.

War Munition Co., Cleveland O.; $1,000,000, commencing with $50; to manufacture powder, projectiles, etc.; E. G. Sherlin, C. A. Sherlin, W. E. Irish, H. H. Anderson and B. Davenport, all of Cleveland.

Operating & Investment Co., Philadelphia, Pa.; $2,000,000, commencing with $500; to equip and own railways, boilers, machinery, etc.; T. L. Mattson, Henry Morris, G. H. Millet, Howland Coit and E. A. Moore, all of Philadelphia.

Union Terminal Coal Storage Co., Claremont, Baltimore, Md.; $500,000, commencing with $500; to conduct a cold storage business; D. B. Martin, E. F. Cook, Henry Lammertz, J. J. Martin and F. R. Shattuck, all of Philadelphia, Pa.

Porto Rico Commercial Co., 60 Grand St., Jersey City, N. J.; $500,000, commencing with $1,000; to do a general shipping and commission business, and to build docks, piers, etc.; Wm. D. Martin, Felix B. Ruthenburg and Isaac W. Taussig, all of New York; Allan L. McDermott, Jersey City.

West India Land & Trading Co., 60 Grand St., Jersey City, N. J.; $25,000, commencing with $2,500; Benjamin W. Morrill, East Orange, N.J.; John Farr and Geo. C. Kobbé, Short Hills, N. J.

Adam Weber Co., Crow's Mills Lane, Weber, N. J.; $150,000, with all paid in; to manufacture clay retorts, fire brick, etc.; Adam Weber, Oscar B. Weber, Albert J. Weber, Chas. C. Weber, and Adolph Ehrenzeller, all of Weber, N. J.

Heckert & Ballztey Hollow Axle Co., 76 Montgomery St., Jersey City, N. J.; $1,000,000, commencing with $1,000; to manufacture and sell steel and iron; John McIntyre, Jersey City, N. J.; Edwin Ballztey, Glen Echo, Md.; William Heckert, Wm. H. Wallace and Geo. B. Hibbard, all of New York.

National Motor Carriage Co., $500,000; Arthur S. Winslow and Thomas D. Merrigan, of New York; Charles W. Parker, of Jersey City, N. J.

Broadhead Contracting Co., Newark, N. J.; $125,000, commencing with $1,000; to do a general contracting business; A. D. Brodhead, Elizabeth, N. J.; Jas. E. Brodhead, Flemington, N. J.; Calvin E. Brodhead, Jr., Perth Amboy, N. J.; Charles Holzhauer, Newark, N. J.; Fred J. Faulks, Newark, N. J.

Citizens' Telephone Co., Spartanburg, S. C.; $8,900; Pres., W. H. Clarke; Mgr. and Treas., C. E. Fleming; Directors, J. H. Montgomery, D. E. Converse, W. H. Clarke, R. H. F. Chapman, John W. Simpson, H. B. Carlisle, B. F. Shockley, John W. Floyd and C. E. Fleming.

Esmond Electric Traction & Signal Co., New York; to build, equip and maintain railways and signals and signal stations and furnish electric heat, light and power; D. M. Maxon, G. E. Cruse, C. S. Jones, D. A. Davies and R. H. E. Starr, all of New York.

WATER SUPPLY AND STREET LIGHTING.

The Town of Cobourg, Ontario, Canada, will receive separate tenders addressed to John Purser, Chairman of the Fire, Water and Light Committee, until 12 noon of the 31st day of October next:

1st.—For the supply of water for fire protection and public use, and,

2d.—For lighting the streets of the Town.

For particulars address the undersigned,

D. H. MINAKER,
Town Clerk.

Cobourg, Ont., Aug. 30, 1898. 36-8t

U. S. ENGINEER OFFICE, Mobile, Ala., September 5, 1898.—Proposals for construction of SHORE PROTECTION at Fort Morgan, Ala., will be received until 12 m., Oct. 5, 1898, and then opened. Information furnished on application. WM. T. ROSSEL, Maj., Engrs. 36-4t

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RAILWAY GRADING.

PETERSBURG RAIL ROAD COMPANY,
ENGINEER'S OFFICE.
RICHMOND, VA., Sept. 3, 1898.

Sealed proposals will be received at the Engineer's Office, Byrd Street Station, Richmond, Va., to be opened the 16TH INST., at noon, for the Graduation of a line about ten miles in length, beginning about two miles south of Petersburg, Va., and running southerly in proximity to the existing railroad.

Profile and specifications may be seen and other information had at the office of the Petersburg Railroad in Petersburg, Va., or at the Engineer's Office, at Byrd Street Station, Richmond, after THURSDAY, THE 8TH INST.

The company reserves the right to reject any and all bids.

E. T. D. MYERS,
Chief Engineer.

36-1t

IMPROVING BLEECKER RESERVOIR.

ALBANY CITY WATER-WORKS.
OFFICE OF THE SUPERINTENDENT.

Sealed proposals will be received by the Board of Water Commissioners, at their office in the City of Albany, N. Y., until Tuesday, September 20th, at 11 o'clock a. m. of that day, for Improving Bleecker Reservoir, consisting of a concrete division wall, cleaning out reservoir and laying distributing pipes.

All bids must be enclosed in a sealed envelope and delivered to said Board at its meeting held at the time and place aforesaid, at which time and place bids will be publicly opened and read, and the award of the contract made as soon thereafter as practicable.

Every proposal for the work must be accompanied by a draft or certified check in the sum of $2,000, issued by a bank in good credit within this state, payable at sight to the Chamberlain of the City of Albany. The amount of bond required on execution of contract for its faithful performance and execution will be $15,000.

The work shall be commenced within one week after signing the contract, and be completed on or before February 1, 1899.

The person or persons to whom the work may be awarded will be required to execute the contract with the required surety within ten days of the date of the award.

Plans may be seen and specifications, form of proposal, bond and contract obtained at this office.

The right is reserved to reject any or all bids.

GEORGE I. BAILEY,
Superintendent.

Dated Albany, N. Y., Sept. 6, 1898. 36-1t

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies READS ENGINEERING NEWS

AVAIL YOURSELF OF THIS PAPER WHEN BIDS ARE WANTED FOR CONSTRUCTION OR FOR FURNISHING SUPPLIES,

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PERSONAL.

Mr. Charles Blucher, civil engineer, of Butte City, Mont., was married Sept. 6 to Miss Nellie Ward, of Bethlehem, Pa.

Mr. J. L. Sterritt has been appointed Superintendent of Streets of Sing Sing, N. Y., to succeed Mr. Edgar F. Wheeler.

Mr. G. M. Briggs, civil engineer and surveyor, has opened an office in the Farmers' and Manufacturers' Bank Building, Poughkeepsie, N. Y.

Mr. W. M. Leftwich, Jr., has been appointed City Engineer of Nashville, Tenn., to succeed Mr. W. W. Southgate. Mr. Felix Smith has been appointed Assistant City Engineer.

Capt. Charles Meyer, City Engineer, of Hoboken, N. J., is dangerously ill with typhoid fever, contracted at Camp Thomas, Chickamauga Park, Ga. He is an officer in the 9th Regt., U. S. Volunteers.

Gen. Peter C. Hains, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, of Baltimore, Md., has returned from Porto Rico and will at once resume his duties as a member of the Nicaragua Canal Commission.

Mr. W. M. Scanlon, who was formerly with the Lee Construction Co., New York city, builders of fireproof floors, is now Superintendent for the firm of Thompson & Adams, builders, Townsend Building, New York city.

Mr. James T. Taylor, M. Am. Soc. C. E., has resigned his position as Chief Engineer of the Pecos Irrigation & Improvement Co., Eddy, N. Mex., and has accepted the position of Chief Engineer of the Honolulu Sugar Co., with offices at Honolulu, H. I.

Mr. William R. Hill, M. Am. Soc. C. E., Chief Engineer and Superintendent of the Water Department, of Syracuse, N. Y., has been appointed as one of the appraisers of the plant of the Fulton Water-Works Co., Fulton, N. Y., which the latter city proposes to purchase.

Mr. J. R. C. Wrenshall, Supervisor of Road, of the Baltimore & Ohio R. R., with headquarters at Baltimore, Md., has been appointed Acting Division Engineer of Maintenance of Way, in charge of the Third Division, with headquarters at Cumberland, Md., to succeed Mr. George L. Hall, resigned.

Col. Samuel M. Mansfield, Corps of Engineers, U. S. Army, on duty at Boston, Mass., has been ordered to San Francisco, Cal., to relieve Col. Chas. R. Suter, M. Am. Soc. C. E., Corps. of Engineers, of his duties as a member of the California Debris Commission to regulate hydraulic mining in that state, and also as Division Engineer of the Pacific Division.

Mr. Morgan Brooks, M. Am. Inst. E. E., President and Manager of the Electrical Engineering Co., Minneapolis, Minn., has been appointed Professor of Electrical Engineering in the University of Nebraska, Lincoln, Neb., to succeed Prof. Robert Bowie Owens, M. Am. Inst. E. E., resigned. Prof. Brooks is a graduate of Brown University, Providence, R. I., in the class of 1881, and of the Stevens Institute of Technology, Hoboken, N. J., in the class of 1883. He has delivered lectures to the engineering students of the University of Minnesota. He will also retain his former position.

OBITUARY.

Mr. Henry Hartwick, building contractor, of Green Ridge, Pa., died Sept. 3, aged 68.

Capt. J. H. Gunning, road builder and contractor, of Vicksburg, Tenn., died Sept. 5.

Mr. John Lovett Keeling, contractor and builder, of Baltimore, Md., died Sept. 6, aged 68.

Mr. Hamilton B. Gaylord, builder, of Philadelphia, Pa., died Sept. 11, aged 82. He was at one time Supervisor of Highways of that city.

Mr. Thomas I. George, civil engineer, died at Towson, Md., Sept. 4, aged 56. He was formerly connected with the United States Goedetic Survey.

Mr. James Wilson, contractor, of Allegheny, Pa., was killed Sept. 2 by falling from the tower of Carnegie Library in that city. He was 60 years of age.

Mr. Walter S. Alexander, of St. Paul, Minn., died Sept. 5. He was the first President of the Eastern Ry. of Minnesota, and from Dec. 1, 1890, until the latter part of 1893 he was also the General Manager of that road. Since December, 1895, he had been connected with the Union Pacific as Assistant to the Master-in-Chancery, in charge of the receivership cases.

Mr. Daniel H. Johnson, for several years Superintendent of the water-works of Salem, Mass., died at Stamford, Conn., Sept. 7, aged 63. He was also a member of the water board for a number of years.

Mr. James P. Hyde, inventor of sanitary and plumbing devices, died at his home in New York city Sept. 9, aged 63. He is said to have been the inventor of the first wooden hydrant in use in that city.

Judge Thomas M. Cooley, who was for four years Chairman of the first Interstate Commerce Commission, died at his home, Ann Arbor, Mich., Sept. 12. He was born in Attica, N. Y., Jan. 6, 1824, and began the study of law in Palmyra, N. Y., in 1842, removing to Michigan in 1843, where he was admitted to the bar in 1846. He followed his profession there and also edited a newspaper. In 1857 he was assigned the task by the State Senate of compiling the general statutes of that state. In 1858 he was appointed Reporter for the Supreme Court of the state, and held that office seven years, during which time he published eight volumes of reports and a digest of all the state decisions. In 1859 he was appointed a professor in the law department of the University of Michigan, which was organized in that year, and was afterwards Dean of the Faculty for many years. In 1864 he was elected to fill a vacancy in the state Supreme Court, and in 1868 and 1869 was Chief Justice. In 1881 he was made Professor of Constitutional and Administrative Law in the School of Political Science of the above-named university, and was Dean of this latter school, as well as Professor of American History in the university. In 1887 he was appointed Receiver of the Wabash R. R., but soon resigned the position to accept the appointment by President Cleveland as Chairman of the first Interstate Commerce Commission. He held the position until 1891, when ill health, resulting from overwork, compelled his resignation. Judge Cooley was an able and voluminous writer on legal subjects, and one of the highest authorities on constitutional law.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Sept. 16. D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF PHILADELPHIA.
Sept. 17. Discussion "On Proper Proportions of Parts of Steam Engines." Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
ENGINEERS' CLUB OF COLUMBUS.
Sept. 17. Secy., H. M. Gates, 12½ North High St., Columbus, O.
TECHNICAL CLUB OF OMAHA.
Sept. 19. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Sept. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
ENGINEERS' CLUB OF MINNEAPOLIS.
Sept. 19. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Sept. 20. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Sept. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Sept. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
ENGINEERS' CLUB OF ST. LOUIS.
Sept. 21. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
WESTERN SOCIETY OF ENGINEERS.
Sept. 21. "The Soudan and Recent British Campaigns There," Col. H. G. Prout. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Sept. 21. Secy., Frank H. Olmsted, Los Angeles, Cal.
ENGINEERING ASSOCIATION OF THE SOUTH.
Sept. 22. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 27. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.
AMERICAN PUBLIC HEALTH ASSOCIATION.
Sept. 27-30. Annual meeting, Ottawa, Canada. Secy., Dr. C. O. Probst, Columbus, O.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Sept. 28. Secy., C. W. Hunt, 220 W. 57th St., New York city.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 28. Secy., R. W. Pope, 26 Cortland St., New York city.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 3. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Oct. 3. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
BROOKLYN ENGINEERS' CLUB.
Oct. 6. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.
CHICAGO ELECTRICAL ASSOCIATION.
Oct. 7. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Oct. 7. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
MONTANA SOCIETY OF ENGINEERS.
Oct. 8. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
Oct. 10. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
THE LOUISIANA ENGINEERING SOCIETY.
Oct. 10. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
NEW ENGLAND RAILROAD CLUB.
Oct. 11. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.
DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 11. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.
NORTHWEST RAILWAY CLUB.
Oct. 11. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 13. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.
ST. LOUIS RAILWAY CLUB.
Oct. 14. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.
AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 18-20. Annual meeting, Richmond, Va. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.
PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.
AMERICAN GAS LIGHT ASSOCIATION.
Oct. 19-21. Annual meeting, Niagara Falls, N. Y. Secy., Alfred E. Forstall, Montclair, N. J.
ENGINEERS' CLUB OF CINCINNATI.
Oct. 20. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
NEW YORK RAILROAD CLUB.
Oct. 20. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Oct. 20. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.
AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 26-28. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

AMERICAN GAS LIGHT ASSOCIATION.—The annual meeting of this association will be held Oct. 19-21 at Niagara Falls. The following papers will be presented: "The Effect of the Depth of Fire Upon the Practical Efficiency of a Water-Gas Generator," Mr. J. M. Rusby, Jersey City, N. J.; "Notes on Mains and Main Laying," Walton Forstall, Philadelphia, Pa.; "The Loss of Illuminating Power of 25 to 30 Candle Gas when Mixed with Air," Dr. E. G. Love, New York, N. Y.; "A Comparison Between the Cost of Pumping Gas by Steam and Gas Engines," Mr. H. L. Rice, Norfolk, Va. Papers will also be read by Mr. E. C. Jones, San Francisco, Cal., and Mr. Irvin Butterworth, Columbus, Ohio.

NATIONAL IRRIGATION CONGRESS.—The seventh annual meeting was held at Cheyenne, Wyo., commencing on Sept. 1, Hon. Joseph M. Carey presiding. After the transaction of routine business a number of interesting papers were read. Mr. E. S. Nettleton, of Colorado, spoke of the success and failures in canal building and the causes thereof; he mentioned that in 1892 Colorado had 1,500,000 acres irrigated, which yielded crops valued at $22,000,000. The value of the 6,800,000 acres now under irrigation in that state had risen from $17,000,000 to $87,000,000. Mr. F. H. Newall, of the U. S. Coast and Geodetic Survey, presented a paper on the measurement of streams with relation to irrigation; Senator F. E. Warren told of the work being done in Congress for irrigation, and thought that the progress being made was satisfactory under the present appropriation of $50,000 per year; Mr. J. S. Emery, of Kansas, discussed the storage of water, and Mr. Elwood Mead, State Engineer of Wyoming, read a paper upon the obstacles to settlement in the arid regions. Mr. Mead said that there were still about 500,000,000 acres of public land in the West which brought no return in rentals or taxes to either the state or the nation. The greater part of this is arid pasture land and he believed that fully 300,000,000 acres of this land could be leased to stockmen without interfering with irrigable land. A rental of 1 ct. per acre would bring in $3,000,000 annually, which sum could be expended upon reservoirs and canals for permanent development.

AMERICAN PUBLIC HEALTH ASSOCIATION.—The 26th annual meeting of this association will be held at Ottawa, Canada, Sept. 27-30. Secretary C. O. Probst has issued a circular calling attention to the meeting and giving instructions regarding hotel and railway arrangements and including other information. The list of subjects for consideration, to be reported upon by committees, is as follows: "Pollution of Water-Supplies;" "Disposal of Garbage and Refuse;" "Animal Diseases and Animal Food;" "Demography and Statistics in Their Sanitary Relation;" "Car Sanitation;" "Steamship and Steamboat Sanitation;" "The Etiology of Yellow Fever;" "The Relation of Forestry to Public Health;" "The Cause and Prevention of Infectious Diseases;" "Public Health Legislation;" "The Cause and Prevention of Infant Mortality;" "Thansportation of Diseased Tissues by Mail;" "The Period During Which Each Contagious Disease is Transmissible and the Length of Time for Which Each Patient is Dangerous to the Community;" "Sanitation, with Special Reference to Drainage, Plumbing and Ventilation of Public and Private Buildings;" "International Arrangement for Protection Against the Transmission of Infectious Diseases;" "Disinfectants;" "To Examine Into the Existing Sanitary Municipal Organizations of the Countries Belonging to the Association, with a View to Report Upon Those Most Successful in Practical Results;" "The Duties and Responsibilities of the Healthy Man for His Own and Others Health."

NEW PUBLICATIONS.

A QUARTER CENTURY OF PUBLIC HEALTH WORK IN MICHIGAN.—By Theo. R. MacClure, Chief Clerk State Board of Health Office, Lansing, Mich. Paper, 7 × 9 ins.; pp. 48; illustrated. Address Board.

This is a review of the work of the State Board of Health of Michigan from 1873 to 1898. There are a number of photographs of members and ex-members of the board.

OHIO STATE BOARD OF HEALTH.—Report for the Year Ending Oct. 31, 1897. C. O. Probst, M. D., Secretary, Columbus, O. Cloth; 7 × 10 ins.; pp. 308; tables and illustrations. Address the Board.

The detailed work of the Board for the year is given in this report, including special reports on new works for water supply and sewerage. There is also a report on tests of mechanical filters at Lorain, O. most of which was published in Engineering News for Oct. 28, 1897.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—Proceedings of the Fourth Annual Convention, Nashville, Tenn., October, 1897. Secretary, D. L. Fulton, Allegheny, Pa. Paper; 6 × 9 ins.; pp. 336; tables, plates and illustrations in the text.

This volume contains a number of valuable papers and reports on street paving, sprinkling, cleaning and lighting, sewerage, water supply, pipe coatings, assessments for public improvements, electrolysis and other subjects.

COTTON FIRES AND COTTON BALES.—By R. H. Scotter, C. E. Publications of the British Fire Prevention Committee, 1 Waterloo Place, Pall Mall, London. Pamph.; 6 × 9 ins.; pp. 16.

This is a brief account of fires in cotton warehouses in Liverpool, and of different systems of baling cotton. The common "turtle-back" form of American bales is condemned as being the most liable to facilitate the breaking out of fire and its spreading into a conflagration, and the new style of round bale adopted by the American Cotton Co. is claimed to be the safest of all.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins)

WATER WHEELS AND WATER MOTORS.—American Impulse Wheel Co., 120 Liberty St., New York. Pamph., 5¾ × 8½ ins.; pp. 36.

This pamphlet contains illustrations and price lists, etc., of the Cazin impulse wheel for high heads, also of the McCormick turbine for low heads, and the same data for water motors.

PROTECTIVE COATINGS FOR IRON AND STEEL.—W. W. Lawrence & Co., Pittsburg, Pa., and Buffalo, N. Y. Pamph., 5¼ × 6¾ ins.; pp. 15.

This pamphlet contains an interesting discussion of the requirements of a good coating for metal, and advertises the merits of "Permanent Paint No. 2050," and "Asphaltic Bridge Conservative No. 1033."

PAINTING TO PREVENT CORROSION; WITH SPECIFICATIONS. By A. H. Sabin, M. Am. Chem. Soc., M. Am. Soc. M. E., etc., etc. Edward Smith & Co., 45 Broadway, New York. Leather, 3½ × 6 ins.; pp. 80; illustrated. $1.25.

This little book can hardly be called advertising matter in the sense that trade literature ordinarily is. In fact we are informed in the introduction that the greater part of the subject matter was submitted in manuscript to the criticism of numerous prominent engineers, and the contents seem to bear out the statement that unusual care has been taken in other respects to present an unprejudiced scientific treatment of the subject of paints for and the painting of metal work to prevent corrosion. For this reason and because the author has, as is well known, devoted much time to the study of paints for metal work, the book is really a valuable contribution to the literature of the subject. The contents consist of an introductory and somewhat general consideration of the questions of preparing metal surfaces for paint and the best methods of applying the paint itself, which is followed by two sets of specifications, one for the very best character of work and the other for ordinary work. In both cases the author gives, first, the clause of the specification proper and then follows with an explanation of the various reasons for the particular requirements it contains. A different style of type and different colored ink distinguish the specification proper from the explanatory matter. The book closes with a general discussion on the painting of structural work, illustrated by views showing different examples of corrosion on the Washington St. Bridge in Boston, Mass. (Eng. News, Jan. 27, 1898). Scattered through the book are quite a number of illustrations of buildings and other structures whose metal work has been painted with the above company's "durable metal coating," and a separate advertising supplement is devoted particularly to explaining the merits of this and the other paints manufactured by the same firm.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Sept. 15.	Fire alarm system, Mobile, Ala. Advertised, Eng. News, Aug. 11 to Sept. 1.	Aug. 11
Sept. 15.	Light-house, Tompkinsville (S. I.), N. Y. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 15.	Asphalt paving, Bloomington, Ill.	Sept. 8
Sept. 15.	Stone, cement, etc., New York, N. Y.	Sept. 8
Sept. 15.	Laying water pipe, Boston, Mass. Advertised, Engineering News, Sept. 8.	Sept. 8
Sept. 15.	Sewers, Cleveland, O.	Sept. 8
Sept. 15.	Sidewalks, etc., Niagara Falls, Ont.	Sept. 15
Sept. 15.	Paving, New York, N. Y.	Sept. 15
Sept. 15.	Asphalt paving, Cedar Rapids, Ia.	Sept. 15
Sept. 16.	Fire hose, Saginaw, Mich.	Sept. 15
Sept. 16.	Enlarging garbage plant, Reading, Pa.	Sept. 15
Sept. 16.	Tunnel sewer, Milwaukee, Wis.	Sept. 15
Sept. 16.	Grading, Shelton, Conn.	Sept. 15
Sept. 16.	Macadamizing, Bridgeport, Conn.	Sept. 15
Sept. 16.	Grading, etc., Duluth, Minn.	Sept. 15
Sept. 16.	Sewer, Omaha, Neb.	Sept. 8
Sept. 16.	Asphalt paving, (2 contracts), Omaha, Neb.	Sept. 8
Sept. 16.	Railway grading (10 miles), Petersburg, Va. Advertised, Engineering News, Sept. 8.	Sept. 8
Sept. 16.	Pipe sewers (6 miles), Shelby, O.	Sept. 1
Sept. 16.	Brick and pipe sewer, Richmond, Ind.	Aug. 25
Sept. 16.	Supplies, Norfolk, Va. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 17.	Storm sewer, Mansfield, O.	Aug. 25
Sept. 17.	Brick paving, Watertown, Wis. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 17.	Sewers, Washington, D. C. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 17.	Electric plant, Duncannon, Pa.	Sept. 8
Sept. 17.	Pig lead, Cleveland, O.	Sept. 8
Sept. 17.	Heating and ventilation, Danville, Ill.	Sept. 8
Sept. 17.	Steam generators, League Island, Pa.	Sept. 15
Sept. 17.	Macadamizing, Rockton, N. Y.	Sept. 15
Sept. 19.	Brick sewer, Jersey City, N. J.	Sept. 15
Sept. 19.	Water-works and sewers, Darlington, Okla.	Sept. 15
Sept. 19.	Paving, flagging, etc., Jersey City, N. J.	Sept. 15
Sept. 19.	Grading, etc., Napa, Cal.	Sept. 15
Sept. 19.	Sidewalks and paving, Syracuse, N. Y.	Sept. 15
Sept. 19.	Brick paving, etc., Patton, Pa.	Sept. 15
Sept. 19.	Brick or stone paving, Grand Forks, N. Dak.	Sept. 15
Sept. 19.	Grading, Alameda, Cal.	Sept. 15
Sept. 19.	Sidewalks, etc., Indianapolis, Ind.	Sept. 15
Sept. 19.	Steel or wooden bridge, Walla Walla, Wash.	Sept. 15
Sept. 19.	Building repairs, Bradford, Pa.	Sept. 15
Sept. 19.	Paving bonds, Youngstown, O.	Sept. 8
Sept. 19.	School building repairs, Rochester, N. Y.	Sept. 8
Sept. 19.	Pipe sewers, Toledo, O.	Sept. 8
Sept. 19.	Heating, Windsor, N. S.	Sept. 8
Sept. 19.	Electric lighting, Portland, Ore.	Sept. 1
Sept. 19.	Jail building, Newport News, Va.	Sept. 1
Sept. 19.	Bridges (2), Newport News, Va.	Sept. 1
Sept. 19.	Heating and ventilating, St. Albans, Vt. Advertised Eng. News, Aug. 25 and Sept. 1.	Aug. 25
Sept. 19.	Hospital plans, San Francisco, Cal.	Aug. 4
Sept. 19.	Jail, Lovelocks, Nev.	Aug. 18
Sept. 19.	Bridge bonds, Los Angeles, Cal.	Aug. 18
Sept. 20.	Viaduct, Cincinnati, O.	Aug. 25
Sept. 20.	Electric light plant, Grand Rapids, Mich. Advertised, Engineering News, Sept. 1.	Sept. 1
Sept. 20.	Highway, Rockville, Md.	Sept. 8
Sept. 20.	Hospital building, Binghamton, N. Y.	Sept. 8
Sept. 20.	Building work, Brooklyn, N. Y.	Sept. 15
Sept. 20.	Pipe sewers, Troy, N. Y.	Sept. 15
Sept. 20.	Pipe sewers, Crafton, Pa.	Sept. 15
Sept. 20.	Sewer pipe, Schuyler, Neb.	Sept. 15
Sept. 20.	Water bonds, Strasburg, Pa.	Sept. 15
Sept. 20.	Grading, paving, etc., Schenectady, N. Y.	Sept. 15
Sept. 20.	Asphalt paving, Long Island City, N. Y.	Sept. 15
Sept. 20.	Steel jail, Dunkirk, N. Y.	Sept. 15
Sept. 20.	Brick sidewalks, Kansas City, Mo.	Sept. 15
Sept. 20.	Court house repairs, Charleston, Ill.	Seut. 15
Sept. 21.	Rotary nozzles, New York, N. Y.	Sept. 15
Sept. 21.	School bonds, ($8,000), Leroy, N. Y.	Sept. 15
Sept. 21.	Repairing sewers, Wildwood, N. J.	Sept. 15
Sept. 21.	Water-works, McComb, Miss.	Sept. 15
Sept. 21.	Incandescent lamps, Chicago, Ill.	Sept. 15
Sept. 21.	School building, New Brunswick, N. J.	Sept. 8
Sept. 21.	Water-works, Bristol, Va.	Sept. 1
Sept. 21.	Canal, Chicago, Ill. Advertised, Aug. 25 to Sept. 15.	Aug. 25
Sept. 22.	Hospital buildings, etc., Central Islip, N.Y.	Sept. 1
Sept. 22.	Electrical apparatus, Central Islip, N.Y.	Sept. 1
Sept. 22.	Power plant, Wrightsville, Pa. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Sept. 22.	Bridge bonds, Elyria, O.	Sept. 8
Sept. 22.	Levee work, New Orleans, La.	Sept. 8
Sept. 22.	Stone jetties, Green Harbor, Mass. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Sept. 22.	Barge, Biloxi, Miss.	Sept. 15
Sept. 22.	Heating, Ogdensburg, N. Y.	Sept. 15
Sept. 22.	School building, Osceola, Wis.	Sept. 15
Sept. 22.	Piles for bridge, Suffolk, Va.	Sept. 15
Sept. 23.	Sidewalks, Indianapolis, Ind.	Sept. 15
Sept. 23.	Asphalt paving, Omaha, Neb.	Sept. 15
Sept. 23.	Road work, Albany, N. Y.	Sept. 15
Sept. 23.	Asphalt paving, Niagara Falls, N. Y.	Sept. 15
Sept. 23.	Gravel roads, Brownstown, Ind.	Sept. 15
Sept. 23.	Cement walks, North Vernon, Ind.	Sept. 15
Sept. 23.	High-school building, Camden, N. J.	Sept. 8
Sept. 23.	Supplies, Watervliet, N. Y.	Aug. 25
Sept. 24.	Capitol building, Columbus, O.	Sept. 1
Sept. 24.	Electric plant, Pensacola, Fla.	Sept. 1
Sept. 24.	Quay wall, San Francisco, Cal.	Sept. 1
Sept. 24.	School building, Shreveport, La.	Sept. 8
Sept. 24.	Building material, Pine Ridge, S. Dak.	Sept. 8
Sept. 24.	Street bonds, Cambridge, O.	Sept. 15
Sept. 26.	Water pump, Marietta, O.	Sept. 15
Sept. 26.	Electric light plant, Modesto, Cal.	Sept. 15
Sept. 26.	Bridge substructure, Westfield, Mass. Advertised, Engineering News, Sept. 15.	Sept. 15
Sept. 26.	Bonds, Dayton, O.	Aug. 25
Sept. 27.	Municipal building work, Brooklyn, N. Y.	Sept. 15
Sept. 27.	High school building, Burlington, Vt. Advertised, Eng. News, Sept. 15 and 22.	Sept. 15
Sept. 28.	School building, Orange, N. J.	Sept. 15
Sept. 28.	Water-works, Harrisville, N. Y.	Sept. 15
Sept. 28.	Electric light bonds, Coffeyville, Kan.	Sept. 15
Sept. 28.	U. S. building, Brockton, Mass. Advertised, Eng. News, Sept. 1 and 8.	Sept. 1
Sept. 29.	Water-works, Wivenhoe, England.	Sept. 1
Sept. 29.	Court house, Marietta, Ga.	Aug. 18
Sept. 29.	Steel bridge, Durango, Colo.	Sept. 15
Sept. 30.	Storm sewer, Amsterdam, N. Y.	Sept. 15
Sept. 30.	Gravel road (7 miles), Rockville, Ind.	Sept. 15
Sept. 30.	Water bonds, Colton, Cal.	Sept. 15
Sept. 30.	School building, Sheboygan, Wis.	Sept. 15
Sept. 30.	Improving reservoir, Albany, N. Y. Advertised, Engineering News, Sept. 8.	Sept. 8
Sept. 30.	Coal shaft, Latrobe, Pa.	Sept. 8
Oct. 1.	Towboat, St. Louis, Mo.	Sept. 8
Oct. 1.	Arc lighting, Marshfield, Wis.	Aug. 18
Oct. 1.	Monitors (4), Washington, D. C.	July 7
Oct. 1.	School building (equipment), St. Thomas, Ont.	July 7
Oct. 1.	Road roller, Sheboygan, Wis. Advertised, Engineering News, Sept. 1.	Sept. 1
Oct. 1.	Head-race (power plant), Montreal, Que. Advertised, Eng. News, Sept. 1 to 15.	Sept. 1
Oct. 1.	Electric plant, New Richmond, O.	Sept. 15
Oct. 1.	Arc lighting, Huntington, W. Va.	Sept. 15
Oct. 1.	School building, Sitka, Ala.	Sept. 15
Oct. 3.	Block pavement, Toledo, O.	Sept. 15
Oct. 3.	Superstructure and repair, Chillicothe, O.	Sept. 15
Oct. 3.	Street work, Toledo, O.	Sept. 1
Oct. 3.	Building plans, Liverpool, England.	Sept. 8
Oct. 3.	Building superstructure, Philadelphia, Pa. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Oct. 3.	Bridge, Flandreau, S. Dak.	Sept. 8
Oct. 4.	Coal conveyors, etc., Chicago, Ill. Advertised, Eng. News. Aug. 25 to Sept. 29.	Aug. 25
Oct. 4.	Bridge, Stockton, Cal.	Sept. 15
Oct. 4.	Brick paving, etc., Norwalk, O.	Sept. 15
Oct. 5.	Granite paving, Cincinnati, O.	Sept. 15
Oct. 5.	Bridge superstructure, Chicago, Ill.	Aug. 11
Oct. 5.	Dredging, Oakland, Cal.	Sept. 8
Oct. 5.	Shore protection, Fort Morgan, Ala. Advertised, Eng. News, Sept. 8 to 29.	Sept. 8
Oct. 10.	Turbine wheels (24), Wrightsville, Pa. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Oct. 10.	Trestle, Chehalis, Wash.	Sept. 8
Oct. 10.	Paving, Toledo, O.	Sept. 15
Oct. 12.	Hospital buildings, San Francisco, Cal.	Sept. 15
Oct. 12.	Park bonds, Spokane, Wash.	Sept. 1
Oct. 13.	Hire of dredging plant, Mobile, Ala. Advertised, Eng. News, Sept. 15 to Oct. 6.	Sept. 15
Oct. 14.	Cement walks, North Vernon, Ind.	Sept. 15
Oct. 17.	Gasholder, etc., Edinburgh, Scotland.	Sept. 1
Oct. 21.	Dry dock, Algiers, La.	Sept. 8
Oct. 24.	Markets, etc., Belem, Brazil.	Apr. 28
Oct. 25.	Jetties, Portland, Ore. Advertised, Eng. News, Aug. 25 to Sept. 15.	Aug. 25
Oct. 30.	School building, Chehalis, Wash.	June 16
Oct. 31.	Water supply, Cobourg, Ont. Advertised, Eng. News, Sept. 8 to Oct. 27.	Sept. 8
Oct. 31.	Electric lighting, Cobourg, Ont. Advertised, Eng. News, Sept. 8 to Oct. 27.	Sept. 8
Nov. 1.	Court house, Garner, Ia.	Sept. 8
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18

RAILWAYS.

ARIZONA.—Press reports state that M. Loewenstein and Max Cohn, owners of the King of Arizona mine at Camp Gleason, are making preparations to build a narrow-gage railway from their property to their mill at Mohawk, Ariz., on the Gila River, a distance of 35 miles.

ATCHISON, TOPEKA & SANTA FE.—B. Lantry Sons, Strong City, Kan., inform us that they will continue to supply Santop rock ballast until cold weather sets in for use on this company's main line west of Kansas City. They have been furnishing about 50 carloads a day all summer. ——Reports state that this company has begun the building of a long switch extending three miles east of Mulvane, Kan., to the farm of Ross Stubbs in Sedgwick county, where a rich field of agatite has been found, and for the mining of which a company has been organized and capitalized to the amount of $50,000. W. H. Earl, Res. Engr., Newton, Kan., informs us that this is only a short track running out to proposed cement works.

ATLANTIC & LAKE SUPERIOR.—Reports from Canada state that those interested in the Atlantic & Lake Superior Ry. have succeeded in floating its bonds in England, and the construction of the proposed extension will begin at once. J. M. Shanly, Ch. Engr., New Carlisle, Que.

AVOYELLES.—This company has been chartered, with a capital stock of $150,000, to operate the old St. Louis, Avoyelles & Southwestern Ry., 36 miles in length, and to construct extensions thereto. Pres., W. B. Spencer, New Orleans; Vice-Pres., Nathan G. Pearsall, Marksville, La.

BRANTFORD & WOODSTOCK.—Reports state that a new line will be surveyed from Brantford to Niagara Falls, via Hamilton, Ont., to connect with the Brantford & Woodstock Ry. W. H. Mitchell, of Kingston, Ont., is said to have a contract for ten miles of grading from Woodstock to Burford, work to be finished by Oct. 15.

CANTON, ABERDEEN & NASHVILLE.—First Vice-President Welling; Second Vice-President Harahan, and Engineer G. B. Fitzhugh, all of the Illinois Central Railway, have been authorized by the Secretary of State of Alabama, to receive subscriptions to the amount of $1,000,000, to the capital stock of this proposed railway from Aberdeen, Miss., to Winfield, Ala., a distance of about 100 miles.

CHICAGO, INDIANA & EASTERN.—Fremont Wilson, Ch. Engr., Fairmount, Ind., informs us that construction work is now under way on the extension of this line between Swayzee, Ind., and Fairmount, a distance of 11 miles. Grading has been completed between these points, and track has been laid within five miles of Swayzee. Work will begin on the extension of the line to Converse, about five miles farther, as soon as track has been laid to Swayzee. This company now has ten miles of railway in operation from Fairmount to Matthews, and an extension from Matthews southeasterly to Richmond is contemplated which will make the completed line from Converse to Richmond about 75 miles in length. Pres., Eugene Stewart, 100 Washington St., Chicago, Ill.

CHICAGO, MILWAUKEE & ST. PAUL.—Reports state that this company has a corps of surveyors at work between Lynn and Stanley, Wis., a distance of about 35 miles, preparatory to a possible extension of its line from the present terminus, near Lynn, to Stanley, on the Wisconsin Central Ry. D. J. Whittemore, Ch. Engr., Chicago, Ill.

CHOCTAW, OKLAHOMA & GULF.—It is announced that Pres. Francis I. Gowan, of Philadelphia, has authorized Henry Wood, Gen. Mgr., to organize a new corporation, to be known as the Choctaw & Memphis R. R. Co., to extend this railway from Wister Junction, Ind. Ter., to a connection with the Little Rock & Memphis R. R. at Little Rock, Ark., a distance of about 150 miles. Surveys are now in progress, and work is expected to commence as soon as locations are made. The citizens of Little Rock have been asked to raise $100,000 to aid in the construction of the road. F. A. Molitor, Ch. Engr., South McAlester, Ind. Ter.

COLUMBIA & WESTERN.—Over 2,000 men are now said to be at work on the construction of the Robson & Penticton branch of this railway now in process of construction from Robson to Midway, B. C., a distance of 105 miles. About 25 sub-contractors are at work between Robson and a point 25 miles west of Brooklyn, under the supervision of the general contractors, Mann, Foley Bros. & Larsen. The contract for constructing the bridges has been let to Porter Bros., McArthur & Roberts, and that for getting out the timber and ties for the line, to the Peter Genelle Mill Co., of Naskup, B. C., and McPherson Bros. & Stout. It is said that about 5,000,000 ft. of this lumber will be used. J. W. Stewart, Supt. of Construction; F. P. Gutelius, Acting Ch. Engr, Trail, B. C.

CRYSTAL RIVER.—Reports state that the main line of this railway will be extended from Glenwood Springs to Hotchkiss, Colo., on the north fork of the Gunnison River. From Pitkin county a line will be built to Delta, in order to connect with the Denver & Rio Grande. The capital stock is $100,000 and the incorporators are, J. C. Osgood, A. C. Cass, D. C. Beaman and J. A. Kebler.

DOOLEY SOUTHERN.—About 8 miles of this new line have been completed from Richwood to Pinia, Ga. A further extension of 27 miles to Irvinville is under way. Pres., B. P. O'Neal, Richwood, Ga.

GALESBURG & GREAT EASTERN.—This company was incorporated, Sept. 6, with a capital stock of $250,000, to construct and operate a railway to connect Galesburg and Lacon, via Etherly, Ill. The incorporators and directors are, Henry Harms, Edward J. Harms, Henry J. Harms, Adam Harrer, Albert J. Harms, Willis Smith, John W. Smith, all of Etherly. Twelve miles of the line have already been in operation between Galesburg and Etherly.

GREAT NORTHERN.—Work has been completed on the extension of the East Minnesota branch from Fosston to Deer River, Minn., 98 miles, and from Cloquet, Minn., to the Nemadji River Bridge, 28 miles, thus giving the railway an entrance into Duluth over the Duluth, Superior & Western Ry., which is now under this company's control. A. Guthrie & Co., St. Paul, Minn., were the contractors.

GULF, BEAUMONT & KANSAS CITY.—Jas. F. Weed, Ch. Engr., Beaumont, Tex., writes us that this company is extending its road from Kirbyville to Jefferson, under the charter of the Gulf, Beaumont & Great Northern R. R. The first 10 miles from Kirbyville to Gibraltar is now under construction. The line is located to San Augustine and the location is being rapidly pushed forward from San Augustine to Jefferson, Tex., via Center. The road is chartered from Sabine Pass to Paris, Tex., a distance of 350 miles. It is expected to build at once the 160 miles from Kirbyville to Jefferson, and immediately thereafter the south division from Beaumont to Sabine Pass. From Kirbyville to San Augustine, a distance of 70 miles, the road passes through the virgin pine forests of East Texas, and there will be no competition for any business originating between the Neches and the Sabine rivers. From San Augustine to Jefferson, and on to Paris, the road passes through the richest agriculaural district of Texas. With deep water facilities at Sabine Pass, and in connection with the Gulf, Beaumont & Kansas City Ry., this railway should do an immense business in lumber traffic to the North and export freight to the South. It will connect with the Missouri, Kansas & Texas, the St. Louis & Iron Mountain, the Houston, East and West Texas, and the Texas Pacific railways, between Center and Jefferson.

HOLLY RIVER & ADDISON.—This company was incorporated in West Virginia, Sept. 10, with a capital stock of $600, to construct a steam railway between Palmer Junction, on the West Virginia & Pittsburg R. R., to Addison, W. Va., a distance of from 15 to 20 miles. The incorporators are G. W. Curtis, Sutton, W. Va.; J. M. Marple, Marpleton, W. Va.; Chas. R. Durbin, Grafton, W. Va.; J. H. Brewster, Brewster, W. Va.; J. T. McGraw, Grafton,

HOLSTON VALLEY.—W. T. Neeley, Secy. and Treas., Bristol, Tenn., informs us that this company has not yet made any plans for extending its line to Shady, Tenn. The road is at present operated from Bristol to Big Creek, a distance of 16 miles.

INDIANA, ILLINOIS & IOWA.—Press reports state that it has been decided to extend this line, the original Chicago Outer Belt System, from Streator, Ill., to a point on the Mississippi River, near Keithsburg or Muscatine, Ia., a distance of about 175 miles. Two corps of surveyors are now in the field, and it is expected that construction will soon be commenced; estimated cost, $750,000. D. Nowlan, Engr. Maintenance of Way, Kankakee, Ill.

INDIANA STONE.—The Eureka Lumber Co. is reported to have been awarded the contract for building this proposed branch of the Chicago, Indianapolis & Louisville Ry. from Clear Creek to Harrodsburg, Ind., a distance of ten miles. Work is to begin soon.

LAUREL & NORTHWESTERN.—Governor McLaurin, of Mississippi, Sept. 5, issued a proclamation permitting the organization of this company, which will build a railway through the counties of Jones and Covington. C. C. Miller, of Meridian, Miss., is said to be at the head of the enterprise.

MEXICAN CENTRAL.—Reports state that about 40 miles of track has been laid on the new extension of this line from Jiminez to Parral, Mexico, a distance of about 55 miles. L. Kingman, Ch. Engr., Mexico, Mex.

MIDLAND OF NOVA SCOTIA.—Reports state that construction work on this line, between Windsor and Truro, N. S., is progressing rapidly, and it is expected that the grading of the 40 miles between Windsor and the Shubenacadie River will be completed by the end of next month. The work of grading and constructing a bridge over the St. Croix River will probably be completed this fall, but no rails will be laid until next spring. It is expected to open the line to traffic about the middle of next summer. Pres., William Strachan, Montreal, Que.

MISSISSIPPI VALLEY.—H. A. Schwanecke, Ch. Engr., Marshall, Mo., informs us that no work is at present under way on this new line of railway, but that it is expected to resume the construction this fall. The proposed route is from East St. Louis to Cairo, via East Carondelet, Harrisonville, Prairie du Rocher, Kaskaskia, Chester, Rockwood, Leo Rock, Grand Tower, Gray's Point and Thebes, a distance of 151 miles. The location has been made of the whole line and construction commenced on 23 miles, between Chester and Leo Rock, besides ten miles being graded south of Harrisonville. A large part of the right of way has also been obtained between Grand Tower and East St. Louis. The firms holding the contracts are the Ware Construction Co., the Massachusetts Tie Co., Cahill & Co., and the St. Louis Bridge & Iron Co., all of St. Louis, Mo. Pres., Thos. N. Chase, St. Louis.

NORTHERN OF KANSAS CITY.—This company was incorporated in Missouri Sept. 3, with a capital stock of $125,000, to build and operate a standard gage railway from Trimblo, in Clinton county, to Gower, in Buchanan county, a distance of eleven miles. The incorporators are Robert Gillham, C. A. Braley, J. T. Nolthenius, F. B. Wilcox and B. N. Simpson, all of Kansas City, Mo.

NORTHWEST.—Isaac E. Blake, Pres., 11 Broadway, New York, informs us that contracts will be let immediately for the construction of this proposed railway from Nagle to Oxbow, via Connor Creek, Flickbar and Powder, Ore., a distance of 55 miles. The surveys have been completed and some preliminary work done; a tunnel and several bridges will have to be built. The total issue of $1,100,000 of bonds has been fully and responsibly disposed of. Carlos Gillespie, Ch. Engr., Huntington, Ore.

ONTARIO & RAINY RIVER.—William Heald, Toronto, Ont., is said to have received the contract for constructing the first 20 miles of this railway, which is proposed to connect a point on the Port Arthur, Duluth & Western, 22 miles west of Port Arthur, Ont., and the Manitoba boundary.

OREGON & MISSOURI NORTHERN.—This company was incorporated in Missouri Sept. 3, with a capital stock of $100,000, to construct and operate a railway from a point in Holt county, on the Kansas City, St. Joseph & Council Bluffs R. R., to Oregon, a distance of five miles. The incoroporators are Irving H. Wheatcroft, A. J. Clark, C. B. Holmes, George G. Moore and others, of Sweetwater, Tex., most of whom are connected with the Colorado Valley Ry. Co.

PERU.—Consular reports state that surveys are being made for a railway to be built from Pacasmayo, on the Pacific coast, to the coal district in the province of Hualgayoc, near the summit of the Andes, 121 miles distant, in order to develop the mining district conceded to C. B. Jones in 1892. A line is already in operation from Pacasmayo to Yonan, 41 miles. G. Clinton Gardner, formerly superintendent of the Pennsylvania R. R. and builder of the Mexican National Ry., states that the cost of constructing the line and purchasing the rolling stock should not exceed $3,000,000.

ST. LOUIS & SAN FRANCISCO.—B. Lantry & Son, Strong City, Kan., are furnishing this company with rock ballast.

SIERRA OF CALIFORNIA.—The West Coast Construction Co. is reported to have sub-lèt a portion of the contract for extending this line from Jamestown to Sonora, Cal., 20 miles, to Erickson Bros., of San Francisco. Pres., Prince A. Poniatowski, San Francisco, Cal.

STATESBORO & EGYPT.—This company has been organized in Statesboro, Ga., according to reports, to construct a railway from Statesboro to a connection with the Florida Central & Peninsula R. R., 31 miles distant. W. C. Parker and R. Simmons are among those interested.

WISCONSIN & MICHIGAN.—S. M. Fischer, Pres., Old Colony Bldg., Chicago, Ill., informs us that T. McGrath, of Green Bay, Wis., has been awarded the contract for the construction of an eight-mile extension of this railway north of Fairthorn Junction, as stated in our last issue. Work has begun in clearing the right of way and graders' tools are on the ground. After having located the line farther on, it is expected to let the contract for constructing eight additional miles of line, which will then terminate at Quinnesec, Mich.

STREET AND ELECTRIC RAILWAYS.

LEWISTON, ME.—John A. Jones, Ch. Engr., Lewiston, Brunswick & Bath Electrical R. R. Co., Lewiston, informs us that this new line has been completed, and that regular trips are now being made over the entire route from Lewiston to Brunswick, via Lisbon, Topsham and Bath, a distance of 36 miles, with a branch from Lewiston to Sabatus about six miles in length. Pres., A. L. Shaw, Bath, Me.

DEDHAM, MASS.—W. W. Mitchell, Pres. Norfolk Western St. Ry. Co., Medfield, Mass., informs us that contracts are now being let for constructing this proposed electric line between Medfield and Dedham, via Westwood, a distance of nine miles. Engrs., Hodges & Harrington, 60 State St., Boston Mass.

FITCHBURG, MASS.—The Gardner, Westminster & Fitchburg Ry. Co. was granted a franchise Sept 6 to construct a street railway to the Westminster town line. This company first petitioned the board of aldermen in October, 1896, but has been opposed by the Fitchburg & Westminster Co.

PLYMOUTH, MASS.—It is reported that the directors of the Plymouth & Sandwich St. Ry. Co. have voted to proceed with building operations, and that a committee has been directed to award contracts for construction work as far as White Horse Beach. Engrs., Harriman Bros., 3 Somerset St., Boston. Address D. E. Damon, Plymouth.

WATERTOWN, MASS.—The Newtonville & Watertown St. Ry. Co. has petitioned the selectmen of Watertown for permission to lay an additional track in Main St., from Watertown Square to Beacon Square. The railway runs from Needham to Allston, through Newtonville and Watertown, and is a single track line from Newtonville to Allston.

WEST SPRINGFIELD, MASS.—It is reported that the West Springfield & Agawam Ry. Co. has been organized to build a trolley line to Agawam. Among those interested are, Jesse W. Starr, George A. Hill, M. L. Tourtellotte, W. B. Chandler, Frank S. Rice, H. L. Morton, H. L. Inman and F. M. Robbins, all of West Springfield.

WHITMAN, MASS.—G. H. Peanon, Town Clk., informs us that the Brockton and Whitman electric railway, which it is proposed to build through this place, has all been surveyed. A town meeting will be held Sept. 23 to consider the application of the company for a franchise.

ALBANY, N. Y.—Surveys are said to be in progress by the Albany Ry. Co. for a new belt line to extend through Delaware Ave., from Madison Ave. and then to Grand St. Edgar S. Fassett, Gen. Mgr.

HOOSICK FALLS, N. Y.—The power station of the Bennington & Hoosick Valley Electric Ry., at Hoosick Falls, was wrecked in a storm Sept. 8 causing damage estimated at $3,500. C. B. Story, Gen. Mgr.

NEW HARTFORD, N. Y.—A hearing will be held at the Cottage Hotel, Utica, on Sept. 24 to consider the application of the Utica Belt Line St. R. R. for a franchise to build in the town of New Hartford.

NEW YORK, N. Y.—The work of changing the motive power of the Broadway cable line of the Metropolitan St. Ry. Co., to electricity, was begun Sept. 9 with a force of about 200 men. Pres., H. H. Vreeland.

NYACK, N. Y.—Press reports state that the Nyack Traction Co. was organized at the office of A. B. Wilgus, 36 Wall St., New York, on Sept. 8, and H. C. Howard appointed president. It is said that surveys for the proposed trolley line will soon be started in order to complete the work before winter sets in.

OSWEGO, N. Y.—Reports state that F. H. Tidman, Receiver of the Lake Ontario & Riverside Ry. Co., has been authorized to issue $15,000 in certificates in order to pay for new rails and a portion of the paving in Bridge St.

YONKERS, N. Y.—It is announced that the Yonkers R. R. has been purchased by the Union Ry. Co., and that it is proposed to extend the track through Dobb's Ferry and Irvington to Tarrytown.

ELIZABETH, N. J.—The Elizabeth St. Ry. Co., which operates a horse-car line on East Grand, New Smith and East Jersey Sts., petitioned the council for a franchise Sept. 6 to change the motive power to the overhead trolley system. A hearing on the application will be given on Sept. 24.

EASTON, PA.—Mayor Hartzell vetoed the ordinance Sept. 6 granting permission to the Easton, Palmer & Bethlehem Electric Ry. to enter the city. The line connects Easton with Bethlehem and is almost completed.

PITTSBURG, PA.—The Pittsburg & Birmingham Traction Co. has under consideration the extension of its line to Whitehall, via Becks Run. The residents of Baldwin township ask for a 5-cent fare and promise the company franchises to Castle Shannon, a distance of over five miles. Pres., Harry Moore.

BALTIMORE, MD.—It is reported that the Baltimore & Northern Electric Ry. Co. has awarded the contract for the stringing of additional feed wire to carry the increased power, which the company is to take from the Belt power house of the Baltimore & Ohio R. R., to J. G. White & Co.

PETERSBURG, VA.—The Petersburg Electric St. Ry. will be sold on Nov. 10, by order of the corporation court. About three miles of line are now in operation.

CHIPPEWA FALLS, WIS.—The Chippewa Valley Electric St. Ry. Co. ran its first car in this city Sept. 1. The line being constructed by this company between this city and Eau Claire may be opened about Sept. 15.

DE PERE, WIS.—The Fox River Electric Ry. Co. has asked the council of De Pere for a franchise to extend its line into that city. Receiver, Mitchell Joannes, Green Bay.

LAWRENCE, KAN.—The Lawrence Ry. Co. was incorporated in Kansas Sept. 6 with a capital stock of $250,000, to build a system of electric railway at Lawrence to handle passengers, freight and mail; the entire line will be 9.89 miles in length. The main line will run from Bismark Grove, in North Lawrence, past the Union Pacific depot and over Massachusetts St. out to Haskell institute; with branches from Massachusetts St. to the state university, the Santa Fe depot, Kentucky St., the McCook Athletic Park, to the cemetery, and from Mississippi and Warren Sts. to the university. The directors are, R. W. Ludington, T. J. Sweeney and S. P. Moore, of Lawrence; C. W. Kincaid, William S. Hooper and Frank Kern, of Mattoon, Ill.; W. D. Ewing, Boston, Mass.

CLAYTON, MO.—The St. Louis county court Sept. 3 granted a franchise to the St. Louis & Kirkwood R. R. Co. to construct a cross county connecting line from the Houseman Air Line, at Brentwood, through Clayton to De Hodiamont, to the main line of the St. Louis & Suburban Ry., thus giving a continuous line from Meramec Highlands to Florissant, and providing the Suburban system with three routes from Meramec Highlands, Kirkwood and Webster Groves to the center of St. Louis. Work must be begun within three months after accepting the franchise.

ST. LOUIS, MO.—Press reports state that the St. Louis, Fenton & Southwestern R. R. Co. will be incorporated within a few days in Missouri, with a capital stock of $1,000,000, to construct 44 miles of electric railway from the city limits, at a connection with the St. Louis, Iron Mountain & Southern R. R. and the Southern Electric Ry., through Fenton to Ware. It is said that work will begin this month, and that the third-rail system will be used. Pres., Thos. F. Sneed.

GAINESVILLE, TEX.—J. M. Lindsay, Pres. Gainesville Park St. Ry. Co., Gainesville, informs us that this company, which was incorporated Aug. 23, already has over four miles of line in operation, and that it also has the right of way and authority to build on all of the streets in this city. It is expected to make the present system eight miles in length. J. Bragellon, Ch. Engr.

ALHAMBRA, CAL.—The people of this place are considering a proposition of the Terminal Ry. Co. to extend its main line, when electricity is installed thereon, from South Pasadena to Alhambra, a distance of three miles.

MEXICO CITY, MEXICO.—Reports from Mexico City state that the Federal District St. Ry. Co. of that city has submitted plans for approval for building an electric street car line to the national department of public works. It is said to be the ultimate intention of the company to equip all of its line in the City of Mexico with electricity; the improvement first to be applied to the Guadaloupe & San Angel line, which traverses the most thickly populated part of the city and runs to many suburbs. The principal power house will be located in what is known as the Indianilla district. The relaying of the track for electric traction and the installation of machinery and conduits will require about eighteen months.

ROME, ITALY.—Press reports state that the Italian Meridonial R. R. Co. at Rome, has just resolved upon the construction of an electric railway between Mandela and Subiaco, in the Province of Rome, and that it is proposed to utilize the water power of the Anniera River for the production of the motive power.

ELECTRIC LIGHT AND POWER.

LEWISTON, ME.—Press reports state as follows: A deal has been closed whereby the Androscoggin Water Power Co. delivers to a syndicate, represented by Waldo Pettingill, Rumford Falls, Me., 67,000 acres of wild land in Oxford county for $200,000. H. Plummer, of Lisbon Falls, Me., is agent of the power company.

BAINBRIDGE, N. Y.—C. C. Hovey has been granted a franchise for a plant, according to reports.

CAZENOVIA, N. Y.—Thos. O'Connell, of Cortland, N. Y., and Jno. O'Connell, of Marathon, N. Y., propose to built a plant.

SYRACUSE, N. Y.—Local papers state that the council will probably soon ask for bids for furnishing and installing a plant for the city hall to cost about $2,000. Alderman Segar, Chn. Finance Com., may be addressed.

CAMDEN, N. J.—Thos. Stephen, Arch., 302 Masonic Temple, Camden, is preparing plans, estimates, etc., for a 5-story warehouse and light manufacturing building to cost $25,000, an addition to the Camden high school building, and also for a pen factory, to cost $50,000. These buildings will require pumps, dynamos, engines, boilers and shafting. Mr. Stephen wishes to correspond with manufacturers.

BRADDOCK, PA.—The question of building a municipal plant to cost about $12,000 is being considered; population, 15,000. It is proposed to have the plant light North Braddock and Rankin as well as this city.

LANSDALE, PA.—The council, it is stated, has let the contract for furnishing and installing a plant to the General Electric Co., Schenectady, N. Y. The plant is to be completed in about 80 days.

ST. CLAIR, PA.—The council proposes to purchase a new 100-HP. steel boiler and a 100-ft. smokestack for the plant, according to reports. Chn. Com., C. J. Fame.

BALTIMORE, MD.—Mayor Malster has signed the ordinances authorizing the construction of the proposed system of underground conduits for the electric wires. The city will issue $1,000,000 of 3½% bonds at once for the work. The electrical commission will at once appoint an engineer to prepare plans and specifications and to superintend the construction.

HUNTINGTON, W. VA.—Bids are asked until Oct. 1 for furnishing 75 2,000-c. p. arc lights, according to reports. Cy. Clk., C. T. Taylor.

McADENSVILLE, N. C.—R. G. Love, Gastonia, N. C., proposes to build an electric plant in connection with the new cotton mill about to be built in this place.

COLUMBIA, S. C.—The Granby Cotton Mfg. Co. has increased its capital stock to $800,000, for the purpose of enlarging its mills and also the electric plant.

SPARTANBURG, S. C.—The Whitner Co., Anderson, S. C., has contracted to build a new plant at this place. The plant of the Aetna Light & Power Co., of this city, has been ordered sold, and the sale will take place at once. For further information see our issue of Aug. 11. Vice-Pres., Eliot Norton, 100 Broadway, New York.

OCALA, FLA.—The council is arranging to issue $15,000 in bonds for improving the plant, according to reports.

PENSACOLA, FLA.—Bids are asked until Sept. 24 for installing a light and power plant at the navy yard in this city. The appropriation for the work is $10,000. Mordecai T. Endicott, Chief Bureau Yards and Docks, U. S. N., Washington, D. C.

HOUMA, LA.—Wilson & Jastremski, Houma, have been granted a 15-year franchise. Work on the plant, it is stated, will begin at once.

NEW IBERIA, LA.—A. J. Cammack, Secy. and Attorney, writes us that the election called for Oct. 17 to vote on the question of a plant and water-works will probably be changed to a later date on account of irregularities in securing signatures to the petition. Nothing can be done until after the election. Population, 7,000.

NEW ORLEANS, LA.—Cohn & Ber and T. M. Miller & Co. have applied for franchises to erect plants and to light this city. Miller & Co. purpose to begin the construction before July 1, 1899, and to have $25,000 worth of work completed in one year from that date.

THIBODEAUX, LA.—The question of building a plant by special tax will probably be voted upon at the election in November.

NATCHEZ, MISS.—Maurice Moses, Pres., writes us that bids will be asked about the end of the month for furnishing the materials and for building the proposed plant to be owned by A. & M. Moses. It will be operated by steam, and will have a capacity of 120 2,000-c. p. arc and 2,000 16-c. p. incandescent lights. The Natchez Light, Power & Transit Co. will be incorporated. The entire plant is yet to be purchased. The city has made a contract to take 100 arc lights.

NEW RICHMOND, O.—Bids are asked until Oct. 1 for furnishing and building a plant to be operated by steam. It will have a capacity for 40 2,000-c. p. and 1,000 16-c.

p. lights; estimated cost, (probably with water-works), $30,000. Des. Engr., E. L. Layman, 32 East 3d St., Cincinnati, O.

COLUMBUS, O.—Councilman Beard introduced a resolution Sept. 6 authorizing the council to rescind the contract with the Columbus Electric Light & Power Co. for lighting this city, the arc lights, it is alleged, not being up to the contracted candle power.

NEW ALBANY, IND.—The Light, Heat & Power Co. has been granted permission to build a 2-story brick addition to its power house, according to reports. Mgr., M. Ruthenberg.

DECATUR, MICH.—The council will soon ask for bids for furnishing and building a plant, according to reports.

HOUGHTON, MICH.—The Peninsula Electric Light & Power Co. has increased its capital stock from $150,000 to $200,000. Mgr., L. E. Morgan.

ST. LOUIS, MICH.—As the regularity and sufficiency of the board of public works of this city has been questioned, notice is given that no bids were opened Sept. 9 for building a plant, and that none will be opened Sept. 26 for the purchase of $20,000 of 4% bonds for the work. New proceedings will be commenced as soon as possible toward securing the improvement. Clk., Jno. R. Wilson; Mayor, Parker Merrill.

CHICAGO, ILL.—Bids are asked until Sept 21 for furnishing incandescent lamps for the public library building. Secy, W. B. Wichersham.

GREENUP, ILL.—W. H. Cuningham, Village Clk., writes us that bids were received Sept. 10 for furnishing and building a plant. The specifications were amended so as to entirely cut out the incandescent service, and also modified as regards size of poles, quality of wire. Poles were substituted for arms for supervision of street lights. The bids were as follows:

Bidder.	Original bid.	Amended bid.
Advance Electric Co.*	$3,455	....
Griswold & Kline, Casey, Ill	2,900	$1,950
R. A. Gay, Effingham, Ill	5,600	1,975
Sanborn Electric Co.†	3,565	2,535

*8 W. Market St., Indianapolis. †22 E. Ohio St., Indianapolis.

SALEM, ILL.—T. C. Reed & Co., Chicago, have been awarded the contract, at $9,000, for furnishing the machinery and installing a plant with a capacity of 50 2,000-c. p. arc and 1,500 16-c. p. incandescent lights.

RICHLAND CENTER, WIS.—A committee is reported to have been appointed to investigate the question of putting in a plant. E. R. Stevens may be addressed.

BUFFALO CENTER, IA.—B. S. Wilder, Lake Mills, Ia., is reported as arranging for the immediate construction of a plant.

HARTLEY, IA.—The council is reported as considering the question of building a plant, according to reports.

SEYMOUR, IA.—The question of building a plant and water-works is being considered.

LITTLE FALLS, MINN.—An election will be held Oct. 4 to vote on the question of issuing $60,000 in bonds for a municipal plant and water-works. It is estimated that the plant will cost about $9,500, and that water-works about $40,000.

PERHAM, MINN.—Chas. F. Loweth, 94 East 4th St., St. Paul, has furnished plans for a plant with a capacity for 7 arc and over 300 incandescent lights, and for a water-works system.

WEST SUPERIOR, WIS.—Press reports state that the council has voted to award a city lighting contract to the Superior Water Light & Power Co., the company having agreed to furnish lights at the same price that Wm. Burgess did in his proposition, noted under Contract Prices last week, and which the council previously accepted. The basis for the contract is $80 a light of 2,000-c. p.

WAYNE, NEB.—The John T. Burke Electric Supply Co., Omaha, Neb., has been awarded the contract for furnishing and building a plant.

COFFEYVILLE, KAN.—Bids are asked until Sept. 28 for the purchase of $17,000 of 6% electric light bonds. Cy. Clk., D. S. Elliott.

WICHITA, KAN.—The council has been petitioned to build a municipal plant. The council is having trouble with the Wichita Light, Gas & Power Co., which is reported by local papers as removing its lamps. A new company is said to be figuring on putting in a plant. W. H. Herbig, of the committee, and Councilman Volk may be addressed.

SHELBINA, MO.—This place voted Sept. 6 to issue $5,000 in bonds for extending the plant. Supt., E. P. Weaver.

HENRIETTA, TEX.—A company is being organized to build a plant, according to reports. E. B. Carver may be addressed.

MASON, TEX.—V. M. Loring, Secy. Mason Electric Light Co., writes us that the contract for the plant has been let. It will be operated by steam and will have a capacity for 400 16-c. p. incandescent lights; estimated cost, $5,500. Des. Engr., Wm. G. Schwirth, San. Antonio, Tex.

COLORADO SPRINGS, COLO.—Geo. W. Jackson, of Colorado Springs, has been granted permission to furnish electricity from the water from Pike's Peak for light and power purposes. Z. G. Simmons, Vice-Pres., Manitou & Pike's Peak Ry. Co., may be addressed.

TACOMA, WASH.—C. B. Talbot, Civil Engr., Tacoma, has submitted a proposition to have the city own its plant. Mr. Talbot's scheme is to bring power generated by the south fork of the Puyallup River, which can be made to furnish 7,000 HP. He wants the city to tap the river 26 miles from town, construct a ditch 8 ft. deep and 38 ft. wide for a distance of about 20 miles, to come to an end three miles from Maplewood Springs, where a fall of nearly 300 ft. can be secured. Estimated cost, $100,000.

HEALDSBURG, CAL.—C. H. Pond, Clk., writes us that the following bids were received Aug. 26 for furnishing and building a plant and water-works: California Bridge Co., San Francisco, Cal., $35,400; A. W. Garrett, Healdsburg, city distributory, $24,986; San Francisco Bridge Co., $32,514; James Stanly, $29,640; Williaus Bilser, $29,260; C. D. Vincent, $36,250. The contract for the electric plant was let to Jas. Stanly, San Francisco, and that for the water-works to the San Francisco Bridge Co., San Francisco.

LOS ANGELES, CAL.—It is proposed to enlarge the plant at the Soldiers' Home. Maj. Wm. H. Bonsall, Soldiers' Home, Cal., may be addressed.

MODESTO, CAL.—Bids are asked by the clerk of the board of trustees until Sept. 26 for furnishing a plant in connection with the water-works.

SANTA ANA, CAL.—A company has been organized to build a plant in this city at a cost of about $15,000.

WILLIAMS, ARIZ.—It is stated that the council will build a plant in this place at once.

HAMILTON, ONT.—The council has engaged Percy Domville, Elect. Engr., Hamilton, to make a complete report upon the cost of installing a municipal electric light and power plant capable of providing 400 arc lights of 2,000-c. p. and 3,000 incandescent lights of 16-c. p., with provision for enlargement to meet the city's requirements for the next 20 years. The report is to include an estimate of the annual cost of operation. S. H. Kent, Asst. Cy. Clk.

BRUSSELS, BELGIUM.—Geo. W. Roosevelt, U. S. Consul at Brussels, states in a report that in view of the increased use of electricity in this country there is a good opportunity for the introduction of American electric apparatus.

NEW COMPANIES.—Santa Anna Water Power Co., Gonzales, Texas; $5,000; to construct a dam across the Guadalupe River and to utilize and control the water power created thereby: R. S. Dilworth, F. R. Starr, Jr., C. T. Rather, G. W. Betts, J. W. Nixon.

BRIDGES.

BOSTON, MASS.—A contract has been awarded to Woodbury & Leighton, at $15,795, for the Boston approach to the Charlestown bridge.

WESTFIELD, MASS.—Bids are asked until Sept. 26 for constructing the abutments, retaining walls and foundations for the new bridge over Little River, at Main St., as described in our advertising columns. O. A. Granger, Chn. Com.; O. E. Parks, Town Engr.

SUFFOLK, VA.—Bids are asked until Sept. 22 for furnishing and driving 36 cypress piles at the bridge across Nansemona River. R. R. Smith, Clk.

WELDON, N. C.—The Atlantic Coast Line has decided to construct a steel bridge across the Roanoke River, near this place. G. Gardner, Ch. Engr., Wilmington, N. C.

AUGUSTA, GA.—The South Carolina & Georgia R. R., the Charlotte, Columbia & Augusta, and the Florida Central & Peninsular R. R. have had a number of bridges destroyed by storms.

MACON, GA.—An iron bridge is to be constructed over the Ocmulgee River, on Fifth St. Address Mayor Price.

HAZLEHURST, MISS.—The county supervisors have voted to build at once two iron bridges over the Pearl River, one to be located at Rockport and one at Georgetown. The supervisors of Simpson county have appropriated $2,500 toward the Georgetown bridge.

CHILLICOTHE, O.—Bids are asked until Oct. 3 for a superstructure of two spans, 242 ft. long each, and for the repair of a 154-ft. span. A. W. Jones, County Engr.; H. S. Adams, County Audr.

COSHOCTON, O.—The county commissioners have decided to build a bridge across the Walhonding River, in Bethlehem township. A hearing will be given Sept. 26. Newton Speckman, County Audr.

DETROIT, MICH.—The board of public works has decided to construct overhead footwalks on the Belle Isle bridge, at an estimated cost of $15,000.

CHICAGO, ILL.—We are informed that a contract has been let to Roemheld & Gallery, at $10,000, for removing and placing three spans of the 61st St. viaduct, at three streets over the upper north branch of the Chicago River. A. G. Riter, Cy. Bridge Engr.

EAU CLAIRE, WIS.—The city has voted in favor of issuing $40,000 in bonds for the construction of the new bridge over the Chippewa River, at Kelsey St.

DES MOINES, IA.—Alderman Hall is preparing plans for a brick and masonry bridge of five arches, over the Des Moines River, on North Bluff St. The work will be done by local labor, according to reports.

DULUTH, MINN.—The Duluth, Missabe & Northern Ry. Co. has awarded a contract to the Wisconsin Bridge & Iron Co., Milwaukee, Wis., for a bridge 400 ft. long, including approaches with a Warren truss span of 165 ft., over the Cloquet River. A steel bridge will be constructed over the Duluth incline road in West Duluth, to take the place of the present trestle. It will consist of two spans of 50 ft. each. The contract has not yet been let. C. H. Martz, Ch. Engr., Duluth.

WICHITA, KAN.—Reports state that a bridge is to be constructed across the Chickasaw River, near Pouca City.

OMAHA, NEB.—The question of repairing the L and Q St. viaducts, at a cost of about $3,000, is being considered by the railways, according to report. Address City Engineer Beal, or Chief Engineer King of the Stock Yards Co.——The Stock Yards Co. has awarded C. E. H. Campbell, Council Bluffs, Ia., a contract to construct a viaduct 700 ft. long, having a capacity of 300 lbs. per sq. ft., at a cost of about $10,000.——The council has taken steps toward the construction of the new 16th St. viaduct, to be erected by the railway companies.

WATERLOO, NEB.—The county commissioners, Omaha, received the lowest bid from J. R. Sheeley & Co., Lincoln, at $2,800, for a 150-ft. steel bridge over the Elkhorn River.

ST. JOSEPH, MO.—The council committee has accepted plans for the new South 6th St. viaduct, which will be constructed by the city and the railroads; estimated cost, $32,500. J. R. Rackliffe, Cy. Engr.——The plans for the viaduct to be constructed by the Chicago Great Western Ry. Co. on Grand Ave., have been submitted to the council, the structure will be 600 ft. long, with a center span of 170 ft.; estimated cost, $15,000. H. Fernstrom, Ch. Engr., St. Paul, Minn.

DURANGO, COLO.—Bids are asked until Sept. 29 for a steel bridge over the Animas River, according to reports. George Weaver, County Clk.

WALLA WALLA, WASH.—Bids are asked until Sept. 19 for constructing a wooden or steel bridge across Mill Creek, at Fourth St. C. W. McLean, Cy. Clk.

LOS ANGELES, CAL.—Street Superintendent Finch has estimated that it will cost $1,200 to replank the Victoria Bridge, which is 600 × 30 ft.

STOCKTON, CAL.—Bids are asked by the county supervisors until Oct. 4 for building a steel bridge across Calaveras River on the Jack Tone Road. County Surv., Geo. A. Atherton, Stockton.

QUEBEC, QUE.—Press reports state as follows: At a meeting of the Quebec Bridge Co. Sept. 9, it was decided to at once call for bids for the construction of the bridge, which is estimated to cost from $3,000,000 to $4,000,000. The amount of capital so far subscribed is $286,000. The report states that the Dominion Government has given assurances that a subsidy of 33⅓% on the cost of the enterprise would be voted at the next session of Parliament. It is expected that the Province of Quebec and the city of Quebec between them will vote subsidies amounting together to another third of the cost, and the balance of the cost will be met by issuing bonds.

ROBSON, B. C.—On account of the death of Mr. Matthew, of Matthew & Keith, the contract for the bridge construction on the Robson-Penticton branch of the Columbia & Western Ry., has been reawarded to Porter Bros. and McArthur & Roberts.

BUILDINGS.

LIVERMORE FALLS, ME.—A fire in this town, Sept. 10, destroyed a large part of the business section, causing a reported loss of about $60,000.

BURLINGTON, VT.—Bids are asked by the school commissioners until Sept. 27 for the construction of a new high school building, as stated in our advertising columns. Supt., H. O. Wheeler; Arch., W. R. B. Wilcox, of Burlington.

BOSTON, MASS.—W. S. Sampson & Son, Boston, and G. A. Cahill, were the lowest bidders, Sept. 6, for erecting schools in South Boston and West Roxbury, at $36,600 and $29,515, respectively.

NEWPORT, R. I.—The Ocean House, on Bellevue Ave., was damaged by fire, Sept. 9, causing an estimated loss of about $90,000; insurance, $30,000. Owner, Henry J. Barbey, New York.

BROOKLYN, N. Y.—Bids are asked by the department of public buildings, lighting and supplies, at 346 Broadway, New York, until Sept. 20, for the work and material necessary to complete the alterations and entire furnishing of the room on the south side of hall, top story, of the City Hall, Borough of Brooklyn; also until Sept. 27, for materials and work required for certain repairs and alterations to the municipal building of the Borough of Brooklyn; Archs., Horgan & Slattery, 1 Madson Ave., New York.——Plans have been prepared, according to reports, for two 4-story brick and stone dwellings, at Carroll St. and Prospect Park West, to cost $48,000. Owner, S. Goodstein, 279 Bridge St., Brooklyn; Arch., Montrose W. Morris, 45 Exchange Place, New York.

DUNKIRK, N. Y.—Bids are asked by the council until Sept. 23 for erecting a new steel jail.

ITHACA, N. Y.—Col. Oliver H. Payne is reported to have made a gift of $1,500,000 to Cornell University in order to establish a new medical college.

LEROY, N. Y.—Bids are asked by the board of education until Sept. 21 for the purchase of $8,000 of school bonds. Clk., Harry H. Falkner.

NEW YORK, N. Y.—Plans are being prepared for a 5-story fireproof stone residence, 35 × 80 ft., to be erected on 79th St., between 5th and Madison Aves., to cost about $125,000. Arch., C. P. H. Gilbert, 1123 Broadway.——Plans are being revised, according to reports, for the new addition to be built for the Catholic Protectory at Van Nest, to cost about $30,000. Archs., Farnsworth & Miller, 111 Nassau St.——Plans have been filed by John Heller, 24 Greenwich Ave., for two 5-story brick flat buildings at 135th St. and Willis Ave., to cost $69,000. Arch., H. T. Howell, 748 East 138th St.; by Ed. C. Edwards, 952 Bergen St., for a 6-story brick warehouse at West Broadway and Prince St., to cost $70,000. Arch., Franklin Baylies, Bible House; by Leith & Glenn, for two 6-story brick flat buildings on 92d St., near the Boulevard, to cost $75,000. Archs, Neville & Bagge, 217 West 125th St.; by John McSweeney, 241 West 103d St., for three 5-story brick and stone flat and store buildings at 125th St. and the Boulevard, to cost $90,000. Archs., Jones & Leo, 967 Boulevard; by Ernest R. and Clarence J. Lawson, 898 West End Ave., for a 6-story brick flat building on 117th St., near Manhattan Ave., to cost $100,000. Arch., G. Fred. Pelham, 503 5th Ave.; by James Livingston, 8 West 91st St., for six 4-story brick dwellings on 103d St., near West End Ave., to cost $120,000, and by Jas. Kilpatrick for two 6-story brick flat buildings on 95th St., near Amsterdam Ave., to cost $120,000. Archs., Neville & Bagge, 217 West 125th St.; by Meyer Beyer, 748 East 138th St., for four 4-story brick flat buildings on 140th St., near St. Ann's Ave., to cost $72,000. Arch., Harry T. Howell; by Louis Perelstein, 96 Monroe St., for a 6-story brick flat and store building at Oak and Monroe Sts., to cost $50,000. Archs., Horenberger & Straub, 122 Bowery; by C. F. Miller, 35 Wall St., for a 6-story brick and stone office and studio building at 564 to 568 5th Ave., to cost $185,000. Arch., C. P. H. Gilbert; by F. W. Gill, 217 Keap St., Brooklyn, N. Y., for two 6-story brick flat buildings at 92d St. and Central Park West, to cost $155,000. Arch., G. W. Spitzer, 156 5th Ave.; by the Riverside Building Co., for six 6-story brick and stone dwellings, at 83d St. and Riverside Drive, to cost $150,000. Arch., C. W. True, 459 Boulevard; by Lorenz F. J. Weiher, Jr., Owner and Arch., 125th St. and Park Ave., for four 5-story brick flat buildings at 150th St. and Brook Ave., to cost $110,000; by Herbert and Henry Jones, 110 Beekman St., for four 5-story brick flat buildings at Brook Ave. and 150th St., to cost $110,000. Arch., L. F. J. Weiher, Jr.——E. F. Dodson & Co., 1123 Broadway, is reported to have been awarded the general contract for constructing a 7-story apartment building on Central Park West, near 94th St., for William Call, to cost about $100,000. Archs., J. E. Ware & Co., 487 5th Ave.

NORTH TARRYTOWN, N. Y.—An election will be held here Sept. 15 in order to decide whether it be advisable to build an addition to the school building, to cost about $20,000.

OGDENSBURG, N. Y.—Bids are asked until Sept. 22, according to reports, for the heating, ventilating and electric wiring of a building for the St. Lawrence State Hospital.

PORT JERVIS, N. Y.—Lorenzo Wood, Port Jervis, is stated to have been awarded the contract for erecting the new Church St. school building at $16,984.

TROY, N. Y.—The Union R. R. Co., of Troy, expects to make extensive alterations to its present station at Troy, including an entire new glass roof; the paving of Union St. with brick, new curbing, etc., and the taking out and replacing part of present tunnel between Congress and Ferry Sts., and strengthening the remainder with concrete. Estimated cost, $100,000. Secy., F. A. Harrington.

NEWARK, N. J.—Plans are about completed for a new school building to be erected at 7th Ave. and Factory St., at a present cost of $35,000. Archs., Ward & Davis, 203 Broadway, New York.

ORANGE, N. J.—Bids are asked until Sept. 28 for erecting the proposed addition to the Lincoln Ave. school building, to cost about $15,000.

TRENTON, N. J.—The Broad St. Bank has given the contract for the structural iron work of its new building on East State St. to the New Jersey Steel & Iron Co., at $20,795. Estimates have been received for the mason work for the foundation, but the contract has not yet been given.

BRADFORD, PA.—Bids are asked until Sept. 19 for the repairing of the Era hook and ladder building. Address Jas. A. Lindsey.

CHESTER, PA.—The contract for erecting the Crozer Home for Incurables is reported to have been awarded to a Chester firm, at $47,480.

PHILADELPHIA, PA.—It is reported that bids will soon be asked for erecting a 12-story apartment house at Broad and Spruce Sts., to cost $750,000. Archs., Dull & Peterson and Crawford Coates, 1107 Walnut St.——The following bids were received by the navy department Sept. 3 for

constructing a steel storehouse, 347 × 61 ft., at the League Island Navy Yard: Thos. M. Leeds, 1216 Race St., Philadelphia, $24,239; J. E. & A. L. Pennock, 305 Walnut St. Philadelphia, $21,487; H. L. Forte, Drexel Bldg., Philadelphia, $28,000; Macey, Henderson & Co., 1215 Filbert St., Philadelphia (accepted), $21,926; Chas. McCaul, 10 North 11th St., Philadelphia, $24,100; Penn Bridge Co., Beaver Falls, Pa., $27,000; Stacey B. Opdyke, Jr., Philadelphia, $28,278.

DENBIGH, VA.—The B. F. Smith Fireproof & Construction Co., of Washington, D. C., was awarded the contract for erecting the new jail building for Warwick county Sept. 6, to cost about $8,000.

ATLANTA, GA.—The county commissioners have decided to employ Grant Wilkins to draw plans for a new court house annex, to cost about $100,000.

MADISONVILLE, KY.—The Pauly Jail & Mfg. Co., St. Louis, Mo., is reported to have received the contract for erecting the proposed Hopkins county jail, at $6,998. Arch., W. C. Morton.

MOREHEAD, KY.—Clark & Howard, of Lexington, Ky., have been awarded the contract for erecting a new court house for Rowan county, at $14,000.

PORT CLINTON, O.—It is reported that plans have been prepared for a new court house for Ottawa county, to cost about $100,000. Archs., Wing & Mahurin, Pixley Block, Fort Wayne, Ind.

WASHINGTON, O.—The Masonic Temple in this town was burned Sept. 11, causing an estimated loss on the building of $40,000.

IRONWOOD, MICH.—Plans have been prepared for a 3-story brick and stone school building, to cost $25,000. Archs., Charlton, Gilbert & Demar, Milwaukee, Wis.

CHARLESTON, ILL.—Bids are asked by the supervisors of Cole county until Sept. 20 for the repairing of the court house. J. K. Rardin, Chn. Bldg. Com.; C. W. Rapp, Arch., 100 Washington St., Chicago, Ill.

CHICAGO, ILL.—The Peavey Grain Co. is said to contemplate the erection of an additional elevator at South Chicago, to cost $100,000.

OSCEOLA, WIS.—Bids are asked until Sept. 22 for the erection of a school building; deposit, $150. Address C. W. Staples, Clk. of School Bd.; Orff & Gilbert, Archs., Minneapolis, Minn.

SHEBOYGAN, WIS.—Bids are asked until about Sept. 30 for erecting a brick and stone school building, 75 × 100 ft., at a cost of about $23,000. Arch., Charles Hilpertshauser.

WAUSAU, WIS.—Reports state that the Northwestern Ry. Co. will make improvements at this place to cost $50,000, including a freight and a passenger station.

DES MOINES, IA.—Reports state that Proudfoot & Bird have prepared plans for a 7-story brick building, to be erected at 5th and Locust Sts., in the spring, by Conrad Youngerman; estimated cost, $100,000.

ST. JAMES, MINN.—The Mankato Plumbing & Heating Co. has been awarded the contract for a steam heating system for the Armstrong Hotel, at $2,625. Arch., F. Thayer, Mankato, Minn.

SOUTH OMAHA, NEB.—The following bids were received by the supervising architect, Washington, D. C., Sept. 7, for a low pressure steam heating and ventilating apparatus for the post-office building at South Omaha:

		Time.
Pittsburg Heating Supply Co., Pittsburg..	$4,100	80 days.
Chafer & Becker, Cleveland, O...........	5,670	80 "
Korsmeyer Plumbg. & Htg. Co., Lincoln.	3,595	80 "
John Rowe & Co., Omaha, Neb..........	4,724	.. ....
Dare & Manning, Omaha, Neb...........	5,642	80 days.
Chas. D. Symms, Lemars, Ia............	4,444	70 "

TWIN BRIDGES, MONT.—It is reported that D. A. Pease, of this city, expects to erect a hotel building here to cost $50,000.

JEROME, ARIZ.—This town was almost entirely destroyed by fire Sept. 11, causing a loss estimated at $1,000,000.

CHEMAWA, ORE.—Pugh & Gray were the lowest bidders for the construction of the proposed school building for the Harrison Training School, at $18,000.

SAN FRANCISCO, CAL.—Bids are asked by the bureau of medicine and surgery, navy department, until Oct. 12, for erecting a new naval hospital at the U. S. Navy Yard, Mare Island. W. K. Van Reyper, Surgeon-General, U. S. N., Washington, D. C.

SITKA, ALASKA.—Bids will be received by John G. Brady, Governor of Alaska, at Sitka, until Oct. 1, for the construction of a school building and teacher's residence at Wood's Island, in St. Paul Harbor, to cost about $2,200.

NEW WESTMINSTER, B. C.—A fire in this city Sept. 11 destroyed most of the business portion of the city. Estimated loss, $2,000,000; insurance, about $1,250,000.

WATER-WORKS.

DANFORTH, ME.—The town clerk writes us that the question of putting in works, which was discussed early in the season, has been dropped.

HALLOWELL, ME.—Local papers state that the commissioners will build a 3,000,000-gallon reservoir near the City Farm pumping station. The reservoir will be 240 × 390 ft.

ESSEX JUNCTION, VT.—G. A. Brownell, Chn. Com., writes us that the committee is investigating the best means of furnishing a water supply to the town. The works will not be built this season. T. W. Sibley is also on the committee.

MONTPELIER, VT.—The Barre & Montpelier Power & Traction Co., it is stated, has decided to install a pumping plant for its car barn and property here.

WEST SPRINGFIELD, MASS.—N. T. Smith, Chn. Comrs., writes us that nothing has yet been done with regard to the proposed improvements to the works. A special town meeting will soon be held to consider the question. The water board will report plans for an additional reservoir and some other changes to the works. Population, 6,700.

HARRISVILLE, N. Y.—Bids are asked until Sept. 28 for furnishing the materials and for building the proposed works recently voted for. Chn. Comrs., F. W. Werner.

NEWARK, N. Y.—The plant of the Newark Water-Works Co. has been sold to the bondholders of the company.

NIAGARA FALLS, N. Y.—The question of extending the city mains to the Niagara University is being considered by the council. It will require a larger pumping capacity to furnish water to the university. Mayor Hastings may be addressed.

RHINEBECK, N. Y.—Jos. M. Johnson, of Millersburg, Pa., has been granted a franchise for works and also a contract for furnishing the town with water. The construction will probably be begun at once.

JERSEY CITY, N. J.—Garwood Ferris has submitted a report in favor of plan No. 1 submitted by Pat'k H. Flynn, Brooklyn, N. Y., for furnishing this city with a water supply. This plan has for its source of supply the Rockaway River at Old Boonton, and is to provide a gravity supply of 70,000,000 gallons a day. The cost will be $8,745,000. It is stated that Mayor Hoos is opposed to the plan. A final conference will be held Sept. 26.——The street and water board will ask for bids at once for furnishing three meters to be placed at Belleville, Kearney and Harrison.

BENNETT, PA.—We are informed that the water supply for this place will be furnished by the Millvale Water-Works by the erection of an additional pump. The question will be voted upon Nov. 8. Address W. A. Young.

BLUERIDGE SUMMIT, PA.—D. G. Adelsberger, Civil Engr., 722 Pennsylvania Ave., Baltimore, Md., is reported to have submitted a plan for new works for this place.

BRADFORD, PA.—The Hazlehurst Water Co. was incorporated Sept. 12 to furnish water to Hazlehurst; capital stock, $12,000, with $1,200 paid in; incorporators, Edwin E. Tait, Treas., Bradford, Pa.; P. C. Blaisdell, Bradford.

CHAMBERSBURG, PA.—The council has voted to purchase a 2,000,000-gallon pump from the Stilwell-Bierce & Smith-Vaile Co., Dayton, O., for $1,950.

CHARLEROI, PA.—The Charleroi Water Co. has let the contract for furnishing two 2,500,000-gallon pumping engines to the Wilson-Snyder Mfg. Co., Pittsburg.

GALLITZIN, PA.—Jas. L. Mitchell, Tyrone, Pa., is reported to have purchased the works in this town. He will improve the plant at once. Population (1890), 2,392.

LANCASTER, PA.—Simon Shissler, Mayor, writes us that Allen Hazen, 220 Broadway, New York, has been engaged to advise the city of the best method of securing a purer water supply. After receiving the report, if favorable, the committee will ask for a loan in the spring to carry out Mr. Hazen's recommendations.

McKEE'S ROCKS, PA.—The question of building municipal works is being considered, according to reports. At present a supply is secured from the works of the Monongahela Water Co., Pittsburg.

STRASBURG, PA.—bids are asked until Sept. 20 for the purchase of $20,000 of 4% water bonds. The council in August accepted a proposition from the Strasburg Water Co. to furnish complete works for $19,000. Burgess, B. F. Book.

YORK, PA.—Local papers state that the board of health is desirous of having another water company to furnish the city with an additional water supply, which is to be filtered. President Hay, of the board, and Mayor Brant may be addressed.

MARTINSBURG, W. VA.—The council is reported as arranging for the immediate construction of the proposed improvements to the works. They will include a new 2,500,000-gallon pump, an increased water supply, etc. Supt., J. M. Shaffer.

DENTON, MD.—The question of building works is being considered, according to reports.

MADISON, GA.—The mayor writes us that no steps have been taken by the city toward building the works under discussion some months ago.

SYLVANIA, GA.—An election will be held Sept. 27 to vote on the question of issuing bonds for an artesian well and a water supply, noted in our issue last week.

MOBILE, ALA.—The following submitted bids Sept. 1 to J. C. Bush, Mayor, for constructing the proposed municipal works, as advertised in Engineering News: W. D. Boyce & Co., St. Louis, Mo.; Addyston Pipe & Steel Co., Cincinnati, O.; Holly Mfg. Co., Lockport, N. Y.; C. H. Eglee Co., Boston, Mass., complete, $538,000; Alabama Construction Co., Anniston; Pleuger & Henger Mfg. Co., St. Louis, Mo.; Healy & McLean, Chicago; Chapman Valve Mfg. Co., Boston; Michigan Brass & Iron Works, Detroit; J. P. Neely, Chattanooga; Glamorgan Pipe & Foundry Co., Lynchburg, Va.; American Pipe & Foundry Co., Chattanooga; Henry R. Worthington, New York; M. T. Lewman & Co., Louisville, Ky., and J. N. Hazlehurst, Atlanta, bidding together, $531,984; Guild & Co., Chattanooga, Tenn., $533,609; Ludlow Valve Mfg. Co., Troy, N. Y. Supervising Engr., T. W. Nicol, Mobile.

CLARKSDALE, MISS.—The Clarksdale Water & Light Co. was incorporated Sept. 3 with a capital stock of $35,000, by Walter Clark, E. L. Anderson and W. P. Holland.

McCOMB CITY, MISS.—Bids are asked until Sept. 21 for constructing works to cost about $40,000. Engrs., Sanders & Porter, Columbia Bldg., Louisville, Ky.; Mayor, C. C. Jarvis.

WINONA, MISS.—The Winona Ice, Electric Light & Water Co. has been incorporated with a capital stock of $100,000, by E. R. Blackston, D. B. Turner and others. The works will probably not be built until after the electric plant is completed.

NEW IBERIA, LA.—A. J. Cammack, Secy. and Attorney, writes us that an election was called for Oct. 17 to vote on the question of building works and a light plant, but it is likely to be set for a later date on account of irregularities in getting signatures to the petition; population, 7,000.

GALLATIN, TENN.—An election will be held Sept. 24 to again vote on the question of building works; estimated cost, $25,000. Mayor, W. L. Oldham.

LOUISVILLE, KY.—Fred. Hoertz, Louisville, has been awarded the contract at $297,390 by the Louisville Water Co. for furnishing the materials and for building the proposed filter plant. The plant is to be completed by Dec. 31, 1899. Pres., Chas. R. Long.

ELYRIA, O.—P. H. Boynton, water-works trustee, writes us that construction on the new works has been stopped for the present on account of an injunction.

FORT RECOVERY, O.—J. D. S. Neeley, Lima, O., is interested in the proposed works for this place.

MARIETTA, O.—Bids are asked until Sept. 26 for furnishing a 3,000,000-gallon pumping engine for the water-works. (Postponement from Aug. 29.) Supt., J. B. West; Pres. Water Comrs., J. H. McConnell.

NEW RICHMOND, O.—We are informed that an election to vote on the question of building works was called for Sept. 12. The water supply will be secured from the Ohio River. A filtration plant will be put in; estimated cost, including electric plant, $30,000. Engr., E. F. Layman, 32 East 3d St., Cincinnati.

BLOOMINGTON, IND.—H. F. Perry, Pres. City Water-Works Co., recently incorporated, writes us that the plant has been in operation several years. Some changes will probably be made by the new company, but no steps have yet been taken in that direction.

CONNERSVILLE, IND.—This place voted Sept. 3 to keep the works in the present location. It is proposed to make a number of improvements to the works.

HENRYVILLE, IND.—The question of building works is being considered, according to reports.

LAKE ODESSA, MICH.—It is stated that this place has voted to issue $10,000 in bonds for the proposed works. Village Pres., Wm. H. McCartney.

EATON RAPIDS, MICH.—This place voted last week to build works to cost about $25,000; population, 2,500. Engrs., Alvord & Shields, The Rookery, Chicago; Secy. Water Bd., Jos. H. Gallery.

GRAND RAPIDS, MICH.—Fire Marshal Lemoine has recommended that the city build two new stand-pipes.——The water-works trustees are considering the question of purchasing another pump for the works.

CHICAGO, ILL.—W. B. Wickersham, Secy. Chicago Public Library, writes us that Thomas & Smith, 16 North Canal St., Chicago, submitted the only bid Sept. 7, at $5,370 for furnishing four pressure water storage tanks. Mr. Wickersham says that the reason given by some contractors for not bidding was that they would not be bound by the clause in the specifications requiring union labor.

KENNEY, ILL.—H. C. Suttle and Andy Hawkyard are interested in the proposed works for this place.

MOLINE, ILL.—Jacob A. Harmon, 21 Arcade Bldg., Peoria, Ill., prepared preliminary plans, estimates and report on a water supply improvement for this city, and submitted same to the council Sept. 8. The plans contemplate the construction of natural or slow sand filters having a capacity of 3,000,000 gallons per 24 hours, a distribution reservoir of 5,000,000 gallons, two settling basins of 2,800,000 gallons each, a water tower and tank, which has a capacity of 185,000 gallons, a pumping station and about $15,000 or $20,000 worth of mains. It is expected that detail plans and specifications will be ready in January.

BARABOO, WIS.—Press reports state that the council has ordered the Baraboo City Water-Works Co. to furnish a larger water supply.

SPRING VALLEY, WIS.—The council, it is stated, will soon issue $2,600 in bonds for works for fire protection.

SEYMOUR, IA.—The question of building works and a light plant is being considered, according to reports.

LITTLE FALLS, MINN.—An election will be held Oct. 4 to vote on the question of issuing $60,000 in bonds for municipal works and a light plant.

PERHAM, MINN.—C. F. Loweth, 94 East 4th St., St. Paul, has prepared plans for small works and a light plant. A steel tower 80 ft. high will be built.

WINONA, MINN.—Local papers state that the question of putting in a pumping plant at the artesian well is being considered; estimated cost, $13,000.

TOPEKA, KAN.—It is stated that Mayor Fellows has called an election to vote on the question of either purchasing the works of the Topeka Water Co. or of building new works. For either plant $440,000 will be issued.

LITTLE ROCK, ARK.—The council fire committee has been directed to investigate the alleged low pressure of the water supply furnished by the Home Water Co. Mayor Woodson and Councilman Reid may be addressed.

COLORADO, TEX.—Robt. M. Webb, Secy. and Treas. Colorado Water-Works Co., recently incorporated, as noted in last week's issue, writes us that the company will do no new work, the plant having already been built; it was only purchased from the owners and a new company organized.

DARLINGTON, OKLA.—Bids are asked until Sept. 19 for furnishing the materials and for building the proposed works and sewers for the school on the Cheyenne and Arapahoe agency. Maj. A. E. Woodson, Acting U. S. Indian Agent, Darlington, or the Indian office, Washington, D. C., may be addressed.

SHAWNEE, OKLA.—Benj. Diesker, Cy. Clk., writes us that this place voted Sept. 2 to issue bonds for works. The supply will be secured from the river about one-fourth mile distant. The plant is not to cost more than $35,000. No contract has been let, nor are the bonds ready for sale. Population, 6,000. Engr., John M. Walker, Independence, Kan.

WAGONER, IND. TER.—J. S. Thatcher, 504 Cockrell Bldg., Dallas, Tex., has completed plans and specifications for the proposed works for this place. The works will consist of a compound duplex steam pump of 1,000,000 gallons capacity, about 10 miles of 4 to 10-in. cast-iron water pipe, 16 × 100 ft. stand pipe, etc. Bids will be received by the city clerk until about Oct. 1.

BRECKENRIDGE, COLO.—Bids were asked until Sept. 12 for furnishing the materials and for building works. The plant is to be completed in 60 days from date of contract. Town Clk., Jas. K. Darnell.

CHEYENNE WELLS, COLO.—The question of securing a water supply is being considered, according to reports.

GOLDFIELD, COLO.—A. W. Grant, Cy. Clk., writes us that the contract for building the proposed works was let Sept. 3 to local contractors. The issue of $25,000 of bonds has been sold. A report states that Sam'l Cummings has the contract.

WARD, COLO.—It is stated that the election called for Aug. 9 to vote on the question of issuing $12,000 in 6% bonds has been postponed to Sept. 27. Engr., D. J. McCanne, 1600 17th St., Denver, Colo.

CENTRALIA, WASH.—It is stated that the works of the Centralia Water Co. will be improved. Pres., W. C. Sharpstien.

FAIRHAVEN, WASH.—It is reported that the Fairhaven City Water & Power Co. has asked for bids for the construction of a 20-in. main from Lake Padden to the city. At present a 14-in. pipe is supplying the city with water.

McMINNVILLE, ORE.—Press reports state that the town is considering the question of securing an increased water supply from the mountains.

THE DALLES, ORE.—The commissioners have been authorized by the council to engage J. B. Goit, The Dalles, to prepare plans, specifications, etc., for extending the works, putting in larger pipes, and for securing a better water supply. S. Polton and M. Randall are on the committee.

COLTON, CAL.—Bids are asked until Sept. 30 for the purchase of 6% water-works bonds. Clk., G. E. Slaughter.

GLENDORA, CAL.—The Glendora-Azusa Water Co. has been incorporated with a capital stock of $50,000, of which $5,100 is paid in; incorporators, D. A. Cole, J. H. Odell, E. O. Kennard, Glendora; and A. P. Griffith, W. R. Powell, W. C. Ormiston and G. C. Matthews, Azusa.

LOS ANGELES, CAL.—Press reports state that on Sept. 11 Judge Oscar appointed Frank A. Gibson, cashier of the First National Bank, to be receiver of the Los Angeles City Water Co., pending the decision of the litigation now under way between the company and the city.

RED BLUFF, CAL.—It is stated that the construction of municipal works, at a cost of about $50,000, is proposed. Town Clk., J. F. Teass.

WHITTIER, CAL.—The board of trustees, it is stated, will soon ask for bids for the purchase of $40,000 of 20-year bonds, for the proposed municipal works.

GRANTSVILLE, UTAH.—A. F. Doremus, Salt Lake City, is reported to have been awarded the contract for building works at about $19,000.

SALT LAKE CITY, UTAH.—The question of securing an increased water supply is being considered. Mayor, John Clark.

IDAHO FALLS, IDAHO.—George Chapin, Chn. Bd. Trustees, writes us that it will be three weeks from Sept. 3 before any steps can be taken for the proposed works, as the city has to wait until the bids for purchasing the bonds are received. The law compels one month's advertising. Population, 1,400.

OTTAWA, ONT.—Robert Surtees, Cy. Engr., has been directed to prepare a statement of cost of a 20,000,000-gallon reservoir and stand-pipes of the same capacity. Mr. Surtees is stated by local papers to have recommended the installation of an extra pump of 10,000,000-gallons as an auxiliary.

STRATHROY, ONT.—Press reports state that this place is considering the question of building works and a sewerage system.

WATERLOO, ONT.—The owners of the works offer to sell the property to the city for $25,000. A board of trade committee, consisting of S. Snyder, Pres. Bd.; Messrs. Fischer, Moore, J. Conrad and Diebel, has been appointed to consider the question in conjunction with the council.

MEXICO, MEX.—The department of communication is making borings near Ajusco for an increased water supply. At first the supply will be for flushing the sewers, according to reports.

HALIFAX, ENGLAND.—The water committee has decided to recommend to the council to proceed with the Walsham Dean reservoir extensions, to cost about $1,000,000.

SEWERAGE.

FRANKLIN, N. H.—The council has voted to build an outlet sewer in a certain street. Mayor Adams may be addressed.

AMHERST, MASS.—At the town meeting to be held Sept. 17 the question of building sewers in three streets will be considered. Chn. Selectmen, Wm. E. Smith.

BOSTON, MASS.—Wm. M. Brown, Jr., Ch. Engr. and Supt. Metropolitan Sewerage Comn., 3 Mount Vernon St., Boston, writes us that the following bids were received Sept. 3 for building additions to the pumping stations of the system, as advertised in Engineering News: Deer Island Station—Edward P. Allis Co., Milwaukee, $27,200, duty guaranteed, 80 million; Geo. F. Blake Mfg. Co., New York, $22,200, duty guaranteed, 75 million; Holly Mfg. Co., Lockport, N. Y., $20,785, duty guaranteed, 75 million; East Boston Station—Allis Co., $2,600; Blake Mfg. Co., $22,200; Holly Mfg. Co., $20,785, duty guaranteed, respectively, as for Deer Island; Charlestown Station—Allis Co., $25,800, duty guaranteed, 75 million; Blake Mfg. Co., $22,200, duty guaranteed, 70 million; Holly Mfg. Co., $20,785, duty guaranteed, 70 million; Alewife Brook, North Somerville Station—Burhorn & Granger, New York, $7,800, duty guaranteed, 50 million; Blake Mfg. Co., $7,500, duty guaranteed, 50 million; P. H. & F. M. Roots Co., 109 Liberty St., New York, $6,745, duty guaranteed, 68 million; Prindle Pump Co., 120 Liberty St., New York, $5,980, duty guaranteed 50 million. The additions for which bids were asked for the North Somerville Station includes a vertical compound condensing engine directly connected with a vertical centrifugal pump; a vertical tubular boiler of the Manning type, and necessary connections. Conditions of maximum capacity: Quantity pumped, 20 cu. ft. per sec. Lift, 13 ft.

HOLYOKE, MASS.—John J. Fitzpatrick, Cy. Engr., writes us that the plans for the Highlands sewers are being prepared. The length will be about 9½ miles. The money has not yet been appropriated.

OLNEYVILLE, R. I.—It is proposed to construct sewers in certain streets.

WESTERLY, R. I.—I. B. Crandall, Pres. Town Council, writes us that a few years ago an approximate cost, with general plans for a system, was made. It is not thought that anything will be done towards securing the system for some years.

AMSTERDAM, N. Y.—Bids are asked until Sept. 30 for constructing storm sewers in certain streets. Secy. Comrs., Geo. McClumpha.

BALLSTON SPA, N. Y.—D. W. Maher, Pres., writes us that plans and specifications for a sewer in Gordon Creek for the extension of the same have been prepared by Harvey M. Gear. An appropriation for this work has been voted by the taxpayers; estimated cost, $4,000.

BUFFALO, N. Y.—The aldermen received the following bids Sept. 6 for constructing a 5-ft. 3-in., 5-ft. 4-in., 5-ft., 4-ft. 9-in., 4-ft. 6-in., 4-ft. 3-in., 4-ft., 3-ft. 9-in. and 3-ft. 6-in. brick sewer in Hampshire St. and Ferry St., from Albany St. to Elmwood Ave.: John Harrer, $34,800; Wm. Franklin, Jr., $34,900; Ritzmann & Miller, $37,900; W. A. Rappich, $38,376; Henry Harter, $38,985; Christ Smith, $45,595.

COHOES, N. Y.—Edward Hayes, Cy. Engr., writes that the statement in our issue of Sept. 1 that "plans for a system marked IXL, prepared by Hunter & Fernald, Melrose, Mass., have been adopted by the commission," is not correct. They received the prize for the best plan submitted. The plan adopted was made by Mr. Hayes, and is similar to the old plan made about a year ago with Rudolph Hering, 100 William St., New York, as consulting engineer.

LANSINGBURG, N. Y.—It is proposed to build a sewer in an alley between 24th and 25th Sts., at a cost of $2,004.

LITTLE FALLS, N. Y.—The council has voted to enlarge certain sewers at a cost of about $8,386, acording to reports. City Engineer Babcock and Mayor Dasey may be addressed.

NEWBURG, N. Y.—The board of public works has recommended to the council the construction of a new sewer in Third St., to cost about $26,647.

SYRACUSE, N. Y.—The city engineer has recommended the construction of a 56 × 84 to 34 × 51-in. brick sewer in West Colvin St. to cost about $26,000, and a 24-in. brick sewer to cost $8,200.

TROY, N. Y.—Bids are asked until Sept. 20 for constructing pipe sewers in three streets. Secy. Contracting Bd., E. Ogden Ross.

JERSEY CITY, N. J.—Bids are asked until Sept. 19 for constructing about 6,000 ft. of 60 to 36-in. brick sewer, etc. Clk. Bd St. and Water Comrs., Geo. T. Bouton.

WILDWOOD, N. J.—Bids are asked until Sept. 21 for repairing and completing the construction of the sewerage system. Clk., Jed Du Bois.

WOODBRIDGE, N. J.—It is stated that an election will be held Sept. 28 to vote on the question of building a system.

BRADDOCK, PA.—The council has been petitioned to build a sewer in Holket Ave. Supt. Pub. Wks., Wm. Howat.

CRAFTON, PA.—Bids are asked until Sept. 20 for constructing 5,140 ft. of 30 to 8-in. pipe sewers. Engr., F. A. McDonald, 813 Penn Bldg., Pittsburg; Clk., R. H. Thomson.

WAYNESBURG, PA.—This place voted Sept. 6 against issuing $19,000 in bonds for constructing a system.

GAINESVILLE, PA.—G. P. Boone, Cy. Clk., writes us that a system for this city has been talked of, but it is not likely that anything will be done this year towards building it.

RANKIN, PA.—The council is reported to have decided to build sewers and pave certain streets notwithstanding that the proposition to issue $25,000 in bonds for the work failed to carry at the recent election.

ORANGEBURG, S. C.—This place is reported to have decided not to build a system at present.

SAVANNAH, GA.—It is stated that the following bids were received by the committee Sept. 1 for building a mile of brick and about 49 miles of pipe sewers for the proposed house drainage system, as advertised in Engineering News: Lauer, Hageman, Brayer & Albaugh, Rochester, N. Y., $269,828; Cranford & Co., Brooklyn, N. Y., $153,495; Greenville Construction Co., $177,021; James F. McCabe, Baltimore, Md., $206,221; Herbert Tate, New York, about $170,000; Miles & Bradt, Atlanta, Ga. (received by mail after opening of bids), about $151,000. Cy. Engr., W. J. Winn.

NASHVILLE, TENN.—The residents of the 10th ward have petitioned the board of public works to build an extension to the Lick Branch sewer at a cost of about $30,000.

COLUMBUS, O.—Director of Public Works Jacobs has suggested that a number of sewers be built at a cost of about $150,000.

MARIETTA, O.—The council has passed an ordinance to build a storm sewer in the Fifth district. Cy. Clk., Carl Becker.

MIDDLETOWN, IND.—It is proposed to construct a sewer in 9th St. Clk., W. L. Campbell.

DELRAY, MICH.—Bids are reported to have been asked by the town clerk for building 9,000 ft. of sewers. The outlet will be into the Rouge River.

WYANDOTTE, MICH.—G. B. Palmer, Engr., Michigan Alkali Co., is reported to have prepared estimates for a system to cost about $33,000.

BLOOMINGTON, ILL.—It is proposed to build the Valley sewer at once.

MILWAUKEE, WIS.—Bids are asked until 10.30 a. m., Sept. 16, for constructing Section No. 6 of the 30th St. sewer tunnel; check, $11,250. The bids for this work received Sept. 8 were considered too high, they ranging from $26 to $32.70 a ft.; total, $78,000. Chn. Bd. Pub. Wks., Geo. H. Benzenberg.

RACINE, WIS.—P. B. Johnson has been awarded the contract for building the sewer extension in 16th St. at $11,641.

DECORAH, IA.—It is proposed to build a system, according to reports. Cy. Clk., E. Mather.

ST. PAUL, MINN.—Bids are asked until Sept. 15 for constructing a sewer in Charles St. Clk. Bd. Pub. Wks., C. H. Bronson.

COLUMBUS, NEB.—Bids are reported as being asked by the West End Sewer Co. for building two miles of pipe sewer at a cost of $5,000.

SCHUYLER, NEB.—Bids are asked until Sept. 20 for furnishing six cars of 25 to 18-in. pipe sewer, according to reports. Clk., N. H. Mapes.

GRAND FORKS, N. DAK.—The aldermen have voted to ask for bids for constructing sewers in certain streets.

BROOKFIELD, MO.—This place, it is stated, will vote at once on the question of issuing $14,000 in bonds for a system.

SEATTLE, WASH.—T. Ryan and J. W. Fitts have been awarded the contracts for building sewers in Dearborn St. and Taylor Ave. at $2,666 and $1,261, respectively.

OAKLAND, CAL.—It is proposed to build sewers in 24th St. at a cost of $8,500, an outlet sewer for the east side, at a cost of about $30,000 and a sewer in the vicinity of Telegraph Ave. and 49th St.

MONTREAL, QUE.—The road committee has decided to recommend to the aldermen the construction of sewers and a sewage disposal farm for St. Denis, to cost about $75,000. Aldermen Brunet and Turner may be addressed.

OTTAWA, ONT.—This city voted Sept. 8 in favor of the main drainage by-law, which authorizes the council to spend $425,000 for a trunk sewer. Chn. Com., Alderman Samuel J. Davis; Consult. Engr., Rudolph Hering, 100 William St., New York.

STRATHROY, ONT.—The question of building a system and water-works is being considered, according to reports.

GARBAGE DISPOSAL—STREET CLEANING

BOSTON, MASS.—Press reports state as follows: Street Superintendent Wells signed a contract Sept. 10 with Herbert Tate, Pres., and Mr. Gooch, Counsel, of the City Refuse Utilization Co. of New York, at $5,500 a year, for the disposal of the refuse in the city. The contract is for 10 years, the city reserving the right to purchase the plant at the end of the first five years. The material will be handled in a building to be erected at Fort Hill Wharf. Work on the plant will begin next week, completing it in time for the plant to be in operation Dec. 1.

ALBANY, N. Y.—The board of contract has given the contract for removing the street dirt, awarded to Jos. S. Droogan last March, to John C. Wasserbach.

BUFFALO, N. Y.—Henry P. Burgard has been awarded the 5-year contract for street cleaning, beginning Sept. 15; bond, $50,000.

UTICA, N. Y.—The council has let the contract for collecting the garbage to Emmett J. Hurley, at $6,445.

READING, PA.—Bids are asked until 4 p. m., Sept. 16, for reconstructing or enlarging the crematory to a capacity for destroying 80 tons of unstrained garbage a day; surety, $3,000. Cy. Engr., S. S. Hoff.

UNIONTOWN, PA.—The borough council is reported as considering the question of purchasing a garbage disposal plant.

WEST CHESTER PA.—A. M. Eachus, St. Comr., is reported as urging the city to purchase additional street sprinklers, etc.

LOUISVILLE, KY.—The board of public works is considering the question of building a crematory to cost about $10,000.

EVANSVILLE, IND.—Frank Pritchett has been awarded the contract for sweeping the streets for one year from Sept. 15 at 18 cts. for 10,000 sq. ft.; total, $5,000.

MARION, IND.—The council and the board of health are considering plans for rebuilding the burned garbage disposal plants.

SOUTH BEND, IND.—L. A. Hull, Cy. Clk., writes us that action is not likely to be taken this season toward securing a garbage disposal plant. The question is only being agitated. Cy. Engr., W. H. Rosencrans.

GALVESTON, TEX.—Dr. W. C. Fisher, Cy. Health Officer, has stated that the city should have two garbage disposal plants.

DENVER, COLO.—The question of a better method of garbage disposal is being considered, according to local papers. Dr. Munn and Superintendent Clark, of the board of health, may be addressed.

SPOKANE, WASH.—W. M. Potter, Health Officer, writes us that nothing has yet been done in regard to a garbage disposal plant.

STREETS AND ROADS.

PITTSFIELD, MASS.—The highway commissioners, Boston, have awarded a contract to Harris & Letteny, Boston, at $6,787, for constructing a section of state roads.

WESTMINSTER, MASS.—C. H. Kelliher, Newburyport, Mass., has been awarded a $3,963 contract for building a state road in this place.

BRIDGEPORT, CONN.—Bids are asked until Sept. 16 for macadamizing on East Main St., according to reports. F. C. Mullins, Clk. Com.

NORWALK, CONN.—Reports state that the question of constructing about 7,000 sq. yds. of brick paving on concrete, is being considered. Chas. N. Wood, Cy. Engr.

SHELTON, CONN.—Bids are asked until 8 p. m., Sept. 16, for grading a section of Canal St. Engr., D. S. Brinsmade, Derby, Conn.; C. V. Case, Borough Clk.

ALBANY, N. Y.—Bids are asked until Sept. 23 for improving the White's Corners Plank Road, between Buffalo and Hamburg. J. L. Little, Division Engr., Powers Block, Rochester; Geo. C. Diehl, County Engr., Buffalo; C. W. Adams, State Engr., Albany.——Plans are being prepared by the clerk of the board of contract, for paving Hamilton St., from Quail St. west. A contract has been awarded to Mulderry Bros., at $32,079, for the brick paving in Elm St.

BUFFALO, N. Y.—The board of public works has awarded a contract to the Barber Asphalt Paving Co., at $33,097, for surfacing Niagara St., from Niagara Square to Porter Ave.

LONG ISLAND CITY, N. Y.—Bids are asked until Sept. 20 for laying asphalt bicycle strips on Fulton Ave. and five other streets. J. P. Keating, Comr. Highways, 150 Nassau St., New York.

NEW YORK, N. Y.—Bids are asked until 11 a. m. Sept. 15 for taking up and relaying pavement now in Park Ave., from 126th St.; also for paving with asphalt pavement the roadway of 19th St., from Eighth to Ninth Ave., etc. J. P. Keating, Comr. Highways, 150 Nassau St.

NIAGARA FALLS, N. Y.—Bids are asked by the board of public works until Sept. 23 for asphalt paving on Cherry St. Walter Jones, Cy. Engr.

PORTCHESTER, N. Y.—The trustees are considering the bid of Erbeck Bros., Homestead, Pa., at $44,533, which was the lowest for paving in Main St.

ROCKTON, N. Y.—Bids are asked until 4.30 p. m., Sept. 17, for grading and macadamizing about 1½ miles of road. F. C. Crane, Cy. Engr., Amsterdam.

SCHENECTADY, N. Y.—Bids are asked by the council until Sept. 20 for grading, flagging, etc., in North St., and paving Hamilton St., from Veeder Ave. to Hulett St.——The question of paving Clinton and Union Sts. will be considered by the aldermen at the October meeting.

SYRACUSE, N. Y.—Bids are asked until Sept. 19 for furnishing the material and for grading plank sidewalks and asphalt paving on certain streets. M. Z. Haven, Cy. Clk.

JERSEY CITY, N. J.—Bids are asked until Sept. 19 for about 1,350 cu. yds. of sand filling, 7,000 sq. ft. of flagging, 6,250 sq. yds. of Belgian paving, etc., on Charles St. Geo. T. Bouton, Clk. Bd. St. Comrs.

PERTH AMBOY, N. J.—A petition has been presented to the board of aldermen for the extension of Wayne St. to Easton St.

WEST HOBOKEN, N. J.—The council has awarded the Barber Asphalt Co. a contract, at $59,552, for paving Clinton Ave.

ALLEGHENY, PA.—New bids are asked for regrading and paving Pennsylvania Ave., from Allegheny Ave. to Beaver Ave. Robt. McAfee, Dir. Pub. Wks.

MAUCH CHUNK, PA.—The council has decided to spend $40,000 in street improvements. The question of increasing the bonded indebtedness to that amount will be voted on at the November election.

NEW KENSINGTON, PA.—It has been voted to issue $45,000 in bonds for street paving, and $15,000 in bonds for sewers, etc.

NORTH WASHINGTON, PA.—Reports state that the council will issue $10,000 in paving bonds.

PATTON, PA.—Bids are asked until Sept. 19 for brick paving, grading, etc., of Magee Ave. E. C. Brown, Borough Engr.

SHAMOKIN, PA.—Ward & Stucker, Harrisburg, Pa., have been awarded a contract to pave Independence St. with Mack brick, which will require about 521,000 brick, at an estimated cost of $20,000.

CUMBERLAND, MD.—Conda Wilson, Chn. St. Com. and J. W. Cook, County Comr., have decided to use the county's appropriation of $2,000 for paving a street west of Mill St.

WILLIAMSPORT, MD.—Reports state that the Cumberland Valley R. R. Co. will macadamize the road to Downsville, a distance of four miles. Address Mayor Thompson.

NEW ORLEANS, LA.—We are informed that the council has rejected all the bids for asphalt paving, etc., in Canal St. The itemized bids were given in our issue of Aug. 25. The specifications called for bids for paving the entire street including the neutral ground, on which four or five street railway tracks run for the entire distance. While the bids were being considered an attempt was made by the city authorities to make some arrangement with the railways by which the paving of the neutral ground could be carried on simultaneously with the rearrangement of their tracks. This, however, fell through, and the railways have threatened to take the matter to court. The council then considered the bids for the street and neutral ground separately, and finally decided to reject all bids. The paving of Claiborne and Camp Sts. was awarded to the General Asphalt Co., at $24,687, and to the Ayres Asphalt Paving Co., at $39,174, respectively.

CAMBRIDGE, O.—Bids are asked until Sept. 24 for the purchase of $9,000 of 4½% street bonds. T. R. Deselm, Cy. Clk.

CINCINNATI, O.—Bids are asked until Oct. 5 for grading, granite curbing and granite paving in Delhi Ave. G. H. Spellmire, Clk. Bd. Cy. Affairs.

NORWALK, O.—Bids are asked until Oct. 4 for furnishing the material and constructing a brick pavement, etc., on Norwood Ave. F. W. Christian, Cy. Clk.

ORRVILLE, O.—Herring & Son, Mansfield, O., have been awarded a contract for paving Main St., to cost about $11,000.

SALEM, O.—Davis & Caldwell, Youngstown, O., submitted the lowest bid Sept. 5 for paving North Lundy St., at $4,392.

TOLEDO, O.—Bids are asked until Oct. 10 for paving in Kelsey Ave. with Wassal or Buckeye repressed blocks, etc. L. P. Harris, Cy. Clk.

TOLEDO, O.—Bids are asked until Oct. 3 for furnishing and constructing Wassall block pavement, etc., on 6-in. concrete foundation, on Ontario St. L. P. Harris, Cy. Clk.

ANDERSON, IND.—The council is considering a proposition to pave six streets with asphalt.

BROWNSTOWN, IND.—Bids are asked until Sept. 23 for constructing 12 gravel or macadam roads. John D. Durment, County Audr.

INDIANAPOLIS, IND.—Bids are asked until 10 a. m., Sept. 19, for constructing cement sidewalks, etc., on portions of five streets, and asphalt paving in 11th St. M. A. Downing, Chn. Bd. Pub. Wks.

INDIANAPOLIS, IND.—Bids are asked until Sept. 23 for sidewalks on Pennsylvania St. and Holloway Ave. M. A. Downing, Chn. Bd. Pub. Wks.

NORTH VERNON, IND.—Bids are asked until Sept. 23 for furnishing the material and constructing cement walks on State St., between Walnut and Greenburg Sts., and until Oct. 14 for cement sidewalks on Hicks St. Chas. H. Everett, Cy. Clk.

ROCKVILLE, IND.—Bids are asked until Sept. 30 for grading and graveling about seven miles of road in Adams and Florida townships. E. H. Owen, County Audr.

OWOSSO, MICH.—The Warren-Scharf Asphalt Paving Co. was awarded a contract Sept. 6 by the council for asphalt and brick combination pavement, to cost about $35,000, according to reports.

CEDAR RAPIDS, IA.—Bids are asked until 12 m., Sept. 15, for asphalt paving on First Ave., between 10th and 13th Sts. R. N. Buck, Chn.

DULUTH, MINN.—Bids are asked until 10 a. m., Sept. 16, for grading, etc., in 34th and 52d Aves. R. Murchison, Clk. Bd. Pub. Wks.

OMAHA, NEB.—Bids are asked until Sept. 23 for resetting old curb and paving with sheet asphalt, brick or stone on 32d Ave. Andrew Rosewater, Chn. Bd. Pub. Wks.

GRAND FORKS, N. DAK.—Bids are asked until 7 p. m., Sept. 19, for brick or stone paving. F. A. Brown, Cy. Audr.

KANSAS CITY, MO.—Bids are asked until Sept. 20 for furnishing and constructing brick sidewalks on Hickory St. H. A. Wise, Cy. Engr.

DENVER, COLO.—The Denver Paving Co. has submitted the lowest bid, at $71,222, for paving with alcatraz asphalt on Champa St.

PORTLAND, ORE.—The council has awarded contracts to the Trinidad Asphalt Paving Co., at $2,544, for paving in Fifth St., and at $15,542 for paving in Alder St.

ALAMEDA, CAL.—Bids are asked until 11 a. m., Sept. 19, for grading a road. F. C. Jordan, Clk.

NAPA, CAL.—Bids are asked until 7:30 p. m., Sept. 19, for grading First St., from Combs to Monroe St. H. H. Thompson, Cy. Clk.

NIAGARA FALLS, ONT.—Bids are asked until 4 p. m., Sept. 15, for 47,000 sq. ft. of concrete sidewalk, 7,000 sq. ft. of brick sidewalk, 8,000 lin. ft. of stone curb, etc. C. H. Mitchell, Engr.; John Robinson, Town Clk.

MANUFACTURING PLANTS.

MILTON, N. H.—The entire plant of the Waumbeck Woolen Mills was burned Sept. 11, at a reported loss of about $90,000; insurance, $70,000.

ALBANY, N. Y.—The Helderberg Cement Co., 86 State St., which recently put in operation a new plant at Howe's Cave, N. Y., is contemplating the quadrupling of its plant this winter.

CONSHOHOCKEN, PA.—The brewing plant at this place was burned Sept. 8; total estimated loss, $100,000.

PHILADELPHIA, PA.—George C. Dietrich is stated to have been awarded the contract for erecting the ordnance machine shop No. 2 for the Midvale Steel Co., at Nicetown, at $69,000.

LYNCHBURG, VA.—The Lynchburg Cotton Mills Co. expects to double the capacity of its plant.

RICHMOND, VA.—Press reports state that a large shipyard may be established in this city as the result of the award for the construction of several torpedo-boats and destroyers to W. R. Trigg & Co., of Richmond. The government allows three months in which to make preparations.

WARSAW, VA.—L. A. Courtney, whose canning plant was recently burned, is expected to rebuild at once.

McADENSVILLE, N. C.—It is reported that contracts will soon be let for erecting a large cotton spinning plant at this place. Among those interested are, J. H. McAden, Charlotte, N. C.; G. C. Love, Gastonia, N. C., and A. P. R. Lyne, Mount Holly, N. C.

REIDSVILLE, N. C.—The capacity of the Edna Cotton Mills is expected to be doubled.

NEWBERRY, S. C.—E. B. Wilbur and others contemplate erecting a cotton mill at this place.

SPRINGFIELD, S. C.—M. L. Gleaton, of Springfield, is interested in a 5,000-spindle cotton mill which it is proposed to erect here.

SHEFFIELD, ALA.—Press reports state that the Anglo-American Steel Co., of Sheffield, incorporated in Alabama Aug. 31, with a capital stock of $1,000,000, will soon erect a large steel mill in this town.

LEXINGTON, MISS.—The Lexington Compress & Oil Mill Co., of Lexington, informs us that W. O. Glass, Yazoo City, Miss., has been awarded the contract for erecting the new buildings, to cost about $8,000. All the contracts let amount to $30,000; some other small additions may be needed.

MEMPHIS, TENN.—The Memphis Grain Elevator & Mfg. Co., and the Eagle Mills, were destroyed by fire Sept. 8. Total loss, $242,000; insurance, $75,000.

TOLEDO, O.—It is reported that the contract for constructing the Ford glass plant has been awarded to the Shiffler Bridge Co., Pittsburg, to cost $250,000.

DETROIT, MICH.—Plans have been prepared, according to reports, for a new brick factory building, 85 x 240 ft., to be erected on Harper Ave., for Murphy, Wasey & Co., at a cost of about $30,000. Arch., R. E. Raseman.

SOUTH MILWAUKEE, WIS.—It is reported that the United States Glue Co. will establish a new plant at Oak Creek, two miles from this city, and that six buildings will be erected at a cost of about $100,000. Pres., Fred. Vogal, Jr.; Vice-Pres., A. O. Trostel, of Milwaukee.

CONTRACT PRICES.

SEWERAGE SYSTEM.—Clinton, Mass.—The Metropolitan Water Board, Boston, received the following bids Sept. 1 for constructing section 2 of the proposed sewerage system, including the intercepting sewer, reservoir, pumping station, force mains, etc., as advertised in Engineering News; contract awarded Owen Cunningham & Son:

Bids Received at Boston, Mass., Sept. 1, 1898, for Constructing Section 2 of the Sewerage System for Clinton.

Quantities.		O. Cunningham & Son, Somerville, Mass.	Edw. R. Patteson, Hartford, Conn.	M. & T. Murphy, Clinton, Mass.	Jos. D. Gennaro, Boston, Mass.	Messrs. Nawn & Brock, Boston. Mass.	Aab & Co., Waltham, Mass.	McCusker Bros., Waltham, Mass.	Chas. G. Craib, Winthrop, Mass.	Jones & Meehan, Boston, Mass.	C. E. Trumbull & Co., Boston, Mass.	Long & Little, Leominster, Mass.	Moulton & O'Mahoney, Boston, Mass.
Earth excavation for intercepting sewer ..	7,100 cu. yds.	$0.40	$0.48	$0.35	$0.40	$0.40	$0.45	$0.80	$0.80	$1.00	$0.65	$0.60	$0.55
For reservoir and pumping station.....	7,500 " "	.50	.55	.90	1.25	.70	.98	.80	1.00	.80	2.00	2.00	2.25
Borrowed earth	1,500 " "	.25	.22	.20	.25	.30	.33	.35	.50	.50	.30	.40	.35
Rock excavation.	200 " "	3.00	1.75	2.40	2.00	3.00	2.50	6.00	4.00	4.00	4.00	4.00	4.00
Brick masonry, Rosendale cement mortar..	330 " "	11.50	9.50	11.25	13.00	13.00	14.40	14.00	12.50	13.00	12.50	14.00	14.00
Brick masonry, Portland cement mortar..	55 " "	13.00	11.70	12.00	16.00	16.00	16.80	15.50	14.00	13.50	14.00	18.00	18.00
Rosendale cement concrete masonry.......	170 " "	4.50	4.00	4.00	4.20	5.00	4.80	5.50	5.00	5.00	6.00	5.00	6.00
Portland cement concrete masonry	1,390 " "	6.50	7.50	6.00	5.80	8.00	7.20	7.00	8.00	7.00	8.00	7.00	9.00
Stone masonry laid in mortar	130 " "	4.00	6.50	7.50	5.80	8.00	8.00	7.00	4.50	10.00	7.00	6.00	10.00
Stone paving.	20 " "	2.00	2.00	1.85	2.00	4.00	2.16	2.50	4.00	5.00	1.50	4.00	3.00
Furnishing and laying vit. pipe 24-in.....	900 lin. ft..	1.00	.85	.88	.82	1.05	1.00	1.05	1.00	1.25	.87	1.00	.88
20-in.....	3,550 " "	.85	.62	.70	.60	.80	.60	.70	.80	1.10	.67	.90	.65
6-in.....	4,000 " "	.25	.14	.20	.12	.20	.24	.15	.20	.25	.25	.30	.25
Laying 18-in. cast-iron pipe..............	2,290 " "	.60	.72	.60	.61	.50	.60	.35	.50	1.00	.55	.90	.80
Laying 16-in. cast-iron pipe	105 " "	.60	1.00	.50	.50	.50	.60	.30	.50	.90	1.00	.90	.75
Spruce lumber placed in foundations	24 M. ft...	25.00	25.00	30.00	30.00	24.00	22.00	17.00	40.00	30.00	40.00	35.00	30.00
Total		$29,390	$29,861	$30,643	$33,247	$33,759	$35,078	$35,774	$38,958	$40,797	$45,326	$46,001	$49,335

CONSTRUCTION MATERIALS.—Fort Delaware, Del.—Lieut.-Col. C. W. Raymond, U. S. Engr., Philadelphia, received the following bids Sept. 5, 1898 for furnishing various construction materials, as advertised in Engineering News: American Rosendale cement, 36,000 bbls., Lawrenceville Cement Co., New York, Beach's brand, 68¾ cts. a bbl.; Newark & Rosendale Lime & Cement Co., New York, Newark brand, 77½ cts.; Lawrence Cement Co., New York, Hoffman brand, 68 cts.; American Portland cement, 4,000 bbls., Wm. J. Donaldson, Philadelphia, Alpha brand, $2.35; Walter F. Bradley Co., Philadelphia, Penn brand, $1.91; Commercial Wood & Cement Co., Philadelphia, Lehigh brand, $2.10; Chas. Warner Co., Wilmington, Del., Atlas brand, $2.45 a bbl.; Broken stone, small, 24,000 cu. yds., Standard Lime & Stone Co., Baltimore, Md.; $1.12 a cu. yd.; Jno. T. Dyer, Norristown, Pa., 98 cts.; Irvine & Carty, Philadelphia, $1.40; Robt. Patterson & Son, Philadelphia, $1 54¼; Delaware Construction Co., Wilmington, $1.04½; Brandywine Granite Co., Wilmington, Del., $1.20; Broken stone, large, 5,000 tons of 2,240 lbs.; (1) being delivered in scows, and (2) delivered in cars, Standard Lime & Stone Co., (1) $1.12 a ton; Jno. T. Dyer, (2) 73 cts.; Delaware Construction Co., (1) 90 cts., (2) 90 cts.; Brandywine Granite Co., (1) 85 cts., (2) 85 cts.; Sand, washed, 9,000 cu. yds., Robt. Patterson & Son, 37½ cts. a cu. yd.; Chas. Warner & Co., 28 cts.; Sand, unwashed, 18,000 cu. yds., Patterson & Son, 29½ cts. a cu. yd.; Delaware Construction Co., 24 cts.; Warner & Co., 24 cts.; I-beams, (1) being for steel I-beams and channels, 163,660 lbs., (2) for bearing plates, 19,668 lbs., and (3) for standard connections, angles and bolts, 1,748 lbs., Phoenix Iron Co., Philadelphia, (1) 1½ cts. a lb.; (2) 1½ cts.; (3) 3 cts. a lb.; A. & P. Roberts Co., Philadelphia, (1) 1 438-1,000 cts.; (2) 1 33-100 cts.; (3) 1 76-100 cts.; Standard Supply & Equipment Co., Philadelphia, (1) 1 4,375-10,000 cts.; (2) 1 3,275-10,000 cts.; (3) 1¾ cts.; totals of bids recommended for acceptance, John T. Dyer, Norristown, Pa., all broken stone, $27,170; Commercial Wood & Cement Co., Philadelphia, American Portland cement, $8,400; Chas. Warner & Co., Wilmington, Del., all sand, $6,840; Standard Supply & Equipment Co., Philadelphia, I-beams, plates, bolts, etc., $2,644; Lawrence Cement Co., New York, American Rosendale cement, $24,480.

SEWAGE FILTER BEDS.—Clinton, Mass.—The following bids were received by the Metropolitan Water Board, dam and aqueduct department, Boston, Sept. 1, for constructing filter beds for the sewerage system in this city, as advertised in Engineering News; contract awarded to Newell & Snowling Construction Co.:

Bids Received at Boston, Mass., Sept. 1, 1898, for Constructing Filter Beds for Sewerage System.

Bidder.	Earth excavation, 64,000 cu.yds.	Masonry. Brick, 80 cu.yds.	Masonry. Cncte., 65 cu.yds.	Stone paving, 15 cu.yds.	Vitrified pipe. 24-in., 1,180 lin. ft.	Vitrified pipe. 18-in., 3,680 lin. ft.	Vitrified pipe. 12-in., 250 lin. ft.	Vitrified pipe. 8-in., 1,720 lin. ft.	Vitrified pipe. 6-in., 1,440 lin. ft.	Total.
Owen Cunningham & Son, Somerville......	$0.20	$11.50	$5.00	$2.50	$1.20	$0.60	$0.45	$0.35	$0.20	$18,709
Newell & Snowling Const'n Co., Uxbridge..	.19	15.00	6.00	5.00	1.00	.60	.40	.55	.53	19,022
Lucian A. Taylor, Boston	.184	13.00	8.15	1.50	1.04	.62	.44	.65	.65	19,041
Neill Devine, Clinton	.19	13.50	7.00	1.50	1.10	.80	.60	.40	.37	19,330
Moulton & O'Mahoney, Boston............	.20	15.00	8.00	3.00	.93	.53	.35	.53	.50	19,332
Long & Little, Leominster................	.19	15.00	6.00	4.00	1.00	.80	.60	.50	.40	19,520
McCusker Bros., Waltham.	.18	13.00	6.00	2.50	1.30	.80	.36	.70	.59	19,609
Andrew Carberry, East Walpole	.21	13.00	5.00	2.00	1.00	.58	.49	.50	.48	19,823
Jos. D. Gennaro, Boston	.21⅞	13.00	5.00	2.00	.99	.73	.50	.50	.40	20,811
Auguste Saucier, South Framingham.......	.22	14.00	5.50	1.50	1.25	.80	.55	.50	.45	21,645
H. P. Nawn and N. S. Brock, Boston......	.24	14.50	6.50	3.50	1.10	.70	.55	.73	.70	23,270
Aab & Co., Waltham	.52	12.50	6.60	2.05	1.10	.64	.57	.51	.46	40,075

DREDGING.—Waukegan, Ill.—The council has let the contract to Calkins, Stickney & Hoit, Detroit, for dredging in the harbor, at 12 cts. a cu. yd.

BRICK PAVING.—Glens Falls, N. Y.—The Troy Public Works Co., Utica, N. Y., has been awarded the contract, at $1.68 a sq. yd., for paving a portion of Glen St. with bevelled-edged brick made by the Eastern Paving Co., Catskill, N. Y.

MISCELLANEOUS CONTRACTS.

BONDS.—Calgary, Alberta, N. W. Ter.—Bids are asked until Oct. 1 for the purchase of $25,000 of 4% bonds. C. McMillan, Cy. Clk., Calgary.

FIRE HOSE.—Saginaw, Mich.—Bids are asked until 4:30 p. m., Sept. 16, for furnishing 1,000 ft. of 2½-in. fire hose. Controller, A. F. Lewis.

BARGE.—Biloxi, Miss.—Bids are asked until Sept. 22 for constructing a barge for the use of dredging. A. C. Smith, Asst. Surgeon, Quarantine Station, Biloxi.

ROTARY NOZZLES.—New York, N. Y.—Bids are asked until Sept. 21 for furnishing three rotary nozzles. Fire Comr., Jno. J. Scannell, 157 E. 67th St., Manhattan.

DREDGING.—Tecumseh, Ont.—Bids are asked until Sept. 17 for dredging in the East Marsh drain. A. J. Halford, Engr., Windsor, Ont.; W. Renaud, Township Clk., Tecumseh.

PIERS, Cleveland, O.—The board of public works has awarded a contract to the L. P. & J. A. Smith Co., Cleveland, at $157,000, for the construction of five piers between Seneca and Erie Sts.

STEAM GENERATORS.—League Island, Pa.—Bids are asked until Sept. 17 for installing steam generators at the League Island navy yard. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

DREDGING PLANT.—Mobile, Ala.—Bids are asked until Oct. 13 for the hire of a dredging plant for work at Mobile River and Bay, as stated in our advertising columns. Maj. Wm. T. Rossell, U. S. Engr., Mobile.

DOCK.—Vancouver, B. C.—The New Vancouver Coal Co. proposes to construct a new loading dock, according to reports.

FIRE TRUCK, ETC.—New Rochelle, N. Y.—The trustees will hold an election Oct. 17 to vote on the question of appropriating $5,000 for the purchase of an aerial fire truck and additional hose. The money will be secured by issuing bonds.

FIRE ALARM SYSTEM.—New Orleans, La.—The fire and lighting committee has referred a petition to the assessment committee, recommending that $25,000 be appropriated for a new fire alarm system. Councilman Lafaye may be addressed.

TELEPHONE LINE.—Monroe, Wis.—Reports state that J. F. Sears, Monticello; Erwin Gabriel, Stewart, and Dr. McKeller, Blanchardsville, are about to erect a long-distance telephone line from Monroe to Blanchardville, including all intervening points.

DREDGING, ETC.—Stockton, Cal.—It is reported that steps are being taken by the board of public works to dredge a channel near this city and for the purchase of two self-dumping mud scows with a capacity of 150 cu. yds. Address the superintendent of streets.

LOCK WALLS, ETC.—Kentucky River, Ky.—Thos. C. Sheridan, Buffalo, W. Va., has been awarded a contract, at $188,398, for constructing the masonry lock walls and abutments for the dams of lock No. 8, Kentucky River, as described in our issue of Aug. 4. Capt. J. G. Warren, U. S. Engr., Louisville, Ky.

SEA WALLS, ETC.—Baltimore, Md.—We are informed that the following bids were received Sept. 9 for constructing sea walls and embankments at North and Hawkins Points, Md., advertised in Engineering News Aug. 18 to Sept. 8. Second Lt. Chas. W. Kutz, U. S. Engr., Baltimore:

Geo. F. Nardin, Baltimore (whole work)........	$28,362
Riley & Brubaker, Philadelphia (whole work)....	37,833
T. B. Jones & Co., Baltimore (whole work).......	36,367
R. P. McCormick, Baltimore (whole work).........	24,967
A. Weber and J. C. Smith, Baltimore (whole work).	28,015
W. D. Johnston, Phila.; J. O. Reynolds, N. Y....	36,036
Wm. E. Anderson, Baltimore (Class B)..........	8,022
Owen Patterson, Baltimore (whole work).........	36,719
Kirk, Driscoll & Co., Syracuse, N. Y. (whole work).	28,986
Wm. McRoberts, Jr., Baltimore (Class B).........	34,144
Roland W. Finch, Baltimore (Class B)..........	8,499
R. P. Fitch, New York (whole work)	39,351
Sanford & Brooks Co., Baltimore (whole work)..	40,243

TELEPHONE SYSTEM.—Kenton, O.—The Home Telephone Co. has let the contract for the construction of the new telephone system to the Central Construction Co., of Wauseon.

TELEPHONE LINE.—Pierre, S. Dak.—Reports state that Nornagle Zeitlow, of the Dakota Central Telephone Co., was in town Aug. 30 to make arrangements to extend the line west from Wolsey.

COALING STATION.—Pago Pago, Samoa.—Cotton Bros., Oakland, Cal., have submitted the lowest bid, at $133,387, for constructing the steel coaling sheds, wharf, etc., for the U. S. coaling station here. A report states, however, that the contract was let Sept. 13 to Healey, Tibbitts & Co., San Francisco, at $142,900.

DREDGING, ETC.—Wilmington, Del.—Bids are asked until Oct. 10 for dredging and rock removing for a channel 150 ft. wide and 18 ft. deep, in the Christiana River and Delaware Harbor, as stated in our advertising columns; $205,846 has been appropriated for this work. Wm. F. Smith, U. S. Agent, Wilmington.

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INDUSTRIAL NOTES.

EXHIBITS AT THE ANNUAL CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

JAMES BRYAN & CO., Pittsburg, Pa., exhibited their rail bonds.

VACUUM OIL CO., Rochester, N. Y., had an exhibit of its products.

THE CORNING BRAKE-SHOE CO., New York, showed its brake-shoes.

OHIO BRASS CO., Mansfield, Ohio, had an attractive display of brass goods.

CHAS. SCOTT SPRING CO., exhibited springs for trolley poles, car trucks, etc.

MEAKER MFG. CO., North Chicago, Ill., exhibited several car-fare registers.

STERLING ARC LAMP CO., New York, exhibited several of its enclosed arc lamps.

KOSMIC OIL FILTER CO., Easton, Pa., exhibited three sizes of Kosmic oil filters.

THE WILLIAMS TRUSS RAIL JOINT CO., Boston, Mass., exhibited a full-sized rail joint.

THE AMERICAN RAILWAY SUPPLY CO., New York, displayed a number of car name plates.

THE MONARCH STOVE & MFG. CO., Mansfield, Ohio, exhibited a track cleaner and car stoves.

JOHN T. McROY, New York, was on hand with specimens of the McRoy vitrified clay conduit.

ELMER P. MORRIS, New York, represented manufacturers of various street railway supplies.

HAM SAND-BOX CO., Troy, N. Y., exhibited a sample "Ham" Sand-Box for use upon trolley cars.

THE DUFF MFG. CO., Allegheny, Pa., showed four or five jacks suitable for car and railway work.

SENFORD MILLS, Senford, Me., displayed samples of plush and mohair suitable for car upholstery.

THE WEBER RAILWAY JOINT MFG. CO., New York, had on exhibition specimen Weber rail joints.

NEW YORK SWITCH & CROSSING CO., New York, had in operation a full-sized electric switch point.

PEARSON JACK CO., Boston, Mass., showed several sizes and styles of its well-known car replacing jack.

D. C. SWEET, Springfield, Mass, had a full-sized Sweet's carwheel grinding machine on exhibition.

A. O. NORTON, Boston, Mass., had several Norton jacks suitable for car replacement and general street railway work.

R. BLISS MFG. CO., Pawtucket, R. I., exhibited a platform equipped with two Wood's patent folding platform gates.

CHRISTENSEN ENGINEERING CO., Milwaukee, Wis., had a comprehensive exhibit of the Christensen air-brake system.

THE CHICAGO RHEOSTAT CO., Chicago, Ill., had on exhibition specimens of its automatic motor starting rheostat.

E. F. DE WITT & CO., Lansingburgh, N. Y., had on exhibition a "Common Sense" sand box for street railway use.

ROCHESTER HOSE BRIDGE CO., Rochester, N. Y., had one of its hose bridges assembled on the floor of the main hall.

LYTE STEEL & LEAD WOVEN TREAD CO., Boston, Mass., had samples of a new form of car step tread on exhibition.

DIAMOND STATE IRON CO., Wilmington, Del., had on exhibition models of the "Churchill" rail joint for tee and girder rails.

THE WM. H. GALLISON CO., Boston, Mass., called attention to its steam piping by means of a large Gallison relief valve.

GOLD STREET CAR HEATING CO., New York, had a number of car heaters on hand, of both flat and cylindrical types.

THE COLUMBIA MACHINE WORKS, Brooklyn, N. Y., had a line of trolley wheels, overhead fittings, commutator bars, etc.

THE ADAMS & WESTLAKE CO., Chicago, exhibited car curtains, lights, flexible rail bonds and numerous other supplies.

THE SANITARY ENGINEERING CO., Philadelphia, Pa., had on hand full-sized models of the "Botfield" noiseless manhole cover.

McCARDELL, WEST & CO., Trenton, N. J., exhibited one of its Trenton trolley wagons with revolving platform and extension tower.

BEMIS CAR BOX CO., Springfield, Mass., exhibited a single truck for short cars and a center-bearing double truck for long cars.

NEW YORK CAR WHEEL WORKS, Buffalo, N. Y., exhibited full-sized standard machined car wheels for electric street railway service.

THE PANTASOTE CO., New York, had several street car seats covered with different patterns of "Pantasote," a substitute for leather.

HAMPDEN CORUNDUM WHEEL CO., Brightwood, Mass., displayed a full-sized special grinding machine for truing up car wheels.

BIBBER-WHITE CO., Boston, Mass., exhibited a full line of trolley fittings, also a number of spring snap knife switches, commutators, etc.

ROBINSON RADICAL TRUCK CO. had two small working models to illustrate the action of the three pairs of wheels in rounding curves.

REED MFG. CO., Erie, Pa., Frederick C. McServees, agent, New York, exhibited several different sizes of the Reed standard pipe wrench.

J. H. McGRADY, Boston, Mass., had a model of a car roof on exhibition upon which was mounted a set of Swift's illuminated reversible signs.

THE R. WOODMAN MFG. & SUPPLY CO., Boston, Mass., exhibited an assortment of ticket punches, single and duplex, and speed gages.

AMERICAN VITRIFIED CONDUIT CO., New York, had a working full-sized exhibit of its subway system.

THE ASHTON VALVE CO., Boston, Mass, exhibited a large assortment of its well-known valves and steam gages.

THE TONKIN BOILER CO., New York, had a Tonkin, internally fired, water-tube boiler installed at one end of the exhibition hall.

THE SAFETY THIRD-RAIL ELECTRIC CO., New York, exhibited a model elevated road about 70 ft. in circumference, operated by its system.

THE STERLING SUPPLY & MFG. CO., New York, showed its fare registers, a variety of brass car fittings, car fenders and other supplies.

PENNSYLVANIA CAR WHEEL CO., Pittsburg, Pa., had specimen motor car and trailer wheels. These were 24, 28, 30 and 33 ins. standard wheels.

THE CONSOLIDATED CAR-HEATING CO., Albany, N. Y., had an array of car heaters, switches, regulators, etc., for various kinds of service.

PENNSYLVANIA STEEL CO., Steelton, Pa., had in its exhibit railway frogs, crossings, switchpoints, etc., using "Adamantine" steel for center plates.

METHUEN ELECTRIC CO., Methuen, Mass., exhibited a new form of insulator for screw coupled wire joints, intended to do away with the use of tape.

J. G. BRILL CO., Philadelphia, Pa., had a large exhibit of car trucks, including their "Perfect," "Eureka Maximum Traction" and other standard forms.

McGUIRE MFG. CO., Chicago, Ill., had on exhibition a large single car truck, a motor truck sweeper and snow plow, and several coal-burning car-heaters.

STANDARD UNDERGROUND CABLE CO., Pittsburg, Pa., showed short sections of wires and cables, which clearly indicate the make up of its goods.

DUQUESNE FORGE CO., Pittsburg, Pa., exhibited several split steel axle gears, which are built up of forged steel tires and cast-steel spokes and hub.

KEYSTONE ELECTRICAL INSTRUMENT CO., Philadelphia, Pa., had a sham switchboard, upon which was a number of station instruments and switches.

BALTIMORE CAR WHEEL CO., Baltimore, Md., exhibited a No. 10 center-bearing truck for heavy car service and a "Lord Baltimore" single truck for lighter work.

WADSWORTH, HOWLAND & CO., Boston, Mass., exhibited a number of panels coated with its coach colors, and also displayed an assortment of prepared paints.

SAMPSON CORDAGE WORKS, Boston, Mass., exhibited a case containing samples of the "Sampson Spot" braided colored cord for bell ropes and fare registers.

ROCHESTER CAR WHEEL WORKS, Rochester, N. Y., had 12 sample wheels of different sizes and four pairs of standard street railway wheels mounted upon car axles.

WAGNER ELECTRIC CO., St. Louis, Mo., had several switchboard instruments for street railway power stations of the dial dead-beat type, also switches and transformers.

PARTRIDGE MOTOR BRUSH CO., Sandusky, O., was represented by its agent, Elmer P. Morris, New York, who exhibited a case of carbon self-lubricating brushes.

CROSBY STEAM GAGE & VALVE CO., Boston, Mass., exhibited spring seat globe and angle valves, recording gages, steam gages, steam indicators and Branden pump valves.

TAUNTON LOCOMOTIVE MFG. CO., Taunton, Mass., had in the basement three full-sized snow plows, weighing from 8½ to 10 tons, and intended for city or interurban service.

WHEEL TRUING BRAKESHOE CO., Detroit, Mich., had samples of its brakeshoes. These shoes have cast pockets into which is compressed a paste of some abrasive material

THE PECKHAM TRUCK CO., New York, had an exhibit which included eleven car trucks designed for special service. This was one of the largest exhibits at the convention.

AMERICAN MASON SAFETY TREAD CO., Boston, Mass., had samples of its safety tread, which consists of a steel base supporting ribs, between which are held strips of lead.

CHAS. N. WOOD, Agent, Boston, Mass., showed a large variety of electric railway supplies, including a trolley pole catching device to hold the pole down should the wheel run off.

J. D. REED, Boston, Mass., exhibited a number of models of rail joints, track sections and methods of supporting rails included in what is termed the "Perfect" railway systems.

THE INCANDESCENT ELECTRIC LIGHT MANIPULATOR & CLEANER CO., Hyde Park, Mass., showed an extension pole and clamp for replacing or cleaning incandescent light bulbs.

MICA INSULATOR CO., New York, exhibited samples of "micanite" goods, showing how this material is made up for commutators, insulating rings and for other electrical purposes.

THE HIPWOOD-BARRETT CAR & FENDER CO., Boston, Mass., exhibited a very neat model of a new type of car fender provided with a device to follow any unevenness of the street surface.

BORDMAN-TUCKER CO., Boston, Mass., had a number of railway telephones in different parts of the hall and a signal telephone set intended for use along the suburban track on exhibition.

SPRINGFIELD MFG. CO., Bridgeport, Conn., had a working exhibit, which included one of its steam and electric car wheel grinders belted to a motor with a pair of wheels in place ready for truing up.

H. W. JOHNS MFG. CO., New York, displayed its regular line of electric railway and car material, including car heaters and insulators of various kinds for use in motor and line construction, etc.,

JOHN F. OHMER REGISTER CO., Dayton, O., exhibited the top and end of a car with the Ohmer register in place. This register makes a printed classified statement of the various fares collected.

BRADY METAL CO., New York, had a number of sample bearings lined with its special lead alloy. Samples of "Magnus" metal and car brasses made of this material and battery zincs were also shown.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., made a display of its products suitable for railway use, including grease for trolleys, graphite paint, belt dressing and other graphite products.

THE BILLINGS & SPENCER CO., Hartford, Conn., displayed several artistic panels upon which were mounted a large number of drop-forged commutator segments for a variety of motors and generators.

PETTIGELL & ANDREWS CO., Boston, Mass., had on exhibition a 600-ft. roll of 500,000 circular mils Okonite wire and short samples of smaller sizes. A miscellaneous assortment of supplies was also shown.

THE AMERICAN RAIL JOINT & MFG. CO., Cleveland, Ohio, had a number of its rail joints on exhibition.

CAMBRIA IRON CO., Johnstown, Pa., showed short sections of rails cut at joints showing the fish-plates and how the joints were made.

THE COMPOSITE BRAKE SHOE CO., Boston, Mass., exhibited a number of specimen "compo" (cork inserted) brake shoes which had seen hard service and several new shoes showing the original appearance.

BEVERLY MACHINE WORKS, Beverly, Mass., had an exhibit of ratchet street car brakes, ratchet clutch vertical brake wheels for vestibule cars, and an assortment of car trimmings and small brass street railway supplies.

BRIGGS CAR CO., builders of the Duplex convertible car, had on exhibition a fine specimen of car work in an improved cylindrical duplex car which can be changed from a closed to an open car by sliding up the windows and sides.

ALBERT & J. M. ANDERSON, MFG. CO., Boston, Mass., displayed a light steel trolley cross-over, enclosed incandescent arc lamps burning 150 hours, hangers, pull-offs, span insulators and a large variety of trolley parts and brass goods.

BOSTON ARTIFICIAL LEATHER CO., Boston, Mass., exhibited a line of material known as "moroccoline," a material used for upholstering chairs, car seats, etc. Several street car seats were covered to show the appearance under working conditions.

HAROLD P. BROWN, New York, had on exhibition specimens of the Edison-Brown plastic rail bond, of various styles. The wearing qualities of this bond in comparison with other types, was shown by bonds which had been in use for some time.

WM. WHARTON, JR., & CO., Philadelphia, Pa., Harrington, Robinson & Co., Agents, Boston, Mass., had on exhibition specimens of special work, such as cross-overs, frogs and switchpoints, all provided with manganese steel wearing plates.

PROVIDENCE CAR FENDER CO., Providence, R. I., had three dash-boards representing car fronts placed together upon which were mounted "Providence Fenders." Distributed about were parts of this fender to show the construction and simplicity of this type.

SHERBURNE & CO., Boston, Mass., as Eastern Agents of the Watson-Stillman Co., New York city, showed hydraulic rail benders with vertical and horizontal plungers, hydraulic punches and jacks, and a motor lifting jack intended for use in the car pit of car barns.

TAYLOR ELECTRIC TRUCK CO., Troy, N. Y., exhibited an improved single truck, a single truck with extension truss for long cars, single extra heavy truck with an 8-ft. wheel base and a pair of regular "Empire State" radial trucks of new design with a swinging bolster.

JOHN STEPHENSON CO., LTD., New York, had inside the hall a beautiful 6-ft. model of the Broadway cable car complete in all details. Just outside the exhibition building was a standard full-sized car such as is now in use upon the Metropolitan Madison Ave. line, New York city.

WALKER CO., Cleveland, O., had a section of conduit street railway about 50 ft. long, complete in all details, and upon this was mounted a single truck equipped with two 33 "S" Walker motors. In addition there were two 15 "L" motors for elevated service; a 33 "S" steel railway motor; solenoid "S" controllers, open and in operation to show the solenoid spark blow-out. Other exhibits showed the construction of its motors.

WILLIAM F. ELLIS, Agent, Boston, Mass., displayed samples of the goods, for which he is the New England agent, as folows: Ramapo Iron Works, Hillburn, N. Y., "Diamond S" brake shoe; Dilworth, Porter & Co., Ltd., Pittsburg, Pa., Goldie perfect point spike and claw tie-plate; Continuous Rail Joint Co. of America, Newark, N. J., joints for tees and girder rails; J. H. Sternbergh & Sons, Reading, Pa., Harvey grip and U. S. rolled thread bolts of steel.

THE JOHNSON CO., Lorain, Ohio, had two exhibits, one on the main floor including short sections of rails and cable slot rails, and a model Dupont truck, and a larger one in the basement. The latter included full-sized frogs, cross-overs, switchpoints, crossings, etc., cast together with steel wearing plates. Also a Dupont single truck with steel motors and controller, and a heavy center-bearing truck for elevated or interurban traffic. Mounted upon wooden frames were also two steel motors swung open to show their construction.

GENERAL ELECTRIC CO., Schenectady, N. Y., made no attempt to display heavy machinery, but its exhibit was by all odds the most prominent at the convention. It consisted of an immense globe, 26 ft. in diameter, mounted upon a cylindrical pedestal. The globe was made in 36 sections, fastened together, and covered with nine layers of papier mache. The continents and islands were then painted on, and small incandescent lamps were placed in all countries where General Electric apparatus is in use. The various countries were marked by small silk flags. Around the pedestal on recessed shelves were placed specimen trolley fittings, switches, circuit breakers, lightning arresters, etc. The inside was fitted up to make a very comfortable reception room. To the rear of the globe was arranged a G. E. motor, equipped with a prony brake, controller, resistance, etc., in circuit with a G. E. car watt-meter, an instrument designed to record the power consumed by an electric car in regular operation, and a switchboard with various instruments was also shown.

WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., had an exhibit which undoubtedly attracted as many visitors as any other at the exhibition. This consisted of a large frame supporting three plates of glass 30 × 72 ins., upon the front of which were secured brass letters forming the sentence "The Name Westinghouse is a Guarantee." The backs of these plates were covered with tin foil and a high electro-motive force supplied to the letters and tin foil caused sparks to pass from the letters around the plate to the tin foil producing a beautiful and noisy effect. To obtain the high potental, a 25-K-W. rotary transformer with separately excited fields, took current from a 300-volt direct-current generator directly connected to a two-phase alternating current motor, the rotary took current from the Boston Lighting Co. The current from the alternating side of the rotary converter operated either 12 alternating arc lamps at 105 volts, or was switched onto a 15-K-W. auto-transformer capable of raising from 80 to 4,000 volts in steps of 5 volts. It then entered the primary of a 50-K-W. high-tension transformer, which stepped the potential up as high as 60,000 volts. The power consumed varied from 5 to 15 K-W. The exhibit also included three standard street railway motors mounted on frames to show their interior, a 35-HP. armature partially wound to show its construction, and a full line of electric apparatus for cars and stations. In addition a new form of pneumatic switch and current breaker was shown, which was operated by air under a pressure of 80 lbs. per sq. in., obtained from a rotary pump built by the Westinghouse Air Brake Co., which was driven by a 2½-HP. motor.

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PERSONAL.

Mr. Henry C. Becker has been appointed President of the Board of Water Commissioners of Watervliet, N. Y.

Dr. George W. Hill has been appointed Lecturer in Celestial Mechanics in Columbia University, New York city.

Prof. J. M. Page has been appointed Associate Professor of Mathematics in the University of Virginia, Charlottesville, Va.

Mr. Ernest Rutherford has been appointed Professor of Physics in McGill University, Montreal, Que., to succeed Prof. John Cox.

Mr. John Lowber Welsh, President of the Union Traction Co., which controls all the street car lines in Philadelphia, Pa., has resigned.

Prof. E. F. Nichols, of Colgate University, Hamilton, N. Y., has accepted the position of Professor of Physics in Dartmouth College, Hanover, N. H.

Mr. Frank E. Wade, electrical engineer, of Scranton, Pa., has gone to Para, Brazil, to plan and erect an electric light and power plant for the government.

Mr. Joseph A. West, civil engineer, of the Sumpter Valley Ry., with headquarters at Baker City, Ore., has been appointed Chief Engineer of the Utah & Pacific R. R.

Mr. Henry S. Fleming, Secretary of the Anthracite Coal Operators' Association, sailed for Europe, Sept. 17, for the purpose of ascertaining what markets exist abroad for American anthracite.

Mr. Irwin J. Macomber, Instructor in Electrical Engineering in Cornell University, Ithaca, N. Y., has been appointed Professor of Electrical Engineering in the Armour Institute of Technology, Chicago, Ill.

Mr. Edwin M. Herr, Superintendent of Motive Power, of the Northern Pacific Ry., with headquarters at St. Paul, Minn., has resigned to become Assistant General Manager of the Westinghouse Air Brake Co., Pittsburg, Pa.

Mr. David J. Jennings, General Manager of the New York, Chicago & St. Louis R. R., has been appointed Manager of the Hoosac Tunnel & Wilmington R. R., with headquarters at Holyoke, Mass., to succeed Mr. Alfred W. Street.

Major Thomas W. Symons, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, with headquarters at Buffalo, N. Y., has been appointed a member of the board of engineers to study and revise the subject of improvements in the waterways at Savannah, Ga., and Beaufort, S. C.

Prof. George Herbert Hamlin, M. Am. Soc. C. E., for 26 years a member of the Faculty of the University of Maine, Orono, Me., and for 17 years Professor of Civil Engineering, has resigned. Mr. Nathan Clifford Glover, of the class of 1896, Assistant Professor of Civil Engineering, has been appointed to succeed him.

Prof. Earle B. Lovell, Adjunct Professor of Civil Engineering in Lafayette College, Easton, Pa., for the past three years, has resigned to accept the position of Adjunct Professor of Civil Engineering in Columbia University, New York city, with special charge of railway engineering and of the Summer School of Surveying.

Mr. Henry St. L. Coppee, M. Am. Soc. C. E., United States Assistant Engineer, with headquarters at Greenville, Miss., has been given charge of all government levees in the Lower Yazoo Levee District in Mississippi. Mr. E. C. Tollinger has been appointed United States Assistant Engineer in charge of the government levees in the Upper Tensas Levee District in Arkansas and Louisiana.

Mr. Gardner Stewart Williams, Assoc. M. Am. Soc. C. E., lately Civil Engineer to the Board of Water Commissioners, Detroit, Mich., has been appointed Professor of Civil Engineering in charge of the Hydraulic Laboratory of Cornell University, Ithaca, N. Y. This is a newly created chair in the College of Civil Engineering. Mr. Williams graduated from the University of Michigan, Ann Arbor, Mich., in 1889, and has spent the nine years since then in water-works construction and on the United States Lighthouse Board.

OBITUARY.

Mr. Edward Allen, contractor and builder of chemical and acid furnaces, of Baltimore, Md., died Sept. 16, aged 55.

Mr. William Becker, stone contractor, of Pittsburg, Pa., died Sept. 14, aged 49.

Mr. Henry A. Cornwall, Manager of the Middlesex Quarry Co., Portland, Conn., died in Providence, R. I., Sept. 17, aged 55.

Mr. Elijah Brainard, dredging contractor, of New York city, was accidentally killed by a fall, Sept. 14. He was 55 years of age.

Mr. E. O. Jones, Superintendent of Bridge Construction of the Houston & Texas Central R. R. for the past 30 years, died at his home in Ennis, Tex., Sept. 9, aged 67.

Mr. Lewis E. Haupt, civil engineer, died in Philadelphia, Pa., Sept. 17, aged 72. He was a brother of Brig.-Gen. Herman Haupt, and was associated with him in the engineering work of the Army of the Potomac during the Civil War. He was an uncle of Prof. Lewis M. Haupt, M. Am. Soc. C. E., of Philadelphia.

Mr. Charles Spinks, of Newport, Ky., for many years one of the leading general contractors of that state, was accidentally drowned in the Ohio River, Sept. 13, while superintending the removal of some empty barges. He built many of the newly constructed streets in Newport, Lexington and Louisville, Ky., and in Cincinnati, O. He also recently completed a $400,000 contract for streets in New Orleans. He was 68 years of age.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Sept. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Sept. 27. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

FRANKLIN INSTITUTE.
Sept. 27. "Rail Bonding with Especial Reference to Cast Weld Joints," W. E. Harrington. Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.

CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 27-29. Annual meeting, Springfield, O. Secy., John Fisher, 11 Riley St., Hamilton, O.

AMERICAN PUBLIC HEALTH ASSOCIATION.
Sept. 27-30. Annual meeting, Ottawa, Canada. Secy., Dr. C. O. Probst, Columbus, O.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Sept. 28. Secy., R. W. Pope, 26 Cortlandt St., New York city.

WESTERN SOCIETY OF ENGINEERS.
Sept. 28. "The Foundations for the U. S. Government Post Office and Customs House Building at Chicago," W. Sooy Smith. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

ENGINEERS' CLUB OF COLUMBUS.
Oct. 1. Secy., H. M. Gates, 12½ North High St., Columbus, O.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 3. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Oct. 3. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 5. Secy., C. W. Hunt, 220 W. 57th St., New York city.

ENGINEERS' CLUB OF ST. LOUIS.
Oct. 5. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

BROOKLYN ENGINEERS' CLUB.
Oct. 6. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N Y.

CHICAGO ELECTRICAL ASSOCIATION.
Oct. 7. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Oct. 7. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

MONTANA SOCIETY OF ENGINEERS.
Oct. 8. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

NATIONAL ROAD PARLIAMENT.
Oct. 8. Omaha, Neb. Martin Dodge, Director Office of Road Inquiry, Washington, D. C.

ENGINEERS' CLUB OF KANSAS CITY.
Oct. 10. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

THE LOUISIANA ENGINEERING SOCIETY.
Oct. 10. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

NEW ENGLAND RAILROAD CLUB.
Oct. 11. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 11. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

NORTHWEST RAILWAY CLUB.
Oct. 11. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

AMERICAN RAILWAY ASSOCIATION.
Oct. 12. Holland House, New York. Secy., W. F. Allen, 24 Park Place, New York.

ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 13. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 13. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ST. LOUIS RAILWAY CLUB.
Oct. 14. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 15. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

TECHNICAL CLUB OF OMAHA.
Oct. 17. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 17. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 18. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 18-20. Annual meeting, Richmond, Va. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Oct. 19. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 19. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Oct. 19. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.

AMERICAN GAS LIGHT ASSOCIATION.
Oct. 19-21. Annual meeting, Niagara Falls, N. Y. Secy., Alfred E. Forstall, Montclair, N. J.

ENGINEERS' CLUB OF CINCINNATI.
Oct. 20. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

NEW YORK RAILROAD CLUB.
Oct. 20. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Oct. 20. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 26-28. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.

THE LOUISIANA ENGINEERING SOCIETY.—A meeting of this society was held Sept. 12. Owing to inclement weather Mr. Llewellyn's paper, "The Evolution of Structural Designs," was postponed.

AMERICAN RAILWAY ASSOCIATION.—The Fall meeting of this association will be held at the Holland House, New York city, Oct. 12, at 11 a. m. Reports will be presented by the Executive Committee and the Committees on Train Rules, Car Service, Safety Appliances, Interlocking and Block Signals, Nominations and the Metric System.

NORTHWEST RAILWAY CLUB.—The first fall meeting of this club was held at St. Paul on Sept. 13. Two papers were read, one by Mr. J. C. Barber, of the Standard Truck Construction Co., Chicago, on "Car Truck Construction and Repairs," the other by Mr. J. H. Goodyear, Chicago & Great Western Ry., on "The Proposed Consolidation of the Master Mechanics' and Master Car Builders' Associations."

FRANKLIN INSTITUTE.—The following is the schedule of meetings to be held during September and October: Sept. 27, Electrical Section, "Rail Bonding with Especial Reference to Cast Weld Joints," Mr. W. E. Harrington; "The Present Status of the Storage Battery," Mr. Herbert Lloyd; Oct. 5, meeting of the Committee on Science and the Arts; Oct. 12, Mining and Metallurgical Section, "Anthracite Coal in Peru," Wm. Griffith, Mining Engineer, Scranton, Pa.

MASSACHUSETTS STREET RAILWAY ASSOCIATION.—The annual meeting of this association was held in Boston, Mass., on Sept. 14. The following officers were elected for the ensuing year: Pres., P. F. Sullivan; First Vice-Pres., John R. Graham; Second Vice-Pres., E. C. Foster; Secy., Chas. S. Clark; Treas., W. F. Pope; Executive Committee, A A. Glasier, E. P. Shaw, Wm. A. Bancroft, F. H. Dewey, S. M. Thomas; Auditing Committee, John N. Akarman, Robert S. Goff, P. L. Saltonstall.

Charles S. Clark, Secy.

NATIONAL ROAD PARLIAMENT.—Mr. Martin Dodge, Director of Office of Road Inquiry, Washington, D. C., acting on behalf of the President of the National Road Parliament, has called a meeting for Oct. 8, at 10 a. m. The meeting will be held in the Auditorium on the grounds of the Trans-Mississippi Exposition, at Omaha, Neb. The object of this meeting is to awaken and promote a general interest in the improvement of public roads, to discuss the best methods of building and maintaining them and to promote good roads legislation.

OHIO VALLEY IMPROVEMENT ASSOCIATION.—The anual convention of this association was held on Sept. 14-15 at Wheeling, W. Va. It will be remembered that this organization has as its object the promotion of industry and commerce in the region contiguous to the Ohio River, by securing the construction by the Government of dams and locks on the navigable rivers.

Resolutions were adopted urging upon Congress the necessity of improving the Ohio River to Cairo, and particularly recommending a dam just below Cincinnati to form a pool there, and one at Marietta. It was also recommended that there be governmental improvements at the pass and at the mouth of the Mississippi.

Louisville, Ky., was selected as the convention city for next year, and the following officers were elected for 1898: Pres., John L. Vance, Gallipolis; Secy., E. P. Wilson, Cincinnati; Vice-Presidents, Hullipen Quarier, Wheeling; F. A. Laidley, Ohio; W. W. Hite, Kentucky; John Gilbert, Indiana; Capt. J. S. Dravo, Pennsylvania; Marion Wright, Illinois.

THE CIVIL ENGINEERS' CLUB OF CLEVELAND.—A meeting of this club was held on Sept. 13, with 27 members and visitors present. The proposed amendment to the constitution, changing the name of the club to "The Cleveland Society of Civil Engineers," was taken up and discussed and lost by a large majority, as was also the original motion to adopt the name, "The Cleveland Society of Engineers." A further motion to adopt "The Cleveland Technical Society" met a like fate.

Mr. John P. Coffin then read a paper on "Some Points of Interest Gathered from an Inspection of the Machinery of Vessels on the Great Lakes, Together with a Synopsis of the Rules Compiled by the Great Lakes Register for Future Construction, and the Reasons for the Same," which was listened to with great attention. The paper reported upon the prevailing types of boilers, engines, pumps and other machinery now afloat on the Great

Lakes, as ascertained from a critical survey of over 1,300 vessels; it mentioned certain defects in design and proportion, and described the rules adopted to govern future construction. Wm. H. Searles, Secy.

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NEW PUBLICATIONS.

PROCEEDINGS AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION, 1898.—Published by the Association, John W. Cloud, Secretary, Chicago, Ill. Cloth, 6 × 9 ins.; pp. 288; illustrated.

This issue of the proceedings contains the papers, special committee reports and the discussions and business transactions of the annual convention, held at Saratoga, N. Y., June 20, 21 and 22, 1898, which were fully reported in Engineering News, of June 23 and 30, 1898.

JOURNAL OF THE AMERICAN ASIATIC ASSOCIATION, Vol. I., No. 1.—Edited by John Foord, P. O. Box 1500, New York city.

The American Asiatic Association was organized in June last. It includes many of the firms, corporations and individuals concerned in the American export trade in the far East. The "Journal" is to be issued "as occasion may require," in order to facilitate the interchange of views among the members, and to provide a medium for the diffusion of information bearing on the development of commercial enterprise in Eastern Asia and Oceanica. The first number of the "Journal" is only four pages 8 × 10 ins. It contains in addition to a number of letters bearing upon the objects of the Association some statistics of Chinese customs revenue and a report of the new trade regulations on the Yangtze River.

THE OHIO MINING JOURNAL.—Official organ of the Ohio Institute of Mining Engineers, Nos 24 and 25. Proceedings of the meetings of Jan., 1895, and Jan. 1896. Published by R. M. Haseltine, Secy. and Treas., Columbus, O. Paper; 6 × 9 ins.; pp. 108, 158.

This volume contains a number of practical papers and discussions of subjects relating to coal mines. Among them are the following: "Long Wall Mining," by Thomas West; "Spontaneous Combustion," by John P. Jones; "The Protection of Miners, by Andrew Roy; "Mine Surveying," by Prof. Frank A. Ray; "Practical Mining," by Thomas H. Love; "Economic Questions Connected with Retort Coke Ovens, with the Resulting By-products," by R. M. Atwater; "Wire Rope Haulage, Its Uses and Abuses," by T. E. Hughes; "Theoretical and Practical Mine Ventilation," by F. C. Keighley; "Mine Wiring—Distribution of Electricity in Coal Mines," by C. A. Pratt.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.—Proceedings of the 13th Annual Meeting, held at Peoria, Ill., Jan. 26, 27, 28, 1898. Recording Secretary, Mr. J. C. Quade, City Engineer, Kewanee, Ill. Paper; 8¾ × 6 ins.; pp. 198. 50 cts.

Contents: Proceedings of meeting and address of the retiring President, Mr. C. C. Stowell; "Chemistry of Water Supply," Prof. A. W. Palmer; "Purification of Sewage by the Ferrozone Polarite System," John W. Alvord; "Deep Well Pumping," E. E. Johnson; "The Improvement of Transportation in Country Districts," E. E. Russell Tratman; "Brick and Macadam Country Roads," J. Ed. Miller; "Improving the Roads of Illinois," J. T. Schmeltzer; Reports of Committees on Public Highways, Water-Works and Supply, Land and City Surveying, Drainage, Weights and Measures, Municipal Engineering, Paving Brick, and Instruments, Blanks and Records; "Railway Construction in Mexico," L. P. Atwood; "Cost of Tie-Plates on R. G. S. M. & P. Ry.," L. P. Atwood; "U. S. Government Geological Survey," John T. Stewart; "Proposed State Supervision of Water Supply and Sewage Disposal," J. A. Harman; "City Map Making," M. Huebinger; Report of Treasurer; List of Members.

MICHIGAN ENGINEERS' ANNUAL. 1898.—Published by the Michigan Engineering Society. F. Hodgman, Secretary, Climax, Mich. Paper; 8⅜ × 5¾ ins.; pp. 200. 50 cts.

Contents: "Our Country Roads," F. Hodgman; "The Engineer's Assistant," W. B. Sears; "Our Absent Members," G. G. Hubbell; "The U. S. Deputy Surveyor," Dorr Skeels; "The Ladies," Col. E. W. Muenscher; "The Country Road Maker," Wm. Appleton; "Engineer's Personal Finances," G. L. Wells; "The Sewage of Pontiac," H. E. Riggs; "A Barrel of Salt," G. G. Hubbell; "Curb and Sidewalk Grades," W. D. Elder; "Interlocking Switch and Signal Systems," Alex. Moore; "Electrolysis," R. C. Smith; "The Intakes of the Great Lakes," T. W. Barrally; "Contract vs. Day Labor," E. W. Muenscher; "The Horseless Carriage," R. E. Olds; "The Inspector and his Duties," H. Hodgman; "The Propeller Wheel," H. C. Pearsons; "A Case in Land Surveying," F. Hodgman; "Materials for Street Paving," "Report of Committee on Drain Laws and Legislation," E. Strong; "Report of Annual Convention and List of Members."

IOWA ENGINEERING SOCIETY.—Proceedings of Tenth Annual Meeting at Cedar Rapids, Iowa, Jan. 19-20, 1898. Secretary, E. P. Boynton, Cedar Rapids, Ia. Paper; 8¾ × 6 ins.; pp. 152. 50 cts.

Contents: Business meeting, addresses and committee reports; "Street Grades," L. H. Stone; "Street Car Service," B. Schreiner; "The Country Surveyor as a Map Publisher," G. S. Pingrey; "Laying a Submerged Water Main," E. P. Boynton; "The Centreville Cemetery," Wm. Steyh; "Education as a Means," Prof. J. T. Beard; "Water Supply of Des Moines," L. Higgins; "Interpretation of Sanitary Water Analysis," Prof. Floyd Davis; "Iowa Geology from an Engineering View," Prof. S. Calvin; "Lights and Lenses," Prof. W. H. Mahaffie; "Artesian Wells of Iowa," Prof. W. H. Norton; "Portland Cement," J. W. Dickinson; "Des Moines Paving Brick and Clays," E. P. Boynton; "Tests of Iowa Building Stone and Paving Brick," Prof. A. Marston; "Graphic Determination of Stresses," Prof. A. V. Sims; "Purification of Water for R. R. Purposes," Prof. Floyd Davis.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

PIPE THREADING AND CUTTING MACHINES.—The Bagnall & Keller Mfg. Co., Edwardsville, Ill. Catalogue No. 14. Pamph., 4½ × 6¾ ins.; pp. 108.

This catalogue contains illustrations and price lists of a great variety of pipe fitters' tools, including the "Peerless" and "Duplex" threading and cutting machines, vises, taps, dies, etc.

SHEET METALS AND METAL SPECIALTIES.—Merchant & Co., Philadelphia, Pa. Pamph., 6 × 9 ins.; pp. 112.

This is an illustrated catalogue and price list of a great variety of things. The firm of Merchant & Co. owns a large tin plate, smelting and refining works, and warehouses in Philadelphia, New York, Brooklyn and Chicago, where are carried stocks of metals, tin-plate, metal shingles, ventilators, cornices, troughs, finials, metallic lathing, sheet metal pipes, and many other articles used by builders. The catalogue will be of service especially to architects and workers in sheet metal.

THE LAKE SHORE LIMITED.—Passenger Department, New York Central & Hudson River R. R., New York, N. Y. Pamph., 4 × 8 ins.; pp. 32; illustrated.

This pamphlet contains, in addition to illustrations and a brief description of the cars and their appointments, a descriptive time table detailing in concise language the principal objects of interest that may be seen from time to time as the train progresses on its daily journey. For instance, in this time table the passenger is given the name of each river crossed, where it rises and where it empties, the name of the town he is passing, its population, principal industries, etc., etc., and a variety of similar information which is of particular interest to the traveler, and which he ordinarily never obtains except at the pains of many questions and much exertion. So far as we know this is a feature not heretofore made use of in railway advertising, and it is in every respect a meritorious one. A copy of this pamphlet will be sent free to any address.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Sept. 22.	Hospital buildings, etc., Central Islip, N.Y.	Sept. 1
Sept. 22.	Power plant, Wrightsville, Pa. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Sept. 22.	Stone jetties, Green Harbor, Mass. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Sept. 22.	Barge, Biloxi, Miss.	Sept. 15
Sept. 22.	Heating, Ogdensburg, N. Y.	Sept. 15
Sept. 22.	School building, Osceola, Wis.	Sept. 15
Sept. 22.	Sewers, Newark, N. J.	Sept. 22
Sept. 22.	Bridge repairs, Paducah, Ky.	Sept. 22
Sept. 22.	Grading, etc., Paducah, Ky.	Sept. 22
Sept. 22.	Paving, Columbus, O.	Sept. 22
Sept. 22.	Grading (17 streets), La Crosse, Wis.	Sept. 22
Sept. 23.	Trestle, wharf, etc., Astoria, Ore.	Sept. 22
Sept. 23.	Macadamizing, Boston, Mass.	Sept. 22
Sept. 23.	Cement walks, etc., Chicago, Ill.	Sept. 22
Sept. 23.	Cedar paving, etc., Detroit, Mich.	Sept. 22
Sept. 23.	Brick paving, Independence, Kan.	Sept. 22
Sept. 23.	Asphalt paving, Omaha, Neb.	Sept. 15
Sept. 23.	Road work, Albany, N. Y.	Sept. 15
Sept. 23.	Gravel roads, Brownstown, Ind.	Sept. 15
Sept. 23.	Cement walks, North Vernon, Ind.	Sept. 15
Sept. 23.	High-school building, Camden, N. J.	Sept. 8
Sept. 23.	Supplies, Watervliet, N. Y.	Aug. 25
Sept. 24.	Capitol building, Columbus, O.	Sept. 1
Sept. 24.	Electric plant, Pensacola, Fla.	Sept. 1
Sept. 24.	Quay wall. San Francisco, Cal.	Sept. 1
Sept. 24.	School building, Shreveport, La.	Sept. 8
Sept. 24.	Building material, Pine Ridge, S. Dak.	Sept. 8
Sept. 24.	Street bonds, Cambridge, O.	Sept. 15
Sept. 24.	Boilers, Providence, R. I.	Sept. 22
Sept. 24.	Iron bridge and abutments, Bradford, Pa.	Sept. 22
Sept. 24.	Market building, Detroit, Mich.	Sept. 22
Sept. 24.	Channel, Waterbury, Conn.	Sept. 22
Sept. 24.	Telephone, etc., Washington, D. C.	Sept. 22
Sept. 24.	Engine house, Pittsburg, Pa.	Sept. 22
Sept. 24.	Sewage disposal beds, Concord, Mass.	Sept. 22
Sept. 26.	Engine and generator, Kings Park, N. Y.	Sept. 22
Sept. 26.	Improvement bonds, Syracuse, N. Y.	Sept. 22
Sept. 26.	Water meters (3), Jersey City, N. J.	Sept. 22
Sept. 26.	Steam heating, Frazee, Minn.	Sept. 22
Sept. 26.	Brick sewers, Springfield, Mass.	Sept. 22
Sept. 26.	Pipe sewer, Bradford, Pa.	Sept. 22
Sept. 26.	Pipe sewer, Jersey City, N. J.	Sept. 22
Sept. 26.	Water pump, Marietta, O.	Sept. 15
Sept. 26.	Electric light plant, Modesto, Cal.	Sept. 15
Sept. 26.	Bridge substructure, Westfield, Mass. Advertised, Engineering News, Sept. 15.	Sept. 15
Sept. 26.	Bonds, Dayton, O.	Aug. 25
Sept. 27.	Municipal building work, Brooklyn, N. Y.	Sept. 15
Sept. 27.	High school building, Burlington, Vt. Advertised, Eng. News, Sept. 15 and 22.	Sept. 15
Sept. 27.	Sewer, Mingo Junction, O.	Sept. 22
Sept. 27.	Pipe sewers, Chicago, Ill.	Sept. 22
Sept. 27.	Asphalt paving, Kansas City, Mo.	Sept. 22
Sept. 27.	Macadamizing, etc., Wilmette, Ill.	Sept. 22
Sept. 27.	Hospital building, Jersey City, N. J.	Sept. 22
Sept. 27.	Street cleaning, Lansingburg, N. Y.	Sept. 22
Sept. 27.	Water pipe, etc., Nashville, Tenn.	Sept. 22
Sept. 27.	Machinery, Boston Navy Yard.	Sept. 22
Sept. 27.	Naval supplies, Washington, D. C.	Sept. 22
Sept. 27.	Naval supplies, New York, N. Y.	Sept. 22
Sept. 27.	Machinery, Norfolk, Va.	Sept. 22
Sept. 27.	Sheet asphalt, Schenectady, N. Y.	Sept. 22
Sept. 27.	Asphalt paving, Louisville, Ky.	Sept. 22
Sept. 27.	Graveling and brk walks, Alexandria, Ind.	Sept. 22
Sept. 27.	Brick paving, etc., Pontiac, Ill. Advertised, Engineering News, Sept. 22.	Sept. 22
Sept. 28.	Bridge (4 144-ft. spans), Eau Claire, Wis.	Sept. 22
Sept. 28.	Brick paving, Steubenville, O.	Sept. 22
Sept. 28.	Brick paving, Salamanca, N. Y. Advertised, Engineering News, Sept. 22.	Sept. 22
Sept. 28.	Sewer, Easton, Minn.	Sept. 22
Sept. 28.	Brick paving, Buffalo, N. Y.	Sept. 22
Sept. 28.	School building, Orange, N. J.	Sept. 15
Sept. 28.	Water-works, Harrisville, N. Y.	Sept. 15
Sept. 28.	Electric light bonds, Coffeyville, Kan.	Sept. 15
Sept. 28.	U. S. building, Brockton, Mass. Advertised, Eng. News, Sept. 1 and 8.	Sept. 1
Sept. 29.	Water-works, Wivenhoe, England.	Sept. 1
Sept. 29.	Court house, Marietta, Ga.	Aug. 18
Sept. 29.	Steel bridge, Durango, Colo.	Sept. 15
Sept. 29.	Laying water pipe, Cincinnati, O.	Sept. 22
Sept. 29.	Water pipe, etc., Buffalo, N. Y.	Sept. 22
Sept. 29.	Street bonds, Phillipsburg, N. J.	Sept. 22
Sept. 30.	Asphalt paving, Niagara Falls, N. Y. Advertised, Engineering News, Sept. 22.	Sept. 22
Sept. 30.	Hospital, National Military Home, Kan.	Sept. 22
Sept. 30.	Asphalt, brick, etc., Omaha, Neb.	Sept. 22
Sept. 30.	Macadam paving, Milford, Conn.	Sept. 22
Sept. 30.	Pipe sewers, Des Moines, Ia.	Sept. 22
Sept. 30.	Storm sewer, Amsterdam, N. Y.	Sept. 15
Sept. 30.	Gravel road (7 miles), Rockville, Ind.	Sept. 15
Sept. 30.	Water bonds, Colton, Cal.	Sept. 15
Sept. 30.	School building, Sheboygan, Wis.	Sept. 15
Sept. 30.	Improving reservoir, Albany, N. Y. Advertised, Engineering News, Sept. 8.	Sept. 8
Sept. 30.	Coal shaft, Latrobe, Pa.	Sept. 8
Oct. 1.	Towboat, St. Louis, Mo.	Sept. 8
Oct. 1.	Arc lighting, Marshfield, Wis.	Aug. 18
Oct. 1.	Monitors (4), Washington, D. C.	July 7
Oct. 1.	School building (equipment), St. Thomas, Ont.	July 7
Oct. 1.	Road roller, Sheboygan, Wis. Advertised, Engineering News, Sept. 1.	Sept. 1
Oct. 1.	Head-race (power plant), Montreal, Que. Advertised, Eng. News, Sept. 1 to 15.	Sept. 1
Oct. 1.	Electric plant, New Richmond, O.	Sept. 15
Oct. 1.	Arc lighting, Huntington, W. Va.	Sept. 15
Oct. 1.	School building, Sitka, Ala.	Sept. 15
Oct. 1.	Canal work, Kirkersville, O.	Sept. 22
Oct. 1.	Pipe sewers, Elizabeth, N. J.	Sept. 22
Oct. 1.	Water-works, Beresford, S. Dak.	Sept. 22
Oct. 1.	School-house bonds, Wadley, Ga.	Sept. 22
Oct. 3.	Flood gates, Dayton, O.	Sept. 22
Oct. 3.	Macadam paving, Atlantic City, N. J. Advertised, Engineering News, Sept. 22.	Sept. 22
Oct. 3.	Brick paving, Atlantic City, N. J. Advertised, Engineering News, Sept. 22.	Sept. 22
Oct. 3.	Pile bridge, Topeka, Kan.	Sept. 22
Oct. 3.	Bridge, Redwood City, Cal.	Sept. 22
Oct. 3.	Bridge (115-ft. long), Westfield, Mass. Advertised, Engineering News, Sept. 22.	Sept. 22
Oct. 3.	Levee work, Dayton, O.	Sept. 22
Oct. 3.	Lumber, New York, N. Y.	Sept. 22
Oct. 3.	Steel bridges (2 spans), Waverly, Ia.	Sept. 22
Oct. 3.	Deep well, Plankinton, S. Dak.	Sept. 22
Oct. 3.	Church building, Mount Carmel, Ill.	Sept. 22
Oct. 3.	Superstructure and repair, Chillicothe, O.	Sept. 15
Oct. 3.	Street work, Toledo, O.	Sept. 1
Oct. 3.	Building plans, Liverpool, England	Sept. 8
Oct. 3.	Building superstructure, Philadelphia, Pa. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Oct. 3.	Bridge, Flandreau, S. Dak.	Sept. 8
Oct. 4.	Coal conveyors, etc., Chicago, Ill. Advertised, Eng. News, Aug. 25 to Sept. 29.	Aug. 25
Oct. 4.	Bridge, Stockton, Cal.	Sept. 15
Oct. 4.	Brick paving, etc., Norwalk, O.	Sept. 15
Oct. 4.	Improving road, Deerfield, N. Y.	Sept. 22
Oct. 4.	Electric plant, Barnesville, Minn.	Sept. 22
Oct. 4.	Electric lighting, Philadelphia, Pa.	Sept. 22
Oct. 4.	High-school building, Troy, N. Y.	Sept. 22
Oct. 4.	Water-works, Eaton Rapids, Mich. Advertised, Eng. News, Sept. 22 and 29.	Sept. 22
Oct. 4.	Grading, etc., Troy, N. Y.	Sept. 22
Oct. 5.	Grading, paving, etc., Cleveland, O.	Sept. 22
Oct. 5.	Granite paving, Cincinnati, O.	Sept. 15
Oct. 5.	Bridge superstructure, Chicago, Ill.	Aug. 11
Oct. 5.	Dredging, Oakland, Cal.	Sept. 8
Oct. 5.	Shore protection, Fort Morgan, Ala. Advertised, Eng. News, Sept. 8 to 29.	Sept. 8
Oct. 6.	Electric light plant, St. Joseph, Ill. Advertised, Engineering News, Sept. 22.	Sept. 22
Oct. 6.	Water-works, Greensboro, Ga.	Sept. 22
Oct. 7.	Arc lighting, Asheville, N. C.	Sept. 22
Oct. 7.	Asphalt and macadam, Cleveland, O.	Sept. 22
Oct. 7.	Granitoid sidewalks, St. Louis, Mo.	Sept. 22
Oct. 8.	Bridge work, Cincinnati, O.	Sept. 22
Oct. 8.	Bridge, New Baltimore, O.	Sept. 22
Oct. 8.	School building, Bisbee, N. Dak.	Sept. 22
Oct. 10.	Sewers and disposal plant, E. Cleveland, O.	Sept. 22
Oct. 10.	Dredging, Wilmington, Del. Advertised, Eng. News, Sept. 15 and 22.	Sept. 22
Oct. 10.	Cement, stone, etc., Ft. Washington, D. C. Advertised, Eng. News, Sept. 22 and 29.	Sept. 22
Oct. 10.	Asphalt and brick paving, Council Bluffs, Ia.	Sept. 22
Oct. 10.	Macadamizing, St. Paul, Minn.	Sept. 22
Oct. 10.	Turbine wheels (24), Wrightsville, Pa. Advertised, Eng. News, Sept. 8 and 15.	Sept. 8
Oct. 10.	Trestle, Chehalis, Wash.	Sept. 8
Oct. 10.	Paving, Toledo, O.	Sept. 15
Oct. 12.	Hospital buildings, San Francisco, Cal.	Sept. 15
Oct. 12.	Park bonds, Spokane, Wash.	Sept. 1
Oct. 12.	Sewers, Cohoes, N. Y.	Sept. 22
Oct. 13.	Hire of dredging plant, Mobile, Ala. Advertised, Eng. News, Sept. 15 to Oct. 6.	Sept. 15
Oct. 14.	Cement walks, North Vernon, Ind.	Sept. 15
Oct. 15.	Water-works, Wagoner, Ind. Ter. Advertised, Eng. News, Sept. 22 to Oct. 6.	Sept. 22
Oct. 15.	Masonry, woodwork, etc., Cincinnati, O.	Sept. 22
Oct. 15.	School building, Harris, Minn.	Sept. 22
Oct. 15.	Sewers, Marietta, O.	Sept. 22
Oct. 17.	Sewerage system, Mobile, Ala. Advertised, Eng. News, Sept. 22 to Oct. 6.	Sept. 22
Oct. 17.	Gasholder, etc., Edinburgh, Scotland.	Sept. 1
Oct. 18.	Railway track, Cincinnati, O.	Sept. 22
Oct. 20.	Viaduct over Lick Run, Cincinnati, O.	Sept. 22
Oct. 21.	Levee work, West Memphis, Tenn. Advertised, Eng. News, Sept. 22 to Oct. 13.	Sept. 22
Oct. 21.	Dry dock, Algiers, La.	Sept. 8
Oct. 23.	Plans for sewer system, Chertsey, Eng.	Sept. 22
Oct. 24.	Markets, etc., Belem, Brazil.	Apr. 28
Oct. 25.	Jetties, Portland, Ore. Advertised, Eng. News, Aug. 25 to Sept. 15.	Aug. 25
Oct. 30.	School building, Chehalis, Wash.	June 16
Nov. 1.	Court house, Garner, Ia.	Sept. 8
Nov. 1.	School building, St. Louis, Mo.	Sept. 22
Nov. 7.	Improving electric plant, Topeka, Kan.	Sept. 22
Nov. 10.	Water supply, Belem, Brazil	Sept. 22
Nov. 15.	Water-works addition, Seattle, Wash. Advertised, Eng. News, Sept. 22 to Nov. 10.	Sept. 22
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18
No date.	Windmill, tanks, etc., Rosebud, S. Dak.	Sept. 22

RAILWAYS.

ABERDEEN & ASHBORO.—This company is now pushing work rapidly on the extension from Troy to Mount Gilead, via Wadeville, N. C., a distance of 13.8 miles, and it is expected that track will be laid by the middle of October. The line is being built by Carpenter & Gibbs. Pres., A. F. Page, Aberdeen, N. C.; Ch. Engr., J. M. Bandy, Greensboro, N. C.

ARIZONA & SOUTHEASTERN.—The Naco branch of this railway, from a point on the main line, eight miles west of Bisbee, Ariz., to the boundary line of Mexico, a distance of four miles, has recently been completed. Supt., Ben Williams, Bisbee.

BAKERSFIELD & LOS ANGELES.—This company has been incorporated in California, according to reports, to construct a railway from Bakersfield over the Tejon Pass to Los Angeles, Cal., a distance of 200 miles. It will connect with the Southern California, a branch of the Santa Fe, running from Mojave to Los Angeles, and with the San Francisco & San Joaquin Valley Ry., thus giving San Francisco another transcontinental road. The incorporators are, Claus Spreckels, John D. Spreckels, A. B. Spreckels, Robert Watt and A. H. Payson, of San Francisco, Cal.

CHICAGO & WABASH VALLEY.—This company was incorporated in Indiana, Sept. 10, with a capital stock of $50,000, to construct about 23 miles of railway from reclaimed lands in Jasper county, purchased four years ago by B. J. Gifford, to a connection with the Eastern Illinois Ry. The incorporators are: Benjamin J. Gifford, Pres., Kankakee, Ind.; James E. Jones, Harlan M. Stone, Charles D. Henry, John B. Reed, Edward D. Calkins and Charles B. Campbell. Mr. Gifford has informed us that the right of way has been obtained and the ties and rails secured; also that the length of the line, at first, would be ten miles.

CHINA.—It is announced that the final contract for granting a concession for the construction of a railway from Hankow to Hong Kong was signed at Washington, D. C., Sept. 14, by the Chinese minister and the American China Development Co. Calvin S. Brice, 80 Broadway, New York, who is said to be the chief promotor of the project, is quoted as stating that the company now has a part of its engineering force on the field, and that a new corps of engineers is being organized, which will make the survey, beginning at Hankow and extending to Canton and thence to Hong Kong, and also beginning at the southern end and coming north on an independent line. The length of the completed line will be over 900 miles, and the estimated cost is from $20,000,000 to $30,000,000. John D. Rockefeller, Levi P. Morton and George P. Bliss are also said to be interested.

CUBA.—Press reports state that Pearson, Simpson & Vaudaria, administrators and engineers of the Western R. R. of Havana, are said to contemplate the extension of its line in Pinar del Rio.

DULUTH & NORTHEASTERN.—This company has been incorporated in Minnesota to build a railway from the Duluth & Iron Range R.R., near Bassett Lake, in a southeasterly direction to Island Lake, 35 miles, and it is proposed to haul logs to this latter place, which is on the Cloquet River. About two hundred men are now said to be at work on the road. The incorporators are, Frederick Weyerhauser, St. Paul, Minn.; J. B. Phelps, Davenport, Ia.; H. C. Hornby, J. E. Lynds and J. H. Heninger, of Cloquet, Minn.

ELK & HIGHLAND.—C. H. Kemp, Kane, Pa., informs us that all the contracts have been let for the construction of this proposed steam railway from Coon Run, Elk county, to Portland, Pa., a distance of 17 miles. Pres., D. H. Miller, of Kane.

ESQUIMALT & NANAIMO.—Reports state that this railway is to be extended from Wellington to Departure Bay, and that new wharves will be built at the latter place. Pres., A. Dunsmuir, Victoria, B. C.

FORT DODGE & OMAHA.—This company was incorporated in Iowa, Sept. 14, with a capital stock of $5,000,000, to construct a line from Fort Dodge southwest to Omaha, via Council Bluffs, Ia., a distance of about 200 miles. Preliminary surveys have been made. The incorporators are: John F. Duncombe, Chas. E. Grafton, Clarence A. Moore, Henry B. Litchfield and N. C. Phillips.

FORT WORTH & RIO GRANDE.—Press reports state that Special Master Thomas P. Martin, of Fort Worth, Tex., has sold the Pan Handle branch of this line, from Pan Handle to Washburn, Tex., 15 miles, for $66,240, the purchaser being E. Wilder, of Topeka, Kan.

GEORGE'S CREEK & CUMBERLAND.—Jas. P. Gaffney, Ch. Engr., Cumberland, Md., writes us, regarding improvements to this line, that no extensions are at present contemplated. Construction from year to year is confined to the betterment of the road, which was completed in 1880, and new steel viaducts have replaced the original wooden structures. The Toledo Bridge Co., Toledo, O., has just completed a viaduct, 270 ft. long and 70 ft. high, at Nedham's Run, on this line. The approaches to this viaduct have been regraded and several sharp curves eliminated. Pres., Jas. A. Millholland, Cumberland.

GREENFIELD & MAXWELL.—J. H. Moulden, Greenfield, Ind., informs us that this proposed railway will not be constructed, as the necessary subsidy was not granted. The company was organized by Mr. Moulden and others to build six miles of line to connect the Cleveland, Cincinnati, Chicago & St. Louis Ry. at Maxwell, Ind., with the Pennsylvania system.

HONDURAS.—Wm. S. Valentine, 51 East 44th St., New York, is quoted as stating that the Honduras syndicate, of which he is a managing director, has completed five miles of new railway, and has graded ten miles additional, and that the old line, which was 57 miles in length, has already been transferred to the syndicate. When completed the road will be about 220 miles long. Construction work has been temporarily suspended.

MARSHALL, TIMPSON & SABINE PASS.—T. S. Garrison, Gen. Mgr., Timpson, Tex., informs us that grading has been completed on this line to a point within two miles of Carthage, and that the rails will soon be laid and the work completed within 30 days. The route is from Timpson to Carthage, Tex., a distance of 20 miles. Pres., L. F. Limbert, Dayton, O.

NORTH BEND & KETTLE CREEK.—This company has recently completed the building of a 3-mile extension from Lebo Run to Black Forest, Pa. A. H. Shaffer, Ch. Engr., Emporium, Pa.

OHIO.—Bids are asked by the commissioners of water works of Cincinnati, O., until Oct. 18, for the construction of a railway track and the delivery of track material on the water-works grounds, between the Cincinnati Georgetown & Portsmouth R. R. and the eastern pumping station of the Cincinnati Water-Works, near the village of California, O.; bond, $500. Pres., Aug. Herrmann, of Cincinnati.

ONTARIO & RAINY RIVER.—We are informed that the surveys have been under way for about two months on a route from Port Arthur to Rainy Lake, a distance of 200 miles, but that no decision has yet been made regarding the route. The first 20 miles have been located and let to E. F. Fauquier, of Ottawa, Ont., who began work on Aug. 10, and has about 250 men and 50 teams on the line, the force to be increased as fast as the line is located. Pres., Wm. Mackenzie, Toronto, Ont.; Ch. Engr., T. H. White, Port Arthur, Ont.

PORTLAND, VANCOUVER & YAKIMA.—L. Gerlinger, Pres., Vancouver, Wash., informs us that engineers are now in the field locating a line for an immediate extension to be 15 miles in length. The capital for construction is assured. As stated in our issue of Sept. 8, this company was incorporated last December to operate the old Vancouver, Klickitat & Yakima Ry., and to complete a line of railway from Vancouver to Yakima, Wash., a distance of 170 miles. J. W. Coovert, Ch. Engr., Vancouver, Wash.

PORTLAND & CAMDEN.—This company was incorporated in Indiana, Sept. 14, with a capital stock of $50,000, to build a road through Jay county 12 miles in length. The directors are, G. A. Mason, Hugh Kapp, W. B. Cooley, D. E. Studebaker and W. J. Cook.

PHILADELPHIA & READING.—Geo. S. Webster, Ch. Engr. of Bureau of Surveys, Philadelphia, Pa., informs us that no definite information can yet be given relative to the elevation of this company's tracks on 9th St. Some preliminary study plans have been prepared, but no negotiations have been entered into between the city and the railway company; nor has an ordinance been introduced in the city councils authorizing the work or making appropriations for the same.

POTOSI & RIO VERDE.—This company was incorporated in New York, Sept. 16, with a capital stock of $200,000, to construct a narrow-gage railway, 66 miles in length, from San Luis Potosi southerly to the district of Rio Verde, Mexico. The motive power is to be either steam or electricity. The directors are: Donald C. Brown, of San Luis Potosi, Mex.; Robert S. Towne, George F. Peabody, Edward M. Shepard, A. Foster Higgins, Charles J. Nourse, Jr., Herbert H. Dean, Samuel H. Ordway and Francis N. Holbrook, of New York.

RALEIGH & CAPE FEAR.—J. A. Mills, Pres., Raleigh, N. C., informs us that 12 miles of track have been laid and 14 miles graded on this proposed line from Raleigh to Lillington, a distance of 35 miles. Regular trains run to Raleigh every other day.

SOUTHERN CALIFORNIA.—Press reports state that surveys have been commenced for a new line from Perris, on the main line, to Lake View, Cal., a distance of about ten miles.

STATESBORO & EGYPT.—W. C. Parker, Statesboro, Ga., informs us that nothing has ever been done towards constructing this proposed line, except a survey made some time ago. The attention of Mr. Parker and associates is now turned toward the projected Statesboro & Savannah R.R., which, he says, will doubtless be built.

UNION COVE & VALLEY.—Bids are being received by this company for 30,000 ties for a standard-gage line, and also for bridge timbers, 8×10 inches, of all lengths. Surveys are said to be under way for a proposed extension. Joseph Johnson, Supt. of Construction, Union, Ore.

WABASH.—Reports state that at the annual meeting of the stockholders of this company, it was decided to build or lease a railway wholly or partially constructed, to fill the gap in the system and connect East Hannibal and Quincy, Ill., 15 miles, and also to build or lease a line to connect Moulton and Albia, Ia., and to make the Wabash a continuous line through those points.

WASHINGTON COUNTY.—F. G. Englesing, Div. Engr., Calais, Me., informs us that grading has been completed, 75 miles of track laid and 44 miles ballasted on this new railway. Station buildings, roundhouses and the telegraph line are nearing completion, and schedule trains should be running by Nov. 1. The length of completed line will be 118¼ miles. Reports state that P. H. Stratton has received the contract to build the turntables at Washington Junction and Eastport, to cost $20,000. Pres., Geo. A. Curran, Calais; Ch. Engr., W. B. Parsons, 22 William St., New York.

YORK SPRINGS.—This company was incorporated in Pennsylvania, Sept. 19, with a capital stock of $125,000, to construct a steam railway from York Springs to Dillsburg, Pa., on the Cumberland Valley R. R., a distance of about 14 miles. The incorporators are, M. B. Cumbler, Pres., Carlisle, Pa.; Geo. H. Trostle and Geo. A. Trimmer, both of York Springs, Pa.; C. W. Webbert, Boiling Springs, Pa.; T. H. Alleman, Steelton, Pa.

STREET AND ELECTRIC RAILWAYS.

BERLIN, N. H.—We are informed that a charter has recently been obtained in this city by the Berlin & Gorham Electric Ry. Co., to construct an electric line proposed to connect Berlin with Gorham, a distance of four miles. Arrangements for construction are now progressing. Carlos P. Day, Pres. Bd. of Directors, of Berlin, may be addressed.

PLYMOUTH, MASS.—We are informed that John Turner & Co., 19 Milk St., Boston, has been awarded the contract for the construction of the first section of 3¼ miles of the proposed Plymouth & Sandwich St. Ry. This section, which is wholly within Plymouth, is expected to be in operation by Dec. 1. The completed line will extend from Plymouth to Sandwich, and will be 16 miles in length. All the necessary permits have been obtained, and surveys have been made for four miles. Pres., H. B. Taylor, Boston; Ch. Engrs., Harriman Bros., 3 Somerset St., Boston, Mass.

BUFFALO, N.Y.—The Buffalo Traction Co. has made an application to the council for permission to construct a single track electric street railway on Chenango St., from Utica St. to Rhode Island St.

MANHASSET (L. I.) N. Y.—The board of railway commissioners has granted the application of the New York & North Shore Ry. Co. for permission to construct an electric road from the terminus of the New York & Queen's County R. R. at Middle Village, through Jamaica, Flushing, Whitestone, College Point and Bay Side to Manhasset, Long Island.

PEEKSKILL, N.Y.—It is reported that the Peekskill Traction Co. has advertised for proposals for furnishing 5,000 ties, and that hopes that the proposed line will be built are again revived. The proposed electric railway will run from this town through Cortlandt and Yorktown, and will be about 12 or 14 miles in length. Pres., Frank Frye; Secy. and Treas., Chas. N. Wells, both of Peekskill.

MONTCLAIR, N. J.—The North Jersey St. Ry. Co. has petitioned the town council for a franchise to construct a new electric line from Bloomfield Ave. through Elm St. and Orange Road to the Orange line. A hearing will be given on Oct. 3.

WESTFIELD, N. J.—The township committee granted a franchise to the Westfield & Elizabeth St. R. R. Co., Sept. 15, to build a trolley line through the township towards Rahway. Pres., A. A. Gaddis, Westfield.

LOCK HAVEN, PA.—It is reported that William Herr has received the contract for constructing a new trolley line on Fairview St., and that work was to begin this week and to be completed within 20 days.

PITTSBURG, PA.—The select council has passed an ordinance granting the Duquesne St. Ry. Co. the right to lay tracks on Oakland Ave.

NEWTOWN, PA.—Thomas A. Connell, of Philadelphia, Pa., was awarded the contract by the Newton Electric St. Ry. Co., Sept. 13, to build an extension to its line from Newtown to Doylestown, via Wightstown, Penn's Park, Wycombe, Forestville and Furlong, a distance of 13¼ miles. Work is to be commenced at once, and must be completed by Dec. 15. The Newtown Electric St. Ry. now controls the entire line from Newtown to Bristol, and when the Doylestown extension is completed will have 28 miles of trolley line in operation. Pres., Thomas P. Chambers, Newtown.

WILMINGTON, DEL.—Reports from this city state that work has been resumed on the Wilmington & Brandywine Springs Electric Ry. by Contractor Mahoney, and that it is now expected to complete the work before Nov. 1. A long bridge will be built across Red Clay Creek, near the terminus of the line, by the Delaware Construction Co. The construction of an extension to Kennett Square will be considered later.

MACON, GA.—T. J. Carling, Pres. and Gen. Mgr., Macon & Indian Spring Electric St. Ry. Co., informs us that he is preparing plans for a new power station and equipment. Contracts have been let for the building and the electrical equipment, but not for the boilers and engines. This company is the successor to the former Macon Gas, Light & Water Co.

POINT WASHINGTON, FLA.—Reports state that a tramway for logging purposes will soon be built in this vicinity by Strickland, Wesley & Co.

CHATTANOOGA, TENN.—Work is in progress by the Chattanooga Rapid Transit Co., on the conversion of the old belt line to East Lake into an electric railway. The company has placed orders for cars and other equipment, and has awarded the contract for erecting a new power house at Ridgedale to Adams & Schneider.

ASHTABULA, O.—The Pennsylvania & Ohio Ry. Co. has been granted a franchise to build a line in this city. Surveyors are now said to be at work between Painesville and Conneaut.

WARSAW, IND.—The council has granted a franchise to Noah J. Clodfelter for the construction of an electric street railway from Warsaw to Winona Lake. Mr. Clodfelter represents a syndicate in control of street railways in the gas belt.

VERNON, MICH.—It is reported that the Long Lake, Durand & Corunna Ry. Co. has asked the Vernon township board for a franchise to build through the township. Vernon City, Durand and Fenton have granted franchises, and as soon as this new request is granted it is expected that bids for the construction of the line will be called for.

QUINCY, ILL.—It is reported that the Quincy St. Ry. Co. has decided to increase its capital stock from $300,000 to $600,000 in order to be enabled to make extensive improvements along its line.

BARABOO, WIS.—A company which has recently been formed to construct an electric railway between Devil's Lake and Kilbourn, via Baraboo, has petitioned the council for a franchise. Among those said to be interested are, H. Cottrell, Milwaukee, Wis., and Herman Grotophorst, of Baraboo.

WICHITA, KAN.—Reports state that the city signed a contract with H. B. Church & Co., of Chicago, Sept. 14, for 15 miles of street railway and 14 new cars and an electric light plant of 200 arc lights. The company is required to have both the plants completed within six months, and has placed $10,000 in cash with City Treasurer Kernan as a guaranty fund.

KANSAS CITY, MO.—The Kansas City Interurban Ry. Co., of Kansas City, was incorporated, Sept. 10, with a capital stock of $300,000. Press reports state that the company has bought that part of the Waldo Park dummy line north of the power house at Brush Creek to Westport, and that it will change it into an electric line and possibly build an extension. H. G. Pert and Henry Pfeiffer, of Kansas City, are said to be interested.

NEVADA, MO.—The council has granted a franchise to Quigley & Co., according to reports, for an electric street railway and also for an electric light and gas plant. It is proposed to extend the electric line at once to Eldorado Springs and other points within a radius of 20 miles; estimated cost of the system, $100,000.

SEDALIA, MO.—We are informed that the Sedalia Electric Co. is a consolidation of the Electric Ry., Light & Power Co. and the Sedalia & Brown Springs Electric Ry. Co., and that it will have control of about 15 miles of track and a light plant in this city. The reconstruction of the old line only will be undertaken at present. Pres., S. H. G. Stewart, 40 Wall St., New York; Ch. Engr., J. C. DeLong, New York.

ST. LOUIS, MO.—Press reports state that the Fourth St. Ry. was sold at public auction, Sept. 20, on the foreclosure of a mortgage, to John H. Overall, at $191,000.

BEAUMONT, TEX.—The council has granted a franchise for the construction of an electric railway in this city to J. C. Ward, E. L. Bacon, James F. Ward, V. Wiess, T. H. Langham and J. F. Keith, all of whom are said to be stockholders in the electric light company.

CORSICANA, TEX.—Reports state that William Elliott has commenced the survey for the proposed street railway, a franchise for which has been granted to M. M. Bright and others.

BOULDER, COLO.—Guy D. Duncan and others contemplate the construction of a street car line in this city, and have asked the council for a franchise.

SPOKANE, WASH.—The Spokane St. Ry. Co. has applied to the council for two new franchises, one of which will permit of the abandonment of a part of its line, and the other allow the construction of a branch line on Boone Ave. through Heath's and Sinto's additions.

OREGON CITY, ORE.—The county court has granted a franchise to W. H. Burghardt, Agt., to build an electric motor line over the county road from the city limits to Highland, a distance of eight miles. It is the ultimate intention to make this line about 40 miles in length, extending it to Wilhoit Springs.

PASADENA, CAL.—The Terminal Ry. Co. has been granted a franchise by the city trustees to install electricity on its lines in Pasadena.

MONTREAL, QUE.—The car sheds of the Montreal St. Ry. Co. were destroyed by fire, Sept. 16, causing a reported loss of $100,000 to the buildings and cars and other equipment contained therein.

PERTH, WEST AUSTRALIA.—Reports state that a tramway project for Perth, to cost about $500,000, is being promoted in London, Eng.

ELECTRIC LIGHT AND POWER.

PORTLAND, ME.—The Cumberland Illuminating Co. has asked for permission to put its wire in Congress, Middle and Exchange Sts. underground.

WATERBURY, VT.—The Bolton Falls Power Co. has let the contract for building the dam for its proposed power plant to W. H. Ward & Co., Lowell, Mass. The dam is to be completed in about 14 weeks. It will be 160 ft. long and 45 ft. high. There will be two steel penstocks, one 11 ft. in diameter and the other 9 ft. The brick power house will be 132 × 25 ft. The contract for furnishing 9,000 ft. of lumber for the dam has been let to G. E. Moody, Waterbury.

AKRON, N. Y.—E. Skinner, of the Buffalo Electric Light Co., Buffalo, N. Y., has submitted a proposition to the board of trustees for an electric light plant to cost about $3,000.

HANNAWA FALLS, N. Y.—A. F. Nims, Philadelphia. N. Y., has been awarded the contract for building a canal and masonry dam for the power plant at this place, to cost, it is stated, about $100,000. Engr., W. C. Johnson, Niagara Falls, N. Y.

SEABRIGHT, N. J.—The plant of the Seabright Electric Light Co. was destroyed by fire Sept. 15, causing a reported loss of $12,000. The new plant, which it is decided to build, will be under the control of the town. Pres. Seabright Light Co., Dr. Jas. J. Reed; Secy., E. S. Nesbitt.

DARBY, PA.—New bids for furnishing the materials and for building a plant will be asked in October. Clk. Council, J. F. Wilby.

EASTON, PA.—Local papers state that T. A. H. Hay and W. O. Hay have sold the old cotton mill on the south side of the city to a New England syndicate. A light and power plant will be built at once by the new owners, it to be in operation by Feb. 1.

PHILADELPHIA, PA.—Bids are asked by the director of public safety until Oct. 4 for electric lighting for next season. Estimates are being prepared for a municipal plant. Chn. Com., Wilson H. Brown.

PITTSBURG, PA.—The Pennsylvania Tube Works Co., according to local papers, is making arrangements for the installation of a light and power plant for its works; estimated cost, $100,000. Gen. Mgr., W. B. Rhodes.

WATERFORD, PA.—Wm. R. Irwin, Erie, Pa., is reported to have been granted a franchise for a plant and awarded a 2-year contract for lighting this town. Chn. Com., Dr. W. H. West.

LYNCHBURG, VA.—Thos. D. Davis, Pres. Council, writes us that preliminary steps are being taken to establish an electrical department. Ordinances on the subject have been submitted to the council and will come up for adoption at the meeting Oct. 7.

NORFOLK, VA.—Edwin Stewart, Paymaster-Gen., U. S. N., Washington, D. C., received the following bids Sept. 13 for furnishing electrical apparatus for the navy yard: N. J. Foundry & Machine Co., 26 Cortlandt St., N. Y., $12,450; Seeman & Halsky, 100 Broadway, New York, $11,486; C. & C. Electric Co., 143 Liberty St., New York, $12,520; Burhorn & Granger, 136 Liberty St., New York, $12,088; General Electric Co., Schenectady, N. Y., $11,200.

ASHEVILLE, N. C.—Bids are asked until Oct. 7 for furnishing 100 2,000-c. p. arc lights for a term of three years, the city to have the privilege of buying the plant. Mayor, F. M. Miller; Cy. Clk., M. W. Robertson.

ORANGEBURG, S. C.—An election will be held Sept. 27 to vote on the question of issuing $40,000 in bonds for a plant and water-works.

MACON, GA.—T. J. Carling, Pres. and Gen. Mgr. Macon & Indian Spring Electric St. Ry. Co., is preparing plans for the power and light station and equipments. The contract for boilers and engines have not been placed: that for the building and electrical equipment has been. The plant will have a capacity for furnishing 235 2,000-c.p. arc and 4,000 16-c.p. incandescent lights.

PRATT CITY, ALA.—Paschal G. Shook has been granted a 15-year franchise. The plant will cost about $9,000.

TUSCUMBIA, ALA.—Press reports state as follows: The light and water company of this city, which holds a 20-year franchise, has been notified that unless it gives to the city water and light within a short time, according to the terms of the agreement with the council, it will be requested to surrender the franchise. Another company is anxious to establish water-works and an electric light plant, if it can secure the franchise.

LUMBERTON, MISS.—The question of building a plant is being considered, according to reports.

NEW ORLEANS, LA.—The council, through the light committee, has rejected the resolution asking for bids for lighting the city with electricity for 10 years. The contract with the Edison company has yet four years before its expiration.

MOUNT BLANCHARD, O.—The question of putting in a plant is being considered, according to reports.

NEW RICHMOND, O.—E. Y. Donhan, Mayor, writes us that this place voted Sept. 12 to issue bonds for building a plant and water-works; population, 2,500.

WAPAKONETA, O.—The electric light plant of Wapakoneta is to be considerably enlarged. Geo. Hornung, Mech. Engr., Newport, Ky., has been employed to prepare the plans and specifications for the building, machinery, etc.

WOOSTER, O.—An election will be held Oct. 3 to vote on the question of issuing $25,000 in bonds for the proposed plant.

PEORIA, ILL.—Bids were asked until Sept. 20 for furnishing 400 2,000-c.p. arc light for two years from Nov. 1, check $20,000. Cy. Clk., R. M. Orr.

ROCK ISLAND, ILL.—The question of a municipal plant is being investigated. The present contract for lighting the city expires in a short time. Mayor, Thos. J. Medill, Jr.; Chn. Com., T. A. Pender.

ST. JOSEPH, ILL.—Bids are asked until 7 p. m., Oct. 6, for furnishing the materials and for building a plant. It will have a brick, metal roof, station; one 60-HP. automatic self-oiling engine; a 54 × 16 tubular boiler; a feed pump and heater; a 30-K-W. 220 volt D. C. generator with instruments, and about four miles pole line, as stated is our advertising columns. Chn. Com., C. W. Gibson; Engr., J. D. Wallace, Champaign, Ill.

RICHLAND CENTER, WIS.—R. H. Dhat, Mayor, writes us that bids for furnishing and erecting a plant will be received late in October; estimated cost, about $6,000. No engineer had been engaged up to Sept. 14. The plant will have 35 or 40 arc lights. The plant will be operated in connection with the water-works. Chn. Com., Thos. Brenden.

BARNESVILLE, MINN.—Bids are asked until Oct. 4 for constructing a plant. Engr., C. F. Loweth, 94 E. 4th St., St. Paul, Minn., or 301 W. 3d St., Davenport, Ia.; Clk., H. H. Snell.

MINNEAPOLIS, MINN.—E. T. Abbott has completed estimates for the proposed Coon Creek power plant. Thos. Lowry and Frederick Weyerhauser may be addressed.

TOPEKA, KAN.—Bids are asked until Nov. 7 for furnishing the materials, machinery, etc., for improving the plant; estimated cost, $9,006. Cy. Engr., Wm. H. Barnes. Mayor, C. A. Fellows; Cy. Clk., S. S. McFadden.

NEVADA, MO.—Quigley & Co. have been granted a 20-year franchise for a plant and a 30-year franchise for a street railway. The city has made a 10-year light contract.

WAHOO, NEB.—The plant at this place owned by S. H. Jones was destroyed by fire Sept. 10, causing a reported loss of about $4,000.

SUMPTER, ORE.—Frank Geiser has been granted a 25-year franchise. Recdr., F. J. Hallock,

CREEDE, COLO.—The Amethyst Electric Light & Power Co.'s plant was destroyed by fire Sept. 8, causing a reported loss of about $14,000.

HOUSTON, TEX.—It is stated that arrangements are being made for the immediate reconstruction of the plant of the Citizens' Light & Power Co. The smokestack will be 60 ft. high, the entire plant costing about $160,000. County Engineer Polk and J. C. Polk are the engineers.

BARRIE, ONT.—E. Donnell, Town Clk. and Treas., writes us that bids have been received for the proposed plant, to cost about $35,000. The by-law has been passed by the ratepayers, but no action can be taken for about two months. Engr., Roderick J. Parke, Toronto, Ont.

NEW COMPANIES.—Trenton-Washington Light Co., Ribsam Bldg., Trenton, N. J.; $100,000, with $1,000 paid in; to introduce in Trenton a system of lighting and heating; E. Raymond Perrine, New York; Forman H. Gordon, Windsor, N. J.; Irvin Aaron, Doylestown, Pa.; George E. Fell, Levi P. Updike, Trenton.

Carteret Electric Light & Power Co., Carteret, N. J., $20,000; John A. Quinn, Jr., Carteret; Wm. J. Landsley, Elizabeth, N. J.; Walter K. Whitaker, Sewaren, N. J.

Westerville Electric Co., Westerville, O.; $9,000; C. L. Bennett, R. B. Adams, H. E. Chinn, E. S. Aldrich, Elec. Engr., Wesley Block, Columbus, O.

Winona Ice, Electric Light & Water Co., Winona, Miss.; $100,000; E. R. Blackston, D. B. Turner, C. S. Harris.

Consolidated Incandescent Light Co., 1 Exchange Place, Jersey City, N. J.; $50,000, with $5,000 paid in; Thos. F. Bedle, Pierre F. Cook, Francis H. McGee, all of Jersey City.

Mill Point Power Co., Amsterdam, N. Y.; $80,000; to furnish light, heat and power to Amsterdam, Charlestown, Florida, Glen, Mohawk, Fonda, Fultonville, Johnstown, Perth, Mayfield and Broadalbin; John Marsh, San Francisco, Cal.; John Begley, Gloversville, N. Y.; H. J. Brady, Cooperstown, N. Y.; P. T. Brady, R. E. Drake, Syracuse.

Clarksdale Water & Light Co., Clarksdale, Miss.; $35,000; Walter Clark, E. L. Anderson, W. P. Holland, P. H. Porter, W. D. Cutrer.

Hughesville Electric Co., Hughesville, Pa.; $1,000, with $100 paid in; J. Sellers Kite, 523 North 40th St., Philadelphia.

Ironclad Resistance Co., Westfield, N. J.; $25,000; to furnish this city with electric light, power and heat. Arthur W. Berresford, Aug. P. Manning, Horace M. Williams.

Citizens' Electric Co., Reading, Pa.; to supply Lebanon and a number of small cities with electric lights.

Kalamazoo Valley Electric Co., Kalamazoo, Mich.; $100,000; to develop the water power of Kalamazoo, Otsego, Plainwell, Allegan and Battle Creek, for lighting, heating and power purposes, and also for electric railways; W. A. Foote, J. B. Foote, C. H. Frisbee, Jackson, Mich.; H. C. Hoagland, Kalamazoo; S. S. Hulbert, Battle Creek, Mich.

Chicago Suburban Water & Light Co., Chicago; $600,000; to deal in gas and electricity; Charles F. Voge, J. M. Gibson, Chares B. Wood.

Lancaster & Jefferson Eectric Light Co., Lancaster, N. H.; $36,000.

BRIDGES.

EASTHAMPTON, MASS.—Bids are asked for the construction of the Ferry St. bridge abutments and dam. Engr., E. C. Davis, Northampton, Mass.

WESTFIELD, MASS.—Bids are asked until Oct. 3 for constructing a bridge, 115 ft. long and 32 ft. wide, as stated in our advertising columns. O. A. Granger, Chn. Com.; O. E. Parks, Town Engr.

CUYLERVILLE, N. Y.—John Vickers, Geneseo, N. Y., has been awarded a contract at $4,379 for the abutment for a bridge.

SCHENECTADY, N. Y.—A petition has been presented to the council to have a viaduct constructed across Vale Cemetery to connect Prospect and Mynderse Sts.

BRADFORD, PA.—Bids are asked until 2 p. m., Sept. 24, for constructing an iron bridge and stone abutments. S. D. Kelly, Jas. McKittrich, Supervisors, St. James Hotel, Bradford.

CARLISLE, PA.—J. O. Huntington, Clk. Com., informs us that the contract for the iron superstructure of the bridge at Bishops' Ford has been let to the Wrought Iron Bridge Co., Canton, O. The substructure has been completed.

WILMINGTON, DEL.—The Delaware Construction Co. has a contract to construct two bridges, 78 and 410 ft. long, for the Wilmington & Brandywine Springs Ry. Co.

PADUCAH, KY.—Bids are asked until 2 p. m., Sept. 22, for repairing the bridge across Island Creek, on Bridge St. J. M. Lang, Mayor.

CINCINNATI, O.—Bids are asked until Oct. 8 for certain bridge work. E. L. Lewis, County Audr.

CINCINNATI, O.—Bids are asked until Oct. 15 for masonry, excavating, fill, etc., for a bridge over the canal and for woodwork on the suspension bridge over Whitewater River. E. L. Lewis, County Audr.——Bids are asked until Oct. 20 for constructing the superstructure and masonry substructure for a railway viaduct over Lick Run. Chas. G. Roth, Clk. Bd. Water-Works Trustees.

CLEVELAND, O.—The county commissioners have awarded contracts as follows: Superstructure five-mile lock bridge, in Newburg township, to Variety Iron Works, at $6,450; substructure for the same bridge, to E. S. & C. F. Doolittle, at an estimated cost of $5,882; substructure of the South Park bridge, in Independence Township, to E. S. & C. F. Doolittle, at an estimated cost of $3,809 superstructure for the same bridge, to the King Bridge Co. at $5,950.

HAMILTON, O.—The contract for the 406-ft. span bridge over the Miami River, on which bids were received by the county commissioners, Aug. 22, was let on Sept. 13 to Peter E. Schwab, at $61,000. The bridge will have a 24-ft. roadway, paved with asphalt or brick, and two 6-foot sidewalks.

NEW BALTIMORE, O.—Bids are asked until Oct. 8 for constructing a bridge across the Great Miami River. E. L. Lewis, County Audr., Cincinnati.

BEDFORD, IND.—F. W. Ranno, Asst. Engr., Southern Indiana Ry. Co., Bedford, writes us that a contract has been made with the Carnegie Steel Co., Ltd., Pittsburg, Pa., for constructing girders over Salt Creek, five miles west of Bedford, and Indian Creek, 16 miles west of Bedford. The Salt Creek bridge will consist of one 100-ft. span deck, plate lattice girder, and two 50-ft. span deck plate girders. Indian Creek bridge to consist of one 100-ft. span deck plate lattice girder and two 56-ft. span deck plate girders. The piers and abutments are now under way and the bridges are to be put in place during October.

EVANSVILLE, IND.—A petition has been presented to the county commissioners for the construction of a bridge over Pigeon Creek.

EAU CLAIRE, WIS.—Bids are asked until Sept. 28 for constructing a bridge of four spans, 144 ft. each, across the Chippewa River, between Kelsey and Bridge Sts., and for removing the old structure. C. A. Alderman, Cy. Engr.; T. P. Cochrane, Clk.

OSHKOSH, WIS.—The following bids were received Sept. 6 for a bridge over Sawyer Creek:

	Design A.	Design B.
Wisconsin Bridge & Iron Co.	$6,194*	$9,984
Wisconsin Bridge & Iron Co.	2,380**	3,800
Milwaukee Bridge & Iron Works	6,400*	7,200
C. L. Strobel, Chicago, Ill.	6,450*	7,700
Meyer & Dombke	2,600**	3,300
Carl Schneider	2,400**	3,200

* Superstructure. ** Substructure.

The Wisconsin Bridge & Iron Co. and Carl Schneider bids were the lowest for design B, which was selected by the council; design A was for a fixed bridge composed of three 67-ft. plate girder through spans. Design B was for a through plate girder draw span of 129 ft., and one 67-ft. plate girder through span.

WAVERLY, IA.—Bids are asked until Oct. 3 for furnishing the material and constructing a steel bridge of two spans, 124 and 123 ft. each, and 22 ft. wide, over the Cedar River. Wm. Weiditschka, County Audr.

BRAINFRD, MINN.—A contract was awarded to L. H. Johnson, Minneapolis, Minn., Sept. 9, at $7,825, for constructing a steel bridge. F. A. Farra, Cy. Clk.

MINNEAPOLIS, MINN.—The South Minneapolis Commercial Club recommends the construction of a bridge over the river from Cedar Ave. to 10th Ave. An effort will be made to secure an appropriation from the legislature. W. E. Brown, Pres.

OMAHA, NEB.—Local papers state that the 16th St. viaduct will be of steel and iron, 52 ft. wide on masonry piers, to cost about $150,000.

TOPEKA, KAN.—Bids are asked until Oct. 3 for constructing a pile bridge, to cost about $1,250. W. H. Barnes, Cy. Engr., 8 City Bldg.

TOPEKA, KAN.—Bids will soon be asked by the county commissioners for the construction of two bridges, 40 and 80 ft. long, between Shawnee and Douglas counties.

JEROME, ARIZ.—Reports state that the railroad bridge between Jerome and Jerome Junction has been burned. The structure was 1,240 ft. long.

LEWISTON, IDAHO.—The construction of the Snake River bridge will commence Oct. 1, according to reports. The structure will be 1,685 ft. long, in 12 spans, with a cantilever span of 374 ft., and will be 56 ft. above high water; estimated cost $80,000.

LATAH, WASH.—The county surveyor, Spokane, Wash., is preparing plans for a bridge over Hangman Creek.

ASTORIA, ORE.—Bids are asked until 12 m., Sept. 23, for constructing a wharf, warehouse and trestle approach at the station of the Astoria & Columbia River R. R. Co. Address the Northwest Construction Co.

PLACERVILLE, CAL.—Bids are asked by the county clerk for a bridge at Bechers Crossing, over the Cosumnes River.

REDWOOD CITY, CAL.—Bids are asked until Oct. 3 for constructing a bridge over Bear Gulch Creek, near Woodside. J. F. Johnston, Clk. Bd. Supervisors.

PARKENHAM, ONT.—Bids are asked until Sept. 26 for constructing a wooden bridge of two spans 41 ft. each and 16 ft. wide: estimated cost, $1,000. A. Murphy, Town Clk., Antrim, Ont.

ROUMANIA, EUROPE.—Reports state that the government has appropriated $5,000,000 for the construction of bridges.

BUILDINGS.

BATH, ME.—Contracts will soon be let, according to reports, for the erection of a new Methodist Church building, to seat about 300 persons.

NORTHAMPTON, MASS.—The general contract for erecting a new library building for Smith College is reported to have been let to the Assurance Construction Co., 32 Broadway, New York, to cost about $60,000. Archs., York & Sawyer, 156 5th Ave., New York.

PLUM BEACH, R. I.—The following bids were received by Lt.-Col. D. P. Hean, U. S. Engr., Tompkinsville (S. I.), N. Y., Sept. 15, for erecting the metal work and superstructure of the Plum Beach light station, R. I., as advertised in Engineering News:

Toomey Brothers & Co., Guilford Conn.	$8,420
" " " reduced bid by letter	7,833
W. H. Flaherty, 7 South St., New York	9,375
Frank C. Arthur, 805 N. 26th St., Philadelphia, Pa.	11,370
Houston Construction Co., Girard Bldg., Phila.	12,803
Ambrose G. Dudley, 100 Broadway, New York	14,775
L. A. Guerber, 171 Broadway, New York	19,500
Wilkins & Kuemmerle, Betz Bldg., Philadelphia	20,500

WESTERLY, R. I.—The Berlin Iron Bridge Co., East Berlin, Conn., has been awarded the contract for furnishing the steel work for the Memorial Hall being erected at Westerly. This building is to be fireproof throughout, with steel floor beams and columns supporting the floor structure, and steel trusses and beams for the roof.

DEPEW, N. Y.—We are informed that Hopkins & Roberts, 245 Broadway, New York, have been awarded the contract for erecting in Depew a 4-story colonial hotel building, 120 × 56 ft., to contain 60 bedrooms. The general contract includes the steam heating, wiring and plumbing. Bids are now being received for the refrigerating plant, electric fixtures, laundry machinery, elevator and furniture. Arch., George Palliser, 32 Park Place, New York.

KINGS PARK (L. I.), N. Y.—Bids are asked until Sept. 26 for the installation of an engine and generator at Kings Park for the Long Island State Hospital. Truman J. Backus, Pres. Bd. of Mgrs., Arbuckle Bldg., Brooklyn, N. Y.; Arch., I. G. Perry, Albany, N. Y.

NEW YORK, N. Y.—Plans are being perfected for a new brick and stone college building to be erected at 1st Ave. and 27th and 28th Sts., for the Cornell Medical College, at a cost of about $500,000. Archs., McKim, Mead & White, 160 5th Ave.——Contracts will probably be let soon for erecting a church building at 66th St. and Central Park West for the First Church of Christ. Archs., Carrere & Hastings, 28 East 41st St.——Press reports state that the Hammerstein Amusement Co., of which William Hammerstein is president, will soon erect an amusement hall at 7th Ave and 42d St., to cost about $250,000. Arch., John B. McElfatrick.——Plans have been filed by Harris Maran, 200 East 80th St., for two 6-story brick flat and store buildings, at 107 to 111 Ludlow St., to cost $50,000. Archs., Horenburger & Straub, 122 Bowery; by John P. Leo, Owner and Arch., 143 West 125th St., for two 5-story brick flat buildings, on the boulevard, near 148th St., to cost $50,000; by Louis Wirth, 914 Prospect Ave., for three 5-story brick flat buildings, on 3d Ave., near Wendover Ave., to cost $66,000. Arch., John Hauser, 1441 3d Ave.; by J. E. Nichols, 155 West 58th St., for a 5-story brick dwelling house, on 79th St., near 5th Ave., to cost $150,-

000. Arch., C. P. H. Gilbert, 1123 Broadway; by Henry Rothschild. 104 East 81st St., for four 5-story brick tenement and store buildings, at 117th St. and 5th Ave., to cost $61,000. Arch., G. F. Pelham, 503 5th Ave.; by Nathan E. Clark, 126 East 83d St., for two 6-story brick flat buildings, at 87th St. and Madison Ave., to cost $155,000. Arch., G. F. Pelham; by John Schnoering, 693 West End Ave., for two 7-story brick flat and store buildings, at 129th St. and 5th Ave., to cost $160,000. Archs., Kurtzer & Rohl, 9 7th St.

NORTH TARRYTOWN, N. Y.—David Silver, Village Clk., informs us that the proposition to erect a $20,000 addition to the present school building was voted down at the election held on Sept. 15, the apparent preference of the voters being for an entirely new structure. The matter was indefinitely postponed.

TROY, N. Y.—Bids are asked until Oct. 4 for the erection of a new high school building in this city. E. Ogden Ross, Secy. Contracting Bd.

JERSEY CITY, N. J.—Bids are asked by the police commissioners until Sept. 27, for erecting an annex to the female ward, including heating plant, in City Hospital, at Baldwin Ave. and Montgomery St. Clk., G. P. Robinson, Cooper Place and Gregory St.

PITTSBURG, PA.—Bids are asked until Sept. 24 for the erection of an engine house at Filbert and Elmer Sts. —Plans have been prepared for an apartment house to cost about $100,000. Archs., Topp & Craig, Bissell Bldg.

WILMINGTON, DEL.—Plans have been accepted for the new high school building to be erected in this city, at a cost of about $85,000. Arch., George H. Pierce, 1133 Broadway, New York.

BALTIMORE, MD.—The Massachusetts Building Co. was granted a permit, Sept. 13, to erect a 12-story brick and stone office buidling, at Charles and Fayette Sts., to cost $350,000.

WASHINGTON, D. C.—Plans are being prepared, according to reports, for the erection of a 6-story fireproof addition to the apartment house at 14th and Binney Sts., owned by Albert Carry; estimated cost, $75,000. Arch., C. A. Didden, 709 13th St., N. W.——Plans have been prepared by A. P. Clark, Jr., 605 F St., N. W., for a 6-story apartment house, 48 × 170 ft., for C. H. Allender.

WASHINGTON, D. C.—A fire in this city. Sept. 19, destroyed the 7-story brick and steel building at 12th and F. Sts., occupied by Robinson, Chery & Co., clothiers. Estimated loss, $175,000.

ATLANTA, GA.—A. L. Kautz, Clk. of County Comrs., Atlanta, informs us that Major Grant Wilkins, of Atlanta, has been employed to prepare plans and specifications for the new Fulton county court house, to cost about $100,000, and that when they have been accepted that bids will be called for.

BIRMINGHAM, ALA.—The commissioners of Jefferson county have decided to erect a new court house annex at 21st St. and Third Alley, at a cost of about $25,000.

WADLEY, GA.—Bids are asked until Oct. 1 for the purchase of $7.000 of town bonds for building a school house. Mayor, S. C. Evans.

LAKE CHARLES, LA.—The Diebold Safe & Lock Co., represented by H. M. White, of Houston, Tex., has received the contract for erecting a new jail for Calcasieu parish, at $14,650.

LOUISVILLE, KY.—We are informed that the Henry Vogt Machine Co., of Louisville, has been awarded the contract, for building a new steel grain elevator in this city for Callahan & Sons. Bids will be received in October for furnishing the equipment, estimated to cost $9,000, including one 30 and one 25-HP. motor, about 4,000 ft. of screw conveyors and other steel work. Arch., Henry Wolthers, Columbia Bldg., Louisville.

TOLEDO, O.—H. G. Conrad has the contract for erecting the four new engine houses in this city, at $26,177.——Reports state that the Lake Shore R. R. Co. contemplates the erection of a new station in this city.

DETROIT, MICH.—Bids are asked until Sept. 24 for building a 4-story stone and brick market and memorial building for the Grand Army on the Cass Market site, bounded by Grand River, Adams and Cass Aves.; deposit, $2,000. D. W. H. Moreland, Pres. Bd. of Pub. Wks.

CHICAGO, ILL.—Plans have been prepared, according to reports, for a 3-story apartment building to be erected at Jackson Ave. and 58th St. for P. A. George, 524 Reaper Block; to cost about $45,000. Arch., Louis Martens, 167 Dearborn St.——S. S. Beaman, Pullman Bldg., is said to have completed plans for the proposed Coliseum building to be erected at 24th and 25th Sts.; estimated cost, $1.000,000. Geo. H. Hurlbert, 12 Sherman St., is said to be the promoter.——The Oliver Sollitt Co., 105 Hartford Bldg., has been awarded the contract for erecting a wholesale store building at 161 Market St., for John Monk, to cost $60,000. Arch., H. B. Wheelock, 226 La Salle St.

MOUNT CARMEL, ILL.—Bids are asked until Oct. 3 for erecting a new Methodist church building; deposit, $500. Treas., R. K. Steer; Archs., Charles Henry & Son, Akron, O.

FRAZEE, MINN.—Bids are asked by Baer Bros., of Frazee, until Sept. 26, for a steam heating plant for a business block in this city; bond, $1,000. Arch., J. A. O'Shea, Fargo, N. Dak.

HARRIS, MINN.—Bids are asked until Oct. 15 for the erection of a school building, with separate bids for heating and ventilation, at Harris. Treas., P. H. Stolberg; Archs., Omeyer & Thori, 409 Chamber of Commerce, St. Paul, Minn.

HELENA, MONT.—The Montana Building Co. is stated to have been awarded the contract for erecting the new capitol building in this city, at $289,891.

OMAHA, NEB.—Bids are being received, according to reports, for the erection of the new station to be erected in this city by the Union Pacific Ry. Co. Archs., Frost & Granger, Chicago, Ill.

NATIONAL MILITARY HOME, KAN.—Bids are asked until Sept. 30 for erecting a cottage for women nurses at western branch of National Home D. V. S.

ST. LOUIS, MO.—Bids are asked until Nov. 1 for the erection of the Jackson, St. school building; deposit, $1,000. Wm. B. Ittner, Comr. of School Bldgs.

BISBEE, N. DAK.—Bids are asked by the school board until Oct. 8 for erecting a 4-room, 2-story frame school building at Bisbee. Clk., William Bursinger; Archs., Omeyer & Thori, St. Paul, Minn.

VENTURA, CAL.—Reports state that plans have been prepared for a new building to be erected at Main and California Sts., at a cost of about $40,000. Archs., Bradbeer & Russell, of Los Angeles.

ST. THOMAS, ONT.—J. H. McKnight & Co., Toronto, Ont., have been awarded the contract for improving the court house of Elgin county, at $33,990. The plumbing will be done by Chas. T. Bull, at $1,047, and the metal work by Stacey & Co., at $1.231, both of St. Thomas.

WATER-WORKS.

HALLOWELL, ME.—Chas. N. Taylor, Natick, Mass., has completed a contract for laying six miles of 6, 8, 12 and 14-in. cast-iron water pipe in this city. He has also just completed building a 1,000,000-gallon distributing reservoir. Mr. Taylor has been awarded the contract for building a 3,500,000-gallon storage reservoir for the works. These reservoirs are clay-lined and paved with granite blocks. Mr. Taylor has also the contract for furnishing the material and for laying the pipe.

WATERVILLE, ME.—Harvey D. Eaton, Cy. Solicitor, writes us that the bill being considered to unite Benson, Fairfield, Winslow and Waterville, to be known as the Kennebec Water district, is only a proposed municipalization of the existing works.

AMSTERDAM, N. Y.—The proposed improvements to the water-works will be as follows: A new 24-in. iron conduit two miles long, from end of Hanns conduit to distributing reservoir; a new high service reservoir, a 15-in. vitrified conduit, from end of McQueen conduit to reservoir, one mile long; a new 36-in. iron diverting conduit through reservoir of Bunn Creek, a 3-acre filter bed with Babcock conduits, at the end of Hanns Creek conduit, etc. The contract for the pipe has been let to the Anniston Pipe & Foundry Co., Anniston, Ala. The work is in charge of Stephen E. Babcock, Consult. Engr., Little Falls, N. Y.

BAINBRIDGE, N.Y.—This place voted, Sept. 10, to issue $22,000 in bonds for municipal works.

BUFFALO, N. Y.—Bids are asked until Sept. 29 for laying a 20-in. cast-iron water pipe across the Buffalo River, at Ohio St.; for furnishing 1,000 extension pieces for hydrants, etc. R. G. Parsons, Secy. Bd. Pub. Wks.

DEPEW, N.Y.—The question of securing its own water supply from Lake Erie is being considered by the city. Henry W. Box, may be addressed.

IRVINGTON, N. Y.—An election will soon be held to vote on the question of extending the works, at a cost of about $50,000.

MASSENA, N.Y.—Watson B. Berry, Pres. Norwood Water Co., writes us that the construction of the proposed works will not begin until early spring. The plans and specifications will be prepared this fall, and contracts will be let during the winter. Capital stock, $15,000. Secy. and Treas., Philip J. Barry.

GLOUCESTER CITY, N.J.—The council has postponed considering the bids received Sept. 15 for furnishing a water-works pump until Sept. 29.

JERSEY CITY, N. J.—Bids are asked until Sept. 26 for furnishing and setting in place three meters at or near the Belleville pumping station. Clk. Water Comrs., Geo. T. Bouton.

BLUE RIDGE SUMMIT, PA.—The proposed works for this place will be constructed by a company. D. G. Adelsberger, 722 Pennsylvania Ave., Baltimore, Md., is preparing plans and estimates. There will be over six miles of 4 to 10-in. pipe, a reservoir on a hill 560 ft. high above source of supply, which will be springs.

KNOXVILLE, PA.—Preliminary work is in progress for complete works to be constructed this fall; estimated cost, $12,000. Engr., Howard Murphy, 326 Walnut St., Philadelphia, Pa.; present address, Knoxville, Pa.

YORK, PA.—Local papers state that the York Water Co. has awarded a contract for furnishing a 4,000,000-gallon filtration plant to the New York Filter Co., New York.

CENTREVILLE, MD.—The town commissioners are considering the question of securing a better water supply. Pres. Comrs., Chas. M. West.

DENTON, MD.—Harry A. Roe writes us that nothing will be done regarding the construction of works, reported in our issue of last week.

POCOMOKE CITY, MD.—Van D. Hitesmith, Knoxville, Tenn., has been awarded the contract, at $19,500, for furnishing the materials, excepting the water pipe, and for building the proposed works and sewerage system. The contract for the cast-iron water pipe has been let to M. J. Drummond & Co., New York, at $6,726. The well for the water supply is being bored by J. H. K. Shannahan.

ORANGEBURG, S. C.—An election will be held Sept. 27 to vote on the question of issuing $40,000 in bonds for works and an electric plant.

COLUMBUS, GA.—L. H. Chappell, Mayor, writes us that no definite steps have yet been taken in regard to a new water supply. An investigation is being made and it is expected to bore for water soon.

GREENSBORO, GA.—Bids are asked until Oct. 6 for furnishing the materials and for building the proposed works. The plant will consist of 21,000 ft. of 4 to 10-in. cast-iron water pipe; 12,000 lbs. of special castings, 32 hydrants, 22 valve boxes, 22 4 to 10-in. valves, a standpipe, 12×120 ft., a 500,000-gallon settling basin, etc. Engr., E. H. Davis, Eatonton, Ga.; Mayor, J. B. Williams; Clk., E. W. Copelan.

McRAE, GA.—The council has let the contract for boring an artesian well for a water supply, according to reports.

ROME, GA.—J. W. Rowersville, Chn. Com., writes us that this city has muddy water at times of much rain. The committee appointed by the council to select the best method has decided upon filtration beds, to be placed at the outlet end of the present settling basin.

MOBILE, ALA.—M. T. Lewman & Co., Louisville, Ky., have been awarded the contract at $460.202 for constructing the proposed works. Supervising Engr., T. W. Nicol, Mobile; Mayor, J. C. Bush.

TUSCUMBIA, ALA.—Press reports state as follows: The light and water company of this city, which holds a 20-year franchise, has been notified that unless it gives to the city water and light within a short time, according to the terms of the agreement with the council, it will be requested to surrender the franchise. Another company is anxious to establish works and an electric plant.

FAYETTEVILLE, TENN.—An election will be held Oct. 15 to vote on the question of issuing $30,000 in bonds for the proposed works. Clk., R. A. Conger; Engrs., Guild & Co., Chattanooga, Tenn.

NASHVILLE, TENN.—Bids are asked until Sept. 27 for furnishing about 250 tons of 6-in. cast-iron water pipe, hydrants, valves, etc.; estimated cost, $5,000. Supt. Bd. Pub. Wks., Geo. Reyer.

CINCINNATI, O.—Bids are asked until Sept. 29 for laying water pipe in a number of streets. Pres., Bd. Cy. Affairs, A. B. Rattermann.

NEW RICHMOND, O.—E. Y. Donham, Mayor, writes us that at the election, Sept. 12, this place voted to issue $30,000 in bonds for works and a light plant. Engr., E. F. Layman, 32 East 3d St., Cincinnati, O.

TROTWOOD, O.—Dr. W. C. Mendenhall, Secy. Trotwood Water Supply Co., writes us that the contract for building the works has not been let. The specifications are not quite prepared. There will be required a pneumatic or air-tight tank, a well about 30 ft. deep, with a capacity of about 30 to 60 bbls. an hour for fire protection and domestic use, about 3,800 ft. of 3 and 4-in. pipe, 12 to 15 hydrants, a gasoline engine, etc. The contracts will be let after asking for bids.

HENRYVILLE, IND.—We are informed that no steps have been taken toward building works, and that there probably will not be for the present.

KEWANNA, IND.—An election was held in this city, Sept. 12, to vote on the question of building works.

EATON RAPIDS, MICH.—Bids are asked until Oct. 4 for furnishing six miles of water pipe, hydrants, special castings, etc., as stated in our advertising columns. Engrs., Alvord & Shields, The Rookery, Chicago; Secy. Water-Works and Lighting Bd., Jas. H. Gallery.

PAW PAW, MICH.—The following bids were received Aug. 17 for furnishing the material and for constructing the works, the bids for pipe, hydrants, specials, etc., being given under Contract Prices: Engr., Geo. S. Pierson, Kalamazoo, Mich.: Pumps,—(1) being for two single pumps, and (2) for one single pump; (3) for two compound pumps and (4) for one compound pump; (5) for two boilers, a heater, feed pump, etc.; buildings, (6) for pumping station and (7) for chimney; water tower, (8) for brick tower and (9) for steel tower: Jos. M. Pearl, (1) $1,900, (2) $900, (5) $2,400, (6) $800, (7) $700; (8) $4,000, (9) $4,500; T. C. Brooks & Sons, Jackson, Mich., (1) $1,300, (5) $1,100, (6) $692, (7) $555, (8) $4,076; Kalamazoo Supply & Construction Co., Kalamazoo, Mich., (1) $1,300, (2) $850, (5) $825, (6) $800, (7) $700, (8) $4,000; M. Walker, (2) $2,765, including pumps and boilers; Laidlaw-Dunn-Gordon Co., Cincinnati, (1) $1,500, (2) $1,025, (3) $1,800, (4) $1,300, (5) $1,200; Snider-Hughes Co., Cleveland, O., (1) $1,375, (2) $900, (3) $1,775, (4) $1,125, (5) $1,450; Stillwell-Bierce & Smith Vaile Co., Dayton, O., (1) $1,150, (2) $700; Goulds Mfg. Co., Seneca Falls, N. Y., (1) $3,632, (2) $3,690—bids include gasoline engines; Geo. Rickman & Sons, (5) $1,019, (6) $692, (7) $555, (8) $1,476, brick work only; Jackson & Church, Saginaw, Mich., (5) $1,443, (8) $3,923; Muskegon Boiler Works, Muskegon, Mich., (5) $1,400, (8) $3,775, (9) $3,275; Biggerstaff & Atkins, (6) $748, (7) $655; Alex. McIntosh, Muskegon, (6) $700, (7) $600; Chicago Bridge & Iron Works, Chicago, Ill., (9) $4,311; Warren City Boiler Works, (9) $3,470; Abendroth & Root Mfg. Co., New York, spiral riveted steel pipe, $5,987; Fairbanks, Morse & Co., Chicago, two 28-HP. gasoline engines, $2,225.

TRENTON, MICH.—It is stated that the Trenton water board will build a new chimney 70 ft. high and will purchase a new engine capable of pumping 750,000 gallons of water daily.

CANTON, ILL.—The board of local improvements has voted to build a new reservoir, to cost about $3,800.

CHICAGO, ILL.—L. E. McGann, Comr. Pub. Wks., it is stated, will urge the council to rebuild the Chicago Ave. pumping station, at a cost of about $500,000.

SOUTH CHICAGO, ILL.—The Troy Laundry Machinery Co. is building a new soap factory at 96th and Erie Sts., South Chicago, and has given L. Wilson, 53 Dearborn St., Chicago, a contract for an artesian well for the water supply of the factory.

CARSON, IA.—The question of building works is again being considered, according to reports.

CLARE, IA.—This town is reported to have voted to build works to cost about $5,000.

ELMORE, MINN.—This place voted Sept. 10, by a majority of 17, to build works. Population, 1,200. Mayor, M. Masmerssen.

BERESFORD, S. DAK.—Bids are asked until Oct. 1 for furnishing the materials and for building the proposed works, to cost about $12,000. Plans and specifications may be seen at the First National Bank, Chicago, Ill. Mayor, August Frieberg.

PLANKINTON, S. DAK.—Bids are asked until Oct. 3 for sinking a deep well for a water supply for the poor farm, according to reports. County Audr., S. G. Kinyon.

ROSEBUD, S. DAK.—Bids are asked by Chas. E. McChesney, U. S. Indian Agent, for furnishing windmills, tanks, etc., for the water-works at this agency.

SIOUX FALLS, S. DAK.—The council on Sept. 14 decided to submit to the voters at the election in November the proposition of issuing bonds for municipal works. It is said that the proposition will be carried almost unanimously. The works will cost, complete, about $130,102. Population, 12,000. Engr., W. R. Coats, Ypsilanti, Mich., and Sioux Falls; Mayor, B. H. Lien.

WAGONER, IND. TER.—Bids are asked until Oct. 15 for constructing the proposed works, as stated in our advertising columns, and as described in our issue of last week. Engr., J. S. Thatcher, Cockrell Bldg., Dallas, Tex.; Mgr. Wagoner Water-Works Co., W. I. Nicholson.

SEATTLE, WASH.—Bids are asked until Nov. 15 for constructing the proposed Cedar River gravity water supply addition, etc., for water-works, as described in our advertising columns; estimated cost, $1,200,000. Secy. Bd. Pub. Wks., Frank Oleson.

ANTELOPE, ORE.—A. D. Sheldon is reported to have been awarded the contract for building the proposed gravity works, at about $5,000.

CONDON, ORE.—This place has voted to issue $3,000 in bonds for the proposed works.

LAKEPORT, CAL.—The board of trustees is arranging for the construction of the proposed works, to cost about $17,000. Town Clk., H. V. Keeling.

SAUSALITO, CAL.—M. M. O'Shaughnessy, Crocker Bldg., San Francisco, is preparing a report on the water supply of this place. Two small companies supply the town and much dissatisfaction exists. After the report has been submitted the trustees will consider the next step. Asst. Engr., J. S. Molony, San Francisco.

TUCSON, ARIZ.—Sylvester Watts is making tests for the proposed new water supply; estimated cost, $100,000.

RICHFIELD, UTAH.—It is reported that arrangements are being made for works. Councilmen L. H. Outzen and W. H. Seegmiller may be addressed.

WATERLOO, ONT.—Wm. Snider writes us that at present the town is supplied with water from the Berlin works, the contract for which expires next year. A committee has been appointed to investigate the question of putting in a pumping station, pipes, etc. A water supply could be secured from artesian wells, it is thought, in sufficient quantity.

WINNIPEG, MAN.—Local papers state that the Winnipeg Water-Works Co. has offered to sell its plant to the city for about $275,000. Mayor Andrews may be addressed.

BELEM, PARA, BRAZIL.—Bids are asked until Nov. 10 for the transfer by the government of the state of Para of the exclusive right for 60 years (to be extended under certain conditions for a further term of 10 years) to supply Belem, the capital, with potable water. The transfer will include certain lands, machinery, plant and other material actually in use in the present water-works or in stock. Further information may be had on application to the Brazilian Consulates and Vice-Consulates at London, England, at Berlin, Germany, and at Washington, D. C., and 22 State St., New York, N. Y.

IRRIGATION.

BEAUMONT, TEX.—The Jefferson County Irrigation Co. has awarded the contract for building an irrigation canal at Pine Island to E. A. Hayne.

SILVER CLIFF, COLO.—Surveys are being made for the West Mountain Valley reservoir to furnish water for the sugar belt raisers of Eastern Colorado and Western Kansas. The dam is to be a half-mile wide and 800 ft. thick at the mouth of Grape Creek canon.

LARAMIE, WYO.—Reports state that the ranchmen of Prairie Dog Creek and tributary streams, propose building a reservoir at the Piney Lakes, near Cloud Peak, for irrigation purposes; estimated cost, $10,000.

RIVERSIDE, CAL.—The people along the Jurupa & West Riverside Canal are planning to abandon their rights in the canal and to construct a pipe system, consisting of about eight miles of 12-in. steel pipe, to cost about $50,000.

NEW COMPANIES.—Gale Ditch Co., Echo, Ore.; $5,000; to construct flumes and ditches for irrigation; Austin Gale, Maggie Gale and May O'Garra.

Glendora-Azusa Water Co., Los Angeles, Cal.; to construct water systems, etc., to supply cities and towns in the Upper San Gabriel Valley with water for irrigation, power, etc.; D. A. Colae, J. H. Odell, E. O. Kennard, Glendora; W. R. Powell, W. C. Ormiston, C. G. Matthews, Azusa.

SEWERAGE

CONCORD, MASS.—Bids are asked until Sept. 24 for furnishing the materials and for grading and preparing the sewage filtration beds in this town. Chn. Comrs., Wm. Wheeler; Engr., Leonard Metcalf, 89 State St., Boston.

SPRINGFIELD, MASS.—Bids are asked until Sept. 26 for constructing 735 ft. of 51-in. and 33 ft. of 60-in. brick sewers. Cy. Engr., C. M. Slocum; Supt of Sts., Wm. L. Dickinson.

COHOES, N.Y.—Bids are asked by the public improvement commission until Oct. 12 for constructing certain sewers.

LYONS, N.Y.—This city has voted to build a sewer in Jackson St., at a cost of $1,000.

NEWBURG, N.Y.—Alderman David Brown writes us that it is proposed to build seven blocks of 4-ft. brick sewer at a cost of about $27,000; average cut, 12. Cy. Engr., Chas. Caldwell.

ELIZABETH, N. J.—Bids are asked until Oct. 1 for constructing about 3,200 ft. of 18 to 12-in. pipe sewers, 26 manholes etc. St. Comr., N. K. Thompson.

JERSEY CITY, N. J.—Bids are asked until Sept. 26 for constructing 400 ft. of 18-in. pipe sewer, etc. Clk. Bd. St. and Water Comrs., Geo. T. Bouton.

NEWARK, N. J.—Bids are asked until 3.30 p. m. Sept. 22 for constructing about 39,000 ft. of brick and pipe sewers. Gen. Supt. of Works, M. F. McLaughlin.

BRADFORD, PA.—Bids are asked until Sept. 26 for constructing a sewer in Washington St. Cy. Clk., Jas. A. Lindsey.

CHESTER, PA.—C. M. Black, Mayor, has approved the ordinance for a sewer in Fourth St.

OAKMONT, PA.—John Dell and Diulles & Bro., Braddock, Pa., have been awarded the contract for building a system at $36,500.

CHESAPEAKE CITY, MD.—The council is reported to have voted to build a system.

POCOMOKE CITY, MD.—Van D. Hitesmith, Knoxville, Tenn., has been awarded the contract for building the system and water-works at $19,500.

MOBILE, ALA.—Bids are asked until Oct. 17 for constructing a system, as stated in our advertising columns. Mayor, J. C. Bush; Supervising Engr., T. W. Nicol, Mobile.

EAST CLEVELAND, O.—Bids are asked until Oct. 10 for constructing sewers in a number of streets, and also for a sewage disposal plant; three bonds of $1,500 required. Engr., Rice Engineering Co., 545 Society for Savings Bldg., Cleveland; Clk., H. B. Chapman.

MARIETTA, O.—Bids are asked until Oct. 15 for constructing sewers in the Fifth district. Cy. Clk., Carl Becker.

MINGO JUNCTION, O.—Bids are asked until Sept. 27 for constructing a sewer in Jumbo Run. Clk., E. E. Pelugh.

NILES, O.—The council will probably ask for bids in October for building a sewer about a mile long, according to reports. Cy. Engr., Wm. Wilson.

DELRAY, MICH.—Jas. Grant, Detroit, has been awarded the contract for laying 8,475 ft. of sewer pipe at about $6,000.

DURAND, MICH.—Wm. H. Putnam, Village Clk., writes us that the council voted Sept. 12 not to take action on the proposed 24 and 20-in. pipe sewer until the spring. Engr., H. A. Riggs, The Nasby, Toledo, O.

CHICAGO, ILL.—Bids are asked until Sept. 27 for constructing pipe sewers in several streets. Pres. Bd. Local Improvements, L. E. McGann.

GALESBURG, ILL.—It is proposed to build a trunk sewer from the Knoxville Road to Cedar Fork Creek, at a cost of about $53,000. City Engineer Blanding may be addressed.

MONMOUTH, ILL.—J. E. Miller, Cy. Engr., writes us that contracts for building the following sewers will be in after adoption by the council Oct. 1: About 1,550 ft. of 12-in. and 1,920 ft. of 15-in. of pipe, and 2,100 ft. of 42-in. and 860 ft. of 24-in. brick sewers; estimated cost, $11,475.

DECORAH, IA.—E. Mathes, Clk., writes us that the council has received bids for plans for sewers. No action has yet been taken.

DES MOINES, IA.—Bids are asked until Sept. 30 for constructing pipe sewers in certain streets. Chn. Bd. Pub. Wks., G. A. Eberhart.

EASTON, MINN.—Bids are asked until Sept. 28 for constructing a sewer. Engrs., M. B. & A. M. Haynes, Waukato, Minn.; Recdr., F. W. Roth.

CLINTON, MO.—It is proposed to construct a sewer in district No. 25.

OTTAWA, ONT.—S. J. Davis, Chn. Com., writes us that the following work is included in the by-law to spend $425.000 voted by the people Sept. 8: Western outlet—6,400 ft. of 5-ft. circular and 2,000 ft. of 4-ft. sewer; mostly through limestone rock and cutting: Eastern outlet—8,300 ft. of 5-across the canal and Rideau River; 6,300 ft. of 5-ft., 9,100 ft. of 6-ft. and 5,300 ft. of 7-ft. sewer, mostly in rock and earth or clay cutting. The work will probably be let in three different contracts. Engrs., Rudolph Hering, 100 William St., New York, and Robert Surtees, Cy. Engr. of Ottawa.

CHERTSEY, ENGLAND.—Plans are asked until Dec. 23 for a system and a sewage disposal plant. The premiums will be $250, $150 and $100, respectively. Clk., T. E. Harland Chaldecott.

GARBAGE DISPOSAL—STREET CLEANING

BRIDGEPORT, CONN.—The board of health has rejected the offer of Frank E. Clark, Pres. Connecticut Reduction Co., recently holding the contract for burning the city garbage, to sell the plant to the city. The board has decided that for the present the garbage will be buried at the town farm. In the meantime the question of erecting a crematory will be considered. Mayor Taylor may be addressed.

LANSINGBURG, N. Y.—Bids are asked by the city clerk until Sept. 27 for cleaning the streets and alleys.

ATLANTIC CITY, N. J.—The council has awarded the contract for building a Smith-Simon incinerating plant to Thos. K. Dalzell, Reading, Pa., at $29,900.

PHILLIPSBURG, N. J.—The council has voted to build a plant to cost about $8,500, according to reports.

BEAVER FALLS, PA.—The Keystone Reduction Co. has been awarded a 5-year contract for removing the garbage, night soil, dead animals, etc. The company will pay the city $400 a year, according to reports. A plant will be built at once.

READING, PA.—H. H. Hammer, Cy. Clk., writes us that the following bids were received Sept. 16 for reconstructing the garbage disposal plant: Chas. Linsey and Benjamin Howland, Philadelphia, $4,453; John H. Hook, Lancaster, Pa., $2,375, and the General American Reduction Co., Philadelphia, $3,250. The question of awarding the contract will be considered at the meeting of the council, Sept. 26.

NEW ORLEANS, LA.—The council has adopted a resolution directing the city engineer and commissioner of public works to prepare specifications for the erection of crematories in order that all garbage collected in the city be destroyed by fire within the time guaranteed to the secretary of war.

MILWAUKEE, WIS.—The aldermen have voted to purchase a plant of the Engel Sanitary & Crematory Co. for $52,500.

SANTIAGO, CUBA.—The Dixon Cremating Co. is said to have been awarded the contract by the U. S. government to furnish this city with a plant.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked until 12 m., Sept. 23, for macadamizing portions of four streets. Benj. W. Wells, Supt. Sts.

WASHINGTON, MASS.—Reports state that W. C. Whitney is considering the question of constructing a road from his residence to Washington St., to cost about $10,000.

MILFORD, CONN.—Bids are asked until Sept. 30 for macadamizing on Broad and Cherry Sts. E. E. Bradley, First Selectman.

ALBANY, N. Y.—A contract has been awarded to Mulderry Bros., at $32,079 for paving Elm St. with brick between Grand St. and Delaware Ave.

BUFFALO, N. Y.—Bids are asked until Sept. 28 for paving in Hirschbeck St. with brick. R. G. Parsons, Secy. Bd. Pub. Wks.——The Buffalo Marblelithic Paving Co. has been awarded a contract for 32,000 sq. ft. of marblelithic sidewalk around Humboldt Park, to cost about $6,000.

DEERFIELD, N.Y.—Bids are asked until Oct. 4 for improving the River Road for 2¼ miles. C. W. Adams, State Engr., Albany.

NEWBURG, N. Y.—David Brown, Alderman, informs us that the question of asphalt paving is being considered at an estimated cost of $26,647. Chas. Caldwell, Cy. Engr.

NIAGARA FALLS, N. Y.—Bids are asked until Sept. 30 for about 1,200 sq. yds. of asphalt paving on Cherry Ave., as stated in our advertising columns. Walter Jones, Cy. Engr.; S. F. Arkush, Clk.

ROCHESTER, N. Y.—Whitmore, Rauber & Vicinus have been awarded a contract at $56,503 for asphalt paving in North Clinton St.

SALAMANCA, N. Y.—Bids are asked by the village clerk until Sept. 28 for furnishing the materials and for 9,755 sq. yds. of brick paving, as stated in our advertising columns.

SCHENECTADY, N. Y.—Bids are asked by the council until Sept. 27 for paving Summit Ave., Franklin and Mynderse Sts., with sheet asphalt.

SYRACUSE, N. Y.—Bids are asked until Sept. 26 for the purchase of $20,000 of improvement bonds. C. F. Allen, Cy. Treas.

TROY, N. Y.—Bids are asked until Oct. 4 for grading and widening Mill St. E. Ogden Ross, Secy. Contracting Bd.

ATLANTIC CITY, N. J.—Bids are asked until Oct. 3 for brick and macadam paving, as described in our advertising columns. Cy. Surv., J. A. Hackney; Chn. Com., Edward S. Lee.

ELIZABETH, N. J.—The board of trade will ask the council to expend $47,000 for asphalt paving, according to reports.

HOBOKEN, N. J.—Bids are asked until Oct. 12 for asphalt paving in portions of nine streets and for improving certain other streets. M. V. McDermott, Cy. Clk.

PHILLIPSBURG, N. J.—Bids are asked until Sept. 29 for the purchase of $60,000 of 4% street improvement bonds. G. G. Stryker, Chn. Finance Com.

ALLEGHENY, PA.—An election will be held to vote on the question of increasing the bond debt $10,000, for paving and grading the Franklin Road.

MAUCH CHUNK, PA.—The city clerk informs us that the question of increasing the bonded indebtedness for street improvements will probably not be submitted to a vote before February.

SCRANTON, PA.—An ordinance will be introduced in the council for an appropriation of about $68,000 for repairing certain paved streets.

WASHINGTON, PA.—An election was held Sept. 16 to vote on the question of appropriating $67,000 for street improvements.

YORK, PA.—The committee has submitted an estimate of 133,915 sq. yds. of paving to be laid throughout the city.

WILLIAMSPORT, MD.—Geo. Thompson, Mayor, informs us that there is a movement being made to secrue better roads by private subscription, and that the county will give double the amount appropriated. S. B. Kenedy, Engr., Chambersburg, Pa.

LOUISVILLE, KY.—Bids are asked by the board of public works until Sept. 27 for asphalt paving in 26th and Oak Sts. The council is considering the question of establishing an asphalt plant to repair pavements.

PADUCAH, KY.—Bids are asked until 2 p.m., Sept. 22, for grading and graveling Bridge St. from Broad St. to Benton Road. Jas. M. Lang, Mayor.

CLEVELAND, O.—Bids are asked until Oct. 5 for grading and paving the Ridge Road for seven-eighths of a mile. J. C. Dorn, County Clk.——Bids are asked until Oct. 7 for asphalt paving, grading, draining, etc., on portions of Pearl and Lorain Sts., and macadamizing on Carter, St. Clair and Superior Sts. Geo. R. Warden, Dir. Pub. Wks.

COLUMBUS, O.—Bids are asked until 12 m., Sept. 22, for furnishing and constructing asphalt, brick or stone pavement on Yale Ave. Jas. A. Fanning, Clk. Bd. Pub. Wks.——The Acme Paving Co. has been awarded a contract at $2,200 for laying new sidewalks on High and Broad Sts., at the state capitol grounds.

COSHOCTON, O.—The following bids have been received for paving Main St.: N. G. Abbott, Columbus, O., $27,758; Adams Bros., Zanesville, O., $20,648; J. N. Kissner, Warsaw, O., $20,647; C. B. McArthur, Kenton, O., $25,019; Townsend & Co., Zanesville, O., $20,764.

MALTA, O.—W. J. Berry, Marietta, O., has been awarded a contract at $8,630 for brick paving.

STEUBENVILLE, O.—Bids are asked until Sept. 28 for paving Fourth St. with brick. Geo. P. McCracken, Cy. Clk.

ALEXANDRIA, IND.—Bids are asked until Sept. 27 for a gravel roadway and brick sidewalks on Harris St. between Canal and Harrison Sts. G. A. Gessner, Jr., Cy. Engr.

ANDERSON, IND.—A petition signed by J. A. Cox and others has been presented to the council for asphalt paving in West Ninth St.

TERRE HAUTE, IND.—The county commissioners have awarded contracts for constructing roads to Jean, Jean & Haxton, Worthington, Ind., at $5,000, Paris Road; Fred S. Jessup, Worthington, Ind., at $3,263, National Road, and $6,739 for the Darwin Road.

DETROIT, MICH.—Bids are asked until 10 a. m., Sept. 23, for furnishing and constructing cedar block pavement, curb, etc., on four streets. D. W. H. Moreland, Pres. Bd. Pub. Wks.

CARTHAGE, ILL.—H. C. Johnson, Secy., writes us that bids will probably be asked about Oct. 15 for 25,935 sq. yds. of brick paving, estimated cost $35,000. The funds will be raised by special assessment. Engr., Thos. McClanahan, Monmouth, Ill.; M. P. Barry, Pres. Local Bd. Improvements.

CHICAGO, ILL.—The West Park commissioners propose to extend the Washington Boulevard to Maywoood, a distance of four miles, at an estimated cost of about $600,000.

CHICAGO, ILL.—Bids are asked until 3 p. m., Sept. 23, for cement walks, brick paving, grading, etc. on the grounds of certain schools. Address Board of Education, 1110 Schiller Bldg.

PONTIAC, ILL.—Bids are asked until Sept. 27 for constructing 3,975 sq. yds. of brick paving, cement curbing, etc., as stated in our advertising columns. F. W. Winkler, Cy. Attorney.

WILMETTE, ILL.—Bids are asked until Sept. 27 for grading, curbing and macadamizing on Wilmette Ave. Wm. J. Pierson, Chn. Bd. Local Improvements.

LA CROSSE, WIS.—Bids are asked until 2 p. m., Sept. 22, for grading portions of 17 streets. D. E. Bice, Chn. Comrs. Pub. Wks.

COUNCIL BLUFFS, IA.—Bids are asked by the council until Oct. 10 for asphalt and brick paving on a number of streets.

ST. PAUL, MINN.—Bids are asked by the county commissioners until Oct. 10 for macadamizing Rice St. and the White Bear Road, estimated cost about $14,000.

OMAHA, NEB.—Bids are asked until Sept. 30 for asphalt, brick or stone paving in 40th St. Andrew Rosewater, Chn.

INDEPENDENCE, KAN.—Bids are asked by the council until 5 p. m., Sept. 23, for 22,000 sq. yds. of two course brick paving, bond for $5,000.

KANSAS CITY, MO.—Bids are asked until Sept. 27 for furnishing and constructing asphalt pavement in nine streets. Henry A. Wise, Cy. Engr.

ST. LOUIS, MO.—Bids are asked until Oct. 7 for granitoid sidewalks around St. Louis Place. Robt. E. McMath, Pres. Bd. Pub. Improvements.

HELENA, MONT.—Bids are asked by the board of public works for granolithic paving and stone gutter in front of the city hall, and for 20 street crossings and furnishing crushed stone, etc.

SACRAMENTO, CAL.—The county supervisors will improve a portion of Riverside Ave. with macadam, to cost about $2,500. Address Supervisor McLaughlin.

MONTREAL, QUE.—The aldermen will present an ordinance to the council to appropriate $3,000 for improving St. Catherine St. and $2,166 for Craig St.

TORONTO, ONT.—The board of public works is considering a proposition to pave Major St. with asphalt, at an estimated cost of $27,290.

MANUFACTURING PLANTS.

EAST BOWDOINHAM, ME.—The ice plant of Clark & Chaplin at this place, consisting of twelve buildings, has been destroyed by fire; estimated loss, $50,000.

MIDDLEBURY, VT.—F. O. Sinclair, Burlington, Vt., is said to have secured the contract for two steel frame buildings, 45×152 ft., and one, 45×200 ft., for the Brandon Italian Marble Co., of Middlebury.

BUFFALO, N. Y.—Bids are asked for erecting a new brewing plant in this city to cost about $100,000. Archs., Esenwein & Johnson, 707 Mooney Bldg.

OSWEGO, N. Y.—It is reported that the malt house of the Stevenson Brewing Co., which was burned some weeks ago, will be replaced in the spring by a new plant, to cost about $100,000. Pres., James McClenahan, of New York.

TROY, N. Y.—Cluett, Coon & Co., of this city, inform us that the building which it expects to erect adjacent to its present collar factories on River St. will be used as a warehouse and not as a factory.

WOODBURY, N. J.—The window glass works at this place, owned by Col. G. G. Green, were destroyed by fire Sept. 19, causing a reported loss of $30,000.

AVONMORE, PA.—Reports from Pittsburg state that W. H. R. Hilliard, M. M. Garland, Oliver Wylie, W. S. Collier and T. H. Jeremiah have organized a company, with $200,000 capital stock, to build and operate a 6-mill tinplate plant at Avonmore that will employ about 300 men.

CONNELLSVILLE, PA.—W. H. Baldridge, of Connellsville, informs us that all the contracts have been let for additions to the plant of the Humbert Tin Plate Co. The extension to the main building will be erected by Wm. B. Scaife & Sons; all additional furnaces, foundations, etc., will be put up by Edward E. Erickson; the new engines will be furnished by Barclay M. Everson, and the hot and cold rolls, housings, etc., by the Totten & Hoag Iron & Steel Co., all of Pittsburg. All other buildings, railway tracks, etc., will be built by the company. Work is to be completed within a month. Pres., Geo. J. Humbert, Connellsville.

WILLIAMSPORT, PA.—The sawmill and lumber yard of Hunt, Deemer & Co. were damaged by fire Sept. 18, causing a reported loss of $75,000.

WHEELING, W. VA.—The Acme Box Co.'s plant at this place was burned Sept. 15, causing a reported loss of $50,000. Owner, John Arbenz.

ROSSVILLE, GA.—It is reported that E. G. Richmond, W. F. Hutcheson and N. A. Campbell, of Chattanooga, Tenn., have decided to erect a new cotton yarn mill at this place, to cost about $90,000.

GADSDEN, ALA.—It is announced that the Dwight Mfg. Co. will double the capacity of its plant, and thus will require 30,000 additional spindles. Mgr., R. A. Mitchell.

DAVENPORT, IA.—John Peters has been awarded the contract for erecting a 2-story warehouse for the Glucose Sugar Refining Co., at $11,250.

MONTREAL, QUE.—Reports state that bids are being received by Peck, Binny & Co. for the reconstruction of their large rolling mills on Mill St., which were lately destroyed by fire. Estimated cost of improvement, $100,000.

CHIHUAHUA, MEX.—Press reports state that Henry C. Creel, of Chihuahua, who is connected with the Chihuahua & Pacific Ry. Co., is about to erect a 20-ton open-hearth steel plant in this city. It is also said that the Wellman-Seaver Engineering Co., of Cleveland, O., will equip the plant.

GAS PLANTS.

BUFFALO, N. Y.—The council has appropriated $1,000 for the hire of an expert to prepare plans for a municipal gas plant.

SANDY HILL, N. Y.—A franchise has been granted to James E. Flood and James D. Sherrill to construct and operate a gas plant for light, fuel, etc. President Filkins, Bd. Village Trustees.

WYNCOTE, PA.—Reports state that a new gas plant is about to be erected here.

FOSTORIA, O.—It is reported that a syndicate represented by Samuel R. Bullock, Philadelphia, Pa., has purchased the plants of the Fostoria Light & Power Co. and the Northwestern Natural Gas Co., and will construct a new gas plant in this city for light and fuel.

FULTON, KY.—Charles Gregory has applied for a franchise to construct and operate a gas plant, according to reports. Population, about 2,000.

LINCOLN, ILL.—The plant of the Lincoln Gas Co. has been sold for $200,000 by Frank M. Mills to Joseph H. Vail, Chicago, representing Eastern capitalists. The plant is bonded for $30,000.

SAN BERNARDINO, CAL.—B. C. Roos writes us that he is about to organize a company to construct a plant for the manufacture of gas, ice and electricity.

NEW COMPANIES.—Crescent Oil & Gas Co., St. Mary's, W. Va.; $50,000, with $100 paid in; to bore for oil, gas, etc.; Henry Lenz, Wm. Muehlbrunner, Allegheny, Pa.; J. A. Elptunstone, J. F. Roessle, Wm. H. Roessle, Pittsburg, Pa.

Paulding Oil & Gas Co., Paulding, O.; $10,000; to drill for gas and oil.

California Oil & Gas Co., Yuma, Arizona; $2,000,000; W. H. Hart, N. Y. Lemance, L. L. Bettys, Henry P. Umbsen, R. J. Davis, D. E. Hayes and W. H. Snedaker.

MISCELLANEOUS CONTRACTS.

FIRE HOSE.—Owosso, Mich.—The fire department has asked the committee to purchase 1,000 ft. of new fire hose.

CEMENT.—Seattle, Wash.—Bids are asked until October for furnishing Portland cement. Capt. Harry Taylor, U. S. Engr.

POLICE SIGNAL SYSTEM.—Gloucester, Mass.—F. E. Davis writes us that a police signal system will be installed at an early date.

GASOLINE ENGINE.—Red Hook, N. Y.—D. W. Wilbur wishes to secure some cheap power (not to exceed 1 HP.) for running a cream separator.

CYCLEWAY.—Pasadena, Cal.—Horace H. Dobbins, Pres. Cycleway Co., has been granted a franchise for a cycleway to cost about $187,500.

TELEPHONE SYSTEM.—Washington, Ga.—A franchise has been awarded to Neil & Grier to establish a telephone exchange for this town and county.

LUMBER.—New York, N. Y.—Bids are asked until Oct. 3 for furnishing spruce joist, roofing boards and white pine. Francis J. Lantry, Comr. Dept. of Correction.

POLICE CALL SYSTEM.—Birmingham, Ala.—The board of aldermen will investigate the cost of repairing the Gamewell police call system which will include about $700 for wiring.

BOILERS.—Providence, R. I.—Bids are asked until 12 m., Sept. 24, for furnishing boilers of about 400 HP. E. K. Glenze, Secy. State House Comrs., 308 Industrial Trust Co. Bldg.

TELEPHONE SYSTEM.—Little Rock, Ark.—The council has granted a franchise to the American Telephone & Telegraph Co. for a telephone system, to have long distance connections.

MACHINERY.—Boston, Mass.—Bids are asked until Sept. 27 for furnishing a quantity of rope making machinery for the navy yard. Edwin Stewart, Paymaster-Gen., U. S. N., Washington, D. C.

DREDGING, ETC.—Portland, Ore.—Chairman McCracken has reported that the channel is in need of dredging on the west side of Coon Island. Two dump scows will be purchased, to cost about $1,400 each.

LEVEE.—Dayton, O.—Bids are asked until Oct. 3 for enlarging the levee along the Miami River, from Euwing St. to the Troy Pike Road, and along the river to the Dayton & Michigan R. R. J. E. Gimperling, Cy. Comptroller.

FLOOD GATES.—Dayton, O.—Bids are asked until Oct. 3 for constructing flood gates across the Miami River and Erie Canal at Apple St., and for constructing masonry at the west end of the Apple St. sewer. J. E. Gimperling, Comptroller.

CEMENT, BROKEN STONE, ETC.—Fort Washington, Md.—Bids are asked until Oct. 10 for furnishing American natural and Portland cement, broken stone, etc., as stated in our advertising columns. Lt.-Col. Chas. J. Allen, Engr.

PARKWORK.—Kansas City, Mo.—A petition has been presented to the commissioners by Thos. W. Gilruth, A. W. Love and others, for the improvement of the West Park district. It is proposed to construct a steel observatory tower on the reservoir site.

CANAL WORK.—Kirkersville, O.—Bids are asked until Oct. 1 for deepening, widening and strengthening the Kirkersville Feeder from Kirkersville to Buckeye Lake. Engr., J. T. Egerton, Ironton, O.; Chas. E. Perkins, Ch. Engr. Bd. Pub. Wks. of Ohio, Columbus.

CHANNEL.—Waterbury, Conn.—Bids are asked until Sept. 24 for constructing a new channel for Little Brook, between East Main St. and Abbott Ave., about 390 ft. long, 6 ft. wide and 5¼ ft. deep, of brick and concrete. R. A. Cairns, Cy. Engr., 9 Leavenworth St.

LEVEE WORK.—Brownsville, Tenn.—Contracts have been awarded to J. R. Kinney and C. A. Short for levee work along the Hatchie River. J. N. E. Moore, Chn.

MACHINERY.—Norfolk, Va.—Bids are asked until Sept. 27 for furnishing the navy yard with a 32-in. swing, triple-geared engine lathe, a 25-in. lathe, an 18-in. lathe, a universal milling machine, drills, trimmers, shapers, etc. Edwin Stewart, Paymaster-Gen., U. S. N., Washington, D. C.

BRICK PAVING.—Glens Falls, N. Y.—W. R. Johnson, Catskill, N. Y., submitted the lowest bid, Sept. 5, for 5,800 sq. yds. of brick paving in Glen St., at $1.80 a sq. yd.

DIKES.—Hudson River.—Col. J. W. Barlow, U. S. Engr., Army Bldg., New York, received the following bids Sept. 8 for repairing and building dikes in the Hudson River and for furnishing paving and rubble stone, as advertised in Engineering News; the bid of Kirk, Driscoll & Co. was recommended for acceptance:

Bids Received at New York City, Sept. 8, 1898, for Repairs to and the Building of Dikes in the Hudson River.

Bidder.	Pine or spruce piles, 193,000 lin. ft.	Round timber, 11,000 lin. ft.	Square timber, yellow pine, 206,000 ft.	Tie rods and screw bolts, 136,000 lbs.	Drift bolts, etc., 43,000 lbs.	Rubble stone put in dike, 11,200 cu. yds.	Quarry spalls put in dike, 2,000 cu. yds.	Rubble stone, delivered, 1,100 cu. yds.	Paving stone, delivered, 1,000 cu. yds.	Total.
International Con. Co., 95 Broad St., New York..	$0.12½	$0.12½	$35.00	$0.04	$0.04	$0.90	$0.75	$0.90	$1.25	$53,690
James Du Bois & Co., 11 Broadway, New York...	.11	.11	27.25	.04¾	.04¾	.95	.95	.95	1.40	51,541
Chas. W. Johnston, Lewes, Del.	.13	.13	18.50	.06	.06	.95	.90	.95	.98	55,536
Frank Pidgeon, Saugerties, N. Y.	.11½	.15	36.00	.03¼	.03¼	.95	1.25	.95	1.25	52,514
P. Sanford Ross, 277 Washington St., Jersey City.	.12¾	.10	35.00	.03½	.03½	1.00	.90	1.00	1.75	55,033
John Berkery, 11-13 William St., New York......	.10	.08	27.50	.05	.05	1.00	1.00	1.00	1.25	50,345
William Parrott, Newburg, N. Y.	.10⅞	.10	38.50	.04	.04	.90	.90	.90	1.50	51,550
Richard Parrott, Newburg, N. Y.	.11½	.11½	35.00	.04	.03½	.85	1.00	1.00	1.50	51,735
A.F. Chapman & Co.,476 Ellicott Sq. Bldg.,Buffalo	.109	.10⅘	33.00	.03⅖	.04	.90	.79	.98	1.75	49,855
John E. Pidgeon, Manlius Center, N. Y.	.10	.09	33.00	.03½	.03½	1.25	1.10	1.25	1.40	52,328
Kirk, Driscoll & Co., 10 Dunfee Bldg., Syracuse.	.11	.09	35.00	.03¾	.03½	.89	.70	.89	1.40	49,782
Wm. D. Fuller, New Baltimore, N. Y.	.10¾	.10	36.00	.04	.04	.87	.75	.94	1.89	50,592

NAVAL SUPPLIES.—New York, N. Y.—Bids are asked until September 27 for furnishing the Brooklyn navy yard with 200,000 ft. B. M. of yellow pine, 2,000 ft. of galvanized steel cable, electric apparatus, about 20,000 fuses, 60,000 ft. of lightning wire, 32,500 ft. of galvanized iron pipe, etc. Edwin Stewart, Paymaster-Gen., U. S. N., Washington, D. C.

TELEPHONE LINE, WHARF, ETC.—Washington, D.C.—Bids are asked until Sept. 24 for building a telephone line, furnishing wooden tanks, a steam pump and extending old ballast wharf at the marine hospital at the South Atlantic Quarantine. Jas. N. Nydegyer, Passed Asst. Surgeon, Treasury Dept., Office of Marine Hospital, Washington.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Sept. 27 for furnishing the navy yard with 71,780 lbs. of cold rolled copper, 300,000 lbs. of round brass, 24,500 lbs. of commercial sheet steel, 600,000 lbs. of ingot copper, etc., and for a heating and ventilating plant for the new experimental model basin. Edwin Stewart, Paymaster-General, U. S. N., Washington.

MACADAM ROAD.—Tuckahoe, N. Y.—Bellew & Merritt Co. has been awarded the contract for Telford macadam paving in Midland Ave., and on Cronin Hill, at $1.24 and $1.19 a sq. yd., respectively, and 50 cts. a lin. ft. for brick gutter. Town Clk., W. J. Fisher.

BROKEN LIMESTONE, ETC.—Brooklyn, N. Y.—The following bids were recently received by Commissioner Keating, of Highways, for furnishing broken limestone and limestone screenings in Brooklyn, wherever needed for street repairs: Norton & Gorman, broken limestone a cu. yd., $1.49, screening, a cu. yd., $1.49; Nicholas Ryan, $1.64, and $1.64; J. Frank Quinn, $1.75 and $1.75, respectively.

WATER-WORKS.—Paw Paw, Mich.—The following bids were received Aug. 17 for furnishing the following materials, etc., for the proposed water-works, the bids for the remainder of the work being given under Water-Works; Alexander & Shaw bid 71 cts., 55 cts., 40½ cts. and 31 cts respectively for furnishing and laying together; the hydrant connections are for fire steamer; Engr., Geo. S. Pierson, Kalamazoo, Mich.:

Bids Received at Paw Paw, Mich., Aug. 17, 1898, for the Construction of Water-Works.

Bidder.	Iron pipe, 335 tons.	Special c'st'gs, 12,000 lbs.	Hydrants: With conns., 10, each.	Hydrants: Without conns., 22, each.	Gates: 10-in., 1, each.	Gates: 8-in., 4, each.	Gates: 6-in., 8, each.	Gates: 4-in., 4, each.	Gate boxes, 17, each.	Laying pipe, a ft.: 10-in., 1,900 ft.	Laying pipe, a ft.: 8-in., 2,400 ft.	Laying pipe, a ft.: 6-in., 11,450 ft.	Laying pipe, a ft.: 4-in., 2,800 ft.
Jas. W. Pearl, Kalamazoo..	$17.50	$0.02½	$29.00	$26.00	$24.00	$19.00	$12.00	$18.00	$3.50	$0.18	$0.15	$0.13	$0.11
T. C. Brooks & Sons,Jackson	15.20	.01¾	23.00	21.50	23.00	16.50	11.50	6.50	2.60	.18	.16	.13	.11
Kalamazoo Sply & Cnstn Co.	16.60	.02¼	36.00	31.00	21.50	16.00	10.00	6.00	2.75	.27	.19	.16	.128
Alexander & Shaw, Chicago.	.....	...	.....	.....	.....	.....	.....	.....	....	.195	.185	.14	.11
M. Walker, Fenton, Mich...	15.80	.01½	24.50	22.25	20.00	15.75	10.65	6.37	2.60	.18	.15	.12	.10
Man & Andrew, Dowagiac..	.....	...	.....	.....	.....	.....	.....	.....	....	.17	.145	.12	.10
R. D. Wood & Co., Phila....	.....	...	22.00†	21.50	22.00	15.00	10.00	6.00	2.40	...	...	...	...
Mich. Brass & Iron Wks.*..	.....	...	21.00§	19.50	20.00	13.75	9.00	5.00	2.50	...	...	...	...
Bourbon Cop'r & Brass Wks	.....	...	18.75‡	.....	20.00	15.00	9.50	6.00	3.12	...	...	...	...

*Detroit. †4-in., $22.00, 4½-in., $23.80. §4-in., 21.00, 5-in., $24.00. ‡4-in.,$18.75 and $22.10, 5-in., $22.75 and $22.30.

LEVEE WORK.—West Memphis, Ark.—Bids are asked until Oct. 21 for constructing 24 miles of levee, containing about 2,193,000 cu. yds. of material, in Crittenden county; also for constructing about eight miles of levee in Lee county, containing about 800,000 cu. yds., as stated in our advertising columns. John B. Driver, Pres. St. Francis Levee Bd., West Memphis; Harry N. Pharr, Ch. Engr., 49 Southern Express Bldg., Memphis, Tenn.

STEAM GENERATORS.—League Island Navy Yard, Pa.—We are informed that M. T. Endicott, Ch. Bureau Yards and Docks, U. S. N., Washington, received the following bids Sept. 17 for furnishing and installing steam generators at the navy yard:

Babcock & Wilcox Co., New York..................	$5,500
Aultman & Taylor Machinery Co., Mansfield, O....	5,469
*Heine Safety Boiler Co., Philadelphia............	5,133
John Baizley, Philadelphia	7,485

*Awarded contract.

CONTRACT PRICES.

DREDGING.—Bridgeport, Conn.—The following bids were received Aug. 31, 1898, by Maj. Smith S. Leach, U.S. Engr., for dredging in Bridgeport Harbor, Conn.; bid of Henry Du Bois Sons recommended for acceptance:

Bidder.	Dredging, Prior to Nov. 30, 1898.*	Dredging, After Nov. 30, 1898.	Total.
Alonzo J. Beardsley, Bridgeport..	$0.08½	.....	$6,800
H.Du Bois Sons,119 South St.,N.Y	.069	$0.035	5,520
E. Brainard, 24 State St., N. Y...	.11	.05½	8,800
Wm. H. Taylor, Jr, Jersey City...	.07½	.03¾	6,000
J. P. Randerson, Albany, N. Y...	.08	.04	6,400

*80,000 cu. yds.

BRICK PAVING.—Albany, N. Y.—The following bids were received by the board of contract Sept. 6 for brick paving in Elm St., from Grand St. to Delaware Ave.; Mulderry Bros. were awarded contract:

Other bids on suuplies were as follows: American Pipe & Foundry Co., Chattanooga, Tenn., pipe, $15.20 a ton; specials, 1¼ cts. a lb.; Lake Shore Foundry, Cleveland, O., $15.80 and 1¾ cts., respectively; Dennis Long & Co., Louisville, Ky., $15.79 and 2 cts.; Addyston Pipe & Steel Co., Cincinnati, O., $16.00 and 2 cts.

REPAIRING LOCKS.—Pittsburg, Pa.—Maj. Chas. F. Powell, U. S. Engr., received the bids Sept. 9, 1898, for certain wrought and cast iron work, for the locks and dams on the Monongahela River, on which extensive repairs are being made by G. W. Hegemier & Co. The iron work is purchased by the government and turned over to the contractor, who is making the repairs. The bids asked were for about 50,000 lbs. of wrought iron, and about 48,000 lbs. of cast iron for lock No. 1. The bids were as follows, a lb.: Fort Pitt Bridge Works, wrought, 2¼ cts., cast 3¾ cts.; Bair & Gazman Co., wrought 2¼ cts., cast 2¾ cts.; Oliver Iron & Steel Co., wrought 2¼ cts.; Union Foundry & Machine Co., wrought 1.85 cts., cast 2.4 cts.; Wm. Yeagle & Co., cast 1.65 cts.; Thos. Carlin's Sons, wrought 2 cts., cast 3 cts.; Pittsburg Mfg. Co., wrought 3 cts., cast 2 cts.; Thomas Marshall, wrought 2½ to 3½ cts., cast 2 to 3½ cts.; Caife Foundry & Machine Co., wrought 4½ cts., cast 4 cts. For lock No. 2, about 32,000 lbs. of wrought iron and 11,000 lbs. of cast iron will be required. The bids for this lot were as follows: Bair & Gazman Co., wrought 4¼ cts., cast 3¾ cts.; Thomas Marshall, wrought 3 to 6 cts., cast 3 cts.; Wm. Yeagle, cast 2.45 cts.; Thomas Carlin's Sons, wrought 5.88 cts., cast 4 cts.; Pittsburg Mfg. Co., wrought 3½ cts., cast 1.875 cts.; Union Foundry & Machine Co., wrought .0542-ct., cast .0388-ct.; Oliver Iron & Steel Co., wrought .0225-ct.; Fort Pitt Bridge Works, wrought 3.87 cts., cast .0225-ct.

ASPHALT PAVING.—Chester, Pa.—The Vulcanite Paving Co., Philadelphia, has been awarded the contract for asphalt paving in Market St., at $1.73 a sq. yd., 5-year guarantee, and at $1.89, 10-year guarantee.

LEVEE WORK.—Carlyle, Ill.—Noble W. Irish, Carlyle, is reported to have been awarded the contract for repairing the old Santa Fe levee on the Kaskaskia River, at 16 cts. a cu. yd.; total, $12,000.

Bids Received at Albany, N. Y., Sept. 6, 1898, for Brick Paving in Elm St.—Grand St. to Delaware Ave.

Quantities.		Frank Pidgeon.	Troy Public Works Co.	Mulderry Bros.	Wm. R. Reynolds.
Kind of brick to be used	....	Catskill.	Troy.	Catskill.	Catskill.
Vitrified brick pavement	11,000 sq. yds.	$1.97	$1.95	$1.68	$1.75
Straight granite curb	6,530 lin. ft..	.75	.70	.60	.67
Circular granite curb	270 " "	.75	.70	1.05	.74
Pavement relaid on sand	70 sq. yds.	.30	.25	.50	.50
Pavement relaid on concrete	10 " "	1.50	1.00	2.50	1.00
Curb relaid on sand	30 lin. ft..	.25	.20	.30	.50
Curb relaid on concrete	50 " "	.40	.30	.45	.40
New vitrified brick sidewalk	60,000 sq. ft...	.08	.10	.09½	.07
New 4-ft. flag sidewalk	10,000 " "	.17	.14	.15	.13
Relaying sidewalk	30,000 " "	.04	.03	.04	.03
Receiving basins	6 each...	85.00	75.00	85.00	70.00
Repairing receiving basins	3 " ...	25.00	25.00	50.00	35.00
Total	....	$35,719	$35,459	$32,083	$30,980
Number of days to complete work at $5 a day.....	....	120	75	50	30

VAPOR LIGHTING.—Washington, D. C.—The district commisioners have received the following bids for furnishing naphtha street lamps and light, the district in all cases to furnish posts and street designations: For 1,000 lamps or over, bidders to furnish lantern and equipment.—American Development Co., $19.50; Sun Vapor Street Lighting Co., $16.72; Pennsylvania Globe Gas Light Co., $20.00; For 1,000 lamps or over, district to furnish lantern, contractor the equipment and light—American Development Co.,$16.80; Sun Vapor Lighting Co., $15.72; Pennsylvania Globe Gas Light Co., $20.00.

ASPHALT PAVING.— Rochester, N. Y.—Whitmore, Rauber & Vicinus, Rochester, submitted the lowest bid at $1.70 a sq. yd. for asphalt paving in North Clinton St., from Clifford St. to the city line; total, $78,000.

BRICK PAVING.—Shamokin, Pa.—D. O. Heim, Shamokin, has been awarded the contract for paving a portion of Shamokin St. with Mack brick, at $1.62 a sq. yd.

BRICK SEWER.—Richmond. Ind.—The following bids were received Sept. 16, for constructing a brick intercepting sewer in North E St.; contract awarded to John F. Cronin:

Bids Received at Richmond, Ind., Sept. 16, 1898, for the Construction of a Brick Intercepting Sewer.

	Items.	Ulrich, Nissley & Williams, Springfield, O.	Greenville Construction Co., Greenville, O.	John F. Cronin, Richmond, Ind.	Schneider & Miller, Richmond, Ind.	Thomas J. Peters, Cincinnati, O.	William Rehling, Richmond, Ind.
Masonry	Brick, a cu. yd.	$8.25	$8.00	$5.75	$10.00	$8.20	$6.00
	Stone, a cu. yd.	8.00	11.00	8.00	10.00	8.00	7.00
	Concrete, a cu. yd.	6.00	7.00	5.25	10.00	8.00	4.00
Excavation, a cu. yd.		.35	.60	.40	.50	.31	.30
Lumber left in trench, per M. ft.		30.00	12.00	15.00	20.00	15.00	...
Cast iron, a lb.		.02	.0125	.025	.03	.03	.025
Pipe, a ton		35.00	35.00	35.00	...	40.00	...
Manholes, each		35.00	37.00	24.00	50.00	...	25.00
Lampholes, each.		15.00	7.00	10.00	15.00	...	8.00
Catchbasins, each		30.00	32.00	35.00	30.00	...	30.00
Inlets, each		25.00	18.00	15.00	25.00	...	15.00
Subdrain pipe, a ft.		.10	.20	.06	...	.10	.07
Channels, each.		.20	.11	.25	.27	.30	.26
Sewer brick, a 1,000.		7.50	6.25	7.00	7.00	...	7.00
Bouldering, a cu. yd.		5.00	...	3.50	2.00	1.00	3.50
Brick sewer, 2,500 ft., complete.		4.70	3.91	3.67	5.83	5.42	3.69
Sewer pipe, discount from list price		84%	87%	82½%	80%	..	75%

LEVEE WORK.—New Orleans, La.—The following contracts were let Sept. 12, 1898, by the Orleans District Levee Board for levee work in the Third District: From New Orleans & Northeastern R. R. to Alvar St. and from Lesseps St. to Ursuline Convent, J. G. Gardner, New Orleans, pilings, etc., 13 7-10 a lin. ft.; sawn timber, $25 a 1,000 ft., B. M., $22,125; Alvar to Lesseps Sts., including cave, Jno. J. Frawley, New Orleans, pilings, etc., 17 25-100 a lin. ft.; wharf timbers, $23.65 a 1,000 ft., B. M. Also 15 cts. a lin. ft. for all old pilings replaced and $13 a 1,000 ft. for all old wharf timbers; $31,900. From upper line of Ursuline Convent to Egania St., pilings, etc., 14 7-10 cts. a lin. ft.; wharf timbers, $21.70 a 1,000 ft., B. M.; $49,140.

DAM.—Columbus, O.—The following bids were received by the clerk of the board of public works, Sept. 10, for furnishing the materials and for constructing the foundation and lower portion of the concrete masonry dam for the new storage reservoir, as advertised in Engineering News:

Bids Received at Columbus, O., Sept. 10, 1898, for Constructing a Concrete Masonry Dam.

Bidder.	Excavation, Earth, Dry, 5,000 cu.yds.	Excavation, Earth, Wet, 3,500 cu.yds.	Excavation, Rock, 1,200 cu.yds.	Concrete masonry, 20,000 cu.yds.	Material alone.	Totals for furnishing cement, Contractor.	Totals for furnishing cement, City.
Greenville Construction Co., Greenville, O.	$0.50	$0.70	$2.00	$6.39	$5.00	$135,150	$67,350
William H. Luchtenberg & Co., Columbus, O.	.25	.75	.75	6.39	3.00	100,775	60,775
Willard & Cornwell, Louisville, Ky.	.22	1.40	1.00	4.69	2.50	101,000	57,200
S. Casparis, Columbus, O.	.30	1.00	1.00	6.04	1.99	127,000	46,000
Assurance Construction Co., New York.	.40	2.00	2.00	5.15	2.55	114,400	62,400
Houston Construction Co., Philadelphia, Pa.	.30	.90	1.00	5.63	3.00	118,450	65,850
Cleveland Construction Co., Cleveland, O.	.40	.60	1.00	5.50	3.50	115,300	75,300

MACADAM ROAD.—Westminster, Mass.—The Massachusetts State Highway Commission, A. B. Fletcher, Secy., Boston, awarded the following contract Sept. 8, 1898, to C. H. Kelleher, Newburyport, Mass.: Excavation, 871 cu. yds., 30 cts. a cu. yd.; excavation, borrow, 200 cu. yds., 35 cts.; ledge excavation, 10 cu. yds., $3.00; rubble masonry laid dry, 10 cu. yds., $5.00; rubble masonry laid in cement, 98 cu. yds., $8.00; gravel, 250 cu. yds., 50 cts.; telford, 100 sq. yds., 25 cts. a sq. yd.; shaping, 5,250 sq.yds., 2 cts.; broken stone in place, 1,254 tons, $1.30 a ton; 12-in. vitrified clay pipe, 40 lin. ft., 50 cts. a lin. ft.; fencing used as guard rail, 710 ft., 15 cts.; side drains, 1,325 ft., 25 cts.; stone monuments, 18 each, $1.00; 18-in. vitrified clay pipe, 175 lin. ft., 90 cts. a lin. ft.; catchbasins, 5 each, $15.00; superstructure of bridge, $175.00; total, $3,964.

BRICK PAVING.—Meadville, Pa.—D. T. McKay, Jr., Cy. Clk., informs us that the following bids were received Sept. 14, for brick paving, the contract being awarded Peter Schenck for Park wire-cut brick:

Bids Received at Meadville, Pa., Sept. 14, 1898, for Brick Paving.

Bidder.	Brick pavement, 1,480 sq. yds., complete; concrete foundation, a sq. yd., Brady Run.	Park.	Mack.	Franklin.	6 x 22-in. curbing, 970 lin. ft.	Edge stones, 100 lin. ft.	Cast-iron gutter plates, &c. 900 lbs.	Storm sewer 12-in., 40 lin. ft.	Storm sewer 10-in., 80 lin. ft.	Working days to complete.	Totals.
Thomas McGuigan*	$1.30	$1.27	.....	$1.25	$0.44	$0.16	$0.01¾	$0.32	$0.30	30	$2,345 to $2,419
Ross & Robinson.†	1.25	1.23	.....	1.23	[1].40 [2].46	[3].31	.01¾	.35	.33	35	2,281 " 2,325
Peter Schenck.§	....	1.23	$1.24	1.20	.38	.32	.01¾	.39	.34	60	2,235 " 2,294
Jas. McAfee & Co.‡	....	1.29	1.29	1.27	.44	.30	.02	.60	.50	30	2,418 " 2,448

*Meadville. †Meadville. §Butler. ‡Allegheny. [1]Ohio sandstone. [2]Natural flag. [3]Berea.

MACADAM ROAD.—Pittsfield, Mass.—The following contract was let Sept. 8, 1898, to Harris & Letteney, Boston, for building a macadam road in this city for the Massachusetts State Highway Commission; Secy., A. B. Fletcher, Boston: Excavation, 3,000 cu. yds., 40 cts a cu. yd.; excavation, borrow, 100 cu. yds., 38 cts.; excavation, ledge, 10 cu. yds., $4.25; rubble masonry, laid dry, 21 cu. yds., $4.60; rubble masonry laid in cement, 60 cu. yds.; $7.80; gravel, 418 cu. yds., 80 cts.; telford, 500 sq. yds., 36 cts.; shaping, 6,684 sq. yds., 2 cts.; broken stone in place, 1,719 tons, $1.94 a ton; 12-in. vitrified clay pipe, 58 cts.; fencing used for guard rail, 1,020 lin ft., 16 cts. a lin. ft.; side drains, 3,200 lin. ft., 29 cts.; stone monuments, 22 each, $1.50; total, $6,987. Extra work at following prices (materials at cost): Foremen, 40 cts. an hour; masons, 35 cts.; masons' helpers, 20 cts.; laborers 16⅔ cts.; double teams and drivers, 45 cts.; single teams and drivers, 30 cts.

INDUSTRIAL NOTES.

EXHIBITS AT THE ANNUAL CONVENTION OF THE NEW ENGLAND WATER-WORKS ASSOCIATION AT PORTSMOUTH, N. H., SEPT. 14 to 16:

VALVES AND HYDRANTS.—Rensselaer Mfg. Co., Troy, N. Y.; Coffin Valve Co., Boston, Mass.

METERS.—Thomson Meter Co., Brooklyn, N. Y.; Union Water Meter Co., Worcester, Mass.; National Meter Co., New York city; Hersey Mfg. Co., South Boston, Mass., Neptune Meter Co., New York city.

MISCELLANEOUS.—Ashcroft Mfg. Co., New York city, pressure and recording gages and safety valves; Fred. M. Gow, Medford, Mass., meter testing bench; Lead-Lined Iron Pipe Co., Wakefield, Mass., service pipe; Henry F. Jenks, Pawtucket, R. I., drinking fountains; Mueller Mfg. Co., Decatur, Ill., water-works supplies and tapping machines; A. P. Smith Mfg Co., Newark, N. J., tapping machines and water-works supplies; Builders' Iron Foundry, Providence, R. I., service boxes; Consolidated Safety Valve Co., safety valve.

EXHIBITORS AT ROADMASTERS' CONVENTION AT DENVER, COLO., SEPT. 13 AND 14.

A. O. Norton, Boston—Jacks.
Continuous Rail Joint Co., Newark, N. J.
National Lock Washer Co., Newark, N. J.
McMullen Woven Wire Fence Co., Chicago.
Page Woven Wire Fence Co., Adrian, Mich.
Weber Rail Joint Mfg. Co., New York, N. Y.
Elliott Switch & Frog Co., East St. Louis, Ill.
Coughlin-Sanford Switch Co., New York, N. Y.
W. Goldie, Jr., & Co., Pittsburg, Pa.—Tie plugs.
Eyeless Tool Co., New York, N. Y.—Track tools.
Macleod & Clark, Cincinnati, O.—The Buckeye light.
Automatic Rail-Joint Spring Co., Chicago.—Nut lock.
Roberts, Throp & Co., Three Rivers, Mich.—Hand cars.
Adams & Westlake, Chicago.—Switch and signal lamps.
Railroad Signal Lamp & Lantern Co., New York, N. Y.
L. S. Ware, Springville, N. Y.—Tie-plate, surfacer and gage.
Hussey, Binns & Co., Pittsburg, Pa.—Tamping shovels.
Ramapo Iron Works, Hillburn, N. Y.—Switches and frogs.
Standard Coupler Co., Chicago.—Wayland insulated rail joint.
Pettibone, Mulliken & Co., Chicago.—Track tools and supplies.
The Q. & C. Co., Chicago—Servis tie-plates and Bryant rail saws.
Buda Foundry & Mfg. Co., Harvey, Ill.—Handcars and track tools.
Fairbanks, Morse & Co., Chicago—Jacks, handcars, cattleguards.
Andrew Warren Railway Supply Co., St. Louis, Mo.—Track tools.
A. Bonzano, Philadelphia, Pa.—Rail joint and anti-creeping device.
Pennsylvania Steel Co., Steelton, Pa.—Switches, frogs and switchstand.
Dilworth & Porter Co., Pittsburg, Pa.—Goldie tie-plates and spikes.
Diamond State Iron Co., Wilmington, Del.—Spikes and the Churchill rail joint.
Railroad Supply Co., Chicago.—Wolhaupter tie-plates, cattle guard and crossing signal.
Matthews Woven Wire Fence Co., Jacksonville, Illl.—Fencing and posts for steel track signs.
M. M. Buck Mfg. Co., St. Louis, Mo.—Track tools and supplies, including enameled iron track flags.

THE PITTSBURG BRIDGE CO., through its New England agents, Collins & Norton, Springfield, Mass., has an order from Fitts Bros., South Framingham, Mass., for the steel framework of their new three-story building at the last-named place.

THE UNITED STATES SANITARY CO., Washington, D. C., has just completed and shipped to Santiago, Cuba, three carloads of its garbage wagons and carts. The company has in press a new booklet which will soon be out, and which will be sent free on application.

THE PITTSBURG REDUCTION CO., Pittsburg, has just received an order for 50,000 lbs. of aluminum from the Russian Government for army purposes. It is stated that the metal is being used in the Russian army for buttons, canteens, cooking utensils, buckles, and even as horse shoes.

MR. E. J. HAYDEN, for over six years a member of the firm of Harold C. Dayton & Co., 138 Dey St., New York, representative in that city of the Dobbie Foundry & Machine Co., Niagara Falls, N. Y., has established a contractors' railway and mill supply business, at 55 Warren St., New York.

THE STILWELL-BIERCE & SMITH-VAILE CO., Dayton, O., through its Chicago house, was recently awarded the contract for a compound direct-acting pumping engine at Missouri Valley, Ia.; also for electrically driven pumps at Alpena, Mich., and an air lift plant at Odell, Ill. The company reports a satisfactory trade in all its lines.

THE CLIMAX ROAD MACHINE CO., Marathon, Pa., reports that it has had to operate its works day and night for the entire past season in order to keep up with its orders for road machines. The business this year has been more than double that for 1897, which was the largest previous year. The plant will be enlarged this fall.

THE HELDERBERG CEMENT CO., 86 State St., Albany, N. Y., which recently put in operation a new plant for the manufacture of Portland cement at Howe's Cave, N. Y., reports that its orders are already more than double the capacity of the plant, and that the capacity of the plant may be quadrupled this winter. Mr. Chas. E. Lee is General Manager and Vice-President.

THE BRODHEAD CONTRACTING CO., recently incorporated as successors to Brodhead & Hickey and C. E. Brodhead & Co., has lately been awarded the contract to build the stockhouse walls and concrete pavement for the two new blast furnaces which are about to be erected by the Ohio Steel Co., at Youngstown, O. There are about 15,000 cu. yds. of rubble masonry and 15,000 cu. yds. of concrete foundation pavement.

THE AMERICAN DIAMOND ROCK DRILL CO., 120 Liberty St., New York, reports among recent orders a drill of 1,500 ft. capacity for Russia; hand drills for the Klondike and for Mexico; a No. 7 drill for Northern New York State; two 1,000-ft. drills for Mexico, and one drill for Sumatra, Asia. The company also reports a marked increase during the past two months in the diamond drill supply trade, both domestic and export, and considerable activity in orders for allied machinery.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., is erecting for Beaman & Smith, Providence, R. I., a new machine shop, 60×130 ft., with a lean-to addition, 20×50 ft. The building will be modern in every respect and will have a maximum amount of light consistent with good construction, will be practically fireproof, and arranged with traveling cranes, trolleys, and such appliances for the easy handling of materials and machines. A portion of the building will be two stories high, arranged for suitable offices, drafting rooms, store-rooms, etc. The framework of the building is steel built in brick work entirely supported by the framework, and is arranged with a view to easily attaching shafting for the transmission of power. An electric traveling crane of 40 ft. span, with a capacity of 15 tons, will run the whole length of the main building.

NEW COMPANIES.—American Indies Co., 110 East Front St., Plainfield, N. J.; $18,000,000, commencing with $50,000; to generate and distribute electricity for purposes of light, heat, power, etc., in the West Indies; R. A. C. Smith, 100 Broadway, New York; Thomas F. Ryan, 32 Liberty St., New York; Anthony N. Brady, Albany, N. Y.; Thomas Dolan and Wm. L. Elkins, of Philadelphia, Pa.

South American Construction Co., Manaos, State of Amazonas, Brazil; $400,000, commencing with $400; to manufacture asphalt pavement, and to lay and sell the same; W. D. Walker, B. F. Brennig, A. L. White, P. L. Lieborman and Rufus W. Fowler, all of New York.

New Rochelle Telephone Co., New Rochelle, N. Y.; $500,000, commencing with $100; to deal in telephones, telephone devices, apparatus and supplies; by George W. Sutton, New Rochelle; A. R. Hopkins, Montclair, N. J.; John H. Scofield and David G. Whitney, Grand View, N. Y.; Horace A. Conner, Brooklyn, N. Y.

Standard Ball Co., New York; $150,000, commencing with $500; to buy, sell, lease or mortgage all mechanical apparatus and metal-turning machines; H. S. Weed, New Canaan, Conn.; Felix Jellenik, R. L. Shainnold, A. T. George and E. M. Johnson, of New York.

Marshall & Huschart Machinery Co., Chicago, Ill.; $50,000; Alfred Marshall, Frank M. Huschart, Benjamin F. March.

Wayne Engineering & Construction Co., Worthington, Ind.; $20,000; C. S. Knight, Thos. Duncan.

Trenton Fire Brick Co., New York Ave., Trenton, N. J.; $100,000, commencing with $15,000; to manufacture and sell vitrified and refractory clay products; Geo. R. Frost, Chas. A. Pope and Francis C. Lowthorpe, all of Trenton.

Rich Patch Iron & Ore Co.; $3,000,000, commencing with $50; to manufacture iron, steel and other metals; John F. Anderson, Walter Woolcott, Ernest E. Davies, Victor H. Conkle and Frederick Maurer, all of Philadelphia, Pa.

Avery Salt Co., Avery Island, La.; $400,000, commencing with $70; to manufacture evaporated salt, and appliances used in said business; Joseph Clark, Wm. L. Chrisman, H. E. Gerhard, Wm. C. Watt and M. G. Saunders, all of Philadelphia, Pa.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morn- If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

The Circulation of ENGINEERING NEWS among Prominent Contractors Probably EXCEEDS that of any other FIVE PAPERS

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PERSONAL.

Mr. H. E. Wells, of Columbus, O., has been appointed Superintendent of the city water-works and electric light plant of Rushville, Ind., to succeed Mr. A. T. Mahin, resigned.

Mr. Julius Le Roy Adams, Jun. Am. Soc. C. E., of Brooklyn, N. Y., has been appointed Chief Engineer of the Hartford, Manchester & Rockville Electric Ry. Co., Hartford, Conn.

Mr. William W. Locke, Assoc. M. Am. Soc. C. E., Sanitary Engineer of the Department of Health, Brooklyn, N. Y., was married Sept. 14, 1898, to Dr. Etta M. Ober, of Nashua, N. H.

Mr. William G. Price, M. Am. Soc. C. E., Chief Engineer of the Chicago City Ry. Co., has resigned to accept a position as engineer with the Peckham Motor Truck & Wheel Co., New York city.

Mr. David R. Lee, Assoc. M. Am. Soc. C. E., has been appointed Supervising Engineer of the Bleecker Reservoir Improvement, Albany, N. Y. He has been connected with the New York state canals, at Syracuse.

Mr. John B. Parsons, General Manager of the Union Traction Co., Philadelphia, Pa., has been elected President of the same, to succeed Mr. John L. Welsh, resigned. Mr. George D. Weidener has been elected Vice-President.

Mr. Frank A. Foster, civil engineer, of Dorchester, Mass., is a candidate for the State Legislature of Massachusetts. He was for 15 years in the office of the City Engineer, of Boston, and for the past four years has been conducting an engineering business in Dorchester, which was his birthplace.

Mr. William Barclay Parsons, M. Am. Soc. C. E., consulting engineer, of New York, and Chief Engineer of the Rapid Transit Board of that city, expects to sail from San Francisco, Cal., Oct. 25, for China, where he will undertake the location and construction of a system of railways for the Brice syndicate.

Mr. A. K. Shurtleff, General Foreman of Bridges and Buildings of the Fremont, Elkhorn & Missouri Valley R. R. and the Sioux City & Pacific R. R., with headquarters at Norfolk, Neb., has been appointed Division Engineer of the Kansas Division and Branches of the Union Pacific R. R., with headquarters at Kansas City, Mo., to succeed Mr. Charles Manhart, resigned.

Messrs. Andrew Onderdonk, Harvey C. Miller, Louis Hawkins, Eben S. Wheeler, M. Am. Soc. C. E., William D. Thomas, Richard B. Post, Percy J. Brune and Horatio H. Trundle, members of the party of engineers which has been engaged in the surveys of the Nicaragua Canal, arrived in New York, Sept. 27, on their way to Washington, D. C., to report to the Canal Commissioners.

Mr. George H. Morse, Electrical Engineer of the St. Joseph & Benton Harbor St. Ry., Electric Light & Power Co., Benton Harbor, Mich., has been appointed Instructor in Electrical Engineering and Machine Design in the University of Nebraska. He graduated from the University of Minnesota in 1893, and was for some time Instructor in Electrical Engineering in that institution.

Dr. William B. Phillips, M. Am. Inst. M. E., of Birmingham, Ala., has accepted the position of editor of the "American Manufacturer," of Pittsburg, Pa., and will take charge of that publication, Oct. 1. He was at one time a member of the staff of the "Engineering and Mining Journal," and has been a frequent contributor to that paper and to the "Mineral Industry." He has also been chemist to the Tennessee Coal, Iron & R. R. Co., and has been connected with the Alabama State University, Tuscaloosa, Ala., and the Alabama Geological Survey.

Mr. Charles E. Bigelow, President of the Geo. F. Blake Mfg. Co., 91 Liberty St., New York city, has accepted the office of President of the Ganswoort Bank in that city and will retire from the former position which he has held for the past four years. For nearly 32 years Mr. Bigelow has been connected with the Knowles Steam Pump Works, and, since its consolidation with the Geo. F. Blake Mfg. Co., he has been prominent in the affairs of the latter corporation. The employees of the company presented him with a handsome ebony gold-headed cane, Sept. 24, and the directors have adopted resolutions expressing their regret at his withdrawal. Mr. Bigelow was one of the organizers of the Gansevoort Bank a number of years ago.

Maj.-Gen. Grenville M. Dodge, U. S. Army, has been appointed President of the War Inquiry Commission, by President McKinley. He was graduated from Norwich University, Norwich, Vt., as a civil engineer, and served throughout the Civil War, being made successively Captain, Colonel, Brigadier-General and, on May 18, 1863, Major-General. He left the army in 1866, and built the Union Pacific Ry. and the Texas Pacific Ry. Since then he has been President of several railways, at present holding that office with the Fort Worth & Denver City R. R. The other members of the commission are: Maj.-Gen. Alexander McD. McCook, U. S. A.; Brig.-Gen. John M. Wilson, Chief of Engineers, U. S. Army, and M. Am. Soc. C. E.; Maj. Stephen C. Mills, Inspector-General, U. S. A., who is the Recorder of the Commission; Mr. Charles Denby, LL.D., who is a veteran of the Civil War, and who was from 1885 until July 11, 1898, Minister to China; Gen. James Beaver, a veteran of the Civil War, and formerly Governor of Pennsylvania; Col. Urban A. Woodbury, of Burlington, Vt., a veteran of the Civil War, and who has been both Lieutenant-Governor and Governor of Vermont; Capt. Evan P. Howell, a veteran of the Confederate Army and a prominent railway man of Georgia; Col. Jas. A. Sexton, a Civil War veteran and a member of the firm of Cribben, Sexton & Co., foundrymen, of Chicago, and Mr. Richard Weightman, who is the Secretary of the Commission and has been an editorial writer on the Washington, D. C., "Post" on subjects connected with conditions in Cuba.

OBITUARY.

Mr. William L. Langridge, builder, of Williamsburg, New York City, died of pneumonia, Sept. 27, aged 55.

Mr. Thomas Collins, of the firm of Collins Bros., railway contractors, of Bellefonte, Pa., died at his home in that city, Sept. 25, aged 75. The firm, which was originally composed of six brothers, is said to have built more miles of railway than any other firm in the world. Among the roads built by them were the Portage R. R. for the Pennsylvania R. R., in 1849, portions of the Philadelphia & Reading, the Lehigh Valley, the Central of New Jersey and others. Mr. Peter Collins is now the sole survivor of the family.

Mr. John M. Toucey, F. Am. Soc. C. E., formerly General Manager of the New York Central & Hudson R. R., died at his home, Garrisons-on-the-Hudson, N. Y., Sept. 23, aged 70. He was born in Newtown, Conn., and entered the railway service in 1848 as station agent on the Naugatuck R. R. He held this position until 1855, when he became connected with the Hudson River R. R., and in 1862 was made Assistant Superintendent of this road. In 1867 he was made Superintendent of the Hudson River Division of the New York Central & Hudson River R. R., and in 1881 became the General Superintendent. He was appointed as General Manager in 1890, and continued in that position until last May, when the office of General Manager was abolished. Mr. Toucey declined the position of Assistant to the President, which was created for him as a substitute, and resigned. He was then retired on a pension.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERS' CLUB OF COLUMBUS.
Oct. 1. Secy., H. M. Gates, 12½ North High St., Columbus, O.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Oct. 3. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Oct. 3. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
FRANKLIN INSTITUTE.
Oct. 5. Meeting Committee on Arts and Sciences. Secy., Wm. H. Wahl, 15 South 7th St., Philadelphia, Pa.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 5. Secy., C. W. Hunt, 220 W. 57th St., New York city.
ENGINEERS' CLUB OF ST. LOUIS.
Oct. 5. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
WESTERN SOCIETY OF ENGINEERS.
Oct. 5. "Track Elevation of the Chicago & Northwestern Ry." Discussion. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
BROOKLYN ENGINEERS' CLUB.
Oct. 6. Secy., A. J. Prevost, Jr., 191 Montague St., Brooklyn, N. Y.
CHICAGO ELECTRICAL ASSOCIATION.
Oct. 7. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Oct. 7. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
MONTANA SOCIETY OF ENGINEERS.
Oct. 8. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
NATIONAL ROAD PARLIAMENT.
Oct. 8. Omaha, Neb. Martin Dodge, Director Office of Road Inquiry, Washington, D. C.
ENGINEERS' CLUB OF KANSAS CITY.
Oct. 10. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
THE LOUISIANA ENGINEERING SOCIETY.
Oct. 10. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
NEW ENGLAND RAILROAD CLUB.
Oct. 11. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.
DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 11. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.
NORTHWEST RAILWAY CLUB.
Oct. 11. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Oct. 11. Secy., Wm. H. Searles, Case Library Building, Cleveland, O.
AMERICAN RAILWAY ASSOCIATION.
Oct. 12. Holland House, New York. Secy., W. F. Allen, 24 Park Place, New York.
ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 13. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 13. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.
ST. LOUIS RAILWAY CLUB.
Oct. 14. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 15. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
TECHNICAL CLUB OF OMAHA.
Oct. 17. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 17. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Oct. 17. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 18. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.
AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 18-20. Annual meeting, Richmond, Va. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Oct. 19. Secy., Frank H. Olmsted, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 19. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Oct. 19. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.
AMERICAN GAS LIGHT ASSOCIATION.
Oct. 19-21. Annual meeting, Niagara Falls, N. Y. Secy., Alfred E. Forstall, Montclair, N. J.
ENGINEERS' CLUB OF CINCINNATI.
Oct. 20. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
NEW YORK RAILROAD CLUB.
Oct. 20. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Oct. 20. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.
AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 26-28. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.
SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.

NEW ENGLAND RAILROAD CLUB.—On Sept. 13 this club enjoyed its annual outing. A special train conveyed the party of about 300 to Fox Point, Providence, where a special steamer was boarded and the trip continued to Crescent Park on the Providence River.

ENGINEERS' CLUB OF ST. LOUIS.—The meeting on Sept. 21 was made a memorial to the late Col. Henry Flad. Addresses were delivered by President Bryan and Mr. Robert Moore. The latter gave a sketch of Col. Flad's life, and paid a high tribute to his inventive genius and high personal character. Richard McCulloch, Secy.

MICHIGAN ENGINEERING SOCIETY.—The next annual meeting will be held at Lansing, Jan. 24 to 26, 1899. The following officers have been elected for the ensuing year: Pres., Prof. Chas. E. Green, Ann Arbor; Vice-Pres., Jay J. Hubbell, Manistee; Secy. and Treas., Frances Hodgman, Climax; Directors—J. D. Davis, Ann Arbor; Wm. D. Sears, Saginaw; Dorr Skeels, Grand Rapids.

RAILWAY SIGNALING CLUB.—The last meeting of this club was held Sept. 13 at the Great Northern Hotel, Chicago. The committee on standard designs for interlocking materials reported, presenting a list of parts that could be readily agreed upon for standardizing. A committee of five was appointed to recommend standard specifications for signaling apparatus. Following this the subject of distant signals and two wires for operating the same was discussed.

WESTERN RAILWAY CLUB.—This club held its first fall meeting on Sept. 20. Mr. G. W. Scott presented a paper on "Heating Large Railroad Stations, Shops and Buildings," in which the use of exhaust steam was recommended as the most economical and satisfactory method. The discussion which followed indicated that this was the opinion of most of those present. It was pointed out by Mr. Thurbell that many of the defects in heating systems were due to poor engineering and not to inherent defects in the system. The following subjects were also discussed: "Economy of and Limitations in Running Locomotives Long Distances;" "Is It Practical, Safe and Economical to Use Spliced Air-Brake Hose?"

THE ENGINEERS' CLUB OF PHILADELPHIA.—The last meeting of this Club was held Sept. 17, with 59 members and visitors present. The evening was devoted to a topical discussion "On the Proper Proportions of Parts of Steam Engines." This was quite generally participated in, the opinion of the majority being that it would be very desirable to adopt standard proportions for the various parts of steam engines intended to furnish standard amounts of horse-power in different classes of service, but that this would only be possible by adopting standards for the quality of materials employed. Secretary L. F. Rondinella announces that the system of conversational meetings will be resumed. They will occur on the second Saturday of each month during the ensuing session. The first meeting of this character will be on Oct. 8.

THE LOUISIANA ENGINEERING SOCIETY.—At the last meeting of this Society, which was held on Sept. 19, Mr. F. T. Llewellyn presented a paper on "The Evolution of Structural Design," postponed from the previous meeting. This paper pointed out the fact that the development of structural design is due rather to varying and improved conditions governing the cost and availability of material than to a more perfect knowledge of the theories of mechanics. Following the paper, Mr. P. E. Carriere exhibited a number of stereopticon views of European scenery.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.—The following schedule of lectures is announced to be given under the auspices of the Department of Engineering: Sept. 30, "The Vessels in the United State Navy in Use in the Recent Spanish-American War," H. W. Raymond, Germantown, Pa.; Nov. 18, "Cableways as Employed in Construction Work and in Excavations," Spencer Miller; Dec. 16, "The Niagara Bridges," Richard S. Buck; Jan. 6, "The Civil and Military Engineering of the Cliff Dwellers," Robt. B. Stanton; Jan. 20, "Underground Rapid Transit and the Proposed Long Island Railway Tunnel between Atlantic Avenue and Lower Manhattan," Chas. E. Jacobs; Feb. 17, "The Brooklyn Water-Works," Arthur S. Tuttle; March 17, "Building Foundations," John F. O'Rourke; April 21, "The Engineering Features of Public Works in the Tropics," O. F. Nichols; May 19, "Deep Foundations of High Buildings and Piers," Henry W. Brinckerhoff.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.—The nineteenth meeting of this association was held at the Hotel Iroquois, Sault Ste. Marie, Sept. 12 and 13. Delegates were present from the Edison companies of Detroit, Chicago, Boston, Brooklyn and New York. At the first session the experience of the several companies in methods of charging for long-hour service was considered. The discussion developed the fact that several systems of charging were in use, but all agreed as to the benefits to be derived from special rates for long-hour service.

At the evening session, Mr. W. S. Barstow, of the Brooklyn Edison Co., described the system of transmission employed by his company, and Mr. J. W. Lieb, Jr., reported the conclusions of the investigating committee, consisting of Messrs. John Van Vleck, Arthur Williams and J. W. Lieb, Jr., which had been sent abroad to inspect foreign electric lighting systems. This was followed by a brief discussion dealing mainly with alternating current systems. The session of the second day began with a description of European meter practice and methods of installing lamps and systems of charging in vogue abroad, by Mr. Arthur Williams. This was followed by papers on metering by Messrs. E. A. Leslie and Charles S. Shepard, of New York, and O. J. Bushnell, of Chicago. The discussion of meters was continued at the afternoon session, at which Messrs. C. C. Perry and W. F. Kingan read papers on metering problems for small stations. The committee on Welsbach burners and acetylene gas presented a full report at this session. At the evening session, reports were received from the Executive Committee, the Committee on Incandescent Lamps, and the Lamp Testing Bureau, and the following officers were elected for 1898: Pres., R. R. Bowker, New York; Vice-Pres., G. R. Stetson, New Bedford, Mass.; Treas., W. S. Barstow, Brooklyn; Secy., Wilson S. Howell, Newark, N. J. (P. O. box 114). Executive Committee—Samuel Insull, Chicago; Chas. L. Edgar, Boston, Mass.; J. W. Lieb, Jr., New York; Alex. Dow, Detroit; J. H. Vail, Philadelphia.

As previously announced the steamer "Northwest," conveyed many of the visitors to and from the convention. On the return trip the delegates were treated to a carriage ride to the points of interest at Mackinaw Island by the General Electric Co.

AMERICAN INSTITUTE OF MINING ENGINEERS.—The seventy-fifth annual meeting of the Institute will be held at the Buffalo Library Bldg., Buffalo, N. Y., beginning Oct. 18. The excursion program includes a steamer excursion about the harbor on the afternoon of Oct. 19; a reception on the evening of Oct. 20; with a list of optional excursions for the morning and afternoon of Oct. 21. It is also planned to hold the business session of Oct. 21 at the International Hotel, Niagara Falls, where an illustrated paper on "Niagara Falls Water Power and Its Transmission and Utilization by Means of the Electric Current" will be presented. Saturday, the last day, will be spent in inspecting the many points of engineering and scenic interest.

The following is a partial list of the papers to be presented: "The Evolution of Mine-Surveying Instruments," Dunbar D. Scott; "Notes on the Forms Assumed by the Charge in the Blast Furnace, as Affected by Various Methods of Filling," Frank Firmstone; "Modern Cupola Practice, with Special Reference to the Discussion of the Physics of Cast-Iron," Bertrand S. Summers; "Experiments in the Sampling of Silver-Lead Bullion," G. M. Roberts; "The Influence of Bismuth on Brass, and Its Relation to Fire-Cracks," Erwin S. Sperry; "Graphic Records of the Screening of Crushed Material," Courtenay DeKalb; "Notes on the Mines of the Frontino and Bolivia Company, Columbia, S. A." Spencer Cragoe; "The Relations between the Chemical Constitution and the Physical Character of Steel," William R. Webster; "Does the Size of Particles have any Influence in Determining the Resistance of Fire-Clays to Heat and to Fluxes?" H. O. Hofman and B. Stoughton; "A Modification of Bischof's Method for Determining the Fusibility of Clays, as Applied to Non-Refractory Clays, and the Resistance of Fire-Clays to Fluxes," H. O. Hofman; "The Superficial Alteration of Western Australia Ore-Deposits," Herbert C. Hoover; "Mineral Lode Locations in British Columbia," William Braden; "The Kytchtym Medal," Dr. Persifor Frazer; "A New Assay for Mercury," Richard E. Chism; "The By-Product Coke-Oven in Some of Its Phases," W. H. Blauvelt; "The Alluvial Deposits of a Dry Country," T. A. Rickard; "Hübnerite in Arizona," Wm. P. Blake. There will also be discussions upon Professor Howe's paper on the "Use of the Tri-Axial Diagram and Triangular Pyramid for Graphical Illustration;" of Dr. Don's paper on the "Genesis of Ore-Deposits;" of Mr. Keller's paper on the "Elimination of Impurities from Copper-Mattes," and on the use of multiple tuyeres for the blast-furnace.

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—This association held its 68th annual meeting at Bristol, England, Sept. 8—12. Like the American Society of similar name, the association is divided into various sections devoted to the consideration of special subjects The following is a list of the papers presented of most interest to engineers:

Section A.—Mathematical and Physical Science.—"On the Conservation of Energy in the Human Body," E. B. Rosa and W. O. Atwater; "Comparison Between Charging a Secondary Cell at Constant Potential and at Constant Current, more especially as Regards Efficiency," A. A. Cahen and J. M. Donaldson; "On the Measurement of Small Differences in Resistance," E. H. Griffiths; "Continuity of Undulatory Theory for Sound Elastic-Solid Light and Electric Waves," Lord Kelvin; "A Platinum Voltmeter," Prof. H. L. Callendar; "The Carbon Consuming Cell of Jacques," S. Skinner; "On Standard High Resistance," J. B. Fawcett; "Experiments on the Influence of Electricity on Plants," S. Lemström; "The Temperature Coefficients of the Resistances Used in 1897 Determination of the Ohm," M. Solomon.

Conference on Terrestrial Magnetism and Atmospheric Electricity.—"On the Construction of Magnets of Constant Intensity Under Changes of Temperature," J. R. Ashworth; "On the Relative Advantages of Long and Short Magnets," Prof. Mascart; "On the Application of Terrestrial Magnetism to the Solution of Some Problems in Cosmical Physics," Prof Arthur Schuster; "On the Relations between the Variations in the Earth Currents, the Electric Currents from the Atmosphere, and the Magnetic Perturbations," Selim Lemström.

Section B.—Chemistry.—"A New Form of Stand for Electrolytic Analysis," Dr. Hugh Marshall; "On a 10-c. p. Lamp to be Used as a Standard of Light," A. G. Vernon Harcourt.

Section F.—Economic Science and Statistics.—"Municipalities as Traders," Geo. Pearson; "Ought Municinal Enterprises to Yield a Profit in Aid of Rates?" E. Cannan; "Economic and Social Influences of Electric Traction," Prof. S. P. Thompson.

Section G.—Mechanical Science.—"Electric Power in Workshops," A. Siemens; "The Application of the Electric Motor to Small Industrial Purposes and its Effect on Trade and on the Community Generally," A. H. Gibbings; "Notes on the Electric Lighting System at Bristol, with Special Reference to the Auxiliary Plant," H. Faraday-Proctor; "Electric Traction by Surface Contact," Prof. Silvanus Thompson and Miles Walker; "Combined Electric Lighting and Power Plant for Docks and Harbors," J. G. Aldridge; "Electrical Canal Haulage," A. H. Allen; "On the Pacific Cable," C. Bright.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The last meeting of this society was held on Sept. 21 at the Society House, New York. As announced, no regular paper was read, and the evening was devoted to the subject of Roads and Road Building.

Mr. James Owens favored thick roads, using a 5-in. telford topped with a 3-in. macadam in preference to an 8-in. macadam. The actual size of stone used should depend upon locality and traffic conditions, smaller sizes serving for light traffic. In all cases sizes of stone must not be mixed. Binders such as sand, gravel, loam, clay or ordinary earth should be used as a temporary means to get a road into shape. The work of the Massachusetts State Road Commission was outlined by Mr. W. E. McClintock. The most difficult roads, which were first built, cost about $10,300 per mile for a 15-ft. road. In most cases the roads consisted of 3 ins. of gravel, 6 ins. of rock, wedged, filled and covered with broken stone and rolled.

Mr. Budd, Road Commissioner of New Jersey, stated that in that state 300 miles of road had been completed under state control, and 300 miles more had been petitioned for. Early roads cost from $7,000 to $10,000. Now roads were made thinner and various modifications had been introduced until the cost had been reduced to $4,000 per mile. Good gravel roads averaged from $1,000 to $1,500 per mile where materials were convenient.

Mr. N. P. Lewis, Engineer of Street Construction and Maintenance, of Brooklyn, considered 20 to 30 ft. as the proper width of city streets and 12 ft. for country roads. Grades and drainage were very important and should receive full attention. He believed that an 8-in. macadam road 12 ft. wide could be built in most parts of New York state for $5,000 per mile and a 6-in. for $3,000.

Mr. E. W. Harrison, Chief Engineer of the Hudson County Public Roads, New Jersey, described the Hudson County Boulevard, which comprises 400,000 yds. of telford macadam, laid in the last 5 years. This road is like a city street, and is from 12 to 14 ins. deep. It is composed of 8 ins. of trap rock telford, 4 ins. of 2 to 2½-in. macadam, with 1½ in.-stone on top and finished to a height of 1½ ins. above grade, with a layer of screenings and flour well watered and rolled about 110 times with a 15-ton roller. Several others expressed their views upon the subject and it was decided to continue the discussion at another meeting.

BOSTON SOCIETY OF CIVIL ENGINEERS.—On Sept. 21 the society had an excursion in the afternoon and a regular monthly meeting in the evening. The excursion was to the new high service reservoir being built by the Metropolitan Water Board in the Middlesex Fells Reservation, which area forms a part of the Metropolitan Park System. The reservoir work comes in the division of the water system in charge of Mr. Dexter Brackett, M. Am. Soc. C. E., the chief engineer of the board being Mr. F. P. Stearns, M. Am. Soc. C. E. The reservoir will have a capacity of 38,000,000 to 40,000,000 gallons. The reservoir will be filled by pumping from Spot Pond, originally the source of the joint water supply of Malden, Melrose and Medfield, but now turned into a distributing reservoir for the Metropolitan Water System, water from the Chestnut Hill reservoir being pumped into Spot Pond, and the reservoir just named being filled from the old Sudbury River and New Nashua systems. The new reservoir in question will be described in a later issue.

At the evening session the chair was occupied by Mr. Howard Carson, M. Am. Soc. C. E., Chief Engineer of the Boston Transit Commission and President of the society. Mr. Carson announced that the piece of ancient lead water pipe, presented to the society by Mr. Clemens Herschel, M. Am. Soc. C. E., of New York city, had been suitably mounted in a glass case, and was on the desk before him and them. He also stated that the celebration of the fiftieth anniversary of the society would probably be held in November. The feature of the evening was a talk by Mr. Carson on the proposed East Boston Tunnel, illustrated by lantern slides, and including a review of various methods of submarine tunnelling. These the speaker divided into two general classes: (1) Working from headings by means of shields or otherwise and (2) building the tunnel in dredged trenches. According to Drinker's "Tunnelling," the first instance of the use of cast-iron plates, or a shield, was in 1864, under Barlow's patent, on a tunnel 7 ft. in diameter, beneath the Thames, near the London Tower, compressed air being used. Beach's shield followed, in 1865. Coming down to recent times, mention was made of the shield 27⅔ ft. high and 19½ ft. long used in the Blackwall tunnel, and of the small size of some recent London subways, only 10 to 11 ft. in diameter, with one railway track. Aside from water-works intakes of comparatively small size, the principal examples of the placing of tubes in dredged trenches were in connection with the Metropolitan Sewerage System. Here large tubes were lined with brick, towed to place and sunk in tidal waters. Although little work of this kind has been done, it has been the subject of many patents.

In the studies for the East Boston tunnel a diagram was prepared showing that two 16-ft. tunnels could be constructed in trenches with much less dredging and greater ease of construction than one 23½-ft. tube. The tripod derricks for lowering the 16-ft. tubes would have to be about 90 ft. in length. The tubes would be imbedded in concrete for a large part of their height.

Regarding the probable route of the tunnel and the conditions under which it might be built and operated. Mr. Carson explained that the statutes of 1894 authorized the Boston Transit Commission to build a two-track tunnel from the subway in Scollay Sq., Boston, to the street surface in Maverick Sq., East Boston, which involves a tunnel beneath the East Boston channel. The law of 1897 changes the location of the Boston end of the tunnel to or near Hanover Sq., and instead of saying the commission may connect these points, the act says it shall do so when the Boston Elevated Railway Co. applies for the right to construct a road on a certain route. The later act also provides that the company named shall pay the city 0.⅜% of the gross receipts of the company and 1 ct. for each passenger carried. There is some ambiguity in the last act as to whether it requires a tunnel beneath the streets of Boston.

As to the needs of a tunnel, the speaker stated that the population of East Boston is about 43,000, and of the other part of the city some 450,000. The East Boston ferries carry about 6,000,000 passengers each way per day and the Boston & Lynn Railway about 1,000,000 more.

Assuming the statute to require a subway for the whole distance between the two terminal points, the start at the Boston end would be made to avoid grade crossings with the present subway by carrying one under the other. The plans sent to the Secretary of War for approval showed the top of the tunnel not less than 35 ft. below the water level at each line of the Harbor Commission, and about 40 ft. below the deepest part of the channel. The shortest of the seven or eight lines studied would be about 6,350 ft. in length between the two terminal points. There would be two 16-ft. tubes, with feeder ducts on each side in the space between the vertical sides of the cars and the tubes. These ducts could be used for passengers to walk on in case of accidental stoppages to the cars. The estimates of cost of the tunnel were not gone into.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Sept. 29.	Court house,	Marietta, Ga.	Aug. 18
Sept. 29.	Water pipe, etc.,	Buffalo, N. Y.	Sept. 22
Sept. 29.	Street bonds,	Phillipsburg, N. J.	Sept. 22
Sept. 29.	Macadamizing, etc.,	Hadley, Mass.	Sept. 29
Sept. 29.	Macadamizing, etc.,	Boston, Mass.	Sept. 29
Sept. 29.	Highway (5,000 lin.ft.),	Walpole, Mass.	Sept. 29

Sept. 29. Brick paving, Scranton, Pa. ....Sept. 29
Sept. 29. Grading, paving, etc., East Cleveland, O...Sept. 29
Sept. 29. Grading, St. Paul, Minn. ....Sept. 29
Sept. 29. Bridge, Albany, Ore. ....Sept. 29
Sept. 30. Dredging, New York, N. Y....Sept. 29
Sept. 30. Pipe sewer, Boston, Mass....Sept. 29
Sept. 30. Grading, filling, etc., Newark, N. J. ....Sept. 29
Sept. 30. Brick walks, Richmond, Ind....Sept. 29
Sept. 30. School building, Camden, N. J. ....Sept. 29
Sept. 30. Asphalt paving, Niagara Falls, N. Y....Sept. 22
Advertised, Engineering News, Sept. 22.
Sept. 30. Hospital, National Military Home, Kan....Sept. 22
Sept. 30. Macadam paving, Milford, Conn. ....Sept. 22
Sept. 30. Pipe sewers, Des Moines, Ia. ....Sept. 22
Sept. 30. Storm sewer, Amsterdam, N. Y. ....Sept. 15
Sept. 30. Gravel road (7 miles), Rockville, Ind....Sept. 15
Sept. 30. School building, Sheboygan, Wis. ....Sept. 15
Sept. 30. Improving reservoir, Albany, N. Y. ....Sept. 8
Advertised, Engineering News, Sept. 8.
Sept. 30. Coal shaft, Latrobe, Pa. ....Sept. 8
Oct. 1. Arc lighting, Marshfield, Wis. ....Aug. 18
Oct. 1. School building (equipment), St. Thomas, Ont. July 7
Oct. 1. Road roller, Sheboygan, Wis....Sept. 1
Advertised, Engineering News, Sept. 1.
Oct. 1. Head-race (power plant), Montreal, Que....Sept. 1
Advertised, Eng. News, Sept. 1 to 15.
Oct. 1. Electric plant, New Richmond, O....Sept. 15
Oct. 1. Arc lighting, Huntington, W. Va....Sept. 15
Oct. 1. Canal work, Kirkersville, O....Sept. 22
Oct. 1. Pipe sewers, Elizabeth, N. J. ....Sept. 22
Oct. 1. Water-works, Beresford, S. Dak. ....Sept. 22
Oct. 1. School-house bonds, Wadley, Ga. ....Sept. 22
Oct. 1. Grading at navy yard, Brooklyn, N. Y. ....Sept. 29
Oct. 1. Paving bridge, Vacaville, Cal. ....Sept. 29
Oct. 1. Curbing, paving, etc., Conshohocken, Pa...Sept. 29
Oct. 1. Dredging, Boston Navy Yard, Mass....Sept. 29
Oct. 1. Retaining wall, Warren, Pa. ....Sept. 29
Oct. 1. Pier, sluiceway, etc., Brantford, Ont....Sept. 29
Oct. 1. Temporary bridge, Cambridge, Mass....Sept. 29
Oct. 1. Pipe sewer, Greenville, Pa. ....Sept. 29
Oct. 1. Water pipe, etc., Sonyea, N. Y. ....Sept. 29
Oct. 3. Enamel signs, St. Paul, Minn. ....Sept. 29
Oct. 3. Paving, grading, etc., Jersey City, N. J....Sept. 29
Oct. 3. School building, New Orleans, La....Sept. 29
Oct. 3. Heating and ventilation, New York, N. Y...Sept. 29
Oct. 3. Bridge approach, Oroville, Cal. ....Sept. 29
Oct. 3. Iron bridges (2), Hazlehurst, Miss....Sept. 29
Oct. 3. Masonry dam, Columbus, O. ....Sept. 29
Oct. 3. Pipe sewers, Albany, N. Y. ....Sept. 29
Oct. 3. Locomotives, etc., London, England....Sept. 29
Oct. 3. Masonry bridge, Kew, London, England....Sept. 29
Oct. 3. Flood gates, Dayton, O. ....Sept. 22
Oct. 3. Macadam paving, Atlantic City, N. J....Sept. 22
Advertised, Engineering News, Sept. 22.
Oct. 3. Brick paving, Atlantic City, N. J. ....Sept. 22
Advertised, Engineering News, Sept. 22.
Oct. 3. Pile bridge, Topeka, Kan. ....Sept. 22
Oct. 3. Bridge, Redwood City, Cal. ....Sept. 22
Oct. 3. Bridge (115-ft. long), Westfield, Mass....Sept. 22
Advertised, Engineering News, Sept. 22.
Oct. 3. Levee work, Dayton, O. ....Sept. 22
Oct. 3. Lumber, New York, N. Y. ....Sept. 22
Oct. 3. Steel bridges (2 spans), Waverly, Ia. ....Sept. 22
Oct. 3. Deep well, Plankinton, S. Dak....Sept. 22
Oct. 3. Church building, Mount Carmel, Ill. ....Sept. 22
Oct. 3. Superstructure and repair, Chillicothe, O. ..Sept. 15
Oct. 3. Street work, Toledo, O. ....Sept. 1
Oct. 3. Building plans, Liverpool, England....Sept. 8
Oct. 3. Building superstructure, Philadelphia, Pa...Sept. 8
Advertised, Eng. News, Sept. 8 and 15.
Oct. 3. Bridge, Flandreau, S. Dak. ....Sept. 8
Oct. 4. Coal conveyors, etc., Chicago, Ill. ....Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 29.
Oct. 4. Bridge, Stockton, Cal. ....Sept. 15
Oct. 4. Brick paving, etc., Norwalk, O. ....Sept. 15
Oct. 4. Improving road, Deerfield, N. Y. ....Sept. 22
Oct. 4. Electric plant, Barnesville, Minn....Sept. 22
Oct. 4. Electric lighting, Philadelphia, Pa. ....Sept. 22
Oct. 4. High-school building, Troy, N. Y....Sept. 22
Oct. 4. Water-works, Eaton Rapids, Mich....Sept. 22
Advertised, Eng. News, Sept. 22 and 29.
Oct. 4. Grading, etc., Troy, N. Y. ....Sept. 22
Oct. 4. Additions to pumping station, Philadelphia. Sept. 29
Oct. 4. Sewer, Kansas City, Mo. ....Sept. 29
Oct. 4. Sewer, New Haven, Conn. ....Sept. 29
Oct. 4. Crushed stone, paving, etc., New Haven....Sept. 29
Oct. 4. Street improvements, Terre Haute, Ind....Sept. 29
Oct. 4. Steam piping, Gowanda, N. Y. ....Sept. 29
Oct. 4. Capitol bonds ($100,000), St. Paul, Minn ...Sept. 29
Oct. 4. Broken stone, etc., Long Island City, N.Y...Sept. 29
Oct. 4. Fire hose, Dunkirk, N. Y. ....Sept. 29
Oct. 5. School building, London, Ont. ....Sept. 29
Oct. 5. Grading and material, Mamaroneck, N. Y...Sept. 29
Oct. 5. Heating apparatus, Fort Logan, Colo....Sept. 29
Oct. 5. Bridge, Heppner, Ore. ....Sept. 29
Oct. 5. Bridge (150 ft. long), Pontiac, Ill....Sept. 29
Advertised, Engineering News, Sept. 29.
Oct. 5. Electric plant, Rathmines, Ireland....Sept. 29
Oct. 5. Grading, paving, etc., Cleveland, O. ....Sept. 22
Oct. 5. Granite paving, Cincinnati, O. ....Sept. 15
Oct. 5. Bridge superstructure, Chicago, Ill. ....Aug. 11
Oct. 5. Dredging, Oakland, Cal. ....Sept. 8
Oct. 5. Shore protection, Fort Morgan, Ala. ....Sept. 8
Advertised, Eng. News, Sept. 8 to 29.
Oct. 6. Electric light plant, St. Joseph, Ill....Sept. 22
Advertised, Engineering News, Sept. 22.
Oct. 6. Water-works, Greensboro, Ga. ....Sept. 22
Oct. 6. Oak sheeting, Cleveland, O. ....Sept. 29
Oct. 6. Brick paving, Erie, Pa. ....Sept. 29
Oct. 6. Paving, etc., and walks, Pittsburg, Pa....Sept. 29
Oct. 6. Grading and material, Ventura, Cal....Sept. 29
Oct. 6. White oak sheeting, Cleveland, O. ....Sept. 29
Oct. 6. Steam heating, Danville, Ill. ....Sept. 29
Oct. 6. Water-works, Osage, Ia. ....Sept. 29
Advertised, Engineering News, Sept. 29.
Oct. 7. Asphalt paving, Rochester, N. Y....Sept. 29
Oct. 7. Brick paving, drainage, etc., Cleveland, O..Sept. 29
Oct. 7. Building, Oberlin, O. ....Sept. 29
Oct. 7. Asphalt, brick paving, etc., Omaha, Neb. ..Sept. 29
Oct. 7. Water pipe, Milledgeville, Ill. ....Sept. 29
Oct. 7. Arc lighting, Asheville, N. C. ....Sept. 22
Oct. 7. Asphalt and macadam, Cleveland, O....Sept. 22
Oct. 7. Granitoid sidewalks, St. Louis, Mo....Sept. 22
Oct. 8. Bridge work, Cincinnati, O. ....Sept. 22
Oct. 8. Bridge, New Baltimore, O. ....Sept. 22
Oct. 8. School building, Bisbee, N. Dak....Sept. 22
Oct. 8. Dredging, etc., League Island Navy Yard, Pa..Sept. 29
Oct. 8. Electric plant, Baltimore, Md....Sept. 29
Oct. 10. Grading and graveling, Muncie, Ind....Sept. 29
Oct. 10. School building extension, Brooklyn, N. Y...Sept. 29
Oct. 10. Elevators (3), New York, N. Y....Sept. 29
Oct. 10. Building brick, Philadelphia, Pa. ....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Oct. 10. Sewers and disposal plant, E. Cleveland, O..Sept. 22
Oct. 10. Dredging, Wilmington, Del. ....Sept. 22
Advertised, Eng. News, Sept. 15 and 22.
Oct. 10. Cement, stone, etc., Ft. Washington, D. C...Sept. 22
Advertised, Eng. News, Sept. 22 and 29.
Oct. 10. Asphalt and brick paving, Council Bluffs, Ia. Sept. 22
Oct. 10. Macadamizing, St. Paul, Minn....Sept. 22
Oct. 10. Turbine wheels (24), Wrightsville, Pa. ....Sept. 8
Advertised, Eng. News, Sept. 8 and 15.
Oct. 10. Trestle, Chehalis, Wash....Sept. 8
Oct. 10. Paving, Toledo, O. ....Sept. 15
Oct. 11. School building, New Brunswick, N. J....Sept. 29
Oct. 11. Building, Boonton, N. J....Sept. 29
Oct. 11. Municipal building work, Brooklyn, N. Y...Sept. 29
Oct. 12. Dredging, Lake Merritt, Oakland, Cal....Sept. 29
Oct. 12. Brick work, Oxford, O. ....Sept. 29
Oct. 12. Hospital buildings, San Francisco, Cal. ....Sept. 15
Oct. 12. Park bonds, Spokane, Wash....Sept. 1
Oct. 12. Sewers, Cohoes, N. Y. ....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Oct. 13. Hire of dredging plant, Mobile, Ala. ....Sept. 15
Advertised, Eng. News, Sept. 15 to Oct. 6.
Oct. 13. Portland cement, Seattle, Wash. ....Sept. 29
Oct. 14. Pipe sewers, Madison, Wis....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Oct. 14. Cement walks, North Vernon, Ind. ....Sept. 15
Oct. 15. Water-works, Wagoner, Ind. Ter....Sept. 22
Advertised, Eng. News, Sept. 22 to Oct. 6.
Oct. 15. Masonry, woodwork, etc., Cincinnati, O....Sept. 22
Oct. 15. School building, Harris, Minn. ....Sept. 22
Oct. 15. Sewers, Marietta, O. ....Sept. 22
Oct. 15. Electric light plant, Charlotte, N. Y....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Oct. 15. Electric plant, Bremerton, Wash. ....Sept. 29
Oct. 15. Water-works, Charlotte, N. Y....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Oct. 17. Street improvements, Hamilton, O. ....Sept. 29
Oct. 17. Water pipe, Wytheville, Va. ....Sept. 29
Oct. 17. Sewerage system, Mobile, Ala. ....Sept. 22
Advertised, Eng. News, Sept. 22 to Oct. 6.
Oct. 17. Gasholder, etc., Edinburgh, Scotland....Sept. 1
Oct. 18. Railway track, Cincinnati, O. ....Sept. 22
Oct. 18. Stone, brick & asphalt pvg., Sharpsburg, Pa. Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Oct. 18. Machinery etc., Naval Station, Puget Sound. Sept. 29
Oct. 19. Levee work, New Orleans, La. ....Sept. 29
Oct. 19. Asphalt paving, Winnipeg, Man. ....Sept. 29
Oct. 20. Viaduct over Lick Run, Cincinnati, O....Sept. 22
Oct. 21. Levee work, West Memphis, Tenn....Sept. 22
Advertised, Eng. News, Sept. 22 to Oct. 13
Oct. 21. Dry dock, Algiers, La. ....Sept. 8
Oct. 22. Bridge, plans and material, Cincinnati, O..Sept. 29
Oct. 22. Electric plant, Litchfield, Ill....Sept. 29
Oct. 22. Dredging, Pensacola Bay, Fla....Sept. 29
Advertised, Eng. News, Sept. 29 to Oct. 13.
Oct. 23. Plans for sewer system, Chertsey, Eng....Sept. 22
Oct. 24. Markets, etc., Belem, Brazil....Apr. 28
Oct. 24. Paving with asphalt, etc., Hamilton, O....Sept. 29
Oct. 24. Water-works, Gallipolis, O....Sept. 29
Oct. 24. Heating plant, St. Peter, Minn. ....Sept. 29
Oct. 25. Jetties, Portland, Ore. ....Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 15.
Oct. 26. Bridge bonds, Cincinnati, O. ....Sept. 29
Oct. 26. Dredging, Newport, R. I. ....Sept. 29
Advertised Eng. News, Sept. 29 to Oct. 20.
Oct. 26. Cement, broken stone, etc., Newport, R. I...Sept. 29
Advertised Eng. News, Sept. 29 to Oct. 20.
Oct. 27. Paving, Camden, N. J....Sept. 29
Oct. 30. School building, Chehalis, Wash. ....June 16
Nov. 1. Court house, Garner, Ia. ....Sept. 8
Nov. 1. School building St. Louis, Mo....Sept. 22
Nov. 7. Improving electric plant, Topeka, Kan. ..Sept. 22
Nov. 10. Water supply, Belem, Brazil ....Sept. 22
Nov. 15. Water-works addition, Seattle, Wash....Sept. 22
Advertised, Eng. News, Sept. 22 to Nov. 10.
Nov. 15. Jail work, San Saba, Tex....Sept. 29
Nov. 21. Government bldgs (8), Sophia, Bulgaria....Sept. 29
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn....Aug. 18
Jan. 2. Bridge, Quebec, Que. ....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Feb. 10. Jail building, Keyser, W. Va. ....Sept. 29
No date. Steam boiler, etc., Lawrence, Kan....Sept. 29

RAILWAYS.

ATKINSON & NORTHERN.—Bids are asked, according to reports, for work on a new line of railway between Atkinson and Perry, Neb., on the Niobrara River, a distance of 25 miles. O. G. Wales, Gen. Mgr., Atkinson.

CALIFORNIA EASTERN.—Press reports state that the California division of this railway company has placed an issue of $684,000 of 5% bonds in London, for the purpose of extending its lines to Calivada, Nev., a distance of 47 miles. The present line is operated between Blake and Manvel, Cal., a distance of about 30 miles. R. S. Seibert, Gen. Mgr., Los Angeles, Cal.

CHICAGO, MILWAUKEE & ST. PAUL.—D. J. Whittemore, Ch. Engr., 1100 Old Colony Bldg., Chicago, Ill., informs us that this company has no intention of building a line this year from Linn to Stanley, Wis., a distance of about 35 miles.

COAHUILA CENTRAL.—The Coahuila Central Construction Co. has been awarded the contract for the construction of this proposed line from Saltillo to Trevino, Mexico, a distance of 60 miles. The construction company, of which W. E. Dorwin is president, and John C. McMynn purchasing agent, both of Chicago, Ill., will also build a hotel at Saltillo and a smelter, with a capacity at first of 600 tons. The railway company was incorporated at Saltillo, June 30, to construct a standard-gage railway, with officers as follows: Pres., S. J. Martin, Saltillo, Mex.; Vice-Pres., John C. McMynn, The Rookery, Chicago; Secy. and Treas., E. W. Stone, Oswego, N. Y.; Gen. Mgr., W. E. Dorwin, Chicago.

COAL RIVER & SOUTHWESTERN.—This company was incorporated in West Virginia, Sept. 19, with a capital stock of $1,500,000, to construct a steam railway from St. Albans to the Norfolk & Western R. R. in Mercer county, W. Va. The incorporators are: James Booth, H. J. Tondy, C. R. Troxbr, W. S. Booth and H. F. Tondy, all of Huntington, W. Va.

EAST LOUISIANA.—We are informed that nothing has yet been done towards the construction of the proposed extension of this line from Covington north to the state line, about 36 miles. John Poitevent, Pres.; E. S. Ferguson, Asst. Gen. Mgr., both of New Orleans, La.

ENGLAND.—Bids are asked by the Burma Railways Co. until Oct. 3 for a number of "F" class engines, duplicate parts of locomotives, and metallic fittings for carriages. Address the company, at 76 Gresham House, Old Broad St., London, E. C., England.

IOWA CENTRAL.—L. M. Martin, Ch. Engr., Marshalltown, Ia., informs us that no extension from Oskaloosa to Des Moines, Ia., has been authorized, nor will any other extensions be made this year. Press reports state that a 3-mile branch was to be built from Albia, Ia., south to new coal fields.

KANSAS CITY, OSCEOLA & SOUTHERN.—J. F. Hinckley, Ch. Engr., Bolivar, Mo., informs us that this line was completed Sept. 1, and is being operated under lease by the St. Louis & San Francisco R. R. Co., which also operates the old line from Osceola to Kansas City. Construction began about Jan. 1 from the terminus of the "Blair Line" at Osceola, and extended to Bolivar, via Vista, Gerster, Weaubleau, Flemington and Cliquot, Mo., a distance of 38.3 miles. Pres., C. Miller, Bangor, Pa. The contractors for the grading and bridge and masonry work were George S. Good & Co., of Lock Haven, Pa., who moved approximately 700,000 cu. yds. of material and erected 5,000 lin. ft. of pile and frame trestle bridge work, 2,000 cu. yds. of culvert masonry and 700 cu. yds. of bridge masonry.

KOREA.—Press reports state that an agreement has been signed at Seoul, Korea, for the construction by Japanese of a railway from Seoul to Fusan.

LEAVENWORTH, KANSAS & WESTERN.—Reports state that a steam ditching machine is at work on this road; also that the roadbed is to be relaid with steel rails. J. O. Brinkerhoff, Act. Gen. Mgr., Kansas City, Mo.

LITTLE RIVER VALLEY.—Track is said to have been laid on the new line from Morris Ferry, Ark., on the Texarkana & Fort Smith branch of the Kansas City, Pittsburg & Gulf R. R., to the state line 7 miles west; grading is in progress. The projected route is from Nashville to Neal Springs, via Howard and Sevier, a distance of 40 miles. Pres., D. C. Richardson, Horatio, Ark.

MANISTIQUE & NORTHWESTERN.—C. E. Kelso, Secy., Manistique, Mich., informs us that Swanson & Wick, of Manistique, have been awarded the contract for grading for an extension of this system from Scotts to Shingleton, Mich., a distance of 8 miles, and that the work is almost completed. About five miles of track has been laid by the company employees, and connection is expected to be made with the Duluth, South Shore & Atlantic Ry. at Shingleton within 20 days. A connection was made with Munissing R. R. at Ackers on Sept. 15. The company will soon control 53 miles of railway in operation between South Manistique and Ackers and Shingleton. Pres., A. J. Fox, Detroit, Mich.; Gen. Mgr., Geo. H. Orr, Manistique.

MARSHFIELD & SOUTHEASTERN.—Chas. H. Grundy, Gen. Mgr., Marshfield, Wis., informs us that no new work on this line is under way, but that the proposed extension from Nekoosa to Princeton, Wis., about 50 miles, is still under consideration. Pres., W. A. Scott, Chicago, Ill.

MEXICAN CENTRAL.—Reports state that this company will soon require considerable track material, as arrangements have been made to build a branch line from Oredain to Tequila, State of Jalisco, a distance of about 30 miles. It is said that the landed proprietors along the route have given the company free right of way and a cash subsidy of $30,000. The company is now building a branch from Jiminez, State or Chihuahua, to Parral. It is also reported that negotiations are being made for the purchase of the Yurecuaro and Zamora division of the Michoacan & Pacific R. R., at present under construction.

NATIONAL INTEROCEANIC, ISTHMUS OF TEHUANTEPEC.—Press reports again state that Pierson & Sons, of England, have leased this railway system, and will reconstruct the entire roadbed; also that the Mexican government will make a harbor at Coatzacoalcos on the Atlantic side of the Isthmus. O. G. Canton, Ch. Engr., Coatzacoalcos, Vera Cruz, Mex.

NEVADA.—Final arrangements have been made, according to reports, for the construction of a line of railway from the smelters in Golconda, Nev., to the copper mines, a distance of 11¾ miles. Orders have been placed for 33,000 ties and the necessary rails and equipment.

PECOS VALLEY & NORTHEASTERN.—Track is being laid on this line between Roswell, N. Mex., and Amarillo, 205 miles, at the rate of over one mile a day, and the work is expected to be completed by Dec. 15. The grading west of the Pecos River has been completed.

PHILADELPHIA & READING.—Reports state that the contract for constructing a 1½-mile extension of this line at Shippensburg, Pa., to a connection with the Western Maryland R. R., has been let to Smith & Campion, Mahoney City, Pa. This new road will be built in order to avoid heavy grades now met with in that vicinity.

PITTSBURG & LAKE ERIE.—In addition to the proposed introduction of a complete electrical block signal system on this railway, plans are said to have been approved and bids asked for interlocking switch systems at the Pittsburg terminals and at the Bellevernon Junction bridge, which is being improved and extended at an expenditure of $100,000. The larger plant will be at the Pittsburg passenger terminals, and is estimated to cost $20,000. The apparatus will be electro-pneumatic and will have 40 levers to be operated. This company has just completed the laying of new 90-lb. steel rails to displace 70-lb. rails. Twenty miles have been put down on the northbound track, and next season both tracks between Pittsburg and Youngstown will have these rails. Between the city and Youngstown the roadbed has been made of a uniform cross-section and is ballasted with slag. J. A. Atwood, Ch. Engr., Pittsburg, Pa.

PITTSBURG, JOHNSTOWN, EBENSBURG & EASTERN.—The contract for the construction of the Altoona terminal of this line from Chestnut Ave. and 9th St., in Hollidaysburg, Pa., to a point on the road above Coleman's, has been awarded to E. M. Wilkins, who is expected to commence work on the same before Oct. 1. Other contracts on that road have been let.

PONTOTOC & STARKVILLE.—It is announced that the supervisors of Chickasaw county, Miss., have contracted with this company to grade, cross-tie, bridge and trestle 13 miles of roadbed from Houston north to the Pontotoc county line. This company was incorporated in Mississippi, as stated in our issue of July 7, to build a line from Pontotoc to Starkville, via Algona, Houlka, Houston and Sparta, Miss., a distance of 60 miles. Pres. N. B. Crawford, Atlanta, Miss., or N. W. Bradford, of Houston, Miss., may be addressed.

POTOSI & RIO VERDE.—Chas. J. Nourse, Jr., 27 William St., New York, a director of this company, whose incorporation was noted in our last issue, informs us that this proposed steam railway will extend from San Luis Potosi, Mexico, in a southeasterly direction into the Rio Verde district, and that the gage will be 36 ins. Capital for construction has been secured, and 40 miles are now under construction by the Potosi & Rio Verde Construction Co. One-half of the grading has been completed, and all the rails and ties purchased. Pres., Robert S. Towne, 27 William St., New York.

SOUTH CAROLINA & GEORGIA EXTENSION.—Reports state that this company has been chartered, with a capital of $500,000, to construct a railway from the southern boundary of North Carolina to the Tennessee State line, via Marion, S. C., a distance of about 140 miles. Among those interested are: John J. Collier and Evan R. Dick, both of Philadelphia, Pa., and Samuel Hunt., Pres. Ohio River & Charleston Ry. Co., Cincinnati, O.

SOUTHPORT & TERMINAL.—This company was incorporated in North Carolina, Sept. 13, with a capital stock of $250,000, to construct and operate a railway from Southport to Wilmington, N. C., with the right to extend the road from Southport, in a westerly direction, through the county of Brunswick to the boundary line between North and South Carolina. The directors are: W. A. Cullen, Conrad Kirk, Henry McDougal, P. Murray, Thomas Hawkins and H. H. Dougherty, of Newark, N. J.; Geo. H. Bellamy, El Paso, N. C.; Franz Mayer, C. C. Brown and A. Vorhees, New York.

UTAH & PACIFIC.—W. D. Hendricks & Son, Richmond, Utah, were awarded the contract, Sept. 17, for constructing the first 75 miles of this line from Milford, Utah, south to the Nevada state line, on the old grade built by the Oregon Short Line R. R. Co. Other bidders were: Holt & Reese and Kimball & Lewis, Salt Lake City, Utah; Roylance & Thompson, of Springville, Utah; C. Erickson & Co., of California; T. W. Stewart and the Corey Bros. Co., of Ogden, Utah. The Colorado Fuel & Iron Co. was awarded the contract for furnishing all necessary bolts, spikes and fastenings. The work of construction was expected to begin within 15 days and to be completed within three months. An extension of the road beyond Stateline as far as Pioche, Nev., is said to be projected. Pres., A. W. M'Cune, Salt Lake City; Ch. Engr., Joseph A. West, Ogden, Utah.

WABASH.—W. S. Lincoln, Ch. Engr., St. Louis, Mo., informs us that no official information has yet been received regarding the proposed extension of this line from East Hannibal to Quincy, Ill., as stated in current reports.

WEST VIRGINIA.—It is reported that J. W. Everhart, formerly surpervisor of track on the West Virginia Central & Pittsburg Ry., will supervise the construction of a short line of railway, an incline plane and a tram-road at Simpson, W. Va., for the New York Coal Co., which owns 1,100 acres of big vein gas coal. Col. Thomas B. Davis, Keyser, W. Va., is connected with the company.

WYOMING & MISSOURI RIVER.—Geo. M. Nix, Pres., Belle Fourche, S. Dak., informs us that this line is again under construction, between Belle Fourche and Aladdin, Wyo., a distance of 18 miles, and work will be completed by Oct. 15. F. C. Tucker, Ch. Engr., Deadwood, S. Dak.

YORK SPRINGS.—M. B. Cumbler, Pres., Carlisle, Pa., informs us that the surveys have been made and the right of way obtained for this proposed railway from York Springs to Dillsburg, Pa., a distance of about nine miles. C. W. Webbert, Ch. Engr., Boiling Springs, Pa.

STREET AND ELECTRIC RAILWAYS.

BERLIN, N. H.—Carlos P. Day, a director of the Berlin Electric Ry. Co., of Berlin, informs us that this company has not yet elected officers, but that a charter has been obtained and capital stock subscribed. As stated in our last issue, this company proposes to construct four miles of line between Berlin and Gorham.

BURLINGTON, VT.—Elias Lyman, Pres. Burlington Traction Co., of Burlington, informs us that the right of way has all been obtained, and the necessary capital secured, for constructing a 1⅛-mile extension of this line over the lower road in this city. The company will do its own work. H. M. McIntosh, Ch. Engr., Burlington.

DEDHAM, MASS.—The Norfolk Western St. Ry. Co. received a charter of incorporation, Sept. 23, and also permission from the railway commissioners to build and operate its proposed electric railway on High St., Dedham. The proposed route of the completed line is from Dedham to Medfield, via Westwood, a distance of nine miles. Work is expected to begin soon. Pres., W. H. Mitchell, Medfield; Engrs., Hodges & Harrington, 60 State St., Boston.

PALMER, MASS.—The Palmer & Monson St. Ry. Co. is said to contemplate the extension of its lines through Palmer, Ware and Warren, in which places franchises have been applied for.

SOMERVILLE, MASS.—The aldermen have granted the Boston Elevated Ry. Co. the right to relocate its tracks on Summer St.

WHITMAN, MASS.—G. H. Pearson, Town Clk., informs us that at the town meeting, on Sept. 23, a franchise was granted to the Brockton & Whitman St. R. R. Co. The contract will probably be let as soon as franchise is obtained in Brockton.

MOUNT VERNON, N. Y.—The trustees of the village of North Pelham have granted a franchise to the Westchester Electric Co. to build a street railway through the village.

NEW HARTFORD, N. Y.—The trustees of this town, Sept. 21, granted a franchise to the Sanquoit Valley Electric St. R. R. Co. to construct a street railway between New Hartford and Utica. Pres., A. P. Seaton.

NYACK, N. Y.—Local reports state that Isaac A. Walker & Son, 1217 to 1219 Girard Bldg., Philadelphia, Pa., have the contract for building the proposed electric street railway of the Nyack Traction Co., and that about 800 men will be employed on the work. The plans and specifications are now said to be in course of completion. Pres., H. C. Howard, Media, Pa.

PENFIELD, N. Y.—A hearing will be given in this town by Henry C. March, Comr. of Highways, Sept. 30, on the application of the Rochester & Sodus Bay Ry. Co. for a franchise to build through Penfield. The company has been granted permission to build along the Ridge Road through Webster. The proposed route of the railway is from Webster to Sodus Point, a distance of 42 miles. Pres., Thos. J. Nicholl, 267 State St., Rochester, N. Y.

PORT CHESTER, N. Y.—The Port Chester St. Ry. Co. filed a certificate of extension of its lines, Sept. 24, one beginning on Main St., running easterly to the State line; the other beginning on Purchase Ave., at Elm Place, and running westerly to the Glenbrook Road.

WATERTOWN, N. Y.—It is reported that the Black River Traction Co. has purchased the plant of the Watertown Brass Co., on Newell St., and that it will soon let contracts for the building of a new power house on the site. Treas., B. B. Taggart, Watertown.

CRANFORD, N. J.—The township committee of Cranford granted a franchise to the Elizabeth & Westfield St. Ry. Co., Sept. 22, to build a trolley line through the town. The company now holds franchises from all the towns between Elizabeth and Plainfield, except through Roselle. Pres., A. A. Gaddis, Westfield, N. J.

JERSEY CITY, N.J.—It is reported that the North Jersey St. Ry. Co., Newark, will build an extension on Jackson Ave., in this city, this fall. David Young, Gen. Mgr.

PERTH AMBOY, N. J.—A new application has been made to the board of aldermen by the Perth Amboy & Sewaren Electric St. Ry. Co. for a franchise to enter the city over Railroad Ave.

PLAINFIELD, N. J.—A public hearing will be given by the council, Oct. 3, on the application of the Plainfield St. Ry. Co. for permission to extend its tracks. Pres., T. N. Nevins.

BANGOR, PA.—A local company is being organized, according to reports, for the construction of an electric railway between East Bangor, Bangor and Pen Argyle.

BUTLER, PA.—The construction of a street railway in this place is said to be wanted by the residents.

CHESTER, PA.—The trolley line now being built between Chester and Wilmington, Del., is expected to be completed by Oct. 1. The new road completes the trolley connection from Philadelphia and New Castle, Del. a distance of 35 miles. Pres., C. W. Clark, Philadelphia, Pa.

BALTIMORE, MD.—The Anne Arundel county commissioners have granted permission to the Baltimore, Marley & Mountain Ry. Co. to construct a line over Curtis Creek and Cabin Branch bridges. The company was recently incorporated with a capital stock of $50,000, to build an electric railway from Baltimore to the mouth of the Magothy River, a distance of 11 miles. The incorporators are: Jas. Bond, Baltimore; Walter R. Townsend, Baltimore county; Robt. Moss, Frank B. Hancock, Bruner R. Anderson, Dr. Elijah Williams, and others, of Anne Arundel county.

LAUREL, MD.—Mayor Phelps and others are said to be interested in the construction of a proposed electric railway to connect Laurel and Savage, via the old Washington & Baltimore turnpike.

WASHINGTON, D. C.—J. D. Croissant, Pres. Washington & University R. R. Co., 821 North Carolina Ave., Washington, informs us that surveys have been made and most of the right of way obtained for this proposed electric railway, from Washington to Glen Echo, via University Heights and University Park, a distance of three miles, with a three-mile extension into Maryland. The capital for construction has not yet all been secured, but 6% bonds will be issued this winter. The charter must be amended by Congress before contracts will be let and work commenced. V. K. Nash, Ch. Engr., Woonsocket, R. I.——Press reports state that the Capital Traction Company is getting together the material preparatory to changing the Love underground system on U St., to the General Electric system, in use on the remainder of its line, next spring. The road for 1⅛ miles will practically have to be rebuilt. It is probable that the underground system will replace the overhead trolley as far as the eastern end of the Cincinnati St. bridge over Rock Creek.

CLEVELAND, O.—Frank De H. Robinson is said to contemplate the construction of a complete new system of street railways in and about Cleveland.

CONNEAUT, O.—We are informed that surveys are about completed and most of the right of way obtained for the proposed electric railway of the Pennsylavia & Ohio Ry. Co. from Painesville to Conneaut, O., a distance of 42 miles. The capital for construction has not yet all been secured, but contracts will probably be let before Jan. 1. The engineering work is being done by the Osborn Co., Osborn Bldg., Cleveland.

DAYTON, O.—Reports state that work began on the construction of the proposed Dayton, Springfield & Urbana Electric Ry. Sept. 19, at Dayton; estimated cost, $600,000. Engr., W. G. Moler.

SOUTH BEND, IND.—The council of Mishawaka granted a franchise to the South Bend & Elkhart Electric Ry. Co. Sept. 19, which proposes to construct an electric line from South Bend to Goshen, via Mishawaka, Elkhart and Osceola, 13 miles. Reports state that Messrs. Delworth and Kennedy, owners of this new system, have bought the Indiana Electric Co.'s lines in Elkhart and connecting Elkhart and Goshen. Other extensions are also contemplated.

ALTON, ILL.—J. F. Porter, Pres. Alton Ry. & Illuminating Co., Alton, informs us that this company proposes to build from Alton to East Alton, through 6th St. and the cemetery, a distance of 5 miles. Contracts will be let early in next year for rails, ties, bonds, macadam, five cars with single trucks, three cars with double trucks, and one 100-K-W. power generator. All steam machinery is now in place.

CHICAGO, ILL.—It is announced that the Northwestern Elevated R. R. Co. will resume work soon to finish its uncompleted system. The Columbia Construction Co. erected over four miles of the structure in 1896, when work had to be suspended for want of sufficient capital.

EDWARDSVILLE, ILL.—H. Renecke, Clk. of Madison county, of Edwardsville, informs us that the Mississippi Valley Ry. Co. has secured the right of way from the county, and most of the towns along the route, and that surveys are now in progress. One route is from St. Louis to Edwardsville and thence to Alton, via East St. Louis, Collinsville and Glen Carbon; another from St. Louis to Alton, via East St. Louis, Brooklyn, Venice, Madison, Granite City, Oldenburgh, East Alton and Upper Alton, a distance of about 60 miles. Contracts will probably be let next February. Pres., Chas. E. Carroll: Vice-Pres., John A. Mehling: Secy. and Treas., August Holthaus, 1449 North 6th St., St. Louis, Mo.

ST. LOUIS, MO.—The Electric Connecting Ry. Co., of St. Louis, has been incorporated with a capital stock of $2,000 by John H. Bobring, M. T. Chestnut and Jas. D. Houseman, Jr.

PORT ANGELES, WASH.—E. W. Chillis, Erie, Pa.; John Cain and Geo. H. Clementson, of Port Angeles, are said to have applied to the council Sept. 15 for a franchise to construct a street railway through this place.

BINGHAM, UTAH.—The Highland Boy Mining Co. expects to build 12,700 ft. of tramway between the mine and the yards of the Rio Grande Western at Bingham. Mgr., Thomas Weir.

MONTREAL, QUE.—F. L. Wanklyn, Mgr. and Ch. Engr. Montreal St. Ry. Co., of Montreal, informs us that this company has commenced the construction of an extension of its line as far as Pine Ave. A further extension to the city limits near the top of Côte des Neiges Hill is under consideration.

PETERSBORO, ONT.—Reports state that the Petersboro & Ashburnham St. Ry. has been sold to Arthur Stevenson, and that some improvements will probably be made.

ST. CATHERINES, ONT.—Press reports state that Haines Bros., of New York, has bought the Niagara Central Ry., and that they will equip it with electricity and establish a new service between St. Catherines and Niagara Falls. The roadbed will be changed and several trestles abandoned.

ELECTRIC LIGHT AND POWER

LANCASTER, N. H.—We are informed that the plant of the Lancaster & Jefferson Electric Co., recently incorporated, is nearly completed.

SOMERVILLE, MASS.—The question of a municipal plant is again being considered. Alderman Lamont may be addressed.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Co. has been awarded the contract for laying conduits for its wires to the American Vitrified Conduit Co., New York, N. Y. The contract will call for the laying of conduits in about 20 miles of streets, in which will be placed about 175 miles of ducts. The cost of laying the conduits will be about $250,000 and that of furnishing and drawing the wires about $250,000.

MYSTIC, CONN.—The Hyer-Sheehan Electric Motor Co., Newburg, N. Y., is reported to have been awarded the contract for furnishing and installing the machinery for the proposed plant for the Mystic Electric & Gas Light Co., at about $25,000. Engr., Thos. C. Perkins, Hartford, Conn.

AKRON, N. Y.—At a recent meeting of the board of trustees it was resolved to call an election for Oct. 10 to vote on the question of an appropriation of $3,000 to install an electric light plant.

CAZENOVIA, N. Y.—Jno. O'Connell, Marathon, N. Y., writes us that the Fairchild Mill property has been leased for a term of years. The installation of a plant with a capacity of 300 16-c. p. lights is about to commence. The contract for the equipment, to cost about $7,000, has been made.

CHARLOTTE, N. Y.—Bids are asked until October 15 for constructing a plant and water-works, as described in our advertising columns. Consult. Elec. Engr., C. O. Mailloux, 150 Nassau St., New York; Pres. Bd., Jno. M. Allen.

HERKIMER, N. Y.—An election will be held Oct. 10 to vote on the question of issuing $13,000 in bonds for a municipal plant, according to reports.

HUDSON, N. Y.—Press reports state that Charles J. Cooper, Brooklyn, N. Y., who recently purchased the Hudson Street Ry., has closed negotiations by which he also becomes sole owner of the plant and franchise of the Hudson Electric Light & Power Co. The consideration is $150,000.

LOWVILLE, N. Y.—The Wetmore Electric Co. is reported to have awarded the contract for a 230-HP. dynamo to the Westinghouse Electric & Mfg. Co., Pittsburg, and that for a 27-in. McCormick water-wheel to the S. Morgan Smith Co., York, Pa. If the demand for electricity warrants it, three dynamos and three wheels will be placed at the Beaver River Falls. The distributing station will be located on the farm of W. L. Babcock, east of the corporation limits of Lowville.

PATCHOGUE, L. I., N. Y.—Press reports state that the Patchogue Electric Light Co. is about to extend its lines from Patchogue through Blue Point, Bayport and Sayville. To meet the expense of the extension the capital stock of the company will be increased from $20,000 to $30,000. The company will also erect a new brick plant at the bank of the Patchogue River and add a 1,000 HP. dynamo and other improvements. Pres., J. S. Havens.

ROCHESTER, N. Y.—Bids are asked until Oct. 3 for electric lighting of the Free Academy building for one year from Nov. 1. Chn. Com., J. F. White, Bd. of Education.

UTICA, N. Y.—Johnson & Morton, 26 Catherine St., Utica, have been awarded the contract for placing a plant in the Broad St. works of the Savage Arms Co.

WATERTOWN, N. Y.—A report states that the aldermen are considering the question of a municipal plant or of renewing the contract with the Watertown Electric Light Co., with a provision that the city have the right to purchase the plant. It is probable that the contract will be renewed. Cy. Engr., C. O. McComb.

WHITESBORO, N. Y.—The council is considering propositions for street lighting from the Utica Electric Light Co. and the Welsbach Lighting Co. of America.

CAMDEN, N. J.—The lighting committee has directed City Clerk Kramer to communicate with cities owning their plants with a view to securing information for a municipal plant for this city.

AVOCA, PA.—The new owners of the Standard Electric Light, Heat & Power Co., it is stated, will improve the plant. Pres., W. H. Hollister, Avoca; Secy. and Treas., J. B. Russell.

BRADFORD, PA.—Benj. W. Brundred and Stanley W. Loomis, Oil City, Pa., have applied for a franchise for a plant. Action will not be taken for some time. Cy. Clk., Jas. A. Lindsey.

DARBY, PA.—J. F. Willy, Clk., writes us that the plans for the proposed plant are still under consideration by the council.

LEBANON, PA.—The contract with the Edison Electric Illuminating Co., of Lebanon, for arc lights, will terminate on June 1, 1899, and the city is about to take steps looking to obtaining bids for 125 arc lights, for a period of from five to ten years. William D. Zehnder, Lebanon, should be addressed. Cy. Engr., George W. Hayes.

MOUNT JOY, PA.—T. E. Bailey & Co., for the Manheim Electric Light, Heat & Power Co., have secured the franchise for lighting this place.

BALTIMORE, MD.—Bids are asked until Oct. 8 for furnishing and installing a plant for the new courthouse in this city. Archs., Wyatt & Nolting, 4 East Lexington St., Baltimore; Chn. Courthouse Com., Felix Angus.

RICHMOND, VA.—It is stated that T. C. Thompson, Supt. Fire Alarm Service, is investigating the cost, etc., of a plant for the almshouse.

GREENSBORO, N. C.—The Industrial & Immigration Association has voted to urge the council to arrange at once for a new contract for electric lighting of the city from Jan. 1, 1899, by asking for bids, and also for granting a franchise for a street railway.

DALTON, GA.—We are informed that at the election Nov. 2 this place will vote on the question of issuing $30,000 in 30-year 6% bonds for a plant and a sewerage system. Engr., J. L. Ludlow, Winslow, N. C.; Mayor, W. H. Pruden.

CRESCENT CITY, FLA.—C. H. Cash and W. J. Pierpont have applied for franchises for lighting plants.

FLORENCE, ALA.—It is stated that the Florence Milling Co. proposes to put in an electric plant at its mill.

PENSACOLA, FLA.—The bureau of yards and docks, U. S. N., Washington, D. C., received but one bid, that from the McCay Engineering Co., Baltimore, Md., at $12,886, for furnishing and installing a plant at the nevy yard. The bid is in excess of the appropriation of $10,000.

COVINGTON, KY.—Alderman Schlosser has introduced an ordinance creating a fund for the erection of a city plant to cost about $42,000.

FERDINAND, IND.—It is reported that this place is to have a plant.

THORNTOWN, IND.—The question of building a plant and water-works is being considered.

DECATUR, MICH.—The following bids were received Sept. 6 for building a plant, the bids for the poles and wire being given under Contract Prices; Engr., Geo. S. Pierson, Kalamazoo, Mich.: (1) being for power station building: (2) for boilers; (3) for engine; dynamos—(4) for two 30 K-W.: (5) for one 30 K-W.: (6) for 50 K-W.: (7) for 23 arc lamps: Carney & Hartsell, Decatur, (1) $985, (2) $325 setting only: (4) $35 setting only: Daniel Carney, Sr., (1) $950, (2) $315 setting only. (4) $35 setting only: Westinghouse Electric & Mfg. Co., Pittsburg, (2) $1,585: (3) $963; (4) $1,675; (5) $875; (6) $1,090; (7) $525: Fort Wayne Electric Corporation, (2) $1,522: (3) $1,116; (4) $1,450; (6) $1,275; (7) $440: General Electric Co., Schenectady, N. Y., (4) $1,677; (5) $869; (6) $1,061, 45 K-W.; (8) $438: Ridgway Dynamo & Engine Co., Ridgway, Pa., (3) $1,025; (6) $1,178; Thos. Muir & Son, agent, 31 Larned St., W., Detroit (Card Electric Co., Mansfield, O.,) (4) $1,186; (5 and 6) $1,438 together; (7) $470; add $265 for installation of generators and switchboards, price for wire, f. o. b., Decatur, 14½ cts. a lb.; (Sprague Electric Co.). (4) $1,320, 33 K-W.; (5 and 6) $1,485, one 33 K-W. and one 48 K-W.; (Warren Electric Mfg. Co., Sandusky, O.,) (5) $670; (6) $795, 45 K-W., and $996, 60 K-W: New York Safety Steam Power Co., 30 Cortlandt St., New York, (2) $1,500; (3) $1,000; Wray-Austin Machinery Co., Detroit, (3) $1,035 and $1,215; Pearl & Mills, agents, Benton Harbor, Mich., (Fort Wayne Electric Corporation) (4, 5 and 6) $4,750, $4,100 and $4,400 respectively, lump bids including 1, 2, 3 and 7; also same with following bids: (Westinghouse Electric Mfg. Co.,) (5) $4,100, (6) $4,450; (General Electric Co.,)

(4) $5,250; (5) $4,450; (6) $4,650; (Western Electric Co.,) (4) $5,150; (5) $4,350; (6) $4,650; add $150 for direct-connected dynamo; add $250 for special boiler. It is stated that the contracts were let to J. W. Pearl and Geo.. Mills, Benton Harbor, at about $7,000.

GRAND RAPIDS, MICH.—The Chase Construction Co., Detroit, has been awarded the contract for furnishing the materials and for building the proposed city plant at $89,-970. The bids will probably be given next week. Engrs., Nagle & Ball, Chicago, Ill.

MOUNT PLEASANT, MICH.—Chas. M. Brooks, mayor, writes us that this place voted Sept. 21 against issuing bonds for a plant and water-works.

LITCHFIELD, ILL.—Bids are asked until Oct. 22 for furnishing electric lights, and for constructing a plant. Cy. Clk., O. D. W. Gooch.

UPPER ALTON, ILL.—The Alton Ry. & Illuminating Co has been awarded a 5-year electric lighting contract, according to reports.

EAU CLAIRE, WIS.—The committee has recommended that the council grant a franchise for an electric lighting plant to David Douglas. Chn. Com., F. Gregoire.

ADA, MINN.—Fred. Hampson, it is stated, proposes to put in a plant.

WICHITA, KAN.—Councilman W. H. Herbig writes us that bids will probably be received within 30 days for the proposed plant for H. B. Church & Co. Mr. Church was in Chicago Sept. 19 negotiating for the construction of the plant in connection with the building of a street line. The plant will have a capacity for furnishing 175 2,000-c. p. arc lights; the number of incandescent lights is not known.

WAHOO, NEB.—S. H. Jones, owner of the electric plant, writes us that he is repairing the burned portion of the plant. In the near future a new engine and dynamo will be put in.

ANACONDA, MONT.—It is stated that arrangements are being made for completing the Big Hole power plant of the Montana Power Co. Work was suspended June 1 by a heavy rise of water which threatened the new structure. The dam is 500 feet wide, and is to supply electric power for Butte and vicinity. Col. T. C. Marshall, Missoula, Mont., may be addressed.

CASSVILLE, MO.—The question of building a plant and water-works is being considered, according to reports. Mayor, Harrison Horine.

ST. LOUIS, MO.—The St. Louis Automatic Refrigerating Co. has applied for permission to build a power plant on the wharf at Dickson St. Pres., Jas. E. Baker.

SAN ANGELO, TEX.—The San Angelo Water-Works Co. has filed an amendment to its charter for the purpose of supplying light, heat and power.

SHERMAN, TEX.—Jno. E. Kern, County Surv.. writes us that the contract for building the plant has been let.

GALLUP, N.MEX.—It is stated that this city wants to put in a municipal plant. The citizens object to the private ownership of the plant.

BREMERTON, WASH.—Bids are asked until Oct. 15 for installing a plant at the U. S. naval station, Puget Sound, Bremerton, Wash., for which $9,800 is appropriated. M. T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C.

LAKE VIEW, CAL.—C. G. Baldwin, of Claremont, Cal., has filed on 125 inches of water flowing into Mill Creek near its source, with which to generate electricity to be used at Lake View, Perris, Menifee, Elsinore and neighboring towns.

REDWOOD CITY, CAL.—The question of building an incandescent plant in connection with the city arc light plant is being considered by the board of trustees.

SANTA BARBARA, CAL.—At the request of Mayor Burke a committee has been appointed to investigate the question of building a plant to cost about $12,000.

BROCKVILLE, ONT.—The "Times" is urging the town to consider the question of securing electric power from Jones Falls, near Smith's Falls, a distance of about 30 miles.

ORILLA, ONT.—John Kennedy, Ch. Engr.,Harbor Comrs., Montreal, Que., is stated to have submitted a report in favor of securing electric power from a waterfall several miles from this place.

SANTIAGO, CUBA.—Press reports state that private parties are negotiating for the construction of a plant.

RATHMINES, IRELAND.—Bids are asked until Oct. 5 for furnishing a plant for this city. Engr., Robt. Hammond, 64 Victoria St., London, S. W.; Secy. Comrs., F. P. Fawcett.

NEW COMPANIES.—Empire Heating & Lighting Co., St. Louis, Mo., $5,000; S. L. Cohen, J. S. Costella, J. C. Robertson.

BRIDGES.

CAMBRIDGE, MASS.—Bids are asked until 12 m., Oct. 1 for constructing a temporary pile bridge over the Charles River, near the West Boston bridge. Josiah Quincy, Chn. Comn.

HARTFORD, CONN.—Geo. Nevero, Clk., informs us that no action other than to apply to the railroad commissioners for plans for a bridge over the tracks at Broad St., has been taken.

LIVINGSTON MANOR, N. Y.—The question of issuing $5,000 of bridge and road bonds will be submitted to a special election.

NIAGARA FALLS, N. Y.—The council is considering the question of overhead bridges at the railroad crossings on Main, Sixth and Pine Sts.

PITTSFORD, N. Y.—Geo. A. Gass, Supt. and Secy. Erie Canal Co., Pittsford, writes us that plans are being prepared for a bridge 80 ft. long and 66 ft. wide, on stone abutments; estimated cost. $18,000. Bids will be asked in October by Geo. W. Aldridge, Supt. Pub. Wks., Albany.

PERTH AMBOY, N. J.—The board of freeholders will begin preparations for a bridge across Woodbridge Creek, at Railroad Ave., at the next meeting.

LANDENBURG, PA.—The Schuylkill Bridge Wks., Phoenixville, Pa., has been awarded a contract for the construction of an iron bridge over White Clay Creek.

WILMINGTON, DEL.—The Edge Moor Bridge Works has been awarded contracts for bridge work as follows: Three bridges, to be built on the Cleveland & Pittsburg division of the Pennsylvania R. R.; two viaducts, to be built on the Lehigh Valley R. R.; one bridge, to be built on the Central R. R. of New Jersey, and two bridges, to be built on the Pennsylvania subway of the Pennsylvania R. R., according to reports.

NEWPORT NEWS, VA.—The Structural Iron Co., Baltimore, has submitted the lowest bid for constructing bridges at 25th and 34th Sts. and Chesapeake & Ohio R. R.; appropriation, $40,000.

CONCORD, N. C.—Bids are asked by the county commissioners for constructing a new bridge at Black's Mills.

ATLANTA, GA.—Reports state that the Atlanta & West Point R. R. Co. will construct five bridges and a tunnel. George C. Smith, Pres.

HAZLEHURST, MISS.—Bids are asked until Oct. 3 for the construction of two iron bridges, one at Rockport and at Georgetown, Miss., over the Pearl River; estimated cost, $15,000. J. D. Dampeer, Clk. County Supervisors.

CONCORD, TENN.—It is reported that Neely & Smith, Chattanooga, have been awarded a contract to construct several masonry culverts, on the Southern R. R., between Knoxville and Chattanooga.

CALIFORNIA, O.—The water-works commissioners, Cincinnati, have received the lowest bid from the Pittsburg Bridge Co., at $22,600, for the superstructure, and J. Delaney, at $4,850, for the masonry, for a bridge to be built at the water-works pumping station. The bids have been rejected.

CHILLICOTHE, O.—The contract for the superstructure of the bridge over Deer Creek has been awarded to the Iron Superstructure Co., Columbus, O. H. S. Adams, County Audr.

CINCINNATI, O.—Bids are asked until Oct. 26 for the purchase of $99,000 of 4% bridge bonds. Henry Korb, Pres. County Comrs.

CINCINNATI, O.—The county commissioners have awarded a contract for the erection of a bridge over Mill Creek, on Riddle Road, to the Brackett Bridge Co., Cincinnati.

CINCINNATI, O.—Bids are asked until Oct. 22 for furnishing plans and material and constructing a wrought-iron truss bridge, in Sycamore township. E. L. Lewis, County Audr.

LORAIN, O.—L. A. Fauver informs us that $175,000 in bonds have been sold for the construction of a draw bridge across the Black River at Erie Ave., to have a 120-ft. clear opening. The Osborn Engineering Co., Cleveland, O., is preparing plans. Address the county commissioners, Elyria, O.

PONTIAC, ILL.—Bids are asked until 12 m., Oct. 5, for constructing a bridge about 150 ft. long over the Vermillion River, as stated in our advertising columns. F. W. Winkler, Cy. Atty.

ELKHORN, NEB.—The Canton Bridge Co., Canton, O., has been awarded a contract, at $4,600, for constructing a county bridge over the Elkhorn River.

OMAHA, NEB.—Andrew Rosewater, Cy. Engr., writes us in regard to the proposed viaducts ordered by the city council to be built, as noted in Engineering News, that under the provisions of the Omaha city charter, requiring railway companies to construct viaducts required by public travel over their line of railway, the Engineering Department of the city is required to make plans and specifications for such work, and after such plans and specifications are approved by the mayor and city council, the railway companies will be officially notified to proceed with the construction of the same. The viaducts will be paid for by the railway companies and constructed by them. They will, doubtless, under joint arrangement, solicit bids for such construction. The city has nothing to do with receiving bids for this work, unless the companies shall refuse to proceed with such construction. In the latter event, the city will advertise and give due notice to all parties who contemplate submitting proposals, and furnish plans and specifications therefor. The viaduct now under consideration is known as the 16th St. Viaduct; is about 1,600 ft. in length, including approaches, and will range from 20 to 40 ft. above the streets and railway tracks. Plans and specifications will probably be submitted to the mayor and city council about Oct. 1, and after being approved, the railway companies will be officially notified to proceed with construction.

NEOSHO FALLS, KAN.—The Canton Bridge Co., Canton, O., has been awarded a $2,100 contract to construct a county bridge at this place.

NEWTON, KAN.—D. W. Wilcox, Mayor, informs us that the subway and viaduct crossings talked of in this city will be erected by the Atchison, Topeka & Santa Fe Ry. Co. The city has nothing to do with the matter, except to grant the privilege.

ST. JOSEPH, MO.—A contract has been awarded to Chas. W. Campbell for the Sixth St. viaduct.——The ordinance for the construction of the Grand Ave. viaduct by the Chicago Great Western Ry. Co. will be decided upon Oct. 5.

DENVER, COLO.—Petitions have been presented to the board of public works for the erection of a part of the old 14th St. viaduct, across Cherry Creek, on Stout St.

CHEHALIS, WASH.—Reports state that the contract for the construction of a bridge over Lincoln Creek has been given to the San Francisco Bridge Co., San Francisco, Cal.

MONTESANO, WASH.—The Columbia Bridge Co., Portland, Ore., has been awarded a contract to construct a steel bridge over the South Bay, according to reports.

ALBANY, ORE.—Bids are asked until 2 p. m., Sept. 29, for a bridge over the north fork of the Santiam River. Frank Crabtree, County Clk.

HEPPNER, ORE.—Bids are asked until Oct. 1 for a bridge over Rock Creek. A. G. Bartholemew, County Judge.

ISLAND CITY, ORE.—The Bullen Bridge Co., Portland, Ore., has been awarded a contract by the county commissioners, at $3,200, for a bridge over the Grande Ronde River.

OROVILLE, CAL.—Bids are asked until Oct. 3 for constructing a new approach to the bridge across the Feather River. H. D. Lansen, County Clk.

REDDING, CAL.—The county supervisors have awarded a contract to the Thompson Bridge Co.. at $6 280, for a bridge across the north fork of Cottonwood Creek.

DELHI, ONT.—Bell & McCubbin, Engrs., St. Thomas, Ont., are preparing plans for a steel bridge 66 ft. long, to be constructed at this place, according to reports.

QUEBEC, QUE.—Bids are asked until Jan. 2 for construction a railway and highway bridge across the St. Lawrence River, as stated in our advertising columns. Ulric Barthe, Secy. Quebec Bridge Co., Quebec.

KEW, LONDON, ENGLAND.—Bids are asked until Oct. 3 for removing the old bridge and constructing a new masonry bridge, repairing approaches, etc., over the Thames River; also for constructing and removing a temporary bridge, according to reports. John W. Barry and C. A. Brereton, Engrs., 21 Delahay St., Westminster.

BUILDINGS.

BATH, ME.—J. T. Crosby, Pastor of Wesley M. E. Church, 33 Union St., Bath, informs us that William Hartwell, of Bath, has the contract for erecting a new church building, to cost between $10,000 and $13,000, and that S. H. Rogers is now completing the foundation for the same. All contracts have been let except those for the pews, the glass and for frescoing. Arch., W. R. Miller, Lewiston, Me.

ST. ALBANS, VT.—The following bids were received by the supervising architect, Washington, D. C., Sept. 19, for a low pressure, return circulation steam heating apparatus in the U. S. building in this city:

		Time.
Gaylord & Eitapence, Binghamton, N. Y.	$5,173	*75 days
Edward P. Bates, Albany, N. Y.	4,373	90 "
John F. Dalton, Savannah, Ga.	3,738	90 "
Huey Bros., Boston, Mass.	4,000	65 "
Richardson & Burgess, Washington	4,967	May 1, '99
G. S. Blodgett Co., Burlington, Vt.	4,994	

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*Working days.

WATERBURY, CONN.—Plans are about completed, according to reports, for a new 12-room brick school building, to cost $40,000. Arch., Theodore B. Peck.

BROOKLYN, N. Y.—Bids are asked by the department of public buildings, at 346 Broadway, New York, until Oct. 11, for materials and work required for certain repairs and alterations to the municipal building of the Borough of Brooklyn, city of New York.——Bids are asked by the board of education, at 585 Broadway, New York, until Oct. 10, for erecting a frame extension to Erasmus high school building, in the Borough of Brooklyn.

GOWANDA, N. Y.—Bids are asked by the managers of the Collins State Homeopathic Hospital, until Oct. 4, for the necessary piping for steam supply from power house to hospital buildings, etc. Treas., Fred. J. Blackman, 626 Ellicott Square, Buffalo; Arch., Aug. C. Esenwein, of Buffalo.

HUNTINGTON (L. I.), N. Y.—The Huntington union school district, Sept. 20, voted to issue $20,000 in bonds for the erection of a new 2-story brick school building.

NEW YORK, N. Y.—Plans have been filed by the Cameron Co., 31 Nassau St., for a 3-story brick store and studio building, at 19th St. and 4th Ave., to cost $160,000. Arch., N. C. Mellen, 27 West 30th St.; by John Kilpatrick, 640 Madison Ave., for three 5-story brick flat and store buildings, at the Boulevard and 131st St., to cost $70,000. Archs., Neville & Bagge, 217 West 125th St.; by Mrs. P. Wertheim, for three 6-story brick and stone store and flat buildings, at 2011 to 2015 1st Ave., to cost $75,000. Arch., Max Muller, 21 Centre St.: by Abraham Stone and others, for two 6-story brick flat and store buildings, at Houston and Manhattan Sts., to cost $55,000. Archs., Horenburger & Straub, 122 Bowery; by Jobst Hoffman, Owner and Arch., 26 West 116th St., for two 5-story brick flat buildings, on 125th St., near the Boulevard, to cost $86,000.

NEW YORK, N. Y.—Bids are asked by the department of correction, 148 East 20th St., until Oct. 10, for installing three elevators on Blackwell's Island; two sureties required, $7 000 each.——Bids are asked by the board of education, at 585 Broadway,until Oct. 3, for heating and ventilating apparatus and electric lighting plant for public schools Nos. 40 and 166, Borough of Manhattan; also for new furniture for public school No. 153, Borough of The Bronx.

BOONTON, N. J.—Bids are asked until Oct. 11 for additions and alterations to the Lathrop Homestead, at Boonton, to provide accommodations for aged and disabled firemen of the state. Chn., Wm. H. Brown, Halsey and Academy Sts., Newark, N. J.

CAMDEN, N. J.—Bids are asked by the commissioners of public instruction until Sept. 30 for erecting a manual training and high school building at Haddon and Newton Aves.; also for a steam heating plant. Chn., C. Schepperkotter; Arch., Thomas Stephens, Masonic Temple.

NEWARK, N. J.—A 4-story brick and steel business building will soon be erected at Beaver and Clinton Sts., for Matthias Plum, at a cost of about $50,000. Arch., Thomas Cressey, 800 Broad St., Newark.

NEW BRUNSWICK, N. J.—Bids are asked by the board of education, until Oct. 11, for erecting a school building on French St., to cost about $26,000, excluding furnishing. Arch., Geo. K. Parsell, 363 George St., New Brunswick. Bids for this work were received from eleven contractors, Sept. 21, but the lowest estimate was that of Daniel Whitlock, at $32,127.

SOMERVILLE, N. J.—Wm. E. Bloodgood is said to be preparing plans for a 2-story building to be erected here for the Hiram Deat's Memorial Home, to cost $30,000.

ALLEGHENY, PA.—A $50,000 mining and engineering school building will be erected in this city this fall for the Western University. Chancellor, W. J. Holland.

PENNSBURG, PA.—G. T. Guthrie, of Philadelphia, has been awarded the contract to build the new stone church building for the German Lutheran Church of Pennsburg. Archs., Milligan & Webber, of Philadelphia.

PHILADELPHIA, PA.—Plans have been filed for a 3-story brick and stone library and hall building to be erected by F. S. Riggs for the Young Friends' Association, at 15th and Cherry Sts., at a cost of about $25,000. Arch., Wm. L. Price, 731 Walnut St.——Armstrong & Printzenhoff have been granted a permit to erect two sheds for the Philadelphia & Reading Ry. Co., to cost $10,000.——The Edgemoor Bridge Works Co. will construct three large corrugated iron frame sheds, with slag roofs, for the Pennsylvania R. R. Co., at a cost of $32,500.——Charles McCaul, 10 North 11th St., has been awarded the contract for erecting a new storage warehouse for Swift & Co., at Callowhill St. and Delaware Ave.——It is reported that several architects have been invited to submit plans for a new church building to be erected at 17th and Sansome Sts. for the Beth Eden Baptist Church, to cost about $500,000. Wm. A. Levering, Dr. W. W. Keen, B. Ogden Oxley, are on the building committee.——Eugene Lentilhorn, 11 Broadway, New York, was the lowest bidder, Sept. 17, for erecting a new steel store house at the League Island Navy Yard, at $15,300.

PHILADELPHIA, PA.—Bids are asked until Oct. 10 for furnishing 9,000,000 building brick, as stated in our advertising columns. E. Kleinsmith, 13th and Market Sts., Philadelphia.——R. C. Ballinger & Co., 218 North 13th St., have been awarded the contract for erecting the Women's Medical College building, on Seybert St., to cost about $30,000. Arch., Addison Hutton, 4th and Chestnut Sts.

WILKESBARRE, PA.—The commissioners of Luzerne county, Sept. 23, decided to build a new court house in this city, on the site of the old building, at a cost of about $450,000.

WASHINGTON, D. C.—Henry Strong, owner of the corner at F and 12th Sts., destroyed recently by fire, is reported as contemplating the immediate erection of a large store building thereon.

NEWPORT NEWS, VA.—The following bids were received, Sept. 19, for erecting a new jail building: W. P. Bosher, of Newport News, $15,250; Pauley Jail Building & Mfg. Co., of St. Louis, $16,000; Brisborne & McGurd, of Newport News, $15,085; Van Dorn Iron Works Co., of Cleveland, O., $15,000.

KEYSER, W. VA.—The clerk of Mineral county, of Keyser, informs us that bids will be received on Feb. 10 for constructing a new county jail building, to cost $10,000, for which plans are now being prepared by Frank P. Milburn, of Charlotte, N. C.

NEW ORLEANS, LA.—Bids are asked until Oct. 3 for erecting a new school building in Algiers. W. S. Douglas, Comptroller.

DAYTON, O.—Plans have been selected, according to reports, for the new $500,000 union railway station to be built in this city. Archs., Elzner & Anderson, Cincinnati, O.

OBERLIN, O.—Bids are asked until Oct. 7, according to reports, for erecting a brick and stone building for the children's home of Lorain county; estimated cost, $32,000. Geo. H. Lewis, County Audr., Elyria, O.

OXFORD, O.—Bids are asked by the trustees of Miami University, until Oct. 12, for the brickwork in connection with certain improvements for said university. W. O. Thompson, Chn. Bldg. Com., Oxford; Archs., Hannaford & Sons, Hulbert Block, Cincinnati, O.

PORT HURON, MICH.—G. S. Germain, of Port Huron, has the contract for erecting a brick roundhouse for the Grand Trunk Ry. System, at 32d St., to cost about $40,000.

CHICAGO, ILL.—Reports state that the Methodist Book Concern has decided to erect a 10-story building at 57 Washington St., to cost about $150,000. Arch., Harry B. Wheelock, 226 La Salle St.——Contracts are being let for erecting an apartment building at 51st Boulevard and Washington Ave., to cost about $50,000. Archs., Wilson & Marshall, 218 La Salle St.

DANVILLE, ILL.—Bids are asked until Oct. 6 for putting in place the steam main and return pipes from the boiler house to the laundry building, etc., at the Danville branch of the National Home for D. V. S. Arch., W. C. Gunnell, of Danville.——We are informed that the following bids were received, Sept. 17, by the above Home, for heating and ventilating of barrack buildings: Pittsburg Heating Supply Co., Pittsburg, Pa., $3,379; L. J. Mueller Furnace Co., Milwaukee, Wis., $2,422; The Prox & Brinkman Mfg. Co., Terre Haute, Ind., $3,148.17; James A. Geiwick, Danville, Ill., $2,700. For plumbing, gas piping, etc., Robert W. Kyle, Wheeling, W. Va., $1,932; The Prox & Brinkman Mfg. Co., Terre Haute, Ind., $2,103.67; F. P. Gleason & Son, Chicago, Ill., $2,150; Jas. A. Gelwick, Danville, Ill., $1,875. For electric lighting apparatus, etc., C. E. Wheelock & Co., Peoria, Ill., $1,400; McFell Electric Co., Chicago, Ill., $1,476; Arthur Frantzen Co., Chicago, Ill., $1,315.

ST. PAUL, MINN.—Bids are asked until Oct. 4 for the purchase of $100,000 of bonds for the purpose of providing funds to facilitate the construction of the new state capitol building. Channing Seabury, Vice-Pres. of Capitol Com.

ST. PETER, MINN.—Bids are asked until Oct. 24 for a heating plant for the court house. Charles Hensel, County Audr.

ELDORADO, KAN.—It is reported that the Atchison, Topeka & Santa Fe Ry. Co. will erect a new $60,000 stone station in this city.

HELENA, MONT.—The following bids were received, Sept. 14, for erecting the new state capitol building in Helena: Montana Building Co., Butte, Mont., $289,891; C. E. H. Campbell, Council Bluffs, Ia., $293,216; Texas Construction Co., Galveston, Tex., $321,370 and $359,865, the difference being in the quality of the fireproofing; G. W. Atkinson & Son, Colorado Springs, Colo., $329,500; D. B. Fotheringham, Spokane, Wash., $342,000; Butler & Ryan, St. Paul, Minn., sandstone, $377,000; granite, $462,000; W. J. Spear, Toledo, O., $404,598; William Goldie & Son, Chicago, Ill., $399,423. As stated in our last issue, the contract was awarded to the Montana Building Co., Jacob Soss, Gen. Mgr., to be completed within 20 months.

SAN SABA, TEX.—Bids are asked until Nov. 15 for constructing two cells about 7×10 ft., with corridor; bond, $500. John Seiders, County Judge.

FORT LOGAN, COLO.—Bids are asked until Oct. 5 for a hot water heating apparatus for the hospital at Fort Logan. Lt.-Col. E. B. Atwood, U. S. Army, Denver, Colo.

STOCKTON, CAL.—Plans are being prepared, according to reports, for a new hotel and bath building, at Jackson's baths, south of Stockton, to cost about $20,000. Archs., Downing & Lemme, Yosemite Bldg., of Stockton.

VENTURA, CAL.—H. A. Giddings has secured the contract for the erection of a bank building in Ventura, to cost about $40,000.

CHARLOTTETOWN, P. E. I.—McDonald & Schurman are reported to have received the contract for erecting the new building for the Prince of Wales College and Normal School, to cost about $35,000. Arch., C. B. Chappell.

ST. GREGOIRE, QUE.—This city has decided to borrow $50,000, in order to erect a new school building.

SARNIA, ONT.—Geo. I. Proctor, of Sarnia, has been awarded the contract for erecting a brick roundhouse here for the Grand Trunk Ry., to cost about $60,000.

LONDON, ONT.—Bids are asked by the department of public works of Ontario, until Oct. 5, for erecting a normal school building at London.

SOPHIA, BULGARIA.—Bids are asked by the Bulgarian government, until Nov. 21, according to reports, for the erection of eight public offices, as follows: A ministry of public works, ways and communications; a ministry of commerce and agriculture; a ministry of the interior; a ministry of public instruction; a ministry for foreign affairs and public worship; a ministry of justice, and an audit office. Particulars can be obtained from the Commercial Department of the Foreign Office.

WATER-WORKS.

BERWICK, ME.—The question of securing a water supply from the works at Somersworth, N. H., is being considered by the citizens of this place. Wm. S. Mathews and Wm. H. Rich are on the committee.

WARREN, ME.—A company is reported to have been organized to build works for this place. Population (1890), 2,097. Pres., Benj. Burton; Treas., W. F. Wight.

WESTON, MASS.—The question of securing an increased water supply is being considered. Water at present is furnished by the Weston Water Co.

BRANFORD, CONN.—The Branford Electric Co. has awarded the contract for building works to M. P. Rice, of Guilford, Conn. Engrs., Nichols & Potter, New Haven,

RIDGEFIELD, CONN.—Local papers state that arrangements are being made by the Ridgefield Water Co. to begin work at once on the proposed works. Population, 1,000; in summer, 2,200.

ALBANY, N. Y.—The following bids were received by the water board Sept. 20 for improving Bleecher reservoir, as advertised in Engineering News: E. N. Haines & Co., Rhinebeck, N. Y. (awarded contract), $28,456; J. Dunfee & Co., Syracuse, $28,644; John Doyle, Albany, $29,677; Frank Pidgeon, Saugerties, $30,438; Dollard & Holler, Albany, $30,926; M. J. Dady, Brooklyn, $32,874; R. B. Lewis, Herkimer, $34,393. Engr.-in-Charge, David R. Lee.

CHARLOTTE, N. Y.—Bids are asked until Oct. 15 for constructing a system of water-works and an electric light plant for this village, as stated in our advertising columns. John M. Allen, Pres. Municipal Bd.

FISHKILL, N. Y.—The question of building works is again being considered.

NIAGARA FALLS, N. Y.—H. A. Keller, Supt. water-works, writes us that the board of public works has directed the city engineer and the superintendent to secure cost of a 10,000,000-gallon filter plant. No report has yet been submitted. The question will have to be voted upon by the citizens.

SONYEA, N. Y.—Bids are asked until Oct. 1 for furnishing the materials and for extending the water mains at the Epileptic State Hospital to the new buildings on the east side of Kisbaqua Creek. There will be required about 4,300 ft. of 4, 8 and 10-in. pipe, 13 valves, 4 hydrants, etc. Supt., Dr. Wm. P. Spratling, Sonyea; Secy., H. E. Brown.

WINDSOR, N. Y.—T. V. Furman, Pres., writes us that it is proposed to buy the works now in use and to put in a new system. Sources of supply are being investigated and it is likely that work will be begun in the spring. The village board will no doubt let the work by contract. Not more than $20,000 in bonds will be issued. Population, 800.

MILTON, DEL.—It is stated that a company will be organized to build works for this place.

PHILADELPHIA, PA.—Bids are asked until Oct. 4 for building boilers, brick chimneys and annex to boiler house for the Roxboro pumping station, and excavating pipe trench and furnishing lead for joints for the Queen Lane pumping main No. 2. Dir. Pub. Wks., Thos. M. Thompson.

WYTHEVILLE, VA.—Bids are asked until Oct. 17 for furnishing and laying 6,155 ft. of 6-in. cast-iron water pipe, 3,591 lbs. of pig lead, 100 lbs. of jute packing, etc. Chn. Com., J. E. Perkins; Financial Agent, W. L. Stanley.

WEST TAMPA, FLA.—The board of trustees have engaged J. N. Hazlehurst, Ch. Engr. Bd. Pub. Wks., Tampa, Fla., to prepare plans for works to cost $30,000. Bonds for the work have been sold. Bids will probably be asked about Nov. 15.

ELBERTON, GA.—The citizens are reported to have voted against granting a franchise for works to Geo. J. Baldwin, of Savannah. The people, however, want to have works, but prefer municipal ownership. Clk., W. B. Henry.

LAKE PROVIDENCE, LA.—R. L. Hill writes us that no decision has yet been made with regard to plans and specifications for city works. Everything awaits the voting of bonds and a special tax in November. No engineer has yet been employed.

HENDERSON, KY.—The Edward P. Allis Co., Milwaukee, Wis., is reported to have been awarded the contract for furnishing a 3,000,000-gallon pump at $12,000.

CINCINNATI, O.—The David Folz Asphalt Paving Co., Cincinnati, has been awarded the contract for the masonry work for the California pumping station at $110,000.

COLUMBUS, O.—Bids are asked until Oct. 3 for furnishing the materials and for constructing a concrete masonry dam for this city. The itemized bids, received Sept. 10, but rejected, were given in our issue of last week. Dir. Pub. Wks., F. A. Jacobs; Clk., Jas. A. Fanning.

GALLIPOLIS, O.—Bids are asked until Oct. 24 for furnishing the materials and for constructing works for the hospital. Archs., Yost & Packard, Columbus; Secy. Bd. of Mgrs. Ohio State Hospital, H. C. Rutter.

JACKSON, O.—This place voted Sept. 19 to issue bonds for works.

McCONNELLSVILLE, O.—This place voted Sept. 19 to issue $20,000 in bonds for works. Cy. Clk., Geo. Birch.

SPRINGFIELD, O.—The superintendent has submitted estimates for about 3,000 ft. of water pipe.

LEWISVILLE, IND.—The question of building works is being considered, according to reports.

LOWELL, IND.—The Lowell Water-Works Co. has been incorporated by John P. Dales, S. M. Bartlett and C. M. Seckner; capital stock, $1,500.

NEW ALBANY, IND.—We are informed that the Home Crystal Water Co. has been granted a 25-year franchise. Work will be started within 60 days from the passage of the ordinance. The company will get $50 per hydrant for 200 hydrants. About 25 miles of 6 to 20-in. pipe will be laid, and two compound 3,000,000-gallon pumps will be put in. Engr., Frank Shefold, New Albany; Pres., Peter Arlund, Copenhagen, Denmark.

THORNTOWN, IND.—The question of building works at once is again being considered.

LAKE ODESSA, MICH.—Bids were asked until Sept. 27 for building the proposed works, to cost $10,000. Pres., Wilson Elliott; Clk., Wm. Goldring.

MOUNT PLEASANT, MICH.—We are informed that this place voted Sept. 21 against issuing bonds for works and a light plant. Mayor, C. M. Brooks; Clk., W. L. Davis.

WAYNE, MICH.—The question of issuing $20,000 in bonds for works is again being considered.

MILLEDGEVILLE, ILL.—Bids are asked until Oct. 7 for furnishing and laying 3,500 ft. of 6 and 8-in. pipe, 7,000 ft. of 4-in. spiral riveted pipe, about 25 double discharge fire hydrants, etc. Clk., S. A. Smith; Pres., J. F. Greenawalt.

MONMOUTH, ILL.—The question of changing the location of the pumping station is reported as being considered. Engr., D. W. Mead, Room 502, Wm. Brown Bldg., Rockford, Ill.; Chn. Com., Councilman Turnbull.

NEKOOSA, WIS.—Thos. E. Nash writes us that this village contemplates putting in works and wishes to hear from contractors. Address the president of the village board.

OSAGE, IA.—Bids are asked until Oct. 6 for furnishing the materials and for constructing works, as stated in our advertising columns. Consult. Engr., G. H. Merridith, Cedar Rapids; Chn. Water Com., J. P. Williams.

WINONA, MINN.—C. E. Kunie, Water Comr., writes us that the city will lay 33 blocks of 6 to 16-in. cast-iron water pipe, set 29 Mathews' hydrants and 10 valves, this fall.

DES MOINES, IA.—The council has directed the Des Moines Water Co. to build new mains in 10 streets.

CASSVILLE, MO.—The question of building works and a light plant is being considered, according to reports. Mayor, Harrison Horine.

SALINA, KAN.—The new work for the plant at this place will consist of the addition of a 10- 16- 12- 18-in. duplex compound non-condensing engine, two new boilers, nine new deep wells, giving a water supply three times the present supply, with means of doubling again when necessary; some new pipe lines and some additions to pumping station. The duplex pump being for a relay is not made condensing. Most of the material is already contracted. The rest will probably be contracted for at once. Engr., G. W. Parsons, 611 Baltimore Ave., Kansas City, Mo.

WYNNE, ARK.—It is stated that the city will issue bonds at once for the proposed works and electric light plant. Chn. Com., Wm. M. Kennedy.

PALESTINE, TEX.—The Palestine Water-Works Co. has been incorporated, with a capital stock of $100,000, by G. K. Cook, W. B. Johnson and G. W. Harris. This company will probably take charge of the old works of the Palestine Water Co.

BRECKENRIDGE, COLO.—D. Mitchell Bros., Denver, Colo., have been awarded the contract for building works, at $21,400.

FLORENCE, COLO.—An election has been called for Oct. 11 to vote on the question of issuing $135,000 in bonds for works. It is proposed to construct two storage reservoirs with a capacity of 95,000,000 gallons. A pipe line, 10½ miles long, will bring the water to Florence from the mountain south of the town. Engr., Hiram Phillips, Oriel Bldg., St. Louis, Mo.

PUEBLO, COLO.—C. P. Allen, Ch. Engr. Denver Union Water Co., Denver, Col., has submitted a report for an increased water supply, to cost about $55,000. T. O. Richards, Supt. Water-Works, has been directed by the trustees to secure prices of materials for the extension.

DAVENPORT, WASH.—It is stated that the council is again considering the question of works.

TACOMA, WASH.—John Holgate, Chn. Fire and Water Comn., writes us that the city has under contemplation plans for both a new source and a better or larger water supply from the present source. Estimated cost, about $200,000.

SAN BERNARDINO, CAL.—The Highland Domestic Water Co. has been incorporated, with a capital stock of $25,000, by C. W. Longmire, C. L. Frazer and G. W. Prescott.

REDLANDS, CAL.—This city is investigating sites for a water supply source for municipal works.

PASADENA, CAL.—W. B. Clapp, Cy. Engr., writes us that the matter of municipal ownership is in the hands of the citizens' committee. It is working for an independent water supply from wells, tunnels, etc., and is not dealing with the present companies. It is proposed to sink test wells at once, and, after plans and estimates are made, submit the bond issue proposition to the voters, which will also include sewer extension, etc. Population, 12,000.

SOMONA, CAL.—An election will be held Oct. 24 to vote on the question of issuing $15,000 in bonds for completing the works. Cy. Clk., Robt. A. Pope.

TEMPE, ARIZ.—The committee has agreed to recommend to the council the granting of a franchise for works to Hoadley & Co. Chn. Com., R. O. Greeves.

VERDUN, QUE.—McConnell & Marion, Montreal, Que., are preparing plans for works and a sewerage system.

STRATHROY, ONT.—R. J. Avery writes us that nothing definite regarding the proposed works has been done as yet. The estimated cost of putting in the works four years ago was $23,000. Population, 3,000. F. J. Craig may be addressed.

XOCHIMILEO, MEXICO, MEX.—Press reports state that this place is to have water-works.

IRRIGATION.

ST. PAUL, MINN.—Bids are asked until Oct. 3 for constructing a ditch in the town of Mounds View. D. M. Sullivan, County Audr.

BEAUMONT, TEX.—A contract has been awarded to E. A. Hayne, by the Jefferson County Irrigation Co., to construct a levee canal nine miles long, from Pine Island bayou.——Geo. W. Fitch has awarded a contract to W. C. Dushine, for constructing a dam across White's bayou, to irrigate about 200 acres for rice cultivation.

JACKSON, CAL.—The Bule Lakes Water Co. is contemplating the construction of a reservoir and ditch system to cost about $400,000, according to reports.

ORANGE, CAL.—At the meeting of the Santa Ana Valley Irrigation Co. to be held Oct. 5, a proposition will be considered to cement the ditches and make other improvements.

SALT LAKE CITY, UTAH.—On Sept. 10 a contract for over a mile of 6-in. double-riveted No. 18 B. W. G. asphalted sheet steel pipe was awarded by A. V. Taylor and associates to S. V. Trent, of Salt Lake City, at 22½ cts. a ft. The pipe will be manufactured by Schaw, Ingram & Batcher, of Sacramento, Cal. It will be used for conveying the water from a spring in Neff's Canon, 10 miles east of Salt Lake City, on to a body of land for fruit-growing. This will be the first instance of water for irrigation in Utah being conveyed for any distance solely through a metal or wooden pipe. W. P. Hardesty, Engr., Salt Lake City.

HEMET, CAL.—The Hemet Water Co. proposes to spend about $20,000 in improving its water system. The flume and ditch will be covered; also a pipe line will be run from the crosscut near Florida to Park Hill, where a reservoir will be built, and large covered filters put in at an elevation of 150 ft. above Hemet, to have a capacity of 500,000 gallons per day. This water will run through an independent pipe line to the Lake Hemet Co. for domestic purposes. The company will also replace their 25 sections of flume, above Florida and Little Lake, the flume to be 36×54 ft. and have a capacity of 4,000 inches. The diversion dam will also be repaired and improved. P. N. Myers, Gen. Mgr.

SEWERAGE.

BOSTON, MASS.—Bids are asked until Sept. 30 for constructing 1,875 ft. of sewers in Savin Hill Ave. Supt. of Sts., Benj. W. Wells.

NEWTON, MASS.—H. D. Woods, Cy. Engr., writes us that plans for sewers for Newton were prepared in 1891. At a recent meeting the aldermen voted to appropriate money for sewers in Upper Falls. The work will be done by the sewer department. The only contracts that may be let will be for brick-cement by the street commission.

NEW HAVEN, CONN.—Bids are asked until Oct. 4 for constructing a sewer in Sherman St. Cy. Engr., C. W. Kelley.

ALBANY, N. Y.—Bids are asked until Oct. 3 for constructing 15 and 10-in. pipe sewer in Clare Ave. Clk. Bd. of Contract, Thos. J. Lanahan.

BUFFALO, N. Y.—The council proposes to build an 8-ft. brick trunk sewer in Emslie and Van Rensselaer Sts., at a cost of about $90,000.

BUFFALO, N. Y.—Bids are asked until Oct. 6 for a 3-ft. 3-in. brick sewer in Hickory St. R. G. Parsons, Secy. Bd.

COHOES, N. Y.—Bids are asked until Oct. 12 for constructing sewers as stated in our advertising columns. Cy. Clk. and Clk. Pub. Improvement Comn., Wm. J. Elliot.

SARATOGA SPRINGS, N. Y.—Bids are asked by the city clerk until Oct. 10 for constructing a sewer, at a cost of $1,000.

SYRACUSE, N. Y.—It is proposed to build a 24 to 15-in. pipe sewer in certain streets at a cost of about $11,000. Cy. Clk., M. Z. Haven.

NEWARK, N. J.—The contract for building sewers in Clinton Ave. has been let to Headley & Christie, at $17,181. Gen. Supt. of Sts, M. F. McLaughlin.

NEW BRUNSWICK, N. J.—It is proposed to construct a sewer in Remsen Ave. Sewer Comr., Chas. W. Kent.

SEA ISLE CITY, N. J.—Arrangements are reported as being made for a sewer to cost about $7,000.

CARLISLE, PA.—The question of building a sewer along the railway track north of Penn St. is being considered. It is probable that plans will be prepared by Chauncey Ives, Ch. Engr. Cumberland Valley R. R. Co., Chambersburg, Pa.

GREENVILLE, PA.—Bids are asked until Oct. 1 for constructing 1½ miles of pipe sewers, according to reports. Borough Secy., H. L. Keck.

SHERADEN, PA.—Bids are asked until Sept. 30 for building 7,100 ft. of 18 and 15-in. pipe sewers, and also for 3,974 cu. yds. of grading in Water St. Borough Engr., Jas. B. Smith, 434 Fourth Ave., Pittsburg.

DALTON, GA.—Plans for a system have been adopted. An election will be held Nov. 2 to vote on the question of issuing $30,000 in 6% 30-year bonds for the system and a light plant. Engr., J. L. Ludlow, Winston, N. C.; Mayor, W. H. Pruden.

PIQUA, O.—Bids will be asked at once by the city clerk for building sewers in the southern portion of the city.

SHELBY, O.—We are informed that the following bids were received Sept. 19 for constructing about six miles of sewers; Engr., J. B. Weddell; Clk., W. F. Sonnanstine: D. R. McArthur, Kenton, O., $21,623; S. S. Eaton, Lafayette, Ind., $28,542; G. P. Jacobs, Chicago Junction, O., $17,126; W. G. Irwin, Greenville, O., $20,260; M. J. Cullan, Sandusky, O., $26,751; Adams Bros., Zaneswill, O., $21,409; C. R. & S. H. DeGroodt, Youngstown, O., $17,142; Ulrick & Co., Springfield, O., $19,878. The work will include: 1,312 ft. of 12-in. pipe; 3,987 ft. of 10-in.; 5,491 ft. of 9-in.; 17,729 ft. of 8-in.; 4,690 ft. of 6-in., and 368 ft. of 10-in. iron pipe; 55 manholes, 63 lampholes and 16 flush tanks. Engineer's estimate, $18,500.

TOLEDO, O.—Jas. McKinney has been awarded the contract for building the sewer in Adams St., at $35,285.

INDIANAPOLIS, IND.—The board of public works proposes to build a main brick sewer in Michigan St. for a distance of 5,155 ft. This sewer will have branches in a number of streets.

BAY CITY, MICH.—Bids are asked by the city clerk until Oct. 3 for constructing a sewer in Raymond Ave.

CHICAGO, ILL.—The board of local improvements has passed ordinances to build 10 miles of sewers and 15 miles of pavements, to cost about $700,000.

GRANITE CITY, ILL.—The councils of this city and Madison, Ill., propose to build a joint system at a cost of $97,000. Councilmen Rosenberg and White, of Granite City, and Grayson and Hinds, of Madison, are on the committee. Julius Pitzmann, of St. Louis, Mo., prepared the plans.

MOLINE, ILL.—The council proposes to build certain sewers and pave in several streets this fall at a cost of about $15,000.

MADISON, WIS.—Bids are asked until Oct. 14 for constructing 21,606 lin. ft. of sewers from 12 to 6-in. and 12 to 3 ft in depth, as stated in our advertising columns. Cy. Engr., McClellan Dodge; Cy. Clk., O. S. Norsman.

CLINTON, IA.—Bids are asked by W. E. Russell, Cy. Clk., for building a sewer in Ash St.

COUNCIL BLUFFS, IA.—It is proposed to construct sewers in certain streets. Cy. Clk., N. C. Phillins.

OSKALOOSA, IA.—D. C. Waggoner, Cy. Clk., writes us that the city will build a system next year. About a mile of intercepting sewer will be built. Cy. Engr., Saml. Ver Ven.

FARGO, N. DAK.—Jos. Kennedy, Fargo, has been awarded the contract for constructing two miles of pipe sewers.

BILLINGS, MONT.—J. R. Hinds & Co., Butte, Mont., have been awarded the contract for building the system at about $15,000. The council will soon be petitioned to make the sewers longer than at present proposed.

BROOKFIELD, MO.—E. E. Ward, Mayor, writes us that the city voted Sept. 13 to put in a system, but voted against issuing the necessary bonds. Another election will soon be held.

KANSAS CITY, MO.—Bids are asked by the city clerk until Oct. 4 for constructing the Vine St. sewer, to cost about $35,000.

GAINESVILLE, TEX.—The New Odorless Sewerage Co. has been incorporated with a capital stock of $50,000 by Jack Steele, M. P. Kelley and W. H. Steele.

GALVESTON, TEX.—The Galveston Sewer Co. has agreed to appoint an arbitrator to consider the question of selling the system to the city. Pres., Isaac Heffron.

SHERMAN, TEX.—J. E. Kern, County Surv., writes us that the city is figuring on putting in a system. Address A. A. Fielder, Mayor.

DENVER, COLO.—The question of making extensions to the system is being considered. David Seerie and H. C. Lowrie, of the Bd. of Pub. Wks., may be addressed.

BLAINE, WASH.—The question of improving the system is being considered. Councilmen Gilday and Glen may be addressed.

RIVERSIDE, CAL.—The citizens have petitioned the city trustees to build new sewers. Supt. of Sts., C. W. Finch.

SANTA ANA, CAL.—Press reports state that the contract for building a second section of the proposed system will be let about Oct. 25.——Frank Heil and J. Damron, Santa Ana, have been awarded the contract for building the first section. The Los Angeles Sewer Pipe Association, Los Angeles, Cal., has the contract for the pipe. The entire system will cost about $65,000. Engr., H. C. Kellogg.

HAMILTON, ONT.—It is proposed to build sewers in two streets at a cost of about $6,200. Councilman Ten Eyck, Chn. Com.

VERDUN, QUE.—McConnell & Marion, Montreal, Que., are preparing plans for a system and water-works, and will superintend the construction.

MEXICO, MEX.—It is stated that the contract for building the system for this city has been let by the sanitation board to Vezin & Letellier, Paris, France. The work is to be completed in four years.

GARBAGE DISPOSAL—STREET CLEANING

BROOKLYN, N. Y.—The board of estimate has appropriated $27,000 for cleaning the sewers.

ATLANTIC CITY, N. J.—Jos. Thompson, Mayor, has vetoed the ordinance awarding the contract for a garbage disposal plant to Thos. K. Dalzell at $29,900, the price being considered excessive.

PHILLIPSBURG, N. J.—B. C. Frost, Mayor, writes us that the construction of a garbage disposal plant for this city is not contemplated.

LANCASTER, PA.—Frank B. Kendig has been awarded the contract, at $1,840, for cleaning the streets from Oct. 1 to April 1, 1899.

WARREN, PA.—Dr. John Curman, Supt. Health, writes us that the trustees have decided on the advice of an expert not to erect a garbage disposal plant.

BALTIMORE, MD.—It is estimated that $506,737 will be required for cleaning the streets the coming year. A number of garbage carts, etc., will probably be purchased. Supt. St. Cleaning, Capt. F. R. Bye.

NEW ORLEANS, LA.—The question of locating garbage disposal plants in different parts of the city is being considered. The present contract for garbage disposal will expire March 1. Councilman Dreyfous may be addressed.

BAY CITY, MICH.—L. E. Ruggles, M. D., Health Officer, writes us that there is a committee from the council to act with the board of health in regard to adopting a plan of garbage disposal. The disposal will probably be by cremation, but nothing definite has been done.

HAMILTON, ONT.—It is stated that W. E. Gower, who was recently awarded the contract to put in a garbage incinerator, has failed to sign the contract.

STREETS AND ROADS.

BOSTON, MASS.—Bids are asked until 12 m., Sept. 29, for macadamizing North Harvard St., from Western Ave. to the Charles River, and Stuart St., between Dartmouth St. and Trinity Place. B. W. Wells, Supt. Sts.

EAST PEPPERELL, MASS.—McCusker Bros., Waltham, Mass., have been awarded a $10,700 contract for road work on Main St.

HADLEY, MASS.—Bids are asked until 12 m., Sept. 29, for macdamizing a section of road. T. C. Mendenhall, Chn. Mass. Highway Comn., 4 Mt. Vernon St., Boston.

WALPOLE, MASS.—Bids are asked until 12 m., Sept. 29, for building about 5,000 lin. ft. of highway. T. C. Mendenhall, Chn. Mass. State Highway Comn., 4 Mt. Vernon St., Boston.

NEW HAVEN, CONN.—Bids are asked until Oct. 4 for crushed stone paving and cobble gutters on Arch, Prospect, Union, Frank and Munson Sts. C. W. Kelly, Cy. Engr.

AUBURN, N. Y.—The council has voted to spend $1,750 to pave a portion of Exchange St. with asphalt.

BROOKLYN, N. Y.—Bids are asked until Oct. 1 for grading at the navy yard, to cost about $15,000. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

MAMARONECK, N. Y.—Bids are asked until Oct. 5 for furnishing the material and grading in Union and Railroad Aves. Chas. W. Buckter, Village Clk.

NEW ROCHELLE, N. Y.—C. W. S. Wilson, Village Engr., informs us that the question of issuing $150,000 for paving etc., will probably not be brought up again until next spring, or until the village becomes a city.

ROCHESTER, N. Y.—Bids are asked until Oct. 7 for asphalt paving on Glenwood Park; estimated cost, $13,500. Chas. M. Beattie, Clk. Executive Bd.

CAMDEN, N. J.—Bids are asked by the council until Oct. 27 for paving Cooper St., from 11th to Federal St.——Bids are soon to be asked for paving Penn St., from 9th to 10th St., with Belgian block.

JERSEY CITY, N. J.—Bids are asked until Oct. 3 for about 340 sq. yds. of Belgian paving, 4,760 cu. yds. of excavation, etc., on Germania Ave. Geo. T. Bouton, Clk. St. Comrs.

NEWARK, N. J.—Bids are asked until Sept. 30 for grading, filling, etc., on Lexington St. and Roseville Ave. M. F. McLaughlin, Gen. Supt. St. Comrs.

CONSHOHOCKEN, PA.—Bids are asked until Oct. 1 for curbing, paving and guttering in portions of about 15 streets. A. L. Murphy, Chn. Com.

ERIE, PA.—Bids are asked by the city engineer until Oct. 6 for paving with brick 17th St., from Peach to State St., about 1,100 sq. yds.

LANSDOWNE, PA.—It has been voted to issue $15,000 in bonds for street improvements, etc.

SCRANTON, PA.—Bids are asked until 7:30 p. m., Sept. 29, for brick paving on Hyde Park Ave. M. T. Lavelle, Cy. Clk.

SHARPSBURG, PA.—Bids are asked until Oct. 18 for 4,862 sq. yds. of stone paving, 27,737 sq. yds. of brick paving, 11,946 sq. yds. of asphaltum paving, etc., as described in our advertising columns. E. C. Hulbert, Borough Engr., 1035 North Canal St.; T. R. Higgins, Clk.

PITTSBURG, PA.—Bids are asked until Oct. 6 for grading, paving, curbing and laying sidewalks in portions of about 18 streets. E. M. Bigelow, Dir. Pub. Wks.

BALTIMORE, MD.—A committee will be appointed by the North Baltimore Improvement Association to ask the council to pave Fulton Ave. with asphalt from Druid Hill to Pennsylvania Ave.

ROCKVILLE, MD.—W. D. Sales, Orange, Va., has been awarded a contract by the county commissioners at $25,757, for constructing about 7¼ miles of pike road, between this place and Bethesda.

CLEVELAND, O.—Bids are asked until Oct. 7 for brick paving, draining, flagging, etc., on Bethesda St. and Bond Alley. Geo. R. Warden, Dir. Pub. Wks.

EAST CLEVELAND, O.—Bids are asked until 12 m., Sept. 29, for grading, draining, and brick paving on Mt. Union St. Walter P. Rice Engineering Co., Engrs., Cleveland; H. B. Chapman, Village Clk.

HAMILTON, O.—Bids are asked until Oct. 17 for constructing a conduit and certain improvements on Market St., between Water and 4th Sts.; estimated cost, $25,000; also until Oct. 24 for 24,000 sq. yds. of asphalt block, sheet asphalt or brick paving, on 2d St., from Central Ave. to Black St. M. O. Burns, Clk.

LORAIN, O.—D. C. Fisher informs us that the proposed paving in 2d St., has been delayed and will not be laid before spring. The people are in favor of asphalt.

MADISONVILLE, O.—Bids are asked until Oct. 6 for constructing cement sidewalks on portions of Peabody, Walnut and Station Sts. and for grading and macadamizing Peabody Ave. Bennett Carter, Clk.

URBANA, O.—Bids are asked until Oct. 10 for furnishing material and grading, graveling, etc., on Sara St. W. E. Berry, Cy. Clk.

ANDERSON, IND.—M. M. Dunlap, Mayor, informs us that it is probable that five streets will be paved next year with asphaltum. Eleventh street and six blocks are now being paved with brick, by Chas. S. Henry and Charles Daniels, respectively. Starry Rogers, Cy. Engr.

LOGANSPORT, IND.—Walter A. Osmer, Cy. Engr., writes us that contracts for brick paving were awarded Sept. 21 to the Lux & Talbott Stone Co., Logansport, for 3d St., amounting to $7,756, and for Sycamore St., at $15,952. Bonds will be issued for payment.

INDIANAPOLIS, IND.—Bids are asked until Oct. 3 for grading, graveling, etc. M. A. Downing, Chn. Bd. Pub. Wks.

MUNCIE, IND.—Bids are asked until Oct. 10 for grading and graveling Olmer Ave. F. W. Clevenger, Cy. Clk.

RICHMOND, IND.—Bids are asked until 2 p. m., Sept. 30, for constructing brick walks on South 6th St. Geo. L. Knollenberg, Clk. Bd. Pub. Improvements.

TERRE HAUTE, IND.—Bids are asked until Oct. 4 for improving Cedar and other streets. Wm. K. Hamilton, Clk.

DETROIT, MICH.—A contract has been awarded to T. J. Kennedy, at $10,479, by the board of public works, for paving in 17th St., with cedar block.

CHICAGO, ILL.—The board of local improvements has passed an ordinance to construct 10 miles of sewers and 15 miles of pavement, to cost about $700,000.

OSKALOOSA, IA.—D. C. Waggoner, Cy. Clk., informs us that 20,000 sq. yds. of brick paving, to cost about $27,000, is proposed. Samuel Verven, Cy. Engr.

ST. PAUL, MINN.—Bids are asked until 2 p. m., Sept. 29, for grading Summit Place and Hamline Ave., and improving Marshall Ave. C. H. Bronson, Clk. Bd. Pub. Wks.

OMAHA, NEB.—Bids are asked until Oct. 7 for asphalt, brick or stone paving, curbing, etc., on Mason St., from 31st to 33d St. Andrew Rosewater, Chn. Bd. Pub. Wks.

FARGO, N. DAK.—The council has awarded a contract to James Kennedy, Fargo, for 71,000 sq. yds. of cedar block paving.

MARSHALL, MO.—H. W. Kolkmeyer & Co., Jefferson City, Mo., has been awarded a contract for macadamizing, etc., at $24,000.

PORTLAND, ORE.—The council proposes to improve Grand Ave., by grading, etc.

VACAVILLE, CAL.—Bids are asked until 1 p. m., Oct. 1 for paving the bridge over Ulatis Creek, with asphalt. A. M. Stevenson, Town Clk.

VENTURA, CAL.—Bids are asked until Oct. 6 for furnishing the material and grading, etc. A. S. Kenagy, County Clk.

MITCHELL, ONT.—The question of borrowing $5,000 for sidewalks will be submitted to a vote, according to reports.

TORONTO, ONT.—Chas. H. Rust, Cy. Engr., writes us that after bids had been received for brick paving on concrete foundation on Major St., a petition has been presented for asphalt. The people who favor brick and those who prefer asphalt paving are now striving to be the first to present a fully signed petition, so that the work may be proceeded with.

WINNIPEG, MAN.—Bids are asked until Oct. 19 for asphalt paving on Portage Ave., about 18,000 sq. yds. C. J. Brown, Cy. Clk.

MANUFACTURING PLANTS.

WATERBURY, CONN.—Holmes, Booth & Haydens, of Waterbury, are making extensive repairs and additions in their plant. The Berlin Iron Bridge Co., East Berlin, Conn., have secured the contract for the steel roof work for the boiler room, 40×80 ft.; the new muffle room, 35×80 ft.; and the new brass mill, 118×90 ft. These new additions are to be fireproof throughout. The side walls will be of brick, the roof supports of steel, and the covering of corrugated iron. The roofs are arranged with skylights for lighting the interior of the building, and monitors for ventilation.

HOMESTEAD, PA.—Press reports state that a large plant for the manufacture of guns will probably be built here by the Carnegie Steel Co.

SHARON, PA.—It is announced that the Bessemer Furnace Co., of Mahoning and Shenango valleys will build a $2,000,000 steel mill at Sharon.

TALLADEGA, ALA.—Howard & Bullock, of Pawtucket, R. I., has been awarded the contract for machinery for the new addition to the Talladega Cotton Mills. Estimated cost of improvements, $50,000.

CLEVELAND, O.—The carpet cleaning works of the D. O. Summers Carpet & Rug Mfg. Co., at 118 East Prospect St., was recently destroyed by fire, causing a loss of about $60,000.

YOUNGSTOWN, O.—It is reported that the Brown & Bonnell Iron Co., of Youngstown, is having plans prepared for the erection of a continuous mill, to cost about $150,000; to be completed by Jan. 1.

LOS ANGELES, CAL.—The Los Angeles Soap Co., whose plant was recently destroyed by fire, informs us that bids are now being received for the erection of a new 4-story brick building. Contracts will be let to local contractors. Archs., Morgan & Walls, Los Angeles.

GAS PLANTS.

BUFFALO, N. Y.—Alderman Franklin has introduced a resolution to grant a permit to the Erie County Natural Gas Fuel Co. to manufacture gas for fuel, etc. E. G. S. Miller, Julius Binz and Arthur W. Hickman are interested.

BUFFALO, N. Y.—F. V. E. Bardol, Cy. Engr., reports that the proposed municipal gas plant will consist of a building 400×90 ft., with two coal pockets, a generating house of the same dimensions and two retort houses; two gas holders, each 157 ft. in diameter, and with a combined capacity of 3,500,000 cu. ft.; two purifying houses, each 50×171 ft.; an engine room, 40×100 ft.; a relief holder, an ammonia and tar tank, two oil tanks, a tar tank and a storehouse and office; estimated cost, about $800,000.

ATLANTIC CITY, N. J.—The Atlantic City Gas & Water Co. will lay a new main on Pacific Ave. Joseph Barton, Pres.

WESTWOOD, N. J.—It is reported that the council is considering a petition for the right to construct gas works.

PITTSBURG, PA.—Reports state that Dr. F. L. Slocum, W. A. Dinker, Joseph Kelling and others, propose to construct a gas plant for fuel, to cost about $100,000.

COLUMBUS, O.—The East Ohio Gas Co. has been incorporated with a capital stock of $1,000,000. It is proposed to pipe natural gas to Canton, Akron and Massillon, O., from the Wheeling gas fields. The council is now considering the granting of a franchise.

GLENVILLE, O.—Bids are asked until Oct. 1 for furnishing gas for light and fuel for 10 years. F. L. Moores, Chn. Com.

CICERO, IND.—It is reported that a franchise has been granted to W. H. Roney for laying gas and water pipes through the town.

WABASH, IND.—The Dieterich Natural Gas Syndicate proposes to install a municipal gas plant, to furnish acetylene gas for illuminating. The apparatus for making coal gas will be taken out and acetylene generators will be substituted and new mains will be laid.

FARIBAULT, MINN.—The Faribault Gas & Engine Co. wants bids for laying about two miles of gas mains, according to reports.

GRAFTON, NEB.—A proposition to establish an acetylene gas plant for lighting the streets is being considered. Messrs. O'Donnell, Cushing and Hinkley compose the committee.

NEW COMPANIES.—Hazlehurst Gas Co., Bradford City, Pa.; $3,000, with $300 paid in; to produce and supply natural gas in Hazlehurst and Hutchins, Pa.; C. V. Merrick, Treas.; Frank A. Fralic, Wm. M. Boyce, D. H. Jack, Bradford, Pa.; H. L. Smith, Binghamton, N. Y.

The City Gas Co., Staunton, Va.; $200,000; R. D. McCue and R. D. Apperson, Staunton; Harry Marquand, New York city; Lewis C. Harris, Forest Hill, N. J., and F. B. Poor, of Hackensack, N. J.

Youngstown Acetylene Gas Co., Youngstown, O.; $10,000; to manufacture acetylene gas, appliances and supplies; W. J. Wallace, Frank A. Williams, E. Hartzell, I. Hartzell, A. I. Nicholas, D. J. Jones and J. Sylvanus.

City of Lincoln Gas Co., Lincoln, Ill.; $100,000; to furnish gas, electricity and water; Frank R. Ferguson, George Skinner, Willis Hutson.

MISCELLANEOUS CONTRACTS.

RETAINING WALL.—Warren, Pa.—Bids are asked untill Oct. 1 for a retaining wall. Joseph Hill, Chn.

PARKS.—San Francisco, Cal.—The board of supervisors have decided to lay out a park at St. Mary's Place.

FIRE HOSE.—Dunkirk, N. Y.—Bids are asked until Oct. 4 for purchasing fire hose. Wm. C. Baumgarten, Clk.

LEVEE WORK.—Dayton, O.—The board of city affairs will soon ask bids for reconstructing the levee along the Miami River, in North Dayton.

CEMENT.—Seattle, Wash.—Bids are asked until Oct. 13 for furnishing Portland cement. Capt. Harry Taylor, U. S. Engr., Burke Bldg., Seattle.

FIRE ALARM IMPROVEMENTS.—Wilmington, Del.—It is proposed to make a number of imporvements to the fire alarm telegraph at a cost of $2,000.

STEAM BOILER.—Lawrence, Kan.—Bids are asked for furnishing a steam boiler, pipe, ete., at the Haskell Institute. H. B. Peairs, Supt. School Service.

FIRE ALARM SYSTEM.—San Francisco, Cal.—Superintendent Hewitt, of the fire alarm and police telegraph, has asked the supervisor for $68,000 for a new fire alarm system and about $10,000 for the building.

DUMP CARS, ETC.—Key West, Fla.—The New Orleans Ry. & Mill Supply Co., New Orleans, La., has been awarded a contract, at $1,140, for furnishing tracks and dump cars at the Key West light house depot.

DREDGING, ETC.—League Island, Pa.—Bids are asked until Oct. 8 for dredging, filling and extending the reserve basin at the navy yard; appropriation, $120,000. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

STEEL PIER.—Atlantic City, N. J.—A steel pier will be constructed at States Ave., with a frontage of about 150 ft. Estimates for the steel work have been invited, according to reports. Geo. A. Dentzel and Kennedy Crossan are interested.

PARK.—Utica, N. Y.—The committee on public improvements of the Chamber of Commerce is considering the question of having a public park. Russel H. Wicks, Edward Trevvett, Thomas E. Kinney, John Carney and J. A. McLoughlin, Com.

DREDGING.—Waukegan, Ill.—The Lake Michigan Dredging Co., Milwaukee, Wis., is reported to have been awarded the contract for dredging the harbor at Waukegan. The contract was first let to a Detroit company, but it is said to have forfeited the contract.

CHANNEL AND JETTIES.—Barnstable, Mass.—Geo. H. Cavanagh, Boston, has been awarded a contract, at $13,690, for constructing two oak pile jetties and a channel 2,600 ft. long and 100 ft. wide, through Dead Neck beach. Woodward Emery, Chn. Harbor and Land Comrs., Boston.

BARGE.—Biloxi, Mass.—We are informed that the following bids were received Sept. 22 for furnishing a barge for the use of dredging: W. N. Johnson, Biloxi, $1,600; Kensington Engine Works, Ltd., Philadelphia, Pa., $2,325. A. C. Smith, Asst. Surgeon, U. S. Quarantine Station, Biloxi.

PIER, SLUICEWAY, ETC.—Brantford, Ont.—Bids are asked until Oct. 1 for constructing a concrete pier with stone and concrete abutment; river excavation, embankments and rip-rap walls; a timber sluiceway dam, 169 ft. long. Chas. Whitney, Chn. Bd. Wks.; T. H. Jones, Cy. Engr.

ELECTRIC WIRE AND POLES.—Decatur, Mich.—The following bids were received Sept. 6, 1898, for furnishing electric wire and poles for the proposed plant, the bids for the dynamos, etc., being given under Electric Light and Power, Engr., Geo. S. Pierson, Kalamazoo, Mich.:

Item.	Westinghouse Electric & Mfg. Co., Pittsburg, Pa.	Fort Wayne (Ind.) Electric Corporation.	Columbian Electric Co., Kalamazoo, Mich.	Pearl & Mills, Fort Wayne, Ind.
Poles 30 ft.	$3.65	$3.27	$3.65	$2.50
Poles 35 ft.	5.20	3.78	4.25	3.00
Wire,§ a 1,000 ft.:				
No. 0000	127.80	327.37*	147.20	13.00
No. 000	106.50	264.74	131.73	11.00
No. 00	85.80	216.00	113.21	9.00
No. 0	72.50	173.83	98.39	8.50
No. 1.	58.63	139.00	84.43	7 50
No. 2.	52.03	112.96	74.38	5.50
No. 3.	44.47	90.69	64.50	4.50
No. 4.	37.69	73.27	57.10	4.00
No. 5.	.....	61.99	51.62	3.50
No. 6.	30.02	51.97	47.37	3.00
No. 8.	24.99	35.46	41.36	2.00
No. 10.	22.15	26.00	37.54	1.50
Hanging lamps	6.00	22.95†	9.15	....

*Fort Wayne wire prices are for double circuit. †Price includes two 35-ft. poles. §Furnished and erected.

ASPHALT PAVING.—Omaha, Neb.—The Grant Paving Co., Omaha, has been awarded the contract at $1.45 a sq. yd. for asphalt paving, and at 62 cts. a lin. ft. for curbing.

BRICK SEWER.—Kearney, N. J.—Wm. S. Logan, Township Engr., Arlington, N. J., informs us that the following bids were received Sept. 13 for constructing a trunk sewer in Kearney township, as advertised in Engineering News; contract awarded P. H. Harrison & Sons; average cut, about 17 ft.; all work above tide-water; material, common New Jersey clay and hardpan:

Bids Received at Kearney, N. J., Sept. 13, 1898, for Constructing a Trunk Sewer in Kearney Township.

Bidder.	Brick sewers 48-in., 2,550 ft.	Brick sewers 36-in., 2,650 ft.	Junctions, Special, 2, each.	Junctions, Special, 1.	Junctions, Special, 3, each.	Junction manholes, 4, each.	Brick manholes, 25, each.	Special junctions 1.	Special junctions 1.	Special junctions 1.	Catch-basins, 21 each.	Total.
Conway & Co., 491 Central Ave., Newark, N. J.	$5.40	$4.92	$100.00	$100.00	$75.00	$35.00	$15.00	$75.00	$75.00	$75.00	$75.00	$29,588
Palisade Ave. Const'n Co., 1 Montgomery St., Jersey City.	6.00	5.90	100.00	110.00	110.00	55.00	37.00	65.00	125.00	65.00	80.00	34,658
W. H. Masterson, Park Ave. and 176th St., New York.	7.68	7.25	150.00	150.00	150.00	100.00	65.00	150.00	150.00	150.00	125.00	44,517
P. H. Harrisan & Sons, 30 So. 9th St., Newark, N. J.	4.96	4.72	175.00	100.00	135.00	40.00	30.00	150.00	200.00	50.00	80.00	29,001
W. R. Skillman, 150 Nassau St., New York	8.00	7.00	85.00	300.00	100.00	150.00	50.00	50.00	50.00	50.00	110.00	43,685
Harry B. Smith, 904 Shumway Ave., Long Island City	6.76	5.68	60.00	60.00	60.00	75.00	35.00	60.00	60.00	60.00	75.00	35,580
J. M. Waddle and L. B. Fitch, 253 Broadway, New York.	9.60	8.00	460.00	225.00	225.00	165.00	45.00	325.00	250.00	75.00	100.00	51,975
Minahan, Fell & Co., Orange, N. J.	5.93	4.90	20.00	20.00	20.00	35.00	35.00	20.00	20.00	20.00	90.00	31,191
Philip Tumulty, Jr., 295 Monmouth St., Jersey City	6.09	5.24	250.00	250.00	250.00	50.00	50.00	150.00	150.00	100.00	100.00	35,016
Fred. Kohlmeyer, 102 Park St., Newark, N. J.	6.95	6.24	174.00	174.00	125.00	30.00	31.50	150.00	100.00	95.00	85.00	38,182
E. K. Conover, 26 Cortlandt St., New York	7.19	5.49	125.00	125.00	125.00	33.00	30.00	110.00	125.00	110.00	78.00	36,498
Headley & Christie, 38 Thomas St., Newark, N. J.	6.65	6.08	80.00	80.00	80.00	60.00	36.50	80.00	80.00	80.00	95.00	36,933
Edward Sargent, Kearney, N. J.	6.40	5.60	100.00	100.00	100.00	30.00	18.00	100.00	100.00	50.00	76.00	34,176
Patrick T. Plunkett, 1099 Summit Ave., Jersey City	6.85	6.45	300.00	300.00	200.00	50.00	40 00	100.00	300.00	100.00	84.00	39,524
Reilly & Brubaker, 215 West 125th St., New York	6.50	5.80	60.00	50.00	50.00	65.00	40.00	26.00	75.00	42.00	80.00	35,384
Troy Public Works Co., Utica, N. Y.	6 60	6.30	100.00	100.00	100.00	50.00	40.00	50.00	100.00	50.00	100.00	37,625

DAM.—Tacoma, Wash.—Henry Longstreth, of the Tacoma Land Co., has applied for permission to repair the dam on the Puyallup River; estimated cost, $2,490.

ENAMEL SIGNS.—St. Paul, Minn.—Bids are asked until Oct. 3 for furnishing enamel iron signs; certified check for 20% of bid. Pres. Bd. Pub. Wks., John Copeland.

TELEPHONE SYSTEM.—Worcester, Mass.—Reports state that a new telephone company will be organized with a capital stock of $150,000. Israel L. Currier is interested.

DREDGING.—Boston Navy Yard, Mass.—Bids are asked until Oct. 1 for dredging; estimated cost, $15,000. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

WHITE OAK SHEETING.—Cleveland, O.—Bids are asked until Oct. 6 for furnishing about 200,000 ft. B. M. of 2-inch white oak sheeting. Geo. R. Warden, Dir. Pub. Wks.

TEAM WORK.—Raceland, La.—Team men with outfits of from 10 to 20 teams are wanted immediately for a large amount of levee work. Address Rogers & Wright, Raceland.

IMPROVING CREEK.—Lockport, N. Y.—Work will begin early this fall on the improvement of Eighteen-Mile Creek. A $15,000 appropriation has been secured to cover the work.

TELEPHONE FRANCHISE.—Summit, N. J.—The Newark Telephone Co. has applied to the council for a franchise to operate in this place. Jos. A. McClary, Rahway, N. J., may be addressed.

DREDGING.—New York, N. Y.—Bids are asked until Sept. 30 for about 200,000 cu. yds. of mud dredging in the North River, at West 34th St. J. S. Cram, Comr. Docks, Pier A, North River.

OAK SHEETING.—Cleveland, O.—Bids are asked until Oct. 6 for furnishing about 200,000 ft. B. M., of 2-in. white oak sheeting in lengths of 13 ft. 6 ins. Did Pub. Wks., Geo. R. Warden.

DREDGING.—Pensacola Bay, Fla.—Bids are asked until Oct. 22 for dredging at the entrance of Pensacola Bay, as stated in our advertising columns. Maj. F. A. Mahan, U. S. Engr., Montgomery, Ala.

DREDGING.—Oakland, Cal.—Bids are asked by the board of public works until Oct. 12 for about 600,000 cu. yds. of dredging in Lake Merritt; estimated cost, $80,000. (Postponement from Oct. 5)

LEVEE WORK.—New Orleans, La.—Bids are asked until Oct. 19 for constructing about 132,500 cu. yds. of earthworks in Barataria levee district. Maj. J. H. Willard, U. S. Engr., 3232 Prytania St.

DREDGING.—Newport, R. I.—Bids are asked until Oct. 26 for dredging in Providence River and Narragansett Bay, R. I., as stated in our advertising columns. Maj. D. W. Lockwood, U. S. Engr., Newport.

BUILDING BRICK.—Philadelphia, Pa.—Bids are asked until Oct. 10 for furnishing 9,000,000 building brick, as stated in our advertising columns. E. Kleinsmith, N. W. corner of 13th St. and Market Sts.

BROKEN STONE, ETC.—Long Island City, N. Y.—Bids are asked until Oct. 4 for furnishing broken stone and screenings of trap rock and gravel. J. P. Keating, Comr. Highways, 150 Nassau St., New York.

MACHINERY AND TOOLS.—Naval Station, Puget Sound, Wash.—Bids are asked until Oct. 18 for furnishing machinery and tools. Edwin Stewart, Paymaster-Gen., Bureau of Supplies, Washington, D. C.

CEMENT, BROKEN STONE, ETC.—Newport, R. I.—Bids are asked until Oct. 26 for furnishing cement, broken stone and sand, as stated in our advertising columns. Maj. D. W. Lockwood, U. S. Engr., Newport.

DOCKS.—North Tonawanda, N. Y.—It is stated that the Tonawanda Iron & Steel Works has contracted with Edward H. Rogers, of Tonawanda, N. Y., for the construction of a continuation of its present dockage. The dock which is about to be constructed will be about 500 ft. in length and will be along the river front of the company's preperty.

OVERHAULING SHIP.—Washington, D. C.—The following bids have been received by the navy department for converting the transport "Mohawk" into a troop-ship: Cramp & Son, Ship Builders, Philadelphia, $104,000; Newport News Dry Dock & Shipbuilding Co., $98,500; J. M. Robbins & Co., $96,855; Bath Iron Wks., $82,800, and the Morgan Iron Wks., $98,800.

CONTRACT PRICES.

INCANDESCENT LAMPS.—Chicago, Ill.—W. B. Wickersham, Secy., Public Library, informs us that the following bids were received Sept. 21, 1898, for furnishing 10,000 incandescent lamps for the library building:

Bidder.	10-c. p., cts.	16-c. p., cts.	32-c. p., cts.	Frosted, 16-c. p., cts.	Frosted, 32-c. p., cts.
J. C. Wormley & Co., Chicago	15½	15½	24½	18½	27½
Chicago Edison Co., Chicago	17	17	27	19⅖	32⅖
Buckeye Electric Co., Chicago	17	17	25½	20	30
The K. & W. Co., Pittsfield, Mass.	16	16	24	19	28
Columbia Incandescent Lamp Co*	17	17	26	20⅖	31½
Fostoria-McQuay Co., Chicago	16	16	25	20	29
Western Electric Co., Chicago	17	17	26	20⅖	31½
Martin J. Insull, Chicago	16	16	26	21	31
Standard Lamp Co., Wabash, Ind.	14	14	22	18	27
Warren (O.) Elec. & Specialty Co.	14	14	23	16¾	27

*St. Louis, Mo.

TUNNEL SEWER.—Milwaukee, Wis.—The board of public works received the following bids Sept. 16, 1898, for constructing Section 6 (2,970 ft.) of the 10-ft. 30th St. brick tunnel sewer; the bids received a few weeks ago are also given—they were rejected as too high; all bidders of Milwaukee, except J. O. Jones, Racine, Wis.; Secy., Daniel B. Bush:

Bidder.	Bids. First.	Bids. Second.
Charles Forrestal	$26.00	$26.50
R. J. Hickey.	29.15	26.50
Reichert Construction Co.	29.15	25.85
James Markey.	29.15	26.70
John O. Jones	27.00	21.94
A. Kellner.	32.70	24.70
James O'Donnell (accepted)	29.00	.....
John J. Crilley	26.30	21.39
J. S. O'Neil	.....	25.90

BRICK PAVING.—Watertown, Wis.—G. H. Stanchfield, Engr., Watertown, informs us that the following bids were received Sept. 17 for brick paving; the bids were rejected; the pavement is to be laid on 6 ins. concrete 1—2—5:

Quantities.		James Cape & Sons, Racine, Wis.	J. Walsh, Davenport, Ia.
Cut.	2,700 cu. yds.	$0.30	$0.35
4 × 30-in. curb	2,166 lin. ft.	.69	.65
Protection curb	592 " "	.30	.40
Pavement: Pumiton brick	5,730 sq. yds.	1.80	1.66
Clinton block	5,730 " "	1.82	...
C. i. gutter bridges	192 each	.90	.80

SUPPLIES.—Fortress Monroe, Va.—Capt. Thos. L. Casey, U. S. Engr., Norfolk, Va., received the following bids Sept. 16, 1898, for furnishing cement, lumber, bolts, etc.; (1) being for American cement, 27,000 bbls.; (2) for Portland cement, 1,250 bbls.; (3) for 2-in. broken stone, 10,650 cu. yds.; (4) for 1-in. broken stone, 7,100 cu. yds.; (5) for broken stone granolithic size, 130 yds.; yellow pine lumber —(6) 10,000 ft. B. M., 1 × 12-in. × 16 ft.; (7) 2 × 4-in. × 16 ft., 2,400 ft.; (8) 2 × 12-in. × 16 ft., 32,000 ft.; (9) 2 × 12-in. × 16 ft., dressed, 32,000 ft.; (10) 2 × 6-in. × 16 ft., 6,000 ft.; (11) 3 × 4-in. × 16 ft.; (12) 3 × 4-in. × 26 ft., 7,500 ft.; (13) 3 × 4-in. × 20 ft., 9,750 ft.; (14) 3 × 6-in. × 16 ft., 2,400 ft.; (15) 1¼ × 3-in. × 16 ft., 6,000 ft., B. M.; steel bolts—(16) 2-in. × 8 ft., 10½ ins., 16; (17) 2½-in. × 6 ft., ¾-in., 36; (18) 2½-in. 9 ft., 2⅝-in. 42; (19) 2-in. steel ring bolts, 20; (20) I-beams and channels, 127,807 lbs.; (21) connection angles, 240 pairs; (22) cast-iron columns, 5: Standard Lime and Stone Co., Baltimore, Md.—(3, 4 and 5) $1.80 a cu. yd.; R. H. Hood & Co., St. Paul Bldg., New York—(1) 84 cts. a bbl., (2) $2.30 a bbl., (3, 4 and 5) $1.389 a cu. yd., (16) $6.40 each, (17) $7.70, (18) $9.40, (19) $7.50, (20) 1.7 cts. a lb., (21) 2¼ cts. a lb., (22) 3 cts. a lb.; Petersburg Iron Works Co., Petersburg, Va.—(16) $3.92, (17) $4.53, (18) $5.48, (19) $5.12, (22) 2¾ cts.; Lawrenceville Cement Co., 26 Cortlandt St., New York—(1) 66.9 cts.; Chas. G. Smith & Son, Washington, D. C.—(3) $1.63, (4) $1.68, (5) $1.88; Atlas Cement Co., 143 Liberty St., New York—(2) $2.41; J. B. Kendall, Washington, D. C.—(16) $7.15, (17) $8.50, (18) $8.50, (19) $7.15; New Jersey Foundry & Mach. Co., 26 Cortlandt St., New York—(16) $4.25, (17) $4.50, (18) $4.75, (19) $6.00, (20 and 21) 1.65 cts., (22) 2.1 cts.; H. A. Rogers, New York—(16) $3.95, (17) $4.40, (18) $6.35, (19) $3.75, (20) 1.67 cts., (21) 1.67 cts., (22) 2.1 cts.; Washington & Potomac River Iron & Land Co., Washington, D. C.—(3) $1.30, (4) $1.69, (5) $1.25; New York & Rosendale Cement Co., 280 Broadway, New York—(1) 66¾ cts.; T. R. Chapple & Co., Richmond, Va.—(3, 4 and 5) $1.52; Jos. Leopold, New York—(3 and 4) $1.56, (5) $1.87; Duke & Smith, Norfolk—(6) $14 per 1,000 ft. B. M., (7) $13, (8) $13.50, (9) $16, (10) $12.50, (11) $12.50, (12) $13, (13) $13, (14) $12.50; (15) $15; McClenahan & Bro. Granite Co., Port Deposit, Md.—(3, 4 and 5) $1.39, (6, 7, 8, 10, 11, 12, 13 and 14) $11, (9) $14, (15) $15.

CEDAR BLOCK PAVING.—Duluth, Minn.—It is stated that P. McDonnell, Duluth, has been awarded the contract for about four miles of cedar block paving at $1.06 a sq. yd.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morn- If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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PERSONAL.

Lieut. Edwin R. Stuart, Corps of Engineers, U. S. Army, has been ordered to duty at Willett's Point, N. Y.

Mr. A. R. Starkey, contractor, of Marquette, Mich., has been appointed Superintendent of the water-works at St. Paul, Minn.

Mr. J. W. O'Neil has been appointed Receiver of the Topeka Water Co., Topeka, Kan., to succeed Mr. Elias Summerfield, resigned.

Mr. Charles E. Phelps, Jr., of Walbrook, Md., has been appointed Chief Engineer of the Electrical Subway Commission, Baltimore, Md.

Mr. Frank A. Tyson, President of the Water Board of Reading, Pa., has resigned, and Mr. Geo. H. Felix has been appointed to succeed him.

Col. Robert Carritt has been appointed Chief Engineer of the Mississippi Valley Ry., with headquarters at 806 Chestnut St., St. Louis, Mo.

Mr. J. B. Stevens, electrical engineer, with the L. I. Fletcher Co., Boston, Mass., has assumed the management of the Cumberland Illuminating Co., Great Falls, Me.

Mr. Seaton M. Scott, M. Am. Soc. M. E., consulting mechanical engineer, of New York city, has removed his offices from 123 Liberty St. to the Bowling Green Offices, 11 Broadway.

Mr. Charles E. White, electrical engineer, of Philadelphia, Pa., has been appointed Manager of the Municipal Light Board, Wakefield, Mass., in charge of the electric light plant.

Mr. W. I. Cooke has been appointed Superintendent of Locomotive Service of the Chicago & Eastern Illinois R. R., with headquarters at Danville, Ill., to succeed Mr. H. A. Dewey.

Messrs. Wm. M. Given and Arthur C. Aldrich have formed a partnership, with the firm name of Given & Aldrich, to conduct a general engineering business, with headquarters in Room 402, Chalifoux Bldg., Birmingham, Ala.

Mr. George H. Campbell, Terminal Agent of the Baltimore & Ohio R. R., at Baltimore, Md., has, in addition to his present duties, been appointed Inspector of Stations and Terminals over the whole line, reporting to the General Superintendents in their respective territories.

Mr. Gustav R. Tuska, Assoc. M. Am. Soc. C. E., Chief Engineer of the Panama R. R. Co., with headquarters in New York city, has also been appointed Consulting Engineer to the American Representative of the Russian Government in connection with the Chinese Railway System.

Col. George E. Waring, Jr., M. Inst. C. E., consulting engineer, of Newport, R. I., and New York city, formerly Commissioner of Street Cleaning of the latter city, has been appointed to visit Cuba to investigate the sanitary condition of the different towns where United States troops are to be located and to report what should be done to improve the same.

Mr. Alfred Lovell, formerly Engineer of Tests of the Northern Pacific Ry., has been appointed Assistant Superintendent of Motive Power, with office at St. Paul, Minn. He will have charge of the routine business of the Motive Power Department during the absence of the Superintendent of Motive Power, and will also attend to special work at the shops and on the line.

Mr. George E. Gifford, M. Am. Soc. C. E., Eastern Representative of the King Bridge Co., Cleveland, O., with headquarters in New York city, has resigned to accept the position of Treasurer of the R. H. Hood Co., 220 Broadway, New York, general contractors. He has been connected with the former company for over 10 years, for the last four being in charge of the New York office.

Mr. Martin Schenck, the Democratic nominee for State Engineer and Surveyor of New York, was born at Palatine Bridge, Montgomery county, N. Y., in 1845, and graduated from the Engineering Department of Union College, Schenectady, N. Y., in 1869. He was engaged in railway surveys and construction until 1883, when he entered the office of the State Engineer, Mr. Elnathan Sweet. He built the dikes and dredged the Hudson River between Albany and Troy, and also was engaged on the Champlain and Erie Canals. In 1891 he was elected State Engineer and served one term, and he has since then been City Engineer of Troy.

Hr. Harry H. Rousseau, Jun. Am. Soc. C. E., Assistant Engineer of the Pittsburg Bridge Co., Pittsburg, Pa., stood first on the list of candidates who passed the recent examination in Washington for the position of Civil Engineer in the United States Navy. Only 18 out of the 50 candidates who took the examination passed. Mr. Rousseau is a graduate of the Rensselaer Polytechnic Institute, Troy, N. Y., in the class of 1891.

Mr. E. G. Rosencrans and Mr. A. D. Mott have formed a partnership, under the firm name of Rosencrans & Mott, with headquarters at 1236 Marquette Bldg., Chicago, and will make a specialty of structural and bridge engineering. Mr. Rosencrans has been for a long time the engineer for Green & Wickes, architects, of Buffalo, N. Y., and Mr. Mott has been with Messrs. Purdy & Henderson, of New York city, for several years.

Mr. A. B. Coalter, of the Engineering Department of the Chesapeake & Ohio Ry., has accepted an offer to go to China in the interests of the Brice Syndicate, which will build a system of railways in that country. He will accompany Mr. William Barclay Parsons, M. Am. Soc. C. E., of New York city, whose going was noted last week, and Mr. Harry Frazier, M. Am. Soc. C. E., Chief Engineer of the Chesapeake & Ohio Ry., with headquarters in Richmond, Va. Mr. Coulter will leave for Hong Kong this week by way of Vancouver, B. C. Upon his return, in about four months, he expects to resume his position with the Chesapeake & Ohio Ry. Co., which has granted him a furlough.

Mr. Edward A. Bond, the Republican nominee for State Engineer and Surveyor of New York, was born in Dexter, Mich., April 22, 1849, and in 1867 begun work for the Delaware, Lackawanna & Western R. R., with which company he remained until 1870, when in that year he was made Assistant to the Chief Engineer of the Utica & Black River R. R. In 1875 he became Chief Engineer and had charge of the building of the lines from Lowville to Clayton and Ogdensburg. In 1886 he was appointed Chief Engineer and General Superintendent of the Carthage & Adirondack Ry., from Carthage to Benson Mines and the Oswegatchie River. He removed to Watertown, N. Y., in 1889, and became a member of the firm of Hinds & Bond, civil engineers.

OBITUARY.

Mr. Bernard Martin, contractor, of Sandusky, O., died Sept. 25, aged 62.

Mr. Charles J. Fox, civil engineer and surveyor, of San Diego, Cal., died at San Lucas, Cal., recently.

Mr. William N. Clarke, a civil engineer engaged on the Soulanges Canal, died in Montreal, Que., Sept. 25, aged 27.

Mr. W. R. Bush, for a number of years owner of the electric light plant and water-works at Lake City, Fla., died Sept. 18.

Mr. H. A. W. Reeves, architect and mechanical engineer, of New York city, died suddenly in the Bank of Commerce Bldg., in that city, Sept. 30, aged 55.

Lieut. Rodmon Vernon Beach, Adjutant of the First Regiment of United States Volunteer Engineers, died at Ponce, Porto Rico, Sept. 28, aged 33. His home was in New Haven, Conn.

Mr. John P. Kelly, civil engineer, of Troy, N. Y., died Sept. 27. He was a graduate of the Rensselaer Polytechnic Institute in that city, and had been an engineer for the Public Improvement Commission and also an Assistant State Engineer.

Mr. William Kingsford, civil engineer and historian, died at his residence in Ottawa, Ont., Sept. 29, aged 78. He was born in London, England, and practiced the profession of civil engineering in that country before coming to the United States and Canada. He was engaged here as an engineer on the Hudson River Ry., the Lachine Canal and Victoria Bridge, and later was in charge of harbor works in the Provinces of Ontario and Quebec. He wrote and published a history of Canada, up to the time of the union of Upper and Lower Canada.

Mr. Thomas Fuller, late Chief Architect of the Department of Public Works, Ottawa, Ont., died Sept. 28, aged 76. He was born in Bath, England, and went to Canada in 1857. In 1859 his design for the Parliament Building at Ottawa was accepted, and he was awarded the second prize in the competition for the Parliament and Department buildings. His design also included a residence for the Governor-General. Mr. Fuller superintended the erection of the Parliament buildings. In 1867 he won the competition for a design for the new state capitol building at Albany, N. Y., and removed to that city to superintend its erection. In 1881 he returned to Canada and was appointed Chief Architect of the Public Works Department, which position he held until about a year ago, when he was superannuated, but retained an advisory position in the department.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

CHICAGO ELECTRICAL ASSOCIATION.
Oct. 7. "Electrical Features of the Late Spanish-American War," Thos. G. Grier. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Oct. 7. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

MONTANA SOCIETY OF ENGINEERS.
Oct. 8. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

NATIONAL ROAD PARLIAMENT.
Oct. 8. Omaha, Neb. Martin Dodge, Director Office of Road Inquiry, Washington, D. C.

ENGINEERS' CLUB OF KANSAS CITY.
Oct. 10. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

THE LOUISIANA ENGINEERING SOCIETY.
Oct. 10. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

NEW ENGLAND RAILROAD CLUB.
Oct. 11. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

DENVER SOCIETY OF CIVIL ENGINEERS.
Oct. 11. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

NORTHWEST RAILWAY CLUB.
Oct. 11. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Oct. 11. Secy., Wm. H. Searles, Case Library Building, Cleveland, O.

AMERICAN RAILWAY ASSOCIATION.
Oct. 12. Holland House, New York. Secy., W. F. Allen, 24 Park Place, New York.

FRANKLIN INSTITUTE.
Oct. 12. "Anthracite Coal in Peru," Wm. Griffith. Secy., Wm. H. Wahl, 15 South 7th St., Philadelphia, Pa.

ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 13. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 13. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ST. LOUIS RAILWAY CLUB.
Oct. 14. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

ENGINEERS' CLUB OF COLUMBUS.
Oct. 15. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 15. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

TECHNICAL CLUB OF OMAHA.
Oct. 17. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 17. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Oct. 17. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 18. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 18-20. Annual meeting, Richmond, Va. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.

WESTERN SOCIETY OF ENGINEERS.
Oct. 19. "Masonry," Geo. S. Morison. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 19. "Stave Pipe—Its Economic Design and the Economy of Its Use," Arthur L. Adams. Secy., C. W. Hunt, 220 W. 57th St., New York city.

ENGINEERS' CLUB OF ST. LOUIS.
Oct. 19. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Oct. 19. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 19. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Oct. 19. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill

PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.

AMERICAN GAS LIGHT ASSOCIATION.
Oct. 19-21. Annual meeting, Niagara Falls, N. Y. Secy., Alfred E. Forstall, Montclair, N. J.

ENGINEERS' CLUB OF CINCINNATI.
Oct. 20. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

NEW YORK RAILROAD CLUB.
Oct. 20. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Oct. 20. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 26-28. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

BROOKLYN ENGINEERS' CLUB.
Nov. 3. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Nov. 7. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 7. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.

RAILWAY SIGNALING CLUB.
Nov. 8. Secy., Earl M. Seitz, Signal Engineer, C. & N. W. Ry., Chicago, Ill.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.

THE WESTERN FOUNDRYMEN'S ASSOCIATION.—This association enjoyed its usual annual outing on Sept. 21. The party, including members and guests, left Chicago by boat for Racine, Wis., where they inspected the works of the J. I. Case Threshing Machine Co. and the Belle City Malleable Iron Co. In the evening an elaborate banquet was served at the Racine Hotel.

ROCHESTER ENGINEERING SOCIETY.—The 5th annual excursion of this society took place on Oct. 1. The trip was over the Lehigh Valley R. R. to visit the docks and coal handling machinery of the Buffalo, Rochester & Pittsburg R. R. and the Lehigh Valley R. R. at Buffalo, N. Y. The Buffalo Engineering Society met the party at the docks and acted as an escort.

ENGINEERS' CLUB OF CINCINNATI.—At the meeting of this club, held Sept. 15, Mr. W. Hildenbrand, who has had charge of the remodeling of the suspension bridge at Cincinnati, read a very interesting paper describing the work; the principal features of which consisted in the putting up of two additional cables, the entire reconstruction of the trusses and floor, the widening of the roadway and footwalks, the lengthening of the approaches and improvement in the grades. This was all accomplished without interfering with or interrupting the heavy travel of electric cars, vehicles and pedestrians. J. F. Wilson, Secy.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The 127th meeting of this society was held at the house of the American Society of Mechanical Engineers, New York city, Sept. 28 The Secretary, Mr. R. W. Pope, read the paper of the evening on "The Photometry of the Enclosed Alternating Arc," by Messrs. C. P. Matthews, W. H. Thompson and J. B. Hilbish, of Purdue University, Lafayette, Ind., which was a report of a series of experiments conducted by the authors to determine something of the behavior of the alternating enclosed arc lamp. An abstract of the paper and discussion is given elsewhere in this issue.

CHICAGO ELECTRICAL ASSOCIATION.—The secretary of this association, Mr. J. R. Cravath, has issued the following list of the papers to be presented at the fall meetings: Oct. 7, "Electrical Features of the Late Spanish-American War," Thos. G. Grier; Oct. 21, "Practical Points on Electrical Measurement," W. B. Hale; Nov. 4, "The Electrical Equipment of a Model Printing Establishment," George A. Damon; Nov. 18, "The Development of the Motor-Cycle," F. B. Rae; Dec. 2, "Practical Points in Street Railway Engineering," W. A. Harding; Dec. 16, "Wireless Telegraphy," Arthur V. Abbott; Jan. 6, "Telephone Engineering—Some Problems, Solved and Unsolved," S. G. McMeen; Jan. 20, "Observations on Ventilating Fans," Gerard Swope.

THE NATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—This association held its 6th annual meeting at the American House, Boston, Mass., Sept. 6-8. Reports from committees on the following subjects were received: "Handling Scrap Materials;" "Locomotive Forging;" "Furnaces;" "Making and Repairing Frogs and Crossings;" Making and Repairing Locomotive Frames;" and "Making and Repairing Track Tools." Mr. Geo. F. Hinkens read a very complete paper on "Compressed Air in the Blacksmith Shop," and also one on "How to Get the Best Results in Working Tool Steel—High and Low Carbon." Papers were also read by Mr. G. L. Lindsay on "The Best Method of Repairing Locomotive and Car Springs," and Mr. N. B. Meissimer, on "Flues and the Best Method of Repairing Lap and Butt Welding."

Officers for the ensuing year were elected as follows: Pres., W. W. McLelland, D. & R. G., Denver, Colo.; First Vice-Pres., G. F. Hinkens, St. P. & D., Gladstone, Minn.; Second Vice-Pres., G. A. Geuthner, Bost. & Me., Boston, Mass.; Secy. and Treas., A. L. Woodworth, C. H. & D., Lima, Ohio. Milwaukee, Wis., was decided upon as the next place of meeting.

AMERICAN PUBLIC HEALTH ASSOCIATION.—The 26th annual meeting of this association was held at Ottawa, Ont., on Sept. 27. About 100 delegates were present. A resolution was adopted recommending the appointment of an American, Canadian and Mexican Commission to arrange to have the Berthilon system of disease classification adopted by the three countries.

A paper entitled "Short-History of Sewage Disposal at the Asylum for the Insane, London, by Dr. R. M. Burke, was read. The sewage of this institution, about 75,000 gallons daily, is forced by a centrifugal pump, upon filter beds which, during freezing weather, are kept soft enough to absorb the water by the heat in the sewage. Fruit and vegetables valued at $200 per acre have since been raised upon the ground.

Mr. Thomas McFarlane, Dominion Analyst, read a paper on "The Disposal of Sewage in Some European Cities," which was followed by a paper entitled "Most Recent Methods of Sewage Disposal," by C. G. Houlyky, and others on "The Filtration of Sewage," by Capt. W. F. Van Buskirk; "The Interpretation of the Chlorine Member in Well Water," by A. McGill; and "The Farm Well," by Frank Shutt.

The afternoon was spent in driving about the city inspecting points of interest, and in the evening a reception was held at the City Hall.

NEW PUBLICATIONS.

AMERICAN STREET RAILWAY DIRECTORY AND BUYERS' MANUAL. First edition. Quarterly. New York: E. L. Powers. Paper; 6 × 9¼ ins.; pp. 82.

This is the first issue of a publication which will be issued quarterly in the future. In includes a complete list of electric, cable, horse and elevated railways in the United States and Canada, in which the names of all the principle officials, mileage, gage of track, number of cars, etc., are given.

The directory is well arranged, neatly printed and will doubtless be welcomed by every dealer in street railway supplies.

REPORT OF THE BUREAU OF MINES OF THE PROVINCE OF ONTARIO.—Vol. VII. Third Part. 1898. Archibald Blue, Director of the Bureau, Toronto, Ont. Pamph.; pp., 60, with several maps, diagrams and photographs.

This report contains some papers of interest to mining engineers and others, as follows: "Economic Geology of Eastern Ontario," being a report on corundum and other minerals, by Prof. W. G. Miller. "Analyses of Corundum and Corundum-Bearing Rock," by Dr. W. L. Goodwin. "The Concentration of Corundum," by Prof. Courtenay de Kalb. "Water Powers of Ontario," by Thomas W. Gibson. "Placer Gold on Vermillion River," by A. H. Gracey. The statistics of mineral production of Ontario for 1897 make a most meager exhibit, considering the undoubtedly great mineral wealth of the Province. They are as follows: Gold, $190,244; nickel, $359,651; copper, $200,067; iron ore, $4,869; pig iron, $288,129.

ELECTRIC STREET RAILWAY HISTORY.—Part I. The Westinghouse Electric & Mfg. Co. Pamph.; 6×9 ins.; pp. 38; illustrated.

This pamphlet tells a most interesting pictorial history of the development of the Westinghouse railway motor, from the old two-pole No. 1 motor, through the four-pole No. 3, No. 12 A, No. 38, No. 38 B, No. 49, to the latest type, No. 50. In these pictures several views of the motor in question are given so that an idea of outside and inside construction and the method of suspension can be gained. As a fitting accompaniment, several illustrations of railway generators and switchboards and the Westinghouse alternating, direct-current system of power transmission are included. These show rotary converters, transformers, etc. In conclusion, a number of interior views of the company's factory and several railway plants using Westinghouse apparatus are shown.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

PECKHAM TRUCKS.—Peckham Truck Co., New York city.

These are half-tone illustrations on loose sheets of various styles of Peckham trucks for street cars of various classes.

THE DEDENDA GONG.—J. G. Brill Co., Philadelphia, Pa. Pamph.; 9 × 6 ins.

This is a brief description of a new form of gong for street cars. The feature of the gong on which stress is laid is its simplicity.

THE LARGEST DYNAMO IN THE WORLD.—By S. H. Short, Walker Electric Co., Cleveland, Ohio. Pamph.; 6 × 8 ins.; illustrated.

This is a neatly gotten up illustrated description of a 3,000-K-W. (4,000 HP.) railway generator, ordered of the Walker company, by the Boston Elevated Ry. Co. The total weight of the machine is 250,000 lbs.

BOOSTERS.—Walker Co., Cleveland, Ohio. Circular, 7⅞ × 10¾ ins.; illustrated.

This is No. 1086, superseding No. 1068, of the regular Walker series of circulars. In it motor-dynamos, or "boosters," as they are generally called, are briefly described and illustrated.

WALKER CAR MOTORS FOR STREET LINES, ELEVATED OR SUBURBAN TRAFFIC.—Circular 1085 describes the Walker motor, outlining various features, such as accessibility, speed, efficiency, simplicity, ease of repair, power, etc. Several illustrations of the armature and field parts are also given.

ALTERNATING CURRENT APPARATUS. — Circular 1084.—This gives a brief description of some of the apparatus built by this company for the generation of alternating currents. Illustrations and dimension tables accompany the text.

THE LOVE UNDERGROUND CONDUIT.—Circular 1083 explains the salient features of this conduit system, which was described in Engineering News, Aug. 4, 1898.

STEEL LIGHTING GENERATORS.—Circular 1081.—This is an illustrated description of a type of generator designed for purposes where the load is fairly constant, or where the load variations are gradual.

TYPE "S," SOLENOID BLOW-OUT CONTROLLER.—Circular 1080 is, as implied in the title, a description of this type of street railway motor controller. Illustrations serve to make its construction and use clear.

RAILWAY SAFETY APPLIANCES.—Safety Appliance Co., Boston, Mass. Pamph.; 6 × 9 ins.

This pamphlet calls attention to several safety appliances for use upon railway cars. These are: A form of brake equalizer; draw-bar adjuster, spring suspension and dead lever take up. These devices are illustrated and briefly described.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Oct. 6.	Electric light plant, St. Joseph, Ill.	Sept. 22
	Advertised, Engineering News, Sept. 22.	
Oct. 6.	Water-works, Greensboro, Ga.	Sept. 22
Oct. 6.	Brick paving, Erie, Pa.	Sept. 29
Oct. 6.	Water-works, Osage, Ia.	Sept. 29
	Advertised, Engineering News, Sept. 29.	
Oct. 6.	Highway (4,600 lin. ft.), Newburyport, Mass.	Oct. 6
Oct. 6.	Sidewalks, Riverton, N. J.	Oct. 6
Oct. 6.	Cement walks and grading, Wilmington, Del.	Oct. 6
Oct. 6.	Paving one alley, Bloomington, Ill.	Oct. 6
Oct. 7.	Steel bridge, and material, Colfax, Wash.	Oct. 6
Oct. 7.	Bridge, Auburn, Cal.	Oct. 6
Oct. 7.	Sewers and paving, Allegheny, Pa.	Oct. 6
Oct. 7.	Brick sewers, Providence, R. I.	Oct. 6
Oct. 7.	Refilling bridge approaches, Pittsburg, Pa.	Oct. 6
Oct. 7.	Grading and paving, Allegheny, Pa.	Oct. 6
Oct. 7.	Pipe sewer, Marion, O.	Oct. 6
Oct. 7.	Building, Oberlin, O.	Sept. 29
Oct. 7.	Water pipe, Milledgeville, Ill.	Sept. 29
Oct. 7.	Arc lighting, Asheville, N. C.	Sept. 22
Oct. 8.	Bridge work, Cincinnati, O.	Sept. 22
Oct. 8.	School building, Bisbee, N. Dak.	Sept. 22
Oct. 8.	Dredging, etc., League Island Navy Yard, Pa.	Sept. 29
Oct. 8.	Electric plant, Baltimore, Md.	Sept. 29
Oct. 8.	Bridge abutments, Tunkhannock, Pa.	Oct. 6
Oct. 8.	Tunnel, Cambridge, Mass.	Oct. 6
Oct. 8.	Grading, paving, etc., Zanesville, O.	Oct. 6
Oct. 8.	Steel stand-pipe, Indian Head, Md.	Oct. 6
Oct. 10.	Masonry abutments and piers, Boston, Mass.	Oct. 6
Oct. 10.	Street bonds, Portchester, N. Y.	Oct. 6
Oct. 10.	Sewer, Camden, N. J.	Oct. 6
Oct. 10.	Sewerage system, Woodbridge, N. J.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Oct. 10.	New substructure, etc., Lansing, Mich.	Oct. 6
Oct. 10.	Paving Canal St., New Orleans, La.	Oct. 6
Oct. 10.	Water-works, Melrose Park, Ill.	Oct. 6
Oct. 10.	Water pipe, The Dalles, Ore.	Oct. 6
Oct. 10.	Electric railway, Nyack, N. Y.	Oct. 6
Oct. 10.	Grading and graveling, Muncie, Ind.	Sept. 29
Oct. 10.	School building extension, Brooklyn, N. Y.	Sept. 29
Oct. 10.	Elevators (3), New York, N. Y.	Sept. 29
Oct. 10.	Building brick, Philadelphia, Pa.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 10.	Sewers and disposal plant, E. Cleveland, O.	Sept. 22
Oct. 10.	Dredging, Wilmington, Del.	Sept. 22
	Advertised, Eng. News, Sept. 15 and 22.	
Oct. 10.	Cement, stone, etc., Ft. Washington, D. C.	Sept. 22
	Advertised, Eng. News, Sept. 22 and 29.	
Oct. 10.	Asphalt and brick paving, Council Bluffs, Ia.	Sept. 22
Oct. 10.	Turbine wheels (24), Wrightsville, Pa.	Sept. 8
	Advertised, Eng. News, Sept. 8 and 15.	
Oct. 10.	Trestle, Chehalis, Wash.	Sept. 8
Oct. 10.	Paving, Toledo, O.	Sept. 15
Oct. 11.	School building, New Brunswick, N. J.	Sept. 29
Oct. 11.	Building, Boonton, N. J.	Sept. 29
Oct. 11.	Municipal building work, Brooklyn, N. Y.	Sept. 29
Oct. 11.	Steel bridges (4), Parker, S. Dak.	Oct. 6
Oct. 11.	Pipe sewers, Clinton, Ia.	Oct. 6
Oct. 11.	Heating, Chicago, Ill.	Oct. 6
Oct. 11.	Sewers, Beloit, Wis.	Oct. 6
Oct. 11.	Levee work, Scioto River, Columbus, O.	Oct. 6
Oct. 11.	Steel shells, etc., at water-works, Chicago	Oct. 6
Oct. 12.	Repairing draw-bridge, Camden, N. J.	Oct. 6
Oct. 12.	Stone arch culvert, etc., Cleveland, O.	Oct. 6
Oct. 12.	Heating, etc., Danville, Ill.	Oct. 6
Oct. 12.	Water-works, Knoxville, Pa.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Oct. 12.	Brick work, Oxford, O.	Sept. 29
Oct. 12.	Hospital buildings, San Francisco, Cal.	Sept. 15
Oct. 12.	Park bonds, Spokane, Wash.	Sept. 1
Oct. 12.	Sewers, Cohoes, N. Y.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 13.	Hire of dredging plant, Mobile, Ala.	Sept. 15
	Advertised, Eng. News, Sept. 15 to Oct. 6.	
Oct. 13.	Portland cement, Seattle, Wash.	Sept. 29
Oct. 13.	School building, Waterbury, Conn.	Oct. 6
Oct. 13.	Asphalt paving, New York, N. Y.	Oct. 6
Oct. 13.	Water tanks, Chicago, Ill.	Oct. 6
Oct. 13.	Park work, New York, N. Y.	Oct. 6
Oct. 13.	Removing ashes, etc., Cleveland, O.	Oct. 6
Oct. 14.	Bridge, Vaucluse, S. C.	Oct. 6
Oct. 14.	Grading and brick paving, Cleveland, O.	Oct. 6
Oct. 14.	Maintaining asphalt, St. Louis, Mo.	Oct. 6
Oct. 14.	Pipe sewers, Madison, Wis.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 14.	Cement walks, North Vernon, Ind.	Sept. 15
Oct. 15.	Water-works, Wagoner, Ind. Ter.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Oct. 6.	
Oct. 15.	Masonry, woodwork, etc., Cincinnati, O.	Sept. 22
Oct. 15.	School building, Harris, Minn.	Sept. 22
Oct. 15.	Sewers, Marietta, O.	Sept. 22
Oct. 15.	Electric light plant, Charlotte, N. Y.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 15.	Electric plant, Bremerton, Wash.	Sept. 29
Oct. 15.	Water-works, Charlotte, N. Y.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 15.	Ocean Ave., improvement, New London, Ct.	Oct. 6
Oct. 15.	Light station, New Haven, Conn.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Oct. 15.	Electric light plant, Wynne, Ark.	Oct. 6
Oct. 15.	Pipe sewer, Passaic, N. J.	Oct. 6
Oct. 15.	Water bonds, Crystal, Minn.	Oct. 6
Oct. 15.	Water-works, Wynne, Ark.	Oct. 6
Oct. 15.	Water supply, Monrovia, Cal.	Oct. 6
Oct. 17.	Electric lighting, Camden, N. J.	Oct. 6
Oct. 17.	Sewers, etc., Albany, N. Y.	Oct. 6
Oct. 17.	Asphalt paving, etc., Logansport, Ind.	Oct. 6
Oct. 17.	Sewer foundation, Burlington, Ia.	Oct. 6
Oct. 17.	Dredging Lake Merritt, Oakland, Cal.	Oct. 6
Oct. 17.	Street improvements, Hamilton, O.	Sept. 29
Oct. 17.	Water pipe, Wytheville, Va.	Sept. 29
Oct. 17.	Sewerage system, Mobile, Ala.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Oct. 6.	
Oct. 17.	Gasholder, etc., Edinburgh, Scotland	Sept. 1
Oct. 18.	Railway track, Cincinnati, O.	Sept. 22
Oct. 18.	Paving, Sharpsburg, Pa.	Oct. 6
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 18.	Machinery etc., Naval Station, Puget Sound.	Sept. 29
Oct. 18.	Street bonds ($60,000), Sharpsburg, Pa.	Oct. 6
Oct. 18.	Water-works, Alden, N. Y.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Oct. 18.	Electric railway franchise, Portage, O.	Oct. 6
Oct. 19.	Sewer, New York, N. Y.	Oct. 6
Oct. 19.	Levee work, New Orleans, La.	Sept. 29
Oct. 19.	Asphalt paving, Winnipeg, Man.	Sept. 29
Oct. 20.	Viaduct over Lick Run, Cincinnati, O.	Sept. 22
Oct. 21.	Levee work, West Memphis, Tenn.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Oct. 13.	
Oct. 21.	Dry dock, Algiers, La.	Sept. 8
Oct. 20.	Electric light bonds, Grafton, W. Va.	Oct. 6
Oct. 20.	Steam heating, etc., York, Pa.	Oct. 6
Oct. 20.	Cottage, Lancaster, O.	Oct. 6
Oct. 22.	Iron bridges (2), Salem, Va.	Oct. 6
Oct. 22.	Bridge, plans and material, Cincinnati, O.	Sept. 29
Oct. 22.	Electric plant, Litchfield, Ill.	Sept. 29
Oct. 22.	Dredging, Pensacola Bay, Fla.	Sept. 29
	Advertised, Eng. News, Sept. 29 to Oct. 13.	
Oct. 23.	Plans for sewer system, Chertsey, Eng.	Sept. 22
Oct. 24.	Markets, etc., Belem, Brazil	Apr. 28
Oct. 24.	Paving with asphalt, etc., Hamilton, O.	Sept. 29
Oct. 24.	Water-works, Gallipolis, O.	Sept. 29
Oct. 24.	Heating plant, St. Peter, Minn.	Sept. 29
Oct. 24.	Storage reservoir, Bradford, Pa.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Oct. 25.	Jetties, Portland, Ore.	Aug. 25
	Advertised, Eng. News, Aug. 25 to Sept. 15.	
Oct. 26.	Bridge bonds, Cincinnati, O.	Sept. 29
Oct. 26.	Dredging, Newport, R. I.	Sept. 29
	Advertised Eng. News, Sept. 29 to Oct. 20.	
Oct. 26.	Cement, broken stone, etc., Newport, R. I.	Sept. 29
	Advertised Eng. News, Sept. 29 to Oct. 20.	
Oct. 26.	Sewer bonds, Glenville, O.	Oct. 6
Oct. 27.	U. S. building, Camden, N. J.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Oct. 27.	Paving, Camden, N. J.	Sept. 29
Oct. 28.	Asphalt, brick or stone, Atlanta, Ga.	Oct. 6
Oct. 28.	Brick paving, etc. (7 Sts.), Cleveland, O.	Oct. 6
Oct. 28.	Brick and stone wall, Atlanta, Ga.	Oct. 6
Oct. 28.	Stone wall, San Francisco, Cal.	Oct. 6
Oct. 29.	Steam tender, Louisville, Ky.	Oct. 6
Oct. 30.	School building, Chehalis, Wash.	June 16
Nov. 1.	Court house, Garner, Ia.	Sept. 8
Nov. 1.	School building, St. Louis, Mo.	Sept. 22
Nov. 7.	Improving electric plant, Topeka, Kan.	Sept. 22
Nov. 9.	Electric light plant, Toronto, Ont.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Nov. 9.	Electric energy, Toronto, Ont.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Nov. 10.	Water supply, Belem, Brazil	Sept. 22
Nov. 15.	Water-works addition, Seattle, Wash.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Nov. 10.	
Nov. 15.	Jail work, San Saba, Tex.	Sept. 29
Nov. 15.	Electric lighting, Greensboro, N. C.	Oct. 6

Nov. 21.	Government bldgs (8), Sophia, Bulgaria	Sept. 29
Nov. 30.	Bridge, etc., and plans, Moline, Ill. Advertised, Eng. News, Oct. 6 and 13.	Oct. 6
Dec. 1.	Electric lighting, Sumter, S. C.	Oct. 6
Dec. 31.	Plans for station, etc., Stockholm, Sweden	June 23
Jan. 1.	City hall plans, Bridgeport, Conn	Aug. 18
Jan. 2.	Bridge, Quebec, Que. Advertised, Eng. News, Sept. 29 and Oct. 6.	Sept. 29
Feb. 10.	Jail building, Keyser, W. Va.	Sept. 29

RAILWAYS.

ALLEGHENY & WESTERN.—S. H. Lea, Res. Engr., Adrian, Pa., informs us that track-laying has been commenced at the eastern end of this line where several miles of grading have been finished. Good progress is being made on the piers for the bridge across the Allegheny River, at Mosgrove, Pa.; work is also being carried on night and day on the "Big Cut" at Lyons farm, containing over 250,000 cu. yds. of material. The stretch of six miles from the Lyons Cut to the Allegheny River is one of the heaviest pieces of work in this country. There are to be two steel viaducts within 1½ miles of Adrian, One of these will have a maximum height of 95 ft.; the other is 102 ft. at its highest point. At the "Devil's Gulch," one mile east of Adrian, is a steep culvert with a fall of more than 40 ft.; over this culvert is an embankment 100 ft. high. The remainder of the line to the river is extremely heavy, and is such as may be termed titanic. The maximum gradient is 1%, compensated for curvature. The rails are 100 lbs. to the yard, and are made by the Carnegie Steel Co.

ATLANTA & WEST POINT.—George C. Smith, Pres., Atlanta, Ga., informs us that this company will build a belt line of steam railway, six miles in length, to extend around the eastern side of Atlanta to the Georgia R. R., and that contracts will be let in 30 to 60 days. The right of way has been obtained, and final location of the line is now being made. Reports state that five or six bridges and a tunnel will have to be erected, and that the cost of the work will be $200,000. G. F. Huggans, Ch .Engr., Montgomery, Ala.

ATLANTIC COAST LINE.—Press reports state that this company has decided to build a branch line from Denmark to Robbins, via Barnwell, S. C. I. R. Kenley, Gen. Mgr., Wilmington, N. C.

BLACK DIAMOND.—Press reports state that Sir Thomas Tancred, representing a company of English capitalists, is inspecting the right of way of this proposed railway from Springfield, Ill., to Port Royal, S. C., a distance of about 1,200 miles. Col. Albert E. Boone, Gen. Mgr., Zanesville, O.

CALIFORNIA NORTHWESTERN.—This company, which has recently been incorporated with a capital stock of $3,000,000, has leased the entire system of the San Francisco & North Pacific Ry. Co. for 20 years. The new company proposes to build a connecting line from the existing railway to the timber belt of Mendocino county. Four locations have been surveyed, but the point of connection has not yet been decided upon. F. K. Zook, Ch. Engr., San Rafael, Cal.

CHOCTAW & MEMPHIS.—Reports state that four corps of engineers are now in the field surveying for this proposed line from the terminus of the Choctaw, Oklahoma & Gulf at Wister Junction, Ind. Ter., to the Little Rock & Memphis R. R., at Little Rock, Ark., 150 miles. Henry Wood, Gen. Mgr., Smith McAlester, Ind. Ter., has stated that rails have been purchased but not the rolling stock; also that the entrance into Little Rock will probably form the south side of the river, which will necessitate the erection of another bridge across the Arkansas.

DULUTH & NORTHEASTERN.—J. H. Heininger, Cloquet, Minn., informs us that this will be a 40-mile first-class logging road to be built for the Cloquet Lumber Co. Surveys have been made, the capital secured and contracts let. The route at present will be from the Duluth & Iron Range R. R. south to the Cloquet River. Pres., F. Weyerhauser, St. Paul, Minn. J. B. Phelps, Davenport, Ia., also informs us that the contract is held by Williamson, Campbell & Gowin, of Duluth.

EL PASO & NORTHEASTERN.—J. L. Campbell, Ch. Engr., El Paso, Tex., informs us that this proposed railway has been completed from El Paso to Alamogordo, N. Mex., a distance of 86 miles. Work on the main line is suspended for the present, pending construction of a branch line, 16 miles in length, to timber along the route. The northern terminus will be at White Oaks, and the completed system will be 165 miles long. George S. Good & Co., El Paso, Tex., and Lock Haven, Pa., are the contractors. Financiering has not yet been entirely completed. After Oct. 1 the chief engineer will be H. A. Sumner. Pres., C. B. Eddy, El Paso.

FLORIDA.—Reports state that Strickland & Wesley, of Point Washington, Fla., desire to communicate with parties regarding the construction of a 10-mile logging railway.

GALVESTON, BRAZOS & SOUTHWESTERN.—Construction work along this proposed line has been abandoned for the present. The route is from Galveston to San Antonio, Tex., a distance of 200 miles. Grading has been completed between Galveston and Angleton, Tex., a distance of 30 miles. Pres., L. P. Featherstone; Ch. Engr., L. E. Beadle, both of Galveston, Tex.

GEORGIA.—A. H. Morgan, manufacturer of cross-ties, etc., Waycross, Ga., informs us that he is in the market for five or six miles of 35 or 40-lb. steel or iron relay rails, f. o. b. Boston, New York, Philadelphia or Baltimore. He also desires to furnish for the West Indies market 100,000 yellow pine ties, delivered at Port Tampa, Fla.

JASPER SOUTHERN.—L. P. Scarborough, Secy., Jasper, Tex., informs us that this company does not expect to extend its lines. The present line is 20 miles in length, extending from Kirbyville to Jasper. Pres., W. J. B. Adams; Ch. Engr., W. W. Blake, both of Jasper.

LOGANSVILLE & LAWRENCEVILLE. — We are informed that A. & C. Wright & Co., of Richmond, Va., completed the grading, trestling and masonry on this line in July; also that tracking is now about completed and operation will soon be commenced. The road is to be a feeder to the Seaboard Air Line, running from Lawrenceville, on this line, to Logansville, via Trip, Ga., a distance of ten miles. Pres., Nathan Bennett, Logansville, Ga.; Ch. Engr., N. E. Lugolf, Portsmouth, Va.

LOUISIANA & NORTHWEST.—J. D. Beardsley, Gen. Mgr., Gibsland, La., informs us that this company has completed the extension from Homer, La., north to Magnolia, Ark., a distance of 36 miles, and that it has acquired the branch of the St. Louis Southwestern Ry., running from Magnolia to the main line at McNeil, 6.4 miles. The present length of the route is 78 miles, from Bienville, La., to McNeil, Ark. William Washburn, Ch. Engr., Gibsland, La.

LOUISVILLE & NASHVILLE.—Reports state that improvements are now in progress along this line between Louisville and Bowling Green, Ky., which have in view the reduction of all grades over 0.8 per cent., where possible. The work is being done by the Globe Construction Co. A. R. Wing is also said to have a contract to build three miles of new road near Green River where the reduction of grade would not be practicable. R. Montfort, Ch. Engr., Louisville, Ky.

MEXICAN CENTRAL.—Lewis Kingman, Ch. Engr., Mexico, Mex., informs us that track-laying was finished Sept. 15, on the new extension of this line from Jiminez to Parral, Mex., a distance of 55 miles. It is proposed to open the line on Oct. 9.

NORTHERN.—Reports state that this company has recently been incorporated in Missouri to construct about ten miles of railway from Trimble to Gower, Mo., with the object of giving the St. Joseph & Grand Ry. a shorter route from St. Joseph to Kansas City. Surveys have been made. A. L. Stillwell, Pres.; H. C. Smith, Asst. Engr., both of Kansas City.

NORTON BAY & YUKON.—Press reports state that this company will begin to build next June a line of railway from the mouth of the Unalaklik River, on Norton Sound, to Kaltag, a town on the Yukon River below Nulato, a distance of about 76 miles. The survey for the first route has been finished, and it is said that the maximum grade will not exceed 2%. Pres., E. A. Gardner, Chicago, Ill.; Ch. Engr., F. A. Hill, Seattle, Wash.

OREGON & MISSOURI NORTHERN.—Robert S. Doubleday, Ch. Engr., Oregon, Mo., informs us that surveys have been made, the right of way arranged for and the capital for construction secured for this proposed line. Most of the contracts have been let, and work is now under way. T. A. Davis, St. Joseph, Mo., is the principal contractor. This company was incorporated Sept. 3 with a capital stock of $100,000, to construct a railway from Forest City to Oregon, Mo., five miles, and thence to extend north and east through towns not yet definitely specified. Pres., Irving H. Wheatcroft, of Oregon, also general manager of the Colorado Valley Ry.

PETERSBURG.—Phillips, Wright & Co., of Richmond, Va., are said to have been awarded the contract Sept. 16 for the graduation of a line about ten miles in length, beginning about two miles south of Petersburg, Va., and running southeasterly in proximity to the existing railway. E. T. D. Myers, Ch. Engr., Richmond, Va.

PORTLAND & NEHALEM.—This company has been organized in Oregon, with a capital stock of $100,000, according to reports, for the construction of a railway from a point on the Nehalem River southeast to Portland, Ore., a distance of about 50 miles. Thornburn Ross, Chamber of Commerce Bldg., Portland, is said to be interested.

SAGINAW SOUTHERN.—This company was incorporated in Arizona, Sept. 28, with a capital stock of $250,000, to construct a railway from Williams, on the Santa Fe Pacific, to Jerome, Ariz., via Cocimino and Yavapai counties, with a total length of 50 miles. Among the incorporators are: John C. Brown, George C. Wharton, Max Salzman, Wm. P. Cutting, Chas. F. Roberts and Edward M. Doe.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—Reports state that work is progressing rapidly on the Franklin tunnel which is being made through the Contra Costa hills, west of Stockton, Cal., and that about 1,700 ft. are now completed. The total length will be 5,700 ft., and work is expected to be finished within ten months. Foley Bros. & Muir, St. Paul, Minn., are the contractors. W. B. Storey, Jr., Ch. Engr., San Francisco, Cal.

SAVANNAH & STATESBORO.—W. C. Parker, of Statesboro, Ga., informs us that part of this proposed railway system is now in operation between Cuyler and Woodburn, Ga., a distance of 13 miles. An extension is in process of construction from Woodburn to Statesboro, five miles. The contract requires the line to be ready for operation in nine months: considerable grading has been completed, and a subscription of $10,000 made by the citizens of Statesboro towards completing the work. The rails are reported to have been bought. Pres., Stilson Hutchins, Washington, D. C.

ST. LOUIS & OKLAHOMA CITY.—Track has been laid on this new line to a point about 65 miles southwest of Sapulpa, Ind. Ter., and the line is in operation between Sapulpa and Stroud, Okla. Grading has been completed for several months along the entire route to Oklahoma City, Okla., a distance of 103½ miles. Pres., T. G. Jones, Oklahoma City.

ST. LOUIS, CHICAGO & ST. PAUL.—Press reports state that Col. William H. Male, Pres. of St. Louis, Alton & Springfield Co., of New York, has been appointed receiver of this company.

SUMMERVILLE, BLUE MOUNTAIN & WALLA WALLA.—This company was incorporated in Oregon at the time of the incorporation of the Union, Cornucopia & Eastern Ry. Co., to construct a railway from a junction on the Union, Cove & Valley Ry. to Walla Walla, via Summerville and Elgin. Joseph Johnson, Supt. of Construction, Union, Ore.

UNION PACIFIC.—Press reports state that this company contemplates the building of a cut-off between Cheyenne and Laramie, which will materially reduce the grade. J. B. Berry, Ch. Engr., Omaha, Neb.——The Seminoe Mining Co. expects to construct a branch line from the main line of the Union Pacific to Seminoe, to be used to haul iron ore from the company's mines. Mgr., E. H. Saltiel.

VIRGINIA.—The citizens of Gloucester county will vote at Gloucester, Va., Nov. 8, on the question of issuing $50,000 of 5% railway aid bonds.

WISCONSIN.—H. Zech, of Crivitz, Wis., contemplates the construction of a railway from Crivitz, on the Chicago, Milwaukee & St. Paul Ry. up the Peshtigo River to a connection with the Minneapolis, St. Paul & Sault Ste. Marie Ry., a distance of about 30 miles. Surveys have been made and work is expected to commence soon.

STREET AND ELECTRIC RAILWAYS.

WESTBROOK, ME.—Reports state that work was commenced on the proposed Westbrook, Windham & Harrison Electric Ry., Sept. 28, under the direction of J. H. Tolman, J. C. Scates, C. M. Waterhouse and C. B. Woodman, the owners of the charter. It is expected to complete the first ten miles, of a total length of 32 miles, within the next six weeks.

BELLOWS FALLS, VT.—The Bellows Falls & Saxtons River Electric Ry. expects to begin the construction of its proposed electric railway, six miles in length, this fall, so as to have cars running by December. Pres., J. H. Holton, Burlington, Vt.; Vice-Pres., A. N. Swain, Bellows Falls; Treas., J. J. Flynn, Burlington.

NEWBURYPORT, MASS.—It is announced that the Newburyport & Amesbury St. Ry. Co. has gone into the hands of a receiver, and that the Citizens' Electric St. Ry. Co. is to be organized, with a capital stock of $150,000, to purchase and improve the system. Among those interested are: W. B. R. Ferguson, Malden, Mass.; B. D. Sumner, Newton; E. P. Shaw, Jr., Brookline; Charles Goss, Amesbury; Jas. F Shaw, Newburyport.

QUINCY, MASS.—The council has ordered a public hearing for Oct. 10 on the petition of the Boston, Quincy & Fall River Bicycle Ry. Co. for the right to build in certain portions of this city. Pres., E. Moody, Boynton.

ALBANY, N. Y.—The map and profile of the route of the proposed Albany, Helderberg & Schoharie Electric Ry. were filed with the clerk of Albany county, Sept. 30, and notices are being served, preparatory to construction. As fully stated in our issue of June 9, the contract for building the line has been awarded to the Albany Construction Co., 93 State St., Albany, of which J. S. Frost, of Albany, is secretary. The route is from Albany to Schoharie, a distance of 42 miles. Pres., Henry Burgett; Treas., Chas. E. Bibbler, both of Boston, Mass.

NYACK, N. Y.—We are informed that Isaac A. Walker & Son, General Railway Contractors, Stephen Girard Bldg., Philadelphia, Pa., have purchased the franchise, rights of way, etc., of the Nyack Traction Co., and have reorganized the company, with the following officers: Pres., Henry C. Howard, Chester, Pa.; Treas., E. F. Walker, and Secy., Geo. D. Howell, both of Philadelphia. The survey has been completed and bids have been advertised for to be in by Oct. 10. The capital for construction has been secured, and contracts will be let as shortly after Oct. 10 as possible. The projected line is about 12 miles in length, and will have all the latest improvements, ballasted track, 70-lb. rail, etc. The route is from Sparkhill along the river road to South Nyack, Nyack and Upper Nyack, with an extension from the ferry at Nyack to the West Shore R. R. station, and from Upper Nyack to Rockland Lake. The road will be built by I. A. Walker & Son.

ROCHESTER, N. Y.—The directors of the Rochester, Charlotte & Manitou R. R. Co. have decided to fill in 1,000 ft. of trestle over the inlets; to put on ten new 4-motor trolley cars, and to build a large platform at Manitou. The question of extending the road four miles to Hilton was also considered. Pres., Michael Doyle, 32 White St.

SKANEATELES, N. Y.—It is reported that construction work on the Inter-Urban St. Ry. has been begun by G. D. Grannis, of Syracuse. The proposed line is to run between Skaneateles and Auburn, with a possible extension to Syracuse. T. H. Mather, of Syracuse, is said to be the engineer in charge.

WEBSTER, N. Y.—The Rochester & Sodus Bay Electric Ry. Co. has secured the right of way through this town.

CAMBRIDGE SPRINGS, PA.—This borough has granted the Erie Transit Co. rights of way upon certain streets for the construction of a new electric railway. Burgess, J. C. Allee.

JOHNSTOWN, PA.—N. F. Thompson, Secy. of Board of Trade, informs us that the Johnstown Board of Trade is promoting the construction of a trolley line from this city to Scalp Level, a distance of seven miles. Arrangements have progressed so far as to assure of the building of a road to connect these points merely for the benefit of Johnstown. It is possible that steam may be the motive power, and freight and passenger traffic handled, but it will soon be more definitely decided.

BALTIMORE, MD.—James Bond, Pres. American Bonding & Trust Co., of Baltimore, informs us that the Baltimore, Marley & Mountain Ry. Co., the incorporation of which was noted in our last issue, is only an organization for making the preliminary surveys and obtaining right of way, etc., after which a permanent organization for construction purposes will be effected.

WASHINGTON, D. C.—E. Saxton, of Washington, is stated to have been awarded the contract for constructing the conduits for the new underground electrical system on the City & Suburban Ry., formerly the Eckington & Soldiers' Home R. R. The contract for the iron work was let to Johnson & Co., of Pennsylvania; for the overhead construction, to J. G. White & Co., Baltimore, Md.; for the track-laying, and overhead section, to W. H. Allen, of Washington.

WHEELING, W. VA.—We are informed that the Wheeling Ry. Co. is now building an extension from its present terminus in Martins Ferry to the north end of the city, a distance of about 1.1 miles, and that the construction of the one-mile extension to the fair grounds has been completed. Pres., T. H. Conderman.

KNOXVILLE, TENN.—It is reported that J. C. Monday, a contractor of Knoxville, is formulating a scheme to build an electric railway to Sevierville from this city. The surveys have all been made, and the Knox county court will be asked to appropriate $100,000 toward building the road, and the Sevier county court $50,000.

PORTAGE, O.—Bids are asked until Oct. 18 for the purchase of a franchise to build an electric line through this village. Address the village clerk.

STEUBENVILLE, O.—Preliminary surveys have been completed for a new street railway line between this city and Mingo Junction, and it is said that the line will be built within the next few months. It is also stated that the line will be a link in the system which is to connect Pittsburg with Wheeling, by way of the towns along the Ohio River.

MEROM, IND.—A. D. Hayworth, of Washington, D. C., and others are said to be interested in the construction of an electric railway from Terre Haute to Merom, 32 miles.

PORTLAND, IND.—N. K. Todd, of Bluffton, Ind., one of the incorporators of the Portland & Camden R. R., informs us that no surveys have yet been made for the projected line, nor has the capital been secured. The company was incorporated to build from Portland to Camden, via Dunkirk, Albany, Pennville and Bluffton, a distance of 12 miles.

HIGHLAND PARK, MICH.—The trustees of this village have granted a franchise to the Detroit Citizens' St. Ry. Co. to extend its line up Woodward Ave. to the Six Mile Road. Pres., Tom L. Johnson, 12 Woodward Ave., Detroit.

CHICAGO, ILL.—Bids are being received, according to reports, by the West Chicago and North Chicago St. R. R. Cos. for equipping their cars with fenders; estimated cost, $300,000.

ROCKFORD, ILL.—The Rock River Construction Co., of Chicago, has received the contract for the building of the proposed Rock River Electric Ry. from Oregon to Rockford, 30 miles, and work is expected to begin at once, so as to be completed by Jan. 1.

WICHITA, KAN.—Finlay Ross, Mayor of Wichita, informs us that the Wichita St. Ry., Light & Power Co. has had its franchise renewed on condition that the entire line of 20 miles be rebuilt of new material, and that new equipment be used; also that work be completed before April 1. Pres., H. B. Church, of Wichita.

KANSAS CITY, MO.—F. W. Sears, Gen. Mgr. of Missouri Electric Ry. Co., Baird Bldg., Kansas City, informs us that surveys have all been made for this proposed 12-mile electric railway from 11th St. and Grand Ave., in Kansas City, to Swopes Park and Dodson, and that a petition for a franchise within the city limits will be presented to the council within 60 days. Right of way outside city limits has been secured. The company is capitalized at $500,000, of which one-half is paid in. No contracts will be let until the city franchise has been granted, which will probably be before Jan. 1. Pres., Henry Smith, New York Life Bldg., Kansas City.

BEAUMONT, TEX.—J. F. Keith informs us that J. C. Ward, Jas. F. Ward, V. Wiess, T. H. Langham and J. F. Keith recently obtained a franchise for building an electric street railway in this city. A company has not yet been organized, but will be in a few days, after getting the details of the privileges finally arranged with the city authorities. The above parties are all stockholders in the Beaumont Ice, Light & Refrigerator Co., of Beaumont. In this plant there are ample buildings and boiler and engine power enough to supply the power for the electric cars, but a suitable dynamo will possibly have to be added. Some practical ideas about the construction and equipping of a railway proper are solicited.

BOULDER, COLO.—The council has granted a street railway franchise to Guy D. Duncan and others. Any street may be used, provided the consent of a majority of the property owners be first obtained.

PORT ANGELES, WASH.—John Cain, E. W. Challis and Geo. H. Clementson have petitioned the city for right to construct and operate a street railway along Liberty St., from Railroad Ave. to Front and other streets.

PASADENA, CAL.—An ordinance has been passed by the trustees granting to Geo. B. Leighton the right to construct and operate an electric street railway on certain streets in Pasadena. H. Dyer, Cy. Clk.

TORONTO, ONT.—It is reported that the Toronto St. Ry. Co. is considering the advisability of extending the Toronto & Scarboro Ry. seven miles from its present terminus, to the west side of the Highland Creek hill. James McDougall, Engr.

SHANGHAI, CHINA.—Consul-General Goodnow, of Shanghai, reports that the construction of an 18-mile overhead wire and trolley street railway is projected for this city. A concession is to be granted to a company, to be known as the Shanghai Traction Co., and will provide for three different routes.

ELECTRIC LIGHT AND POWER.

NEWPORT, R. I.—The plant of the Newport Golf Club, together with the pumping station, was destroyed by fire Oct. 3, causing a reported loss of about $9.000.

ALBION, N. Y.—The board of trustees of the State House of Refuge, it is stated, is considering the question of building a plant.

CENTRAL ISLIP (L. I.), N. Y.—The Commercial Construction Co., 1 Madison Ave., New York, has been awarded the contract, at $27,825, for electric wiring, etc., for the 36 new buildings at the Manhattan State Hospital, Central Islip.

EAST SYRACUSE, N. Y.—The franchise for plant recently granted to M. C. Mulford, of Syracuse, has become void, on account of Mr. Mulford not giving the $5,000 bond within 30 days.

PORT CHESTER, N. Y.—Press reports state that the Port Chester Electric Lighting Co. has purchased the plant and franchises of the Westchester Gas & Electric Co., and will begin in a short time to build a new plant to supply Port Chester, Rye, Harrison and Mamaroneck. Capital stock, $50,000. William E. Ward, Pres.; J. Addison Johnston, Vice-Pres.; William L. Ward, Treas. Walter S. Comby, Secy., writes us that it has not yet been decided when the question of building the new plant will be taken up.

WORCESTER, N. Y.—John Van Benthuysen has been awarded a contract to light this place; the plant to be in operation by Jan. 1.

CAMDEN, N. J.—Bids are asked until Oct. 17 for lighting the streets with electricity for a term of one, three or five years, beginning July 1, 1899. Chn. Com., Chas. C. Southard.

SEA ISLE CITY, N. J.—Walter Sexton, Pemberton, N. J., has submitted the lowest bid for lighting this place with electricity. Mayor Sickles has appointed Councilmen Whittington and Grumley to arrange the contract.

DUNCANNON, PA.—John E. Graybill, York, Pa., has been awarded the contract for constructing the plant at this place. It will have a capacity for 1,000 incandescent and 12 arc lights.

EAST MAUCH CHUNK, PA.—This place is reported to have voted to build a municipal plant.

FREDERICKSBURG, VA.—The committee on light of the council, Capt. T. McCracken, Chn., has presented a report recommending the building of an electric light plant to be owned and operated by the city. The report will be published and bids asked for, after which the matter will be voted on at a special meeting; estimated cost, $13,000. Mayor, A. P. Rowe.

GRAFTON, W. VA.—Bids are asked until Oct. 20 for the purchase of $10,000 of 5% 20-year electric light bonds. Chn. Com., O. G. Angir.

HINTON, W. VA.—The Wilson Aluminum Co., 97 Cedar St., New York, is reported to have begun the construction of a plant for developing the power of the Kanawha Falls and the New River Falls, several miles from this place.

GREENSBORO, N. C.—Bids are asked until Nov. 15 for lighting the streets with electricity for three or more years from Jan. 1. There will be required 70 or more 1,200-c. p. arc lights for city use. Commercial lighting will be wanted. Population, 10,000. Chn. Com., B. H. Merrimon.

SUMTER, S. C.—Bids are asked until Dec. 1. for furnishing this place with 37 2,000-c. p. arc lights for a term of 10 or 15 years; also for furnishing, if necessary, 160 incandescent lights for the opera house. Cy. Clk., C. H. Hurst.

WHITESBURG, GA.—We are informed that the Sewell Paper Co. wishes to purchase a 50-light dynamo, which will also be used to operate a pump 1,200 yards away for pumping water. Prices are wanted for furnishing and for putting in the dynamo.

CRESCENT CITY, FLA.—W. L. MeLeod, Pres. Council, writes us that a franchise has been granted to the Pierpont Mfg. Co. Work on the plant is to be begun within 90 days from Sept. 26, the date of signing franchise.

FLORENCE, ALA.—J. C. Rea, Mgr. Florence Milling Co., writes us that bids are wanted at once for furnishing certain machines for the proposed light plant for its mill. There will be wanted a dynamo and lamps. The power will be taken from the machinery already in place. There will be required 50 16-c p. lights.

OPELIKA, ALA.—Press reports state that the council proposes to build a municipal plant in time to light the city at the expiration of the contracts with the Opelika Electric Light & Power Co.

STURGIS, KY.—The question of electric lighting is being considered.

CAMBRIDGE, O.—Bids are asked until Oct. 10 for furnishing eight arc lights for a term of five years. Cy. Clk., T. R. Deselm.

DAYTON, O.—A new company will soon apply for a franchise for lighting this city with electricity. W. C. Henning, of Henning & Henning, Lawyers, Callahan Bank Bldg., Dayton, may be addressed.

GERMANTOWN, O.—L. S. Crickmore, Mayor, writes us that G. L. McKibben, Van Wert, O., has been engaged to prepare plans and specifications for a plant.

THORNTOWN, IND.—W. E. Young, Clk., writes us that it is doubtful if a plant is built in this place, reported as being considered.

TIPTON, IND.—J. S. Tarkington, Kokomo, Ind., has purchased the plant of the Tipton Electric Light Co., and, it is stated, will extend it.

ST. LOUIS, MICH.—Parker Merrill, Mayor, and J. R. Wilson, City Clerk, will ask the board of supervisors for permission, Oct. 21, to construct a power dam across Pine River. The dam is to be 13½ ft. high above bed of stream, to be built of piles, timber, etc.; to be an overflow dam, with apron at least 200 ft. wide, with intake and tailrace; to have a shute 10 ft. wide for the passage of logs and timber in the middle of the river, and to have a fish-shute, as provided for by law.

WYANDOTTE, MICH.—The question of building a municipal plant is being considered, according to reports.

KENOSHA, WIS.—The Milwaukee, Racine & Kenosha Electric Co. has applied for a new franchise. Mayor Pettit may be addressed.

MARINETTE, WIS.—Harry McCallum, Marinette, is reported to have made a survey of the water power of the Peshtigo River for H. Zech, of Crivitz, Wis.

BURLINGTON, IA.—The council is considering plans for redistricting the city and changing the lights. There are at present 131 arc and 290 incandescent lights, while under the new arrangement there would be 230 arc lights of 2,000 c. p. Mayor Naumann may be addressed.

SHERIDAN, MONT.—The council has granted Mr. Quirk a franchise for a plant; it to be completed in a month.

WYNNE, ARK.—Bids are asked until Oct. 15 for constructing a plant and water-works, to cost about $15,000. Cy. Recdr., Geo. W. Eldridge.

SENECA, MO.—The question of lighting this place with electricity is being considered by the Brodrick Realty Co.; population, 1,500.

WHARTON, TEX.—G. C. Gifford is reported as arranging for the construction of a plant and water-works for this place.

TEKOA, WASH.—The plant owned by Frank Mahoney and Edward Mahoney was destroyed by fire Sept. 20, causing a reported loss of about $1,500.

PORTLAND, ORE.—The council has awarded the contract for lighting the streets for two years from April 1, 1899, to the Portland General Electric Co. Gen. Mgr., H. W. Goode.

LONG BEACH, CAL.—The building of a plant to cost about $12,000 is being urged by Mayor Johnson.

LAKE MEGANTIC, QUE.—The question of building a plant is being considered by the council, according to reports.

MONTREAL, QUE.—The Lachine Rapids Hydraulic & Land Co., Montreal, is reported to have been awarded the contract for furnishing power to the plant of the Standard Light & Power Co., 11 Chenneville St. A number of improvements will be made to the plant. Supt. L. R. H. & L. Co., R. S. Kelsch.

PORT ARTHUR, ONT.—Edward S. Janison, Arch., 151 La Salle St., Chicago, Ill., is making efforts to have a power plant and canal built above the Ecarte Falls on the Kaministiqua River; estimated cost, $1,000,000.

TORONTO, ONT.—Bids are asked until Nov. 9 for supplying electric energy, to be used for electric lighting, power, etc., and for furnishing the machinery and for installing a complete plant, as described in our advertising columns. Chn. Bd. of Control and Mayor, John Shaw.

EAST LONDON, CAPE OF GOOD HOPE, AFRICA.—It is stated that this city wants bids for lighting the streets by electricity. Population, 10,000.

JOHANNESBURG, TRANSVAAL, AFRICA.—It is stated that the council is raising a loan of $750,000 for extending the city plant, etc. The new plant to be ordered out of this loan comprises a carburetted water-gas plant, two sets of 300-K-W. three-phone generators, with compound condensing engines and boilers of 600 HP.; two direct-coupled exciters of 30 K-W. each, condensing plant and other accessories. British, German and American competition will be considered.

NEW COMPANIES.—Eureka Electric Co., Chicago; $10,000; J. Kusel, Arnold Cohn, H. J. Kusel.

Georgia Lighting & Heating Co., Atlanta, Ga.; $100,000; Pres. and Mgr., Col. J. F. Burke; Secy. and Treas., R. J. Thurmond.

Dowd Electrical Co., Albany, N. Y.; $100,000; Charles Henry Fitch, of Pepperell, Mass., and four others.

Kenova Industrial Co., Charleston, W. Va.; $1,000,000; W. B. Campbell, Philadelphia, Pa.; Henry Kyd Douglas, Hagerstown, Md.; Walter H. Doyle, Norfolk, Va.; Joseph A. Gale, Roanoke, Va.; W. H. Travers, Charlestown, W. Va.

Easton Power Co., Easton, Pa.; $200,000, with $20,000 paid in; Treas., Arthur E. Childs, Boston; Alfred Clarke, Lowell, Mass.; Wm. O. Hay, Easton, Pa.

North Hudson Light, Heat & Power Co., Hoboken, N. J.; Albert B. Carlton, 124 Broad St., Elizabeth, N. J.; Frank M. Stillman, Rahway, N. J.; Samuel Hathaway, Jersey City; Arthur K. Bonta, 200 11th St., Hoboken.

McKinney Electric Light & Motor Power Co., McKinney, Tex.; $17,000; L. A. Scott, J. P. Nenney, D. T. Pardue.

Kitson Hydro-Carbon Light & Heat Co. of Arkansas, Little Rock, Ark.; $500,000, with $125 paid in; the light is an invention of Missouri parties; H. W. Perry, Pres.; E. L. Brown, Maxwell Coffin, J. M. Steward, Ashley Cockerill.

New Jersey-Washington Light Co., 7 Rilsam Bldg., Trenton, N. J.; $100,000, with $1,000 paid in; E. Raymond Perrine, New York; T. R. Allen, Trenton; N. W. Black, Cumbus, N. J.; S. W. Semple, Burlington, N. J.

BRIDGES.

BOSTON, MASS.—Bids are asked until Oct. 10 for two masonry abutments and masonry pier for the bridge on the Columbia Road. B. W. Wells, Supt. Sts.

NIAGARA FALLS, N. Y.—S. F. Arkush, Cy. Clk., informs us that nothing definite has yet been decided for the proposed bridges at Main, Sixth and Pine Sts.

CAMDEN, N. J.—Bids are asked until Oct. 12 for repairing the turntable of the Federal St. draw bridge over Cooper's Creek. Dr. J. B. Davis, Chn. Com.

JERSEY CITY, N. J.—Mortimer Lampson, Comr. St. and Water Bd., has had plans prepared for a proposed viaduct on Communipaw Ave. to extend from Monitor St. to Phillip St., about 1,600 ft.; estimated cost, $90,000.

SOMERVILLE, N. J.—The council has awarded a contract to the Berlin Iron Bridge Co., East Berlin, Conn., for constructing an iron truss bridge of 60-ft. span and 14-ft. roadway.

LACEYVILLE, PA.—A company has been organized by Dr. D. W. Sturdevant, Pres., Geo. L. Johnson, Vice-Pres., John B. Edwards, Secy. and others, for the construction of a bridge at this place, for which the contract has been awarded to the Horseheads Bridge Co., Horseheads, N. Y., at $30,000.

PITTSBURG, PA.—Bids are asked until 12 m., Oct. 7, for refilling approaches and masonry work on certain bridges. W. E. Thompson, County Controller.

TUNKHANNOCK, PA.—Bids are asked by the county commissioners until Oct. 8 for the abutments of the Meshoppen Creek bridge.

SALEM, VA.—Bids are asked until Oct. 22 for constructing two iron bridges across Mason's Creek. J. C. Langhorne, Chn. County Comrs.

DOBSON, N. C.—The county commissioners will reconstruct the iron bridge over Fish River, between Mt. Airy and Dobson.——The floods have destroyed a number of small trestles and bridges on the Northwestern Division of the Southern Ry., in Surry, Wilkes and Forsyth counties.

VAUCLUSE, S. C.—Bids are asked until Oct. 14 for rebuilding a bridge on the Vaucluse & Graniteville Road. Thos. B. Raborn, Supervisor, Aiken, S. C.

CLEVELAND, O.—Bids are asked until Oct. 12 for constructing a stone arch culvert with retaining walls, etc., on Euclid Ave., over Nine-Mile Creek. J. C. Dorn, Clk. County Comrs.

KENTLAND, IND.—Local papers state that five new bridges will be constructed this fall by the county commissioners.

GRAND RAPIDS, MICH.—Reports state that the chief engineer of the Toledo, Saginaw & Muskegon R. R., Mayor Balbirnie and City Attorney Sessions have decided to take immediate steps for a bridge or a grade crossing at Biedler St.

HART, MICH.—C. B. Stevens, Village Pres., informs us that a contract has been let to the Groton Bridge & Mfg. Co., Groton, N. Y., by the township, for building a 1,200-ft. steel bridge 20 ft. wide, on steel tubing and concrete substructure, to cost $6,000.

LANSING, MICH.—Bids are asked until Oct. 10 for erecting the old Michigan Ave. bridge at Kalamazoo St., on a new substructure. An amount of new material, bolts, rods, castings, etc., will be required. Jasper C. Davis, Cy. Engr.

GALESBURG, ILL.—It is reported that the county will construct a new bridge near Abington.

MOLINE, ILL.—Bids are asked until Nov. 30 for designs and for the construction of a high bridge across Rock Creek; also for removing the old structure, as stated in our advertising columns. Maj. W. L. Marshall, U. S. Engr., 1637 Indiana Ave., Chicago, Ill.

DES MOINES, IA.—G. A. Eberhart, Bd. Pub. Wks., informs us that nothing will be done in regard to the proposed bridge over the Des Moines River at East Sixth St., until after April 1, 1899. The abutments may then be contracted for.

ROYALTON, MINN.—Geo. E. Wilson informs us that there is some talk of building a bridge but nothing more.

ST. PAUL, MINN.—A. Munster, Engr. Bridges, informs us that bids were wanted Oct. 4 for constructing a combination bridge, one span 168 ft. long and 32 ft. wide, and 178 ft. of trestle, on masonry foundation.

PARKER, S. DAK.—Bids are asked by the county commissioners until Oct. 11 for constructing four steel bridges over the Vermillion River, according to reports.

COLFAX, WASH.—Bids are asked until Oct. 7 for furnishing the material and constructing a steel bridge of one span 140 ft. long and 20 ft. wide over the North Palouse River, in Palouse City, and a bridge across Union Flat Creek. John Tobin, County Audr.

SEATTLE, WASH.—An ordinance has been passed and referred to the street committee for two bridges on Jackson St.

AUBURN, CAL.—Bids are asked until Oct. 7 for constructing a bridge over the Central Pacific R. R., near Colfax Ave. Lee E. Wallace, Cy. Clk.

SAN JOSE, CAL.—The county surveyor has been authorized to prepare plans for a bridge across Isabel Creek, on the Kincaid Road.

WOODLAND, CAL.—The proposition to repair the bridge across Putah Creek at Winters, or to construct a new steel structure, to cost from $15,000 to $20,000, has been laid over until some future time. No agreement could be made between the county commissioners and the railroad company interested, according to reports.

RATHDRUM, IDAHO.—Bids will soon be asked by the county commissioners for a bridge on the Priest River, according to reports.

TORONTO, ONT.—The council is considering the question of a new bridge over the Don River at Queen St. Chas. H. Rust, Cy. Engr., will report on the cost of a low level bridge.

BUILDINGS.

BOSTON, MASS.—Mead, Mason & Co., 13 Exchange St., Boston, have been awarded the contract for erecting the East Boston high school building, at $203,006.

BROCKTON, MASS.—McIlvain, Unkefer & Co., of Pittsburg, were the lowest bidders, Sept. 28, for the erection, except heating plant and electric wire conduits, of the public building in this city, at $43,353; time, 12 months. Other bidders were: Daniel O'Connell & Son, Holyoke, Mass., $52,000, time, Oct. 1, 1899; Prescott H. Jackson, Brockton, $57,321, 12 mos.; Conners Bros., Lowell, Mass., $57,210, 12 mos.; McNeil Bros., Boston, $58,900, 12 mos.; Mackie Bros., Brockton, $56,800, 11 mos.; Geo. Howard, Brockton, $51,839, 1 year; Norcross Bros, Worcester, Mass, $63,444, 12 mos. Lowest bid accepted.

BROOKLINE, MASS.—Bids are asked until Oct. 6, at 5 p. m., for the erection of a building for police and court purposes at Washington and Prospect Sts. F. W. Lawrence, Chn. Bldg. Com.

NEW HAVEN, CONN.—Bids are asked until Oct. 15 for erecting the New Haven Harbor breakwater light station, as stated in our advertising columns. Lieut.-Col. D. P. Heap, U. S. Engr., Tompkinsville, (S. I.), N. Y.

WATERBURY, CONN.—Bids are asked until Oct. 13 for the erection of the Drayer St. school building. The architect, Theodore B. Peck, 65 Bank St., Waterbury, informs us that the building will be of brick and wood, 73 × 123 ft., two stories in height, with a slate roof, and heated by steam. Augustus I. Goodrich, Chn. District Com.

BINGHAMTON, N. Y.—Burr W. Mosher, Cy. Clk., informs us that Treacey Farley was the lowest bidder, Sept. 20, for erecting an isolation ward for the city hospital, at $4,050. Bids were also received for this work or for heating and plumbing apparatus, from E. L. Sullivan, Youngs & Bogart, John Schulte, D. J. Malone, C. E. Boughton & Co., Shapley & Wells, and Gaylord & Eitapenc.

BUFFALO, N. Y.—Reports state that the U. S. lighthouse board has decided to recommend Congress to appropriate $50,000 for the establishment of a new lighthouse supply station near Buffalo.

CENTRAL ISLIP (L. I.), N. Y.—Bids were received by the Manhattan State Hospital, Pres., Henry E. Howland, 1 Madison Ave., New York, Sept. 22, for the construction of four groups of hospital buildings at this place. McGibben & Son, of Brooklyn, were the lowest bidders for non-fireproof construction, at $656,370; A. Pasquini, of Albany, was the lowest for fireproof construction throughout, at $823,208; and Miles Leonard, of Binghamton, N. Y., the lowest for fireproof construction of three floors and non-fireproof roof, at $734,810, and for fireproof construction of central buildings and connecting corridors, at $679,707. The Artesian Well & Drilling Co., of New York, was the lowest bidder for the water supply and distribution, at $28,720; James Fay, New York, lowest for plumbing and drainage, at $49,750; the Commercial Construction Co., 1 Madison Ave., New York, lowest for the engines and generators, at $11,800, and for electric wire and fixtures, at $27,825. E. Rutzler, 178 Centre St., New York, is also said to have been the lowest bidder for the heating apparatus, at $240,292.

MOUNT VERNON, N .Y.—It is reported that the citizens of this city are agitating the erection of a new library building, to cost about $25,000.

NEW YORK, N. Y.—Plans are being prepared, according to reports, for a new medical department building, for Columbia University, at 1st Ave. and 27th St., to cost about $500,000. Archs., McKim, Mead & White, 160 5th Ave.——Plans have been filed by the city for a 3-story brick and stone engine house, at 119 Maiden Lane, to cost $55,000. Archs., Horgan & Slattery, 1 Madison Ave.; by Gottfried Piel, 333 West 76th St., for a 4-story and attic frame dwelling, at 87th St. and Riverside Drive, to cost $60,000. Arch., Hubert Drosser, 2 Stone St; by W. E. Thompson, 327 West 70th St., for six 4-story brick dwellings, at 329 to 339 West 70th St., to cost $56,000. Arch., J. W. Davison, 225 Cambreling Ave.; by F. V. Gaines, 103 West 93d St., for four 5-story brick flat buildings, on 135th St., near Brown Place, to cost $88,000. Arch., Harry T. Howell, 748 East 138th St.; by Emil Greene, 182 East 72d St., for four 5-story brick flats, on 117th St., near 5th Ave., to cost $104,000. Arch., Edward Wenz, 1491 3d Ave.——E. F. Dobson & Co., 1133 Broadway, is stated to have received the contract for erecting a 7-story apartment building on Central Park West, near 94th St., for William Call, to cost $115,000. Arch., Jas. E. Ware & Son, 3 West 29th St.

NEW YORK, N. Y.—We are informed that the following bids were received Oct. 3 for a heating and ventilating apparatus and electric lighting plant for public school No. 40: Blake & Williams, $30,290; E. Rietzler, $30,225; Francis Bros. & Jellett, $30,950; The Wells & Newton Co., $30,175; Francis Dobson, 218 East 42d St. (accepted), $29,350; Evans, Almirall & Co., $30,150. The bids for a similar plant in public school No. 166 were as follows: Francis Bros. & Jellett, $33,910; Francis Dobson (accepted), $32,500; Blake & Williams, $33,397; James Curran Mfg. Co., $33,975; E. Rietzler, $33,297; The Wells & Newton Co., $33,740; Evans, Almirall & Co., $34,303.

CAMDEN, N. J.—Bids are asked by the supervising architect, Washington, D. C., until Oct. 27, for the construction, except heating apparatus and electric wire conduits, of the U. S. building in this city, as stated in our advertising columns. Archs., Rankin & Kellogg, 1024 Walnut St., Philadelphia, Pa.

CAMDEN, N. J.—W. H. Day, of Camden, was awarded the contract, Sept. 30, for erecting the new high school building at Haddon and Newton Aves., at $52,600. C. W. Cramer bid lowest on the heating apparatus, at $4,000. Arch., Thomas Stephens, Masonic Temple.

AMBLER, PA.—The Trinity Episcopal Church of this place is erecting a new church building, to cost about $50,000.

HOMESTEAD, PA.—The school board has decided to erect a new $50,000 school building in the 2d Ward.

PHILADELPHIA, PA.—Plans have been prepared for a new $30,000 colonial dwelling house, to be erected on Powelton Ave., West Philadelphia, for C. C. Febiger. Archs., H. W. Sellers and Chester Kirk.——Reports state that J. E. & A. L. Pennock will soon erect a 3-story brick, stone and iron stable for the Gas Improvement Co., at 9th and Diamond Sts., to cost $55,000.——A new memorial home will soon be completed in Germantown for the St. Joseph's Female Orphan Asylum, at Church Lane and Stenton Ave., to cost about $65,000.

PHILADELPHIA, PA.—Bids were received by the supervising architect, Washington, D. C., Oct. 3, for the construction of the superstructure, except interior finish, of the U. S. Mint building in Philadelphia. There were 15 bidders. The propositions of Norcross Bros., of Worcester, Mass., at $480,000 for marble, and of Charles McCaul, of Philadelphia, at $441,743 for Mount Desert granite, were the lowest.

YORK, PA.—Bids are asked by the commissioners of York county, at the office of the Security Title & Trust Co., until Oct. 20, for the installation of a steam heating, mechanical ventilating and power plant in the county court house. Arch., J. A. Dempwolf, York.

OAKLAND, MD.—The commissioners of Garrett county have decided to build a new jail building, with steel cages, etc.

NEWPORT NEWS, VA.—The Pauly Jail Mfg. Co., of St. Louis, Mo., is said to have been awarded the contract for the erection of the new city jail and emergency hospital; cost, about $16,000.

NORFOLK, VA.—Bids will soon be asked, according to reports, for the erection of the proposed U. S. court house in this city. Archs., Wyatt & Nolting, 301 North Charles St., Baltimore, Md.

BUCKHANNON, W. VA.—We are informed that bids were asked until Oct. 5 for a jail and sheriff's residence for Upshur county. J. J. Morgan, County Clk.; Harrison Albright, Arch., Charleston, W. Va.

COLUMBUS, O.—The following lump bids are said to have been received by the capitol commission, Sept. 24, for erecting the new addition to the capitol building in this city. Archs., Hannaford & Sons, of Cincinnati, O.:

Andrew Doll	$309,300
N. C. Hinsdale, Detroit, Mich	318,150
P. H. McCormick & Co.,	304.920
L. D. Beaman & Co	325,950
J. A. Rowe & Son	297.800
Nicholl & Carr	330,552
Wittenmeyer Bros., Columbus	354,753
W. H. Ellis, Washington, D. C	292,000
James Westwater, Columbus	311,000
E. M. Campfield & Co., Richmond, Ind	394,000
George Schneider, Columbus	310,000
Norcross Bros., Worcester, Mass	424,224

The commission awarded contracts, Sept. 28, to 13 different bidders, as follows: Daniel W. McGrath, Columbus, for excavation, $2,240; stone masonry, $12,000; fireproofing, $15,237; Scully & Moss, Cincinnati, brick work, $20,700; plastering, $9,900; cement work, $5,493; F. & J. Wittenmeyer, Columbus, cut stone work, $80,000; New Columbus Bridge Co., Columbus, iron work, $43,450; S. & J. Osborne, Jr., & Co., Cincinnati, asphalt, $4,000; Pelt & Schuster Co., Cincinnati, sheet metal work, $1,731.54; Norcross Bros., Cleveland, marble work, $34,700; August Roehr, Bucyrus, carpenter work, $17,770; Mosaic Tile Co., Zanesville, mosaic work, $6,929; E. & J. McNamara, Columbus, plumbing, $9,958; gas piping, $1,027.56; N. D. Beard, Columbus, painting and glazing, $6,250; Pittsburg Heating Supply Co., Pittsburg, steam heating, $4,971; Electric Supply & Construction Co., Columbus, electric light wiring, $3,194.

LANCASTER, O.—Bids are asked by the trustees of the Boys' Industrial School, until Oct. 20, for the erection of a cottage. Secy., C. D. Hilles; Archs., Richards & McCarty, Columbus, O.

DETROIT, MICH.—Plans are being prepared by Nettleton & Kahn for a nurse's home for Grace Hospital, to be erected at Willis Ave. and John R. St.——Spitzley Bros. were the lowest bidders for erecting the new G. A. R. memorial building on the Cass market site, Sept. 24, at $40,382, being for Bedford cut stone and ashler.

CHICAGO, ILL.—The board of education has been granted a permit to erect a new school building, at 627 North Oakley Ave., to cost $85,000; Rosenbaum Bros., to erect a brick elevator, at 457 to 465 85th St., to cost $60,000; Henry Smith, to erect a 4-story brick apartment building, at 6154 to 6158 Madison Ave., to cost $40,000.—Plans are being prepared for a 3-story brick and stone apartment building, to be erected at Vincennes Road and Lafayette Ave., for T. A. Cantwell, to cost $35,000. Archs., Healy & Gilbert, 6305 Cottage Grove Ave.

CHICAGO, ILL.—Bids are asked until Oct. 11 for a heating apparatus for the new pumping stations at Springfield Ave. and at Central Park Ave. L. E. M'Gann, Comr.

DANVILLE, ILL.—Bids are asked until Oct. 12 for putting in place complete the heating and ventilating apparatus, plumbing apparatus and gas piping, laundry machinery, engine, etc., in the laundry building at the Danville branch of the National Home for D. V. S. Arch., W. C. Gunnell.

DUBUQUE, IA.—Bids will soon be asked, according to reports, for erecting the new seminary building for the Theological Seminary, to cost about $250,000. Archs., Buechner & Jacobson, St. Paul, Minn.

ELDORA, IA.—It is reported that the proposition to issue $45,000 in bonds for the erection of a new court house will be voted upon at the November election. Audr., C. R. Lyon.

DE SMET, S. DAK.—The contract for heating the new court house has been let to Hess & Brown, of Watertown, S. Dak., at $1,317. Other bidders were: Pond & Hasey, at $1,645, and the Archambe Heating Co., at $1,523.

KANSAS CITY, MO.—The Portsmouth Investment Co. is said to contemplate the erection of a new auditorium building in this city, to cost $50,000. It is reported that the contract for erecting the building has been let to J. W. Wood, of Chicago.

SPRINGFIELD, MO.—The St. Louis & San Francisco Ry. Co. proposes to erect a $40,000 hospital building in this city, provided that the site be donated.

ST. LOUIS, MO.—A fire in this city, Sept. 28, destroyed the building at 410 North 4th St., occupied by C. & W. McClain, causing a reported loss of about $80,000.——Reports state that the St. Louis Realty & Amusement Co. will erect a new theater building at Franklin and 7th Sts., to cost about $125,000.——T. J. Harbaugh has been granted a permit to erect several store and flat buildings at Taylor and Finney Aves., to cost about $30,000.

COLORADO SPRINGS, COLO.—A fire in this city, Oct. 1, damaged the Antlers Hotel and adjoining buildings, causing a reported loss of $1,000,000.

SEATTLE WASH.—The Great Northern Ry. Co. has been granted a permit to erect a 2-story brick building on Jackson St., near 2d Ave., to cost about $70,000.

TREHERNE, MAN.—The business portion of this village was burned Sept. 27, at a loss of about $50,000.

MEXICO, MEX.—It is reported that Milliken Bros. have been awarded the contract for furnishing the structural iron for the new building to be erected here for R. Booker & Co.; total cost, $150,000. Archs., De Lemos & Cordes, 130 Fulton St., New York.

TOKIO, JAPAN.—Press reports state that M. Manizu, an architect in the service of the Japanese government, is in New York, and that he desires all information and circulars regarding the heating and ventilating of buildings. Address, care of Y. Wooyeno & Co., 540 Broadway, New York.

WATER-WORKS.

HOLYOKE, MASS.—Jos. L. Tighe, Engr., Water Dept., has submitted a report for a new reservoir to supply the Highlands; estimated cost, $50,000.

NORTHFIELD, MASS.—We are informed that H. Osborne, of Northampton, Mass., has been awarded the contract for building an intake reservoir for the water-works for the Mount Hermon School, Northfield. The Deane Steam Pump Co., Holyoke, Mass., has the contract for the pumps, and the Flint Building & Construction Co., Monson, Mass., has the contract for building the supply reservoir and laying the pipe. The school has 700 pupils. Engr., E. C. Davis, Northampton, Mass.

TURNER'S FALLS, MASS.—The Geo. F. Blake Mfg. Co., 93 Liberty St., New York, is reported to have been awarded the contract for furnishing a new pump at the water-works.

WEST SPRINGFIELD, MASS.—At a town meeting held Sept. 27 the water commissioners were directed to employ an engineer to report on methods for a new water supply, etc.; estimated cost of new works, $25,000. Chn. Com., N. T. Smith.

ALDEN, N. Y.—Bids are asked until Oct. 18 for furnishing the materials and for building works to cost about $18,000, as stated in our advertising columns. Engr., J. F. Witmer, 705 Ellicott Bldg., Buffalo, N. Y.; Clk., Albert Yager.

BAINBRIDGE, N. Y.—J. Warren Lamb, Cooperstown, N. Y., is preparing plans for the proposed city works, for which $22,000 in bonds were voted Sept. 10.

BUFFALO, N. Y.—The commissioners of public works received the following bids Sept. 29 for a 20-in. water pipe across Buffalo River at Ohio St.—Hingston & Woods, all the work, $12,025; George W. Moore, laying pipe, etc., $15,494; Lake Erie Boiler Works, pipe, $2,895; Charles A. Haskin, $16,000; Farrar & Trefts, furnishing pipe, $2,343; Buffalo Dredging Co., laying the pipe, $9,750.

CHURCHVILLE, N. Y.—Sage & Potter, of this place, have submitted a proposition to furnish this town with water. The town will lay the pipe and erect the stand-pipe. The contract will be for five or ten years.

EAST HAMPTON (L. I.), N. Y.—A company is about to be organized to build works for this place. The capital stock will be $20,000, of which amount $14,000 has been subscribed. T. J. Gardiner, B. H. Van Scoy and Geo. A. Eldredge are interested.

HARRISVILLE, N. Y.—F. W. Werner, Chn. Com., writes us that J. W. Siegrist, Utica, N. Y., has been awarded the contract for building the works at $6,702.

BRADFORD, PA.—Bids are asked until Oct. 24 for constructing a 92,000,000-gallon storage reservoir, as described in our advertising columns. Secy. Water Comrs., E. N. Braddock.

KNOXVILLE, PA.—Bids are asked until Oct. 12 for furnishing the materials and for building works, as stated in our advertising columns. Engr., Howard Murphy, 260 South 3d St., Philadelphia; Clk., Henry A. Ashton.

BOONSBORO, MD.—W. L. Given, Burgess, writes us that the contract to supply this town with water for fire purposes has been let to the Boonsboro Water Co., who will build the works. The contract for the materials has been let and the construction of the reservoir begun. The contract for furnishing the pipe has been let to the Southern Pipe Co. Engr., H. G. Frederick, Boonsboro, Md., and Millersburg, Pa.

INDIAN HEAD, MD.—Bids are asked until Oct. 8 for furnishing and constructing a steel stand-pipe at the Naval Proving Ground, Indian Head. Chas. O'Niel, Ch. Bureau of Ordnance, Navy Dept., Washington, D. C.

WILLIAMSPORT, MD. — G. W. McCardell, Editor "Leader," writes us that the town is trying to secure plans for works. The town voted to issue bonds for works and an electric light plant, but they have not yet been issued. Population, 2,000.

COLUMBIA, S. C.—W. B. Smith Whaley, Chn., Caldwell Robertson and E. W. Robinson are on the committee to take charge of the letting of contracts for the new works and a sewerage system and to superintend the construction of the same. The contracts will probably be let in a short time; estimated cost, $450,000. Cy. Engr., C. C. Wilson.

GALLATIN, TENN.—D. K. Spillers, Chn. Com., writes us that this place voted Sept. 24 to build works, for which $35,000 will be appropriated. The water supply will be secured from the Cumberland River, three miles distant.

ROCHESTER, KY.—This place will vote Oct. 14 on the question of issuing bonds for works, according to reports.

LEWISVILLE, IND.—A. M. Potter, Jr., Clk., writes us that this village will put in works in the spring. There will be required a 20,000-gallon tank on a tower 60 ft. high.

NEW ALBANY, IND.—The Home Crystal Water Co. was incorporated Sept. 27 with a capital stock of $200,000. The board of directors is as follows: Peter Arlund, Copenhagen, Denmark; George Borgerding, Frank Shefold, Engr., New Albany; Ed. M. Bir, H. T. Sutton, G. E. D. Waggoner and L. Bloomfield. This company was recently granted a franchise by the council, noted in our issue of last week. The company has agreed to begin to furnish water to the city within a year.

TRAVERSE CITY, MICH.—This city has voted to issue $100,000 in bonds for municipal works, according to reports.

CHICAGO, ILL.—Bids are asked until Oct. 11 for furnishing and constructing a steel sheel with four stuffing boxes and glands for a well at the Springfield Ave. pumping station, and also for one at the Central Park Ave. Station. Comr. Pub. Wks., L. E. McGann.

CHICAGO, ILL.—Bids are asked until Oct. 13 for furnishing water tanks and connections for the Chicago Public Library Building. Secy., W. B. Wickersham, Public Library Bldg.

MELROSE PARK, ILL.—Bids are asked until Oct. 10 for furnishing the materials and for constructing works and laying the pipe. Engr., W. B. Ewing, 1706 Marquette Bldg., Chicago; Clk., Wm. Leeseberg.

MONMOUTH, ILL. — I. Trumbull, Chn. Water Com., writes us that the city has purchased ground near the railway and is about to build new works there and abandon the old plant. The council has appropriated $5,800 for work on it this year. It is probable that D. W. Mead, Rockford, Ill., will prepare the plans.

WHITEHALL, ILL.—It is reported that an election will be held Oct. 10 to vote on the question of issuing bonds for works.

BARABOO, WIS.—The Baraboo City Water-Works Co. has decided to increase the water supply from springs located about half a mile from the works. The improvements will be made mostly by the company and probably no contracts will be let. Cy. Engr., W. G. Kirckoffer.

MANILLA, IA.—The council has rejected the bids received by C. V. Campbell, Mayor, Sept. 19 for building works to cost about $3,000. The town will build the works.

OTO, IA.—The question of building works, it is stated, is being considered.

UTE, IA.—It is stated that the council is considering the question of building works at a cost of about $4,000.

WEBSTER CITY, IA.—Jno. E. Quackenbush, Webster City, has been awarded the contract at $3,000 for building a 100,000-gallon water tank on a steel tower 80 ft. high.

CRYSTAL, MINN.—Bids are asked until Oct. 15 for the purchase of $6,000 of 6% 20-year water bonds, according to reports. Chn. Com., W. C. Wilkinson.

ODESSA, MO.—This place is reported to have voted against issuing $10,000 in bonds for works.

WYNNE, ARK.—Bids are asked until Oct. 15 for furnishing the materials and for building the works and electric light plant, estimated to cost about $15,000. Secy. Bd. Pub. Impts., M. Holly; Cy. Recdr., Geo. W. Eldridge.

RODGERS, TEX.—Jos. S. Thompson writes us that work on the proposed plant will be begun about Oct. 15, it will cost about $5,000. Next year a pump will be put in at the artesian well.

WHARTON, TEX.—G. C. Gifford has been granted a 25-year franchise for new works and an electric light plant. It is stated that work will be begun at once.

NEW WHATCOM, WASH.—The council is stated to have made a survey for a new 24-in. water main 8,000 ft. long from Lake Whatcom, to take the place of a smaller main. The improvement will cost about $15,000.

THE DALLES, ORE.—Bids are asked until Oct. 10 for furnishing and laying 2,400 ft. of 12-in. cast-iron water pipe and also 4,120 ft. of 4 to 10-in. pipe, 11,000 lbs. of specials, 16 double-nozzle hydrants, etc. Clk. Water Comrs., Simeon Bolton.

LONG BEACH, CAL.—The question of building municipal works is again being considered; estimated cost, $20,000.

MONROVIA, CAL.—Bids are asked until Oct. 15 for furnishing this place with a water supply, or for constructing works for the city. Clk., W. A. Walker.

SAUSALITO, CAL.—We are informed that the report to the town trustees recommends the construction of a new works by the town, to include a pumping plant with a daily capacity of 200,000 gallons, a 500,000-gallon service reservoir and 10 miles of distributing mains, the water to be procured from wells 1½ miles southwest of the town. Engr., M. M. O'Shaughnessy, Crocker Bldg., San Francisco, Cal.

TUCSON, ARIZ.—Press reports state as follows: The Tucson Water Co., notwithstanding the passage by Congress of an act to enable Tucson to raise money by sale of bonds to build municipal works, is making preparations to enlarge its works. Sylvester Watts, Pres. Water Co., left a few days ago for the East to purchase material for the new works. The works will be changed from a gravity system to a steam plant. A 500,000-gallon stand-pipe will be erected on the highest place in town. The station will be equipped with a 2,000,000-gallon triple expansion and condensing pumping engine. There will be two boilers, each 66-in. shell and 18 ft. long. Test wells have been sunk 30 ft. and fine water has been developed. There will be ten of these wells.

GANANOQUE, ONT.—The question of improving the works and of building a sewerage system is being considered. Mayor, W. B. Carroll.

STIRLING, ONT.—H. S. Ferguson, Reeve, writes us that this place voted Sept. 23 to build gravity works at a cost of $20,000. It is probable that no work will be done until next summer. The water supply will be secured from Somerset Lake, nearly 300 ft. above the town and about two miles distant. Dr. Parker may be addressed.

WINNIPEG, MAN.—The council has decided to offer the English holders of the Winnipeg Water-Works Co.'s bonds $200,000 for the entire plant. This is understood to be final and calls for a release of all liabilities and encumbrances. The bondholders have asked $275,000.

ST. LAMBERT, QUE.—The St. Lambert Water-Works Co. has been incorporated to operate the works already built; capital stock, $100,000; incorporators, T. J. Drummond, Geo. E. Gudevil and Jos. T. McCall.

GLASGOW, SCOTLAND.—Press reports state that the following bids were received last month for furnishing this corporation with water pipe: R. D. Wood & Co., Philadelphia, 12-ft. lengths, $23,971; Robert Maclaren & Co., Glasgow, 9-ft. lengths, $24,274; Robert Laidlow & Son, 9 or 12-ft. lengths, $25,656; D. Y. Stewart & Co., 9 or 12-ft. lengths, $29,199. An amendment was proposed to divide the contract, giving $10,182 worth of it to R. D. Wood & Co., Philadelphia, and the balance to Robert Maclaren & Co., Glasgow. Robert Maclaren & Co. have declined to accept the contract on the conditions agreed to at the meeting. They state that their bid was for the entire contract and not for a fraction. If they accepted the contract as given they would have to add $3.12 a ton extra. Sir James Marwick, Town Clk.

IRRIGATION.

GERING, NEB.—Bids are asked until Oct. 8 for enlarging the Mitchell irrigation district canal, about 28,000 cu. yds. of material to be removed, according to reports. L. L. Raymond, Secy.

EVANSTON, WYO.—Asst. State Engr. C. Johnston has surveyed sites for reservoirs in Uinta county, to supply water to the ranches. A dam will be constructed near Iron Mountain 30 ft. high and 570 ft. long, another 20 ft. high and 430 ft. long and a reservoir on Horse Creek to cover about 10 acres. State Engineer Elwood Mead, Cheyenne, will examine the water rights claims.

BEAUMONT, TEX.—The Pine Island Irrigation & Canal Co., Beaumont, has awarded Contractor Jenkins a contract for a canal, including 300,000 cu. yds. of excavation, 3,800 yds. of flue work, boxing drains, etc.

ALBUQUERQUE, N. MEX.—J. B. Quigley & Co. will put in dams, reservoirs and ditches for irrigating their property, according to reports.

NEW COMPANIES.—Poso Canal & Irrigation Co., Bakersfield, Cal.; $100,000; H. E. Phillips, E. Browns, Spotteswood; E. O. Miller, J. G. Knox, Visalia.

Meadow Irrigation Co., Meadow, Utah; $7,128; Edwin Stott, John Nield, H. G. Lahrum, James M. Stewart and S. M. Smith.

Bingham Irrigation & Falls Co., Idaho Falls, Ida.; $50,000; to build a canal for irrigation and power purposes and a dam 12 ft. high across Snake River. Plans are being prepared by Charles Chapin, and work is to be commenced at once.

Mill Creek Reservoir Co., Woodside, Mont.; $5,000; to construct irrigation ditches to irrigate lands of the west side of Bitter Root River and to generate power to run mills; C. J. Moore, O. L. Kenney and others.

Lamar & Arkansas Ditch Co., Lamar, Colo.; $10,000; to irrigate in Bent and Prowers counties, and to control the Colorado & Kansas canal; Charles Maxwell, Adam Maxwell and C. C. Goddard.

Granite Reservoir & Irrigation Co., Salt Lake City, Utah; A. Brand, J. Boyce, A. W. Thompson and others.

Big Pine Irrigation Co., Big Pine, Cal.; $4,000, with $2 615 paid in; to store water for irrigation, etc.; Louis Schalten, Edward Reinhackle, C. L. Meyers, John W. McMurry and J. C. Crocker.

Calcasieu Irrigation & Rice Milling Co., Alexandria, La.; $500,000; to construct canals from Kinder to the Calcasieu River, to irrigate about 40,000 acres; W. F. Blackman, G. W. Bolton, E. J. Hardtner, A. Alberton, H. S. G. Gossens, J. S. Sullivan, Joseph Levinall, of Alexandria, and G. O. Elms, of Opelousas.

Northwestern Irrigation Co., Kalispel, Mont.; $12,000; Joseph Frederickson, L. H. Bradburn and U. P. Shenfeldt.

SEWERAGE.

SOMERVILLE, MASS. — The aldermen have voted to build a separate house drainage system from the Poplar St. connection of the Metropolitan system; estimated cost, about $20,000. Aldermen Lamont and Kilmer may be addressed.

SPRINGFIELD, MASS.—The sewer committee has been asked to recommend the construction of a new sewer in Oak St., Indian Orchard, to cost about $8,000.

PROVIDENCE, R. I.—Bids are asked until Oct. 7 for constructing about 1,520 ft. of 60, 48 and 36-in. brick sewer. Comr. Pub. Wks., Robt. E. Smith.

NORFOLK, CONN.—This place is reported to have voted to issue $10,000 in bonds for new sewers.

ALBANY, N. Y.—Bids are asked until Oct. 17 for constructing sewers in four streets, and also for improving the drainage of Knox St. Clk. Bd. of Contract, Thos. J. Lanahan.

NEWBURG, N. Y.—The question of building a sewer in First St. is being considered. Aldermen Brown and Bullis may be addressed.

NEW YORK, N. Y.—Bids are asked by the department of sewers, 265 Broadway, until Oct. 19, for constructing a temporary private sewer in 18th Ave., between 57th and 75th Sts., for the drainage of the Disciplinary Training School.

WATERTOWN, N. Y.—The council has been petitioned to build a sewer in Washington St.

CAMDEN, N. J.—Bids are asked by the city clerk until Oct. 10 for building a sewer in Federal St.

NEWARK, N. J.—It is stated that Alexander Potter, 137 Broadway, New York, has submitted a report on the proposed trunk sewer system to tide water. It will be for the use of Newark, Irvington, Millburn and South Orange. It is reported that the system will cost, including the right of way, about $109,000. Chn. Joint Sewer Com., Robt. S. Sinclair, South Orange.

NEWARK, N. J.—Jos. D. Alessio has been awarded the contract for building the East Branch lateral sewers, at $12,951.

PASSAIC, N. J.—Bids are asked until Oct. 15 for constructing a 15-in. pipe sewer in Madison St. Chn. Com., Cornelius Kievitt.

STOCKTON, N. J.—It is proposed to build a 5-ft. brick sewer in Federal St., from Cooper Ave. to Cooper Creek; estimated cost, $7,500.

WOODBRIDGE, N. J.—Bids are asked until Oct. 10 for constructing sewers, as described in our advertising columns. Engr., C. C. Hommann, Perth Amboy, N. J.; Chn. Com., E. W. Christie.

ALLEGHENY, PA.—Bids are asked until Oct. 7 for constructing sewers and for paving in several streets. Dir. Pub. Wks., Robt. McAfee.

PITTSBURG, PA.—Bids are asked until Sept. 6 for constructing sewers and for paving, grading, etc., in a number of streets. Dir. Pub. Wks., Edward M. Bigelow.

SOMERSET, PA.—It is stated that this borough will issue $20,000 in bonds for a system. Secy. Council, R. E. Myers.

PRINCESS ANNE, MD.—The town commissioners are considering the question of extending the system.

COLUMBIA, S. C.—W. B. Smith Whaley, Chn. Com.; W. J. Murray and Robt. W. Shands are on the committee to let contracts for building the proposed system and the water-works. It is probable bids will be asked soon.

BUCYRUS, O.—The committee has recommended the construction of sewers in Elm and Prospect Sts.

DAYTON, O.—Bids are asked until Oct. 6 for building a storm water sewer in Loraine Ave. Pres. Bd. City Affairs, J. L. Baker.——Bids are also asked until Oct. 12 and 17 for storm water sewers in two streets.

GLENVILLE, O.—Bids are asked until Oct. 26 for the purchase of $21,000 of 6% sewer bonds. Mayor, Robt. C. Wright; Clk., I. C. Farley.

MARION, O.—Bids are asked until Oct. 7 for building 1,475 ft. of 15-in. pipe sewer. Cy. Clk., Jas. I. Beatty.

INDIANAPOLIS, IND.—Bids are asked until Oct. 12 for building a local sewer in La Salle St. Chn. Bd. Pub. Wks., M. A. Downing.

SHERIDAN, IND.—Specifications have been prepared for constructing about 3,800 ft. of 24 to 12-in. pipe sewers in 4th St. Engr., J. A. Nutchell; Pres. Bd. Trustees, Jas. E. Starbuck.

CHICAGO, ILL.—The engineering commission has completed its plans for the 95th St. sewer system by which the Calumet district is to be drained. It is understood that the plans contemplate an outlay of from $1,500,000 to $2,000,000. In view of the fact that there is at present a large number of workmen in this city out of employment, Mayor Harrison is anxious to have the work under way during the winter. L. E. McGann, Comr. Pub. Wks.

BELOIT, WIS.—Bids are asked until Oct. 11 for constructing sewers in several streets. Chn. Bd. Pub. Wks., E. S. Greene.

BURLINGTON, IA.—Bids are asked until Oct. 17 for constructing the foundation of the outfall of the Valley St. sewer; excavating about 1,000 cu. yds., riprap about 800 cu. yds., Portland cement concrete about 500 cu. yds., piling about 8,000 lin. ft.; check, $800. Cy. Engr., Emmet Steece.

CLINTON, IA.—Bids are asked until Oct. 11 for constructing 36 to 10-in. pipe sewers in several streets. Cy. Clk., W. E. Russell.

COLUMBIA, MO.—R. K. Roberts, Cy. Clk., writes us that the proposition to issue $25,000 in bonds for a system was defeated Sept. 27.

INDEPENDENCE, MO.—S. H. Woodson, Mayor, writes us that a proposition for building sewers in this city will be voted upon within 50 days. Engr., Andrew Rosewater, Bee Bldg., Omaha, Neb.; Cy. Engr., H. M. Pendleton.

DENVER, COLO.—The board of public works has adopted plans for a system in Capitol Hill storm sewer District No. 1; estimated cost, $400,600. It is expected that work will be begun soon and that the system will be completed by Oct. 1, 1900. Engr., H. C. Lowrie.

VICTOR, COLO.—M. Donovan has been awarded the contracts for building a system at $57,980, according to reports.

GRASS VALLEY, CAL.—Geo. L. Nusbaumer, Oakland, Cal., has submitted a report and estimates for a system to cost about $37,000. Cy. Surv., Fred. M. Miller.

LONG BEACH, CAL.—It is proposed to construct a system at a cost of about $25,000. Mayor Johnson may be addressed.

LOS ANGELES, CAL.—Plans have been approved for a sewer in the Arroyo de los Posos district; estimated cost, $10,000.

GANANOQUE, ONT.—The question of building a system and water-works is being considered. Mayor, W. B. Carroll; Geo. Taylor, Dr. E. L. Atkinson and J. F. Green are on the committee.

GARBAGE DISPOSAL—STREET CLEANING

LANSINGBURG, N. Y.—Adolph C. Sorensen has been awarded the contract, at $1,872, for removing the refuse from the streets for one year, beginning Oct. 1.

ATLANTIC CITY, N. J.—Bids were asked until Oct. 3 for constructing a Smith-Siemens garbage crematory. Engr., M. V. Smith; Chn. Com., S. H. Kelly; Clk., E. D. Irelan.

CLEVELAND, O.—Bids are asked until Oct. 3 for furnishing the apparatus and for removing the ashes, soot, debris, etc., from the Fairmount and Division St. pumping stations for one year. Dir. Pub. Wks., Geo. R. Warden.

BAY CITY, MICH.—The Sanitary Garbage Co. has been granted a license to collect kitchen refuse.

OMAHA, NEB.—The question of purchasing a road scraper and a street sweeper is being considered. Alderman Barrett may be addressed.

KANSAS CITY, MO.—It has been decided to build a garbage dump at a cost of about $2,300. Supt. of Bldgs., Wallace Love.

STREETS AND ROADS.

GLOUCESTER, MASS.—The committee has recommended the purchase of a new road roller to cost $3,500, according to reports.

NEWBURYPORT, MASS.—Bids are asked until 12 m., Oct. 6, for constructing 4,600 lin. ft. of highway. T. C. Mendenhall, Chn. State Highway Comn., Boston.

WOBURN, MASS.—An ordinance has been presented to the council to appropriate $6,500 for macadamizing.

WICKFORD, R. I.—This place has appropriated $15,000 for macadamizing.

NEW LONDON, CONN.—Bids are asked until Oct. 15 for improving Ocean Ave.; surety, $1,000. Geo. K. Crandall, Cy. Surveyor; Peleg Williams, Chn. Com.

AUBURN, N. Y.—E. H. Herrling, Cy. Clk., informs us that a contract has been awarded to the Warren-Scharf Asphalt Paving Co., New York, at $1,750 for 1,015 sq. yds. of asphalt, as a sample.

GREECE, N. Y.—John Paine informs us that plans have been secured for the improvement of the Ridge road, but have not yet been submitted to the board of supervisors.

KINGSTON, N. Y.—John T. Cummings, Cy. Clk., informs us that the question of paving 5,000 sq. yds. with asphalt, at an estimated cost of $10,000, will be reported favorably by the street committee, provided that the adjacent property owners sustain 75% of the cost. W. Klingberg, Cy. Engr.

NEW YORK, N. Y.—Bids are asked until Oct. 13 for paving the carriageway at 59th St. and Fifth Ave. with asphalt. Geo. C. Clausen, Comr. Parks, Arsenal, Central Park.

PORT CHESTER, N. Y.—Bids are asked by the village trustees until Oct. 10 for the purchase of $42,000 of 3½% street paving bonds.

POUGHKEEPSIE, N. Y.—A petition has been presented to the board of public works for Trinidad sheet asphalt paving on North Clover St., for 760 ft.

SCHENECTADY, N. Y.—The council has fixed the cost of the proposed Albany St. paving. at $26,868.

YONKERS, N. Y.—The Barber Asphalt Co., New York, has been awarded a contract by the council, at $37,143, for paving on South Broadway with sheet asphalt.

ELIZABETH, N. J.—Peter Bonnett, P. Egenolf, Joseph McManus, Fred. C. Marsh and H. H. Isham have been appointed a committee to consider the question of paving the city streets with asphalt, according to reports.

PLAINFIELD, N. J.—An ordinance will be introduced in the council Oct. 7 for asphalt paving on Park Ave., Watchung Ave., Front St. and Somerset St.; estimated cost, about $24,395. Elliot T. Barrows, Chn. Com.

RIVERTON, N. J.—Bids are asked until Oct. 6 for constructing sidewalks on portions of Lippincott Ave. Edward Stoughton, Mayor; Chas. S. Walnut, Borough Clk.

ALLEGHENY, PA.—Bids are asked until 2 p. m., Oct. 7, for grading and paving Pennsylvania Ave., between Allegheny Ave. and Beaver Ave. Robt. McAfee, Dir. Dept. Pub. Wks.

OAKMONT, PA.—Bids were received Oct. 5 for the purchase of $65,000 of 4% street improvement bonds. Albert McGee, Pres. Council; W. A. Tomlinson, Clk.

PHILADELPHIA, PA.—The bureau of highways has asked for an appropriation of $1,497,588 for the year 1899.

RANKIN, PA.—Reports state that new bids will be asked by the council for paving Bell Ave; Ott Bros., Pittsburg, to whom the contract was awarded, at $3,885, have withdrawn.

SHARPSBURG, PA.—Bids are asked until Oct. 18 for the purchase of $60,000 in 4% street improvement bonds. Geo. D. McMorran, Chn. Finance Com.

YARDLEY, PA.—The Delaware River Quarry & Construction Co., Philadelphia, has been awarded a contract, at $5,475, for about 7,000 sq. yds. of macadam on Main St.

WILMINGTON, DEL.—Bids are asked until 7 p. m., Oct. 6, for grading and laying cement walks in the 8th St. Park. Henry R. Smith, Chn. Park Com.

ANNAPOLIS, MD. — The county commissioners have awarded a contract to Joseph M. Bryan, Baltimore, at $2,399, for about three-fourths of a mile of gravel road.——The council has appropriated $12,000 to pave Prince George St. with brick. L. J. M. Boyd, Frank H. Stockett, D. O. Parlett, Com.

OAKLAND, MD.—Reports state that the council will issue $25,000 in bonds for street improvements, and an electric light plant.

LEESBURG, VA.—It is reported that the Leesburg & Point Rocks Turnpike Co. has awarded a contract to Frank E. Conrad, Winchester, Va., at $6,000, for improving the road between Leesburg and Limestone.

PIEDMONT, W. VA.—Bids are asked by the council for brick paving in Childs Ave., according to reports.

ATLANTA, GA.—Bids are asked until Oct. 28 for furnishing and constructing asphalt brick or stone paving at the county jail yard. Grant Wilkins, Engr., 9½ Peachtree St.; Walter R. Brown, Chn. County Comrs.

NEW ORLEANS, LA.—Bids are asked until Oct. 10 for paving a portion of Canal St. with asphalt and brick. W. S. Douglass, Comptroller.

CLEVELAND, TENN.—J. I. Harrison, County Clk., informs us that the question of issuing bonds for new roads, etc., may be considered by Jan. 1.

BRIDGEPORT, O.—Reports state that the proposition to issue $60,000 in bonds for paving, is again to be voted upon.

CLEVELAND, O.—Bids are asked until Oct. 14 for grading, etc., and brick paving on seven streets. Geo. R. Warden, Dir. Pub. Wks.

CLEVELAND, O.—Bids are asked until Oct. 28 for grading, draining, curbing and brick paving in Scott and six other streets. Geo. R. Warden, Dir. Pub. Wks.

HAMILTON, O.—L. A. Dillon, Cy. Engr., has submitted plans for the proposed macadamizing of North 3d St.; estimated cost, $32,288. The plans have been referred to the committee on public improvements.

MARSHALL, O.—Resolutions have been passed to pave portions of Lafayette Ave., Jefferson Ave., North St. and Arrow St. with Trinidad asphalt. Jno. G. Miller, Mayor; A. R. James, Cy. Clk.

ZANESVILLE, O.—Bids are asked until Oct. 8 for furnishing material and grading and paving Luck Ave., from Abington Ave. to Belknap St. C. N. Bainter, Cy. Clk.

INDIANAPOLIS, IND.—A hearing will be given Oct. 17 to consider the proposed improvement of portions of Southerland Ave., 27th St., Miami St. and College Ave., by constructing new sidewalks, grading, paving, etc. M. A. Downing, Chn. Bd. Pub. Wks.

LOGANSPORT, IND.—Bids are asked until Oct. 17 for furnishing the material and for excavating, grading and asphalt paving on 8-in. concrete base, on Market St.; surety, $500. A. D. Fansler, Cy. Clk.

GRAND RAPIDS, MICH.—The board of public works has awarded a contract to Albert Prange, at $7,233, for improving Lyons St., and to Rens & Hoogerhyde, at $3,790, for improving Grand Ave.

BLOOMINGTON, ILL.—Bids are asked until 12 m., Oct. 6, for furnishing and constructing pavement in one alley. C. F. Koch, Pres. Bd. Local Improvements.

WATERTOWN, WIS.—H. Mulberger, Mayor, writes us that bids for paving five blocks of Main St. with brick were opened Sept. 17. Only two bids were received, which, owing to irregularities in each and to the high figure, $4.80 a lin. ft., front, including curbing, were not accepted. It is apparently the intention of the council to increase the proposed amount of paving to 15 blocks, for which the contract will be awarded early next spring.

ST. PAUL, MINN.—L. W. Rundlett, Cy. Engr., has submitted estimates to the board of public works for the proposed paving in East Seventh St.; with asphalt, $35,710; sandstone, $37,400; brick, $30,655. The contract will be awarded some time between Feb. 1 and April 1.

FARGO, N. DAK.—J. A. Johnson, Mayor, writes us that it is proposed to pave 80,000 sq. yds. with cedar block,at $1.06 per sq. yd. Bonds will be issued, bearing 7%, due on or before Jan. 1, 1910, and to be retired at any time after Jan. 1, 1902. S. F. Crabbe, Cy. Engr.

ST. LOUIS, MO.—Bids are asked until Oct. 14 for maintaining the natural rock asphalt pavement on Olive St., between Grand Ave. and Vandeventer Ave. Robt. E. McMath, Pres. Bd. Pub. Wks.——A hearing will be held Oct. 14 to consider petitions for improvements in 14 alleys and 18 streets; estimated cost, $189.520. Emory S. Foster, Secy. Bd. Pub. Wks.

FORT WORTH, TEX.—The city engineer has been instructed to estimate the cost of different materials for paving in Main, Houston and Cross Sts.

SHERMAN, TEX.—C. P. Gregory, Chn. St. Com., informs us that no money has yet been appropriated for the proposed paving.

PORTLAND, ORE.—The council proposes to grade portions of six streets. A. N. Gambell, Auditor.

OAKLAND, CAL.—A contract has been awarded to Hillhouse & Reardon to pave Clay St. with bitumen, from Seventh St. to San Pablo Ave.

SAN FRANCISCO, CAL.—The street committee has decided to pave 15 blocks with bitumen.

WINDSOR, ONT.—John Bairs, Mayor, informs us that no steps have been taken towards asphalt paving, as stated in our issue of July 21.

MEXICO, MEX.—The Mexican Asphalt Pavement Co. has been awarded a contract for about 36,000 sq. yds. of sheet asphalt paving on the streets of the Paseo Land & Improvement Co.

MANUFACTURING PLANTS.

OTIS, ME.—It is reported that Whitcomb & Haynes, of Elkworth, Me., will erect a mill this fall at the foot of Floods Pond.

WEYMOUTH, MASS.—The Bradley Fertilizer Co.'s works at Weymouth were damaged by fire, Sept. 28, causing a reported loss of $500,000. Insurance was as follows: $85,000 on the building, $53,000 on the machinery and $107,000 on the stock.

HARRISON, N. J.—A fire in this city, Sept. 28, destroyed the leather factory of Hahn & Stumpf, at Warren and Jersey Sts., causing an estimated loss of $70,000. The plant consisted of a dozen 2-story frame buildings, and contained considerable machinery.

LUZERNE, PA.—The foundry of J. T. Snyder, at Bennet Station, was recently destroyed by fire, causing a loss of about $12,000.

PARKERSBURG, W. VA.—The sawmill, dryhouse and lumber yard of Kreps & Pope, situated several miles east of this city, were totally destroyed by fire. Loss, $20,000; insurance, $4,000.

ANDERSON, S. C.—It is reported that efforts are being made to organize a company, with a capital stock of $125,000, to erect a new cotton mill in this city. Among those interested are: R. S. Hill, Pres. of Farmers' & Merchants' Bank; J. R. Vandiver, Dr. S. M. Orr and Geo. M. Evans.

LOUISVILLE, KY.—The Callahan & Sons Grain Co. has been granted a permit to erect a grain elevator at 13th and Lexington Sts., to cost $14,500.

CINCINNATI, O.—The Lodge & Shipley Machine Tool Co., of Cincinnati, informs us that all the contracts, except for brick and carpentry work, have been let, including engines, boilers and electric plant.

PAINESVILLE, O.—The Robison Basket Co., of this city, informs us that it has erected a temporary building to replace the one destroyed by fire on Aug. 7, causing a loss of over $100,000, and that from 23,000 to 25,000 grape baskets are now manufactured daily. Pres., Jas. T. Robison.

BEDFORD, IND.—Reports state that the Portland Cement Co., of Utah, has leased oolithic limestone lands near Bedford, and will erect a $125,000 plant.

CHEBOYGAN, MICH.—Thompson Smith's Sons, sawmill, at Duncan City, a suburb of Cheboygan, was damaged by fire Sept. 26, causing a loss of about $125,000; insurance, $60,000.

ENSLEY, ALA.—It is reported that the Riter-Conley Co., of Pittsburg, has contracted to erect ten 50-ton "Wellman" rolling furnaces for an open-hearth steel furnace plant for the Alabama Steel & Shipbuilding Co., at Ensley.——We are informed that the Tennessee Coal, Iron & R. R. Co., who operate foundries at Birmingham, Ala., and at South Pittsburg, Pa., is about to erect a new foundry, 240 × 80 ft., at Ensley, to do its own work. Vice-Pres., J. Bowron, Birmingham, Ala.

CUMBERLAND, WIS.—The plant of the Beaver Dam Lumber Co., including mill, yards and contents, was totally destroyed Sept. 29, causing a reported loss of $150,000.

HOPE, KAN.—It is reported that the Kansas Cement Co. is making arrangements to double its present capacity. Mgr., Major H. B. Merrell.

CARTHAGE, MO.—The elevator of McDaniel & Morrow was burned Sept. 24, causing a loss to the building of $30,000.

CRIPPLE CREEK, COLO.—It is proposed to build a hot water heating plant for supplying heat to the buildings in this city, to cost about $100,000.

BELLEVILLE, ONT.—The council has decided to offer a $50,000 bonus to F. A. Mitchell, of Norwich, Conn., to have him remove his rolling mills to this city.

GAS PLANTS.

SHIPPENSBURG, PA.—Reports state that J. H. Miller, McKeesport, Pa., has leased the works of the Shippensburg Gas Co., and will improve the plant.

FLORENCE, ALA.—Reports state that the Florence Gas Light & Fuel Co. will enlarge its plant and lay several thousand feet of additional mains. A proposition has been made to the council to furnish 65 additional street lights.

SANTA ROSA, CAL.—The Santa Rosa Lighting Co. will extend the gas pipe line on East Fourth St., from McDonald Ave. to St. Helena Ave., and on Cherry St., from Beaver to King St.

GALT, ONT.—The council has decided to purchase the plant of the Galt Gas Light Co., according to report.

NEW COMPANIES.—Seneca Oil Co., Salamanca, N. Y.; $144,000; to produce petroleum oil and gas; Edward B. Vreeland, Salamanca, and others.

Hope Natural Gas Co., Oil City, Pa.; $500,000, with $200,000 paid in; to produce, pipe and sell natural gas; E. Strong, John Tonkin and H. McSweeney, of Oil City, Pa.; C. N. Payne and Robert S. Hampton, of Titusville, Pa.

MISCELLANEOUS CONTRACTS.

TELEPHONE SYSTEM.—Jackson, Mich.—The New State Telephone Co. has been granted a franchise in this place.

DAM.—Middletown, O.—The state dam will be repaired, at an estimated cost of $4,350. Chas. Hayman, Supt. Canals, Columbus.

TELEPHONE SYSTEM.—Bordentown, N. J.—The council has granted a franchise to the Bordentown Telephone & Telegraph Co.

TELEPHONE SYSTEM.—St. Paul, Minn.—The Mississippi Valley Telephone Co. has been granted a franchise to operate in this city.

STEAM TENDER.—Louisville, Ky.—Bids are asked until Oct. 29 for constructing a steam tender. Capt. Geo. A. Zinn, U. S. Engr., Louisville.

TELEPHONE LINE.—Elyria, O.—A new telephone line will be constructed between Lorain and Elyria, by the Ohio Toll Line Co., according to reports.

WALL.—Atlanta, Ga.—Bids are asked until Oct. 28 for building a brick and stone wall and for the material for the county jail enclosure. A. L. Kontz, County Clk.

BULKHEAD. — Stockton, Cal. — Bids are asked by the board of public works for constructing a bulkhead 110 ft. long at the wharf of the Navigation & Improvement Co.

JETTY.—Stockton, Cal.—State Engineer Randall is preparing plans for a jetty 1,500 ft. long and 125 ft. wide, at the mouth of the San Joaquin River, according to reports.

CHANNEL.—Waterbury, Conn.—R. A. Cairns, Cy. Engr., writes us that the following bids were received Sept. 24, 1898, for dredging a channel in Little Brook; all local bidders; Chatfield & Chatfield awarded contract:

Quantities.		Chatfield & Chatfield.	Gaffney & Martin.	Edw. McManus.
6 × 5½-ft. conduit.*	215 lin. ft.	$17.25	$25.00	$17.00
6 × 4½-ft. conduit*	200 " "	15.25	21.00	16.75
Stone paving†	20 sq. yds.	.75	1.35	1.25
Extra for Portl'd cement	200 cu. yds.	1.15	4.75	1.69
Manholes	2 each	15.00	12.00	24.00
Receiving basins	3 "	18.00	95.00	30.00
Total		$7,088	$10,861	$7,506

*Brick and concrete. †Dry, 15 in. deep in old channel.

Channel excavation, about 8 ft. deep by 10 ft. wide; gravel and boulders. Brook water to be cared for during construction. Several buildings are to be gone under and supported at considerable expense. There will be 8-in. sewer brick; a lower lining of 4-in. vitrified brick, and a concrete invert of 8 ins., 1½ ft., and 2 ft.

CANAL FEEDER.—Chicago, Ill.—Maj. W. L. Marshall, U. S. Engr., received the following bids Sept. 21 for constructing eight miles of earthwork for a feeder of the Illinois & Mississippi Canal, south of Rock Falls, Ill., for which work there is available $200,000, as advertised in Engineering News:

Bids Received at Chicago, Ill., Sept. 21, 1898, for Canal Feeder on the Illinois & Mississippi Canal.

Bidder.	Earthwork, Miles 1 to 8, inclusive. 1, 243,055 cu.yds. cts.	2, 160,488 cu.yds. cts.	3, 113,678 cu.yds. cts.	4, 133,293 cu.yds. cts.	5, 119,531 cu.yds. cts.	6, 160,699 cu.yds. cts.	7, 190,597 cu.yds. cts.	8, 149,876 cu.yds. cts.
Joel E. Loomis, Prophetstown, Ill.	....	....	9.0	11.0	....	....	....	....
J. H. McShane & Co., Omaha, Neb.	....	....	....	....	....	....	14.45	14.45
Cogan & Pound, Chicago, Ill.	15.0	15.0	11.5	11.5	10.0	12.0	12.0	12.0
Callahan Construction Co., Omaha, Neb.	11.5	13.63	11.9	13.25	8.35	12.75	13.9	11.8
Michael Sullivan, Cincinnati, O.	21.0	18.0	17.0	18.0	....	....	....	....
Corbett & Currie, Chicago, Ill.	....	....	....	....	7.95	....	....	....
Canal Construction Co., Chicago, Ill.	18.0	16.0	14.5	14.5	14.5	14.75	15.75	15.75
John J. McCaughey, Summit, Ill.	....	....	....	....	19.9	16.64	....	....
R. C. Cushing & Co., Chicago, Ill.	18.0	20.0	20.0	18.0	20.0	17.0	17.0	17.0

DREDGING.—Oakland, Cal.—Bids are asked until Oct. 17 for dredging Lake Merritt; estimated cost $80,000. (Postponement from Oct. 12.) H. W. Thomas, Secy. Bd.

LEVEE WORK.—Columbus, O.—Bids are asked until Oct. 11 for furnishing the material and repairing and heightening the levee along the Scioto River. Jas. A. Fanning, Clk.

TUNNEL.—Cambridge, Mass.—Bids are asked until Oct. 8 for a tunnel in the court yard at East Cambridge. Olin W. Cutter, Arch., 85 State St., Boston; L. S. Gould, County Comr., Boston.

STONE WALL.—San Francisco, Cal.—Bids are asked until Oct. 28 for constructing a stone wall along the southern boundary of the military reservation. Lieut.-Col. Oscar F. Long, Dept. Q. M., 36 New Montgomery St.

TELEPHONE LINE.—Brussels, Belgium.—Press reports state that Consul Roosevelt, Brussels, reports under date of Aug. 15 that a telephone line will be constructed between Brussels, Berlin and Paris, about 621 miles long.

PARK WORK.—New York, N. Y.—Bids are asked until Oct. 13 for furnishing material and setting granite coping, asphalt, etc., laying out tree plots, sod, etc., and erecting a lavatory, including cement floor and steps. Geo. C. Clausen, Comr. Parks, Arsenal, Central Park.

TELEPHONE LINE.—Bel Air, Md.—The Baltimore & Hartford County Telephone Co. has been incorporated with a capital stock of $60,000 to construct 12 miles of telephone line. The directors are Dr. J. F. H. Gorsuch, H. J. Hollingsworth, D. F. Benson, Edward J. Bell and Walter P. Reckord, Mgr.

HARBOR IMPROVEMENTS. — Montevideo, Uruguay.— Bids are asked by the provisional government of Uruguay for the improvement of the harbor of Montevideo; estimated cost, $15,000,000. Tenders from American and European contractors are desired, according to reports. Albert W. Swalm, U. S. Consul.

BRIDGE SUBSTRUCTURE.—Westfield, Mass.—We are informed that the following bids were received Sept. 26, 1898, for building the substructure for a bridge over Little River at Main St., Westfield, as advertised in Engineering News; F. T. Ley & Co. received the contract; Engrs., O. E. Parks:

Bidder.	Piling, 7,000 lin. ft.	Grillage, 10,000 ft. B. M.	Concrete, 240 cu.yds.	Rubble masy, 530 cu. yds.	Cut stone, 50 cu. yds.	Total.
F. T. Ley & Co.[1]	$0.15	$35.00	$6.50	$7.20	$14.55	$7,504
A. H. Wright & Son.[1]	.17	21.50	5.00	8.50	16.90	7,955
R. D. Maynard[1]	.18	30.00	6.00	9.00	17.00	8,620
G. M. Atkins & Co.[2]	.20	25 00	7.00	9.00	16.00	8,900
Lathrop & Shea[3]	.18	22.00	6.00	9.75	17.00	8,938
W.N.Flynt Gran. Co[4]	.20	23.00	6.75	9.95	16 00	9,324
H. C. Wood[5]	.16	27.30	10.80	8.95	16.25	9,541
H. W. Warner[6]	.25	30.00	7.50	9.00	20.00	9,620
G. R. Blodgett[5]	.18	30.00	8.50	9.25	22.50	9,628
Maloney & Peterson.[1]	.24	22.00	8.00	9.00	22.00	9,690

[1] Springfield. [2] Palmer. [3] New Haven, Conn. [4] Monson. [5] Westfield. [6] Leeds.

STEEL RAILS.—Washington, D. C.—The following bids were received by the U. S. Engineers Sept. 6, 1898, for furnishing steel rails; (1) being rails per ton; (2) for plates, each, (3) for bolts per 100; Penn Steel Co., Steelton, Pa., (1) $20, (2) 15 cts., (3) $2,50; Barber & Ross, Washington, (1) $22.82; W. A. Pate, Washington, (1) $23.90, (2) 39 cts, (3) $2.10.

BRICK PAVING.—Salamanca, N. Y.—G. E. De Golia informs us that the following bids were received Sept. 28, for brick paving; contract being let to Sheehan & McGahn:

Bids Received at Salamanca, N. Y., Sept. 28, 1898, for Brick Paving.

Quantities.		Sheehan & McGahn, Bradford,	M.H.Hubbell & Co.,Salamanca,	Peter Schenck, Meadville, Pa.	B. U. Taylor, & Co., Olean, N. Y.	E. Fee, Olean, N. Y.	G. Berlin, Meadville, Pa.	Ross & Robinson.	Jamestown Contract'g Jamestown, N. Y.
Excavating	5,250 cu. yds.	$0.18	$0.20	$0.30	$0.24	$0.20	$0.22	$0.25	$0 20
Pavement	9,755 sq. yds.	1.24	1.24	1.21	1.35	1.33	1.20	1.34	1.27
Curb Straight	7,695 lin. ft.	.30	.30	.32	.44	.38	.40	.30	.33
Curb Circular	390 " "	.50	.30	.63	.54	.54	.55	.50	.40
Curb Resetting	230 " "	.10	.10	.10	.10	.20	.25	.14	.10
4-in. tile	200 " "	.10	.04	.15	.06	.08	.20	.18	.06
Sewer manholes	10 each	25.00	23.00	26.00	30.00	24.00	22.00	25.00	20 00
Catchbasins	3 "	30.00	25.00	25.00	25.00	24.00	22.00	33.00	18.00
Sewer inlets	3 "	30.00	10.00	18.00	17.00	13.50	15.00	25.00	18 00
Total		$16,018	$15,938	$16,529	$18,487	$17,573	$16,582	$17,380	$16,477

PARK.—Philadelphia, Pa.—Chief Eisenhower, Bureau of Pub. Property, City Hall, is receiving estimates on plans, etc., for a new city park, to be located at Allegheny Ave., Wellington, Ellwood and Belgrade Sts. A fountain will be erected in the center and other work will include grading, walks, paving, curbing, etc.

TELEPHONE SYSTEM.—Thomasville, N. C.—The Thomasville Telephone Co., with a capital stock of $6,000, has been incorporated by F. S. Lambeth, J. W. Lambeth, C. A. Julian, J. F. Haden, W. E. Evans, R. W. Thomas, C. R. Thomas, W. M. Morton, A. Johnson, J. B. Boone and J. A. Green, to erect a telephone system in Thomasville and Davidson county.

PARK WORK.—Philadelphia, Pa.—The commissioners have asked for an appropriation of $561,000 for the maintenance of Fairmount Park for the coming year, which will include a new east shore drive, $50,000; dredging the Schuylkill River, $25,000; sprinkling drives, etc., $20,000; macadamizing, $10,000; electric lighting, gasoline and naphtha lamps, $42,300; electric lights in the East,West and Wissahickon sections, $32,300; etc.

CONTRACT PRICES.

STONE JETTIES.—Green Harbor, Mass.—Frederick N. Wales, Clk. Bd. Harbor and Land Comrs., Room 131, State House, Boston, writes us that the following bids were received Sept. 22, 1898, for constructing stone jetties at Green Harbor, as advertised in Engineering News: Thos. A. Rowe, 209 Washington St., Boston, $1.47 a ton; Simon Hess, 28 Bond St., New York, $1.44; Rockport Granite Co., 31 State St., Boston (awarded contract), $1.19; Keyes & Daloia, 12 Marion St.,Charlestown, $1.49; Pigeon Hill Granite Co., Rockport, Mass., $1.65; S. & E. S. Belden, Hartford, Conn., $1.63.

WATER PIPE, ETC.—Nashville, Tenn. — F. E. Kuhn, Secy. Bd. Pub. and Affairs, writes us that the following bids were received Sept. 27, 1898, for furnishing cast-iron water pipe, pig lead, valves and hydrants; 6-in. water pipe, 250 tons:

	A ton.
Addyston Pipe & Steel Co., Cincinnati	$17.00
R. D. Wood & Co., Philadelphia	21.00
Ohio Pipe Co., Columbus, O.	18.08
Dennis Long & Co., Louisville	16.34
*Keith, Simmers & Co., Nashville	14.75

*Agents for the Chattanooga Pipe Works, awarded contract.

Pig Lead, five tons.	A 100 lbs.
Clark & Knight, Nashville	$4.29½
Keith, Simmers & Co., Nashville	4.29½
National Lead Co., Louisville, Ky.	4.40
N. O. Nelson Mfg. Co., St. Louis	4.30
L. M. Rumsey Mfg. Co., St. Louis (accepted)	4.25
6-in. Valves, 25.	Each.
Keith, Simmers & Co., Rensselaer valve	$12.00
Keith, Simmers & Co., Ludlow valve (accepted)	11.24
Ludlow Valve Mfg. Co., Troy, N. Y.	11.25
Fire Hydrants, 25.	Each.
R. D. Wood & Co., Philadelphia	$17.84
Michigan Brass & Iron Works, Detroit (accepted)	16.40
Geo. S. Parks & Co., Agents	22.00

MASONRY DAM.—Hyde Park-on-the-Hudson, N. Y.—We are informed that the contract for building an uncoursed rubble stone masonry dam set in Knickerbocker Portland cement mortar has been let to D. Cuozzo, 150 Nassau St., New York, at $9.08 a cu. yd. Engr., Owen Morris, Hyde Park.

STREET CLEANING.—Los Angeles, Cal.—T. J. Zeehandelaar, Secy. Merchants' & Manufacturers' Association, writes us the contract for the street cleaning has been awarded to Franklin & Alexander, 201 Currier Bldg., Los Angeles, at 14½ cts. a 1,000 sq. yds. The life of the contract is from Nov. 21, 1898, to July 1, 1901. The area covers about 15 miles of asphalt paved streets; the work to be done daily by machine. In addition to the contract let the city will sweep the business portion of town (76,942 sq. yds.) by hand every day during business hours, the work to be done under the direction and supervision of the street superintendent. Local papers state that the following were the bids received Sept. 12, 1898, for the street cleaning: Specifications A being for machine sweeping of the entire city, specifications B for hand-sweeping the business section of the city, and specifications C for machine sweeping of all paved streets not included under B: H. R. Tibbets, specifications A, 23½ cts. a 1,000 sq. yds.; C. A. Potter, specifications A, 26½ cts. a 1,000 sq. yds.; Franklin & Alexander, specifications A, 14½ cts. a 1,000 sq. yds.; specifications B, 55 cts. a 1,000 sq. yds.; specifications C, 18½ cts. a 1,000 sq. yds.; Ramish & Marsh, specifications A, 21 cts. a 1,000 sq. yds.; B, 55 cts. a 1,000 sq. yds., C., 21 cts. a 1,000 sq. yds.; W. I. Hollingsworth, specifications A, class 1, 26 cts. a 1,000 sq. yds.; class 2, 28 cts. a 1,000 sq. yds.; class 3, 30 cts. a 1,000 sq. yds.; specifications B, to furnish 20 men with hand brooms and shovels, besides the necessary men to sprinkle the roadway and remove dirt, for 59 cts. a 1,000 sq. yds.; specifications C, 31 cts. a 1,000 sq. yds.

ELECTRIC LIGHT PLANT.—Grand Rapids, Mich.—The following bids were received Sept. 20 for furnishing the machinery, etc., and for building a plant, as advertised in Engineering News; in total bids for boilers all are for Hawley furnaces, except the Arbuckle-Ryan Co.; Engrs., Nagle & Ball, New York Life Bldg., Chicago, Ill.; Pres. Bd. Pub. Wks., Wm. T. Johnston; Secy., Fred A. Twamley:

BIDS RECEIVED AT GRAND RAPIDS, MICH., SEPT. 20, 1898, FOR MACHINERY, ETC., FOR AN ELECTRIC LIGHT PLANT.

Boilers.

Bidder.	Type.	Capacity.	Heating surface, sq. ft. Boilers.	Heating surface, sq. ft. Economizer.	Boilers. Plain grate.	Boilers. Hawley.	Boilers. Murphy.	Boilers. Roney.	Boilers. American.	Economizer.	Stack.	Total.	Evaporation, Ind. screenings.	Time, days.
Aultman & Taylor Mfg. Co., Mansfield, O.	Hor. water-tube.	(3) 200-HP.	6,111	2,016	$6,950	$1,800	$1,960	$2,080	$1,950	$1,960	$2,750	$13,463[1]	8 lbs. screenings.	75
Babcock & Wilcox Co., New York	" "	(3) 203-HP.	6,108	2,016	7,775	2,400	Add $600* and $525.†			2,107	3,501	16,658[2]	8½ lbs. Ind. scr's.[3]	75
Heine Safety Boiler Co., St. Louis, Mo.	" "	(3) 200-HP.	4,944	.....	7,233	2,400	Add $310.†		2,166	.....	2,950	......	7½ lbs. screen'gs	90
Henry Brobst	" "	(3) 200-HP.	6,000	2,016	6,349	2,400	.....	.....	.....	2,104	3,375	14,266[4]	8 lbs. Ind. slack.	110
Wickes Bros., East Saginaw, Mich.	Vert. water-tube.	(3) 200-HP.	6,036	2,016	5,792	2,100	.....	.....	2,166	2,119	2,719	12,730	8 lbs. Ohio slack.	90
Arbuckle-Ryan Co. (Stirling), Chicago	" "	(3) 200-HP.	6,210	2,016	7,000	.....	2,500	.....	.....	2,100	3,000	14,600	10½ lbs. lump.[5]	..

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*For oven furnace. †For flues. [1] For 200 lbs. pressure add $1,050; $240 per 1-10-lb. forfeit or bonus. [2] Add $350 for molded fire brick; $100 per 1-10-lb. forfeit or bonus. [3] 8½ lbs. Ind. run of mine. [4] $100 for ¼-lb. forfeit or bonus. [5] West Virginia coal = 14,500 B. T. U.

Engines.

Bidder.	Type.	Revolutions.	Horse-power.	Engines.	Condenser.	Total.	Steam used, lbs.	Correction. Steam used.	Correction. House and crane.	Comparative value.
Arbuckle-Ryan Co., Chicago, Ill.	Tanden triple.	150	(2) 600	$15,366	$5,100	$20,466	13.5	......	$7,000	$27,466
	" comp.	150	(2) 600	12,966	5,100	18,066	15.0	$4,688	7,000	29,753
	" "	150	(2) 300	10,281	4,700	14,981	15.5	6,250	7,000	28,231
Bullock Mfg. Co., Chicago (Williams).	" triple.	460	(6) 110	......	.....	23,300	14.7	3,750	.....	27,050

Electrical Apparatus.

Bidder.	Price of dynamos, including switchboard. 80 lights.	100 lights.	125 lights.	150 lights.	(6) 125 lights.	500 lamps and carbons. Single.	Do'ble.	Enclos'd.	Pole line complete.
Western Electric Co., Chicago, Ill.	$1,680	$2,069	$2,808[1]	$2,897	$16,850[1]	$8,630	$9,713	$8,455	$36,500
			2,706	3,147	16,234				
Fort Wayne (Ind.) Electric Corporation	1,653	2,054	2,655	3,094	......[6]	8,555	9,788	8,380	......
General Electric Co., Schenectady, N. Y.	1,709[2]	2,147	2,731	3,216	16,183[3]	8,605	9,637	8,524	......
	1,709	2,697[4]							
Adams-Bagnall Electric Co., Cleveland, O.	.....	.....	.....	.....	......	8,750	.....	9,000	......
Chase Construction Co., Detroit, Mich.	.....	.....	.....	.....	......	8,500	.....	8,610	35,870
Electric Installation Co., Chicago, Ill.	.....	.....	.....	.....	......	.....	.....	.....	34,000
Furniture City Elec. Co., Grand Rapids, Mich	.....	.....	.....	.....	......	.....	.....	.....	36,000
G. R. Electric, Light & Power Co.	.....	.....	.....	.....	......	.....	.....	.....	37,500[5]

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[1] Direct-connected, 460 revolutions. [2] 6.5 ampere dynamo. [3] 9.6 ampere dynamo only. [4] 110 lights. [5] Pole line (proposition 5) without towers, $12,340; cost to make compare with new line, $25,160; total, $37,500. [6] Only 5 dynamos bid on.

Chase Construction Co., Detroit, Mich.—(3) 200-HP. Cahall B. & W. boilers, (2) 600-HP. Russell engines No. 2, (6) 60-K-W. dynamos, 500 arc lamps A-B, pole line construction; total, $89,970; boilers, 200 lbs. extra, $1,050, total, $91,020; B. & W. boilers, extra, $3,243, total, $93,213; Stirling boilers, extra, $935, total, $90,905; triple expansion Russell engine No. 1, $2,400, total, $92,370; (2) 400-HP. compound engine, deduct $3,085, total, $86,885; 6 direct-connected engines extra, $6,490, total, $96,460. The Chase company secured the contract at $89,970. N. Y. Finance & Construction Co., New York.—(3) 233-HP. automatic engines, 240 revolutions; (4) 150-HP. Parkhurst compound boilers, steam piping, (6) 125-light dynamos, foundations, belts, crane and scales; total, $55,600. Arbuckle-Ryan Co.—Bid No. 1.: (2) 600-HP. triple engines, (3) 200-HP. Stirling boilers; total, $35,000; bid No. 2.: (2) 600-HP. compound engines, (3) 200-HP. Stirling boilers; total, $32,600; bid No. 3.: (2) 400-HP. compound engines, (3) 200-HP. Stirling boilers; total, $29,600.

LAYING WATER PIPE.—Lynn, Mass.—The following contract was let by the Metropolitan Water Board, Boston, Sept. 15, 1898, to O'Rourke & Nelson, Boston, for laying cast-iron pipe in Lynn: Laying 16-in. cast-iron pipe, 12,200 lin. ft., 65 cts.; laying 12-in. cast-iron pipe, 2,800 lin. ft., 45 cts.; laying 4-in. cast-iron pipe for blow-offs, 200 lin. ft., 25 cts.; excavation—rock, above grade, 25 cu. yds., $2.00; rock, below grade, 10 cu. yds., $3.50; earth, below grade, 10 cu. yds., 50 cts.; setting air valves, 5 valves, $1.50 each; chambers for valves less than 20 ins. diameter and air valves, 19 chambers, $20.00 each; concrete masonry, 10 cu. yds., $2.50; total, $9,743.

ARC LIGHTING.—Peoria, Ill.—Robt. M. Orr, Cy. Clk., writes us that the contract for lighting the city for two years from Nov. 1, with 400 2,000-c. p. arc lights has been renewed with the Peoria General Electric Co. at $98 a light a year; the service to be all night and every night.

QUAY WALL.—San Francisco, Cal.—We are informed that the following bids were received Sept. 24, 1898, by Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Washington, D. C., for building an extension to the quay wall at the Mare Island Navy Yard, San Francisco:

Bidder.	A lin. ft.	Total.	Length wall.
T. Thomson, San Francisco	$72.00	$24,552	341 ft.
J. A. McMahon, San Francisco	70.75	24,126	341 "
Johnson & Petersen, Oakland	79.40	30,966	390 "
W. H. Healy, San Francisco	68.45	26,696	390 "
Cal. Bdg & Constn Co, Oakdale	.....	29,969	...
San Francisco (Cal.) Bridge Co.	81.10	27,655	341 "

ASPHALT PAVING.—Louisville, Ky.—The Southwestern Alcatraz Co. submitted the lowest bid Sept. 27 for asphalt paving at $18 and $17.50 a sq. of 100 ft., 5-year guarantee, and at $24 and $23 a sq., 10-year guarantee.

BRICK PAVING.—Scranton, Pa.—The following bids were received in councils Sept. 22, 1898, for paving a portion of Dix Court with vitrified brick on a 6-in. concrete base: V. H. O'Hara, Scranton, Pa., $1.73 a sq. yd. for pave, 47 cts. a lin. ft. for straight curb, 83 cts. a ft. for circular curb, 15 cts. a lin. ft. for resetting curb; M. J. Ruddy, Scranton, $1.75 a sq. yd. for pave, 49 cts. a lin. ft. for straight curb, 85 cts. a lin. ft. for circular curb; W. S. Langstaff, Jr. and Thos. J. Hughes, Scranton, Pa., $1.88 a sq. yd. for pave; 47 cts. a lin. ft. for straight curb, 82 cts. a lin. ft. for circular curb. Joseph P. Phillips, Cy. Engr.

LEVEE WORK.—Marysville, Cal.—The levee commissioners awarded the following contracts Sept. 15, 1898, for levee work near Marysville: Jacob Schimpf, sections 1, 4 and 5, for 3,667 cu. yds., at 22½ cts.; 3,596 yds., at 19c.; 3,941 yds., 18c, respectively. Willis, O'Brien & Ruff, section 2, 4,549 cu. yds., 19½ cts.; John Lopez, section 3, 602 cu. yds., 17½ cts. Work will be commenced at once.

ASPHALT PAVING.—Chicago, Ill.—The Barber Asphalt Paving Co. has been awarded the contract, at $2.15 a sq. yd., for asphalt paving in North Clark St. and in North State St. The work is to be completed Oct. 31 and Nov. 30, respectively, for each street.

SIDEWALKS.—St. Paul, Minn.—The following were the only bids received by the board of public works for removing about six miles of old wooden sidewalks and laying cinder and gravel walks: Nicholas Feyen, 15.7 cts. a lin. ft., grading, 30 cts. a cu. yd.; Fielding & Shefley, 10 cts. a lin. ft., grading 15 cts. a yd.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—
New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.75 cts.
Chicago—Angle bars, 1.10 cts. to 1.15 cts.; spikes, 1.55 cts. to 1.60 cts.; track bolts, hexagonal, 1.90 cts. to 2.00 cts.; square, 1.80 cts. to 1.90 cts.

RAILS, STEEL—
New York, new, $18.00 to $19.00; old iron, $11.00 to $11.50; old steel $9.00.
Chicago, new, $20.00 to $22.50; old iron, $12.50 to $12.75; steel, $7.75 to $8.50.
Pittsburg, new $18.00 to $19.00; old iron, $13.50 to $13.75; steel, $10.00.

STRUCTURAL STEEL—
New York—Beams, 1.40 cts. to 1.45 cts.; channels, 1.40 cts. to 1.45 cts.; tees, 1.45 cts. to 1.50 cts.; angles, 1.25 cts. to 1.30 cts.; rivets, 1.75 cts. to 1.85 cts.
Chicago—Beams, 1.35 cts. to 1.50 cts.; channels, 1.35 cts. to 1.50 cts.; tees, 1.40 cts. to 1.50 cts.; angles, 1.30 cts. to 1.35 cts.
Pittsburg—Beams, 1.20 cts. to 1.30 cts.; channels, 1.20 cts. to 1.30 cts.; tees, 1.20 cts. to 1.25 cts.; angles, 1.10 cts. to 1.15 cts.

PLATES AND SHEETS—
New York—Universal mill plates, 1.25 cts. to 1.30 cts.; tank, 1.35 cts. to 1.40 cts.; shell, 1.40 cts. to 1.45 cts.; flange, 1.60 cts. to 1.70 cts.; firebox, 2.25 cts. to 2.50 cts.
Chicago—Universal mill plates, 1.30 cts. to 1.35 cts.; tank, 1.25 cts. to 1.30 cts.; shell, 1.55 cts. to 1.65 cts.; flange, 1.30 cts. to 1.50 cts.; firebox, 1.75 cts. to 4.00 cts.; sheets, 2 cts. to 2.05 cts.
Pittsburg—Universal mill plates, 1.10 cts. to 1.15 cts.; tank, 1.10 cts. to 1.15 cts.; shell, 1.30 cts. to 1.35 cts.; flange, 1.20 cts. to 1.25 cts.; firebox, 1.35 cts. upwards; sheets, 1.90 cts. to 1.95 cts.

MERCHANT STEEL—
Machinery, per lb., 1.60 cts. to 1.70 cts.
Tool, per lb., 5.50 cts. to 7 cts.

IRON—
Pig Iron:
New York—No. 1, $11.25 to $11.50; No. 2, $10.50 to $10.75.
Chicago—No. 1, $11.50 to $12.50; No. 2, $11.00 to $12.00.
Pittsburg—No. 1, $10.50 to $10.75; No. 2, $10.10 to $10.25.
Bar Iron:
New York, common, $1.07½ cts. to 1.10 cts.; refined, 1.15 cts. to 1.20 cts.
Chicago, common, 1.05 cts. to 1.10 cts.; refined, 1.15 cts. to 1.20 cts.
Sheets:
Common American, per lb., 1.45 cts. to 2.55 cts.
Russia, per lb., 10½ cts. to 11 cts.

LUMBER—
New York:
Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.
Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in. butts, 4¼ cts. to 4½ cts.
Spruce, special cargoes, per M, $15.00 to $17.50.
Yellow pine, random cargoes, $14.50 to $17.00.
North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.
San Francisco:
Oregon pine, per M, $15.50 to $17.50.
Redwood, per M, $18.00 to $20.00.
Redwood tank stock, up to 10 ft., $24.00 to $25.00.

GENERAL MATERIALS—
Lead, New York, 3.90 cts. to 3.95 cts.
Nails, Pittsburg, 1.40 cts.
Solder, per lb., 8¼ cts. to 11½ cts.
Spelter, per lb., 3.90 cts. to 4.00 cts.
Copper ingots, 12.25 cts. to 12.40 cts.
Granite, rough, New York, cu. ft., 40 cts. to 50 cts.
Limestone, New York, cu. ft., 70 cts. to 80 cts.
Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.
Slate, Penn. block, per square, $4.00 to $5.00.
White lead, American, per lb., 5½ cts. to 6 cts.
Lime, common state, per bbl., 70 cts.

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INDUSTRIAL NOTES.

THE AMERICAN VITRIFIED CONDUIT CO., New York, has the contract to construct the conduits for the underground wires and cables of the Narragansett Electric Lighting Co., Providence, R. I. Mr. C. J. Field, M. Am. Inst. E. E., 30 Broad St., New York, is the General Manager and Engineer of the former company.

THE ALABAMA BRIDGE AND BOILER CO., Birmingham, Ala., has made an assignment. It is stated that the company had a capital of $12,000.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., announces that it has secured control of the Melan patent for concrete-and-steel arch bridges in the New England States.

THE ST. LOUIS CAR CO., St. Louis, Mo., has orders for 250 street cars from the Japanese government, according to report, to be shipped within 90 days, and to cost about $300,000.

THE RITER-CONLEY CO., Pittsburg, Pa., manufacturers and builders of blast furnaces, steel plants, iron roofs, buildings, etc., has become an incorporated company under the firm-name of the Riter-Conley Mfg. Co.

LA COMPAGNIE GENERALE DES ASPHALTES DE FRANCE, LTD., known as the General Asphalt Co., has opened an office at 204 Carondelet St., New Orleans, La., in charge of Mr. Alfred F. Harley, Consulting Engineer.

THE GOULD'S MFG. CO., Seneca Falls, N. Y., has of late been awarded contracts for a number of municipal pumping plants, among the latest being orders from St. Mary's, Pa., for a large double-acting triplex power pump, operated by a gas engine, and also at Lanesboro, Minn., Morris, Minn., and some large contracts for Canadian towns.

THE CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., has orders for four 100-inch hydraulic riveting machines for the Schoen Pressed Steel Co., Pittsburg; a 1,000-ton hydraulic flanging press for the Riter-Conley Co., Pittsburg; a four-ton hammer for the Burgess Steel & Iron Co., Portsmouth, O.; a complete hydraulic riveting plant for the Cleveland Steam Boiler Co., Cleveland, O., and an order for 80 tons of steel castings for a Western foundry.

WATER-WORKS APPLIANCES.—The following exhibits of water-works appliances were made at the meeting of the Central States Water-Works Association at Springfield, O., Sept. 27-9:

General Supplies.—Dayton Supply Co., Dayton, O.; H. Mueller Mfg. Co., Decatur, Ill.

Meters.—National Meter Co., New York city; Thomson Meter Co., Brooklyn, N. Y.; Pittsburg Meter Co., East Pittsburg, Pa.; Neptune Meter Co., New York city; H. R. Worthington, New York city; Hersey Mfg. Co., South Boston, Mass.

Miscellaneous.—Wm. Engberg, St. Joseph, Mich., Automatic Device for Controlling Valves; R. D. Wood & Co., Philadelphia, Pa., Mathews Fire Hydrant; Hoppes Mfg. Co., Springfield, O., Live Steam Feed Water Purifier; Trump Mfg. Co., Springfield, O., Hoppes Meter Box; Lagonda Mfg. Co., Springfield, O., Weinland Boiler Tube Cleaners; Moran Flexible Steam Joint Co., Louisville, Ky., Flexible Joints; Lead-Lined Iron Pipe Co., Wakefield, Mass., Service Pipe; Henry R. Worthington, New York, Pumps; A. P. Smith Mfg. Co., Newark, N. J., Pipe Tapping Machines; G. T. Latta, Ludlow, Ky., Hydraulic Tunnelling Apparatus for Service Pipes.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies READS ENGINEERING NEWS

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PERSONAL.

Mr. A. M. Parent has been appointed Manager of the works of the Pullman Palace Car Co., Chicago, Ill.

Mr. F. C. Finkle, of San Bernardino, Cal., has been appointed Chief Engineer of the Redlands Electric Light & Power Co., Redlands, Cal.

Mr. F. S. Higbid has been appointed Roadmaster of the Panama R. R., to succeed Mr. R. G. Ward, with headquarters at Colon, Columbia.

Mr. Richard Caffrey, General Roadmaster of the Lehigh Valley R. R., with headquarters at South Bethlehem, Pa., has been appointed Engineer of Maintenance of Way.

Mr. John E. Davis, civil engineer, of Oskaloosa, Ia., was married, Sept. 28, to Miss Laura A. Gunn, of that city. Mr. Davis was formerly City Engineer of Oskaloosa.

Mr. W. S. Huyette, contracting engineer for Wickes Bros., Saginaw, Mich., stationary and marine boiler makers, has opened an office at 1214 Marquette Building, Chicago.

Mr. Elwood Mead, M. Am. Soc. C. E., State Engineer of Wyoming, has been studying irrigation in Montana in connection with an investigation being carried on by the U. S. Department of Agriculture.

Mr. Albert S. Crane, Jun. M. Am. Soc. C. E., Assistant Engineer in the Department of Sewers, New York city, has resigned to accept the position of Assistant Engineer of the American Lake Superior Power Co., Sault Ste. Marie, Mich.

Mr. W. P. Brown, M. Am. Soc. C. E., has assumed charge of the New York office of the King Bridge Co., located at 501 Fifth Ave. Mr. Brown has been connected with the King Bridge Co. for a number of years at their home office in Cleveland, O.

Mr. G. R. Joughins, formerly Superintendent of Motive Power of the Norfolk & Southern R. R., with office at Berkeley, Va., has been appointed Mechanical Superintendent of the Intercolonial Ry., with headquarters at Moncton, N. B.

Prof. Edgar W. Bass, Professor of Mathematics in the United States Military Academy at West Point, has been placed on the retired list. Professor Bass graduated at West Point in the class of 1868. He was appointed Professor of Mathematics ten years later, and has held the position ever since.

Mr. Andrew C. Cunningham, M. Am. Soc. C. E., of the firm of Stowell & Cunningham, civil engineers, of Albany, N. Y., and Mr. Fred. Thompson, civil engineer, of the District of Columbia, have been appointed Civil Engineers in the United States Navy, with the relative rank of Lieutenant (junior grade).

Mr. Wm. Jackson, M. Am. Soc. C. E., City Engineer of Boston, will make a study of the bridges in the principal large cities in Europe, to obtain information for use in connection with his work as engineer of the Cambridge (Massachusetts) Bridge Commission. According to press dispatches Mr. Jackson sailed early this week.

Mr. L. N. Case, Superintendent of the water-works at Detroit, Mich., has been appointed Manager of the Duluth, Minn., water-works, to succeed Mr. C. E. Vanbergen, resigned. Mr. Vanbergen's appointment was noted in our issue of Sept. 8. Mr. Jas. S. Matterson has been appointed Assistant Secretary of the Duluth Water-Works.

Mr. J. W. Schaub, M. Am. Soc. C. E., has opened an office at 1731 Monadnock Block, Chicago, for independent practice as a bridge engineer. He was formerly Engineer of the Detroit Bridge & Iron Works, Detroit, Mich., and later of the Hamilton Bridge Works, Hamilton, Ont. Mr. Schaub has recently perfected designs for a new type of bascule bridge.

Capt. Alfred E. Hunt, M. Am. Soc. C. E., President of the Pittsburg Reduction Co., Pittsburg, Pa., who went to the front with Battery B, 18th Regiment Pennsylvania Volunteers, is prominently mentioned as a desirable candidate for the next Mayor of Pittsburg. He recently returned here from the front in very poor health, but has been rapidly recuperating.

Mr. G. H. Dunlop, civil engineer, of Melbourne, Victoria, Australia, is now in this country, on his way to England. He is studying American methods and machinery for the excavation and handling of material, including steam shovels, grading machines and conveying plants, with a view to introducing them on work in Australia. He is the inventor of a new form of wooden lining for tunnels, which has been used in about 3,500 ft. of sewer tunnel in Melbourne.

Hon. John H. Moffitt, General Manager of the Syracuse Rapid Transit Ry., Syracuse, N. Y., who for the past eight years has been connected with the street railways of that city, has resigned his position. Mr. C. Loomis Allen has been appointed Acting General Manager to fill the vacancy. Mr. Allen has been the Engineer of the Syracuse street railways for the past four years, during their construction and reconstruction, and lately has held the position of Assistant General Manager.

Mr. R. Krumm, of Columbus, O., says U. S. Minister Allen, of Corea, under date of July 16, 1898, has been engaged as Chief Engineer of the Corean government. He is "to direct all engineering work, such as the laying out of irrigation works, roads, bridges, fortifications, etc." Mr. Krumm, who is a graduate of the University of Ohio, has a five years' contract, at $300 a month for the first year, and an increase of $50 a month each year. He will also have house and certain other expenses, it is said, paid by the government. He is now engaged on the Seoul-Chemulpo Ry.

The officers of the American Society of Civil Engineers, for the coming year, as named by the Nominating Committee, and which are to be voted for Jan. 18, 1899, are as follows: For President, Mr. Desmond FitzGerald, Boston, Mass.; Vice-Presidents, Mr. Robert Cartwright, Rochester, N. Y., and Mr. Robert Moore, St. Louis, Mo.; Treasurer, Mr. John Thomson, New York city; Directors, Messrs. John A. Bensel, C. W. Buchholz and Saml. Whinery, New York city; Mr. Edmund K. Turner, Boston, Mass.; Prof. Palmer C. Ricketts, Troy, N. Y., and Mr. Jas. D. Schuyler, Los Angeles, Cal.

OBITUARY.

Gen. Jas. L. Botsford, a retired iron manufacturer, died at Youngstown, O., Oct. 6, aged 66.

Mr. Elbert Fleet, formerly Fire and Water Commissioner of Long Island City, N. Y., died Oct. 5, aged 62.

Mr. Charles Patterson, civil engineer, died suddenly, at Mapimi, Mex., Aug. 26. His home was in Doylestown, Pa.

Mr. Platte R. Bush, civil engineer, of Saginaw, Mich., died in Harper Hospital, Detroit, Aug. 4, aged 25. He was a graduate of the University of Michigan, Ann Arbor.

Mr. W. H. Cline, Chief Engineer, U. S. N., retired, died in the Long Island College Hospital on Oct. 5. He was born in Baltimore on Sept. 3, 1837. In 1861 he entered the Navy on the ship "Wyoming," and took part in the chase of the "Alabama." He was promoted to Chief Engineer in 1887, and retired on Aug. 27, 1894.

Mr. A. W. Stedman, late Chief Engineer of the Lehigh Valley R. R., died at Mauch Chunk, Pa., Oct. 7. Mr. Stedman entered the service of the Lehigh Valley R. R. when a boy, as a rodman in the engineer corps, and worked his way up to the position of Chief Engineer, which position he held until about three years ago, when his health began to fail.

Mr. William E. Gilbert, Vice-President and Treasurer of the Gilbert Car Mfg. Co., Green Island, N. Y., died at Eagle Mills, N. Y., Sept. 29, aged 58. He was born in Troy, N. Y., and became associated with his father, the late Uri Gilbert, in 1863, under the firm name of Uri Gilbert & Son, railway car builders. In 1882 the firm became the Gilbert Car Mfg. Co., and Mr. Wm. E. Gilbert became the Vice-President and Treasurer.

Mr. Silas E. Weir, a member of the engineering staff of the West Virginia Central & Pittsburg R. R., died at his home in Elkins, W. Va., Oct. 5, of typhoid fever. He was born in New Brunswick, N. J., and graduated from Rutgers College, in that city, in 1871. He was for some years City Engineer of New Brunswick, and later went to Kentucky, where he built several railway tunnels. He was afterwards made Engineer in charge of the Wilkesbarre Division of the Lehigh Valley R. R.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ST. LOUIS RAILWAY CLUB.
Oct. 14. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

ENGINEERS' CLUB OF COLUMBUS.
Oct. 15. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' CLUB OF PHILADELPHIA.
Oct. 15. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

TECHNICAL CLUB OF OMAHA.
Oct. 17. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Oct. 17. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Oct. 17. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Oct. 18. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 18. Annual meeting, Buffalo, N. Y. Secy., R. W. Raymond, P. O. Box 223, New York city.

AMERICAN ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 18-20. Annual meeting, Richmond, Va. Secy., S. F. Patterson, Boston & Maine R. R., Concord, N. H.

WESTERN SOCIETY OF ENGINEERS.
Oct. 19. "Masonry," Geo. S. Morison. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Oct. 19. "Stave Pipe—Its Economic Design and the Economy of Its Use," Arthur L. Adams. Secy., C. W. Hunt, 220 W. 57th St., New York city.

ENGINEERS' CLUB OF ST. LOUIS.
Oct. 19. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Oct. 19. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Oct. 19. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Oct. 19. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.
Oct. 19-20. Annual meeting, Scranton, Pa. Secy., S. P. Light, Lebanon, Pa.

AMERICAN GAS LIGHT ASSOCIATION.
Oct. 19-21. Annual meeting, Niagara Falls, N. Y. Secy., Alfred E. Forstall, Montclair, N. J.

ENGINEERS' CLUB OF CINCINNATI.
Oct. 20. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

NEW YORK RAILROAD CLUB.
Oct. 20. "Purchasing Materials," H. B. Hodges. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Oct. 20. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

CHICAGO ELECTRICAL ASSOCIATION.
Oct. 21. "Practical Points on Electrical Measurement," W. B. Hale. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Oct. 25. Secy., Wm. H. Searles, Case Library Building, Cleveland, O.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 26-28. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 27. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 27. Secy., C. B. Wilson, 1,000 Broad St., Nashville, Tenn.

BROOKLYN ENGINEERS' CLUB.
Nov. 3. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 4. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Nov. 7. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 7. Secy., C. L. Annan, City Engineers' Office, St. Paul, Minn.

NEW ENGLAND RAILROAD CLUB.
Nov. 8. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 8. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

RAILWAY SIGNALING CLUB.
Nov. 8. Secy., Earl M. Seitz, Signal Engineer, C. & N. W. Ry., Chicago, Ill.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.

CENTRAL RAILWAY CLUB.
Nov. 11. Secy., H. D. Vought, 114 Fifth Ave., New York city.

MONTANA SOCIETY OF ENGINEERS.
Nov. 12. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

ENGINEERS' CLUB OF KANSAS CITY.
Nov. 14. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

THE LOUISIANA ENGINEERING SOCIETY.
Nov. 14. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

NORTHWEST RAILWAY CLUB.
Nov. 15. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

THE ENGINEERS' CLUB OF COLUMBUS.—A regular meeting of this club was held Oct. 1. Mr. H. M. Layman presented an interesting paper on "Progress in Electric Lighting," which was discussed quite fully.

NEW YORK RAILROAD CLUB.—This club held its first meeting of the season on Sept. 15, at 12 W. 31st St., New York city. Mr. W. S. Rogers presented a paper on "Cost, Keeping and Accounting." Prof. H. Wade Hibbard outlined the course of railway engineering recently established at Sibley College, Cornell University.

TEXAS RAILWAY CLUB.—A meeting of this club was held at Rockport, Tex., on Sept. 19, at which Mr. F. Hufsmith read a paper on "The Safety in Train Air Brake Appliances." A paper by Mr. A. S. Grant on "The Necessity of Harmony in Departments of Railway Service," presented at the last meeting, was discussed quite fully. An invitation from the Agricultural and Mechanical College at Bryan to visit the college was accepted.

BROOKLYN ENGINEERS' CLUB.—On Oct. 6 this club gave a complimentary dinner to its members, who had volunteered for service in the war with Spain. Of the 15 who enlisted all except one, Corporal Edward C. Brown, returned home. This number formed 15% of the total active membership. An interesting toast list was presented, and the event proved most enjoyable.

It is announced that Mr. Willard C. Tuttle will read a paper on "Foundry Moulding Machines for Snap Flask Work," on Oct. 13. The informal "library talks" will be resumed on Oct. 20 with a paper on "Testing of Steam Boilers," by Mr. R. P. Bolton.

WESTERN SOCIETY OF ENGINEERS.—At the meeting, on Oct. 5, there was an exceptionally large attendance to listen to a paper on "The Track Elevation of the Chicago & Northwestern Ry.," which was read by Mr. Louis H. Evans, the engineer in charge of the work. The paper was illustrated by drawings and stereopticon views, showing the character of the work, much of which has been described in our columns. Special arrangements had been made to have the track elevation work of other railways in Chicago described by the several engineers in charge. The work on the Illinois Central R. R. was described by Mr. H. W. Parkhurst; that on the Chicago, Milwaukee & St. Paul Ry. by Messrs. Webb, Rogers and Reichmann, and that on the Chicago, Burlington & Quincy R. R. by Mr. G. H. Bremner. Time did not permit a full discussion, but the subject will be taken up at a later meeting and will include the following: Lake Shore & Michigan Southern Ry. and Chicago, Rock Island & Pacific Ry., Mr. L. H. Clarke; Pittsburg, Fort Wayne & Chicago Ry., Mr. W. H. Coverdale; Pittsburg, Cincinnati, Chicago & St. Louis Ry., Mr. Thomas H. Johnson; and the 16th St. crossing, Mr. G. W. Vaughn.

On Oct. 8, a special train, provided by the Chicago & Northwestern Ry., carried a large party of members and guests over this road to examine the work on the Chicago, Milwaukee & St. Paul Ry., and on the Pittsburg, Chicago, Cincinnati & St. Louis Ry. Arrangements are being made for a special trip to the Trans-Mississippi Exhibition at Omaha, Neb., Oct. 14 to 16.

THE ENGINEERS' CLUB OF PHILADELPHIA.—This club held a regular meeting on Oct. 1, with 57 members and visitors present, at which various routine business was transacted. Later, Mr. Josiah Dow presented the first paper of the evening on the "Dow Steam Engine and Chronometric Governor." This engine is a modification of the Corliss type, intended to effect greater economy in the use of steam by a new arrangement of valves and steam ports, and by means of the chronometric governor to preserve greater regularity of speed under varying loads than has hitherto been attainable. The theory of the general subject of steam-engine economy was thoroughly reviewed and the details of the author's improvements were described with the aid of stereopticon views.

The paper was discussed by Mr. Francis Schumann, who, after seeing the engine in operation, expressed the opinion that it was such a decided improvement over other types of steam engines that he believed it would mark an epoch in the development of steam power.

Mr. John C. Trautwine, Jr., presented the second paper of the evening by its title, "Popular Errors about Water Meters."

It was announced that at the meeting of Oct. 15, Mr. George S. Webster would present a paper on "The Construction of the Pennsylvania Avenue Subway and Tunnel, Philadelphia," and that Mr. Webster had extended an invitation to members to visit the work on the afternoon of Oct. 22.

ENGINEERS' CLUB OF ST. LOUIS.—The 476th meeting of this club was held Oct. 5, with 18 present.

Prof. J. H. Kinealy moved that the secretary address letters of thanks to the Wiggins Ferry Co., and to Mr. Lemon Parker for courtesies extended to the club during the summer.

A letter was then read from Mr. Charles L. Bouton, who had been appointed a delegate from the Engineers' Club of St. Louis to the 50th Anniversary Celebration of the Society of Civil Engineers of France. The President stated that the Missouri Historical Society had invited the club to participate in the arrangements for the celebration of the Louisiana Purchase.

The discussion of the smoke abatement movement in St. Louis was then taken up. Mr. Eugene McQuillan, the attorney for the Citizens' Smoke Abatement Association, addressed the club in regard to the legal questions involved. He stated that an ordinance had been passed by the Municipal Assembly several years ago which prescribe a punishment for the emission of dense, black smoke. Several convictions had been secured under this ordinance, and the smoke nuisance had been largely abated, until an appeal case the Supreme Court of Missouri decided that the Municipal Assembly had exceeded its rights under the City Charter in passing the ordinance. Mr. McQuillan stated that a new ordinance was in course of preparation, and is soon to be introduced in the Municipal Assembly.

Richard McCulloch, Secy.

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NEW PUBLICATIONS.

LITERARY MAGAZINES.—The leading topic in all the magazines this month is, of course, the war and the questions which have grown out of it. Even the English reviews give prominent place to these topics. The "Contemporary" and "Fortnightly Review" for September each contain papers on the Carlist movement in Spain. Most Americans have an idea that the Carlist party in Spanish politics is actuated merely by the desire to secure a throne for their leader and fat places for his personal followers. If the writers in the above magazines tell the truth, however, Carlism aims at quite a revolution in methods of government. It promises home rule in local and provincial affairs, in place of the present plan of controlling everything at Madrid. The indictment which the defenders of Carlism bring against the present Spanish government is a formidable one, and Americans who wish to obtain some idea of Spanish political conditions will do well to read these articles.

The English reviews also have something to say respecting the new problems which this country has had forced upon it. In the "Nineteenth Century" we find an article on "The New American Imperialism," in which the writer expresses the opinion that for the United States to undertake a policy of colonial expansion is "Manifest Destiny." In the "North American Review," M. W. Haseltine writes on "What Shall Be Done About the Philippines?" He urges that the United States should keep them, but thinks it would be fair for us to assume that part of the Spanish public debt which was secured by the Philippine revenues, and, in addition, one-fifth part of the Cuban debt. The best article by far on the Philippine question that we have anywhere seen, however, is by Prof. Dean C. Worcester, of Cornell, in the October "Century." Prof. Worcester has such an intimate knowledge of the islands and their people as is possessed probably by hardly any other American of education and prominence. Briefly summarized, Prof. Worcester's opinion is that Spain would find it difficult, if not impossible, to re-establish her sovereignty in the Philippines, even if she were given a free hand. To turn the islands over to native rule would result in perpetual anarchy and civil war. European powers would at once step in and establish governments under their own flags to protect their interests, and would be justified in so doing. Any nation attempting to govern the Philippines, however, Prof. Worcester thinks, will have some knotty problems on its hands, and he sets forth very clearly what some of these problems are. We may note under what Prof. Worcester says as to the unhealthfulness of the climate the following incident, which will be of especial interest to our readers:

> About eight years ago, General Manager Higgins of the Manila & Dapitan Ry., having secured a concession from the Spanish government, organized in London a party of about 40 Englishmen, civil engineers and others, who were to survey the route and build and afterward assist in the operation and management of the railroad. Mr. Higgins gave special attention to the physical condition of his assistants, selecting only men that he believed could stand the severe climate of the archipelago. To-day not more than half of the members of that party are alive.

Of course, the stories of the war are prominent this month. That which will attract most general attention is Richard Harding Davis' account of the Battle of Santiago. We will note here that one of the chief indictments which he brings against General Shafter in this article is that there was no reconnoissance of the enemy's position and the country over which the attacking army had to pass before the memorable advance on July 1. Apparently, Davis was unaware of the reconnoissance work done by the engineers of the army, and so well described by Mr. E. J. Chibas on another page of this issue of Engineering News.

Another and almost equally good account of the taking of San Juan and Caney is given by Caspar Whitney in the October "Harper's," and the charge as to the lack of reconnoissance before the battle is repeated. This magazine also contains an interesting summary, by Wm. E. Griffis, of the past exploits of our navy in Asiatic waters.

Besides Prof. Worcester's article, noted above, the "Century" contains a description of the most remarkable "bore," or wave in the estuary of a tidal river, that has ever been recorded. The river is the Tsien-Tang-Kiang of China. According to observations by Capt. Moore, of the British survey ship "Rambler," in 1888, and 1892, this bore advances with a height of 11 to 12 ft., and the breakers which form just back of the advancing wall of water are 25 to 30 ft. above the level of the still water just in front of them. We should also notice here another "Century" article, in which an account is given of the famous "pony express," which for some two years in the early '60s carried mails from St. Joseph, Mo., to Sacramento, Cal., on a schedule time of 8 days. The quickest trip of this express was the carriage of President Lincoln's inaugural address, which was done in 7 days 17 hours (185 hours), or an average of 10.7 miles per hour, for the total distance of 1,950 miles.

The "Review of Reviews" for October, besides its usual summary of current events, has two timely papers on "Medical and Sanitary Aspects of the War," by Dr. Carroll Dunham, and "Some Military Lessons of the Struggle," by Lieut. John H. Parker.

"The North American Review" contains an account of "The Movement for Municipal Reform," by Clinton R. Woodruff, Secretary of the National Municipal League, detailing the progress that has been made toward the improvement of municipal government in several of the principal American cities. Admiral P. H. Colomb discusses the strategic position of the United States, under its new conditions, and concludes that the new possessions in the East and West Indies will weaken the country, from a military point of view, far more than they will strengthen it. The article is one which should be read by everyone who desires to form correct opinions respecting our future policy with respect to national defence.

Both "The Century" and the "Cosmopolitan" have excellent papers on the Omaha Exposition, and the latter magazine has also a popular description of the packing industry as carried on at the Union Stock Yards, Chicago.

The October "Atlantic" opens with two thoughtful papers upon the new "era of good feeling" between the United States and England, one by Hon. Carl Schurz and the other by Mr. A. V. Dicey. A historical paper on "The Development of Our Foreign Policy" is also worth mention here.

In the current "Popular Science Monthly," Mr. Edward Atkinson has a paper in which he endeavors to trace in a scientific manner the evolution of high wages from low cost of labor. "The First Half Century of the American Association for the Advancement of Science" is reviewed by Prof. Daniel S. Martin, and Dr. F. S. Oswold writes on "Weather Freaks of the West Indies," a subject of more immediate interest to us now than a year ago.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

CHAIN SAW MORTISERS.—The New Britain Machine Co. New Britain, Conn. Pamph.; 6 × 9 ins.; pp. 22.

The chain saw mortiser is a machine made for rapid mortising of timber. Its principal feature is a steel chain, each link of which has a sharpened saw tooth, so formed as to carry out its own chip. The chain travels about 1,500 feet per minute, in which time 40,000 teeth are presented to the work. Six different styles are built for different classes of work.

THE CASE HIGH-SPEED ENGINE.—The New Britain Mfg. Co. New Britain, Conn. Pamph.; 6 × 9 ins.; pp. 40.

The Case automatic engine has now been on the market for ten years. It belongs to the general type of oscillating engines, but has some features peculiarly its own, which distinguish it from earlier engines of the type which were at one time quite common. The cylinder rocks not on trunnions, but on its whole exterior surface, which is of cylindrical shape, and rocks inside of a chamber in which it is said to be balanced on a film of steam so that it rocks with practically no friction. This style of construction makes the engine exceedingly compact, so that it occupies much less space than any reciprocating engine of the same power. It is built in sizes from 2½ to 25 HP. Besides the usual style, in which the bed is bolted to the floor foundation, "bracket" and "hanger" engines are built, adapted to be bolted to the side walls or overhead beams of a room.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Oct. 13.	Hire of dredging plant, Mobile, Ala.	Sept. 15
	Advertised, Eng. News, Sept. 15 to Oct. 6.	
Oct. 13.	School building, Waterbury, Conn.	Oct. 6
Oct. 13.	Asphalt paving, New York, N. Y.	Oct. 6
Oct. 13.	Park work, New York, N. Y.	Oct. 6
Oct. 13.	Removing ashes, etc., Cleveland, O.	Oct. 6
Oct. 13.	Macadam road, North Reading, Mass.	Oct. 13
Oct. 13.	Brick paving, Williamsport, Pa.	Oct. 13
Oct. 14.	Breakwater, Ellensburg, Wash.	Oct. 13
Oct. 14.	Brick sewer, Springfield, Mass.	Oct. 13
Oct. 14.	Paving, Chicago, Ill.	Oct. 13
Oct. 14.	Grading 33d St., Omaha, Neb.	Oct. 13
Oct. 14.	Bridge, Vaucluse, S. C.	Oct. 6
Oct. 14.	Pipe sewers, Madison, Wis.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 15.	Water-works, Wagoner, Ind. Ter.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Oct. 6.	
Oct. 15.	Masonry, woodwork, etc., Cincinnati, O.	Sept. 22
Oct. 15.	School building, Harris, Minn.	Sept. 22
Oct. 15.	Electric light plant, Charlotte, N. Y.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 15.	Electric plant, Bremerton, Wash.	Sept. 29
Oct. 15.	Water-works, Charlotte, N. Y.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 15.	Ocean Ave., improvement, New London, Ct.	Oct. 6
Oct. 15.	Light station, New Haven, Conn.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Oct. 15.	Electric light plant, Wynne, Ark.	Oct. 6
Oct. 15.	Pipe sewer, Passaic, N. J.	Oct. 6
Oct. 15.	Water bonds, Crystal, Minn.	Oct. 6
Oct. 15.	Church building, New York, N. Y.	Oct. 13
Oct. 15.	Refreshment pavilion, Washington, D. C.	Oct. 13
Oct. 15.	Stone culverts, Jamestown, N. Y.	Oct. 13
Oct. 15.	Additions to pumping station, Chicago, Ill.	Oct. 13
Oct. 15.	Grading, brick paving, Cleveland, O.	Oct. 13
Oct. 15.	Cobble paving, etc., Detroit, Mich.	Oct. 13
Oct. 15.	Water-works, Bainbridge, N. Y.	Oct. 13
Oct. 15.	Water bonds, Spring Lake, N. J.	Oct. 13
Oct. 17.	Heating, ventilating, etc., New York.	Oct. 13
Oct. 17.	City hall, superstructure, Freeport, Ill.	Oct. 13
Oct. 17.	Street work, St. Paul, Minn.	Oct. 13
Oct. 17.	Storm sewer, Hamilton, O.	Oct. 13
Oct. 17.	Water pipe, Boston, Mass.	Oct. 13
Oct. 17.	Water supply well, Needham, Mass.	Oct. 13
Oct. 17.	Asphalt paving, Philadelphia, Pa.	Oct. 13
Oct. 17.	Curbing, etc., Montgomery, Ala.	Oct. 13
Oct. 17.	Sewers, etc., Albany, N. Y.	Oct. 6
Oct. 17.	Asphalt paving, etc., Logansport, Ind.	Oct. 6
Oct. 17.	Sewer foundation, Burlington, Ia.	Oct. 6
Oct. 17.	Dredging Lake Merritt, Oakland, Cal.	Oct. 6
Oct. 17.	Water pipe, Wytheville, Va.	Sept. 29
Oct. 17.	Sewerage system, Mobile, Ala.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Oct. 6.	
Oct. 17.	**Gasholder, etc., Edinburgh, Scotland**	**Sept. 1**
Oct. 18.	Railway track, Cincinnati, O.	Sept. 22
Oct. 18.	Paving, Sharpsburg, Pa.	Oct. 6
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Oct. 18.	Machinery etc., Naval Station, Puget Sound.	Sept. 29
Oct. 18.	Street bonds ($60,000), Sharpsburg, Pa.	Oct. 6
Oct. 18.	Water-works, Alden, N. Y.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Oct. 18.	Electric railway franchise, Portage, O.	Oct. 6
Oct. 18.	Pipe sewers, Columbus, O.	Oct. 13
Oct. 18.	Stand-pipe, boilers, etc., Eaton Rapids, Mich.	Oct. 13
	Advertised, Engineering News, Oct. 6.	
Oct. 18.	Water-works, Perham, Minn.	Oct. 13
Oct. 18.	Electric plant, Perham, Minn.	Oct. 13
Oct. 18.	Paving, Columbus, O.	Oct. 13
Oct. 19.	Sewers, Indianapolis, Ind.	Oct. 13
Oct. 19.	Building, New York, N. Y.	Oct. 13
Oct. 19.	Bridge at Broad St., New Haven, Conn.	Oct. 13
Oct. 19.	Paving, etc., Cleveland, O.	Oct. 13
Oct. 19.	Sewer, New York, N. Y.	Oct. 6
Oct. 19.	Levee work, New Orleans, La.	Sept. 29
Oct. 19.	Asphalt paving, Winnipeg, Man.	Sept. 29
Oct. 20.	Viaduct over Lick Run, Cincinnati, O.	Sept. 22
Oct. 20.	Greenhouses, etc., New York, N. Y.	Oct. 13
Oct. 20.	Bridge work, St. Joseph, Mo.	Oct. 13
Oct. 20.	Brick chimneys (3), Buffalo, N. Y.	Oct. 13
Oct. 20.	Bridge, 150-ft. span, Jackson, W. Va.	Oct. 13
Oct. 20.	Electric conduits, Erie, Pa.	Oct. 13
Oct. 20.	Asylum building, Newark, N. Y.	Oct. 13
Oct. 20.	Water pipe, etc., New York, N. Y.	Oct. 13
Oct. 20.	Macadam road, Enfield, Mass.	Oct. 13
Oct. 20.	Asphalt paving, Reading, Pa.	Oct. 13
Oct. 20.	Repairing roads (15 sections), St. Joseph, Mo.	Oct. 13
Oct. 20.	Water-works, Shawnee, Okla.	Oct. 13
Oct. 20.	Electric light bonds, Grafton, W. Va.	Oct. 6
Oct. 20.	Steam heating, etc., York, Pa.	Oct. 6
Oct. 20.	Cottage, Lancaster, O.	Oct. 6
Oct. 21.	Interior finish, Columbus, Ga.	Oct. 13
Oct. 21.	Paving, Buffalo, N. Y.	Oct. 13

Oct. 21. Sewer pipe, cement, etc., Newton, Mass.....Oct. 13
Oct. 21. Levee work, West Memphis, Tenn.........Sept. 22
Advertised, Eng. News, Sept. 22 to Oct. 13.
Oct. 22. Electric lighting, heating, etc., Buffalo, N.Y..Oct. 13
Oct. 22. Electric light plant, Port Royal, S. C. ......Oct. 13
Oct. 22. Drainage, Harvel, Ill. ....Oct. 13
Oct. 22. Dredging at navy yard, Brooklyn, N.Y.....Oct. 13
Oct. 22. Sewers, Washington, D. C..................Oct. 13
Oct. 22. Pipe sewers, Lebanon, O. ....Oct. 13
Oct. 22. Iron bridges (2), Salem, Va. ....Oct. 6
Oct. 22. Bridge, plans and material, Cincinnati, O..Sept. 29
Oct. 22. Electric plant, Litchfield, Ill..................Sept. 29
Oct. 22. Dredging, Pensacola Bay, Fla..............Sept. 29
Advertised, Eng. News, Sept. 29 to Oct. 13.
Oct. 23. Plans for sewer system, Chertsey, Eng....Sept. 22
Oct. 24. Markets, etc., Belem, Brazil................Apr. 28
Oct. 24. Paving with asphalt, etc., Hamilton, O....Sept. 29
Oct. 24. Water-works, Gallipolis, O..................Sept. 29
Oct. 24. Heating plant, St. Peter, Minn. ....Sept. 29
Oct. 24. Storage reservoir, Bradford, Pa..............Oct. 6
Advertised, Eng. News, Oct. 6 and 13.
Oct. 24. Fire engine house, Chicago, Ill. ....Oct. 13
Oct. 24. Elevators (3), New York, N. Y. ....Oct. 13
Oct. 24. Sewers, Toledo, O. ....Oct. 13
Oct. 24. Sewers, (3½ miles), Whiting, Ind. ....Oct. 13
Oct. 24. Brick paving, Toledo, O. ....Oct. 13
Oct. 25. Sewers, Rockford, Ill. ....Oct. 13
Advertised, Engineering News, Oct. 13.
Oct. 25. Viaduct approaches, Nashville, Tenn. ......Oct. 13
Advertised, Engineering News, Oct. 13.
Oct. 25. Sewers, Watertown, Mass..................Oct. 13
Oct. 25. Sewers, Tampa, Fla. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 25. Pipe sewer, Huntington, Ind. ....Oct. 13
Oct. 25. Water filter, Ashland, Wis. ....Oct. 13
Oct. 25. Jetties, Portland, Ore. ....Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 15.
Oct. 25. Brick paving, etc., Tampa, Fla. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 25. Street bonds, Oakland, Md. ....Oct. 13
Oct. 25. Brick sidewalk, Huntington, Ind. ....Oct. 13
Oct. 26. Addition to water-works, Norfolk, Va. ......Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 26. Bridge bonds, Cincinnati, O. ....Sept. 29
Oct. 26. Dredging, Newport, R. I. ....Sept. 29
Advertised Eng. News, Sept. 29 to Oct. 20.
Oct. 26. Cement, broken stone, etc., Newport, R. I...Sept. 29
Advertised Eng. News, Sept. 29 to Oct. 20.
Oct. 26. Sewer bonds, Glenville, O. ....Oct. 6
Oct. 27. U. S. building, Camden, N. J...............Oct. 6
Advertised, Eng. News, Oct. 6 and 13.
Oct. 27. Paving, Camden, N. J......................Sept. 29
Oct. 27. Electrical machinery, Hull, England. ......Oct. 13
Oct. 28. Heating plant, Genoa, Neb. ....Oct. 13
Oct. 28. Pipe sewer, Monticello, Ind. ....Oct. 13
Oct. 28. Asphalt, brick or stone, Atlanta, Ga.........Oct. 6
Oct. 28. Brick paving, etc. (7 Sts.), Cleveland, O. ....Oct. 6
Oct. 28. Brick and stone wall, Atlanta, Ga. ....Oct. 6
Oct. 28. Stone wall, San Francisco, Cal..............Oct. 6
Oct. 29. Steam tender, Louisville, Ky. ....Oct. 6
Oct. 29. Grading and brick paving, Cleveland, O.....Oct. 13
Oct. 29. Grading and cement walks, Irvington, Ind. ..Oct. 13
Oct. 30. School building, Chehalis, Wash. ....June 16
Oct. 31. Dry dock, Algiers, La. ....Oct. 13
Oct. 31. Metal work, Mobile, Ala. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Nov. 1. Hospital plans, New York, N. Y...........Oct. 13
Nov. 1. Bridge, Corydon, Ia. ....Oct. 13
Nov. 1. Artesian well, Jamestown, N. Dak..........Oct. 13
Nov. 1. Sidewalks, Terre Haute, Ind. ....Oct. 13
Nov. 1. Court house, Garner, Ia. ....Sept. 8
Nov. 1. School building, St. Louis, Mo............Sept. 22
Nov. 3. Repairing sidewalks, Cincinnati, O........Oct. 13
Nov. 4. Piers and abutments, Coshocton, O.........Oct. 13
Nov. 5. Substructure, Center St., Cleveland, O......Oct. 13
Nov. 5. Sewers, East Cleveland, O. ....Oct. 13
Nov. 7. Viaduct superstructure, Cincinnati, O. .....Oct. 13
Nov. 7. Bridge, Webster St., Oakland, Cal. ....Oct. 13
Nov. 7. Plank sidewalks, (1 year), Cincinnati, O...Oct. 13
Nov. 7. Wooden bridge (190 ft. long), Magnolia, Miss. Oct. 13
Nov. 7. Brick paving, Toledo, O.....................Oct. 13
Nov. 7. Improving electric plant, Topeka, Kan. ..Sept. 22
Nov. 9. Electric light plant, Toronto, Ont. ....Oct. 6
Advertised, Engineering News, Oct. 6.
Nov. 9. Electric energy, Toronto, Ont...............Oct. 6
Advertised, Engineering News, Oct. 6.
Nov. 9. Bridge, Sable Creek, San Jose, Cal. ....Oct. 13
Nov. 10. Water supply, Belem, Brazil ....Sept. 22
Nov. 11. Bridges, (3), Olivet, S. Dak. ....Oct. 13
Nov. 12. Water bonds ($130,000), Reno, N. Mex......Oct. 13
Nov. 14. Removing wreck, Rockland Harbor, Me.....Oct. 13
Nov. 15. Industrial school, Ellendale, N. Dak.......Oct. 13
Nov. 15. Water-works addition, Seattle, Wash......Sept. 22
Advertised, Eng. News, Sept. 22 to Nov. 10.
Nov. 15. Jail work, San Saba, Tex.................Sept. 29
Nov. 15. Electric lighting, Greensboro, N. C. ......Oct. 6
Nov. 16. Electric lighting, Camden, N. J............Oct. 13
Advertised, Eng. News, Oct. 13 to 27.
Nov. 21. Government bldgs (8), Sophia, Bulgaria....Sept. 29
Nov. 30. Bridge, etc., and plans, Moline, Ill.........Oct. 6
Advertised, Eng. News, Oct. 6 and 13.
Dec. 1. Electric lighting, Sumter, S. C. ....Oct. 6
Dec. 1. Electric light plant, Clinton, Ill. ....Oct. 13
Dec. 2. Arc lighting, Asheville, N. C. ....Oct. 13
Dec. 15. Storm sewers, Denver, Colo.................Oct. 13
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn..........Aug. 18
Jan. 2. Bridge, Quebec, Que. ....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Feb. 10. Jail building, Keyser, W. Va. ....Sept. 29

RAILWAYS.

ATLANTIC COAST LINE.—J. R. Kenly, Gen. Mgr., Wilmington, N. C., informs us that the work on the extension of this line, from Denmark to Robbins, via Barnwell, S C., has not yet been commenced, nor have the surveys yet been completed.

BOYER VALLEY.—This company was incorporated in Iowa, Oct. 5, with a capital stock of $10,000, to build a branch line of the Chicago & Northwestern Ry. from Sac City, to Denison, 25 miles, with a contemplated extension from Stockholm into Harrison county; total length, 100 miles. The incorporators and first board of directors are Marvin Hughitt, M. M. Kuckmer, J. M. Whitman, J. B. Bidford and H. R. McCulloch, all of whom are officers of the Chicago & Northwestern, 22 5th Ave, Chicago, Ill.

BRAINERD & NORTHERN.—Contractors Bagley, Huebner and Lisette have begun actual construction work on the last seven miles of the extension of this line between Walker and Bemidji, Minn., 30 miles, according to reports.

CANTON, ABERDEEN & NASHVILLE. — C. D. Smith & Co., Birmingham, Ala., are reported to have been awarded the contract for building the first section of this line from Winfield to New River, Ala., a distance of about 10 miles. The work is estimated to cost $100,000, and it is expected that it will be completed by Jan. 1. This company was chartered in Alabama Sept. 27 by men interested in the Illinois Central Ry., and it is proposed to build in all about 68 miles of railway from West Point, Miss., on the Illinois Central, to coal lands in Lamar and Fayette counties, Ala.

CHIHUHUA & PACIFIC.—Press reports state that this company, which is building 373 miles of railway in Mexico, is in the market for eight steam pumps and boilers for water stations for the new line. Pres., Almeric H. Paget, 80 Broadway, New York.

CEDAR RAPIDS BELT.—It has been announced at Cedar Rapids, Ia., that the Northwestern, Milwaukee, Illinois Central, and Burlington, Cedar Rapids & Northern Rys. have organized the City Belt Line, which will extend down the river from the new Northwestern bridge to the new roundhouse of that company, a distance of nearly three miles. Four tracks will be constructed, the most of the way on a fill in the river, protected by a retaining wall. It is thought that the line will relieve the present tracks through the business center of the city of 90% of its former freight traffic. Work will be commenced as soon as the Northwestern bridge is completed. The right of way has been secured and a survey made.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company has submitted a proposition to the council of Columbus, O., whereby the company agrees to raise its tracks and enlarge its embankment from the Scioto River westward to a point near the state pumping station at West Columbus, at a cost to the city of $29,150. This sum is to pay for 70,000 cu. yds. of material at 35 cts. a cu. yd.; 560 cu. yds. of retaining wall, at $5; ballasting 6,800 ft. of track, $1,500, etc. It is said that the council favors the acceptance of the proposition. George W. Kittredge, Ch. Engr., Cincinnati, O.

COBBOSSEECONTEE.—We are informed that this company has been organized in Gardiner, Me., to build about one mile of spur track from the Maine Central Ry. along the stream, to facilitate freight shipments from the mills of the S. D. Warren Paper Co. and others. Pres., R. H. Gardiner, Boston, Mass.; Clk. and Treas., W .E. Maxey, Gardiner; Directors, J. S. Maxey, H. E. Merriam and others, of Gardiner.

COLUMBUS, LIMA & MILWAUKEE.—Reports state that this company has been reorganized, and that arrangements have been made for the immediate completion of the road from Cleveland to Defiance, O. The roadbed and bridges were built eight years ago, and since then have lain idle. It is said to be the intention of the new company to extend the line to Milwaukee and to Columbus. Pres., J. G. W. Cowles, Pres. Cleveland Trust Co., Cleveland, O.; Vice-Pres., H. R. Reynolds; Directors, Daniel Coolridge, Pres. Lorain Steel Co., Lorain, O., and others.

DULUTH & NORTHERN MINNESOTA.—Reports state that six miles of track have been laid on this proposed line and that grading is completed for four miles more. Considerable bridge building will have to be done, however, before track-laying can be proceeded with. The company is still in need of men. It has not yet been decided how extensive the logging operations of Alger, Smith & Co. will be in the territory which the road is intended to open up. M. S. Smith, Pres., Detroit, Mich.; R. N. Marble, Asst.-Gen. Mgr., Duluth, Minn.

FORT WORTH & NORTHWESTERN.—W. D. MacMillan, Secy., Fort Worth, Tex., informs us that no contracts have yet been let for the building of this line, nor is the company ready as yet for construction. The proposed route is from Fort Worth northwest to Throckmorton, Tex., a distance of about 100 miles. Pres., B. B. Paddock, Fort Worth, Tex.

GARNER, CEDAR RAPIDS & NORTHERN.—This company is said to have just begun the construction of a line of railway from Hayfield Junction, the present terminus of the Burlington, Cedar Rapids & Northern Ry., northwesterly through the northern part of Hancock county and into Kossuth county, via Crystal Lake, Ia., a total distance of 20 miles.

GEORGIA & ALABAMA TERMINAL.—Press reports state that $1,000,000 is to be spent by this company in building railway terminals on Hutchinson's Island, opposite Savannah, Ga. The terminals will probably be leased by the Georgia & Alabama Ry. Co., Cecil Gabbett, Vice-Pres. and Gen. Mgr., Savannah.

GEORGIA NORTHERN.—This company is said to have definitely decided to complete its line between Moultrie and Albany, Ga., a distance of about 25 miles. It is expected to lay a 45-lb. steel rail. Pres., J. F. Pidcock, Moultrie, Ga.

GEORGIA PINE.—The directors of this company have resolved to amend its charter so as to permit of an extension of its line from Arlington, northerly to Columbus, via Cuthbert and Lumpkin, Ga., a distance of about 90 miles. Pres., J. P. Williams, Savannah, Ga.; Ch. Engr., Arthur Pew, Damascus, Ga.

GRAND MARAIS & NORTH SHORE.—R. W. Nichols, Ch. Engr., Duluth, Minn., informs us that the survey for this projected line from Grand Marais to Two Harbors, Minn., 90 miles, has not yet been finished. Contracts will be let as soon as surveys are completed; the right of way has been obtained. Pres., E. K. Lewis, Duluth.

GRAND TRUNK.—McCormick & McLeod, Bracebridge, Ont., have been awarded a three-years' contract according to reports, for ties for the northern division and the main line between Toronto and Montreal. Jos. Hobson, Ch. Engr., Montreal, Que.

LICKING VALLEY.—J. Morrow, Audr., Yale, Ky., informs us that four miles of this line have been graded, and track is now being laid. It is proposed to build a 15-mile extension up Licking River Valley, Ky. Pres., E. A. Smith, Providence, R. I.; Ch. Engr., J. D. Ramsey, Yale, Ky.

LITTLE RIVER VALLEY.—F. M. Butts, Secy., Horatio, Ark., informs us that this company has already built about eight miles of railway with its own capital, and that the work is now being pushed farther west. The projected route is from Nashville to Neal Springs, via Howard and Sevier, Ark., a distance of 40 miles. Pres., D. C. Richardson; Ch. Engr., S. L. Morrow, both of Horatio.

MANITOBA & NORTHWESTERN.—It is again announced that this line has passed into the hands of E. P. Osler, of Toronto, Ont.; William Hendrie, Hamilton, Ont., and others, and that it is the intention of the new owners to commence immediately a number of necessary improvements.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Reports state that about 60 miles of track have been laid on the 78-mile extension from Kulm, N. Dak., in La Moure county, to a junction with the old grade of the Aberdeen, Bismarck & Northwestern Ry., which was built in 1887 from Aberdeen, S. Dak., to Bismarck, N. Dak., but not ironed. Thomas Greene, Acting Ch. Engr., Minneapolis.

MONTGOMERY, HAYNESVILLE & CAMDEN.—We are informed that all correspondence for the official, engineering and construction departments of this railway company should be addressed to Sol. D. Bloch, Pres., Montgomery, Ala. The company proposes to construct a line from Montgomery to Camden, Ala., and thence to Suggsville, on the Mobile & Birmingham R. R. This latter stretch, from Camden to Suggsville, 45 miles, has recently been surveyed. J. A. Milner, Ch. Engr., Birmingham, Ala.

MUSKOGEE COAL & RY.—J. T. Nelson, Secy., Indian Territory Consolidated Coal Co., Fort Scott, Kan., informs us that the surveys have been made and the entire right of way obtained for this proposed line from Muskogee, Ind. Ter., to Guthrie, Okla., a distance of about 194 miles. Grading and masonry work has been completed for 12 miles, and ties laid.

PACIFIC & ARCTIC.—Press reports state that this railway now under construction from Skaguay to Selkirk, Alaska, is progressing rapidly, rails having been laid to White Pass, and trains operated to that point. The work is being done by the Pacific Contracting Co., Dexter, Horton & Co. Bank Bldg., Seattle, Wash., and of which E. C. Hawkins is chief engineer. John Hislop, Asst. Ch. Engr., Skaguay, Alaska.

PERRIS & LAKEVIEW.—This company has been incorporated in California, with a capital stock of $80,000, by W. G. Nevin, G. Holterhoff, Jr., E. Chambers, H. J. Stevens, and A. P. McGinness, of Los Angeles, Cal.

PITTSBURG & LAKE ERIE.—J. A. Atwood, Ch. Engr., Pittsburg, Pa., informs us that this company is building a quarter of a mile of second track across the Youghiogheny River, near McKeesport, Pa. C. I. McDonald has the masonry contract, at about $25,000; and the Keystone Bridge Co., the bridge work, at about $75,000.

RUSSIA.—Press reports state that the department of the imperial Russian ministry of finance, charged with the management of Russian railways, is about to discuss the construction of the projected Northern Ry. to St. Petersburg. As the grevious famine is making itself rapidly felt in the Government of Kasan and also in the neighboring governments it has been decided to begin the work of construction as soon as possible, so as to find work for the starving peasants.

SIOUX FALLS & PACIFIC.—This company is reported to have been incorporated to build in South Dakota to the Wyoming state line. P. E. Woodworth, H. H. Smith, C. E. McKinney, T. H. Brown and H. H. Lien are the incorporators.

TEXAS WESTERN.—We are informed that surveys are being made, and data collected for the reconstruction of this line to the city limits of Houston. E. A. Campbell, Gen. Mgr., Houston, Tex.

UNION PACIFIC.—New steel rails are being laid on the Salina & Oakley, Kan., branch in place of the old iron rails now in use. When the work is completed, it is expected that the iron rails on the McPherson branch will also be replaced with steel rails.

YELLOWSTONE PARK.—This company has been incorporated in Washington, with a capital stock of $1,500,000. It is proposed to operate a railway from the main line of the Northern Pacific at Bozeman, or Manhattan, through the counties of Park and Gallatin, Mont., the general route of the road being from a point near Brisbin westerly via Trail Creek, to Meadow Creek, Bozeman and Ferris, Hot Springs, thence southerly up the West Gallatin River to its intersection with Dodge Creek, ten miles. Branch lines are to run to Flat Head Pass in the Bridger Mountains from Ferris and to Hot Springs and to Three Forks. The road was incorporated some time ago as the Gallatin Ry., but the name has been changed because it has been found the line will have to pass through more than one county. The line will tap a region said to be almost inaccessible, but to contain some of the finest coal in Montana; it will also traverse a fine barley belt. Work is expected to be completed by Dec. 1. George Turner and W. W. D. Turner, of Spokane, Wash.; and Frank A. Hall, of Bozeman, Mont., are said to be interested.

STREET AND ELECTRIC RAILWAYS.

BURLINGTON, VT.—The "Free Press" announces that the contract for completing the Burlington & Hinesburg R. R., and for the electrical works, has been awarded to C. W. Blakeslee, New Haven, Conn., and that work is to be commenced this week. The rails have been ordered, and tracklaying will soon begin at the Burlington end. This road was projected as a steam railway, and considerable work done on it several years ago. The distance to Hinesburg is 12 miles.——At a special meeting of the Aldermen last week it was voted, 5 to 4, not to allow the Burlington & Grand Isle R. R. Co. to lay tracks into the city. The company refuses to enter the city over the tracks of the Burlington Traction Co., and the beginning of work on this electric railway is thus delayed. F. O. Sinclair, of Burlington, can give information in regard to either of the above roads.

EAST BRIDGEWATER, MASS.—The selectmen of this town Oct. 7 granted a franchise to the company which proposes to construct an electric railway between Whitman and Plymouth, for the right to lay rails in Washington St.

MONSON, MASS.—The Palmer & Monson St. Ry. Co. has been granted a franchise to build in this town, one route being upon the quarry road and the other upon the lower road. Charles F. Grosvenor, H. P. Holden and E. C. Hastings, of Palmer, are directors in the company.

NEEDHAM, MASS.—The railroad commissioners have authorized the Natick & Cochituate St. Ry. Co. to extend its tracks in Needham. Pres., H. Harwood, Natick.

PITTSFIELD, MASS.—The aldermen have granted a permit to the Pittsfield Electric St. Ry. Co. to lay additional tracks on North and Wahconah Sts. Mgr., P. C. Dolan.

WORCESTER, MASS.—The Worcester & Webster St. Ry. Co. has been granted a charter, with a capital stock of $150,000, to construct an electric street railway from the city hall in Worcester to Webster, via Auburn and Oxford, a distance of 15 miles. The directors are, Julius Garst, George A. Bigelow, E. L. Parker and E. P. Knowles, of Worcester; E. S. Hill, Webster; L. E. Thayer, Oxford; H. S. Shaw, Webster.

PHILMONT, N. Y.—The Columbia Traction Co., of this place, has been incorporated with a capital stock of $100,000, of which $1,500 is paid in, to construct and operate a street railway in Philmont, Columbia county. The incorporators are, Franklin G. Simmons, William C. Allen and Ernest F. Foote, of Rutherford, N. J. Principal office, 332 Harrison Ave., Harrison, N. J.

BRADDOCK, PA.—At a meeting of the North Braddock council Oct. 4, a petition was brought up for a franchise for a new street railway to run from Wilkinsburg to Turtle Creek via Swissvale, Hawkins, North Braddock and Bessemer, running eastward along the Pennsylvania R. R. L. G. Wood, of Pittsburg, is representing the company. If the petition passes, the line is expected to be completed by July, 1899.

ERIE, PA.—The council has passed an ordinance permitting the Erie City Passenger Ry., operated by the Erie Electric Motor Co., to extend its tracks to the Behrend paper mill.

PHILADELPHIA, PA.—Reports state that the Southwestern Traction Ry. Co. has begun work on its new trolley line in the 1st, 26th, 27th and 36th Wards. The new line will start at Mifflin and Otsego Sts., and will run along the latter to Jackson St., and thence to old Moyamensing Ave. to Penrose Ferry Road and to the new Penrose Ferry bridge and across the bridge to State Island Road, with its western terminus at the eastern side of Bow Creek. The primary object of the road is to open up to extensive building operations a tract of land west of Broad St. Pres., Edgar A. Tennis; Treas., U. H. Hapsenplug; Directors, William J. Burns, William O. Smith and H. M. Van Zandt.

WEST CHESTER, PA.—At a special meeting of the borough council Oct. 3 it was decided to grant a right of way to the Philadelphia, Castle Rock & West Chester Ry. Co. to enter this town by way of Gay St. to Matlock St. The line is expected to be in operation by about Dec. 10.

BALTIMORE, MD.—It is reported that the Consolidated Ry. Co., of Baltimore, has awarded the contract for building a connecting line between its Towson & Catonsville branch and the Edmondson Ave. line, of Ellicott City, to D. E. Evans, of Baltimore. Wm. A. House, Gen. Mgr.

LAUREL, MD.—D. G. Adelsberger, Engr., 722 Pennsylvania Ave., Baltimore, Md., informs us that the electric street railway project for Laurel has not yet developed, and has made but little progress towards development.

WASHINGTON, D. C.—Reports state that the contract for track work on that portion of the City & Suburban Ry. lying without the District of Columbia has been awarded to Allen & Talty, of Washington, while the trolley work on the same portion has been let to J. G. White & Co., of Baltimore. The work of constructing the portion in this city will soon be commenced. This work involves the removing and adjusting of about six and one-half miles of water mains to make room for the underground conduits. It is stated that the entire line to Berwyn will be in operation not later than Feb. 15; the roadbed has already been completed as far as that place. The power for the new line will be furnished by the Potomac Electric Power Co., of which O. T. Crosby, of Washington, is president. Mr. Crosby is also president of the railway company. Mr. A. E. Randle, Pres. Capital Ry. Co., has been granted permission by the district commissioners to extend the road through Pencote woods, from Nichols Ave. to the Alexandria branch of the Baltimore & Ohio R. R.

KING WILLIAM, VA.—A county election of King William county is to be held to vote upon the proposition of issuing $40,000 in bonds to aid in the construction of a standard gage electric railway from Richmond to Gloucester. Col. W. R. Aylett, of King William, is said to be interested.

GREENSBORO, N. C.—The Industrial & Immigration Association of Greensboro is urging investors to consider the proposition of building an electric street railway and power plant at this place. Population, 10,000. Secy., W. M. Barber.

BIRMINGHAM, ALA.—The Birmingham Ry. & Electric Co. has begun the work of reconstructing the lines of its city division, requiring the laying of new cross-ties, new rails and new switches.

CANTON, O.—Bids are asked by Louis N. Ley, Cy. Clk., until Oct. 22, for the construction and operation of street railway route No. 4, as follows: beginning on Navarre St. at the intersection with South Market St., thence southwest on Navarre St. to Garfield Ave., thence south on Garfield Ave. to Bridge St.; deposit, $100.

SANDUSKY, O.—It is reported that John MacKelvey of Sandusky, is promoting a deal for a New York syndicate for the consolidation of a number of Northern Ohio electric railways, among them being the Sandusky, Milan & Norwalk Ry. of which G. A. Dewitt is president, and the People's Electric Ry., of Sandusky. The transaction is said to be the first step of a scheme to build a net work of electric lines to connect with Cleveland and Toledo.

ELWOOD, IND.—A. J. Applegate, of Perkinsville, and Mayor Harbit, are said to be interested in a proposed electric railway to run from Elwood to Noblesville, via Perkinsville, a distance of 23 miles.

RICHMOND, IND.—Mayor Zimmerman has appointed Frank Spinning, Theodore Woodhurst, Henry Cutter, George Mashmeyer and John Rolling as a committee to secure an electric railway for this city.

ANN ARBOR, MICH.—Reports state that Col. Mapes, the projector of the Lansing, Dexter & Ann Arbor Electric Ry., has stated that work would begin in 30 days on constructing this line from Ann Arbor towards Dexter, and next spring from Mason to Dexter.

WAUKEGAN, ILL.—J. H. Van Vlissingen, of Chicago, representing the projected Chicago, Waukegan & North Shore Ry. Co., is said to be negotiating with the council for a right of way into the city from the north. The line is intended to connect Kenosha, linking the Milwaukee, Racine & Kenosha and the Chicago & Milwaukee Electric Rys. It will also do a freight business, connecting with the Elgin, Joliet & Eastern Ry. here.

KENOSHA, WIS.—J. M. Blatt, Supt. Milwaukee, Racine & Kenosha Electric Ry. Co., Racine, Wis., informs us that this line runs south from the City Hall in Milwaukee to the north city limits of Kenosha, a distance of 35 miles, and that a franchise is being obtained through Kenosha for a distance of two miles, one mile of which is expected to be built this fall. Nothing will be built; it is only extending tracks and overhead work from the present terminal one mile south to the heart of Kenosha. A 60-lb. tee-rail and standard ties will be used. Pres., Matthew Slush.

SEDALIA, MO.—The Sedalia Electric & St. Ry. Co. was incorporated, Oct. 7, with a capital stock of $400,000, to construct a street railway. The incorporators are, Carlton H. Reeve, Jas. C. Delong, John C. Van Riper and others.

PINE BLUFF, ARK.—Walter S. Jeter, D. C. Bell, W. H. Langford and other citizens have been appointed as a committee to investigate the advisability of erecting a $150,000 power plant for lighting and street railway purposes. Col. S. W. Fordyce., Pres. St. Louis Southwestern Ry. Co., of St. Louis, is interested.

CRIPPLE CREEK, COLO.—It is announced that the survey for the proposed electric line from Colorado Springs to Cripple Creek has been completed. The power will be obtained from Lake Moraine; estimated total cost, $700,000. Among those interested are, W. S. Jackson; Cashier of El Paso Bank, of Colorado Springs; P. S. Simmons, Pres. of Cog Road; A. E. Carlton, Pres. of First National Bank, of Cripple Creek.

ST. CATHERINES, ONT.—Haines Bros., 100 Broadway, New York, informs us that the St. Catherines & Niagara Central Ry. was recently purchased outright by Charles D. Haines, of Kinderhook, N. Y. Stephen D. Lake, Welland House, St. Catherines, Ont., is chief engineer, and is now at work in putting the present road in first-class condition. The line will be extended from Clifton to the Canadian Park and to a connection at the bridge with the electric railway that is operated over the bridge, a distance of one mile. From St. Catherines, the line will be extended three miles to Port Dalhousie. The motive power will be electricity.

ELECTRIC LIGHT AND POWER.

MONTPELIER, VT.—New bids have been asked by the council for lighting the city for two years from March 1.

ANDOVER, MASS.—At the special town meeting, held Sept. 26, the committee on lighting submitted its report. Another chance will be given the Andover Electric Co. to bid for the contract. Chn. Com., Colver J. Stone.

BATH, N. Y.—Bids are asked until Oct. 22 for steam heating, electric lighting, refrigerating plant and plumbing for the Soldiers' and Sailors' Home; check, 10% of bid. O. H. Smith, Secy.

LOCKPORT, N. Y.—Willard T. Ransom, of this city, and others, have obtained options on property along the east bank of the 18 Mile Creek from Newfane to Charlotteville, a distance of about ten miles. The options will expire April 1. Mr. Ransom writes us that it is proposed to produce 2,000 HP. with a 50-ft. dam. It is expected that construction will soon be begun.

MUMFORD, N. Y.—It is proposed to build a new plant. J. F. Ward may be addressed.

SHERMAN, N. Y.—The Sherman Electric Light Co., recently organized, will build a plant at once. It will have a capacity for 700 16-c. p. incandescent lights. Secy., T. J. Newell.

WATERTOWN, N. Y.—The Watertown Electric Light Co. has purchased the power plant and factory of Zimmerman & Hardiman. The company proposes to extend its plant. D. C. Middleton may be addressed.

WHITESBORO, N. Y.—Another election will be held Oct. 24 to vote on two propositions for public lighting. Proposition No. 1 is to pay $2,200 a year for five years for 29 2,000-c. p. arc lights. Proposition No. 2 is to spend $2,100 a year for three years for 72 60-c. p. Welsbach lights to be furnished by the Welsbach St. Lamp Co.

CAMDEN, N. J.—Bids are asked until Nov. 16 for lighting the streets with electricity for a term of one, three or five years, as stated in our advertising columns. Chn. Com., Chas. C. Southard.

STIRLING, N. J.—Plans for a plant are being considered, according to reports.

EASTON, PA.—Bids have been asked by Alfred Clarke, Elec. Engr., 23 Central St., Boston, Mass., for constructing a plant, to cost about $200,000 for the Easton Power Co., recently incorporated. About 1,500 HP. will be secured. W. A. Thompson is in charge of the work.

ERIE, PA.—Bids are asked by the city engineer until Oct. 20 for 400 lin. ft. of lateral electrical conduit in 9th St., 420 ft. in 7th St., and 440 ft. in Peach St., from 7th to 6th Sts., containing 6 to 32 ducts.

JOHNSTOWN, PA.—Bids are asked until Oct. 18 for furnishing about 250 2,000-c. p. arc lights for a term of one to ten years, according to reports. Cy. Clk., J. W. Cramer.

PHILADELPHIA, PA.—Press reports state that bids will soon be asked for furnishing the machinery and for building a city plant. It will have a capacity for furnishing 2,000 arc lights. The plant is estimated to cost about $250,000. The maintenance, with the overhead system, will be about $175,000 a year; with the underground system, already built, about $200,000 a year. Engr., J. J. De Kinder, Girard Bldg., Philadelphia; Chn. Com., Wilson H. Brown; Dir. Pub. Safety, F. M. Riter.

ST. MICHAELS, MD.—The town commissioners are considering the question of either lighting the town with electricity or with acetylene gas in place of gasoline, at present used.

WASHINGTON, D. C.—Otto Mears, Pres. Chesapeake Bay Construction Co., 1420 New York Ave., N. W., Washington, writes us that the company will soon ask for bids for building water-works at the Chesapeake Bay terminus of the railway, it to be so constructed as to furnish power for an electric plant.

FREDERICKSBURG, VA.—D. Franklin Stokes, Philadelphia, has been engaged to prepare plans for a plant. It is probable that bids will be asked soon; estimated cost, $13,000. Chn. Com., T. McCracken.

WINCHESTER, VA.—The light committee has voted to award the contract for putting in a plant in connection with the water-works to the Fort Wayne Electric Corporation, Fort Wayne, Ind.

ASHEVILLE, N. C.—Bids are asked until Dec. 2 for furnishing 100 2,000-c. p. arc lights for a term of three years, the city to have the privilege of buying the plant. (Postponement from Oct. 7.) Mayor, F. M. Miller; Cy. Clk., M. W. Robertson.

CHAPEL HILL, N. C.—T. F. Lloyd writes us that bids for constructing a plant of 150 lights, etc., for a new mill will be wanted about the first of the year.

RALEIGH, N. C.—The Penitentiary Board is considering the advisability of putting in a plant at the state prison. ——J. E. Ray, Supt. State Institution for the Blind, has been directed to purchase a plant. The buildings are two miles apart.

ORANGEBURG, S. C.—This place voted Sept. 27 to issue $40,000 in bonds for a plant and water-works. Dr. J. G. Wannamaker and M. Rayson are on the committee.

PORT ROYAL, S. C.—Bids are asked until Oct. 22 for furnishing the machinery and for building a plant at the U. S. naval station; appropriation, $20,000. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

SPARTANBURG, S. C.—Press reports state as follows; The purchasers of the Aetna light plant have taken no steps yet looking to the improvement of the service. It was understood that they would remodel the plant, and give better and cheaper light. Up to this month nothing has been done. It was expected that the Whitney company would have begun work by this time, but their plans also have failed.

MONROE, LA.—An election will be held Nov. 9 to vote on the question of issuing $153,000 in 40-year 5% bonds, a part of which sum will be used for a plant, water-works, school building, etc.

NATCHITOCHES, LA.—It is probable that an election will be called to vote on the question of issuing bonds for a plant and water-works.

THIBODEAUX, LA.—The question of building a city plant will be voted upon at the election in November.

PALMYRA, O.—The plant of the Palmyra Electric Light Co. will be rebuilt at once, according to reports. Pres., Orin J. Garlock.

WEST UNION, O.—A. A. Kirschner & Co., Manchester, O., have applied for a 20-year franchise.

COLUMBIA CITY, IND.—The council has purchased the plant owned by J. H. Ruch for $21,600, according to reports. The plant will be used for commercial lighting only.

MIDDLETOWN, IND.—The Fort Wayne Electric Corporation, Fort Wayne, has been granted a 10-year franchise. The plant is to be completed in 60 days.

ROCKVILLE, IND.—Jas. B. Nelson, 61 Baldwin Block, Indianapolis, Ind., has been engaged to prepare plans and specifications for a combined plant and water-works. The contract will be let at once. Population, 2,500.

EATON RAPIDS, MICH.—Bids are asked until Oct. 18 for erecting power house, pumps, etc., as stated in our advertising columns last week. Secy. Water and Lighting Bd., Jas. H. Gallery.

IRONWOOD, MICH.—The question of more lights and a better water supply is being considered. Mayor, E. D. Nelson.

CHICAGO, ILL.—A new electric plant to cost $200,000 will shortly be added to the Illinois Steel Co.'s property at South Chicago. Ground was broken Oct. 5 for the new structure just south of the new blast furnaces. The building will be of brick. Its dimensions are 50 × 135 ft. It is the intention of the company to rush the work to completion before winter sets in.

CLINTON, ILL.—Bids are asked until Dec. 1 for certain machinery and work in connection with the proposed plant to be built by H. Surgart. We are informed that the plant will have a capacity for 80 2,000-c. p. arc and 2,000 16-c. p. incandescent lights; estimated cost, $15,000. Henry Johnson is the designing engineer and R. E. Rock the official in charge.

BARRON, WIS.—This place has voted to issue $1,200 in bonds for a plant.

MANAWA, WIS.—The council is reported to have decided to light the town by electricity, the power to be furnished by the Little Wolf River Lumber Co.

MARSHFIELD, WIS.—Only one bid was received Oct. 6 for lighting the town, it being from the Marshfield Water, Electric Light & Power Co. It is stated that the bid was rejected, and that the committee was instructed to investigate the question of a municipal plant.

EARLHAM, IA.—The question of building a plant is being considered, according to reports.

EMMETSBURG, IA.—An election will be held Oct. 20 to vote on the question of granting a 20-year franchise to John McNamara, Fulton, Ill.

GLENCOE, MINN.—It is stated that W. C. Russell is securing estimates for a plant.

LITTLE FALLS, MINN.—It is stated that this city voted Oct. 4 to issue $60,000 in bonds for a plant and water-works.

MINNEAPOLIS, MINN.—E. T. Abbott, Engr. of Hennepin county, Minneapolis, has completed his report to the Twin City Rapid Transit Co. for the proposed dam and power plant on the Mississippi River, about 3½ miles above the city limits, near Rice Creek. The company has acquired more than half of the flowage rights. The dam will back up water about 12 miles. The dam and machinery will cost about $450,000, and the flowage rights and real estate will cost $75,000. With the dam now used below the falls the company would be able to do away with all its steam plants, and also have an excess of 3,000 or 4,000 HP. to sell. Congress passed the bill last winter giving the company permission to build. It is probable that a beginning will be made this winter.

OLIVIA, MINN.—The question of putting in a plant is being considered by the council, according to reports.

PERHAM, MINN.—Bids are asked until Oct. 18 for furnishing the materials and for putting in a plant and water-works. The plant will have seven arc and 300 incandescent lights. Engr., Chas. F. Loweth, 94 East 4th St., St. Paul, Minn., and Davenport, Ia.; Recdr., R. E. Bachman.

HILLSBORO, N. DAK.—The committee is said to have recommended the building of a plant, at a cost of about $5,000.

SENECA, MO.—The Brodrick Realty Co. writes us that a small plant will be wanted, on the completion of the distillery plant, to light this town, furnish power to the distillery, etc. Population, 1,500. J. E. Schreiner, Seneca, may be addressed.

SEATTLE, WASH.—Bids are asked until Oct. 31 for furnishing street lights for one year from Jan. 1; check, $1,000. Secy. Bd. Pub. Wks., Frank Oleson.

TACOMA, WASH.—The council will be petitioned to investigate the practicability of securing power from the Puyallup River, noted in our issue of Sept. 15. It is stated that a plant can be built for about $290,000.

REDLANDS, CAL.—It is probable that the city trustees will soon ask for bids for lighting the city with electricity.

REDWOOD CITY, CAL.—The city trustees have engaged an engineer to prepare plans for an incandescent light plant.

VISALIA, CAL.—Press reports state that the Mount Whitney Power Co. will soon begin the construction of its proposed plant. The water will be diverted from the Kaweah River. Water will be conveyed through pipe 3,300 ft. and will have a vertical fall of 1,300 ft. Wm. H. Hammond and A. G. Wilson are interested.

YREKA, CAL.—James Quinne, of the Yreka Electric Light Co., is making arrangements to put in a power plant. If he secures the contract for furnishing power for mines and other purposes outside of town, he will also furnish power for machinery in this city.

PROVO, UTAH.—The committee has recommended that a municipal plant be built. Chn. Com., J. B. Keeler.

HULL, QUE.—Press reports state that bids will soon be asked by the city clerk for constructing a plant to cost $4,000.

MONTREAL, QUE.—Barry, Ross & McRae, Niagara Falls, Ont., are reported to have been awarded the contract for the construction of a central power house, etc., for the development of 100,000 HP. at Shawinigan Falls, on the St. Maurice River, near Three Rivers, Que., as advertised and described in Engineering News, Sept. 1. Secy. Shawinigan Water & Power Co., B. Shepherd, Montreal; Engrs., T. Pringle & Son, Imperial Bldg., Montreal.

ORILLA, ONT.—We are informed that bids will be asked in November by the town for furnishing the machinery and for building the electric power and light plant. It will be located on the Severn River, about 16 miles from this place. It is to take the place of a steam power plant now owned and operated by the town. Wm. Kennedy, Jr., Room 14, Y. M. C. A. Bldg., Montreal, Que., will prepare general specifications for the hydraulic and mechanical work.

HULL, ENGLAND.—Bids are asked until Oct. 27 for furnishing certain machinery for an addition to the light plant. Elec. Engr., A. S. Barnard, Daggerlane, Hull; Cy. Treas., Geo. Milner.

BRIDGES.

HARTFORD, CONN.—Bids are asked until Oct. 19 for constructing a bridge over the tracks on Broad St. C. H. Bunce, Cy. Engr.; Chas. H. Northam, Pres. Bd. St. Comrs.

ONEIDA, N. Y.—The town board is considering the question of repairing a number of small bridges.

JERSEY CITY, N. J.—A report has been submitted to the board of freeholders by Edlow W. Harrison, Ch. Engr., recommending the construction of a viaduct to be 1,840 ft. long and 35 ft. wide, on the extension of the proposed boulevard to connect Jersey City and Hoboken.

WESTFIELD, MASS.—The following bids were received Oct. 3 for constructing the superstructure for a bridge over Little River at Main St. Oren E. Parks, Engr.:

Walsh Boiler & Iron Works, Springfield, Mass.	$4,290
Springfield Construction Co., Springfield, Mass.	4,497
Harrington, Robinson & Co., Boston, Mass.	5,640
Boston Bridge Works, Boston, Mass.	5,650
Wrought Iron Bridge Co., Canton, O.	5,700
Massillon Bridge Co., Massillon, O.	5,783
Groton Bridge & Mfg. Co., Groton, N. Y.	5,847
King Bridge Co., Cleveland, O.	6,145
Pittsburg Bridge Co., Pittsburg, Pa.	6,149
Variety Iron Works Co., Cleveland, O.	6,200
N. E. Structural Co., Boston, Mass.	6,267
Canton Bridge Co., Canton, O.	6,487
Berlin Iron Bridge Co., E. Berlin, Conn.	6,700
Edge Moor Bridge Wks., Wilmington, Del.	6,748
N. J. Steel & Iron Co., Trenton, N. J.	6,750
Horseheads Bridge Co., Horseheads, N. Y.	6,800
Vermont Construction Co., St. Albans, Vt.	6,900
Toledo Bridge Co., Toledo, O.	6,900
New Columbus Bridge Co., Columbus, O.	7,540
Youngstown Bridge Co., Youngstown, O.	8,473

NEWARK, N.J.—Bids were asked until Oct. 10 for a brick and steel culvert on Springfield Ave., Irvington, and for extending with steel and concrete, the bridge over Third River, Brookfield Ave., Nutley. James Owen, County Engr., Newark.

McKEES ROCKS, PA.—Reports state that J. M. Schoonmaker, Vice-Pres. and Gen. Mgr., Pittsburg & Lake Erie R. R. Co., Pittsburg, has asked the council to take steps for the construction of an overhead bridge at Turner Station.

PHILADELPHIA, PA.—The council has appropriated $810,000 for the construction of bridges during the year 1899.

JACKSON, W. VA.—Bids are asked by the county commissioners until Oct. 20 for a 150-ft. span bridge, 16 ft. wide, with a capacity of 70 lbs. per sq. ft., on masonry foundation. V. A. Dunbar, Design. Engr., Parkersburg, W. Va. ——Plans are being prepared by V. A. Dunbar, Parkersburg, W. Va., for a 125-ft. span Pratt truss. Address County Commissioners, Jackson.

MAGNOLIA, MISS.—Bids are asked until Nov. 7 for constructing a wooden bridge 190 ft. long, over the Boyne Chillo River, near Summit. W. C. Vaught, County Clk.

CHATTANOOGA, TENN.—Reports state that a number of bridges on the Cincinnati, New Orleans & Texas Pacific Ry., between Cincinnati, O., and Chattanooga, are to be repaired at once. G. B. Nicholson, Ch. Engr., Cincinnati, O.; A. Griggs, Div. Supt., and M. Walsh, Supt. Bridges, Somerset, Ky.

NASHVILLE, TENN.—Bids are asked until Oct. 25 for constructing the approaches to the Broad St. and Church St. viaducts, as described in our advertising columns. W.M. Leftwitch, Jr., Cy. Engr.

CINCINNATI, O.—Bids are asked until Nov. 7 for constructing the superstructure of a steel railroad viaduct across the valley of Lick Run. Chas. G. Roth, Clk. Comrs. Water-Wks.

CLEVELAND, O.—Bids are asked until Nov. 5 for constructing the masonry substructure, foundations, abutments, piers, approaches, etc., for the rebuilding of the Center St. bridge over the Cuyahoga River. Geo. R. Warden, Dir. Pub. Wks.

COSHOCTON, O.—Bids are asked until Nov. 4 for constructing three piers and the abutments for a bridge over the Walhonding River, in Bethlehem township, according to reports. Newton Speckman, County Audr.

PONTIAC, ILL.—A contract was awarded Oct. 5 to the Joliet Bridge & Iron Co., Joliet, Ill., at $4,379, for a 150-ft. span steel bridge, 18-ft. roadway, stone piers. G. W. Lacey, Cy. Clk.

EAU CLAIRE, WIS.—The following bids were received Sept. 28 for constructing a new steel bridge of four spans, of 144 ft. each, across the Chippewa River, between Kelsey Ave. and Bridge Sts., and also for removing the old structure: Butler-Ryan Co., sub work, piers and abutments, limestone footing and Dunnville stone above, $20,500; Winona stone for facing, $24,000; Kettle River, stone for facing, $27,000; backing of Dunnville stone. Chas. Stone, masonry, piles and timber foundation, Dunnville sandstone, $8.25 a cu. yd.; Winona limestone and limestone for footing posts, $8.50; piling (driven and cut off), 30 cts. a lin. ft.; lumber per M. ft., in grillage, B. M., $20; rip-rap, $2.50 a cu. yd. Dibley & Robinson, superstructure, taking down, removing old bridge and piling on shore not more than 1,000 ft. away, $33,200. Lafayette Bridge Co., superstructure and substructure, $49,932; remove old bridge for material in it. Newell & Stack, substructure and superstructure, $44,830. W. S. Hewitt, superstructure only, including removal of old structure and piling material within 1,000 ft. of old site, $29,500. J. B. Marsh, three river foundations, $8,100; two shore foundations, $3,200; substructure, $31,500; new steel superstructure, $19,100; taking down and removing old spans, $600; taking down and removing old substructure, $400; will allow for old bridge and piers, $600; bids 5, 6 and 7 contingent upon acceptance of bid No. 4. Milwaukee Bridge & Iron Works, superstructure and substructure, $48,272; superstructure, $29,032; deduct the sum of $400 from each of above bids if allowed to retain old materials in old bridge. Bids based upon using 4-in. rock elm plank. H. E. Horton, bridge complete with elm floor, $50,736; bridge complete, oak floor, $51,736; taking down old bridge if it becomes the property of city, $1,000; if it becomes bidders' property, nothing. Gillette-Herzog Mfg. Co., superstructure, $31,300; foundation, $19,000; will remove old bridge if given material. Pittsburg Bridge Co., substructure and superstructure, $50,500. The Canton Bridge Co., superstructure, including taking down old spans, material to become the bidders, $36,000; superstructure complete, including taking down old spans and hauling it not over 1,000 yards, material to remain property of city, $36,500; substructure, $19,000; will not take substructure without superstructure. Wisconsin Bridge & Iron Co., superstructure and substructure, $47,794; superstructure, $28,998; above bids include taking down and removal of present bridge; bid is based on rock elm plank in roadway. Wrought Iron Bridge Co., substructure, including piers and abutments, $18,997 superstructure, including taking down and removing old bridge, $31,773; substructure and superstructure, $50,493; remove old bridge for the material. L. H. Johnson, superstructure, $31,897. Hoff Bros., Redwing or Winona stone in the three river piers and Dunnville stone for abutments, bridge complete, $50,900; Redwing or Winona stone throughout, $52,700; Kettle River sandstone in the three river piers and Dunnville stone for abutments, $51,800; Kettle River stone throughout, $56,000. Carnegie Steel Co., Ltd., superstructure, $28,137; removing old bridge, included in above, $250; substructure and superstructure, including taking down old bridge and piling where designated by engineer, $46,922; removing old bridge, included in above, $250. C. A. Alderman, Cy. Engr.

ST. PAUL, MINN.—The county commissioners have passed a resolution authorizing the Minneapolis, St. Paul & Sault Ste. Marie Ry. Co. to construct a bridge at Rice St., with two spans 45 ft. wide, with a trestle support in the center, affording two roadways each 18 ft. clear; estimated cost, about $9,500. Thos. Greene, Acting Ch. Engr.

BURLINGTON, IA.—J. H. Sparks & Co., St. Joseph, Mo., have been awarded a contract at $3,640 for five county bridges.

CORYDON, IA.—Bids are asked until Nov. 1 for constructing a bridge of wood and iron, according to reports. W. E. Dennis, County Audr.

OLIVET, S. DAK.—Bids are asked until Nov. 11 for constructing a steel bridge over the James River, of three spans, 185, 50 and 35 ft. and two other bridges of 40 and 30 ft. spans, respectively, according to reports. J. S. Mueller, County Audr.

ST. JOSEPH, MO.—Bids are asked until Oct. 20 for constructing and repairing certain bridges, according to reports. Theo. Steinacker, County Surveyor.

HOUSTON, TEX.—We are informed that bids will soon be asked for a bridge over Buffalo Bayou, on Franklin Ave. W. Bradburn & Co., Engrs.; I. A. Miller, Cy. Engr.; P. S. Banner, Secy.

SPOKANE, WASH.—J. W. Strack, County Surveyor, writes us that a contract was awarded Sept. 30 to Oliver Bros., Spokane, at $775, for constructing two 60-ft. Howe truss spans, with 40-ft. approaches and 16 ft. wide, on crib and rock filled foundation, near Latah, Wash. He also states that a new bridge, probably a combination Pratt truss of 200-ft. span and approaches, will be advertised by the county commissioners about Oct. 17, to be built over the Spokane River, 18 miles east of Spokane; estimated cost, about $5,000. J. W. Strack, Design. Engr., Spokane.

FRESNO, CAL.—Bids will soon be asked by the county supervisors for constructing a bridge 520 ft. long of two spans 120 ft. each; estimated cost, $10,000. Address County Surveyor Hoxie.

LOS ANGELES, CAL.—It is reported that J. H. Dockweiler, Cy. Engr., is preparing plans for three bridges to cost about $23,000. One on Ninth St.,Ave. 26 and Hollenbeck Park. The bonds have been sold and bids will soon be asked.

OAKLAND, CAL.—Bids are asked until Nov. 7 for the construction of the Webster St. bridge over San Antonio Estuary, and removing the foundation of the old structure. Frank C. Jordan, Clk. Supvs.

SAN JOSE, CAL.—Bids are asked by the county supervisors until Nov. 9 for constructing a bridge over Isabel Creek, on the Kincaid Road.

BUILDINGS.

BURLINGTON, VT.—Prescott, Buckley & Callanan, Keeseville, N. Y., were the lowest bidders for the construction of a new high school building in this city, at $82,400. Supt., H. O. Wheeler; Arch., W. R. B. Wilcox, of Burlington.

BROOKLINE, MASS.—The following bids were received Oct. 6 for the erection of a building for police and court purposes, at Washington and Prospect Sts.; bids were submitted for a building of granite and brick or entirely of granite: W. H. & H. A. Root, $67,177 and $72,572; Woodbury & Leighton, $73.546 and $73.546; McNeil Bros., $67,900 and $72,700; Ira G. Hersey, $67,700 and $71,000; Watts H, Bowker, $63,979.85 and $67,479.85; Charles King & Co., $68,000 and $72,000; Mack & Moore, $62,700 and $65,700; Norcross Bros., $74,337 and $76,426; Johnson Bros., $66,984 and $69,754; H. P. Cummings & Co., $66,839 and $70,119; C. H. Dodge, $68,506 and $71,659; E. W. Clark & Co., $65.591 and $70,140. For heating and ventilating: Walworth Construction & Supply Co., $3,225; Huey Bros., $2,797; Smith & Anthony Co., $3,449 and $3,212; Walker & Pratt Mfg. Co., $4,345; A. B. Franklin, $4,720; Buertal & Co., $3,339; Ingalls & Kendricken, $2,972. For plumbing: Burkett & Co., $4,635; Joseph Tucker & Sons, $3,750; Pierce & Cox, $3,865; C. H. Cronin, $3,726; John Manning, $3,970.

BALLSTON SPA, N. Y. — F. R. Comstock, Arch., 98 5th Ave., New York, is completing plans for a large high school building at this place. The exterior will be of cut stone and red face brick and black slate roof with copper trimmings; the interior finish will be of hard wood, with partitions of metal lath.

BUFFALO, N. Y.—Bids will soon be asked, according to reports, for erecting a new school building to replace School No. 16. Plans have recently been approved for a 20-room building, to cost $75,000. Arch., Frederick Mohr, 265 East Utica St.

DAVIDS ISLAND, N. Y.—M. Gibbons & Son, Brooklyn, N. Y., have been awarded the contract for erecting new hospital buildings on Davids Island, opposite New Rochelle, to cost about $30,000. Work is to commence at once.

GOWANDA, N. Y.—Edward P. Bates, of Buffalo, was the lowest bidder, Oct. 4, for piping for steam supply to the hospital buildings, at $9,384.

NEWARK, N. Y.—Bids are asked until Oct. 20 for erecting a cottage dormitory on the Custodial Asylum grounds at Newark. Address E. K. Burnham, Treas.; C. W. Winspear, Supt., both of Newark.

NEW YORK, N. Y.—Bids are asked until Oct. 15 for erecting a new church building, at Central Park West and 68th St., for the Second Church of Christ (Scientist). Plans call for a steel frame building, and floors and partitions to be of the wire construction, with concrete, 90 × 96 ft., with an auditorium to seat 1,000 persons. The exterior will be of marble, with roofing of Blacksley and copper, and the floors of marble. All wood work will be of mahogany, and there will be considerable bronze work. Address F. R. Comstock, Arch., 98 5th Ave.——Bids are asked by the board of education, at 585 Broadway, until Oct. 17, for supplying new furniture for Public Schools 42, 158 and 160, Borough of Manhattan; also for paving, grading, etc., at Public School 20, Borough of Richmond; also for heating and ventilating apparatus and electric light plant for Public School 167, Borough of The Bronx, etc.——Bids are asked by the fire department, 157 East 67th St., until Oct. 19, for erecting a building for the department on Main St., 150 ft. east of Arnow Place, Borough of The Bronx; sureties, $4,000.——Bids are asked by the department of parks, Arsenal Bldg., until Oct. 20, for the construction of a range of greenhouses and appurtenances in Central Park, near Fifth Ave. and 105th St.——Plans will be received until Nov. 1, according to reports, for a new 6-story fireproof hospital building, to be erected by the Beth Israel Hospital, 206 East Broadway, at Jefferson and Cherry Sts., to cost about $75,000. Harry Fischel, Chn. Bldg. Com., 215 East Broadway.——Plans have been filed by Mrs. Mary Schafer, 640 Eagle Ave., for four 4-story brick flat and store buildings, at German Place and 157th St., to cost $80,000. Arch., Edward Wenz. 1491 3d Ave.; by Hammerstein Amusement Co., for a 4-story brick concert hall, at 42d St. and 7th Ave., to cost $50,000. Archs., J. B. McElfatrick & Son, 1402 Broadway; by Joseph A. Farley, for four 4-story brick dwellings, on 108th St., near the Boulevard, to cost $110,000. Archs., James & Leo, 967 Boulevard; by Babette Blumenthal, 1840 3d Ave., for four 5-story brick flat buildings, on 118th St., near 5th Ave., to cost $104,000. Arch., Rudolph Werner, 1825 Vanderbilt Ave.; for eight 4-story brick flat buildings, at Jackson Ave. and 156th St., to cost $84,000. Arch., W. C. Dickerson, 3d Ave. and 149th St.; by Isaac Mayer, 69 East 107th St., for four 5-story brick flat and store buildings, at 82d St. and Park Ave., to cost $114,000. Arch., John Hauser, 1441 3d Ave.; by McCracken & Dagnell, 400 West 152d St., for four 5-story brick flat buildings, on 149th St., near the Boulevard, to cost $95,000. Arch., Neville & Bagge, 217 West 125th St.

NEW YORK, N. Y.—Bids are asked by the department of correction, 148 East 20th St., until Oct. 24, for installing three elevators on Blackwell's Island; two sureties, $7,000 each.

OGDENSBURG, N. Y.—Breen Bros., of Utica, have secured the contract for heating the new infirmary building of the State Hospital at Ogdensburg, at $6,700.

TROY, N. Y.—Behan & Casey were awarded the contract for the stone work on the erection of the new high school building in this city, at $76,430, using Indiana limestone; Nial Bros. received the contract for carpentry work, at $17,868; William Loeble, for roofing, at $2,965; M. Mahoney, for heating and ventilating, at $9,708, and for steel and iron work, $13,400. Bids are asked for plumbing and gas fitting until Oct. 14. Other bidders on the masonry work were E. Broderick & Son, $95,304; Jas. H. Morrissey, Indiana stone, $81,300; Chas. Crowley, Indiana stone, $87,712; Wm. Ellis, Indiana stone, $94,800; P. H. Buckley, $106,000; C. P. Boland, of Troy, Indiana stone, $92,553. Arch., F. M. Cummings, Times Bldg., Troy.

ATLANTIC CITY, N. J.—A fire in this city, Oct. 8, destroyed a number of amusement buildings at Tennessee, New York and Ocean Aves., causing a reported loss of $200,000.

OCEAN GROVE, N. J.—The contract for the steam heating plant for the Memorial Hospital has been awarded to Bazley & Burns, of Long Branch, N. J., to cost about $1,800.

SOMERVILLE, N. J.—Bids are being received by J. E. & A. L. Pennock, 305 Walnut St., Philadelphia, Pa., according to reports, for erecting a 2-story fireproof school building at this place. Arch., Wm. E. Bloodgood, 64 Cedar St., New York.

PHILADELPHIA, PA.—Contracts will soon be let for erecting the proposed Lyric Theatre building, at Haverford and Belmont Aves., to cost about $150,000. Arch., J. D. Allen, 1017 Chestnut St.——Contractors Doyle & Doah have been granted a permit to build a new 3-story brick and stone building for the Children's Homeopathic Hospital, to cost about $50,000. Archs., Keen & Mead, 13th and Walnut Sts.——Jackson, Hook & Co. have received the contract for the erection of a 1-story brick and iron storage warehouse, 55 × 150 ft., at McKean St., near Moyamensing Ave., for Thomas, Roberts & Stevenson.—— The following were the lowest bids submitted by the different bidders, Oct. 3, for erecting the superstructure, except interior finish, of the U. S. Mint building in this city; the first sum is for marble and the second for granite: Allen B. Rorke, Philadelphia, (a) New Hampshire marble, $505,000, (b) Holmesburg, Pa., granite, $450,000; James B. Smith, New York, (a) Beaver Dam, Md., $550,983, (b) Hurricane Island, Me., $516,170; Norcross Bros., Worcester, Mass., (a) Georgia, $480,000, (b) Troy, $483,000; George Mann, Baltimore, (a) Beaver Dam, Md., $499,000, (b) Woodstock, Md., $482,500; Charles McCaul, Philadelphia, (a) New York light, $528,743, (b) Mt. Desert, $441,743; Amberg Granite Co., Chicago, (a) Amberg, $550,000; J. E. & A. E. Pennock, Philadelphia, (a) Lee, Mass., $568,000, (b) Woodstock, Md., $545,000; John Gill & Sons, Cleveland, O., (a) Ashley Falls, Mass., $520,000, (b) Hummelstown white, $469,500; McIlvain, Unkefer & Co., Pittsburg, (a) Cockeysville, Md., $559,773, (b) Lacolet, $487,492; Girard Construction Co., Philadelphia, (a) Dorset, Vt., or Lee, Mass., $600,300, (b) Walboro, Me., $515,000; P. J. Carlin & Co., Brooklyn, N. Y., (a) Beaver Dam, $497,393, (b) Walboro, Me., or Petersburg, Va., $467,000; William H. Ellis, Cincinnati, (a) Georgia, $604,900; (b) Blue Hill, Me., $492,000; Prescott, Buckley & Callanan, Keeseville, N. Y., (a) Lee, Mass., $494,000, (b) Hurricane Island, $471,200; William Booth & Co., New York, (a) Hurricane Island, $471,200; D. W. Thomas, Baltimore, (a) Beaver Dam, $570,000 (b) Woodstock, Md., $545,000.

PITTSBURG, PA.—Kerr & Fox have been awarded the contract for erecting engine house No. 28, at Filbert and Elmore Sts., at $33,324.

SCRANTON, PA.—Plans are being completed for a stone residence to be erected in Scranton for L. A. Watres, including three cottages, a large stable, and boiler house containing heating and lighting plants. Arch., F. R. Comstock, 98 5th Ave., New York.

WILKESBARRE, PA.—E. T. Long has been awarded the contract for the erection of the new asylum building at Retreat by the central poor board, at $159,071.

WASHINGTON, D. C.—Bids are asked until Oct. 15 for the erection of a frame refreshment pavilion, covering about 18,000 sq. ft., with cellarage, etc., on the west shore of Chesapeake Bay, about 55 miles south of Baltimore, at the terminus of the Chesapeake Beach Ry. from Washington. Address the company, 1420 New York Ave., N. W., Washington, D. C.

BALTIMORE, MD.—The receivers of the Baltimore & Ohio R. R. have adopted plans and are about ready to let the contract for a new $100,000 inbound freight station in Baltimore. The new building will be 600 ft. long, 42 ft. wide and 6 stories high, and will occupy the site of the present inbound station on Eutaw St., between Camden and Barre Sts. The new building will have a cold storage plant in the basement, and the upper floors will be used as a storage warehouse, and all freight will be loaded and unloaded from wagons under cover. The tracks will be so arranged that 75 cars can be unloaded at one time.

RALEIGH, N. C.—Bids will soon be asked for the erection of a new cathedral in this city for the Church of the Good Sherherd (Episcopal), to cost between $25,000 and $40,000. Rector, D. I. McK. Pittinger.

COLUMBUS, GA.—Bids are asked by the supervising architect, Washington, D. C., until Oct. 21, for the completion of the interior finish, plumbing and approaches of the post-office building.

MOBILE, ALA.—Bids are asked until Oct. 31 for furnishing metal work for six day beacons for Florida Reefs, as stated in our advertising columns. Lt.-Col. A. N. Damrell, U. S. Engrs., Mobile.

TOLEDO, O.—A. Bentley & Son are stated to have received the contract for erecting a building on Cherry St., to be occupied by the Dow-Snell Co., to cost about $50,000.

LOWELL, IND.—The Post Office Building, Nichols Opera House and adjacent buildings were damaged by fire, Oct. 6, causing a reported loss of $40,000.

DETROIT, MICH.—Robert Y. Ogg, Secy. Bd. of Pub. Wks., informs us that H. P. O'Connell, of Detroit, was the lowest bidder for erecting the market building, at $9,570.

CHICAGO, ILL.—Plans have been completed for the new 9-story Ayer building, to be erected at 215 and 221 Wabash Ave., at an estimated cost of $225,000. Archs., Holabird & Roche, 1618 Monadnock Block.——Plans have been prepared, according to reports, for a new building to be erected for the All Soul's Church, at Langley Ave. and Oakwood Boulevard, to cost $100,000. Arch., Dwight H. Perkins, 1107 Steinway Hall.——A building permit has been granted to Lincoln Brooke for a 5-story apartment building, to be erected at 3600 to 3604 Wabash Ave., to cost $105,000.

CHICAGO, ILL.—Bids are asked by the department of public works, L. E. M'Gann, Comr., until Oct. 24, for erecting the fire engine house at Michigan Ave. and Washington St.; deposit, $5,000.

FREEPORT, ILL.—We are informed that bids will be received until Oct. 17 for all of the superstructural masonry, wrought and cast-iron work, slate and metal roofing, and all of the carpenter work and material necessary to prepare the new city hall building for plastering. Geo. H. Tandy, Cy. Clk.; D. S. Schureman, Arch., 215 South Church St., Rockford, Ill.

DAVENPORT, IA.—Plans are being prepared for a 5-story brick office building, to be erected here for M. D. Peterson, to cost about $50,000. Archs., Clausen & Burrows, 205 West 3d St.

DES MOINES, IA.—The commissioners of Polk county have decided to submit to the people at the November election a proposition for the issuance of $400,000 in bonds for the erection of a new county court house.

SPENCER, IA.—The proposition of erecting a new $40,000 court house for Clay county will be considered at the November election.

GENOA, NEB.—Bids are asked by the Department of the Interior, Washington, D. C., until Oct. 28, for the construction of a combination high and low pressure steam-heating plant at the Genoa Industrial School. Supt., J. E. Rose, Genoa.

OMAHA, NEB.—The Grace & Hyde Co., Chicago, Ill., has been awarded the contract for erecting the new union station for the Union Pacific Ry. Co., to be 350 ft. in length. The Crane Elevator Co., Chicago, will erect the electric elevators, and John Rowe & Co., Omaha, install the plumbing. Total estimated cost, $300,000. Archs., Frost & Granger, Chicago.

ELLENDALE, N. DAK.—Bids are asked until Nov. 15, according to reports, for erecting a building for the State Industrial and Manual Training School. T. H. Fans, Secy. Bd. of Trustees, Ludden, N. Dak.

OGDEN, UTAH.—Bids are asked until Oct. 17 for lining the county jail with sheet steel; bond, $250. John Seaman, Com. in Charge.

WATER-WORKS.

BERWICK, ME.—At the town meeting held Oct. 3 it was voted to postpone action with reference to securing a better water supply.

PLYMOUTH, N. H.—A committee has been appointed to investigate the question of the municipal ownership of the works and to submit a report Nov. 24. The town appropriated $500 for expenses of the committee, which is composed of J. N. McCoy, Frank H. Rollins and C. J. Ayer.

BOSTON, MASS.—Bids are asked until Oct. 17 for furnishing the Pauper Institutions Department with 134 tons of cast-iron water pipe; bond, $1,000. Chn. Trustees, Wm. T. Sedgwick, 28 Court Square, Boston.

NEEDHAM, MASS.—Bids are asked until Oct. 17 for constructing a supply well. Engr., Louis E. Hawes, Tremont Bldg., Boston; Chn. Comrs., Edmund G. Pond.

BAINBRIDGE, N. Y.—Bids are asked until Oct. 15 for constructing the proposed works and for furnishing the hydrants. The contract for furnishing 34,000 ft. of pipe was let Oct. 8. There will be required 40 hydrants, 20,000 lbs. special castings, a reservoir, etc. J. C. Scott, Clk., writes us that the water supply will be secured from a creek; estimated cost, $22,000. Engr., J. Warren Lamb, Cooperstown, N. Y.

BUFFALO, N. Y.—Esenwein & Johnson, Mooney Bldg., have submitted plans to the board of public works for the $700,000 pumping station. It will have eight boilers and engines.

CANISTEO, N. Y.—Press reports state that the council is considering the question of purchasing the works of the Canisteo Water-Works Co.

CHURCHVILLE, N.Y.—C. H. Sage writes us that the proposed new works will require a triplex power pump, a stand-pipe, 12 × 75 ft.; 6,000 ft. of 3-in. and 3,000 ft. of 4-in. cast-iron water pipe; 12 to 15 hydrants, one 4-in. gate valve, etc.; estimated cost, $4,000. A special election will be held soon to vote on the question.

IRVINGTON, N. Y.—At the election Oct. 4 this place voted to appropriate $50,000 for extending the water-works.

NEW YORK, N. Y.—Bids are asked until Oct. 20 for improving the pumping plant at Queens Point, Queens and for furnishing and laying water pipe in the Southern Boulevard, Manhattan. Comr. Water Supply, Wm. Dalton, 150 Nassau St., New York.

SARATOGA SPRINGS, N. Y.—The village engineer has submitted plans and specifications for a main from the Greenfield reservoir; estimated cost, $4,000.

ALLENHURST, N. J.—An election will be held Nov. 4 to vote on the question of purchasing the works of the Coast Water & Sewer Co.

NEWARK, N. J.—The board of works has ordered the sinking of more wells at Belleville for a better water supply.

ORANGE, N. J.—Press reports state as follows: Four reports on the question of increasing the water supply of Orange were presented at the meeting of the council Oct. 3, and after each had been read it was decided to engage another consulting engineer to meet with the council, City Engineer Fred. T. Crane, and Peter Milne, consulting engineer, 1241 Dean St., Brooklyn, N. Y., and discuss the various reports. The various plans suggested are to lay a 16-in. main from the present reservoir to Scotland St., to enlarge Campbell's Pond, to locate another reservoir at Hemlock Falls, when it would be necessary to build a pumping station on South Orange Ave., and then connect with a 16-in. main to the city; a pump at the sewage pumping station in Orange Valley, and the purchase of land for a reservoir at St. Cloud with a main running to Northfield Road, which would require a station to pump water into the present reservoir; estimated cost, about $100,000.

SPRING LAKE, N. J.—Bids are asked until Oct. 15 for the purchase of $70,000 of 30-year 5% gold bonds for constructing the proposed works and a sewerage system. Mayor, E. V. Patterson.

ALLENTOWN, PA.—The council has passed to the second reading an ordinance appropriating $14,000 for the purchase of Schantz's spring, four miles west of the city.

NORRISTOWN, PA.—The Norristown Water Co. has offered to build a 12-in. water main in Main St., at a cost of about $1,500.

PHILADELPHIA, PA.—Bids were opened at the Bureau of Water Oct. 4 for improvements to the Roxborough pumping station, the lowest and the highest bids for each item being as follows: Boilers, I. P. Morris Co., $27,742; Robert Wetherill & Co., $28,800; Brick chimney, Macy, Henderson & Co., $8,487; S. Opdyke, Jr., $14,360. Annex to boiler house, H. C. Nichols Co., $17,983; S. Opdyke, Jr., $34,600.

TYRONE, PA.—The council has offered to purchase the works of the Tyrone Gas & Water Co. for $90,000. This place voted July 7, 1897, to purchase the works.

INDIAN HEAD, MD.—E. S. Brandt, Ch. Clk. Bureau of Ordnance, Navy Dept., Washington, D. C., writes us that the following bids were received Oct. 8 for furnishing and installing a steel stand-pipe:

		Days.
Robt. Wetherill & Co., Chester, Pa..........	$10,250	180
R. D. Wood & Co., Philadelphia..............	8,200	120
Riter-Conley Co., Pittsburg, Pa..............	9,757	115
Maryland Steel Co., Sparrows Point.........	13,124	150

WASHINGTON, D. C.—Otto Mears, Pres. Chesapeake Bay Construction Co., 1420 New York Ave., N. W., Washington, writes us that the company will soon ask for bids to build water-works at Chesapeake Bay terminus of the railway, the plant to be so constructed as to furnish power also for electric lights. The company will ask for plans to be submitted for works of the character mentioned to supply a town of 5,000 people.

NORFOLK, VA.—Bids are asked until Oct. 26 for constructing dams, waste weirs and canals for an addition to the water-works and canals, as stated in our advertising columns. H. L. Smith, Supt. Water Dept.

DURHAM, N. C.—Judge Purnell, of the Federal Court bench, at Raleigh, has appointed P. H. Hardy, Philadelphia, Pa., as receiver for the Durham Water Co.

GREENSBORO, N. C.—It is stated that the city proposes to issue bonds for new works and a sewerage system, to cost about $50,000.

SALEM, N. C.—New York and New Jersey parties, who are about to build a manufacturing plant here, propose to construct works and a sewerage system.

ORANGEBURG, S. C.—This place voted Sept. 27 to issue $40,000 in bonds for works and a light plant. Dr. J. G. Wannamaker, M. Thomas and Dr. T. C. Doyle are on the committee.

SYLVANIA, GA.—E. K. Overstreet writes us that the election to vote on the question of issuing bonds for an artesian well was postponed.

MONROE, LA.—At the election Nov. 9 this place will vote on the question of issuing $153,000 in bonds for purchasing the works and light plant of the Monroe Water-Works & Light Co. and for building a sewer system, etc.

NATCHITOCHES, LA.—It is probable that this place will again soon vote on the question of issuing bonds for works and a light plant. Estimated cost, about $20,000. Population, 2,000.

WHITE CASTLE, LA.—Local papers state that a company will be organized to build works.

KNOXVILLE, TENN.—The question of the city purchasing the works of the Knoxville Water Co. is being considered by the council. Alderman W. H. Goss may be addressed.

BRAZIL, IND.—The question of securing an increased water supply from the Wabash River, a distance of 12 miles, is being considered by the council, according to reports. Estimated cost, $125,000.

ROCKVILLE, IND.—Jas. B. Nelson, 61 Baldwins Block, Indianapolis, Ind., has prepared plans and specifications for combined works and electric light plant. It is the intention of the council to let the contract without delay. Population, 2,500.

EATON RAPIDS, MICH.—Bids are asked until Oct. 18 for the power house, stand-pipe, pumps and boilers for the proposed works, as stated in our advertising columns last week. Bids were opened Oct. 4 for furnishing the pipe, castings, etc. Secy. Bd., Jas. H. Gallery.

IRONWOOD, MICH.—It is proposed to extend the works of the Ironwood Water Co. It is probable that a stand-pipe will be erected on the hill north of the city. Supt., J. S. Kennedy.

CHICAGO, ILL.—Bids are asked until Oct. 15 for building an addition to the 68th St. pumping station. Comr. Pub. Wks., L. E. McGann.

ASHLAND, WIS.—Bids are asked until about Oct. 20 for furnishing the materials and for building a water filter, with piping, etc., at the Vermillion Lake School near Tower, Wis. Address the U. S. Indian warehouse, 1602 State St., Chicago, Ill., the Indian office, Washington, or S. W. Campbell, U. S. Indian Agent, La Pointer Agency, Ashland.

CANBY, MINN.—It is reported that estimates for works will be secured, after which an election to vote on the question will be held.

LITTLE FALLS, MINN.—This place voted Oct. 4 to issue $60,000 in bonds for works and an electric plant, according to reports.

PERHAM, MINN.—Bids are asked until Oct. 18 for furnishing the materials and for constructing small works and a light plant. Engr., Chas. F. Loweth, St. Paul, Minn., and 301 W. 3d St., Davenport, Ia.; Recdr., R. E. Bachman.

ADAIR, IA.—The question of building works to cost about $10,000 is being considered, according to reports.

BLOCKTON, IA.—This place voted Oct. 1 to issue bonds for works. Population, 1,000.

UTE, IA.—J. R. Carter writes us that an election will be held Oct. 20 to vote on the question of issuing bonds for works. Population, 450.

FREMONT, NEB.—It is proposed to extend the water mains in Nye and Maxwell Aves.

JAMESTOWN, N. DAK.—Bids are asked until Nov. 1 for sinking a 4 and 6-in. artesian well 1,500 ft., with and without guarantee of water. City Audr., Geo. C. Eager.

BRITTON, S. DAK.—R. C. Libbey, it is stated, proposes to sink an artesian well.

CORSICANA, TEX.—Upton Blair, Engr. Compress Co., is reported as investigating sources for a water supply.

SHAWNEE, OKLA.—Bids are asked until Oct. 20 for furnishing the materials and for building works; estimated cost, $35,000. Check, $1,000. Address R. H. Clayton and E. E. Hood.

RENO, NEV.—Bids are asked until Nov. 12 for the purchase of $130,000 of 6% water bonds for the proposed works. Pres. Council, R. S. Osburn; Clk., F. B. Porter.

WARD, COLO.—This place voted Sept. 27 to issue $12,000 in bonds for works. As soon as the bonds are sold bids for the construction will be asked. Engr., D. J. McCanne, 1600 17th St., Denver, Colo.

OAKESDALE, WASH.—The construction of works is proposed, according to reports.

ROSALIA, WASH.—The council has levied a tax of 7 mills for the proposed works to cost about $2,500.

SAN LUIS OBISPO, CAL.—The town trustees have voted to take definite steps at once for the construction of municipal works to cost about $90,000. Cy. Clk., J. A. Goodrich.

WHITTIER, CAL.—Plans for the proposed works prepared by Burr Bassell, 524 Stimson Block, Los Angeles, Cal., have been accepted by the city trustees. About $40,000 of 20-year bonds will be sold. Cy. Engr., J. J. Jessup.

SHERBROOKE, QUE.—The following improvements to the works have been recommended by Willis Chipman, Bay St., Toronto, Ont.: Larger intake pipe, $4,000; duplicate of pumping machinery, $3,000; repairs to reservoir and new main, $4,000; filtration plant, $18,000; replacing of water mains, $33,000.

ST. CATHARINES, ONT.—The question of making certain improvements to the works and for putting in a filtration plant of 1,000,000 gallons capacity, is being considered; estimated cost, $14,000.

NEW DENVER, B. C.—J. C. Harris, it is stated, proposes to construct works for this place. Water will be secured from wells two miles distant.

PACHUCA, MEX.—Press reports state that the state government of Hidalgo has purchased the Pachuca water-works for $250,000, payable in installments extending over more than ten years. The plant consists of dams and reservoirs, eleven kilometers of conduits and four kilometers of distributing pipe, and said to be in first-class condition.

MATEHUALA, SAN LUIS POTOSI, MEX.—Press reports state that W. B. A. Dingwall proposes to build works for this city.

SEWERAGE.

BOSTON, MASS.—The Metropolitan Sewerage Commission has awarded the contracts for proposed additions to the pumping plants at Deer Island, on the southerly side of Chelsea Creek, in East Boston, and at Malden bridge, in Charlestown, to the E. P. Allis Co., of Milwaukee. The bid for that at Deer Island is $27,200; at East Boston, $25,600; at Charlestown, $25,800. Chief Engineer Brown, of the commission, is busy making a study for the new high level sewerage system for the Charles and Neponset River valleys.

CONCORD, MASS.—The contract for preparing the sewage filtration beds for this place has been let to J. W. Meskill, 164 Broadway, Everett, Mass., at $1,473. The itemized bids will be given next week. Engr., Leonard Metcalf, 89 State St., Boston.

NEWTON, MASS.—Bids are asked until Oct. 21 for furnishing about 90,000 ft. of 24 to 4-in. sewer pipe, about 4,700 bbls. of American cement, 800 lbs. of Portland cement and 200 cast-iron manhole frames and covers; check, $200. St. Comr., Chas. W. Ross.

SPRINGFIELD, MASS.—Bids are asked until Oct. 14 for constructing 600 ft. of egg-shaped, 26 × 39-in. brick sewer. Cy. Engr., Chas. M. Slocum; Supt. of Sts., Wm. L. Dickinson.

WATERTOWN, MASS.—Bids are asked until Oct. 25 for building a sewer at the Watertown Arsenal. Maj. J. W. Reilly, Ordnance Dept., Commanding.

BINGHAMTON, N. Y.—The council has voted to build a sewer in Clinton St. Mayor, Jerome De Witt.

BUFFALO, N. Y.—Mayor Diehl has vetoed the ordinance appropriating $90,000 for a sewer in Emslie and Van Rensselaer Sts.——The council has voted to build a sewer in Bryant St.

BUFFALO, N. Y.—The filling of the Hamburgh Canal is being agitated and plans have been prepared by City Engineer Bardol. The sewage disposal and filling of the canal will cost about $700,000.——New bids will be asked for constructing a sewer in Hampshire and Ferry Sts., to cost about $34,000.

NEWBURG, N. Y.—The board of public works has recommended that the council build an iron pipe and brick relief sewer in First St., fro Dubois St. to the river, at a cost of about $36,600. Cy. Clk., D. J. Coutant.

ONEIDA, N. Y.—The council will be petitioned Oct. 18 to extend the sewers.

ROCHESTER, N. Y.—H. N. Cowles was awarded contract Oct. 3 for building a sewer in North Clinton St., at $6,867.

HOBOKEN, N. J.—Local papers state that steps have been taken by the council for improving the sewers in the uptown section of the city. It is said that this is the first movement towards the reconstruction of the system of the city. Cy. Surv., W. F. Whittemore.

SPRING LAKE, N. J.—Bids are asked until Oct. 15 for the purchase of $70,000 of 30-year 5% bonds for a sewerage system and water-works. Mayor, E. V. Patterson.

CARLISLE, PA.—Maj. Chauncey Ives, Chambersburg, Pa., has been engaged to prepare plans, etc., for a system.

KINGSTON, PA.—Plans for a system have been prepared by Borough Engineer Wright. Burgess Starbird may be addressed.

WASHINGTON, D. C.—Bids are asked by the district commission until Oct.22 for building sewers.——Local papers state that Capt. Lansing H. Beach, the District Engr. Comr., has returned from a visit to Boston and Brockton, Mass., and Providence, R. I. He inspected the sewage pumping stations, the precipitation works and the filtration beds of the sewer systems of those cities. Congress has appropriated $25,000 for the preparation of plans for a sewage pumping station at the foot of New Jersey Ave., and it was in connection with these plans that Capt. Beach made his trip north. It is proposed to pump the sewage across and under the Eastern Branch, from the point mentioned, and then raised to such a height as would cause the sewage, by natural gravitation, to flow into the river, several miles below. It is believed the sewage can be carried across the hills at less expense than it would cost to precipitate it. It is the purpose of the Commission to use every effort to secure the necessary appropriations at the coming session of Congress.

RICHMOND, VA.—The question of improving the Fifth St. sewer is being considered.

TAMPA, FLA.—Bids are asked until Oct. 25 for furnishing the materials and for constructing 40,000 ft. of pipe sewers and house connections, as stated in our advertising columns. Ch. Engr., J. N. Hazlehurst; Pres. Bd. Pub. Wks., W. B. Henderson.

MEMPHIS, TENN.—The council proposes to spend $150,000 for sewers. Mayor Williams may be addressed.

COLUMBUS, O.—Bids are asked until Oct. 18 for building an 18 and 12-in. pipe sewer in Spruce St. Clk. Bd. Pub. Wks., Jas. A. Fanning.——The residents of the West Side have petitioned the council to build additional sewers to drain that portion of the city.

EAST CLEVELAND, O.—Bids are asked until Nov. 5 for constructing sewers in a number of streets. Engr., Walter P. Rice Engineering Co., Society for Savings Bldg., Cleveland; Clk., H. B. Chapman.

HAMILTON, O.—Bids are asked until Oct. 17 for constructing a storm sewer in Fourth St. Cy. Engr., L. A. Dillon; Cy. Clk., M. O. Burns.

LEBANON, O.—Bids are asked until Oct. 22 for constructing 1,262 ft. of 12-in. and 182 ft. of 6-in. pipe sewers, with necessary appurtenances. Cy. Engr., W. R. Kemper.

TOLEDO, O.—Bids are asked until Oct. 24 for constructing 15 and 12-in. pipe sewers in certain streets. Cy. Clk., L. P. Harris.——Bids will be asked at once to construct an 84 to 66-in. brick sewer in certain streets.

WELLSVILLE, O.—E. J. Millar, Wheeling, W. Va., has submitted plans and specifications for a system. At the election to be held Nov. 8 the question of issuing $75,000 in bonds for the system will be voted upon.

HUNTINGTON, IND.—Bids are asked until Oct. 25 for constructing a 24-in. pipe sewer in Warren St. Cy. Engr., Frank Guthrie; Cy. Clk., C. H. Cutshall.

INDIANAPOLIS, IND.—The city engineer is preparing plans for sewers in a number of streets to cost a total of about $160,000.

INDIANAPOLIS, IND.—Bids are asked until Oct. 19 for building sewers in West Michigan St. Pres. Bd. Pub. Wks., M. A. Downing.

LOGANSPORT, IND.—Bids are asked by the sewer committee for building 1,100 ft. of 30-in. pipe sewer in Penn St., to cost $1,200.

MONTICELLO, IND.—Bids are asked until Oct. 28 for building a 30-in. pipe sewer in Washington St. Pres. Bd. Trustees, M. Wolz; Clk., W. M. Hamlin; Cy. Engr., Web. P. Bushnell.

RICHMOND, IND.—Bids are asked until Oct. 14 for building a certain sewer. Clk. Bd., Geo. J. Knollenberg.

WHITING, IND.—Bids are asked until Oct. 24 for furnishing the materials and for constructing about 2½ miles of pipe and about a mile of brick sewers. Town Clk., John G. Erdlitz; Pres. Bd. Trustees, C. A. Johnson.

GROSSEPOINTE, MICH.—The council proposes to build a trunk sewer to the lake front.

VICKSBURG, MICH.—The Vicksburg Sewer Co. has been incorporated to operate the system here. Capital stock, $2,000. Pres., Wm. W. Scott; Secy., Frank S. Coller; Treas., Elbert L. Page.

CHICAGO, ILL.—Bids are asked until Oct. 14 for building sewers in a large number of streets. Pres. Bd. Local Improvements, L. E. McGann.

ROCKFORD, ILL.—Bids are asked until Oct. 25 for furnishing the material and constructing certain sewers on the Eighth St. sewer district, as described in our advertising columns. E. W. Brown, Pres. Bd. Local Improvements; Edwin Main, Cy. Engr.

FARGO, N. DAK.—J. A. Johnson, Mayor, writes us that it is proposed to build a mile of 15 and 12-in. pipe sewers at a cost of $2.15 a ft. Cy. Engr., S. F. Crabbe.

DENVER, COLO.—We are informed that plans and specifications, report, etc., for storm sewers, to cost $400,664, were adopted Sept. 23. This amount is for main sewers alone, the largest of which will be 81 ins. in diameter. The plans as adopted contemplate the drainage of 2,100 acres at a total cost of about $1,000,000. The contracts for the storm sewers will probably be let Dec. 15. Des. Engr., Harvey C. Lowrie, Denver; Pres. Bd. Pub. Wks., S. N. Wood.

SANTA MONICA, CAL.—Press reports state as follows: Plans and specifications are being prepared for a branch sewer which is to afford drainage for a long stretch of beach places, from which the sewage cannot be carried by gravity into the new system. In order to dispose of the sewage draining into this branch, it will be necessary to raise it by pumping. A receiving tank will be located near central portion and in connection with it a 40-HP. pump will be installed. The tank will have a capacity of 100,000 gallons. The sewer will be built on a grade to drain into the basin, from which it may be pumped into the present trunk sewer and carried to sea. The pump will have a capacity of 100,000 gallons an hour. Of the 8,000 ft. of sewer proposed, only about 1,000 ft. are to be built soon. Cost of the whole of this branch is estimated at $13,000, and of that part to be built at once about $7,500. It will be paid for out of the $40,000 bond issue, which the city has made.

LACHINE, QUE.—The council is reported to have decided to take up the matter this winter of building a system for this place; estimated cost, about $200,000.

MERIDA, YUCATAN, MEX.—It is stated that a contract will soon be let by the municipal authorities for building a system for this city; estimated cost, $1,467,000; population, 60,000.

GARBAGE DISPOSAL—STREET CLEANING

ATLANTIC CITY, N. J.—The following bids were received by the council Oct. 3 for erecting a new garbage crematory: Rudolph R. Baizley, $31,585; Fred. T. Moore, $32,211, and Cyrus Borgner, $33,265. The bids were called to see if the contracts recently let for the work to Thos. K. Dalzell, at $29,000 was too high. The council, at an adjourned meeting Oct. 4, voted to reject the bids as too high, the estimate of Mr. Dalzell still standing.

WELLSVILLE, O.—The board of health has directed the secretary to ask for estimates for building a garbage disposal plant. Messrs. Dennis, Ashley and Whitacre, of the board, may be addressed.

MILWAUKEE, WIS.—It is stated that the Engel Cremation & Sanitary Co. will begin work in a few days on its proposed plant for this city. A bond for $52,500, the amount of the contract, has been deposited. Engr. and Supt., Robt. Robinson; Gen. Mgr., C. W. Smith.

LONG BEACH, CAL.—It is proposed by the town trustees to purchase a street sprinkling wagon for $2,500.

STREETS AND ROADS.

HALLOWELL, ME.—A contract has been awarded to A. G. Westcott for about 75,000 paving blocks, according to reports.

CHELMSFORD, MASS.—Bids are asked until 12 m., Oct. 13, for about 4,400 lin. ft. of highway. T. C. Mendenhall, Chn. Mass. Highway Comn., 4 Mt. Vernon St., Boston.

NORTH READING, MASS.—Bids are asked until 12 m., Oct. 13, for about 2,700 lin. ft. of highway. T. C. Mendenhall, Chn. Mass. Highway Comn., 4 Mt. Vernon St.

MERRIMAC, MASS.—Bids are asked until 12 m., Oct. 13, for 1,600 lin. ft. of highway. T. C. Mendenhall, Chn. Mass. Highway Comn., 4 Mt. Vernon St., Boston.

GLOUCESTER, MASS.—John J. Somes, Cy. Clk., informs us that the city will not purchase a new road roller, but will repair the old one at a cost of $800.

PITTSFIELD, MASS.—The commissioners of Columbia county, N. Y., and Berkshire county, Mass., will construct a road between Pittsford and New Lebanon, N. Y.; estimated cost, $7,875.

QUINCY, MASS.—Commissioner of Works Knowlton has estimated the cost of the proposed sidewalks at $7,807.

WESTERLY, R. I.—The council has voted to purchase a steam road roller.

ENFIELD, CONN.—Bids are asked until Oct. 20 for a section of new road on High and Enfield Sts. Henry D. Alden, First Selectman.

WOBURN, MASS.—John H. Time, Cy. Clk., informs us that the council has not provided funds for the proposed macadamizing, to cost $6,500, and the work will probably not be done this year.

DEERFIELD, N. Y.—The state board of public works, Albany, has awarded a contract to James J. Dwyer, Utica, at $13,806, for the improvement of the River Road, for about 2½ miles.

BUFFALO, N. Y.—Bids are asked until Oct. 21 for furnishing the material and for paving on Mechanic and Hydraulic Sts. R. G. Parsons, Secy. Bd. Pub. Wks.——A committee has been appointed to consider the proposed improvement of Niagara Square.

LANSINGBURG, N. Y.—Chas. A. Roemer, Cy. Engr., informs us that a contract has been awarded to Thos. H. Kane, Troy, N. Y., at about $64,000, for about 50,854 sq. yds. of macadam.

PATCHOGUE (L. I.), N. Y.—The village trustees have decided to have new sidewalks laid on Main St. and Ocean Ave., with stone or brick.

POUGHKEEPSIE, N. Y.—Bids were asked until Oct. 11 for repaving Crannell St., between Main and Mill Sts.; surety, $1,000. Chas. E. Fowler, Supt.

SILVER CREEK, N. Y.—The city council has engaged O. H. Gardner, Jamestown, N. Y., to make a survey of the town and establish a grade throughout the village.

SYRACUSE, N. Y.—The council has passed a resolution to pave McBride St. with asphalt, between James and Ash Sts.

ATLANTIC CITY, N. J.—The Delaware River Quarry & Construction Co., Lambertville, N. J., was awarded a contract Oct. 3, at $56,963, for macadamizing on Pacific Ave. The itemized bids are given under Contract Prices. J. A. Hackney, Cy. Surv.; Edwards S. Lee, Chn. Com.

BAYONNE, N. J.—The council has awarded a contract to Rehill & Edwards, at $4,660, for grading on Ave. B.

GREENSBURG, PA.—A resolution has been passed by the council to pave Pennsylvania Ave. with brick, from West Pittsburg St. to Second St. F. V. B. Laird, Pres.; Ira C. Snyder, Cy. Clk.

JERSEY CITY, N. J.—Reports state that Chief Engineer Van Keuren and Chairman Nolan, of the street board, will urge the North Jersey St. Ry. Co. to pave between the tracks on Pavonia Ave.

NORRISTOWN, PA.—The highway committee has recommended that the terms of the Buffalo Pitts Co., Buffalo, N. Y., be accepted, for furnishing a road roller for $3,500, on 30 days' trial.

PHILADELPHIA, PA.—Bids are asked until Oct. 17 for about 720 sq. yds. of asphalt and 175 sq. yds. of concrete. Address Wm. H. Lambert, 395 City Hall.

READING, PA.—Bids are asked until Oct. 20 for 4,000 sq. yds. of asphalt paving and 1,000 lin. ft. of curbing, on South Fifth St. S. S. Hoff, Cy. Engr.

WASHINGTON, PA.—Geo. L. Walker, Burgess, informs us that it has been voted to issue $67,000 in bonds for paving, which will be done next spring. Geo. Jenkins, Engr.

WILLIAMSPORT, PA.—Bids are asked until 12 m., Oct. 13, for paving on West St. with brick, on 6-in. concrete foundation. Theo. Cornman, Cy. Clk.; H. C. Reeder, Deputy Cy. Engr.

HANOVER, PA.—An election will be held in a few weeks to vote on a proposition to borrow $50,000 for paving and highway improvements, according to reports.

OAKLAND, MD.—Bids are asked until Oct. 25 for the purchase of $13,000 of 4% street improvement bonds. R. S. Jamison, Mayor.

PETERSBURG, VA.—The proposed brick paving, etc., on Sycamore St., from Old St. to Washington St., is estimated to cost $14,330. N. T. Patterson, Pres.

ST. AUGUSTINE, FLA.—P. S. Amon, Cy. Clk., informs us that the council has appropriated an amount equal to the city's portion, for paving St. George St. with brick, a distance of about four blocks.

TAMPA, FLA.—Bids are asked until Oct. 25 for furnishing the material and paving about 28,865 sq. yds. with brick and for 14,500 ft. of granite curbing, as stated in our advertising columns. W. B. Henderson, Pres.; J. N. Hazlehurst, Ch. Engr.

MONTGOMERY, ALA.—Bids are asked until Oct. 17 for furnishing the material and setting stone curbing and surface sewers for six months. R. H. Sommerville, Treas.

CINCINNATI, O.—Bids are asked until Nov. 3 for constructing and repairing artificial stone sidewalks for one year. Geo. H. Spellmire, Clk. Bd. Cy. Affairs.

CINCINNATI, O.—Bids are asked until Nov. 7 for constructing and repairing of all plank sidewalks on the eastern and western districts for one year. Geo. H. Spellmire, Clk. Bd. Cy. Affairs.

CLEVELAND, O.—Bids are asked until Oct. 15 for grading and brick paving on Hickory Lane and four other streets, and until Oct. 29 for grading and Medina block paving on Willett and Quincy Sts. Geo. R. Warden, Dir. Pub. Wks.

CLEVELAND, O.—Bids are asked until Oct. 19 for furnishing and laying stone flagging on certain streets, and until Oct. 29 for grading, draining and paving portions of nine streets. Geo. R. Warden, Dir. Pub. Wks.

COLUMBUS, O.—Bids are asked until Oct. 18 for furnishing and constructing brick, asphalt and macadam pavement on Grant St., Wilson Ave., and Latta Ave., respectively. James A. Fanning, Clk. Bd. Pub. Wks.

TOLEDO, O.—Bids are asked until Oct. 24 for furnishing and constructing Buckeye brick pavement, etc., on 21st St., and until Nov. 7 for paving on Eastern Ave. with Buckeye brick, etc. L. P. Harris, Cy. Clk.——The council has passed ordinances for paving on Knower St. and one alley with Buckeye, Wassall blocks, etc., and constructing stone or brick sidewalks on Superior and Erie Sts.

URBANA, O.—The council has resolved to lay brick sidewalks on Dugan and Kenton Sts.

HUNTINGTON, IND.—Bids are asked until Oct. 25 for furnishing the material and constructing 6-ft. brick sidewalks on Washington St. and one alley. Frank Guthrie, Cy. Engr.

IRVINGTON, IND.—Bids are asked until Oct. 29 for grading and constructing cement sidewalks on Irvington Ave. John V. Coyner, Cy. Engr.

NEW ALBANY, IND.—We are informed that the question of constructing a turnpike to Bridgeport, a distance of 10 miles, is still in contemplation, and will be determined in a few days. Harry Vance, County Audr.; E. B. Coolman, County Surveyor.

RICHMOND, IND.—Bids are asked until 2 p. m., Oct. 14, for grading, graveling and setting curb and gutter on North D St., between 15th and 16th Sts. Geo. J. Knollenberg, Clk.

TERRE HAUTE, IND.—Bids are asked by the council until Nov. 1 for concrete and brick sidewalks and grading in certain streets.

DETROIT, MICH.—Bids are asked until Oct. 15 for furnishing and laying about 1,251 sq. yds. of cobble paving and for 621 yds. of excavation. D. W. H. Moreland, Pres. Bd. Pub. Wks.

GRAND RAPIDS, MICH.—Geo. W. Ames, Cy. Engr., has submitted estimates for the proposed paving of Canal St.; with asphalt, $18,625; brick, $13,250.

SAGINAW, MICH.—Resolutions have been passed by the council for constructing numerous sidewalks.

CARTHAGE, ILL.—Thos. S. McLanahan, Monmouth, Ill., is preparing plans and specifications for the improvement of the streets around the public square, and Main St. from the square to the depot, in Carthage, by paving them with brick; requiring about 25,735 sq. yds. brick and 16,420 lin. ft. of curbing and excavating about 9,000 cu. yds. Total distance about one mile, 30 ft. wide. Bids will soon be asked. Address Thos. S. McLanahan.

CHICAGO, ILL.—Bids are asked until Oct. 14 for asphalt, brick, granite and macadam paving, according to reports. L. E. McGann, Pres. Bd. Local Improvements.

QUINCY, ILL.—F. Grover, County Engr., has estimated the cost of the proposed Missouri Road at $12,000. A meeting was held Oct. 4 to consider the plans, according to reports.

OSKALOOSA, IA.—S. Ver Veer, Cy. Engr., advises us that about 1½ miles of brick paving will probably be laid next year. He states that a similar amount has been laid during the past season.

ST. PAUL, MINN.—The county commissioners are considering the question of constructing new roads.

ST. PAUL, MINN.—Bids are asked until Oct. 17 for improving Feronia and Dewey Aves. C. H. Bronson, Clk. Bd. Pub. Wks.

OMAHA, NEB.—Bids are asked until 2 p. m., Oct. 14, for grading 33d St., from Davenport St. to Chicago St. Andrew Rosewater, Chn. Bd. Pub. Wks.

ST. JOSEPH, MO.—Bids are asked until Oct. 20 for repairing 15 sections of road. Theo. Steinacker, County Surveyor.——Bids will soon be asked by the council for paving Seventh St. with asphalt from Robidoux to Olive St.

MANUFACTURING PLANTS.

MILFORD, ME.—It is reported that J. Fred Webster contemplates the erection of a large pulp and paper mill at Milford, near the plant of the Bodwell Water Power Co.

COHOES, N. Y.—The J. H. Murphy Mfg. Co. has been incorporated, with a capital stock of $150,000, to establish a plant for the manufacture of knit goods. The machinery has not yet been secured.

NIAGARA FALLS, N. Y.—Reports state that the Union Carbide Co. has made a contract with the Niagara Falls Power Co. for additional 6,000 HP., and that this will necessitate the construction of a new plant to cost about $150,000.

HOMESTEAD, PA.—The Penn Bridge Co., of Beaver Falls, Pa., is reported to have received the contract for erecting the ingot mold buildings for the Leechburg Foundry & Machine Co., of Pittsburg, which expects to remove its plant from Leechburg to Homestead.

READING, PA.—J. S. Koch has been awarded the contract for erecting a machine shop for the Carpenter Steel Works, 36×136 ft., with a 40-ft. L. Besides this, the new annex will include a crusher, laboratory, etc., to cost about $200,000.

BROOKVILLE, PA.—George W. Sykes, of Reynoldsville, and Levi Heidrick, of Brookville, will build a woollen mill at this place, to employ 100 men and cost $50,000, according to reports. Other capitalists are expected to establish a kindling wood factory, while a paper mill is among the possibilities.

RICHMOND, VA.—It is reported that the Richmond Locomotive & Machine Works contemplates the establishment of a steel plant in connection with its already extensive plant in this city.

CHINA GROVE, N. C.—The erection of a new cotton spinning mill at this place is contemplated by a company of local business men. It is said that the machinery, and probably an electric light plant, will soon be contracted for.

WELDON, N.C.—A company was incorporated Oct. 1 with a capital stock of $50,000, by W. E. Daniel, W. A. Pierce, W. T. Shaw, and others, to build and operate a large fireproof knitting mill on the Roanoke River, near Weldon.

SALUDA, S. C.—Reports state that a 7,000-spindle cotton mill will soon be started at this place by Alvin Estheridge, of Saluda, and W. S. Howland. Contracts have not yet been awarded.

CLARKSVILLE, TENN.—A fire in this city Oct. 5 destroyed the Grange tobacco warehouse, containing 4,500 hogsheads of tobacco; the Louisville & Nashville Ry. station, six freight cars, and Geacey Bros.' coal and storage shed. Total loss, over $400,000; insurance, about $300,000.

WINSTON, N. C.—Reports state that a company has recently bought 1,700 building lots in the suburbs of this city, and that it proposes to build a number of small manufacturing plants and cottages for the operators.

CLIO, S. C.—The Red Bluff Cotton Mills Co. has doubled the capacity of its plant, and will buy new machinery, according to reports.

YORKVILLE, S. C.—W. N. Ashe and others contemplate the erection of a new cotton mill here, near the present plant, to have a capacity of about 10,000 spindles.

OWOSSO, MICH.—Reports state that L. E. Woodward, whose factory was burned recently, has promised to erect a $100,000 plant, if the town would grant him a bonus of $20,000.

YPSILANTI, MICH.—The mill of the Peninsula Paper Co. was burned Sept. 28, causing a reported loss of $80,000.

SOUTH MILWAUKEE, WIS.—The United States Glue Co. has had plans prepared for its new glue factory to be erected near South Milwaukee, at a cost of about $110,000. Reports state that Paul Riesen has the masonry contract; Hansell & Elcock Foundry Co., of Chicago, the iron contract. Work is expected to be completed by Jan. 1.

GAS PLANTS.

SARATOGA SPRINGS, N. Y.—The board of street commissioners has received an application from Albert L. Judson, Albany, for a franchise for an electric light and gas plant.

TYRONE, PA.—The council has passed a resolution to purchase the gas and electric lighting plant of the Tyrone Gas & Water Co., for $90,000.

WILMINGTON, DEL.—The Wilmington Coal Gas Co. will increase the capital stock from $550,000 to $600,000, for the enlargement and improvement of the works and the extension of the mains. Edward Betts, Pres.

BIRMINGHAM, ALA.—Reports state that an opportunity is now open to any party who desires to establish a gas plant. The franchise which was awarded to Messrs. London and Haas has been annulled. Walter Moore, J. J. Altman and R. H. Kerr, Com.

FRESNO, CAL.—The Fresno Gas Co. will take up the 4-in. mains on Mariposs St. and substitute 8-in. mains. It is also the intention of the company to put in 8-in. pipes in the place of the 4-in. on K St., between Fresno and Tulare. Other improvements are talked of, according to reports.

MISCELLANEOUS CONTRACTS.

CULVERTS.—Jamestown, N. Y.—Bids are asked until Oct. 15 for building two stone culverts. C. P. Carlson, Chn. Com. Bd. Pub. Wks.

LIMESTONE.—Binghamton, N. Y.—The Helderberg Cement Co., Howe Cave, N. Y., has been awarded a contract to furnish 4,000 tons of limestone.

BREAKWATER.—Ellensburg, Wash.—Bids are asked until 10 p. m., Oct. 14, for constructing a breakwater across the Teanaway River. S. T. Sterling, County Clk.

RIVER WORK.—Maple Rapids, Mich.—Reports state that a contract has been awarded to Charles Kerr, Ashley, Mich., at about $40,000 for improving the Maple River.

DREDGING.—Boston Harbor, Mass.—The harbor and land commissioners have awarded a contract to Simon Hess, New York, at $29,990, for dredging in the south bay.

DREDGING.—Brooklyn Navy Yard, N. Y.—Bids are asked until Oct. 22 for dredging at the Brooklyn navy yard. M. T. Endicott, Ch. Bureau Yds. and Docks, Washington, D. C.

FIRE ENGINE.—Averill Park, N. Y.—Andrew Knowlson has been appointed chairman of a committee to ascertain the prices of fire engines, and to select a suitable site for an engine house.

COAL CONVEYORS.—Buffalo, N. Y.—The board of public works has received but one bid; that of the Aultman Co., Canton, O., at $16,800, for furnishing coal conveyors of a daily capacity of 200 tons.

CREMATORY.—Los Gatos, Cal.—Plans are being prepared, according to reports, for a crematory for the cemetery at Los Gatos, including a chapel, to cost about $60,000. Arch., T. P. Ross, Columbian Bldg., San Francisco, Cal.

CHIMNEYS.—Buffalo, N. Y.—Bids are asked by the department of public works until Oct. 20 for constructing three brick chimneys, each 8 ft. in diameter and 225 ft. in height, including necessary flues, changes of boilers, etc.

REMOVING WRECK.—Rockland Harbor, Me.—Bids are asked until Nov. 14 for removing the wreck of the schooner "William H. Jones," including cargo, as stated in our advertising columns. Maj. R. L. Hoxie, U. S. Engr., Portland, Me.

DRY DOCK.—Algiers, La.—Bids are asked until Oct. 31 (postponement from Oct. 21) for a combined floating and gravity steel dry dock, with shore connections and appurtenances. Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Washington, D. C.

DRAINAGE.—Harvel, Ill.—Bids are asked by the commissioners of Union Drainage District No. 2 of Kings and Harvel townships until Oct. 22 for the construction and improvement of a number of drains, requiring the excavation of about 108,167 cu. yds. of material; 26 bridges, and approximately 16,935 ft. of 8, 10 and 12-in. tiles. Engr., J. W. Dappert, Taylorville, Ill.

HOISTING ENGINES.—Buffalo, N. Y.—The following bids have been received by the board of public works for furnishing hoisting engines: American Hoist & Derrick Co., $1,390 for No. 90; $1,000 for No. 18; Lake Erie Boiler Works, hoisting engines, $2,500; S. Flory Manufacturing Co., Bangor, Pa., $915; Dobbie Foundry & Machine Co., $1,021 and $1,440, or $1,656 and $2,280.

HEATING AND PURIFYING APPARATUS.—Buffalo, N. Y.—Bids have been received by the board of public works for heating and purifying apparatus, for 34 boilers, in groups; from the following: Hoppes Manufacturing Co., Springfield, O., $14,440; Irlbacker & Sons, $8,743; Fuel Economizer Co., Matteawan, N. Y., six fuel economizers, $22,500; Manchester Manufacturing Co., North Manchester, Ind., $5,500; Robert Learmouth, $9,192; C. C. Peck, $5,500, or $3,225, or $4,000.

TELEPHONE WORK.—Bristol, R. I.—The Providence Telephone Co. has applied for permission to lay underground wires between Union and Washington Sts. Councilmen Church, Mason and Thompson may be addressed.

ICE SHIELDS.—Buffalo, N. Y.—The board of public works received the following bids Sept. 29 for furnishing ice shields for the inlet pier: Hingston & Woods, $8,200; Joseph J. Churchyard, $8,490; Lake Erie Boiler Works, $17,195; Buffalo Dredging Co., $9,600.

TUNNEL.—Boston, Mass.—The following bids were received Oct. 10 for the construction of the tunnel at the East Cambridge registry of deeds building: Richard Falvey, $7,833; Cyrus Bartan, $10,400; C. E. Trumbull, $8,500; P. T. Carter, $9,300; James Wilkinson, $5,800; G. C. Emmerson, $9,456.40; Charles McMahon, $7,970; Henry, McGahey, $8,833; I. C. Harris & Co., $8,300; Jarvis Engineering Co., $7,777; A. H. Kittredge, $8,014; Connors Bros., $7,895; Albert Eichorn, $10,987; Gustavius Co., $8,500.

CONTRACT PRICES.

STREET SIGNS.—St. Paul, Minn.—The following bids were received by the board of public works Oct. 3 for furnishing 1,200 street signs to be placed at street intersections which are illuminated with electric lights: Caesar Bros., New York, 30 cts. for both 24 and 26-in. signs; total cost, $360; C. Neuman, St. Paul, 33 and 35 cts. each; Thompson Paint Co., St. Paul, 55 and 60 cts.; F. M. Bendick & Co., Chicago, 39½ cts., both sizes; Noyes Bros. & Cutler, St. Paul, 35 and 36 cts.; Enamel Iron Co., Beaver Falls, Pa., 33 cts., both sizes; M. N. Webber, St. Paul, 47 and 50 cts.; T. R. Wilwerscheid, St. Paul, 37½ cts. both sizes; St. Louis Enamel Iron Co., 42 cts., both sizes. Clk., C. H. Bronson.

CONDUITS.—Erie, Pa.—The following bids were received Sept. 26, 1898, for 3-in. conduit laterals in 9th St. and in South Park Row: George B. Kelley, 9½ cts. a ft. in 9-duct conduits; J. McCormick & Son, 10½ cts.; Kraft & Walther, 7 7-10 cts.; Mayer Bros., 9½ cts. There were various other bids for 16 and 32-duct conduits and for the manholes, service boxes and 3-in. wrought iron pipe. Camp ducts, like those in use in the present conduit, were specified and others bid for either that material or corrugated wood.

IMPROVING RESERVOIR.—Albany, N. Y.—The following bids were received Sept. 20 for improving the Bleecker reservoir, as advertised in Engineering News; E. M. Haines & Co. awarded contract; Supt. Water-Works, George I. Bailey:

Bids Received at Albany, N. Y., Sept. 20, 1898, for Improving the Bleecker Reservoir.

Quantities.		E. M. Haines & Co., Rhinebeck, N. Y.	J. Dunfee & Co., Syracuse, N. Y.	John Doyle, Albany.	Frank Pidgeon, Saugerties, N. Y.	Dollard & Holler, Albany.	Michael J. Dady, Brooklyn, N. Y.	R. B. Lewis, Herkimer, N. Y.
Bailing and draining		$7,500	$5,950	$4,500	$8,000	$6,904	$7,150	$7,500
Excavation	14,500 cu. yds.	.38	.51½	.55	.40	.53	.50	.60
Excavation for water pipes	2,000 " "	.35	.31	.75	1.00	.50	.60	.50
Procuring and puddling	150 " "	.60	.99	3.00	1.50	1.44	1.00	1.50
Concrete masonry	1,000 " "	7.00	6.15	6.00	6.50	4.92	6.25	8.00
Brick masonry	40 " "	8.50	10.00	9.00	10.00	10.09	15.00	12.00
Coping	25 " "	12.00	25.00	35.00	25.00	60.51	25.00	15.00
Foundation timber	20,000 ft. B.M.	24.00	18.00	15.00	25.00	17.60	25.00	25.00
Sheet piling	13,000 " "	24.00	25.00	17.50	28.00	17.60	25.00	40.00
Gutter tile	720 lin. ft.	.25	.15	.25	.50	.21	.50	.30
12-in. drain pipe	70 " "	.30	.45	1.35	.50	.30	1.00	.50
12-in. water pipe	680 " "	1.10	1.09	1.35	1.75	.99	1.50	1.00
16-in. water pipe	80 " "	1.65	2.49	2.30	1.85	1.38	2.00	4.00
30-in. water pipe	1,100 " "	4.15	4.23	5.25	3.70	5.92	5.70	5.00
Setting 12-in. valve and box	3 each	13.00	21.00	5.00	4.00	4.00	15.00	3.00
Placing 30-in. valves	4 "	100.00	90.00	15.00	6.00	7.50	100.00	25.00
Placing 30-in. sluice gates	3 "	25 00	95.00	20.00	15.00	10.00	100.00	25.00
Manhole covers	4 "	7.00	9.95	15.00	15.00	12.00	25.00	15.00
Cast-iron grating	600 lbs.	.02¼	.05¼	.05	.04	.05	.04	.10
Gas pipe railing	75 lin. ft.	.30	1.15	1.50	.74	1.16	1.00	.50
Total		$28,456	$28 644	$29,677	$30,438	$30,926	$32,874	$34,393

ROADS.—Boston, Mass.—The following contracts were let Sept. 15, 1898, by the Massachusetts State Highway Commission, for constructing roads in Phillipston, Uxbridge and Townsend, Mass.; Secy., A. B. Fletcher: Phillipston—J. J. Welch & Co., Salem, Mass.—Excavation, 1,160 cu. yds., 30 cts. a cu. yd.; excavation, borrow, 500 cu. yds., 40 cts.; ledge excavation, 115 cu. yds., $2.00; rubble masonry laid dry, 25 cu. yds., $4.00; rubble masonry laid in cement, 24 cu. yds., $7.00; gravel, 335 cu. yds., 50 cts.; Telford, 100 sq. yds., 35 cts.; shaping, 6,904 sq. yds., 2 cts.; broken stone in place, 1,657 tons, $1.39; 12-in. vitrified clay pipe, 30 lin. ft., 60 cts.; fencing used as guard rail, 650 ft., 15 cts.; side drains, 100 ft., 35 cts.; stone monuments, 10, each, $1.50; 24-in., vitrified clay pipe, 60 lin. ft., $2.00; total, $3,975. Uxbridge—H. H Pike and E. E. Eames, Paxton, Mass.—Excavation, 1,110 cu. yds., 32 cts.; ledge excavation, 10 cu. yds., $1.50; rubble masonry laid dry, 34 cu. yds., $3.00 rubble masonry laid in cement, 30 cu. yds., $7.00; gravel, 363 cu. yds., 46 cts.; Telford, 100 sq. yds., 30 cts.; shaping, 7,360 sq. yds., 1.5 cts.; broken stone in place, 1,766 tons, $1.28; 12-in. vitrified clay pipe, 100 lin. ft., 60 cts.; fencing used as guard rail, 250 ft., 15 cts.; side drains, 600 ft., 26 cts.; stone monuments, 14, each, $1 50; total, $3,525. Townsend—C. H. Kelleher, Newburyport, Mass.—Excavation, 1,064 cu. yds., 30 cts.; ledge excavation, 10 cu. yds., $2.50; rubble masonry laid dry, 10 cu. yds., $4.50; rubble masonry laid in cement, 6 cu. yds., $8.00; gravel, 100 cu. yds., 60 cts.; Telford, 100 sq. yds., 35 cts.; shaping, 8,369 sq. yds., 2 cts.; broken stone in place, 2,030 tons, $1.35; 12-in. vitrified clay pipe, 140 lin. ft., 60 cts.; fencing used as guard rail, 50 ft., 20 cts.; side drains, 100 ft., 30 cts.; stone monuments, 15, each, $2 00; total, $3,594. Extra work at following prices: Materials at cost; foremen, 40 cts. per hour; masons, 35 cts.; masons' helpers, 20 cts.; laborers, 16⅔ cts.; double teams and drivers, 45 cts. an hour; single teams and drivers, 30 cts.

PAVING.—Atlantic City, N. J.—The following bids were received Oct. 3 for brick paving and for 6-in. macadam paving on a 4-in. gravel foundation in Pacific Ave., as advertised in Engineering News; contract awarded the Delaware River Quarry & Construction Co.; Cy. Surv., J. W. Hackney:

Bids Received at Atlantic City, N. J., Oct. 3, 1898, for Brick and Macadam Paving.

Bidder.	Macadam, 42,086 sq.yds.	Vitrified brick, 11,165 sq.yds.	Concrete, 304 cu.yds.	Curb: Straight, 21,744 lin ft.	Curb: Curved, 2,826 lin.ft.	Curb: Resetting, 100 lin.ft.	Total.
Del. River Quarry & Construction Co., Lambertville, N.J.	$0.62	$1.75	$4.50	$0.38	$0.60	$0.05	$56,963
Dennis Roe, Trenton, N. J.	.63	2.05	4.49	.39	.77	.03	61,427
J. B. Reilly & Co., Atlantic City, N. J.	.69	2.09	4.50	.35	.54	.04	62,883
Kennedy, Crossan & Co., Philadelphia, Pa.	.73	2.47	5.90	.355	.50	.10	63,879
Connell & McCann, New York, N. Y.	.67	2.25	5.00	.35	.60	.05	64,363
Thomas J. McGovern, Trenton, N. J.	.69	2.25	6.60	.40	.60	1.00	66,448
Alcatraz Paving Co., Philadelphia, Pa.	.79	2.00	4.75	.37	.55	.10	66,632
Fred T. Ley & Co., Springfield, Mass.	.73	1.87	4.25	.43	.57	.25	69,236
Michael J. Dady, Brooklyn, N. Y.	.81	2 23	5.00	.35	.65	.10	69,965
David McMahon & Co., Philadelphia, Pa.	1.10	2.05	4.49	.39	.77	.03	81,924
Frank Pidgeon, Saugerties, N. Y.	1.05	2.59	6.50	.58	.95	.20	90,400

ASPHALT PAVING.—Niagara Falls, N. Y.—S. F. Arkush, Cy. Clk., writes us that the following bid was received Sept. 30, 1898, for asphalt paving: Barber Asphalt Paving Co., Buffalo, N. Y., pavement, 1,200 sq. yds., $2.44; excavation, 75 cu. yds., $1.50; overhaul 50 cu. yds., 2 cts.; sewer connections, 100 ft., $1.50; water connections, 100 ft., 90 cts.; gas connections, 100 ft., 25 cts.; trenches, 20 rock excavations, $3.50; $3,302.

SEWER WORK.—Steubenville, O.—Floto Bros. were awarded the contract Sept. 20 for the new sewer at Calligan's crossing by the Commissioners as follows: Hauling 48-in. pipe 12 ft. long, weight 7,200 lbs., from Mingo to Calligan's, piece $3; excavating and filling a cu. yd., 34 cts.; laying the pipe a lin. ft., 28 cts.; hauling 30-in. pipe by 12-ft. long, weight 3,000 lbs., to Mingo flour mill, $1.50 each; excavating and filling, 34 cts.; laying 30-in. pipe, 17 cts. a lin. ft. Castner Bros'. bid was as follows: Hauling 48-in. pipe, $7.75 a joint; excavation, 40 cts. a cu. yd. Hauling 30-in. pipe, $4.50 a joint.

FLOOD GATES.—Dayton, O.—The following bids were received Oct. 3, 1898, for furnishing and placing flood gates on the canal at the Apple St. sewer; Comptroller J. E. Gimperling:

Quantities.		O'Connor & Kirchner.	Bruno Ritty.
Masonry (limestone)	191.5 perches.	$6.50	$8.50
Rubble masonry	80 "	4.15	4.50
Canal gates	—— each	265.00	300.00
Sewer gate	—— "	995.00	1,125.00
Foundation timber	16,027 ft. B.M.	20.00	24.00
Total		$3,157.29	$3,797.40

INDUSTRIAL NOTES.

MR. L. WILSON, 53 Dearborn St., Chicago, has the contract to sink an artesian well for the Plano Co., West Pullman, Ill.

THE AMERICAN ELECTRICAL & MAINTENANCE CO., 451 Greenwich St., New York, went into the hands of receivers, Oct. 7. Liabilities, $35,199; nominal assets, $29,126. Alfred K. Warren and Francis Higgins were appointed receivers.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., is furnishing the steel roof for one of the store houses of the Laflin & Rand Powder Co., Pompton, N. J. The building is 45 × 150 ft., with roof trusses of steel covered with corrugated iron supported on steel purlins.

THE Q & C COMPANY, Chicago, announces that the Dustless Roadbed Co., of Philadelphia, has placed its entire business in the hands of the Q & C Co. This company has already treated several hundred miles of track with oil, and the Q & C Co. is now negotiating for large additional quantities.

THE RUSSELL SNOW-PLOW CO., Tremont Bldg., Boston, Mass., reports that it has an order for a Russell wing elevator snow plow, size No. 2, from each of the following lines: Grand Rapids & Indiana Ry.; Chicago & West Michigan Ry., and Detroit, Grand Rapids & Western R. R. The plows for the last two named roads are to have the Russell air flanger added to the same and are also to be equipped with Westinghouse air brakes.

THE AMERICAN WOOD PRESERVING CO., Philadelphia, has just received an order from the New York Central & Hudson River R. R. Co. for several hundred gallons of moss green "Woodiline stains," for use on roofs. The company now makes a stain, using the wood preservative "Woodiline" as a basis, and the penetrative qualities of the preservative united with coloring matter combines to make the color more permanent, it is claimed, than in other stains. It has been used in exposed places on the sea coast especially since December, 1895, on the cottage of Mr. Wilson Brown, Superintendent of the South Amboy Division of the Pennsylvania R. R., at Seaside Park, N. J.

THE RISDON IRON & LOCOMOTIVE WORKS, San Francisco, Cal., are building gold dredges that will handle 2,000 cu. yds. of gravel a day at a depth of 50 ft. below water, and at a cost, it is claimed, of 3 cts a cu. yd. The company has recently built an Evans elevator at Breckenridge, Colo., for use in placer mining where water under pressure is available and facilities for a gravity dump do not exist. It will handle 2,000 cu. yds. of gravel a day, being sunk 43 ft. to bed rock and working under a pressure of 145 ft. at the surface. The first elevator was so satisfactory, it is stated, that a second one has been built. The Alaska Treadwell Mill of 240 stamps, which is said to crush 250,000 tons of ore a year, at a cost of 35 cts. a ton and a 3,500-HP. hoisting engine for the Washoe Copper Co., Butte, Mont., are among some of the orders filled by the company.

LES USINES CLEMENT is the name of a company which has been organized in France to build American motor vehicles and chainless bicycles. A large plant, the main building of which is 400 × 800 ft., has just been completed at Levallois-on-the-Seine, directly outside of the fortifications of Paris. In this building will be installed, it is stated, several hundred thousand dollars' worth of American machine tools, of which about $100,000 worth is now open for bids. The machinery will all be operated by electricity and two 500-HP. engines have already been purchased in Europe for the purpose and will be direct-connected to dynamos, one of which will be situated at the end of each line of shafting. The motor vehicles to be manufactured will be of the gasoline and electric types. Mr. Hart O. Berg, formerly Manager of the Colt's Patent Firearms Co., Hartford, Conn., will be the General Manager, and Mr. A. F. Bardwell, Superintendent of the motor carriage department of the Pope Mfg. Co., Hartford, will be the General Superintendent. The Superintendent of the Machine Shop will be Mr. R. C. Lewis, who has been the Manufacturing Superintendent of the Yale & Towne Mfg. Co., Stamford, Conn. It is stated that the only connection which the Pope Mfg. Co. will have with the French company is that the former is to receive a royalty on its patents, which will be used.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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PERSONAL.

Lieut. Thos. R. Sullivan, First Regiment, and Capt. John A. Laird, Third Regiment, United States Volunteer Engineers, have been honorably discharged.

Mr. C. G. Edwards has been appointed Assistant Engineer, and Mr. Raleigh Thomas, Chief Draftsman, of the Subway Commission of Baltimore, Md.

Mr. J. Robert Fortune, Chief Draftsman of the Murphy Iron Works, Detroit, Mich., has resigned to accept a similar position with the American Stoker Co., New York city.

Mr. Christopher Steadman, civil engineer, on the engineering staff of the State Highway Commission of Massachusetts, was married, Oct. 10, to Miss Lena M. Redmond, of Salem, Mass.

Capt. Jas. G. Warren, Corps of Engineers, U. S. A., has been detailed as Engineer of the Ninth Lighthouse District, with headquarters at Detroit, Mich., to relieve Lieut. Col. Milton B. Adams, Corps of Engineers, transferred.

Mr. H. A. Sumner, Chief Engineer of the Alamogordo & Sacramento Mountain Ry., a subsidiary line of the El Paso & Northeastern Ry., has been appointed Chief Engineer of the latter road also, with headquarters at Alamogordo, N. Mex.

Mr. Thomas E. Inslee, Assistant Superintendent of the foundry of the H. B. Smith Co., manufacturer of steam and water heating apparatus, Westfield, Mass., has resigned, and Mr. Arthur A. Brown, of Champaign, Ill., has been appointed to succeed him.

Mr. Wallace C. Johnson, M. Am. Soc. C. E., Chief Engineer, of the Niagara Falls Hydraulic Power & Mfg. Co., Niagara Falls, N. Y., has been appointed Consulting Engineer of the Shawinigan Water & Power Co., Shawinigan Falls, Que., on the St. Maurice River.

Mr. A. C. Bell, Jun. Am. Soc. C. E., City Engineer of New Orleans, La., has been authorized by the City Council to spend ten days in studying the asphalt pavements of Washington, New York city, Troy, Syracuse, Detroit and Chicago. Mr. Bell was in New York this week for that purpose.

Mr. John Lundie, formerly connected with the Illinois Central R. R., has been appointed Electrical Expert of the Brooklyn Elevated R. R., Brooklyn, N. Y., and will at once begin preparing plans and specifications for the proposed change of motive power from steam to electricity. The cost involved will be about $750,000.

Mr. Leighton Lee, Superintendent of the firm of Lee & Co., engineers and contractors, of Philadelphia, Pa., in attempting to board an elevated train in Chicago, Ill., Oct. 14, after the platform gates had been closed, missed his footing and fell through the trestle work upon a picket fence 25 ft. below. He received injuries that will probably prove fatal.

OBITUARY.

Mr. Edwin Darling, formerly Superintendent of the waterworks at Pawtucket, R. I., died recently, aged 64.

Mr. George Wilson Phillips, mechanical engineer and inventor, died at Springfield, Mass., Oct. 14, aged 79.

Mr. James Carmichael, Superintendent of the machine shops of the Harlan & Hollingsworth Co., Wilmington, Del., died Oct. 8, aged 69.

Mr. Charles Edward Widener, civil engineer, of Cumberland, Md., died of pneumonia, Oct. 11, aged 45. He was City Engineer of Cumberland in 1893 and 1897.

Mr. Chas. E. Van Houten, contractor and builder, of New York city, was killed at Jamaica, N. Y., Oct. 13, while walking on the track of the Long Island R. R. He was 79 years of age.

Mr. William W. Boyington, architect, of Chicago, Ill., died at his home in Highland Park, Oct. 16, aged 80 He was the architect of many churches in Chicago and vicinity, of the old University of Chicago and its Observatory, and the Rock Island and Northwestern railway depots.

Mr. John Malcolm Forbes, Sr., President of the Board of Directors of the Chicago, Burlington & Quincy R. R., died at his home, Milton, Mass., Oct. 13. He was born in Bordeaux, France, Feb. 23, 1813, and was brought to this country by his parents while an infant. He became interested in Western railways in 1836, and was for many years President of the Michigan Central R. R., and Chairman of the Board of Directors of the Chicago, Burlington & Quincy R. R.

Mr. William G. Morris, senior member of the firm of Morris & Barlow, malleable iron founders, of Newark, N. Y., died suddenly in Philadelphia, Pa., Oct. 5, while attending the convention of the Foundrymen's Association. He was born in Newark, and began his mechanical career as an apprentice of the late Seth Boyden.

Mr. Frank F. Hemenway, M. Am. Soc. M. E., who for 14 years was connected with the Editorial Department of the "American Machinist," for several years as its Editor-in-Chief, died at his home in Brooklyn, N. Y., Oct. 14. He was born at Hartford, N. Y., Oct. 29, 1837, and served a regular apprenticeship as a machinist in Keene, N. H. For some time following he worked in the Putnam Shops, Fitchburg, Mass., and then at the outbreak of the Civil War he enlisted in the Union Army. After the war he was employed in various machine shops, and about 1870 entered the shops of the Troy & Boston R. R., now the Fitchburg R. R., at Troy, N. Y., where he was associated with the late George W. Richardson. Mr. Hemenway did the work and the experimenting connected with the inventing and the perfecting of the Richardson pop safety valve, and also had much to do with the development of the Richardson balanced slide valve and other inventions. From the railway shops he went to those of Starbuck Bros., Troy, N. Y., and after a year or two became Foreman of the machine shop, holding this position as long as the works continued in operation. While connected with this establishment he invented the Hemenway automatic cut-off engine, and about the same time became a charter member of the American Society of Mechanical Engineers. His literary work began about 1879, when he first contributed to the columns of the "American Machinist," of which he became an associate editor in July, 1881. In 1885 he published his book on the steam engine indicator. He was made Editor-in-Chief of the above periodical in July, 1887, upon the death of Mr. Jackson Baily, and held this position until October, 1894, when he resigned.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN GAS LIGHT ASSOCIATION.
Oct. 19.-21. Annual meeting, Niagara Falls, N. Y. Secy., Alfred E. Forstall, Montclair, N. J.

NEW YORK RAILROAD CLUB.
Oct. 20. "Purchasing Materials," H. B. Hodges. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Oct. 20. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

THE DETROIT ENGINEERING SOCIETY.
Oct. 21. "Coal-Handling Machinery," C. W. Russell. Secy., Henry Goldmark, Wayne Co. Sav. Bank Bldg., Detroit, Mich.

CHICAGO ELECTRICAL ASSOCIATION.
Oct. 21. "Practical Points on Electrical Measurement," W. B. Hale. Secy., J. R. Cravath, 825 Monodnock Block, Chicago, Ill

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Oct. 25. Secy., Wm. H. Searles, Case Library Building, Cleveland, O.

FRANKLIN INSTITUTE.
Oct. 25. "Thermo-Electric and Galvanic Action Compared," Chas. J. Reed; "Electric Elevators," Wm. J. Baxter, Jr. Secy., Wm. Wahl, 15 South Seventh St., Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT.
Oct. 26-28. Annual meeting, Washington, D. C. Secy., D. L. Fulton, Bureau of Highways and Sewers, Allegheny, Pa.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Oct. 27. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ENGINEERING ASSOCIATION OF THE SOUTH.
Oct. 27. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

WESTERN SOCIETY OF ENGINEERS.
Nov. 2. "Construction of Retaining Walls for the Sanitary District of Chicago," James W. Beardsley; "Berthier Method of Coal Calorimetry," Chas V. Kerr; "Brakes for Electric Cars," William G. Price. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 2. Secy., C. W. Hunt, 220 W. 57th St. New York city.

ENGINEERS' CLUB OF ST. LOUIS.
Nov. 2. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

BROOKLYN ENGINEERS' CLUB.
Nov. 3. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 4. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

ENGINEERS' CLUB OF COLUMBUS.
Nov. 5. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Nov. 7. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 7. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.

NEW ENGLAND RAILROAD CLUB.
Nov. 8. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 8. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.

RAILWAY SIGNALING CLUB.
Nov. 8. Secy., Earl M. Seitz, Signal Engineer, C. & N. W. Ry., Chicago, Ill.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.

ST. LOUIS RAILWAY CLUB.
Nov. 11. "The Performance of a Four-Cylinder Compound Locomotive." Discussion. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

CENTRAL RAILWAY CLUB.
Nov. 11. Secy., H. D. Vought, 114 Fifth Ave., New York city.

MONTANA SOCIETY OF ENGINEERS.
Nov. 12. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

ENGINEERS' CLUB OF KANSAS CITY.
Nov. 14. "Rectification of the Red and Atchaflaya Rivers," A. F. Woolley, Jr. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

THE LOUISIANA ENGINEERING SOCIETY.
Nov. 14. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

NORTHWEST RAILWAY CLUB.
Nov. 15. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 15. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Nov. 16. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 16. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Nov. 16. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

ENGINEERS' CLUB OF CINCINNATI.
Nov. 17. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 19. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

TECHNICAL CLUB OF OMAHA.
Nov. 21. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 21. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 21. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ST. LOUIS RAILWAY CLUB.—At the meeting held Oct. 14, Prof. C. M. Woodward delivered an address entitled, "What Shall We Do With Our Boys?"

NEW ENGLAND RAILROAD CLUB.—A regular meeting of this club was held at Boston, Mass., on Oct. 11, at which a paper on "Present and Future Economy in Railway Equipment Painting," by Mr. Chas. E. Copp, was discussed.

BOSTON SOCIETY OF CIVIL ENGINEERS.—This society will visit Holyoke, Mass., on Oct. 22, where they will be entertained by the Holyoke Water Power Co. The new dam, the plant of the Deane Steam Pump Co., and other points of interest in the vicinity will be inspected.

BROOKLYN ENGINEERS' CLUB.—A regular meeting of this club was held Oct. 13. Routine business was followed by the appointment of a nominating committee to prepare a list of officers for the ensuing year, and the reading of a paper on "Foundry Moulding Machines for Snap Flask Work," by Mr. Willard S. Tuttle.

FRANKLIN INSTITUTE.—The bulletin for the month of October, issued by the Committee on Meetings, is as follows: Oct. 25, "Thermo-Electric and Galvanic Actions Compared," Charles J. Reed; "Electric Elevators," Wm. Baxter, Jr. Nov. 9, Meeting of the Mining and Metallurgical Section. "Mining and Minting of Gold and Silver," Mr. A. E. Outerbridge, Jr.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.—The fifth annual convention of this society will be held in Washington, D. C., Oct. 26-28, as already announced. The program as far as it is at present completed includes the following papers: "Utilization of the Sewage of Vienna, Germany," Capt. L. H. Beach, U. S. A., Wash., D. C.; "Tree Planting in the Streets of Washington" and "A Street Extension Plan for the Entire District of Columbia," Wm. P. Richards, Wash., D. C.; "The Selection of Paving Materials," Geo. W. Tillson, Brooklyn, N. Y.; "The Proper Regulating of Curbing and Streets," Horace Andrews, Albany, N. Y.; "Cost of Repairs to Asphalt Pavements in Buffalo, N. Y.," C. B. Guthrie, Buffalo, N. Y.; "Electrolysis Tests at Dayton, Ohio," Harold P. Brown, New York city.

THE LOUISIANA ENGINEERING SOCIETY.—The regular meeting of this society was held Oct. 11. The evening was devoted to a paper entitled, "Live Engineering Questions of the Hour," by the Secretary, Mr. J. F. Coleman, which was a resumé of local questions, such as river bank protection, sewage disposal and street paving in New Orleans.

One of the causes of caving banks was attributed to underlying strata of quicksand, and some of the methods of overcoming this were described. The drainage question he considered solved by the plan adopted and now being executed by the city. The sewerage question was so nearly akin to drainage that it might be considered part of it. There was, however, a question as to the advisability of discharging sewage into the Mississippi River.

A plan of rearrangement of the track on Canal street was then exhibited and fully discussed.

THE CIVIL ENGINEERS' CLUB OF CLEVELAND.—The regular monthly meeting of this club was held Oct. 11. The discussion upon the proposed amendment to the Constitution, changing the name of the club, was resumed. It was finally moved as an amendment to strike out the proposed term "The Cleveland Society of Engineers" and insert "The Cleveland Engineering Society." This was carried.

Mr. Arthur A. Skeels, member of the club, presented some "Notes and Observations on a Recent Trip Through Mexico." Monterey was described as a most ancient and foreign-looking city. Its water supply is taken from local wells, and its sanitation is exceedingly bad. It, however, has electric lights and street cars hauled by mules.

Guadalajara is the most beautiful town in Mexico; the theater and church are magnificent edifices and not far away are the Falls of Juanacatlan, the largest water falls in Mexico. These falls are utilized for power, and furnish electricity for lighting the city. Wm. H. Searles, Secy.

CHICAGO ELECTRICAL ASSOCIATION.—At the regular meeting of this association, held Oct. 7, Mr. Thos. G. Grier read a paper on "The Use of Electricity in the Spanish-American War."

This was a brief review of the electrical work done along the coast of the United States in connection with submarine mines, range finders for fortifications, etc. The harbor defenses of New York and Boston were described in more detail. The extensive use of the telephone, the use of the X-ray apparatus and other devices on land, and the helm indicators, speed indicators, direction indicators and range finders on shipboard were all interestingly described.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.—The sixth annual meeting of this society will be held in New York City, at the house of the American Society of Mechanical Engineers, 12 West 31st street, the first session opening at 10 a. m., November 10.

The following are the papers to be read and the topics for discussion: Nov. 10—"Torpedo Boat Destroyers for Sea Service, with Special Reference to the Conditions that Prevail on the Pacific Coast," G. W. Dickie; "The Standard Navy Boats," Arthur B. Cassidy; "Bilge Keels and Rolling Experiments U. S. S. 'Oregon,' " Asst. Naval Constructor Lawrence Spear, U. S. N.; "Steam Economy Test of a Unique Form of Feed Pump," F. M. Wheeler; "Portable Pneumatic Riverters in Shipbuilding," W. I. Babcock. Topical discussion of the following questions: "The utility of Torpedo Boats, and has the Sub-Marine Boat a place?"; "In what respects have the recent Naval Engagements affected opinion as to the value and best distribution of armor for war-ships?" Nov. 11.—"The Steam Yacht as a Naval Auxiliary," William P. Stephens; "Designs of the New Vessels for the U. S. Navy," Chief Constructor Philip Hichborn, U. S. N.; "Methods of Securing Water-tight Work," Asst. Naval Constructor H. G. Smith, U. S. N.; "Tests of the Strength of a Longitudinal Bulkhead Separating Two Engine Rooms," Naval Constructor J. L. Woodward, U. S. N.; "An Electrically Operated 150 Ton Revolving Derrick," Walter A. Post; "Stability of a Battleship under Damaged Conditions," Prof. Cecil H. Peabody. Topical discussions of the following questions: "Under the circumstances of the Blockade at Santiago, which was the more economical method of maintaining the boilers in readiness for immediate action—banking the fires or keeping them spread but very thin?"; "Can you give any data as to the cost in coal of maintaining the engines and boilers in readiness for immediate service?"; "What, if any, difficulty was there in maintaining the supply of fresh water for the boilers, and, if there was any difficulty, to what do you attribute it?"; "As a result of experience on the Blockade, what particular points about the machinery were most likely to give trouble, and what could be done to prevent a recurrence of such trouble?" On the evening of November 11 a banquet will be held at Delmonico's.

AMERICAN RAILWAY ASSOCIATION.—The regular fall meeting was held at the Holland House, New York city, on Oct. 12-13. There were present 100 delegates, representing 95 members. The Executive Committee reported that the membership is now 248 companies, operating 163,000 miles of railway, and also reported in favor of the amendment presented at the last meeting prohibiting voting by proxy at future meetings. This was adopted by the association.

The principal business of this meeting was the consideration of the revision of the Standard Code of Train Rules which was presented by the Committee on Train Rules. The greater part of the two days was devoted to this. Some amendments were suggested and were referred to the committee for consideration, and final action was deferred until the spring meeting. The Committee on Car Service reported in favor of the per diem plan of settling for car interchange between roads at a rate of 15 cts. per day. After some discussion further consideration was postponed until the next meeting.

The Committee on Safety Appliances presented some statistics showing what progress had been made towards the introduction of automatic car couplers and air-brakes and repeated the recommendation made at the meeting of last spring with reference to the restrictions upon the use of power brakes not conforming to the M. C. B. standard of excellence. As this matter was not brought up until the latter part of the last session it was laid over until the spring meeting.

The Committee on the Metric System reported as follows:

> The events of grave and national importance that have transpired during the past six months, which may result in changes in the foreign relations of the country, have been used as an argument by those who favor the adoption here of the Metric System. It is claimed that unless our manufacturers make their goods according to the metric weights and measures they will be handicapped in their competition for foreign markets. If, however, such a demand should arise from any cause, it would be important that our railway officials should know what would be necessary for them to do in making the change.
>
> Your Committee has, therefore, under consideration a plan by which it hopes to be able to report upon the methods which it would be necessary to employ in the introduction of the Metric System in each railway department. This would include an examination into the difficulties to be overcome and the expense involved in changing from one system to another.

In addition the committee presented an abstract of a paper by Mr. Edward Grafstom, of the Pittsburg, Cincinnati, Chicago & St. Louis Ry., giving experience during the adoption of the metric system in foreign countries.

The Committees on Safety Appliances and on Car Service were re-elected.

The date of time table change was fixed as Nov. 13, and the association adjourned to meet in Detroit, Mich., next April.

THE AMERICAN BOILER MANUFACTURERS' ASSOCIATION.—The 10th annual meeting of this association was held, Oct. 3-6, at the Southern Hotel, St. Louis, Mo. The formalities of opening the meeting were pleasantly disposed of, after which attention was for a short time centered upon Secretary E. D. Meier, who read his report and the reports of the various committees. The rest of the morning was devoted to a brief discussion of the report of the committee on Uniform Boiler Specifications, and on Betterment of Business Conditions, both of which were finally assigned for special consideration at following sessions.

On Oct. 4, the consideration of the report of the Committe on Uniform Standard Specifications was resumed, and, after considerable discussion, was finally adopted in the form given elsewhere in this issue. After the appointment of a committee on the next place of meeting the meeting adjourned to the following day.

The forenoon of Oct. 5 was given up to committee reports, and the consideration of applications for membership. Cleveland, O., and the month of July were selected as the place and time of the next meeting.

Mr. E. D. Meier, the secretary, offered his resignation, saying that after nine years in that position he felt it for the best interests of the association to elect a new man to fill the office. His resignation was accepted with general regret.

The following list of officers was then submitted by the Nominating Committee and unanimously elected: Pres., Henry J. Hartley, Philadelphia, Pa.; First Vice-Pres., Daniel Connally, Cleveland, Ohio; Second Vice-Pres., John O'Brien, St. Louis, Mo.; Third Vice-Pres., R. D. Monroe, Jr., Pittsburg, Pa.; Secy., J. D. Farasey, Cleveland, Ohio; Treas., Richard Hammond, Buffalo, N. Y.

The session of the last day was brief, and was devoted to various unfinished business and minor matters. Immediately after adjournment those present witnessed a practical boiler test at the John O'Brien Boiler Works. This boiler was a horizontal tubular boiler, 14 × 5 ft., with 50 tubes, made of ⅜-in. steel, with a tensile strength of 55,000 lbs., intended to work at pressures below 200 lbs., 400 lbs. per sq. in. caused considerable leakage at the rivets, 600 lbs. increased the leakage so that the boiler was almost hidden by the spray. At 660 lbs. per sq. in. an expansion of over 3 ins. was observed.

The afternoons of the convention days were devoted to inspection tours, the Anheuser-Busch Brewing Co., the city water-works and other points of interest being included.

NEW PUBLICATIONS.

REPORT OF ONTARIO BUREAU OF MINES, Vol. VII., Third Part, 1898. Printed by order of the Legislative Assembly of Ontario. Toronto. Paper; 9¾ × 6½ ins.; pp. 207 to 265.

The bulk of this report is taken up in the location of corundum deposits in Ontario, its analyses and concentration. Short reports follow upon the water powers of Ontario; placer gold on Vermillion River, and mining schools and mining classes.

SURFACE PLANTS OF BITUMINOUS COLLIERIES AND COKE WORKS. Wilkins & Davison, Civil Engineers, Pittsburg, Pa. Pamph.; 6 × 9 ins.; pp. 43.

This pamphlet is a reprint of several illustrated articles that have appeared in "Mines and Minerals" and in the "American Manufacturer," describing head shafts, tipples and coke plants that have been designed and erected by Messrs. Wilkins & Davison. The illustrations are excellent, and the articles should be of interest to owners and managers of coal mines.

STREET RAILWAY FRANCHISES AND OPERATIONS IN CHICAGO.—Report of a Special Committee of the City Council; Chairman, Carter H. Harrison (Mayor); Secretary, George G. Hooker. Cloth; 8vo.; pp. 313; numerous folding tables and a map.

A special committee to investigate the franchises, financial operations, and wages paid by the street railway companies, was appointed in October, 1897, and made its report in March, 1898, but the report has only recently been issued. The report is unfriendly to the companies, but contains much interesting and important information.

PUBLIC WATER SUPPLIES.—Address by Judge George Hillyer, President Water Board, Atlanta, Ga., before the Detroit Convention of the League of American Municipalities, Aug. 3, 1898. Reprinted from "City Government" of August, 1898, by the New York Filter Mfg. Co., 26 Cortlandt St., New York. Paper; 4 × 7 ins.; pp. 12.

Although this pamphlet is being distributed for advertising purposes it was not written with that end in view. It describes the water-works of Atlanta, and the benefits of meters, filtration and municipal ownership, as seen by the author and shown by the official records. It makes an especially strong showing for the use of meters and indicates that without them filtration might be out of the question.

REPORT OF THE RAILWAY COMMISSIONERS FOR NEW SOUTH WALES, AUSTRALIA.—Paper; 8vo.; pp. 39; maps and diagrams.

This colony has 2,691 miles of railway, all owned by the government, and in the year ending June 30, 1898, the total earnings amounted to $15,133,740, while the total expenditures were $8,073,025. The operating expenses were 53.34% of the gross earnings. During the year, meetings of the premiers and the railway commissioners of the several colonies were held to consider the question of establishing uniform gage, and thus eliminating the present troubles incident to break of gage. The tramways and street railways of Sydney (which are also owned by the government) aggregate 65 miles, operated partly by cable and partly by electricity.

ORES OF NOVA SCOTIA; Gold, Lead and Copper.—E. Gilpin, Jr., LL.D., F. R. S. C., Inspector of Mines, Halifax, N. S. Pamph.; 6½×10 ins.; pp. 46; with map.

This report contains in abbreviated form the most important facts, collected from public and private sources, relating to the gold, lead and copper deposits of Nova Scotia. The lead and copper deposits are as yet undeveloped, but they are said to be widespread and promising. The gold fields became known about 1860, and many mines were started in the next ten years, most of which were unprofitable, but recently there has been quite a revival, and veins and deposits are being profitably worked, on business principles, which a few years ago would have been spurned. Local investors are now able to mine and mill quartz profitably on a small scale, when the crushed quartz does not yield over $2 of free gold per ton. The gold production of Nova Scotia since 1862 has amounted to over $12,000,000, averaging about $12 per ton of crushed quartz.

THE COLUMBIA ENGINEER.—Transactions of the Engineering Society of Columbia University, New York. Published by the Society. Cloth; 7 × 10 ins.; pp. 158; illustrated.

This is the annual proceedings of the Engineering Society of Columbia University. The following is a list of the papers contained "Some Details of Rapid Transit," Wm. Barclay Parsons; "Some Reservoirs Which I Have Seen," J. James R. Croes; "Subterranean Temperatures," Prof. William Hollock; "Sewage Disposal," Col. George E. Waring, Jr.; "Engineering Features of the Nicaragua Canal Problem," Foster Crowell; "Interpretations of Water Analyses," George C. Whipple; "Treatment of Steel for Car Axles," L. R. Pomeroy; "Masonry," George S. Morison; "Railroad Accidents and Their Prevention," Col. H. G. Prout; "Heating and Ventilation of Buildings at the New Site of Columbia University," George A. Suter; "New and Old Systems of Power Distribution in Factories," Gano S. Dunn; "Improved Canal Facilities Between Lake Erie and New York City," Prof. William H. Burr; "The Inspection of the Materials of Engineering," P. S. Hildreth.

TWELFTH ANNUAL REPORT OF THE COMMISSIONER OF LABOR, 1897.—Economic Aspects of the Liquor Problem. Washington Government Printing Office: Cloth; 8vo.; pp. 275.

The Department of Labor has been engaged during the past year in investigating the effect of machinery upon labor and the cost of production, and has also carried on an investigation relating to municipal and private gas, electric and water plants, besides the investigation into the liquor question, to which latter subject the whole of the present report is devoted. The reports on the other subjects are, as yet, incomplete, and their publication is postponed to a later date. The report on the economic aspect of the liquor problem includes statistics of manufacture; importation, distribution and sale; consumption; revenue, national, state and municipal; capital invested and labor employed; experience and practice of employers in regard to use of intoxicants by their employees; recommendations from employers in regard to means to be adopted for lessening the consumption of liquors; and a digest of the liquor laws of the several states and territories. It appears that there was a considerable decrease in the per capita consumption of liquors in the United States from 1893 to 1896, as shown in the following figures, in gallons per capita: Distilled spirits, from 1.51 to 1.00; wines, 0.48 to 0.26; malt liquors, 16.08 to 15.16; total, 18.07 to 16.42. Whether this was due to decreasing appetites or to the hard times is not stated. A comparison of the figures of 1880 and 1890 shows a great increase in the drinking, which may be a result of increasing capacity to purchase, or of increasing appetite, or both. The figures for these years are: Distilled spirits, 1.27 to 1.40; wines, 0.56 to 0.46; malt liquors, 8.26 to 13.67; total, 10.00 to 15.53. The report is a magazine of information from which the student of the liquor question, the political economist and the legislator may draw their own conclusions.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

COMBINATION STOVE AND FURNACES.—The National Pipe Bending Co., New Haven, Conn.

This is a circular briefly describing a form of stove and furnace for water and air heating of houses.

POLYPHASE INDUCTOR GENERATORS.—Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Circular; 7 × 10 ins.; illustrated.

This is circular 201 of the Westinghouse series. It illustrates and briefly describes the type of generator in which the armature and field is stationary and the moving part is reduced to a star-shaped rotating piece of iron with no moving wire. These machines are manufactured in sizes ranging from 180 to 750 K-W., either belted or direct connected.

LONG-BURNING ARC LAMPS—For Direct and Alternating Current Circuits.—Circular 202 calls attention to some of the latest forms of arc lamps on the market. They are of the enclosed type for use on 110-volt circuits with a burning limit per trimming of about 100 hours. Other types are shown and described, and some information regarding globes, carbons, etc., is given.

CONCRETE MIXERS.—The Contractors' Plant Co., 85 Water St., Boston, Mass. Paper; 5 × 7 ins.; pp. 11; illustrated.

This pamphlet describes a portable mixer, in which the mixing is done while the material passes through the device by gravity.

ELECTRIC RAILWAY GENERATORS.—Walker Co., Cleveland, Ohio. Pamph.; 8 × 10⅞ ins.; illustrated.

In this circular, which is number 1082 of the Walker series, the requirements of a modern street railway generator are outlined, and the manner in which the apparatus manufactured by this company fulfills these requirements is fully explained.

THE AMERICAN FEED WATER HEATER.—The Whitlock Coil Pipe Co., Elmwood, Conn., U. S. A. Pamph.; 3½ × 6 ins.

This is a small pamphlet outlining the construction of the American feed water heater and describing briefly the advantages accruing from the use of feed water heaters in general.

TELEPHONY.—The International Correspondence Schools. Scranton, Pa. Pamph.; 4 × 6½ ins.; pp. 30.

This is a brief synopsis of the course in telephony recently established by this school. It is divided into three parts: Principles, Apparatus and Circuits; Telephone Exchanges and Systems; and Telephone Lines and Their Construction.

RUBBER GOODS.—The Mechanical Rubber Co., Chicago, Ill. Pamph.; 5½ × 8½ ins.; pp. 76.

In this pamphlet is given a complete illustrated list of rubber goods such as: general belting, concentrator belts, hose for water, steam and air, and a great variety of rubber goods for mechanical purposes.

THE NATIONAL FEED WATER HEATER.—The National Pipe Bending Co., New Haven, Conn. Pamph.; 3½ × 6 ins.

This is an attractive little pamphlet calling attention to the merits of the National Feed Water Heater. In addition, tables and illustrations afford an idea of the construction and dimensions of the several types manufactured.

GRINDING AND POLISHING MACHINERY.—Builders' Iron Foundry, Providence, R. I. Pamph.; 3½ × 6 ins.; pp. 112.

The Builders' Iron Foundry has added to its extensive foundry and machine business a department for the manufacture of grinding and polishing machinery, countershafts and wood polishing wheels. The pamphlet is an illustrated catalogue and price list of productions in this line.

THE NATIONAL FEED WATER HEATER.—The National Pipe Bending Co., New Haven, Conn. Pamph.; 3¼ × 6 ins.; pp. 60.

This little pamphlet starts with the statement given on the cover, "Our Record 700,000 HP." and in the following 60 pages gives the names and addresses of some of the manufactories, power plants, etc., using "National" feed water heaters and included in the total.

THE CORRESPONDENCE SCHOOL OF SHEET METAL PATTERN DRAFTING.—The International Correspondence Schools, Scranton, Pa. Pamph., 6 × 9 ins.; pp. 88.

This pamphlet contains information on the correspondence method of teaching the subject of drafting for sheet metal workers, which has for some time been one of the many courses of study taught by the International Correspondence Schools.

STREET RAILWAY TRACK.—Lap-Joint Railway Track Co., Bowling Green Building, New York. Paper; 6 × 9¼ ins.; pp. 11.

This pamphlet describes the built-up or compound rail systems invented by Mr. T. H. Gibbon, Chief Engineer of the company, and used in combination with metal ties or chairs. The track has been laid in Albany, Fulton and Brooklyn, N. Y. It was described in our columns some time ago.

THE GENERAL ELECTRIC CO., AT OMAHA.—The General Electric Co., Schenectady, N. Y. Pamph.; 5⅛ × 7¾ ins.; illustrated.

This is an attractive little pamphlet from the press of the General Electric Co., in which is given a series of characteristic illustrations of its apparatus, including arc lamps, and generators, single phase, polyphase and monocyclic generators, transformers, street-car motors and controllers and various other apparatus.

MAIL CHUTING.—An Occasional Brochure. Part Two. The Cutler Mfg. Co. Rochester, N. Y. Five engraved sketches by Henry P. Kirby; 8 × 10 ins.

The "mail chute" is in common use in office and public buildings, for dropping letters from the several upper floors to a mail box on the ground floor. The Cutler Mfg. Co. has chosen an odd way to advertise its business, but a very good one. The sketches have nothing to do with mail chuting, but represent specimens of cathedral and other Gothic architecture.

COMBINED SIDEWALK AND VAULT ROOF.—P. H. Jackson & Co., 228 First St., San Francisco, Cal. Photograph, backed with circular.

This is a view taken beneath the sidewalk of a building in San Francisco where use has been made of Jackson's combined artificial stone sidewalk and galvanized corrugated steel roof for vaults. The total thickness is less than 4 ins., making a form of construction readily adaptable to limited vertical spaces.

THE CORRESPONDENCE SCHOOL OF PEDAGOGY.—The International Correspondence Schools, Scranton, Pa. Pamph., 6 × 9 ins.; pp. 72.

This pamphlet is a "circular of information" describing a system of home study in the pedagogies of arithmetic, grammar, history, orthography, geography, civics and rhetoric. The course of study is intended to take the place of the training received in normal schools, and is especially recommended to those now engaged in teaching.

STEAM BOILERS, FOUNDRY CUPOLAS, ETC.—The Bigelow Co., New Haven, Conn. Pamph.; 9¼ × 11½ ins.; pp. 32.

This is an illustrated descriptive list of the various forms of steam boilers and boiler appurtenances manufactured by the Bigelow Co., and includes return tubular boilers for high or low pressure services, sparkless boilers, locomotive boilers and the Bigelow-Manning vertical tubular boiler. In addition, packing house apparatus, such as dryers, digesters and coolers and foundry cupolas, tuyer plates, forges, etc., manufactured by this company, are mentioned.

ORE AND ROCK CRUSHERS; SCREENING AND CONVEYING MACHINERY. Earle C. Bacon, Engineer, Havemeyer Building, New York. Farrel Foundry & Machine Co., Ansonia, Conn. Pamph; 7½ × 9¾ ins.; pp. 74.

This pamphlet is a very complete illustrated catalogue and price list of crushers of the Blata and other patterns, crushings rolls, revolving screens, bucket and rubber belt conveyors, chute gates, etc. Sectional drawings and photographs of many complete screening and crushing plants are given.

WOOD'S WATER TUBE SAFETY BOILERS.—New Haven Boiler Works, New Haven, Conn. Pamph., 9¼ × 11½ ins.

This pamphlet is made up of a number of illustrations of details of the Wood's Water Tube Safety Boiler and an accompanying description, in which such matters as circulation of water, rapid steaming, dry steam, accessibility for cleaning and repairs, capacity, etc., are treated. There is also included a set of directions for operating the boiler and a partial list of users.

POWER AND ELECTRIC PUMPS.—The Goulds Mfg. Co., Seneca Falls, N. Y. Paper; 7 × 7 ins.; pp. 20; illustrated.

One of these catalogues describes a variety of power pumps, including those for water supplies, boiler feeding and hydraulic power. The other is devoted to electric pumps for house supplies, both on the open and closed tank systems; and to electric pumps for a variety of other purposes, including supplies for hydraulic elevators, boilers, fire protection, mines, fountains, villages and supplementary service for cities.

PUMPS, GOVERNORS, VALVES.—The Gardner Governor Co. Quincy, Ill. Pamph.; 7¾ × 5¼ ins.; pp. 21.

The Gardner governor was first made in 1860, and its total sales to date are upwards of 135,000. Four styles are illustrated in this catalogue, two of them having springs in addition to the revolving balls, making them suitable for high-speed engines. The Gardner pump is of the direct-acting, duplex type. It is made in various styles and sizes. The catalogue also shows a pump governor, a balanced lever valve, and globe and angle valves.

THE GENERAL ELECTRIC AT BOSTON.—The General Electric Co., Schenectady, N. Y. Pamph.; 5¼×7¾ ins.; pp. 66; illustrated.

This is one of the neatest pamphlets that has come to our attention in some time. It was published for distribution at the American Street Ry. Convention, held in Boston, Sept. 6-9, and contains descriptions of the various street railway plants of the city and vicinity. A considerable proportion, however, is given up to descriptions of the many points of interest and the best routes for sight-seers to follow.

ELECTRICITY FOR MACHINE DRIVING.—Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Pamph.; 6 × 9 ins.; illustrated.

This is a brochure pointing out in a brief manner a few of the advantages secured by using separate electric motors in place of long lines of shafting and the usual system of belting. A list of industries to which electric motors are applicable and the advantages to be derived are given, the latter being subdivided into such topics as reliability, convenience and flexibility, saving of power, sanitary improvements, increased output, etc.

ARMOR-PLATE.—The Carnegie Steel Co., Limited, Pittsburg, Pa. Cloth; 12¾ × 9¼ ins.; pp. 73, of photogravures and text.

This handsome publication, printed in both English and French, illustrates and briefly describes the armor-making plant of the Carnegie Steel Co.; presents views of a large number of the new ships of the United States Navy, and shows the results of ballistic tests of armor-plate of various forms and thicknesses made by this firm. The text accompanying these plates gives the location, date and conditions of each test, and the results for each round.

SURFACE CONDENSERS; COOLING TOWERS; FEED-WATER HEATERS.—Wheeler Condenser & Engineering Co., 120 Liberty St., New York. Three pamphlets; 6 × 9 ins.; pp. 30, 16, 19.

These three pamphlets contain illustrated descriptions of several styles of the "Wheeler" surface condensers and feed-water heaters, and of the "Barnard" cooling tower, used for cooling the circulating water discharged from surface condensers. In this tower the water is cooled by passing down over a series of vertical galvanized steel wire mats while a current of air is blown upward through the mats by means of a fan.

CORLISS AND COLUMBIA ELECTRIC ENGINE STOPS.—Springfield Engine Stop Co., Springfield, Mass. Circular; 6 × 9 ins.; also a pamphlet, 8¼ × 5 ins.

These are brief descriptions of a form of electric engine stop which consists of a small steam cylinder, controlled by an electrically operated valve, whose function is to raise the side rod of the Corliss governor, thus lifting the governor balls and preventing the grab hooks from opening the main engine valves. The electric valve can be operated from any point by pressing a button. Reasons for employing an engine stop and several letters from users are included.

GRANITE ROCK WOOL.—American Insulating Material Mfg. Co., 215 North Third St., St. Louis, Mo. Paper, 7¾ × 10¾ ins.; pp. 32.

This material is said to be made by converting granite rock to a fibrous condition, and is claimed to be superior to the ordinary mineral wool made from furnace slag in its freedom from acids and impurities. It is adapted for boiler and pipe coverings, for sound deadening and heat insulation in all classes of building, and especially in cold storage warehouses, ice houses, etc., and in passenger car and refrigerator car construction. An analysis is given showing that the material is free from sulphuric acid and contains much less alumina and iron oxide than mineral wool. It weighs about 7 lbs. per cu. ft., and is sold put up in burlap bags at $30 per ton of 2,000 lbs. The material is also used for the filtration of water, and is made up in sectional forms for use in boilers, steam pipes, brine tanks, etc.

POWER TRANSMISSION AND CONVEYING MACHINERY.—The Link Belt Machinery Co., Chicago, Ill. Paper; 6 × 9 ins.; pp. 300; illustrated.

This catalogue replaces all previous catalogues of the above-named company's products in standard conveying, hoisting and power transmission machinery. It illustrates and describes briefly complete plants and separate machines, fittings and supplies for conveyors, elevators, coal screening and washing machinery; coal and ash handling plants; cane conveyors, granulators, strainers, etc., for sugar refineries and plantations; packing house elevators and conveyors; grain elevator and flour mill conveying and packing machinery; barrel and bottle washing and conveying machinery for breweries, malt houses and distilleries; conveyors for fish, fruit and vegetable canneries, log hauls, conveyors and elevators for saw mills, etc., etc. The book is handsomely printed and illustrated and is provided with an adequate index.

SUPPLEMENTARY GAS FUEL FOR STEAM BOILERS.—Economy Mfg. Co., New York. Pamph.; 7 × 10 ins.; pp. 16.

This pamphlet describes W. L. Teter's patent system for "perfecting the combustion of coal" under steam boilers. A retort formed of a coil of 2-in. pipes is placed just back of the bridge wall, and into it is carried a current of steam and a small quantity of oil which is fed in drop by drop. The mixture of superheated steam and petroleum vapor is taken from the retort to a series of pipes which are placed parallel to and a short distance below the grate bars. These pipes are perforated with a number of small holes, which serve to distribute the steam and vapor uniformly under the grates. An increase of from 20 to 40% in efficiency is, of course, claimed for this device, and a $500,000 company has been formed to exploit it. Whatever merit this device has is probably due to its discharging steam under the grate, which may prevent the formation of clinker and improve the draft, but this is not new nor patentable.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Oct. 20.	Viaduct over Lick Run, Cincinnati, O.	Sept. 22
Oct. 20.	Greenhouses, etc., New York, N. Y.	Oct. 13
Oct. 20.	Brick chimneys (3), Buffalo, N. Y.	Oct. 13
Oct. 20.	Bridge, 150-ft. span, Jackson, W. Va.	Oct. 13
Oct. 20.	Electric conduits, Erie, Pa.	Oct. 13
Oct. 20.	Asylum building, Newark, N. Y.	Oct. 13
Oct. 20.	Water pipe, etc., New York, N. Y.	Oct. 13
Oct. 20.	Macadam road, Enfield, Mass.	Oct. 13
Oct. 20.	Water-works, Shawnee, Okla.	Oct. 13
Oct. 20.	Electric light bonds, Grafton, W. Va.	Oct. 6
Oct. 20.	Steam heating, etc., York, Pa.	Oct. 6
Oct. 20.	Cottage, Lancaster, O.	Oct. 6
Oct. 20.	Levee work, New Orleans, La.	Oct. 20
Oct. 20.	Highway (3,000 lin.ft.), Sudbury, Mass.	Oct. 20
Oct. 20.	New Lebanon road, New Lebanon, N.Y.	Oct. 20
Oct. 20.	Pumping engine, Fort Wayne, Ind.	Oct. 20
Oct. 20.	Bridge approach, Kansas City, Mo.	Oct. 20
Oct. 21.	Granite walks, St. Louis, Mo.	Oct. 20
Oct. 21.	Grading, Terryville, Conn.	Oct. 20
Oct. 21.	Grading, paving, etc., Dayton, O.	Oct. 20
Oct. 21.	Brick sewer, Memphis, Tenn.	Oct. 20
Oct. 21.	Wire (750 miles), Washington, D. C.	Oct. 20
Oct. 21.	Interior finish, Columbus, Ga.	Oct. 13
Oct. 21.	Paving, Buffalo, N. Y.	Oct. 13
Oct. 21.	Sewer pipe, cement, etc., Newton, Mass.	Oct. 13
Oct. 21.	Levee work, West Memphis, Tenn.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Oct. 13.	
Oct. 22.	Electric lighting, heating, etc., Buffalo, N.Y.	Oct. 13
Oct. 22.	Electric light plant, Port Royal, S. C.	Oct. 13
Oct. 22.	Drainage, Harvel, Ill.	Oct. 13
Oct. 22.	Dredging at navy yard, Brooklyn, N.Y.	Oct. 13
Oct. 22.	Sewers, Washington, D. C.	Oct. 13
Oct. 22.	Pipe sewers, Lebanon, O.	Oct. 13
Oct. 22.	Iron bridges (2), Salem, Va.	Oct. 6
Oct. 22.	Bridge, plans and material, Cincinnati, O.	Sept. 29
Oct. 22.	Electric plant, Litchfield, Ill.	Sept. 29
Oct. 22.	Dredging, Pensacola Bay, Fla.	Sept. 29
	Advertised, Eng. News, Sept. 29 to Oct. 13.	
Oct. 22.	Grading, North Main St., Thomaston, Conn.	Oct. 20
Oct. 22.	Grading Michigan Ave., Washington, D. C.	Oct. 20
Oct. 22.	Heating, plumbing, etc., Bath, N. Y.	Oct. 20
Oct. 22.	Electric plants (2), Boston, Mass.	Oct. 20
Oct. 22.	Laying water mains, Amsterdam, N. Y.	Oct. 20
Oct. 22.	Extending water mains, Bremerton, Wash.	Oct. 20
Oct. 22.	Fire alarm system, Mobile, Ala.	Oct. 20
	Advertised, Engineering News, Oct. 20.	
Oct. 22.	Bonds, Troy, O.	Oct. 20
Oct. 24.	Markets, etc., Belem, Brazil	Apr. 28
Oct. 24.	Paving with asphalt, etc., Hamilton, O.	Sept. 29
Oct. 24.	Water-works, Gallipolis, O.	Sept. 29
Oct. 24.	Heating plant, St. Peter, Minn.	Sept. 29
Oct. 24.	Storage reservoir, Bradford, Pa.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Oct. 24.	Fire engine house, Chicago, Ill.	Oct. 13
Oct. 24.	Elevators (3), New York, N. Y.	Oct. 13
Oct. 24.	Sewers, Toledo, O.	Oct. 13
Oct. 24.	Sewers, (3¼ miles), Whiting, Ind.	Oct. 13
Oct. 24.	Brick paving, Toledo, O.	Oct. 13
Oct. 24.	Highway, Rochester, Mass.	Oct. 20
Oct. 24.	Grading, etc., Main St., Woodbury, Conn.	Oct. 20
Oct. 24.	Brick paving, etc., Louisville, Ky.	Oct. 20
Oct. 24.	Paving bonds, Cambridge, O.	Oct. 20

Oct. 24. Sidewalk bonds, Richwood, O. ....Oct. 20
Oct. 24. Paving, Indianapolis, Ind. ....Oct. 20
Oct. 24. Electric and gas light fixtures, New York....Oct. 20
Oct. 24. Water pipe, Deadwood, S. Dak....Oct. 20
Oct. 24. Plumbing, repairs, etc., Binghamton, N. Y....Oct. 20
Oct. 25. Paving bonds, Salem, O. ....Oct. 20
Oct. 25. Electric plant, Chicago Junction, O. ....Oct. 20
Advertised, Engineering News, Oct. 20.
Oct. 25. Flood gates, Dayton, O. ....Oct. 20
Oct. 25. Sewers, Rockford, Ill. ....Oct. 13
Advertised, Engineering News, Oct. 13.
Oct. 25. Viaduct approaches, Nashville, Tenn. ....Oct. 13
Advertised, Engineering News, Oct. 13.
Oct. 25. Sewers, Tampa, Fla. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 25. Pipe sewer, Huntington, Ind. ....Oct. 13
Oct. 25. Water filter, Ashland, Wis. ....Oct. 13
Oct. 25. Jetties, Portland, Ore. ....Aug. 25
Advertised, Eng. News, Aug. 25 to Sept. 15.
Oct. 25. Brick paving, etc., Tampa, Fla. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 25. Street bonds, Oakland, Md. ....Oct. 13
Oct. 25. Brick sidewalk, Huntington, Ind. ....Oct. 13
Oct. 26. Addition to water-works, Norfolk, Va. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 26. Bridge bonds, Cincinnati, O. ....Sept. 29
Oct. 26. Dredging, Newport, R. I. ....Sept. 29
Advertised Eng. News, Sept. 29 to Oct. 20.
Oct. 26. Cement, broken stone, etc., Newport, R. I...Sept. 29
Advertised Eng. News, Sept. 29 to Oct. 20.
Oct. 26. Sewer bonds, Glenville, O. ....Oct. 6
Oct. 26. Asphalt paving, Marshall, Mo. ....Oct. 20
Oct. 26. Brick sewer, Buffalo, N. Y. ....Oct. 20
Oct. 26. Pig lead, (150 tons), Baltimore, Md. ....Oct. 20
Oct. 26. Bridge, Eau Claire, Wis. ....Oct. 20
Oct. 26. Combination bridges, Unionville, Mo. ....Oct. 20
Oct. 26. School building, Laharpe, Ill. ....Oct. 20
Oct. 26. Sewers, Hoboken, N. J. ....Oct. 20
Oct. 26. Ladder truck and boilers, New York, N. Y...Oct. 20
Oct. 26. Wharf, dredging, etc., St. John, N. B....Oct. 20
Oct. 27. Macadamizing, etc., Findlay, O. ....Oct. 20
Oct. 27. Building, Central Islip (L.I.), N. Y. ....Oct. 20
Oct. 27. Heat'g, plumb'g, etc., Ward's Isld., N. Y. H..Oct. 20
Oct. 27. Building substructure, Boise, Mont. ....Oct. 20
Oct. 27. Stone, Brooklyn, N. Y. ....Oct. 20
Oct. 27. Asphalt paving, Winnipeg, Man. ....Oct. 20
Oct. 27. U. S. building, Camden, N. J....Oct. 6
Advertised, Eng. News, Oct. 6 and 13.
Oct. 27. Paving, Camden, N. J....Sept. 29
Oct. 27. Electrical machinery, Hull, England. ....Oct. 13
Oct. 28. Heating plant, Genoa, Neb. ....Oct. 13
Oct. 28. Pipe sewer, Monticello, Ind. ....Oct. 13
Oct. 28. Asphalt, brick or stone, Atlanta, Ga....Oct. 6
Oct. 28. Brick paving, etc. (7 Sts.), Cleveland, O. ....Oct. 6
Oct. 28. Brick and stone wall, Atlanta, Ga. ....Oct. 6
Oct. 28. Stone wall, San Francisco, Cal....Oct. 6
Oct. 28. Grading and paving, New Orleans, La. ....Oct. 20
Oct. 28. Cement sidewalks, Chicago, Ill. ....Oct. 20
Oct. 28. Pipe sewers, Chicago, Ill. ....Oct. 20
Oct. 28. Laying water mains, Chicago, Ill. ....Oct. 20
Oct. 29. Brick paving, Olean, N. Y....Oct. 20
Advertised, Engineering News, Oct. 20.
Oct. 28. Macadam, curb, etc., Warren, O....Oct. 20
Oct. 28. Drill hall, Kingston, Ont. ....Oct. 20
Oct. 29. Electric traveling crane, Norfolk, Va. ....Oct. 20
Oct. 29. Steam tender, Louisville, Ky. ....Oct. 6
Oct. 29. Grading and brick paving, Cleveland, O....Oct. 13
Oct. 29. Grading and cement walks, Irvington, Ind. ..Oct. 13
Oct. 30. School building, Chehalis, Wash. ....June 16
Oct. 31. Metal work, Mobile, Ala. ....Oct. 13
Advertised, Eng. News, Oct. 13 and 20.
Oct. 31. Pumping engine (3,000,000 galls.), Marietta, O. Oct. 20
Oct. 31. Electric bonds, Winnebago City, Minn....Oct. 20
Nov. 1. Road bonds, Utica, N. Y. ....Oct. 20
Nov. 1. Water pipe (20,000 ft.), Spring Lake, N.J...Oct. 20
Advertised, Engineering News, Oct. 20.
Nov. 1. Pipe sewers (4,600 ft.), Spring Lake, N.J...Oct. 20
Advertised, Engineering News, Oct. 20.
Nov. 1. Arc lighting, Hull, Que....Oct. 20
Nov. 1. Hospital plans, New York, N. Y....Oct. 13
Nov. 1. Bridge, Corydon, Ia. ....Oct. 13
Nov. 1. Artesian well, Jamestown, N. Dak....Oct. 13
Nov. 1. Sidewalks, Terre Haute, Ind. ....Oct. 13
Nov. 1. Court house, Garner, Ia. ....Sept. 8
Nov. 1. School building, St. Louis, Mo....Sept. 22
Nov. 2. Heating, etc., Baltimore, Md. ....Oct. 20
Nov. 2. Electric lighting, etc., Baltimore, Md....Oct. 20
Nov. 2. Harbor work, Stockton, Cal. ....Oct. 20
Nov. 3. U. S. building, Chicago, Ill. ....Oct. 20
Advertised, Eng. News, Oct. 20 and 27.
Nov. 3. Roads, walks, etc., Fort Hancock, N. J. ....Oct. 20
Nov. 3. Highway work, Pittsburg, Pa....Oct. 20
Nov. 3. Repairing sidewalks, Cincinnati, O....Oct. 13
Nov. 4. Piers and abutments, Coshocton, O....Oct. 13
Nov. 5. Substructure, Center St., Cleveland, O....Oct. 13
Nov. 5. Sewers, East Cleveland, O. ....Oct. 13
Nov. 5. School building, Marion, O. ....Oct. 20
Nov. 5. Wells and shafts, Gila County, Ariz....Oct. 20
Nov. 7. Bridge at Curtis' Ford, Wilkesboro, N. C...Oct. 20
Nov. 7. Viaduct superstructure, Cincinnati, O. ....Oct. 13
Nov. 7. Bridge, Webster St., Oakland, Cal. ....Oct. 13
Nov. 7. Plank sidewalks, (1 year), Cincinnati, O...Oct. 13
Nov. 7. Wooden bridge (190 ft. long), Magnolia, Miss. Oct. 13
Nov. 7. Brick paving, Toledo, O....Oct. 13
Nov. 7. Improving electric plant, Topeka, Kan. ..Sept. 22
Nov. 8. Electric plant, etc., Wynne, Ark. ....Oct. 20
Nov. 8. Water-Works, etc., Wynne, Ark. ....Oct. 20
Nov. 8. Surveys, Olympia, Wash. ....Oct. 20
Nov. 9. Paving, etc., Cohoes, N. Y. ....Oct. 20
Nov. 9. Improving drawbridge, Camden, N. J....Oct. 20
Advertised, Engineering News, Oct. 20.
Nov. 9. School building, Fort Sill, Okla. ....Oct. 20
Nov. 9. Electric light plant, Toronto, Ont. ....Oct. 6
Advertised, Engineering News, Oct. 6.
Nov. 9. Electric energy, Toronto, Ont....Oct. 6
Advertised, Engineering News, Oct. 6.
Nov. 9. Bridge, Sable Creek, San Jose, Cal. ....Oct. 13
Nov. 10. Water supply, Belem, Brazil ....Sept. 22
Nov. 10. Water bonds, ($30,000), New Richmond, O..Oct. 20
Nov. 10. College building, Cincinnati, O. ....Oct. 20
Nov. 10. Court house bonds, Doniphan, Mo. ....Oct. 20
Nov. 10. Fish hatchery, etc., Spearfish, S. Dak....Oct. 20
Nov. 10. Electric bonds, New Richmond, O. ....Oct. 20
Nov. 11. Bridges, (3), Olivet, S. Dak. ....Oct. 13
Nov. 12. Water bonds ($130,000), Reno, N. Mex....Oct. 13
Nov. 12. Buildings ($106,250), Mare Island, Cal....Oct. 20
Nov. 12. Dredging, Port Royal, S. C. ....Oct. 20
Nov. 14. Steel bridge (100 ft.), Houston, Tex. ....Oct. 20
Advertised, Eng. New, Oct. 20 to Nov. 3.
Nov. 14. Removing wreck, Rockland Harbor, Me....Oct. 13
Nov. 15. Industrial school, Ellendale, N. Dak....Oct. 13
Nov. 15. Water-works addition, Seattle, Wash....Sept. 22
Advertised, Eng. News, Sept. 22 to Nov. 10.
Nov. 15. Jail work, San Saba, Tex....Sept. 29
Nov. 15. Electric lighting, Greensboro, N. C. ....Oct. 6
Nov. 15. Dredging bay, Coos Bay, Ore. ....Oct. 20
Advertised, Eng. News, Oct. 20 to Nov. 10.
Nov. 16. Electrical machinery, Cleveland, O....Oct. 20
Nov. 16. Electric lighting, Camden, N. J....Oct. 13
Advertised, Eng. News, Oct. 13 to 27.
Nov. 21. Government bldgs (8), Sophia, Bulgaria....Sept. 29
Nov. 26. Boat shelter roof, Mare Island, Cal. ....Oct. 20
Nov. 30. Dry dock, Algiers, La. ....Oct. 20
Nov. 30. Bridge, etc., and plans, Moline, Ill....Oct. 6
Advertised, Eng. News, Oct. 6 and 13.
Dec. 1. Electric lighting, Sumter, S. C. ....Oct. 6
Dec. 1. Electric light plant, Clinton, Ill. ....Oct. 13
Dec. 2. Arc lighting, Asheville, N. C. ....Oct. 13
Dec. 7. Changing Van Buren St. bridge, Chicago, Ill. Oct. 20
Dec. 15. Storm sewers, Denver, Colo....Oct. 13
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn....Aug. 18
Jan. 2. Bridge, Quebec, Que. ....Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Feb. 10. Jail building, Keyser, W. Va. ....Sept. 29
No date. School building, Somerville, N. J....Oct. 20

RAILWAYS.

ARGENTINE.—Press reports from Germany state that Herr Schiefiner, a German capitalist, has just secured from the Argentine government a concession for the construction of a complete network of railways, having a total length of 2,000 miles, which, when complete, will serve the entire southern portion of the province of Buenos Ayres as far as Bahia Blanca. A German-Belgian syndicate will be formed for the undertaking.

ASHLAND & WOOSTER.—J. L. Eberhardt, Ch. Engr., Wooster, O., informs us that surveys have been made and the right of way secured for about 40 miles of this proposed line from Ashland to Beech City, via Jeromeville, Austin, Terra Cotta, Wooster, Applecreek and West Lebanon, O., a distance of 52 miles. When final location has been made, the capital for construction will be forthcoming. No contracts of importance will be let. Pres., H. B. Camp, Akron, O.

ATLANTIC, VALDOSTA & WESTERN.—F. W. Long, Ch. Engr., Haylow, Ga., informs us that contracts are now being let for work on this proposed line between Valdosta and Jacksonville, via Haylow, Ga., and Crawford, Fla., a distance of 105 miles. All surveys have been made, the right of way obtained and capital secured. J. D. Hardin, Naylor, Ga., will do some of the work. The line is already built between Haylow and Ewing, 49 miles. G. S. Baxter & Co., of Haylow, are interested. Pres., Walton Ferguson, Jr., 18 Wall St., New York.

BAKERSFIELD & LOS ANGELES.—W. B. Storey, Jr., Ch. Engr. of San Francisco & San Jocquin Valley Ry., 321 Market St., San Francisco, Cal., informs us that this company, whose incorporation was noted in our issue of Sept. 22, has been organized in San Francisco to build a line from Bakersfield to Los Angeles, Cal., an estimated distance of 200 miles, and that this is practically all. The organization has been effected in order to enable surveys to be made and a route to be decided upon. The country to be passed over is excessively rough and the work will be necessarily heavy. It cannot be definitely stated that the road will be built until the cost of same is known. Press reports state that Mr. Storey left for Bakersfield, Oct. 6, to make a reconnoissance of the Tejon Pass and the surrounding country.

CANADIAN PACIFIC.—Reports state that most of the track has been laid on the Crow's Nest Pass extension of this railway from Lethbridge, N. W. T., to Kootenay Lake, B. C., over Crow's Nest Pass of the Rocky Mountains. Work on the proposed Columbia & Western extension, from Robson to Midway, B. C., will be in progress throughout the winter. W. F. Tye, Ch. Engr., Trail, B. C.

CANADIAN PACIFIC.—We are informed that the Ontario and Quebec division of this system is now being double-tracked between St. Anne de Bellevue, Que., and Western Junction, 6½ miles from Montreal, a distance of fourteen miles. The grading, of which there will be about 3,000 cu.yds., will be done by J. W. Munroe, Pembroke, Ont. R. W. Leonard, Ch. Engr. and Mgr. of Construction, Montreal Junction, Montreal.

CAPE FEAR & NORTHERN.—Press reports state that this railway, which is in course of construction between Apex and Holly Springs, N. C., 60 miles, will be extended south to Fayetteville, and north to Durham, connecting at the latter place with the Lynchburg & Durham line of railway. Pres., Benjamin Duke, Durham, N. C.

CHICAGO & NORTHWESTERN.—This company is reported to have let contracts for grading a new line from Denison to Algona, via Pocahontas, Ia., a distance of about 90 miles. This will provide a much shorter route than that through Sioux City.

CHIHUAHUA & PACIFIC.—Thos. J. Brennan, Secy., 80 Broadway, New York, informs us that about 10 miles of track has been laid on this proposed line from Chihuahua, Mex., via Guerrero, to the Pacific Coast, a distance of 600 kilometers (372.6 miles), and that grading has been completed on about 40 kilometers; steel bridges are now being erected. The equipment will consist of five locomotives, fifty box cars, thirty flat cars, two cabooses and nine passenger and combination coaches, most of which have already been built and delivered. The company is in the market for pumps and boilers for eight water stations and for two 60-ft. turntables. Pres., Almeric H. Paget, New York; Ch. Engr. E. S. Safford, Chihuahua.

CHINA.—Wm. Barclay Parsons, 22 William St., New York, has been engaged by the American-China Development Co. to go to China in order to locate the proposed line of railway from Hankow to Hong Kong, the contract for which was signed at Washington, D. C., by the Chinese minister and the company, on Sept. 14. Surveys are to be commenced at once.

CUBA.—It is reported that Col. Hecker, who is in charge of the transportation bureau of the war department of the United States, has been sent to Cuba to secure data and information relative to the construction of a system of railways on that island.

DALLASTOWN.—This company has been incorporated in Pennsylvania, Oct. 12, with a capital stock of $12,000, to construct a steam railway between Dallastown and a point on the York Southern R. R., one mile east of Dallastown, Pa. The incorporators are, Daniel F. Lafeau, Pres.; Henry H. Weber and George E. Neff, of York, Pa.; John C. Heckert and Charles Kohler, of Dallastown.

GEORGIA & ALABAMA.—Reports state that the Georgia & Alabama Terminal Co. has been organized, with a capital stock of $300,000, by W. W. Williamson, C. D. Baldwin, W. V. Davis and others, of Savannah, Ga., in order to construct new terminals for this railway on Hutchinson Island, near Savannah. The work will probably be done by the Georgia Construction Co., which has recently been incorporated for that purpose by W. W. Mackall, J. R. Anderson, W. W. Williamson, of Savannah, and others.

GILA VALLEY, GLOBE & NORTHERN.—A. C. Laird, Secy., Los Angeles, Cal., informs us that the Midland Construction is now at work extending this line from Geronimo to Globe, Ariz., via San Carlos, 58 miles. The entire line has been located and right of way obtained. Much of the grading has been completed and some track has been laid. Pres., William Garland, Los Angeles; Ch. Engr., Russell Chase, Geronimo, Ariz.

GREAT EASTERN.—This company was incorporated in North Carolina, October 14, with a capital stock of $650,000, to construct a railway, 130 miles in length, through Johnston, Wayne, Greene, Pitt, Beaufort and Hyde counties to a connection with the Southern Ry. at Goldsboro or Selma, N. C. J. D. McCormick and J. N. Allen, of New York; J. W. Lynch, Kinston; J. H. McCleary, Suffolk; Geo. W. Suggs and Josiah Exum, of Snow Hill, are directors.

GREENBRIER.—J. M. Gill, Huntington, W. Va., informs us that nothing further has been done towards building this line than to obtain a charter for the company. It was proposed to construct a railway from White Sulphur Springs, W. Va., to the coal and lumber district at the fork of the Greenbrier River.

KELLYTON & ROCKFORD.—This company was incorporated in Alabama, Oct. 6, with a capital stock of $50,000, to construct and operate a railway from Rockford to Kellyton, Ala., on the Central of Georgia Ry., a distance of about 15 miles. The incorporators are J. P. Batson, E. V. Jones, H. W. Pond and others, of Rockford.

LOUISIANA & ARKANSAS.—J. A. Buchanan, Gen. Mgr., Stamps, Ark., informs us that the construction of this line was completed Oct. 1, running from Stamps, Ark., to a connection with the Arkansas, Louisiana & Southern at Cotton Valley, La., a distance of 38 miles. The line is now open for traffic from Stamps to Sibley, La. Pres., Wm. Buchanan, Stamps.

MANSFIELD SHORT LINE.—We are informed that four miles of this proposed line from Lucas to Shelby, via Mansfield and Springfield, O., a distance of 19 miles, have been graded, and the contracts let for the necessary ties and steel rails. The Lucas Construction Co., of Mansfield, are the general contractors, and the Crouch Construction Co., of Chicago, the sub-contractors. Pres., C. W. French; Ch. Engr., R. E. Harwood, both of Mansfield.

MEXICO.—Press reports state that the Mexican government has granted a concession for a standard gage railway, 150 kilometers maximum length, with a liberal subsidy, to the Inguaran Copper Mining Co., in which the Paris Rothschilds are said to be interested. The railway is being planned to connect the mines with the Bay of Zituataneza, on the Pacific Coast, and will be an outlet for the copper productions.

MUNISING.—E. H. Scott, Gen. Mgr., La Porte, Ind., informs us that it is not likely that further construction will be undertaken on this line before next spring. The company already has 47 miles in operation from Munising, on Lake Superior, to Little Lake, Mich., on the Chicago & Northwestern Ry. The total projected length of the system is 110 miles. Pres., Daniel P. Eelles, Rocky River, O.; Ch. Engr., R. C. Young, Munising.

OHIO SOUTHERN.—This line is reported to have been sold, October 15, by John T. Adams, Special Master, of Waverly, O., to W. A. Read, of New York, and others, for $2,000,000, which was the upset price.

ROSSFORD & TOLEDO.—This company was incorporated in Ohio, October 12, with a capital stock of $10,000, to construct a short line of railway from the foot of the Maumee Rapids to the Cincinnati, Hamilton & Dayton Ry. The incorporators are: Edward Ford, Rathbun Fuller, William P. Tyler, Matthias R. Pepper, Thomas R. Taylor and F. H. Tanner, with headquarters at Toledo, O.

SANTA FE, PRESCOTT & PHOENIX.—W. A. Drake, Ch. Engr., Prescott, Ariz., informs us that this line has been completed to Mayer, Ariz., a distance of 25.8 miles, and that operation was to commence on October 15. Pres., F. M. Murphy, Prescott.

ST. LOUIS, OKLAHOMA & SOUTHERN.—C. N. Points, Director, Shawnee, Okla., informs us that this company has located 200 miles of this projected line from Claremore south to Willis, Ind. Ter., on the Red River, via Okmulgee, Wewoka, Sasakwa and Tishomingo. It is also expected to locate a 100-mile branch soon through Shawnee to Purcell. Pres., Gov. John F. Brown, Sasakwa, Ind. Ter.

TENNESSEE.—Press reports state that the Stevens Lumber Co. has determined to construct a new standard gage railway from Dyersburg to Tiptonville, Tenn., a distance of 28 miles. Six miles of line are now in operation as a logging road, but it is proposed to open the completed line to general service.

UTAH & PACIFIC.—Jos. A. West, Ch. Engr., Milford, Utah, informs us that the surveys have all been made, the right of way obtained and capital secured for the first 76 miles of this line, which, when completed, will be 576 miles in length. The contract for its construction, as stated heretofore, has been let to W. D. Hendricks & Sons, Richmond, Utah. Actual work on the line began October 3. Pres., A. W. McCune, Salt Lake City, Utah.

WELLINGTON & POWELLSVILLE.—J. W. Branning, Pres., Edenton, N. C., informs that this line has been completed and was opened for business on September 15. The extension just completed runs from Windsor to Ahoskie, N. C., a distance of 18 miles.

WESTERN RY. CONSTRUCTION.—This company, with offices at New York, was incorporated in West Virginia, October 8, with a capital stock of $5,000,000, with $100 paid in, to construct and operate a railway between Culiacan, State of Sinaloa, across the Sierra Madre Mountains, to Durango, Mexico. The incorporators are: John R. Newberry and R. J. Hartman, of Los Angeles, Cal.; Floyd B. Wilson, James Yalden and Bryan W. Tichenor, of New York.

WILMINGTON & NORTHERN.—Reports state that the Baltimore & Ohio R. R. Co. purchased this line, October 12, extending from Wilmington, Del., to Reading, Pa., 90 miles, and it will open up a new southern route from the anthracite coal regions in Pennsylvania.

STREET AND ELECTRIC RAILWAYS.

BANGOR, ME.—It is reported that the Bangor, Hampton & Winterport Ry. Co. is preparing plans to extend its line in the early spring to Winterport, and to complete the same by July 1. Pres., H. L. Mitchell, 29 Hammond St.

HAMPTON FALLS, N. H.—The Hampton & Amesbury St. Ry. Co. has petitioned the railroad commissioners of New Hampshire for authority to issue $40,000 of capital stock in order to construct and equip a street railway in Hampton Falls and Seabrook, a distance of four miles.

BELLOWS FALLS, VT.—F. C. Kennedy, of Burlington, Vt., informs us that all the franchises have been granted and the capital secured for the proposed Bellows Falls & Saxtons River Electric Ry., from Bellows Falls to Rockingham, via Westminster, Vt., a distance of six miles. Contracts will all be let ready for construction and some of the work done this fall and completed early next spring. Pres., J. H. Holton, Burlington; Ch. Engr., V. K. Nash, Woonsocket, R. I.

BURLINGTON, VT.—We are informed that C. W. Blakeslee & Sons, New Haven, Conn., will commence work at once on the construction of the Burlington & Hinesburgh R. R., which is to be an electric line, 16 miles in length, to be operated between Burlington and Hinesburgh. Surveys have been made and most of the right of way obtained and track supplies ordered. Pres., W. T. Babcock, Boston, Mass.; Ch. Engr., F. O. Sinclair, Burlington.

BRAINTREE, MASS.—It is reported that the selectmen of this town have granted a franchise to the Braintree & Weymouth St. Ry. Co., of Weymouth, to build on Meadow Road and French's Ave.

NEW BEDFORD, MASS.—It is reported that the New Bedford, Brockton & Middleboro St. Ry. Co. has decided upon a route for its proposed line, and will probably request a new franchise within a few days. Mayor Ashley is said to be interested.

QUINCY, MASS.—The Quincy & Boston St. Ry. Co. will soon build a carhouse, according to reports, near Neponset bridge on Robinson's wharf. The dimensions will be 93 × 23 × 144 ft., and the cost, $15,000. B. J. Weeks, Purchasing Agt. and Supt., 4 Washington St., Quincy.

WHITMAN, MASS.—Waldo Dyer, of Whitman, a director of the Brockton & Whitman St. Ry. Co., informs us that the surveys have been made, the location granted and the capital secured for this proposed electric line from Brockton to Whitman, a distance of 3½ miles. The franchise was granted on Sept. 23. Jas. F. Shaw & Co., 53 State St., Boston, Mass., have charge of the construction work. Vestibule cars will be used, and the line will serve as a connecting link in the system which is projected to run from Brockton to Rockland and Nantasket Beach, via Whitman and Abington, 30 miles. Work will begin at once. Pres., John J. Whipple, of Brockton.——We are also informed that a new organization, the Old Colony St. Ry. Co., proposes to build a 10-mile electric line in this locality early next spring, probably in April. The promotors are ready to receive proposals as to the cost of construction, etc., and may be addressed at P. O. Box 466, Whitman.

WORCESTER, MASS.—E. S. Hill, Tremont Bldg., Boston, Mass., informs us that the capital has been secured for the construction of the proposed Worcester & Webster St. Ry. from Worcester to Webster, via Auburn and Oxford, 15 miles, and that the contract has been let to the New England Electrical Ry. Construction Co., of Worcester. As stated in our last issue, the company was recently chartered, with a capital stock of $150,000. Pres., Julius Garst, of Worcester.

BRISTOL, R. I.—The Lap Joint Railway Track Co., 11 Broadway, New York, is reported to have begun work on the proposed electric line to Mount Hope. A power house and car shed will be built at Mount Hope Park, and work is to be completed before May 1.

ALBANY, N. Y.—J. S. Frost, Secy. Albany Construction Co., of Albany, contractor for the proposed Albany, Helderberg & Schoharie Electric Ry., informs us that the map and profile have been filed in Albany, and preliminary steps been taken preparatory to commencing the construction work. The route is from Albany to Schoharie, via Delmar, New Scotland, New Salem, Thompson's Lake, East Berne, Berne, West Berne and Gallupville, a distance of 42 miles. Pres.. Henry W. Burgett, 82 Devonshire St., Boston, Mass.; Ch. Engr., George Yost, Albany.

BROOKLYN, N. Y.—It is announced that plans and specifications are being prepared for the changing of the motive power on the Fifth and Lexington Ave. lines of the Brooklyn Elevated R. R.; estimated cost, $750,000.

MARION, N. Y.—It is reported that L. Brown and C. L. Tassell, of Marion, are securing the right of way for a proposed electric railway between that village and Palmyra. It is said that the line will be constructed during the coming year, as a part of the capital has already been pledged; estimated cost, about $75,000.

NEW YORK, N. Y.—The board of railroad commissioners, August 28, authorized the Twenty-eighth and Twenty-ninth St. Crosstown Ry. Co., controlled by the Metropolitan St. Ry. Co., New York, to change the motive power of its line from horse to the underground electric system.

ATLANTIC CITY, N. J.—The Atlantic City St. Ry. was granted a franchise, Oct. 10, to construct and operate a double-track crosstown trolley line from South Carolina Ave. and the beach to the inlet section, via South Carolina, Arctic and Rhode Island Aves. Levi C. Albertson is interested.

SOUTH ORANGE, N. J.—The village trustees, October 17, granted a franchise to the South Orange and Maplewood Traction Co., to maintain a grade across Montrose Ave.

ALLENTOWN, PA.—The Inland Traction Co., of Allentown, was incorporated, Oct. 14, with a capital stock of $200,000, to construct a street railway in Montgomery county, 12 miles in length. The incorporators are: John H. Pascoe, Allentown; J. B. Alderfer, Pres.; Edwin S. Landis and Edwin H. Alderfer, of Souderton, Pa.; C. F. Hecklen, Quakertown, Pa.

JOHNSTOWN, PA.—The Johnstown and Somerset Traction Co. is stated to have been incorporated, October 5, by Charles S. Price, Morris L. Woolf, Pres.; David Barry, secretary; Herbert H. Weaver, and Fred Krebs, of Johnstown. It is proposed to build a trolley line from Johnstown to Geistown, Scalp Level and Windber, with several branches.

NEWTOWN, PA.—A. Chambers, of Newtown, informs us that all of the right of way has been obtained for this proposed line between Newtown and Doylestown, 14 miles. Thos. A. Connell, of Philadelphia, the contractor, began work just outside of Newtown on Oct. 10. It is reported that work will be completed by Dec. 15. Pres., Thos. P. Chambers; Ch. Engr., B. F. Knabb, both of Newtown.

BALTIMORE, MD.—David E. Evans & Co., of Baltimore, are said to have been awarded a contract, Oct. 12, for the construction of the Schroeder St. line of the Consolidated Ry. Co., to a connection, on Saratoga St., with the old Columbia & Maryland Ry.

WASHINGTON, D. C.—The stockholders of the Columbia Ry. Co. have been granted permission to issue $500,000 in bonds for the extension of the line eastward and the changing of motive power in the city from cable to underground electricity. This eastern extension is from 15th St. and Benning Road to the District line, connecting with the Chesapeake Beach Ry., with a branch line from Deanewood to Kenilworth, about seven miles in all. Its construction will involve the erection of a steel bridge 500 ft. long. It is reported that contracts for this extension will soon be let.

LYNCHBURG, VA.—The Lynchburg Electric Ry. & Light Co. has been granted a franchise by the council for constructing new lines in this city. Pres., H. P. Woodson; Directors, W. C. Ivey, R. I. Owen and others.

NEW ORLEANS, LA.—Alden McLellan, Pres. St. Charles St. R. R. Co., informs us that this company does not contemplate the building of any extensions in the near future, as currently reported.

NASHVILLE, TENN.—Reports state that the construction of an electric railway from Nashville to Lebanon and Smithville is contemplated by Pittsburg capitalists. E. E. Beard, of Lebanon, can give further information.

CINCINNATI, O.—The Cincinnati, Milford & Goshen St. Ry. Co. was incorporated, Oct. 10, with a capital stock of $10,000, to build an electric line from Linwood, in Cincinnati, to Goshen, along the Cincinnati, Columbus & Wooster Turnpike. The incorporators are: W. A. Goodwin, F. B. Niederhelman, W. C. Compton, Pres. of the Turnpike Co.; Lennox O. Goodwin and S. W. Kittering.

CLEVELAND, O.—Reports state that about 15 miles of grading have been completed on the new Cleveland & Eastern Electric Ry., and that rails for the road have been contracted for. E. G. Tillotson, Vice-Pres. Lorain & Cleveland Ry. Co., 61 Garfield Bldg., Cincinnati, is said to be interested.

CLEVELAND, O.—It is announced that the Cleveland, Berea, Elyria & Oberlin Ry. Co. is going to extend its line next summer from Oberlin to Norfolk, about 30 miles, and that the right of way is now being obtained. Pres., A. H. Pomeroy, Garfield Bldg.

LANCASTER, O.—We are informed that the Fairfield Traction Co. has been organized, with $100,000 capital stock, to build a railway between Lancaster, O., and the Boys' Industrial School, a State institution, six miles south of Lancaster. The contract for constructing the line ready for equipment has been awarded to Ingham & Neeb, of Lancaster, and work is to commence at once.

LOGANSPORT, IND.—The commissioners of Carroll county have granted a franchise for the proposed Logansport & Burlington Electric Ry. to the Business Men's Association, of this city, which will organize a company to build a line.

SUMMIT CITY, MICH.—Clark Cornwall, of Jackson, Mich.; Arthur Woodard, Ann Arbor. Mich., and Walter Joslyn, Ysilanti, Mich., have been granted a franchise by the township board of Summit to construct an electric railway to Vandercook's Lake to Summit.

EL PASO, TEX.—The citizens of this place contemplate the construction of an electric street railway in this city.

SHAWNEE, OKLA.—C. N. Points, Director of St. Louis & Oklahoma Southern Ry. Co., Shawnee, informs us that he has a franchise for a street railway in Shawnee, which it is expected to build soon. Information regarding street railway construction is solicited.

AUSTRALIA.—Press reports state that J. G. White & Co., Engineers and Contractors, 29 Broadway, New York, are beginning to ask quotations on the various requirements for the electric railway which they are soon to build in one of the principal towns in Australia.

ELECTRIC LIGHT AND POWER.

WILDER, VT.—The contract for installing the electric lighting plant for the Wilder Club & Library Building has been awarded to Austin & Letteney, Tremont Bldg., Boston, Mass.

BOSTON, MASS.—An ordinance is before the council authorizing an appropriation of $7,000 for extending the electric plant on Deer Island.

BOSTON, MASS.—Bids are asked until 12 noon, Oct. 22, for furnishing the machinery and for installing a plant at the new battery at Grover's Cliff, Winthrop, and also a plant at Nantasket Head, Hull. Each plant will consist of a boiler, one direct connected generating set, one switchboard, one storage battery, the electric blowers and starting boxes for the blowers. The plants must be completed by Dec. 31. Col. S. M. Mansfield, U. S. Engr..

PITTSFIELD, MASS.—Press reports state as follows: A scheme is on foot, backed by capitalists from New York and the west, for the consolidation of the entire electric light plants of Pittsfield, Lenox, Lee, Housatonic and Great Barrington, for the purpose of furnishing light and power to all towns and villages in Southern Berkshire. The plans of the promoters further contemplate the establishment of a railway between Pittsfield and Great Barrington—possibly a three-rail line. A number of the capitalists who have been in Pittsfield are reported as having said that $2,000,000 is available, if the necessary purchases to carry out the plans can be made. Daniel Odell and Charles N. Nelson, New York; E. A. Merrill, Minneapolis, and Thomas Greenwood, Great Barrington, are interested.

SOMERVILLE, MASS.—The council has voted in favor of establishing a municipal plant. It is probable that the question will be submitted to a vote of the citizens, Nov. 16. Alderman Lamont, Chn. Com., and Mayor Perry may be addressed.

PROVIDENCE, R. I.—The stockholders of the Narragansett Electric Lighting Co. have voted to increase the capital stock to $4,000,000, to enable the company to carry on its proposed improvements.

CROMWELL, CONN.—F. H. C. Reynolds, Pres. Cromwell Water Co., 7 Exchange Place, Boston, is reported as considering the question of building a plant in connection with the water-works.

EAST HARTFORD, CONN.—The fire district has voted to light the district with electricity. It has been recommended to make a short contract with the East Hartford Light & Power Co. The committee has also recommended that authority be secured from the legislature to build a plant to be owned by the fire district. The committee consists of E. E. King, Chn., C. F. Bingham, C. R. Forbes and A. W. Wickham.

AKRON, N. Y.—This place voted, Oct. 10, to build a municipal plant.

AUBURN, N. Y.—Press reports state that the D. M. Osborne Co. proposes to build an electric plant on the raceway to supply light and power to its three plants in the different parts of this city. The company has been asked to have the plant large enough to furnish commercial lighting.

BELFAST, N. Y.—It is stated that arrangements are being made for the proposed plant.

CANANDAIGUA, N. Y.—Thos. H. Bennett and M. D. Munger are interested in a new company which has applied for permission to build a plant. The capital stock will be about $30,000.

CHARLOTTE, N. Y.—The citizens have asked that another special election be called to allow them to reconsider their previous vote in favor of a plant and water-works, to cost $10,000 and $25,000 respectively. Bids were asked until Oct. 15 for constructing these improvements, as advertised in Engineering News, Sept. 29 and Oct. 6. Now it is proposed that so much of the sum realized on the bonds as relates to the electric lighting shall be invested and the proceeds therefrom used to pay the interest, and should any surplus be left the amount is to be added to the principal. It also authorizes the board to enter into a contract with some individual or corporation to furnish the lighting for the village instead of the village, through municipal ownership, furnishing its own lights. Engrs., Stanwix Engineering Co., Rome, N. Y.

CHATHAM, N. Y.—J. M. Klinglesmith has purchased the Spengler farm, water power, etc. It is stated that the purchaser will at once build a power plant.

HUDSON, N. Y.—Erskine Waldron, a taxpayer of this city, has commenced action in the Supreme Court looking towards annulling the lighting contract recently let to the Hudson Light & Power Co.

GREENPORT (L. I.), N. Y.—The question of the municipal ownership of the plant and water-works is being considered.

MALONE, N. Y.—F. D. Kilburn and J. F. Wright, Malone, and J. H. Abbott, of Gouverneur, N. Y., have organized a new electric light company. If the franchise already asked for is granted, work on the plant will begin at once.

MUMFORD, N. Y.—J. Ward writes us that F. H. Hyde, whose plant was destroyed in February, has purchased dynamos for the new plant, noted in our issue of last week as proposed.

NEW YORK, N. Y.—Bids are asked until Oct. 24 for furnishing gas and electric light fixtures, etc., for the department of public charities. Pres. Dept., J. W. Keller, foot East 26th St., Manhattan.

NIAGARA FALLS, N. Y.—The Union Carbide Co., of this city, has made a contract with the Niagara Falls Power Co. for 5,000-HP. in addition to that already secured.

PALMYRA, N. Y.—Olin J. Garlock, Pres. Palmyra Electric Light & Power Co., writes us that the company is building a new station, to which the old machinery will be moved. The plant will have a capacity for 32 1,200-c. p. and 1,800 16-c. p. incandescent lights; estimated cost, $35,000. Supt. and Vice-Pres., W. D. Willcox.

SHERMAN, N. Y.—T. J. Newell, Secy. Sherman Electric Light Co., writes us that the contract for furnishing the materials and for building the plant has been let to H. King & Son, Corry, Pa. The plant will have 8 to 12 arc and 350 to 700 16-c. p. incandescent lights. J. L. Thayer writes that it will be completed Dec. 1.

SIDNEY, N. Y.—Press reports state that the Sidney Camp Grove Association has decided to put in a plant and water-works for its grounds.

UTICA, N. Y.—The Utica Electric Mfg. & Supply Co. has been awarded the contract for furnishing and placing a 200 incandescent light machine in the plant of the New York Mills Co., of this city.

WATERTOWN, N. Y.—The Watertown Electric Co. has submitted a proposition to light the streets under a new contract. Pres., D. C. Middleton.

CRANFORD, N. J.—The township committee has awarded a 5-year contract for furnishing 196 lights to the Suburban Electric Light Co., at $15 a light a year.

IRVINGTON, N. J.—The question of this place having its own plant is being considered by the council. Councilman Lacombe may be addressed.

HALLSTEAD, PA.—The council has awarded a contract for electric lighting, according to reports. Work on the plant will be begun at once. The city will take six 2,000-c. p. arc and 25 32-c. p. incandescent lights. The D. L. & W. Ry. Co. will take 14 arc lights for its yards, besides other lights for the roundhouse and other property.

MARCUSHOOK, PA.—The council has passed an ordinance granting a five-year franchise for a plant to Walter G. Rust.

NEW BLOOMFIELD, PA.—The Perry Electric Light, Heat & Power Co. has submitted a proposition to light this place. The company has already begun the construction of its line from Newport to this place.

PERKASIE, PA.—The borough council has decided to submit the question at the next election of either granting a franchise for a plant or of erecting a municipal plant.

PHILADELPHIA, PA.—A meeting of the Southern Electric Light & Power Co. will be held Nov. 23 to consider the question of increasing the capital stock from $400,000 to $2,000,000. Pres., John M. Mack, Tacomy, Philadelphia.

TYRONE, PA.—A report states that the council has passed a resolution instructing the legal committee to offer the Tyrone Gas & Water Co. $90,000 for the assets, property and franchises, and if the same is not accepted, proceedings are to be instituted to take the plants under the provisions of the acts of the assembly. On July 7, 1897, this place voted to increase the debt for municipal plants.

BALTIMORE, MD.—Bids are asked until Nov. 2 for the electric lighting, heating, etc., of the executive and wardens' buildings at the state penitentiary. Arch., Jackson C. Gott, 1 East Fayette St.; Engr., Herbert G. Gear, Baltimore; Warden, John E. Weyler.—The courthouse commissioners received the following bids, Oct. 8, for furnishing the machinery and installing a plant at the new courthouse; Archs., Wyatt & Nolting, 4 East Lexington St: The McCay-Howard Engineering Co., Baltimore, 2-wire system, with Wheeler dynamo and Ball, Fisher or Ideal engine, $37,349, or with Buffalo Forge engine, $36,869; with General Electric or Walker dynamo, $37,369 or $37,849. The same company submitted separate bids for engines, generators and switchboards, ranging from $11,460 to $12,590. For wiring alone it bid $25,269 for a 2-wire system. Blake & Williams, New York, $34,840, 2-wire system, $35,104 3-wire system. J. F. Ferguson & Co., Philadelphia, $30,500 2-wire system, $31,500 3-wire plant; wiring alone, $18,000. The Southern Electric Co., Baltimore, 2-wire system, with Wheeler dynamo, $36,869; with General Electric dynamo, $37,369; for dynamos and engines alone, Crocker, $11,460; General Electric, $11,960; wiring alone, 2-wire system, $25,869. The same company offered engines, dynamos and switchboard, using the Ideal engine and Bullock dynamo, for $13,627. T. M. Mobrey, Philadelphia, $24,000 2-wire system $25,000 for 3-wire system. The D'Olier Engineering Co., Philadelphia, engine and dynamo for 2-wire plant, $12,782; complete, 2-wire plant for $28,781. Engines and dynamos alone the bids were: Cohen & Staughton, $12,226; Walker Co., $13,098; Crook, Horner & Co., $12,295 and $12,650; Fort Wayne Electric Corporation, $12,200; F. T. Potter, New York, $18,184; Talmadge & Wilson, Washington, D. C., $16,000 and $16,500; Thomas C. Basshor & Co., $12,620 and $12,935. Contract was let to Ferguson & Co., Philadelphia. It was not determined which system will be used. The contract for engines and generators will not be awarded until a future meeting of the commission.

WILLIAMSPORT, MD.—The committee will submit its report for a plant and water-works in a few days. L. D. Byron and Dr. W. S. Richardson are on the committee.

FREDERICKSBURG, VA.—T. McCracken, Chn. Com., writes us that bids for furnishing the machines and for building a plant will probably be received in about 30 days. The plant will have a capacity for 72 2,000-c. p. arc lights; estimated cost, $10,000. Engr., Fort Wayne Electric Corporation, Fort Wayne, Ind.

HAMPTON, VA.—The Chesapeake Light & Power Co. proposes to extend its plant. Mgr., Segar Whiting.

GREENSBORO, N. C.—Bids are asked until Nov. 15 for lighting the streets with electricity for three or more years from Jan. 1. There will be required 70 or more 1,200-c. p. arc lights for city use. Extensive commercial lighting will be wanted. Population, 10,000. Chn. Com., B. H. Merrimon.

HAW RIVER, N. C.—The Granite Cotton Mills Co., owned by Holt Bros. & A. W. Haywood, will install a plant of about 750 lights capacity.

SUMTER, S. C.—Bids are asked until Dec. 1 for furnishing this place with 37 2,000-c. p. arc lights for a term of 10 or 15 years; also for furnishing, if necessary, 160 incandescent lights for the opera house and for commercial lighting. Cy. Clk., C. H. Hurst.

FITZGERALD, GA.—The council is reported to have voted to award the contract for building a plant and waterworks to Moore &McRae, Atlanta, Ga.

FLORENCE, ALA.—Frank M. Perry, it is stated, is interested in the proposed electric light and power plant.

OPELIKA, ALA.—G. L. Webster, Cy. Clk., writes us that it is not definitely settled as yet whether the council will put in a plant or continue to have the city lighted by contract. The question will be finally decided upon in a few months.

NEW ORLEANS, LA.—The Crescent City Electric Co. has purchased land at Carrollton Ave. and the New Basin, on which it proposes to build a plant. The machinery, it is stated, will be purchased at once. The plant will have about 1,220 H. P. Gen. Mgr. and Supt., J. B. Craven.

CHICAGO JUNCTION, O.—Bids are asked until Oct. 25 for furnishing the material and for building a complete plant, as described in our advertising columns. Engr., Chas. F. Sturtevant, St. Louis, Mo.; Clk., Louis Simmermacher; Mayor, Louis C. Hess.

CLEVELAND, O.—Bids are asked until Nov. 16 for furnishing the following machinery for the addition to the plant at the Cleveland State Hospital: Div. I—Two 50-K-W.—110 W. direct connected dynamos to operate about 300 R. P. M.—Change in present switchboard and addition thereto—connecting wires from dynamo to switchboard, and one 10-HP. motor, one 7½-HP. motor, one 4-HP. motor, or (an alternative bid) one 50-K-W. dynamo, and the balance as stated above. Div. II—Two automatic high-speed engines, each to develop 75-HP. at ¼ cut off and 80 lbs. pressure at the throttle and foundations for same, or (an alternative bid), one engine of the above size. Div. III—Wiring. From the present main to the location of motor in the serving room, laundry, and machine shop, and change in the existing wiring and wiring for two arc lamps and two 50-c. p. incandescent lamps. Engrs., E. P. Roberts & Co., Osborn Bldg., Cleveland; Secy., State Hospital, H. C. Eyman.——A report states that the trustees of the Cleveland State Hospital have awarded Russell & Co., of Massillon, O., the contract for furnishing the engine and dynamos for the new electric light plant to be erected at the institution.

GIRARD, O.—The question of building a plant is being considered by the council.

LIMA, O.—The council has directed the committee to secure estimates for a new lighting contract, and also for a municipal plant. Councilman McClurg may be addressed.

NEW RICHMOND, O.—Bids are asked until Nov. 10 for the purchase of $30,000 of electric light plant and waterworks bonds, according to reports. Clk., Chas. R. Day.

KOKOMO, IND.—Press reports state as follows: The electric light plant of the Citizens' Light & Power Co. was ordered sold at receiver's sale by Judge Mount Oct. 11, the sale to take place Nov. 12. The company does the lighting at $70 a light, and is capitalized at $70,000. The creditors urging the sale are the Capital National Bank, Indianapolis; American Savings Bank, Detroit, and Joseph L. Cohn, of Indianapolis. Pres., E. Snow, Indianapolis.

WORTHINGTON, IND.—C. A. Geckler, Clk., writes us that a franchise and contract for a plant and public lighting have been given to C. S. Knight, of the Fort Wayne Electric Corporation, and also for water-works. The city will use 34 lights and 41 hydrants. The town will have the option to purchase the plants within 30 days after completion.——Press reports state that the case of several citizens of Worthington as plaintiffs against the town board and C. S. Knight, contractor, to enjoin the latter from putting in a water-works and an electric light plant at this place was dismissed from court Oct. 7.

LAWTON, MICH.—This place voted Oct. 11 to issue $5,000 in bonds for electric lights.

GRAND RAPIDS, MICH.—The council has overruled the mayor's veto by awarding the contract for furnishing the machinery and for building the plant to the Chase Construction Co., 1113 Majestic Bldg., Detroit, Mich. The bids for the machinery were given under Contract Prices in our issue of Oct. 6.

JONESVILLE, MICH.—This place voted, October 10, to issue $28,000 in bonds for a plant and water-works, according to reports.

LEROY, ILL.—The Leroy Electric Light, Power & Heating Co. has purchased land for its new plant, according to reports.

ST. JOSEPH, ILL.—The bids received Oct. 6 for furnishing and erecting a plant, as advertised in our issue of Sept. 22, have been rejected. Engr., J. D. Wallace, Champaign, Ill.; Chn. Com., C. W. Gibson.

MANAWA, WIS.—We are informed that the Little Wolf River Co. is figuring on putting in a plant to be operated by steam for its own use. The company will probably buy a small dynamo and an engine. The plant will have a capacity for 100 16-c. p. lights.

MARSHFIELD, WIS.—John H. Thomas, Cy. Clk., writes us that the council rejected the bids for furnishing 28 arc lights opened Oct. 1 on account of their being too high. The city may build its own plant.

SOUTH MILWAUKEE, WIS.—The council has resolved to purchase the plant of the South Milwaukee Electric Light & Power Co. for $19,000, paying for it in monthly installments covering a period of ten years, the amount paid each month being the same that the city would pay as rent for the lights. The mayor is stated in a later reported to have vetoed the resolution.——The company has asked for a renewal of its contract. Mayor, George Bush.

RED LAKE FALLS, MINN.—We are informed that the contract for a water power plant for this place has been let to Marcus Johnson. It will have a capacity for 10 1,200-c. p. arc lights

WINNEBAGO CITY, MINN.—Bids are asked until Oct. 31 for the purchase of $8,000 of 5% bonds for the proposed plant. Pres. Village Council, Andrew C. Dunn.

WINONA, MINN.—L. D. Frost, Recdr., writes us that nothing has yet been done in regard to the building of a municipal plant. It is stated that a committee has been appointed to investigate the question and to make a report about Jan. 1.

COGGON, IA.—It is stated that the question of building a plant is being considered.

HILLSBORO, N. DAK.—Fred. L. Goodman, Mayor, writes us that the question of building a plant has been agitated, but no definite action has as yet been taken; estimated cost, $3,000.

HORTON, KAN.—The council is reported to have awarded the contract for the proposed plant to the Warrick Electric Co., Cleveland, O.

PONCA, NEB.—The question of building a plant is being considered, according to reports.

PINE BLUFF, ARK.—Walter S. Jeter is reported as interested in the proposed electric light plant and street railway; estimated cost, $150,000.

WYNNE, ARK.—Bids are asked until Nov. 8 for furnishing the machinery and for building a plant and waterworks, to cost about $15,000. (Postponement from Oct. 15.) Engr., Owen Ford, Security Bldg., St. Louis, Mo.; Chn. Com., W. M. Kennedy.

TUSCARORA, NEV.—Press reports state that the Tuscarora mines are to be developed on a large scale. S. N. Milner, Mgr. of the Dexter mine, and associates, will harness the Snake River in Idaho and utilize its power. A stand-pipe will be built and the necessary dynamos will be installed. The distance from Snake River to Tuscarora in a direct line is about 115 miles, and $100,000 will be used for building the line and plant, which will deliver about 5,000 HP. at Tuscarora.

ANACORTES, WASH.—It is stated that the council has repealed the ordinance granting a franchise for a light and power plant to the Skagit Mill Co.

TACOMA, WASH.—C. B. Talbot, Civil Engr., writes us that he has projected a water power plant, to cost about $260,000. The council is considering the question of building it, it having been petitioned to do so by 800 citizens. It is proposed to secure about 12,000 HP. from the Puyallup River by way of a canal and flume, 8 × 12 ft. One-third is to be equipped for present use. The contractor is to receive annual payments of $60,000 until paid.

REDWOOD CITY, CAL.—Daniel R. Stafford, Town Clk., writes us that bids will soon be asked for an incandescent plant in connection with the water-works; estimated cost, about $3,000.

LONG BEACH, CAL.—O. F. A. Johnson, Pres. Bd. Trustees, writes us that nothing has been done yet in regard to the proposed plant. The opposition is so strong that it is probable the question will be dropped for this year.

LOS ANGELES, CAL.—The National Board of Managers has appropriated $4,500 for a plant at the Soldiers' Home in this city. Maj. W. H. Bonsall, of the board of managers, Los Angeles, may be addressed.

POMONA, CAL.—The trustees have terminated the contract with the San Antonio Light & Power Co. It is stated that the question of a municipal plant will be decided soon.

SANTA BARBARA, CAL.—Edmund M. Burke, Mayor, writes us that it will be over three months before bids will be asked for building the proposed plant. On Sept. 15 the council appointed a committee to investigate municipal ownership, but it has not yet commenced its labors. The plant will have 60 or more 2,000-c. p. arc and 1,000 16-c. p. incandescent lights, and will probably be operated by steam power. It is said that the local lighting company has been furnishing poor lights at high prices. Population, 10,000. Information is specially solicited by Mayor Burke and Chas. Weile, Chn. Com.; Cy. Engr., Frank F. Flournoy.

STOCKTON, CAL.—The Standard Electric Co. of California, the company organized by Prince A. Poniatowski and his associates for the purpose of conducting electricity from the electrical works of the Blue Lakes Water Co., in Calaveras county, to San Francisco, and for supplying intermediate towns, will apply for a franchise covering the city of Stockton, allowing the company to distribute its power throughout this city.

SALT LAKE CITY, UTAH.—The council is considering the question of making the Utah Power Co. forfeit its franchise, granted Dec. 26, 1896. It is stated that the company has done no work on its proposed plant. Pres., Francis Armstrong.

HULL, QUE.—Bids are asked until Nov. 1 for supplying and maintaining 50 1,600-c. p. arc lights. R. W. Farley, Cy. Engr., writes us that the question of building a municipal plant is at the same time under consideration.

MITCHELL, ONT.—The council is reported as considering the question of extending the city plant, at a cost of about $5,000.

PORT ARTHUR, ONT.—It is stated that this town has made an arrangement with Edward S. Jennison, Arch., 134 Van Buren St., Chicago, Ill., for the supply of 560 HP. and of 500,000,000 gallons of water a year from his power canal at Kakabeka Falls. The contract is to be submitted to the people for their approval at once. Mr. Jennison agrees to have the works completed within three years. Mr. Jennison will attempt to have manufacturing plants established here to utilize the power. Estimated cost, about $1,000,000.

NELSON, B. C.—Judge Walkem, Victoria, B. C., has submitted a decision against the council purchasing the plant of the Victoria Electric Co. for $48,000. Mayor Houston may be addressed.

CHINA.—A. L. Kuehmsted, Treas. and Gen. Mgr. the Charles E. Gregory Co., 47 South Jefferson St., Chicago, Ill., has received an order for an electric light plant for a town in North China. This plant, it is said, will be the first of the kind to be installed in that part of China. It consists of a 1,000-light dynamo, together with a complete equipment. It is considered by parties in the trade that this will be the beginning for quite a business in medium-sized plants from that part of the world.

NEW COMPANIES.—International Incandescent Light Co., Philadelphia, Pa.; $1,000,000, with $100 paid in; W. H. Hollis, W. D. Black, W. W. Lucas, G. H. Taylor.

New York Gas & Electric Light, Heat & Power Co., New York; $25,000,000; Henry J. Honmens, Frank D. Allen, F. Allen, J. F. Yawger, Louis M. King, C. N. Flint, M. W. Smith, New York. Flower & Co., New York, and Samuel A. Beardsley, Utica, N. Y., are said to be behind the company.

Pratt-Ensley Light & Power Co., Pratt City, Ala.; J. M. Landsden, Jr., Roger M. Newbold, J. M. Meigham.

The Myerstown Electric Light & Heating Co., Myerstown, Pa.; $20,000; to furnish light, heat and power; Dr. W. G. Bower, Hattie E. Bower, A. S. Rummel, Robert H. Sechler.

Erie County Electric Co., Erie, Pa.; $10,000, with $1,000 paid in; Treas., Wm. C. Readro, New York; Wm. E. Brown, New York; Wm. S. Carroll, Erie.

Kanawha Electric Co., Montgomery, W. Va., $25,000, with $50 paid in; J. W. Strangham, Dego, W. Va.; W. L. Montgomery, Jacob Segal, Montgomery.

Metropolitan Electric Co., Ottawa, Ont.; Jas. Robinson, Montreal, Que.; A. B. Broderick, T. Lindsay, Ottawa.

Pike's Peak Power Co., Colorado Springs, Colo. and Council Bluffs, Ia.; $100,000; Henry M. Blackmen, T. A. Chapman, D. W. Ross.

Black Canyon Hydraulic & Electric Power Co., Prescott, Ariz.; $5,000,000; Louis C. F. Lotz, H. S. Hildreth, Chas. V. Van Duzer.

Sherman Electric Light Co., Sherman, N. Y.; $5,000; Pres., J. L. Thayer; Secy., T. J. Newell; Treas., C. H. Corbett.

Winn Water & Power Co., Winn, Me.; Pres., Nathaniel M. Jones, Lincoln, Me.; Clk., M. F. Scott, Winn.

Hinsdale Electric Light & Power Co., Lake City, Colo.; $100,000; R. E. Peniston, D. K. Anders, Thos. L. Ashworth.

Union Incandescent Light Co., New York; $8,000; to manufacture incandescent gas lamps, mantles and globes; Leon Pistner, 230 East 50th St., New York.

BRIDGES.

ASHFIELD, MASS.—The following bids were received, Oct. 6, for constructing a bridge. A. B. Fletcher, Secy. Mass. Highway Comn., Boston:

Boston Bridge Works, Boston, Mass	$1,425
King Bridge Co., Cleveland, O	1,430
N. E. Structural Co., Everett, Mass	1,432
Walsh Boiler & Iron Works, Springfield (accepted)	895
Berlin Iron Bridge Co., E. Berlin, Conn	1,460
New Jersey Steel & Iron Co., Trenton, N. J.	1,375
Wrought Iron Bridge Co., Canton, O	1,476
Massillon Bridge Co., Massillon, O	1,503
Pittsburg Bridge Co., Pittsburg, Pa	1,349

BOSTON, MASS.—A contract has been awarded to D. F. O'Connell, at $23,800 for constructing two masonry abutments and a central pier for the bridge over the railway track on the Columbia Road. B. W. Wells, Supt. Sts.

CAMBRIDGE, MASS.—The board of aldermen has authorized an issue of $50,000 of 3½% bridge bonds, according to reports.

MALTA, N. Y.—The city clerk informs us that it has been decided not to construct the proposed bridge at Baker's flats to have a span of 84 × 18 ft., at present.

NORWICH, N. Y.—Bids will soon be asked by the highway commissioner for designs and the construction of a new iron bridge over the Canasawacta Creek at West Main St.

CAMDEN, N. J.—Bids are asked until November 9 for the improvement of the turning of the draw of the Federal Street bridge, over Cooper's Creek, as stated in our advertising columns. Dr. J. B. Davis, Chn. Com., Bd Freeholders.

KNOXVILLE, PA.—Reports state that the Knoxville Land and Improvement Co. propose to construct a steel viaduct, 500 ft. long.

NEWTOWN, PA.—A. Chambers, Newtown, writes us that a contract has been awarded to Thos. H. Connell, Fidelity Bldg., Broad and Arch streets, Philadelphia, for constructing a plate girder bridge of one span, 65 ft. wide, on stone foundation.

WASHINGTON, D. C.—Surveys are being made for the construction of the Massachusetts Ave. and the Connecticut Ave. bridges over Rock Creek.

NEWPORT NEWS, VA.—The King Bridge Co., Cleveland, O., has been awarded a contract by the council at $43,989, for constructing viaducts at 25th and 34th Sts. and Chesapeake & Ohio R. R.

RICHMOND, VA.—An ordinance has been passed by the council to construct a bridge over the alley at the Old Dominion hospital. Benj. T. August, Clk.

WILKESBORO, N. C.—Bids are asked by the county commissioners until Nov. 7 for constructing a bridge at Curtis Ford, Yadkin River; also for a number of smaller bridges.

SPARTANBURG, S. C.—Reports state that the Southern Ry. Co. proposes to construct a new iron bridge at North Church St. C. H. Hudson, Ch. Engr., Washington, D. C.

INVERNESS, FLA.—Bids are asked by the county commissioners for a bridge at Tsala Apopka Lake, according to reports.

SELMA, ALA.—P. Y. Wood, Probate Judge, informs us that a contract has been awarded to the Indiana Bridge Co., Muncie, Ind., for an iron bridge over the Cahaba River, between Beloit and Cahaba.

CINCINNATI, O.—The board of city affairs has decided to construct a viaduct over the railroad tracks at Brighton station, from State Ave. to Barnard St.; estimated cost, $250,000, according to reports.

CHICAGO, ILL.—Bids are asked until Dec. 7 for furnishing the material and for changing the substructure and superstructure of the approach span at Van Buren St. across the by-pass along the Chicago River. James Reddick, Clk. Bd. Sanitary Trustees, 1110 Security Bldg.——The sanitary trustees have decided to ask new bids for the construction of the eight-track railroad bridge at Campbell Ave. over the drainage channel, on account of an injunction between the city and C. L. Strobel, who had formerly been awarded the contract. Bids will be received only on the Scherzer design.

KANKAKEE, ILL.—H. A. Magunder, Mayor, writes us that it is proposed to construct a stone or concrete bridge of six 100-ft. spans, 40 ft. wide, on stone foundation. The matter has just been taken up by the council, and probably the bridge will not be built before next season. W. K. Woodruff, Des. Engr., Kankakee.

PEKIN, ILL.—A contract was awarded, Oct. 8, for an iron bridge across the Mackinaw River, to the Wrought Iron Bridge Co., Canton O., according to report.

PONTIAC, ILL.—G. W. Lacey, Cy. Clk., informs us that the following bids were received Oct. 5 for a steel bridge, 150-ft. span, 18-ft. roadway and 6-ft. sidewalk on stone piers; advertised in Engineering News, Sept. 29:

Joliet Bridge & Iron Co., Joliet, Ill. (accepted)	$4,379
Indianapolis Bridge & Iron Co., Indianapolis, Ind	4,800
B. F. Parks & Co., Cedar Rapids, Ia	4,587
Bellefontaine Bridge & Iron Co., Bellefontaine, O.	4,587
Massillon Bridge Co., Massillon, O	4,477
King Bridge Co., Cleveland, O	4,492
Toledo Bridge Co., Toledo, O	4,740
Lafayette Bridge Co., Lafayette Ind.	4,575
R. D. Wheaton Bridge Co., Chicago, Ill	4,590
L. S. Leversedge & Co., Chicago, Ill.	4,800
I. J. Walker, Chicago, Ill.	4,900

EAU CLAIRE, WIS.—Bids are asked until Oct. 26 for constructing a bridge across the Chippewa River, between Kelsey and Bridge Sts. A description of the bids received Sept. 28, which have been rejected, was given in our issue of Oct. 13. T. P. Cochrane, Cy. Clk.

FORT DODGE, IA.—The Mason City & Fort Dodge R. R. Co. has awarded a contract to Geo. Keppner, at $3,000, for constructing two bridges.

MINNEAPOLIS, MINN.—The question of issuing $80,000 in bonds for the construction of a bridge over the Mississippi River, connecting 32d Ave. and 25th Ave., will be submitted to a vote at the election, Nov. 1.

ST. PAUL, MINN.—The board of aldermen has awarded a contract to Wm. A. Lee, at $8,000, for reconstructing the Forest St. bridge.

TOPEKA, KAN.—The county commissioners are considering a proposition to construct a steel bridge 800 ft. long over the Kansas River, near Valencia, to cost about $14,000. Address Commissioner Williams.

WELLINGTON, KAN.—The county commissioners are considering the question of constructing a new bridge over the Minnescha River, near Belle Plaine, according to reports.

WICHITA, KAN.—Estimates have been submitted to the council by H. H. Hendershot, Asst. Cy. Engr., for a proposed viaduct on Douglas Ave., from Fourth to Washington Ave. Length, 1,500 ft.; width, 34 ft.; 25,000 cu. yds.

of dirt; 8,000 cu. yds. of masonry; if steel is used it will take 550 tons; estimated cost, $95,000; stóne, estimated cost, $60,000.

KANSAS CITY, MO.—Bids are asked until 10.30 a. m., Oct. 20, for grading the approaches to the bridge over Blue River. Thos. F. Callahan, County Surveyor.

ST. CHARLES, MO.—The St. Charles Co. is considering the question of constructing a bridge over the Missouri River. Theo. Bruere, Pres., informs us that no specifications have yet been prepared.

UNIONVILLE, MO.—Bids are asked until Oct. 26 for constructing a number of steel and combination bridges, according to reports. Chas. C. Bailey, Bridge Comr.

POCAHONTAS, ARK.—J. M. Rose, Pres., Pocahontas Bridge Co., informs us that plans have been prepared by M. S. Hasie, Fort Worth, Tex., for a steel railway and highway bridge, 210 and 97-ft. spans, 18 ft. wide, on steel cylinder piers; estimated cost, $35,000.

HOUSTON, TEX.—Bids are asked until Nov. 14 for constructing a 100-ft. steel bridge over Buffalo Bayou, as stated in our advertising columns. Cy. Engr., I. Austin Miller; Mayor, S. H. Brashear.

LOS ANGELES, CAL.—Press reports state that the Southern Pacific R. R. Co. will shortly have in process of construction in different parts of California, 12 steel railway bridges, to cost about $300,000. The company purposes by degrees to substitute steel bridges for crossings of other styles throughout its entire system.

CHATHAM, ONT.—Owen McKay, Ch. Engr., Lake Erie & Detroit River Ry., Walkerville, Ont., writes us that B. Douglas, Bridge Engr., Michigan Central Ry., Detroit, Mich., is now preparing plans for a new steel bridge over the River Thames, for the Erie & Huron Ry. The structure will be 270 ft. long, and consist of two girder spans, 75 inches in length, and a draw span of 120 ft. The plans will be submitted to Owen McKay, Ch. Engr.

TORONTO, ONT.—Chas. H. Rust, Cy. Engr., writes us that no definite action has yet been taken by the council in regard to the proposed bridge across the River Don, on Queen St.; span, 125 × 66 ft.; bow string design, capacity 150 lbs. per sq. ft., on stone and concrete foundation.

BUILDINGS.

FAIR HAVEN, VT.—A fire in this city destroyed Knight's Block, a 3-story building used as an opera house, with stores beneath, causing an estimated loss of $40,000; insurance, $30,000.

ST. ALBANS, VT.—We are informed that Huey Bros., 4 Oliver St., Boston, Mass., received the contract for heating the U. S. Building in this city, at $4,000; time, 65 days. John F. Dalton, of Savannah, Ga., was the lowest bidder at $3,738; time, 90 days.

NEW HAVEN, CONN.—The following bids were received by Lt.-Col. D. P. Heap, U. S. Engrs., Tompkinsville (S. I.) N. Y., October 15, for erecting the New Haven Harbor breakwater light station, as advertised in "Engineering News":

Toomey Bros. & Co., Guilford, Conn.	$24,000
Clinton Stephane & Son, 44 Broadway, New York	29,225
Houston Const'n Co., Girard Bldg., Philadelphia	31,822
Ambrose F. Dudley, 100 Broadway, New York	32,450
B. & B. S. Belden, Hartford, Conn.	33,600

BATAVIA, N. Y.—W. D. Smith was the lowest bidder for installing a steam heating apparatus in Ellicott Hall, for the town trustees, at $1,134. Arch., Geo. F. Metzger, Buffalo, N. Y.

BATH, N. Y.—Bids are asked until October 22 for plumbing, steam heating, electric lighting and refrigerating plants at the New York State Soldiers' Home, at Bath. Secy., O. H. Smith.

BINGHAMTON, N. Y.—Bids are asked until Oct. 24 for erecting additions, alterations and repairs, plumbing and electric wiring and fixtures of the North building of the Binghamton State Hospital. Pres., John B. Stanbrough, Binghamton; Arch., I. G. Perry, Albany, N. Y.

BROOKLYN, N. Y.—It is reported that Ernest Raymond, 38th St. and Fort Hamilton Ave., will erect thirty-two 2-story frame dwellings, at 40th St. and 12th Ave; total cost, $103,600.

BUFFALO, N. Y.—The board of park commissioners has directed that bids be asked for a steam heating plant to be installed at the Park Zoological Gardens.——The board of public works has accepted plans for the new 3-story building for School No. 19, to cost $70,000. Arch., Robt. A. Wallace.——The Pan-American Exposition Co. now proposes to hold the fair in 1901, according to reports. Secy., Richmond C. Hill; Arch., Esenwein & Johnson, 707 Mooney Bldg.

CENTRAL ISLIP (L. I.), N. Y.—Bids are asked until Oct. 27 for erecting and finishing a building for the present heating and lighting plant at Central Islip. Henry E. Howland, Pres. Bd. of Mgrs., 1 Madison Ave., New York.

JAMESTOWN, N. Y.—Reports state that a brick building has been presented to the Y. M. C. A., which will remodel it at a cost of about $20,000.

NEW YORK, N. Y.—Bids are asked by the board of education, at 585 Broadway, until October 24, for supplying furniture for Public School 2 and additions; for furniture for Public School 137; also for improving sanitary condition of lots in the rear of Public School 34, Borough of Manhattan.—Reports state that De Lemos & Cordes, 130 Fulton St., are preparing plans for two additional stories, 186x300 ft., on the rear of the present building, at 6th Ave. and 18th and 19th Sts., to cost about $200,000.——Plans have been filed by P. J. Quirk, 2,088 7th Ave., for two 6-story brick and stone flat buildings, on 124th St., near Lexington Ave., to cost $115,000. Arch., Henry Anderson, 1,180 Broadway; by William Call, 1,133 Broadway, for a 6-story brick flat building on Central Park West, near 94th St., to cost $100,000; by Abraham Perelman, 161 Orchard St., for four 6-story brick flat and store buildings, at 133 and 135 Goerck St., to cost $100,000. Archs., Horenburger & Straub, 122 Bowery; by Louis F. Dommerich, 314 West 75th St., for an 8-story brick warehouse, at 64 to 68 Wooster St., to cost $90,000. Arch., E. H. Kendall, 150 5th Ave.; by Paul B. Pugh, 674 Columbus Ave., for a 10-story brick flat building, on 15th St., east of Union Square, to cost $150,000. Arch., G. A. Schellenger, 128 Broadway; by Terence Farley's Sons, 253 Columbus Ave., for seven 6-story brick and stone dwelling houses, at 90th St. and West End Ave., to cost $119,000. Arch., Clarence True, 459 Boulevard.

SONYEA, N. Y.—It is reported that the state board of charity, October 13, approved plans for fifteen dormitory buildings and other structures for the Craig Colony for Epileptics, at Sonyea, to cost about $115,000; and also plans for improvements to the Orange and Niagara county almshouses and the Thomas Asylum for Indian Children.

UTICA, N. Y.—J. Phil Bannigan, Clk. of School Bd., informs us that all contracts have been awarded for erecting the new academy building which, when completed, is estimated to cost $155,000. John Ulrich, of Utica, has the carpentry contract; McDermott & Scott, of Utica, have the masonry contract; Peck-Williamson Heating & Ventilating Co., Cincinnati, O., has the heating contract. Arch., Jacob Agne, Jr., 32 Arcade Bldg., Utica.

TROY, N. Y.—M. Kennedy has been awarded the contract for plumbing for the new high school building, at $5,124.

WARD'S ISLAND, N. Y.—Bids are asked until Oct. 27 for erecting steam heating, plumbing and drainage apparatuses and electric wiring and fixtures for a cold storage building at Ward's Island, New York, N. Y., for the Manhattan State Hospital. Henry E. Howland, Pres. Bd. of Mgrs., 1 Madison Ave., New York.

PLAINFIELD, N. J.—The 3-story brick building on North Ave., occupied by the Bard Cycle Co. and others, was destroyed by fire, October 16, causing an estimated loss of $60,000.

SOMERVILLE, N. J.—We are informed that bids are being received for the erection of a 2-story fireproof building, 43 × 160 ft., to be used as a children's home; estimated cost, $25,000. Arch., Wm. E. Bloodgood, 64 Cedar St., New York.

BALTIMORE, MD.—Bids are asked by the directors of the Maryland Penitentiary until Nov. 2 for the electric lighting and power and heating plants, refectory, etc., for the executive and warden's buildings. Warden, John F. Weyler; Arch., Jackson E. Gott, 1 East Lafayette Place, Baltimore.

GASTONIA, N. C.—Plans have been completed for a new city hall building, which will contain steel cages in the basement for jail purposes. Arch., C. C. Hook, Charlotte, N. C.

SAVANNAH, GA.—The following bids were received by the supervising architect, Washington, D. C., Oct. 13, for furnishing an electric passenger elevator for the U. S. public building at Savannah:

		Time.
Morse, Williams & Co., Philadelphia	$3,817	2 mos.
Sprague Electric Co., New York	3,735	90 days.
Crane Elevator Co., Chicago, Ill.	3,900	60 days.
Standard Elevator & Mfg. Co., Chicago	3,600	90 days.
Otis Bros. & Co., New York	$4,100 and 3,400	6 w'ks.
Eaton & Prince Co., Chicago	3,900	3 mos.

WINCHESTER, TENN.—The Pauly Jail Co., St. Louis, Mo., is stated to have been awarded the contract for erecting a new jail building at this place, including electric light plant, etc., at $9,700.

LOUISVILLE, KY.—The county commissioners have granted a contract to M. Bush & Co. for the erection of an addition to the jail, at $2,750.

CINCINNATI, O.—Bids are asked by the directors of the University of Cincinnati until Nov. 10 for the excavation and masonry, brick work, cut stone work, plastering, cement work, roofing, painting and glazing, iron work, carpenter work, plumbing and gas fitting, marble work, tile work and electric light wiring required for the south wing, known as Cunningham Hall, of the new University building; reported cost, $60,000. Chn., J. G. Schmidlapp; Archs., S. Hannaford & Sons.

MARIETTA, O.—The proposition of constructing a new court house for Washington county, to cost about $125,000, is to be submitted to the voters at the elections on Nov. 8.

MARION O.—Bids are asked until Nov. 5 for a small brick school building for Marion township. J. M. Monnett Pres. Bd. of Education; Sloan & Ault, Archs., Marion.

DETROIT, MICH.—Plans have been prepared, according to reports, for a 4-story brick and stone flat building to be erected for C. H. Colwell, on Canfield Ave., near Woodward Ave. Arch., Norval Wardrop, 61 West Fort St.

CHICAGO, ILL.—Reports state that a 3-story brick and stone store and flat building, 100 × 150 ft., will be erected for John Shelley at Woodlawn Ave. and 63d St., to cost $50,000. Arch., Harold Flower, Monroe Ave. and 63d St.——Julien Blaine has been granted a permit to erect a 4-story apartment building at 157 and 159 East 47th St., to cost $38,000. Arch., A. Foster, 4310 Cottage Grove Ave.——The Ladies' Auxiliary of the Lying-in Hospital contemplates the erection of a new hospital building, to cost $60,000.——A new 4-story brick and stone hospital building will be built on Frankfort St., near Robey St., for the St. Anthony's Hospital and Orphanage, at Hoyne Ave. and Homer St. Dr. Paul Pollach is interested.

CHICAGO, ILL.—Bids are asked until Nov. 3 for constructing an extension to the temporary postoffice building, as stated in our advertising columns. Supervising Arch., Jas. Knox Taylor, Washington, D. C.

LAHARPE, ILL.—Bids are asked until Oct. 26, extension of time, for erecting a new 2-story school building 77 × 75 ft., to cost about $14,000. Archs., Payne & Son, Carthage, Ill.

MINNEAPOLIS, MINN.—The board of education has requested that a proposition to issue $200,000 in bonds for the erection of new school buildings be submitted to the people at the November elections.——J. & W. A. Elliott have been awarded the contract for the masonry work on the east wing of the new city hospital building, at $14,500; and the Wisconsin Bridge & Iron Co., for erecting the structural iron, at $5,000.

WHEATON, MINN.—Plans and specifications are being asked by Independent School District No. 32 for a new school building, to cost from $12,000 to $14,000. Clk., T. K. Mork.

SPEARFISH, S. DAK.—Bids are asked by the U. S. fish commission, Washington, D. C., until Nov. 10, for the construction of a fish hatchery workshop and icehouse at Spearfish. Comr., George M. Bowers.

BUTTE, MONT.—Dolan & Hamill are reported to have received the general contract for the new Lincoln school building, at $36,803.

DONIPHAN, MO.—Bids are asked by Ripley county, until Nov. 10, for the purchase of $20,000 of 4% courthouse and jail bonds. W. C. S. Lackey, County Treas.

ST. LOUIS, MO.—The Hill-O'Meara Construction Co. has been awarded the contract for erecting a new 10-story steel and brick building at 6th and Olive Sts., to cost about $250,000. Work is to be completed by May 1. The proposition to build a new $1,000,000 public library building in St. Louis will be submitted to the voters next April.

FORT SILL, OKLA.—Bids are asked by the department of the interior, Washington, D. C., until Nov. 9, for the construction of a brick school building at the Fort Sill Boarding School, Kiowa Agency. W. T. Walker, Indian Agt., Kiowa Agency, Anadarko, Okla.

VICTOR, COLO.—Wm. J. Prift & Co. have been awarded the contract for the completion of the Union Grand Opera House.

TACOMA, WASH.—A fire in this city, Oct. 11, damaged the unfinished Olympia Hotel, built by the Tacoma Land Co. in 1892, at a cost of about $400,000; estimated loss, $200,000. Archs., G. W. & W. G. Hewitt, Bullit Bldg., Philadelphia, Pa.

MARE ISLAND, CAL.—Bids are asked until Nov. 12 for the erection of twelve officers' quarters at the U. S. Navy Yard, Mare Island; appropriation, $106,250; also until Nov. 26 for the construction of shelter roof for boats, appropriation, $14,300. Address Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Washington, D. C.——The following bids were received Oct. 12 for erecting a hospital building at the Mare Island Navy Yard, San Francisco:

Dennis Jordan, San Francisco	$82,000
J. H. McKay, San Francisco	75,820
F. A. Williams, San Francisco	84,684
R. H. Bassett, Fruitvale, Cal.	90,895
W. L. Prather, Jr., Oakland, Cal.	75,987
James B. McKenzie, San Francisco	81,400
Andrew Dahlberg, San Francisco	72,441
C. A. Fletcher, San Francisco	83,935
John J. Flanagan, San Francisco	71,000
J. Phillips, San Francisco	76,500
Hannah Bros., San Francisco	94,867
C. C. Blair, Vallejo, Cal.	79,650
Hawkins & Lindsay, San Francisco	78,391
Henry Jacks, San Francisco	84,150
Phil Sheridan, Berkeley, Cal.	91,775
W. W. Anderson & Robert Greig, San Francisco	97,000
Linnott & McCann, San Francisco	79,890
C. M. Depew & E. L. Brookes, San Francisco	78,815
Andrew Wilkie, San Francisco	83,607
Matthew McGowan, San Francisco	74,000

SAN FRANCISCO, CAL.—Contracts have been let, according to reports, for a 2-story building to be erected on Sutter St., between Scott and Devisadero Sts., for the Mount Zion Hospital. Arch., M. J. Lyon, 120 Sutter St.

BOISE, IDAHO.—Bids are asked by the supervising architect, Washington, D. C., until Oct. 27, for the excavation, foundations and exterior stone walls of basement for the U. S. public building in Boise.

KINGSTON, ONT.—Bids are asked by the department of public works, Ottawa, Ont., until Oct. 28, for the erection of a drill hall at Kingston. Secy., E. F. E. Roy; Arch., Arthur Ellis, Kingston.

TORONTO, ONT.—It is reported that plans have been prepared for a 7-story brick and stone hotel building, 207 × 197 ft., to be erected by Aemilius Jarvis and others on King St., at a cost of about $1,750,000. Archs., Harding & Gooch, 252 Broadway, New York.

SALTILLO, MEX.—A new bank and post office building will be erected for the Coahuila Bank of Saltillo, according to reports, to cost about $75,000. Archs., O. H. P. Rudesill & Son, Monterey, Mex.

WATER-WORKS.

BRIDGETON, ME.—It is stated that the council is again planning for a new water supply.

CAMBRIDGE, MASS.—Mayor Sortwell has vetoed the ordinance appropriating $8,000 for the construction of the Hobbs Brook reservoir.

AMSTERDAM, N. Y.—Bids are asked until 7:30 p. m., Oct. 22, for hauling, etc., about 5,900 ft. of 36 to 10-in. cast-iron and vitrified pipe. Pres. Comrs., John Kellogg.

BUFFALO, N. Y.—The commissioners of public works have rejected the bids opened Sept. 29 for laying a 20-in. pipe across Buffalo River to afford protection from fire to those on the island. The bid of Hingston & Woods, which was lowest, was $1,675 in excess of the appropriation of $10,000 made by the council. It is believed that the property owners will make a protest in order to secure the work being done this winter if possible.

CHARLOTTE, N. Y.—We are informed that the citizens of this place have asked that another election be held for them to reconsider their vote of last spring on the question of issuing $25,000 in bonds for works, and $10,000 for an electric plant. Bids were asked, until October 15, for furnishing the machinery and for building the plants, as advertised in Engineering News. The plans were prepared by the Stanwix Engineering Co., Rome, N. Y.

GREENPORT (L. I), N. Y.—The village trustees are considering the question of the municipal ownership of the works of the Greenport City Water Co.

JAMAICA (L. I.), N. Y.—The Jamaica Water Supply Co. has issued $400,000 of 5% bonds, $250,000 of which is to be used in retiring outstanding bonds and the remainder is to be used in the building of the proposed extension of the mains to Queens and Hollis, and the installing of new hydrants in that territory. The capital stock of the company is $300,000, divided into 3,000 shares of $100 each. The majority of the stock is held by Boody, McLellan & Co., David A Boody, ex-Mayor of Brooklyn, and the estate of John and John C. Lockwood.

SIDNEY, N. Y.—It is stated that the Sidney Camp Grove Association has decided to build works and a light plant for its grounds.

WEST TROY, N. Y.—The Watervliet water board, it is reported, is considering the question of asking the taxpayers to grant it authority to purchase the works of the West Troy Water Co.

EAST NEWARK, N. J.—Edward Kenney, Mayor, has applied to the street and water board to extend the water mains to this borough, the borough to pay the cost of the mains, etc.

FRENCHTOWN, N. J.—The question of securing a water supply is being considered.

GLOUCESTER, N. J.—The following bids were received Sept. 15, but not opened until Oct. 11, for furnishing a 2,500,000-gallon pumping engine: Robert Wetherill, $10,825; Loretz & Sons, $10,450; Givin, Longacre & Lamborne, $13,217 and $12,587; Barr Pumping Engine Co., $10,000.

JERSEY CITY, N. J.—The National Meter Co., New York, has been awarded the contract for furnishing three meters for the Belleville works, at $8,474.

ORANGE, N. J.—We are informed that nothing definite has yet been done in regard to an increased water supply. Several plans have been suggested, as noted in our issue of last week. Pres. Council, Geo. Letrhidge; Chn. Com., Alderman Cuddy.

SPRING LAKE, N. J.—Bids are asked, until Nov. 1, for furnishing and laying about 20,000 ft. of water-pipe, as stated in our advertising columns. Engrs., Lehlbach Bros., Newark, N. J.; Mayor, E. V. Patterson.

CARBONDALE, PA.—The Crystal Lake Water Co., it is stated, has decided to build a new dam next summer. The dam will be 54 ft. high and 42 ft. thick at the bottom.

ERIE, PA.—The select council has voted against an ordinance introduced by Councilman Emling creating a board of water and light commissioners.

LANCASTER, PA.—Local papers state that Allen Hazen, St. Paul Bldg., New York, and Dr. M. L. Davis will complete a report, plans, etc., for a 10,000,000-gallon filtration plant. Supt., E. H. Frailey.

MEADVILLE, PA.—On account of errors in the legislation for the purchase of the works of the Meadville Water Co. another election will be held Nov. 8 to vote on the question of appropriating $153,000 for the purchase.

MILLERSBURG, PA.—The Swartara Water Co. has been incorporated, with a capital stock of $500, of which $50 is paid in; Treas., E. H. Leffler, Millersburg; incorporators, N. C. Freck, R. E. Woodside and H. L. Lark, Millersburg.

PHILADELPHIA, PA.—An application is pending for a charter for a corporation to be known as the Philadelphia Water Co., the object of which, is is stated, is to supply the city with pure water. The incorporators named in the application for a charter are: J. W. Marshall, William J. Moore, John D. Hughes, Thomas A. Berry and John S. Thackeray, of Chestnut St., and their solicitor is H. W. Clark.

MILTON, DEL.—Alderman S. B. Chandler writes us that this town has no works, except a pump. There is a good water supply at the head of navigation at the mill pond. It is probable that in the near future works, an electric light plant, etc., will be built. Population, 1,400.

WILMINGTON, DEL.—The water commissioners have been asked to extend the water mains to Edgemoor.

BALTIMORE, MD.—Bids are asked until Oct. 26 for furnishing about 150 tons of Omaha pig lead. Ch. Engr., Water Bd., Wm. L. Kenly.——The Tuxedo Park Protective Association has granted a 25-year franchise to the Tuxedo & Embla Parks Water & Light Co.

HARPER'S FERRY, W. VA.—Mrs. H. R. Miles, Pres. Village Improvement Society, 1610 Q St., N. W., Washington, D. C., writes us that an engineer (probably W. A. McFarland, Washington) had been engaged by the society to submit estimates for works, to cost about $35,000. The water supply could be secured from the Potomac River on the north or the Shenandoah River on the south side of the town. The matter of issuing bonds will be agitated. It will probably be some time before the question is submitted to a vote of the people.

HINTON, W. VA.—The Hinton Water-Works Co. wants estimates for a 1,000,000-gallon filter, according to reports.

LOGAN, W. VA.—Chas. Bennett and Mr. Campbell are interested in the proposed works for this place.

CAMDEN, S. C.—The council is reported as again having taken up the question of building works, and that contracts will be let this winter.

CHARLESTON, S. C.—The ways and means committee has submitted another plan for obtaining an increased water supply for municipal works.

ORANGEBURG, S. C.—F. Demas, Clk., writes us that the city will issue $40,000 of 5% bonds for the proposed works and electric plant. No definite plans have been decided upon. The water supply will be secured from artesian wells. Population, 5,000. Up to Oct. 12 no engineer had been engaged. T. M. Rayser and T. C. Doyle are on the committee.

ATLANTA, GA.—This city voted Oct. 5 against issuing $200,000 in bonds for extending the water mains. Mayor, Chas. A. Collier.

FITZGERALD, GA.—The contract for building works and a light plant has been let to Moore & McRae, Atlanta, Ga.

GREENSBORO, GA.—Capt. A. W. Walton and L. J. Wagner, Rome, Ga., are reported to have been awarded the contract for building the works, noted in our issue of Sept. 22. Mayor, J. B. Williams.

CRYSTAL SPRINGS, MISS.—Bids are reported as wanted for the purchase of $16,000 of bonds for constructing the proposed works and electric plant. Engr., W. G. Kirkpatrick, Jackson, Miss. Chn. Com., W. C. Wilkinson.

TULLAHOMA, TENN.—The question of building works is again being considered. Mayor, H. Henley.

RUSSELLVILLE, KY.—B. B. Andrews, Mayor, writes us that the city has contemplated building water-works, but on account of a bonded indebtedness, no action will be taken at present. Mayor Andrews is very desirous of having works in this place. Population, 3,500.

STURGIS, KY.—The council is reported as planning to build the proposed works.

ALLIANCE, O.—At the election Nov. 8 this city will vote on the question of purchasing the works of the Alliance Water-Works Co. Councilman Conger, Chn. Com.

COLUMBUS, O.—The board of public works has rejected the bids received, October 3, for constructing the new water-works dam, on account of their being too high. Local papers state that city will do the work itself. The itemized bids are given in another column.

MARIETTA, O.—Bids are asked until Oct. 31 for furnishing and installing a 3,000,000-gallon pumping engine. Supt., J. B. West; Pres. Trustees, J. H. McConnell.

NEW RICHMOND, O.—Bids are asked until Nov. 10 for the purchase of $30,000 of bonds for the proposed works and electric plant. A filtration plant will be put in. The water supply will be secured from the Ohio River. Engr., E. F. Layman, 32 East 3d St., Cincinnati; Cy. Clk., C. R. Day.

URBANA, O.—The council has appropriated $300 for plans for the proposed municipal works. Population (1890), 7,000. Councilmen Hitt and Brennan may be addressed. Bids for building the works will probably be asked soon.

WELLSVILLE, O.—The council has decided not to submit the question of issuing bonds for extending the water mains at the election Nov 8, according to reports.

CICERO, IND.—The Home Gas & Water Co. has been incorporated, with a capital stock of $15,000, by Wm. Winkel and Wm. H. Roney.

FORT WAYNE, IND.—Bids are asked until Oct. 20 for furnishing and installing a 6,000,000-gallon high duty pumping engine, according to reports. Chn. Trustees, Wm. Tagtmeyer.

NEW ALBANY, IND.—The Home Crystal Water Co. has awarded the contract for two 150-HP. boilers to M. Zier & Co., at $6,600. Other contracts are soon to be let. Engr., Frank Shefold.

WORTHINGTON, IND.—C. A. Geckler, Clk., writes us that a franchise for works and a light plant has been granted to C. S. Knight, of the Fort Wayne Electric Corporation, Fort Wayne, Ind. The city will use 41 hydrants and 34 lights, to be put in at a cost of $39,000. The city has the option of purchasing the plants within 30 days after completion.

BAY CITY, MICH.—The water board is making estimates for extensions to the water mains for next year. The board laid two miles of mains this year.

GRAND RAPIDS, MICH.—The committee has been authorized to engage a mechanical engineer to recommend the best method for increasing the capacity of the pumping station.

JONESVILLE, MICH.—This place voted Oct. 10 to issue $28,000 in bonds for works and an electric plant.

DETROIT, MICH.—It is proposed to put in a new system of intake pipes, at a cost of from $40,000 to $120,000. Supt., Marshall H. Godfrey; Engr., C. W. Hubbell.

ALTON, ILL.—The committee has recommended that the council negotiate for the purchase of the works of the New England Water-Works Co. and that the question be submitted to a vote of the citizens.

CHICAGO, ILL.—Bids are asked, until October 28, for laying water-mains in a number of streets. L. E. McGann, Comr. Bd. Local Improvements.

MILLEDGEVILLE, ILL.—The council has rejected the bids received Oct. 7 for furnishing about 10,500 ft. of 4, 6 and 8-in. cast-iron water pipe, etc., according to reports. Pres., J. F. Greenawalt.

WHITEHALL, ILL.—This place voted, Oct. 10, to issue $8,500 in bonds for the proposed works.

PERSIA, IA.—Reports state that this place has voted to issue $3,000 in bonds for works. Recdr., L. D. Tupper.

BERESFORD, S. DAK.—The following bids have been received by Aug. Frieberg, Mayor, for furnishing the tank for the proposed works, to cost about $12,000: Jackson & Moss, Des Moines, Ia., $6,485 and $6,823; W. W. Allen & Co., Hawarden, Ia., $5,928 and $6,428.

DEADWOOD, S. DAK.—Bids are asked until Oct. 24 for furnishing 4,000 ft. of 4 and 10-in. cast-iron water pipe, special castings, etc. Bids were opened Oct. 17 for building a 200,000-gallon tank, excavating, etc., for the works. Chn. Com., D. A. McPherson.

BOZEMAN, MONT.—This city has voted for the third time in favor of issuing $165,000 of 5% 20-year bonds for the purchase of the works of the Bozeman Water-Works Co. The mains will probably be extended about a mile. Cy. Clk., Geo. D. Pease.

TOPEKA, KAN.—It has been decided to hold the election Nov. 12 to vote on the question of purchasing the works or building a new plant instead of Nov. 5. Mayor Fellows may be addressed.

CARTHAGE, MO.—The Carthage Water Co. has been incorporated, with a capital stock of $125,000, by H. H. Harding, E. B. Jacobs and Howard Gray.

INDEPENDENCE, MO.—An election will be held Nov. 1 to vote on the question of issuing $75,000 in bonds for extending the works and the sewerage system.

WYNNE, ARK.—Bids are asked until Nov. 8 for furnishing the materials and for building the proposed works and electric light plant, to cost about $15,000. (Postponement from Oct. 15.) Engr., Owen Ford, 710 Security Bldg., St. Louis, Mo.; Chn. Com., Wm. M. Kennedy.

WACO, TEX.—Press reports state that the Bell Water Co. will probably rebuild at once the stand-pipe which is said to have burst Oct. 6. There were two iron standpipes, one of 188,000 gallons, 20 × 80 ft., and the other of 206,000, 20 × 88 ft. Pres., J. D. Bell.

CRIPPLE CREEK, COLO.—Two plans are being considered for a better water supply. One plan proposed is to turn the waters of Oil Creek through the saddle between Carbonate and Tenderfoot hills and thence into Cripple Creek. If this can be accomplished the city can get a supply of 400,000 gallons a day. Another plan is to buy the works of the Michigan Pipe Co., Bay City, Mich., the owner of the works on Beaver Creek. The reservoir has a storage capacity of 78,000,000 and a daily flow of 1,600,000 gallons. J. Stanley Jones may be addressed.

FLORENCE, COLO.—P. T. McGuire, Mayor, writes us that the proposed works will furnish water by gravity, the water supply being secured from the mountains. There will be required 10½ miles of supply main, four miles of laterals, 40 hydrants, a stand-pipe, 30 × 50 ft., etc.; estimated cost, $135,000. Bids will probably be wanted in about 25 days. Engr., Hiram Phillips, Oriel Bldg., St. Louis.

GREELEY, COLO.—The council is reported as considering plans for increasing the water supply. Population (1890), 2,400.

LAKE CITY, COLO.—This place is reported to have voted to change its water supply from Lake Fork Branch to Wade's Gulch, so that the former stream may be used by the mills.

PALMER LAKE, COLO.—The question of a better water supply is being considered, according to reports. P. O., Palmer.

BREMERTON, WASH.—Bids are asked until Oct. 22 for extending the mains at the Puget Sound naval station, Bremerton. Appropriation, $4,007. M. T. Endicott, Ch. Bureau Yards and Docks, U. S. Navy, Washington, D. C.

SEATTLE, WASH.—Bids are asked until Nov. 15 for constructing certain additions to the water-works, as described in our advertising columns. The plans and specifications may be seen at the office of the Engineering News Publishing Co., Monadnock Block, Chicago, and 220 Broadway, New York. Secy. Bd. Pub. Wks., Frank Oleson.

HEMET, CAL.—W. B. Rider, Redlands, Cal., is reported as making surveys for the proposed filtration plant for the Lake Hemet Water Co.

OAKLAND, CAL.—The Investors & Promoters Co. has secured permission to build works for the Alvarado district. Orestes Pierce and Wm. Pierce Johnson are interested.

PASADENA, CAL.—Bids are asked until Oct. 25 for deepening the city well, etc. Cy. Clk., Herman Dyer.——It is stated that J. B. Lippincott has been engaged to prepare plans and estimates of cost for works. Bonds will be issued for the purposes.

PORTERSVILLE, CAL.—The Portersville Water Development & Improvement Co. has been incorporated, with a capital stock of $10,600, all of which has been subscribed. It is said that all contracts have been let. G. T. Frost, W. C. Brumfield and W. W. Henry are interested.

REDLANDS, CAL.—Press reports state that the trustees have taken the first steps for the municipal works. Later on a proposition will be made to issue bonds from $8,000 to $15,000 for the purpose of making investigations as to the sources, etc., of a water supply, and the cost. W. P. McIntosh has made a proposition to sell to the city the Mentone Tunnel, 1,300 ft. long, in the bed of Mill Creek Canyon, in which there has been developed 75 ins. of water, and an excavation partly made for a submerged dam, for $125,000.

SAN MATEO, CAL.—This city will vote Oct. 22 on the question of issuing $80,000 in bonds for works. Engr., C. E. Moore, Santa Clara, Cal.

SAN PEDRO, CAL.—The trustees will probably soon submit to the voters the question of issuing about $50,000 in bonds for new works.

SALT LAKE CITY, UTAH.—The city engineer has been directed to investigate the sources for an additional water supply. The council has appropriated $2,500 to pay for surveys, etc. Councilmen Robertson, Callister and Morris may be addressed.

SANDY, UTAH.—The Sandy Pipe Line Co. has been incorporated to build works and an irrigation plant in this place; capital stock, $5,000. C. C. Craps, A. G. Robertson and Wells Clark are interested.

VERDUN, QUE.—Matthew Dineen, Montreal, Que., has been awarded the contract for laying 2,750 ft. of 10-in. main for the works. The Three Rivers Iron Works Co., Montreal, has been awarded the contract to furnish the cast-iron water pipe and special castings. Work on the plant will begin Oct. 10. Plans and specifications for the complete works are not yet ready. Engrs., McConnell & Marion, New York Life Bldg., Montreal.

BARRIE, ONT.—Two of the three arbitrators engaged to make a valuation of the works of the Barrie Water-Works Co. in order that the city might purchase the plant have estimated the works to be worth $70,684 with interest. A report states that the Council has passed a by-law to be submitted on Nov. 14, asking authority to issue bonds to raise $100,000 to be used in purchasing the water-works, paying the expenses of the arbitration, and extension of the system to other parts of the town.

TORONTO, ONT.—Bids are asked until Oct. 26 for filling the old filter basin on the island. Mayor and Chn. Bd. Control, John Shaw.

YMIR, B. C.—The Ymir Water-Works Co. has been incorporated to build works to cost about $2,500.

IRRIGATION.

GREAT FALLS, MONT.—Reports state that the Conrad Investment Co. awarded a contract to Daniel McGovern for 3½ miles of irrigating canal, near Dupuyer.——The commissioner of Indian affairs has been authorized to spend $34,000 for improving the irrigation system on the Fort Belknap reservation, according to reports.

SHIELDS, MONT.—It is reported that Henry Shadean, Shields, has filed with the county clerk a notice of location, claiming 160 inches of the waters of Crazy Creek, to be used for irrigating purposes.

BEAUMONT, TEX.—The Beaumont Irrigation Co., Beaumont, has awarded a contract to Andrews & Son, New Orleans, La., for constructing a 12-mile twin levee irrigating canal in this county. The contract was previously let to E. A. Hayne. A. F. Goodhue, Pres., and W. S. Davidson, Secy. and Treas., Beaumont.

KIONA, WASH.—Frank Dudley, Niagara Falls, N. Y., has purchased the Kiona ditch and will award a contract for repairing and enlarging it, according to reports.

LOS ANGELES, CAL.—The Santa Ana Valley Irrigation Co. held a meeting, Oct. 4, to consider the question of improving the irrigation system, according to reports.

SANTA ANA, CAL.—It is intended to raise $15,000 to be expended in the cementing and extension of ditches throughout this district. Address M. Nisson, Santa Ana.

CHEYENNE, WYO.—The Wyoming Development Co. proposes to build a storage reservoir on the Laramie plains, and is arranging to commence work at once to store the waters of the Laramie River during the next flood season. The reservoir will be built near the McGill ranch, 20 miles east of Rock Creek. The dam will be 30 ft. high, and the reservoir will cover 5,060 acres and contain 80,000 acre-ft. of water; estimated cost, $65,000, according to reports.

NEW COMPANIES.—Western Ditch & Land Co., Denver, Colo.; $35,000; James H. Crandall, John B. Andrews, W. G. Brown, Denver.

North Side Irrigation Ditch Co., Craig, Colo.; $25,000; Charles A. Seymour, J. Lee Tower, George D. Woolley, Alexander S. Robinson and A. M. Raney, Craig.

New Deal Water Co., Los Angeles, Cal.; $100,000; to acquire wells, pipe lines, flume, ditches, etc., in Los Angeles county; W. T. Michael, J. E. Marsh, D. C. Tegue, William Ferry, H. O. Mace.

Lompoc Valley Water Co., Lompoc, Cal.; $100,000, with $80,400 paid in; to deal in water, construct canals, dams, etc.; E. E. Hall, H. S. Hall, A. G. S. Hall, H. Poland and C. A. Stilson.

Portersville Water Development & Improvement Co., Portersville, Cal.; $10,600; to do a general aqueduct and irrigation business; G. T. Frost, W. C. Brumfield, W. W. Henry, James Wilson, H. F. Brey.

SEWERAGE.

HAVERHILL, MASS.—The aldermen are considering plans for a trunk sewer or sewage disposal beds for the new Hale hospital buildings. Wm. W. Roberts writes that no action has yet been taken.

INDIAN ORCHARD, MASS.—R. D. Maynard, of Springfield, Mass., has been awarded the contract for building a sewer in this place, at $2,397.

BROOKLINE, MASS.—T. F. Crimmings and C. E. Trumbull & Co. have been awarded the contract for building sections 1 and 2 of the 26 × 39-in. brick sewer to connect with the Metropolitan sewer, at $2,960 and $8,081, respectively.

LAWRENCE, MASS.—R. J. Shea, Cy. Audr., writes us that a loan of $75,000 has been authorized for sewers. The sewers are being constructed under the direction of the superintendent of streets. Cy. Engr., Arthur D. Marble.

WEBSTER, MASS.—It is probable that the system will be extended next year at a cost of about $20,000.

BUFFALO, N. Y.—Bids are asked until Oct. 26 for constructing a 3½ and 2¼-ft. brick sewer in Bryant St. Secy. Bd. Pub. Wks., R. G. Parsons.——The committee has recommended the construction of the Emslie and Van Rensselaer St. sewer at a cost of $90,000. The ordinance recently passed by the council was vetoed by the Mayor.

LANSINGBURG, N. Y.—Chas. A. Roemer, Village Engr., writes us that the village is awaiting a reply from the state board of health in regard to a trunk sewer, which it is proposed to build to drain the low lands in the Fourth Ward.

OWEGO, N. Y.—Surveys are being made for an extension to the system.

SYRACUSE, N. Y.—It is proposed to build a trunk sewer in the First Ward at a cost of about $60,000. Bids will probably soon be asked. Alderman Costello may be addressed.

UTICA, N. Y.—The council is again considering the question of a new sewer in Neilson and Mills Sts. The sewer was first recommended by Rudolph Hering, 100 William St., New York. Alderman Luker may be addressed.

ALLENHURST, N. J.—The question of purchasing the plants of the Coast Water & Sewer Co. will be voted upon Nov. 4.

GLOUCESTER, N. J.—The council has voted to build a sewer in Ridgeway St.

HOBOKEN, N. J.—Bids are asked until Oct. 26 for cleaning and repairing the Newark St. sewer. Cy. Clk., M. V. McDermott.

SOUTH ORANGE, N. J.—It is stated that Robert S. Sinclair, Chn. Joint Sewerage Com., having in charge the proposed sewer for West Orange, South Orange, Vailsburg, Irvington and Millburn, reported, Oct. 17, that the engineer had submitted a plan to the committee for a joint outlet sewer from a point about two miles south of Irvington, emptying into Staten Island Sound, where it would have an outlet into 20 ft. of water, with a rapid tidal flow. This was so far removed from existing water rights as to be unlikely to be affected by any action of the Passaic Valley Commission. The estimated cost of the outlet is $110,000, exclusive of the rights of way, which it is thought will not prove excessive.

SPRING LAKE, N. J.—Bids are asked until Nov. 1 for constructing about 4,600 ft. of pipe sewers and ocean outlet for the same, as stated in our advertising columns. Bids were opened Oct. 15 for the purchase of $70,000 of 30-year 5% sewer and water bonds. Engrs., Lehlbach Bros., 770 Broad St., Newark, N. J.; Mayor, E. V. Patterson.

STOCKTON, N. J.—B. F. Sweeten & Son, Camden, N. J., have been awarded the contract for building a sewer in Federal St.

NEW HAVEN, PA.—The council has decided to spend $6,500 for sewers, etc. Burgess. J. B. Maloney.

WARREN, PA.—Four citizens have subscribed $4,000 towards the state hospital sewage disposal plant. This amount, together with the state appropriation of $10,000, will probably be sufficient to commence the building of the plant at once.

WASHINGTON, D. C.—Capt. Lansing H. Beach, U. S. Engr. and Engr. Comr. for the District of Columbia, writes us as follows in regard to the improvements to the system: Several years ago plans were prepared by a board of experts for a system of sewage disposal for Washington. providing for the construction of intercepting sewers and the collection of all sewage at the foot of New Jersey Ave., from which point it was to be pumped across the Anacostia River and flowed by gravity to such a point down the Potomac River that there would be no danger of its being carried back to the city by the inflowing tide. About $500,000 worth of work has been done upon the intercepting sewers to date; the entire system is estimated to cost about $4,000,000. The appropriations made by congress during its last session provided for the construction of some more of the interceptors and the preparation of plans for the sewage pumping station. This work is now in progress.

NORFOLK, VA.—Jas. L. Winston writes us that another election will be held Nov. 8 to vote on the question of building sewers in the Brambleton Ward, at a cost of about $105,000.

WINSTON, N. C.—It is stated that certain northern parties interested in the proposed manufacturing plants to be built here, will take steps for the construction of a system and water-works.

NEW ORLEANS, LA.—The New Orleans Sewer Co. has submitted a proposition to the council for the construction of a system. The company offers to furnish a bond for $50,000. Work on the system will begin within six months after signing the contract. Councilman Clark has introduced an ordinance instructing the city engineer to prepare plans and specifications for the sewering of New Orleans, and submit the same to the council with the object of adjudicating a franchise for the sewering of the city in accordance with the terms of the charter, which provides that all franchises shall be sold to the highest bidder. Mr. Dreyfous has introduced an ordinance inviting all persons desiring to compete for the erection and operation of a sewerage system, to present their plans and propositions within 30 days, all further negotiations with the old sewerage company in the meantime to be broken off. Secy. New Orleans Sewerage Co., Samuel Henderson, Jr.

CHATTANOOGA, TENN.—The question of improving the Washington St. sewer at a cost of about $10,000 is being considered.

MEMPHIS, TENN.—Bids are asked until 12 noon, Oct. 21, for furnishing the materials and for building 5,800 ft. of 4-ft. brick sewer, etc., from the city limits to the Wolf River; check, $500. Mayor, J. J. Williams.

EAST CLEVELAND, O.—The following bids were received, Oct. 10, for constructing sewers in a number of streets, and also for a sewage disposal plant; all bidders of Cleveland when otherwise not stated: Sewage disposal plant; Herbert Tate, New York, $21,787; D. A. Tompkins Co., Charlotte, N. C., $20,670. Sewers: Cleveland Contracting Co., $11,515, $9,609 for section Nos. 3 and 4, respectively; R. J. Clements, $14,309, $14,204; R. H. Gray, $13,134, $11,222; Wm. McDowell, $15,169, $11,984; The Northern Ohio Paving & Construction Co., $15,999, $13,197; Ford P. Beers, $14,178, $11,423; R. P. Burnett, $23,183, $17,884; Clements Bros. Construction Co., informal, $13,188. Engrs., The Walter P. Rice Engineering Co., Society for Savings Bldg., Cleveland; Clk., N. A. Chapman.

ST. BERNARD, O.—Jos. Schwegman, Mayor, writes us that the council has done nothing definite towards the construction of a system.

BEARDSTOWN, ILL.—The question of improving the system and of paving certain streets is being considered.

CHICAGO, ILL.—Bids are asked until Oct. 28 for constructing pipe sewers in a number of streets. L. E. McGann, Comr. Bd. Pub. Wks.

FARIBAULT, MINN.—O'Neil & Son, Faribault, have been awarded the contract for building a sewer in the east side, at a cost of $10,000.

SIOUX FALLS, S. DAK.—The South Side Sewerage Co. has been incorporated with a capital stock of $12,000 by Park Davis, Adrian L. Peck and C. O. Bailey.

TOPEKA, KAN.—The question of building a sewer in North Topeka will soon be considered again by the council.

CARROLLTON, MO.—Wm. Riblett, Cy. Clk., writes us that an election will be held Oct. 25 to vote on the question of issuing $50,000 in bonds for constructing a system and for paving. Alex. Trotter, Thos. B. Goodson and Herman David are on the committee.

INDEPENDENCE, MO.—An election will be held Nov. 1 to vote on the question of issuing $75,000 in bonds for extending the system and water-works.

KANSAS CITY, MO.—Mike Walsh has been awarded the contract, at $38,598, for building the Vine St. sewer.

MACON, MO.—F. W. Blees has offered to donate $5,000 to aid in the construction of the proposed system, to cost about $25,000.

MADISON, MO.—The question of issuing $50,000 in bonds for a system is being considered by the village board, according to reports.

ST. JOSEPH, MO.—It is proposed to construct 15 and 12-in. pipe sewers in two streets. Cy. Clk., C. S. Shepherd; Mayor, P. J. Kirchner.

SHERMAN, TEX.—A. A. Fielder, Mayor, and Geo. E. Hardwicke are in Philadelphia, Pa., to confer with Geo. W. Ruch, in regard to building the proposed system, to cost about $200,000.

GRAND JUNCTION, COLO.—The question of constructing a system is being considered.

PALO ALTO, CAL.—This place will vote about Oct. 22 on the question of issuing $40,000 in bonds for a system. Engr., C. E. Moore, Santa Clara, Cal.

VERDUN, QUE.—Plans and specifications for the proposed system and water-works are not yet ready, but work on certain pipe laying has already been begun. Engrs., McConnell & Marion, New York Life Bldg., Montreal, Que.

GARBAGE DISPOSAL—STREET CLEANING

NEWTON, MASS.—The question of building a garbage disposal plant is being considered. It is proposed to ask Watertown and Waltham to join in the construction and the use of it.

BRIDGEPORT, CONN.—The board of health is securing information about garbage disposal plants; estimated cost, $12,000.

BUFFALO, N. Y.—Henry P. Burgard, Prudential Bldg., Buffalo, who was recently awarded the contract for cleaning District No. 12, under the 5-year contract, will soon begin work. It is said that he has not yet purchased the necessary cleaning and sweeping machines.

NEW ROCHELLE, N. Y.—It is reported that Frederick Lorenzen has recommended the construction of a plant.

ATLANTIC CITY, N. J.—M. V. Smith, Philadelphia, has been awarded the contract for constructing a garbage crematory, at $27,500, this bid being lower than Thos. Dalzell's, at $29,900.

NORRISTOWN, PA.—L. Lemish, Philadelphia, has submitted a proposition to the board of health to remove and dispose of the garbage of the city.

READING, PA.—The General American Reduction Co., Philadelphia, has been awarded the contract, at $3,250, for reconstructing the crematory, according to reports.

ATLANTA, GA.—The question of hauling the city garbage to the dumps by the cars of the Collins Park & Belt St. Ry. Co. is being considered by the city officials. The city pays $60,000 a year for collecting and hauling the garbage, and it is thought that this plan will save the city about $16,000 a year. The mayor is in favor of a new crematory.

NEW ORLEANS, LA.—Councilmen Clark and Dreyfous have introduced an ordinance authorizing the council to ask for bids for the construction of two garbage plants, one in the upper and the other in the lower section of the city.

LOUISVILLE, KY.—The aldermen and the board of health are considering the question of the city's purchasing a plant.

MANSFIELD, O.—The council is again considering the question of better methods for the disposal of the garbage.

MILWAUKEE, WIS.—Local papers state that the plans for the garbage crematory to be erected on Jones' Island were submitted to the board of public works Oct. 7. The building will be 140 × 44 ft., on foundation walls, and two stories high, constructed of brick with a slate roof. There will also be a coal shed, 156 × 28 ft., 1-story high, also of brick with a slate roof. The plant will be built by the Engel Cremation & Sanitary Co., as noted last week.

GAINESVILLE, TEX.—Press reports state that the council will rebuild the garbage crematory, destroyed by fire Oct. 5.

HOT SPRINGS, S. DAK.—The City Garbage Co. has been incorporated, with a capital stock of $12,000, by Alex. McDonald, of Omaha, Neb., and Chas. L. Fargo, of Hot Springs.

MITCHELL, S. DAK.—The council has authorized Councilman Edwards and the board of health to investigate the subject of a garbage crematory.

OAKLAND, CAL.—J. W. Northup has applied for a 50-year franchise to collect and cremate garbage. Mr. Northup, it is stated, represents the company recently granted a like franchise in San Francisco.

SAN FRANCISCO, CAL.—Bids were asked until Oct. 17 for collecting and removing the garbage and refuse for a period of two years from Jan. 1, 1899; bond, $12,500. Clk. Bd. Supervisors, Jno. A. Russell.——Local papers state as follows: A communication was received Oct 7 by the supervisors from the Merchants' Association, asking that action be postponed on the garbage collection contract until Oct. 24, for the reason that the specifications for the proposed work do not appear to be satisfactory. The association stated that it is collecting data from other cities.

STREETS AND ROADS.

QUINCY, MASS.—C. F. Knowlton, Comr. Pub. Wks., informs us that the sidewalks mentioned in our last issue have been constructed.

ROCHESTER, MASS.—Bids are asked until Oct. 24 for constructing a highway about seven-eighths of a mile long. J. Dwelley, County Comr., Plymouth, Mass.

SUDBURY, MASS.—Bids are asked until 12 m., Oct. 20, for building about 3,000 lin. ft. of highway. T. C. Mendenhall, Chn. Mass. Highway Comn., Boston.

FERRYVILLE, CONN.—Bids are asked until 2 p. m., Oct. 21, for grading a section of the Flag Hollow Hill Road. Henry E. Hinman, First Selectman, Plymouth, Conn.

THOMASTON, CONN.—Bids are asked until Oct. 22 for grading on North Main St. Aaron Thomas, First Selectman.

WOODBURY, CONN.—Bids are asked until Oct. 24 for grading and graveling on Main St. Chas. S. Curtiss, First Selectman.

ALBANY, N. Y.—Horace Andrews, Cy. Engr., is preparing plans for paving on Elizabeth, Hamilton, Rose and Dove Sts., to be constructed in 1899.

COHOES, N. Y.—Bids are asked by the public improvement commission until Nov. 9, for grading and paving of South Saratoga St.

NEW LEBANON, N. Y.—Bids are asked until 12 m., Oct. 20, for improving the road from New Lebanon to Pittsfield, Mass. C. W. Adams, State Engr., Albany.

OLEAN, N. Y.—Bids are asked until October 29 for constructing a brick pavement on concrete foundation, on South St., about 1,200 sq. yds., as stated in our advertising columns. F. L. Bartlett, Chn. Pub. Wks.; E. E. Allen, Supt. Sts.

PATCHOGUE, (L. I.), N. Y.—Jas. T. Losee, Village Clk., informs us that no steps have been taken for new sidewalks on Main St. and Ocean Ave.

SALAMANCA, N. Y.—The council has awarded a contract to Shean & McGann, Dunkirk, N. Y., at $15,000, for about 9,755 sq. yds. of brick paving.

SYRACUSE, N. Y.—The following bids were received, Oct. 10, for paving North Salina St., from James to Fulton St., and Fulton St., from Salina St. to Belden Ave. Empire Contracting Co., Alcatraz asphalt, $29,260.80; Warren-Scharf asphalt, $29,260.80; Warren-Scharf Asphalt Paving Co., Trinidad asphalt, $29,227.60; Columbia Construction Co. (accepted), Trinidad asphalt, $29,014.70; Asphaltina Construction Co., asphaltina, $29,036.50.

UTICA, N. Y.—Bids are asked until Nov. 1 for the purchase of $8,000 of 6% road bonds, according to reports. W. E. Richards, County Treas.

FORT HANCOCK, N. J.—Bids are asked until Nov. 3 for grading, constructing roads, walks, etc: Capt. G. G. Bailey, Q. M., Army Bldg., Whitehall St., New York.

PITTSBURG, PA.—Bids are asked until Nov. 3 for improving certain highways. F. W. Patterson, County Engr.; W. E. Thompson, County Controller.

SHIPPENSBURG, PA.—Reports state that the council is considering the question of issuing $10,000 in bonds for street improvements.

WASHINGTON, D. C.—Bids are asked until 12 m., Oct. 22, for grading Michigan Ave. J. B. Wight, Chn. Comrs.

NORFOLK, VA.—W. T. Brooke, Cy. Engr., has estimated the proposed paving on Brambleton Ave., 19,000 sq. yds., with Belgian block, at $32,300, with brick, $36,100; Park Ave., 13,600 sq. yds., with Belgian block, at $23,120, with brick, at $25,840. Messrs. Ferrebee, Gale and Sterling, Bd. of Local Improvements, have been appointed a committee to consider the question of issuing $20,000 in bonds for the work.

PETERSBURG, VA.—N. T. Patterson, Pres. Com. Council, informs us that the question of paving is being considered by the street committee which will probably report at the meeting of the council Nov. 1. It has not yet been decided whether Sycamore St. will be paved with brick or asphalt.

MONROE, LA.—The street committee has been authorized to contract with the Talbot Paving Co., Detroit, Mich., for the paving of Desiard St., from the river to Sixth St., according to reports.

NEW ORLEANS, LA.—Bids are asked by the Orleans & Jefferson Ry. Co., Ltd., until Oct. 28, for grading on Napoleon Ave., and for grading and paving the Metairie Road. Robt. R. Zell, Engr., 708 Union St.

LOUISVILLE, KY.—Bids are asked until 12 m., Oct. 24, for grading, curbing and brick paving on portions of 12 streets. Chas. F. Grainger, Chn. Bd. Pub. Wks.

AKRON, O.—The council has awarded a contract to P. T. McCourt & Co., for brick paving on Bittman St., from Maple to Crosby St.

CAMBRIDGE, O.—Bids are asked until Oct. 24 for the purchase of $24,000 of 4½% street paving bonds, according to report. T. R. Deselin, Cy. Clk.

CINCINNATI, O.—The following bids have been received by the board of city affairs for improving Delta Ave.: William Fogarty, (accepted), $23,822; A. J. Strauss, $24,678; Queen City Construction Co., $24,892; J. M. Quill, $25,399.60; J. W. Sullivan, $25,664; A. J. Henkel & Bro., $25,727; Vansandt & Medes, $26,800; T. Evans, $24,607; McCaren & Dawson, $26,943; D. Foltz Asphalt Co., $26,247; T. Folz, $25,008; N. J. Williams, $26,067; J. A. Ebersole, $26,267.

DAYTON, O.—Bids are asked until 12 m., Oct. 21, for grading, graveling and paving in five alleys. J. L. Baker, Pres. Bd. Cy. Affairs.

FINDLAY, O.—Bids are asked until Oct. 27 for grading, draining, macadamizing, etc., on East Hardin St., from Main to East St. A. W. Ray, Clk.

RICHWOOD, O.—Bids are asked until Oct. 24 for the purchase of $6,000 of 6% sidewalk bonds, according to report. S. D. Evans, Village Clk.

SALEM, O.—Bids are asked until Oct. 25 for the purchase of $5,047 in paving bonds, according to report. Geo. Holmes, Cy. Clk.

TOLEDO, O.—It is stated that the viewers have reported favorably on the proposed stone road, about 18 miles long, to connect Maumee, Waterville and Whitehouse, at a cost of about $80,000. The question will soon come before the county commissioners.

WARREN, O.—Bids are asked until Oct. 28 for furnishing the material and constructing 1,400 lin. ft. of curbing and drain tile, 800 cu. yds. of excavation and 2,400 sq. yds. of macadam. A. E. Andrews, Cy. Clk.

GREENCASTLE, IND.—Reports state that a contract has been awarded to O'Brien & Co., Cloverdale, Ind., at $11,500, for macadamizing in Warren township.

INDIANAPOLIS, IND.—Bids are asked until Oct. 24 for asphalt paving, etc., on 14th St., and brick paving on Geisendorf St. M. A. Downing, Chn. Bd. Pub. Wks.

GRAND RAPIDS, MICH.—Geo. W. Ames, Cy. Engr., informs us that nothing has been done toward the repaving of Canal St, besides securing estimates.

CARTHAGE, ILL.—N. P. Berry, Mayor, informs us that about three-fourths of a mile, 40 ft. wide, will be paved with brick, early next summer.

CHICAGO, ILL.—Bids are asked until October 28 for constructing cement sidewalks on about 20 streets. L. E. McGann, Pres. Bd. Local Improvements.

DECORAH, IA.—E. Mather writes us that the council has decided to pave about 1,000 lin. ft. There will be nothing done this season. T. F. Acechmoody, Cy. Clk.

ST. PAUL, MINN.—The county commissioners awarded a contract, Oct. 10, to John W. Fleetham, at $16,985, for macadamizing about 2 1-7 miles, on Rice St. and White Bear Road.

LEAVENWORTH, KAN.—J. D. Edmond, Mayor, writes us that at the last meeting of the council bids were received for brick and asphalt paving, but have been rejected. New bids are now being asked. He also states that considerable paving will be laid in the near future.

CARROLLTON, MO.—Wm. Riblett, Cy. Clk., writes us that an election will be held, Oct. 25, to vote on a proposition to issue $50,000 in bonds for paving and constructing sewers. Alex. Trotter, Thos. B. Goodson, Herman David and others, compose the committee.

KANSAS CITY, MO.—The park board has awarded a contract to Adam Armstrong, at $34,454, for paving Benton Boulevard, between 24th and 31st Sts., and to Bunton, Schryer & McGannon, Indianapolis, Ind., at $49,127, for constructing sidewalks, curb, gutter, etc., on Benton Boulevard, between Independence Ave. and 31st St.

MARSHALL, MO.—Bids are asked until Oct. 26 for furnishing and constructing Trinidad asphalt pavement and stone curb on portions of Lafayette Ave., Jefferson Ave., North and Arrow Sts. Jno. G. Miller, Mayor; A. R. James, Clk.

ST. LOUIS, MO.—Bids are asked, until 12 m., October 21, for furnishing and constructing granitoid walks around market. Robert E. McMath, Pres., Bd. Pub. Wks.

BEAUMONT, TEX.—Aldermen Kelly, Ives and Millard have been appointed a committee to secure plans and specifications of different kinds of paving, according to reports. D. P. Wheat, Mayor.

TACOMA, WASH.—Reports state that County Surveyor Bullard has completed a survey for a new road from Carbonado to Mount Ranier, and work will soon be commenced.

SAN FRANCISCO, CAL.—The board of supervisors has passed a resolution to pave Market St. with bitumen, between Sixth St. and Van Ness Ave.

WINNIPEG, MAN.—Bids are asked until Oct. 27, for asphalt paving on Poladd Ave., about 18,000 sq. yds., according to reports. C. J. Brown, Cy. Clk.

MANUFACTURING PLANTS.

OAKVILLE, CONN.—It is reported that plans have been prepared for a 2-story office building and two additions to the factory of the Oakville Co., to cost about $30,000. Arch., Theo. B. Peck, 65 Bank St., Waterbury, Conn.

BUFFALO, N. Y.—The Buffalo Co-operative Brewing Co. filed plans, Oct. 10, for a new brick building to replace the present plant at High and Michigan Sts., to cost about $84,000.

OSWEGO, N. Y.—George Barlow, of Seneca Falls, N. Y., has been awarded the contract for the masonry work on the foundation of the McGowan brewery.

CAMDEN, N. J.—The oilcloth and pattern factory of Dorner & Visser was destroyed by fire Oct. 13, causing a loss of about $35,000.

HARRISON, N. J.—The Berlin Iron Bridge Co., of East Berlin, Conn., is erecting an extension, 51 × 152 ft., to the foundry of the Benjamin Atha & Illingworth Co., at Harrison. The framework is to be of steel throughout; the sides are covered with corrugated iron on steel purlins, and are arranged for suitable doors and windows. The side columns support a 30-ton electric crane having a span of 46 ft. The roof construction is of steel trusses and purlins arranged with openings in the roof for skylights.

JERSEY CITY, N. J.—A fire in this city, Oct. 9, damaged the storage building of the Eagle Brewery, at 186 9th St., causing a loss of about $45,000.

WILMINGTON, DEL.—The 5-story morocco factory of Tadham & Hickman, at 208 West 4th St., was burned Oct. 7, causing a reported loss of $35,000.——Reports state that extensive improvements are to be made to the works of the Johnson Forge Co., at Wilmington.

MACON, GA.—A fire in this city Oct. 13 destroyed the candy and cracker factory of the Winn-Johnson Co., and adjoining buildings, causing a total loss of about $125,000.

COTTONPORT, LA.—It is reported that the sugar refinery on the Dora plantation, owned by F. Regard, was destroyed by fire, Oct. 11, causing a loss of about $75,000; insurance, $40,000.

MAUMEE, O.—The Dewey Glass Co., of Cincinnati, will erect a 24-pot window factory at Maumee, according to reports. It will cost $50,000, and will be completed in six months.

DETROIT, MICH.—A building permit has been granted for the erection of a factory and warehouse building for the Boydell Bros. White Lead & Color Co., at Champlain and Beaubien Sts., to cost $50,000. Archs., A. C. Varney & Co., 48 Campau Bldg.

UNION CITY, MICH.—A recent fire at the Peerless Portland Cement Co.'s works destroyed property valued at about $40,000. The new $200,000 brick and iron factory had just commenced operations.

MILWAUKEE, WIS.—Reports state that new additions will be built to the trunk factory of Abel & Bach, at St. Paul Ave. and 18th St., to cost about $75,000.

GAS PLANTS.

SOMERSET, KY.—The Kentucky Oil & Pipe Line Co. has awarded a contract to the National Tube Works Co., Pittsburg, Pa., at about $45,000, for the construction of a pipe line from Somerset to Slick Ford, a distance of about 36 miles; capacity, about 2,500 bbls. per day. H. W. Breckenridge, Gen. Mgr., Wellsville, N. Y.

CHARLOTTE, N. C.—The Consolidated Gas Co., Philadelphia, Pa., has decided to purchase the works of the Charlotte Gas Light Co. for $50,000. The plant and service will be enlarged and new apparatus and machinery will be installed.

DAYTONA, FLA.—Reports state that the council is considering the question of constructing acetylene gas works. Address E. Dillingham.

MASSILLON, O.—The council has granted a franchise to the East Ohio Gas Co. It has been proposed to lay eight miles of pipe within four months, and within one year 20 miles must be laid. Natural gas will be piped from West Virginia, according to reports.

NEW COMPANIES.—Louisville Gas Co., Louisville, Ky.; $15,000; Frederick Forcht, Jr., Albert Struby and Joseph O'Donnell.

James Oil Co., Charleston, W. Va.; $250,000 with $35 paid in; to operate for oil and gas; L. James, A. C. Hickel, J. H. Gaines, D. J. W. Clarkson, J. A. Jones, Charleston, W. Va.

Somerset Gas Light Co., 32 Division St., Somerville, N. J.; $25,000, with $5,000 paid in; to construct, maintain and operate gas works; A. M Young, New York; James L. Griggs, Chas. R. Knapp, John R. Garretson, Chas. J. Smith, A. G. Anderson, C. H. Bateman, James Brown, Jr., Peter Struve, Mathew P. Lane, Somerville, N. J.

Kentucky Oil & Pipe Line Co., Somerset, Ky.; $50,000; E. B. Sayre, Lexington, Ky.; George B. White, Paris, Ky.; J. A. Geary, Lexington, Ky.; J. B. Henady, Somerset, Ky.; H. W. Breckinridge, Weltville, N. Y.; O. H. Waddle, Somerset, Ky.; F. M. Hardin, Winton Place, O.; R. Kolker, Somerset, Ky.

American Gas Engine Co., Fort Wayne, Ind.; $50,000; O. N. Guldin, E. F. Lloyd, Fort Wayne; Wm. W. Goodwin, Bordentown, N. J.; Wm. Henry White, New York, E. W. Mumford, Philadelphia, Pa.

Canisteo Gas Co., Canisteo, N. Y.; $25,000; to manufacture and supply gas; J. B. Bradley, Bolivar; E. C. Bradley, Wellsville; William T. Morris, Penn Yan.

Home Gas & Water Co., Cicero, Ind.; $15,000; to construct a gas plant this fall and a water-works system next spring; William Michel, William H. Roney, Emil Dietz, George J. Hall, William J. Case.

MISCELLANEOUS CONTRACTS.

WHARF.—Baltimore, Md.—C. C. Buckman proposes to construct a wharf 200 ft. long at Calvert St., according to reports.

LEVEE.—Union City, Tenn.—The county court has authorized an appropriation of $5,000 for a levee across the Ohio River bottom.

SURVEY.—Olympia, Wash.—Bids are asked until Nov. 8 for surveying certain districts. W. McMicken, U. S. Surveyor-Gen., Olympia.

CHEMICAL FIRE-ENGINES.—Albany, N. Y.—The fire commissioners have decided to purchase two chemical fire engines, according to reports.

BONDS.—Troy, O.—Bids are asked until Oct. 22 for the purchase of $7,000 of 6% ditch bonds, according to reports. J. T. Bartmess, County Audr.

DAM.—Wichita, Kan.—The council has awarded a contract to J. R. Burton, at $2,633, for furnishing the material and constructing a dam across the Little River.

LEVEE WORK.—New Orleans, La.—Bids are asked by the board of state engineers, until 12 m., October 20, for about 31,500 cu. yds. of levee work on sections 3 and 4.

DREDGING.—Coos Bay, Ore.—Bids are asked until Nov. 15 for dredging in Coos Bay, as stated in our advertising columns. Maj. W. L. Fisk, U. S. Engr., Portland, Ore.

HARBOR WORK.—Stockton, Cal.—Bids are asked until Nov. 2 for improving the San Joaquin River and Stockton Channel. John Markley, Secy. Pub. Wks., Sacramento.

INSULATED WIRE.—Richmond, Va.—Bids were asked until Oct. 17 for furnishing the fire alarm department with about 10 miles of No. 10 B. & S. gage insulated wire. W. H. Thompson, Supt.

DREDGING.—Port Royal, S. C.—Bids are asked until until Nov. 12 for dredging at the U. S. naval station; appropriation, $100,000. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

DRAINAGE PUMPS.—San Francisco, Cal.—The Pumping Association in charge of the arrangements to drain the lower Comstock levels has asked for bids for furnishing the necessary pumping machinery.

FIRE ENGINE.—Laurel, Md.—This place will establish a fire department and will purchase an engine and other apparatus. Wm. H. Diven, Pres.; M. J. Tighe, Treas., and Lawrence A. Ellis, Ch. Engr., are interested.

STONE.—Brooklyn, N. Y.—Bids are asked until Oct 27 for furnishing large field stone or boulders, about 140,000 cu. ft., at Sunset Park. Geo. C. Clausen, Chn. Park Comrs., Arsenal, Central Park, New York.

TRAVELING CRANE.—Norfolk, Va.—Bids are asked until Oct 29 for furnishing an electric traveling crane and bridge, with a capacity of 40 tons, for the navy yard. Edwin Stewart, Paymaster Gen., Washington, D. C.

WHARF.—Palatka, Fla.—Reports state that the Georgia Southern & Florida Ry. Co. has awarded a contract to Capt. William Boyd for the construction of a new storage wharf, 30 × 250 ft. Jeff Lane, Gen. Supt., Macon, Ga.

STORAGE CYLINDERS.—Mare Island, Cal.—Reports state that bids will soon be asked by the navy department, Washington, D. C., for the erection of tanks for the cold storage cylinders at the navy yard; appropriation, $43,000.

FLOOD GATES.—Dayton, O.—Bids are asked until Oct. 25 for furnishing and constructing flood gates and masonry across the tail race owned by the Cooper Hydraulic Co., at Perry St. J. L. Baker, Pres.; J. E. Gimperling, Cy. Comptroller.

DRY DOCK.—Algiers, La.—Bids are asked until Nov. 30 (postponement from Oct. 31) for a combined floating and graving steel dock, with shore connections and appurtenances, for the U. S. naval reservation. M. T. Endicott, Ch. of Bureau, Washington, D. C.

WIRE.—Washington, D. C.—Bids are asked until 2 p. m., Oct. 21, for furnishing about 50 miles of stranded wire, seven ply; 50 miles stranded wire, insulated and braided, seven ply; 350 miles, No. 8, galvanized iron wire; 300 miles, No. 14, galvanized iron wire; 3,000 porcelain insulators. A. W. Greely, Ch. Signal Officer.

TELEPHONE LINE.—Charlotte, N. C.—The Queen City Telephone Co., Charlotte, has decided to establish a telephone service between Charlotte and Salisbury, a distance of about 50 miles, taking in several intermediate towns. Address J. A. Helvin, Queen City Telephone Co., and L. T. Coltraine, Concord local exchange, Concord, N. C.

WHARF, DREDGING, ETC.—St. John, N. B.—Bids are asked by the Intercolonial Ry. Co. until Oct. 26 for constructing a wharf 160 × 650 ft., using 60-ft. piles, dredging the berth to a depth of 28 ft. at low water, removing the rock, etc., and furnishing a diving outfit. A freight-shed will be built on the wharf. W. B. McKenzie, Ch. Engr., Monocton, N. B.; Station Master Ross, St. John.

PIERS, ETC.—Philadelphia, Pa.—The following requests have been presented to the board of port wardens for permission to construct piers, etc.: The William Cramp & Son's Ship Building Co., to fill a dock near Norris St.; the Pennsylvania R. R. Co., for a temporary rack of piles at Dock St.; Belt Line R. R. Co., for a track trestle, near Bridesburg; Thos. Clyde, for the extension of Pier No. 1; J. B. King Co., for a pier 350 × 60 ft. at Morton St., Chester, Pa.; Pennsylvania Steel Casting & Machine Co., Chester, Pa., for the extension of a bulkhead.

REFITTING TRANSPORT.—Washington, D. C.—The following bids have been received by the navy department for refitting the steamer "Massachusetts" as a permanent transport: The Atlantic Works, East Boston, Mass, $109,000; Morse Iron Works, $96,000, to be completed in 50 working days; Maryland Steel Co., Sparrow's Point, Md., $137,000, to be completed in 90 days; John N. Robins Co., $98,000; Newport News Shipbuilding & Dry Dock Co., Newport News, Va., $99,500, to be completed in eight weeks; William Cramp & Son's Ship & Engine Building Co., Philadelphia, Pa., $120,000, to be completed by Dec. 10 if turned over at once; if allowed to go to sea first, 60 days from date of delivery.

WELL DRILLS AND WINDMILLS.—Cape Town, South Africa.—Press reports state that Consul J. G. Stowe, Cape Town, states that the demand for windmills in South Africa is to increase after the various systems of irrigation are established. A number of American windmills have already been introduced in South Africa, but as they are entered at the custom houses under the head of agricultural implements, it is not possible to ascertain the number or value. Well drills have also been introduced, but not in sufficient numbers to meet the demand. The windmills manufactured in the United States, if properly pushed, will meet with success. Samples and tests will produce quicker and better results than catalogues.

WELLS AND SHAFTS.—Gila County, Ariz.—Bids are asked until Nov. 5 for sinking wells and shafts to ascertain the depth of bed rock at a place on Gila River, known as Buttes, and also on Queen Creek. H. Rizer, Acting Dir. U. S. Geological Survey, Washington, D. C.

TIDE GATES.—Cohasset, Mass.—A hearing was to be given by the harbor and land commissioners, Boston, Oct. 12, to consider an application for permission to construct tide gates at Little Harbor. Address B. Preston Clark, Cohasset, or Woodward Emery, Chn., Boston.

FIRE ALARM SYSTEM.—Mobile, Ala.—Bids are asked until Oct. 22 for furnishing and installing a complete fire alarm system, including 52 signal boxes, about 35 miles of No. 12 copper wire, etc., as stated in our advertising columns. Cary W. Butt, Chn. Com.; J. C. Bush, Mayor.

TELEPHONE CONDUITS.—Harrisburg, Pa.—The Pennsylvania Telephone Co. has decided to lay the wires in conduits of creosoted wooden pipes made in Norfolk, Va. A new office building will be erected at Walnut St. and Court Ave.; also a new switch board will be established, to cost about $25,000.

LADDER TRUCK AND BOILERS.—New York, N. Y.—Bids are asked until Oct. 26 for furnishing one Haye's extension ladder truck and fire escape and for repairing 10 steam fire-engines, to be furnished with new Fox sectional water-tube boilers, etc. John J. Scannell, Fire Comr., 157 East 67th St.

CONTRACT PRICES.

LAYING WATER PIPE.—Boston, Mass.—The Metropolitan Water Board, 3 Mount Vernon St., Boston, received the following bids Sept. 15 for laying cast-iron water pipe in Revere and Saugus; the contract was awarded Mirick & Wentworth; Ch. Engr., Frederic P. Stearns:

Bids Received at Boston, Mass., Sept. 15, 1898, for Laying Cast-iron Water Pipe in Revere and Saugus.

Bidder.	Laying cast-iron pipe, 16-in., 19,200 lin. ft.	Laying cast-iron pipe, 4-in., for blw-offs, 200 lin. ft.	Excavation, Rock, Above grade, 25 cu.yds.	Excavation, Rock, Below grade, 10 cu.yds.	Excavation, Earth, Below grade, 10 cu.yds.	Setting air valves, 8, each.	Chambers for valves,* 18, each.	Concrete masonry, 10 cu.yds.	Total.
Mirick & Wentworth, Malden, Mass......	$0.53	$0.40	$3.00	$4.00	$0.50	$2.50	$40.00	$5.00	$11,166
Michael Russo, Boston, Mass............	.55	.50	3.00	3.00	.80	3.00	35.00	5.00	11,477
O'Rourke & Nelson, Boston, Mass........	.65	.25	2.00	3.50	.50	1.50	20.00	2.50	13,017
Bruno & Salomone, E. Boston, Mass......	.64	.30	2.50	2.50	.60	3.00	30.00	4.50	13,051
The C. H. Eglee Co., Boston, Mass.......	.68	.68	3.50	5.00	1.00	3.00	40.00	6.00	14,144
C. W. Snyder & Son, Dayton, O.	.69	.50	4.00	5.00	.80	2.50	33.00	6.00	14,180
Chas. G. Craib, Winthrop, Mass..........	.70	.25	6.00	6.00	1.00	3.00	35.00	6.00	14,424
Richard Falvey, Somerville, Mass........	.73	.40	3.00	3.00	.60	3.00	25.00	4.50	14,726
D. F. O'Connell, Boston, Mass...........	.75	.50	4.00	8.00	1.25	3.00	45.00	6.00	15,587
L. A. Taylor, Worcester, Mass...........	.85	.30	3.00	3.00	.60	3.00	25.00	5.00	17,015

*Less than 20 ins. diameter and air valves.

DREDGING.—Wilmington, Del.—Gen. W. F. Smith, U. S. Engr., received the following bids Oct. 10, 1898, for dredging a channel 100 ft. wide and 18 ft. deep from mouth of the Christiana River to the Delaware Pulp Works, and dredging will continue further up the river as far as the appropriation of $205,000 from the last Congress will permit:.

Bidder.	Dredging, a cu.yd.	Capacity of plant, cu.yds. a day.	Work, To begin in days.	Work, To be completed.
Am. Dredging Co., Philadelphia*	$0.171	5,000	20	Aug. 31
Rittenhouse-Moore Co., Mobile.†	.18	6,000	60	June 30
Internat'l Cont'g Co., Syracuse*	.1499	4,000	15	Oct. 1.
Atlas Dredg. Co., Wilmington.*	.178	4,000	30	Oct. 1.
N. Y. Dredging Co., New York§	.12⅗	3,500	60	......
Baltimore (Md.) Dredging Co.*	.18	4,000	30	Oct. 1.
Sanford & Brooks Co, Baltimore‡	.195	.....	60	June 30
Simon Hess, New York*.......	.1428	3,500	30	Nov. 1
Removing Rock.				
Chas. W. Johnson, Lewes, Del.	13.45	.....	30	Sept. 30
Simon Hess, New York.......	20.00	25	60	July 1.
H. T. Dunbar & Co., Phila.‖..	11.83	30	30	July 1.
P. Sanford Ross, Jersey City...	14.70	..	30	Sept. 15
Isaac T. Brown, New York.....	13.45	25	30	Nov. 1.
Internat'l Cont'g. Co., Syracuse	19.00	25	30	July 1.
J. J. Fitzpatrick, Plattsburg, N.Y.	7.13	..	30	July 1.

*Measured in place; material to be deposited behind dikes along banks of Christiana. †Material to be thrown ashore. §Material to be deposited on Christiana marshes. ‡Material to be deposited on adjacent low lands or towed away. ‖$10.83 if a depth of 18.5 ft. is reached.

CEMENT.—Fort Washington, D. C.—The following bids were opened Oct. 10, 1898, by Lieut.-Col. Chas. J. Allen, U. S. Engr., Washington, D. C., for furnishing 2,000 bbls. of Portland, and 11,000 bbls. natural cement at Fort Washington, D.C.; (1) natural cement, (2) Portland cement: New York & Rosendale Cement Co., New York—(1) Brooklyn Bridge brand, 69¾ cts. a bbl.; Lawrenceville Cement Co., New York—(1) Beach brand, 68 cts.; Maryland Cement Co., Baltimore, Md.—(2) Toltec brand, $2.15 a bbl.; Jas. H. McGill, Washington—(2) Atlas brand, $2.74.

DAM.—Columbus, O.—The following bids were received Oct. 3, in response to a second call for constructing the dam for a storage reservoir, and for furnishing cement for the same (should the city decide to buy it and furnish it to contractors); the first bids received for this work were published in our issue of Sept. 22:

Bids Received at Columbus, O., Oct. 3, 1898, for Construc tion of Dam for Storage Reservoir.

Quantities.	W. H. Luchtenberg, Columbus, O.	S. Carparis, Columbus, O.	J. Westwater, Columbus, O.	H. Karg, Fostoria; J. Whissel, Lancaster, Pa.	Assurance Construction Co., New York.	Fred M. Hooves Columbus, O.	Cleveland (O.) Contracting Co.	Willard & Cornwell, Louisville, Ky.	Greenville (O.) Construction Co.
Dry earth excavation .... 5,000 cu. yds.	$0.30	$0.30	$0.25	$0.20	$0.25	$0.30	$0.20	$0.24	$0.50
Wet earth excavation .... 3,500 " "	1.10	1.50	.75	1.00	1.30	1.00	.80	1.25	.80
Rock excavation .... 1,200 " "	1.10	1.50	.75	1.10	2.00	1.00	1.00	.80	1.50
Concrete mas'ry, cmt & labor. 20,000 " "	4.58	5.10	6.00	4.50	4.75	4.96	4.75	4.60	5.20
Without cement	2.48	2.20	3.50	2.35	2.20	2.06	3.50	2,45	3.60
Total, without cement	$56,270	$52,550	$74,810	$52,820	$54,200	$47,000	$75,000	$55,535	$79,100

Cement.—Pennsylvania Fuel Co., Columbus, "Bull Dog," in sacks, $2.15 a bbl.; imported, in barrels, $2.85. Standard Silicia Cement Co., 66 Maiden Lane, New York, in bbls., $2.34; in bags, $2.19. E. C. Stitt, Columbus, in paper sacks, $2.18. J. P. Carlisle, Columbus, $2.45 a bbl.; in cloth bags, $2.20; paper bags, $2.25. Acme Paving Co., Atlas, in bbls., $2.20; in cloth bags, $2.00; imported Largerdorfer, in bbls., $2,75, for 1899 delivery only.

IRON BRIDGE BEAMS.—Boston, Mass.—The following bids were received Oct. 6, 1898, by the Massachusetts State Highway Board for furnishing iron beams for bridges in the towns of Buckland, Brookfield, Lunenburg and Warren; contract awarded Walsh Boiler & Iron Works; Secy., A. B. Fletcher:

Bidder.	Towns, Buckland, cts.	Brookfield, cts.	Lunenburg, cts.	Warren, cts.
N. J. Steel & Iron Co.,Trenton	3.24	3.17	3.29	3.19
Walsh B. & I. Wks., Springfield	2.5	2.4	2.5	2.3
Wr't Iron Bridge Co.,Canton,O.	3.5	3.5	3.5	3.5
King Bridge Co., Cleveland, O.	4.1	4.0	4.2	4.0
Boston (Mass.) Bridge Works..	3.6	3.6	3.9	3.6
Berlin Iron Bridge Co.,E.Berlin	4.0	3.52	5.0	3.5
Massillon (O.) Bridge Co......	3.5	3.5	3.5	3.5

ASPHALT PAVING.—New Orleans, La.—The following bids were received Oct. 10 for asphalt paving in Canal St.; A. C. Bell, Cy. Engr., is visiting several of the cities in which Belden & Seely have laid asphalt pavements, he will be away about two weeks:

Bids Received at New Orleans, La., Oct. 10, 1898, for Asphalt Paving in Canal St.

Quantities.		S. W. Alcatraz Asphalt & Const'n Co.	Ayers Asphalt Co.	Barber Asphalt Co.	Belden & Seely.
Canal St., from Delta to Liberty—Roadway:					
Asphalt	42,000 sq. yds.	$2.49	$2.23	$2.10	$2.10
Concrete gutter bottom	100 cu. yds.	1.25	1.75	1.26	1.25
Old curbing relined and reset	7,000 lin. ft.	.10	.14	.12	.10
Cypress lumber, per M ft.	25,000 ft. B.M.	14.00	17.00	15.00	14.75
Bricks, per M	60,000	15.00	16.00	16.00	14.50
Cast iron, per lb.	50,000 lbs.	.02	.02	.02	.01¾
12-in. pipe	2,300 lin. ft.	.36½	.50	.64	.40
18-in. “	1,000 “ “	.61½	.74	.99	.65
20-in. “	1,000 “ “	.76½	1.27	1.15	.80
24-in. “	900 “ “	.97½	1.49	1.41	1.00
30-in. “	1,600 “ “	1.77	2.60	2.56	1.90
36-in. “	500 “ “	2.73	4.10	3.75	3.00
Concrete in catchbasins, etc., a cu. yd.		4.00	4.75	4.25	4.25
New curb, a sq. ft.		.40	.45	.45	.45
Wheel guards, each		7.50	7.50	9.50	8.00
Total		$114,949	$107,911	$102,353	$98,949
Canal St., from Delta to Liberty—Neutral ground:					
Asphalt	21,000 sq. yds.	$2.15	$1.98	$1.85	$1.70
Belgian blocks	1,000 “ “	3.50	3.25	2.50	2.70
Gutter bottom	90 “ “	1.25	1.75	1.26	1.25
Cast iron, per lb.	12,000 lbs.	.02	.02	.02	.01¾
3-in. pipe, a lin. ft.	1,000 lin. ft.	.20	.15	.06	.20
12-in. “ “		.38	.50	.64	.50
24-in. “ “		.97½	1.49	1.41	1.25
30-in. “ “		1.77	2.60	2.56	1.90
Concrete, a cu. yd.		4.00	4.75	4.25	4.25
New curbing, a sq. ft.		.40	.45	.45	.45
Old curbing relined and reset, a lin. ft.		.10	.14	.12	.10
Cypress lumber, per M ft.		14.00	17.00	15.00	14.75
Wheel guards, each		7.50	7.50	9.50	8.00
Total		$49,203	$45,378	$41,763	$38,923

Canal St., from Delta to Liberty—Neutral ground, vitrified brick:		Belden & Seely.
Vitrified brick	21,000 sq. yds.	$2.50
Belgian blocks	1,000 “ “	2.90
Gutter bottom	90 “ “	1.25
Cast iron	12,000 lbs.	.02
3-in. pipe	1,000 lin. ft.	.20
6-in. “ a lin. ft.		.30
8-in. “ “		.40
12-in. “ “		.50
24-in. “ “		1.25
30-in. “ “		2.00
Concrete, a cu. yd.		4.00
New curbing, a lin. ft.		.45
Old curbing relined and reset, a lin. ft.		.10
Cypress lumber, per M ft.		14.75
Wheel guards, each		8.00
Total		$55,953

ASPHALT PAVING—Louisville, Ky.—The board of public works received the following bids Sept. 28, 1898, for asphalt paving in Oak and 26th Sts.; total cost, about $100,000; Southwestern Alcatraz & Construction Co. were awarded the contract:

Bidder.	Guarantees 5 yrs.		10 yrs.	
Breckinridge Asphalt Co...	$15.00	No. 1.	$17.76	No. 1.
	15.00	“ 2.	17.76	“ 2.
S.-W. Alcatraz & Cnstn Co.	18.00	“ 1.	24.00	“ 1.
	17.00	“ 2.	23.00	“ 2.
Barber Asphalt Paving Co.	18.70	“ 1.	23 50	“ 1.
	17.70	“ 2.	23.50	“ 2.
Assyrian Asphalt Co.......	18.50	“ 1.	24.31	“ 1.
	17.83	“ 2.	22.46	“ 2.

BRICK PAVING.—Scranton, Pa.—The following bids were received Sept. 29, 1898, for 5,415 sq. yds. of brick paving on 6-in. gravel or broken stone foundation; Cy. Engr., Jos. P. Phillips:

Items.	George McDonald, Newark, N. J.	Alcatraz Paving Co., Philadelphia, Pa.	Mears & Flynn, Scranton.
Brick paving, a sq. yd.	$1.69	$1.42	$1.64
4×24-in. straight curb, a lin.ft	.69	.47	.56
With tile drain, a lin.ft.	.85	.62	.68
4×24-in. circul'r curb, a lin.ft	1.00	.95	.85
With tile drain, a lin.ft.	1.15	1.10	.97
Redressing curb, a lin. ft.	.30	.10	.37

BROKEN STONE.—Fort Washington, D. C.—Bids were opened Oct. 10, 1898, by Lieut.-Col. Chas. J. Allen, U. S. Engr., for delivering broken stone at Fort Washington, as follows; (1) coarse broken stone, (2) fine broken stone; (3) granolithic broken stone: Chas. G. Smith & Son, Washington, D. C.—(1) $1.32 a cu. yd., (2) $1.32, (3) $1.32; Washington & Potomac River Iron & Land Co., Washington.—(1) $1.24 a cu. yd., (2) $1.19, (3) $1.00.

FILTRATION BEDS.—Concord, Mass.—The following bids were received Sept. 24 for preparing sewage filtration beds for the system in this city; J. W. Maskill was awarded contract; Engr., Leonard Metcalf, 89 State St., Boston:

Bids Received at Concord, Mass., Sept. 24, 1898, for Filtration Beds.

Bidder.	Grubbing, 4 acres.	Excavation Rock, 10 cu.yds.	Excavation Earth, 5,000 cu.yds.	Brick mas'ry, 16 cu.yds.	Paving, 75 sq.yds.	Underdrains, lin.ft.	Distribution pipes, 1,600 lin.ft.	Total.
J. W. Maskill, 164 Broadway, Everett, Mass.	$33.00	$1.25	$0.19	$11.00	$0.35	$0.17	$0.11	$1,473
Charles McDermott & Son, 388 Pleasant St., Brockton	80.00	4.00	.16	10.00	.75	.50	.12	1,568
David Hall, Littleton, Mass.	85.00	.25	.20	11.00	.50	.09	.12	1,748
C. W. Prescott, Concord, Mass.	80.00	1.00	.25	9.75	.50	.05	.08	1,902
A. H. Stowell and John Ben, Highlandville, Mass.	80.00	.24	.24	12.00	2.00	.10	.10	2,024
A. E. Weaving, Dorchester; Henry Stupney, Crescent Beach	75.00	2.00	.25	11.50	2.00	.05	.15	2,144
J. J. Braithwaite, Southboro, Mass.	195.00	1.40	.21	10.50	.60	.06	.06	2,153
T. W. Kinser & Sons, 610 Tremont Bldg., Boston	250.00	1.00	.40	12.00	1.50	.25	.15	3,555

SEWERS.—Sheboygan, Wis.—C. U. Boley, Cy. Engr., writes us that the following bids were received Oct. 1, 1898, for constructing certain sewers; contract awarded to Hackworthy Construction Co.:

Quantities.				R. Nommensen, Sheboygan.	Hackworthy Const'n Co., Appleton.	Wm. Schaetzer, Sheboygan.
Brick	42-in;	depth, 8 ft.	943 ft.	$2.75	$2.73	$2.90
	36-in.;	“ 9 “	400 “	2.40	2.38	2.58
	30-in.;	“ 15 “	2,212 “	2.40	2.38	2.35
Pipe.	18-in.;	“ 12.3“	1,379 “	1.00	.88	1.30
	15-in.;	“ 11.3“	2,049 “	.80	.69	.95
	12-in.;	“ 10 “	1,739 “	.60	.58	.75
Manholes, each			47	25.00	24.00	22.00
Total				$14,099	$13,555	$15,055

Note.—The 42-in. and 36-in. sewers are in dry sand; the 30, 18, 15, and 12-in. sewers are in sandy soil with quicksand and water below.

ASPHALT PAVING.—Chicago, Ill.—Press reports state that the following lowest bids were received by the commissioner of public works Oct. 15, 1898, for asphalt paving in about 39 miles of streets: Bermudez Asphalt Co.—Oak St., $1.65 a sq. yd.; highest bid for same work, $2.37; Schiller St., lowest bid, $1.69; highest, $2.60; Turner Ave., lowest bid, $1.67; highest, $2.65; West Van Buren St., lowest bid, $1.87; highest, $2.65. The Bermudez Asphalt Co. is the lowest bidder in all the figures given, and gives a 10-years' guarantee. Total, about $500,000. L. E. McGann, Comr., is quoted as stating that these are the lowest bids for asphalt paving ever received in Chicago.

GRANITE BLOCK PAVING.—Cincinnati, O.—The following bids were received Oct. 5 for granite block paving in Delhi Ave., from West 6th St. to Garfield Ace.; Ch. Engr., Thos. B. Punshon; Pres. Bd. City Affairs, A| B. Rattermann; Asst. Clk., Jno. D. Harris:

Bids Received at Cincinnati, O., Oct. 5, 1898, for Granite Block Paving in Delhi Ave.

Bidder.	Broken stone, 200 cu.yds.	Concrete, 1,150 c. yds.	Crossings, 350 lin.ft.	Curbs, 5,120 lin.ft.	Curb, circular, 100 lin.ft.	Grading, 6,000 c.yds.	Granite, 6,900 sq.yds.	Rolling, 6,900 sq.yds.	Repvg granite, 30 sq.yds.	Total.
W. Fogarty, 2550 Burnet Ave.	$0.01	$2.40	$0.72	$0.82	$1.27	$0.01	$2.35	$0.03	$0.01	$23,822
Van Sandt & Meeds, 518 Walnut St.	.01	2.55	.84	.95	1.40	.01	2.66	.02	.50	26,800
J. M. Quill, 1052 Pine st	.01	2.70	.83	.89	1.35	.01	2.47	.03	.01	25,400
Queen City Const'n Co. represented by E.M.Costello	1.00	1.90	1.00	1.00	1.20	.15	2.30	.02	.30	24,892
H. J. Strack, 1128 Dayton St.	.01	2.00	.85	.93	1.45	.01	2.45	.03	.01	24,678
J. W. Sullivan, 3230 Beresford Ave.	.01	2.40	.80	.85	1.35	.18	2.45	.02	.40	25,664
A. J. Henkel & Bros., 621 Main St.	.01	2.87	.90	.90	1.10	.01	2.48	.03	.40	25,727
T. Evans, 1228 Ida St.	.01	1.55	.75	.85	.01	.01	2.60	.03	.01	24,607
McCarren & Dowson, Cincinnati, O.	.54	2.50	.84	1.05	1.37	.01	2.59	.03	.50	26,943
D. Folz Asphalt Paving Co., 8th and Plum Sts.	1.50	2.60	.85	.92	1.50	.10	2.45	.04	.60	26,247
F. Folz, 134 East Court St.	.01	3.00	.01	.99	.01	.01	2.35	.03	.01	25,008
A. J. Wellmann, 2841 Stanton Ave.	1.00	2.30	.85	1.05	1.00	.01	2.50	.02	.01	26,067
J. A. Eberhardt, 19 and 20 Wiggins Block	1.25	2.50	.80	.87	1.50	.20	2.43	.04	.50	26,267

ROAD ROLLER.—Sheboygan, Wis.—We are informed that the following bids were received Oct. 1, 1898, for furnishing a 28,000-lb. steam road roller, f. o. b. Sheboygan, as advertised in Engineering News; Cy. Engr., C. U. Boley:

O. S. Kelly Co., Springfield, O.	$3,250*
Russell & Co., Massillon, O.	2,500
Optenburg & Sonnenmann, Sheboygan, Wis.	3,250†
Buffalo Pitts Co., Buffalo, N. Y.	3,300

*30,000-lb. roller, $3,350; 33,000-lb., $3,450; 35,000-lb., $3,500; 37,000-lb., $3,700. †Steam steering gear; $3,050 for hand steering gear.

ASPHALT PAVING.—Denver, Colo.—The contract for paving in Champa St. with Alcatraz asphalt is reported to have been let to the Denver Paving Co. at $1.98; total, $71,219.

ASPHALT PAVING.—Kansas City, Mo.—The Barber Asphalt Paving Co., New York, has been awarded the contracts for about 50,000 sq. yds. of asphalt paving in 8 streets at the following prices: 10-year guarantee, $1.85 a yd., $2.24, $2.34; 5-year guarantee, $2.12 a yd.

STATE HIGHWAYS.—Boston, Mass.—The Massachusetts State Highway Commission, 3 Mount Vernon St., Boston, awarded the following contracts Oct. 13, 1898, for building highways in certain towns; Secy., A. B. Fletcher, Boston: North Reading, Mass.—Contract awarded to C. H. Kelleher, Newburyport, Mass.: Excavation, 2,100 cu. yds., 25 cts. a cu. yd.; ledge excavation, 20 cu. yds., $2.00; rubble masonry—laid dry, 42 cu. yds., $4.50 a cu. yd.; laid in cement, 22 cu. yds., $8.00; gravel, 300 cu. yds., 45 cts.; Telford, 100 sq. yds., 20 cts. a sq. yd.; shaping, 6,274 sq. yds., 2 cts.; broken stone, in place, 1,506 tons, $1.30 a ton; 12-in. vitrified clay pipe, 30 lin. ft., 60 cts. a lin. ft.; fencing used as guard rail, 1,070 lin. ft., 20 cts.; side drains, 500 lin. ft., 35 cts.; stone monuments, 8, each $1.50; total, $3,587. Chelmsford.—Awarded to C. H. Kelleher, Newburyport: Excavation, 2,200 cu. yds., 25 cts. a cu. yd.; ledge excavation, 10 cu. yds., $2.00; rubble masonry—laid dry, 15 cu. yds., $5; laid in cement, 10 cu.yds.,$8; gravel 600 cu.yds.,45 cts.; Telford, 100 sq. yds., 30 cts. a sq. yd.; shaping, 11,592 sq. yds., 2 cts.; broken stone, in place, 3,043 tons, $1.90 a ton; 12-in. vitrified clay pipe, 50 lin. ft., 60 cts. a lin. ft.; fencing used as guard rail, 100 lin. ft., 20 cts.; side drains, 100 lin. ft., 20 cts.; stone monuments, 19, each $1.00; 10-in. vitrified clay pipe, 50 lin. ft., 50 cts. a lin. ft.; catchbasins, 1, $20.00; total, $7,173. Merrimac.—Awarded to M. Cashman, Newburyport: Excavation, 150 cu. yds., 32 cts., a cu. yd.; excavation, borrow, 1,000 cu. yds., 40 cts.; ledge excavation, 30 cu. yds., $1.50; rubble masonry—laid dry, 17 cu. yds., $3.00; laid in cement, 11 cu. yds., $5.00; gravel, 600 cu. yds., 60 cts.; Telford, 100 sq. yds., 40 cts. a sq. yd.; shaping, 3,705 sq. yds., 1¾ cts.; broken stone, in place, 890 tons, $1.35 a ton; 12-in. vitrified clay pipe, 30 lin. ft., 50 cts., a lin. ft.; fencing used as guard rail, 50 ft., 23 cts.; side drains, 800 lin. ft., 22 cts.; stone monuments, 9, each 75 cts.; total, $2,475. Extra work at following prices; materials at cost: Foreman, 40 cts, an hour; masons, 35 cts.; mason's helpers, 20 cts.; laborers, 16⅔ cts.; double teams and drivers, 45 cts.; single teams and drivers, 30 cts.; side drain extensions, 20 cts. a lin. ft.

STATE HIGHWAY.—Boston, Mass.—The Massachusetts State Highway Commission, Boston, awarded the following contracts for building state highways in Northboro, Sept. 22, 1898, and in Hadley and Walpole, Mass., Sept. 29, 1898; Secy., A. B. Fletcher: Northboro.—Fred. E. Ellis, Melrose: Excavation, 2,060 cu. yds., 40 cts.; ledge excavation, 150 cu. yds., $1.00; rubble masonry laid dry, 21 cu. yds., $6.00; rubble masonry laid in cement, 14 cu. yds., $9.00; gravel, 500 cu. yds., 45 cts.; Telford, 100 sq. yds., 30 cts.; shaping, 9,040 sq. yds., 2 cts.; broken stone in place, 2,170 tons, $1.20; 12-in. vitrified clay pipe, 30 lin. ft., 80 cts.; fencing used as guard rail, 120 lin. ft., 30 cts.; side drains, 100 lin. ft., 30 cts.; stone monuments, 22, each $1.50; total, $4,389. Hadley.—A. J. Wellington, Boston: Excavation, 460 cu. yds., 50 cts.; excavation borrow, 600 cu. yds., 60 cts.; ledge excavation, 10 cu. yds., $4.00; rubble masonry laid dry, 10 cu. yds., $6.00; rubble masonry laid in cement, 10 cu. yds., $12.00; gravel, 300 cu. yds., 80 cts.; Telford, 100 sq. yds., 50 cts.; shaping, 5,717 sq. yds., 2 cts.; broken stone in place, 1,470 tons, $2.20; 12-in. vitrified clay pipe, 30 lin. ft., 70 cts.; fencing used as guard rail, 100 lin. ft., 25 cts.; side drains, 500 lin. ft., 50 cts.; stone monuments, 13 each, $1.50; total, $4,764. Walpole.—John J. Falvey, Somerville: Excavation, 2,570 cu. yds., 30 cts.; excavation, borrow, 200 cu. yds., 30 cts.; ledge excavation, 10 cu. yds., $2.00; rubble masonry laid dry, 110 cu. yds., $3.00; rubble masonry laid in cement, 36 cu. yds., $6.00; gravel, 100 cu. yds., 35 cts.; Telford, 100 sq. yds., 35 cts.; shaping, 11,525 sq. yds., 2 cts.; broken stone in place, 2,766 tons, $1.28; 12-in. vitrified clay pipe, 106 lin. ft., 60 cts.; fencing used as guard rail, 550 lin. ft., 20 cts.; side drains, 750 lin. ft., 30 cts.; stone monuments, 20, each, $1.50; total, $5,667.

STATE HIGHWAYS.—Newburyport and South Hadley, Mass.—The Massachusetts State Highway Commission, Boston, awarded the following contracts Oct. 6, 1898, for constructing highways in Newburyport and South Hadley, Mass.; Secy., A. B. Fletcher: Newburyport—Michael Cashman, Newburyport—Excavation, 98 cu. yds., 17 cts. a cu. yd.; ledge excavation, 40 cu. yds., 10 cts.; rubble masonry laid dry, 32 cu. yds., $2.50; rubble masonry laid in cement, 32 cu. yds., $3.50; gravel, 600 cu. yds., 29 cts.; Telford, 100 sq. yds., 40 cts. a sq. yd.; shaping, 10,732 sq. yds., 1 ct.; broken stone, in place, 2,760 tons, $1.00; 8-in. vitrified clay pipe, 25 lin. ft., 25 cts. a lin. ft.; fencing used as guard rail, 100 lin. ft., 23 cts.; side drains, 300 lin. ft., 20 cts.; stone monuments, 23, each 50 cts.; catchbasins, 2, each $26.00; 18-in. cast-iron pipe, 60 lin. ft., $1.60; total, $3,693. South Hadley.—Amos D. Bridge, Hazardville, Conn. —Excavation, 400 cu. yds., 20 cts. a cu. yd.; excavation, borrow, 300 cu. yds., 50 cts.; ledge excavation, 10 cu. yds., $1.40; rubble masonry—laid dry, 10 cu. yds., $3.75; laid in cement, 10 cu. yds., $6.00; gravel, 350 cu. yds., 60 cts.; Telford, 10 sq. yds., 60 cts. a sq. yd.; shaping, 7,063 sq. yds., 2½ cts.; broken stone, in place, 1,818 tons, $1.90 a ton; 12-in. vitrified clay pipe, 30 lin. ft., 70 cts. a lin. ft.; fencing used as guard rail, 100 lin. ft., 15 cts.; side drains, 100 lin. ft., 22 cts.; stone monuments, 6, each $1.50; total, $4,255.

ELECTRIC LIGHTING.—Philadelphia, Pa.—The following bids were received by the director of public safety, Oct. 4, 1898, for arc lighting for 1899: The Brush Co., which lights the center of the city, and has by far the greatest number of lights, bids for its pole lines, south of Pennsylvania Ave., 30 cts. a light a night; north of Pennsylvania Ave., 31½ cts.; for light supplied through the city's underground cables, 29 cts., and for service on its own cables, 32 cts. The Powelton Electric Co., whose lines cover the district west of the Schuylkill, 32 cts. for its overhead lines, and 29 cts. when supplied over the city's cables. The Manufacturers' Electric Co., which operates between Susquehanna Ave. and Lehigh Ave., east of Broad St., 33 cts. for overhead lines, 29 cts. over the city's cables; 512 lights. The Diamond Electric Co., operating between Montgomery Ave. and Tioga St., 33 cts. for its overhead lines, and 29 cts. for lights supplied over the city's cables; 510 lights. The Suburban Electric Co., supplying 543 lights in the 23d and 35th Wards, 35½ cts. for overhead lines. The Wissahickon Electric Light Co., supplying 189 lights in Manayunk, Wissahickon, Roxborough and Falls of Schuylkill, 34 cts. for overhead lines. The Germantown Electric Light Co., supplying Germantown and Chestnut Hill, 35¼ cts. The Cheltenham Electric Light & Power Co., competing for the eastern portion of the 22d Ward in competition with the Germantown company, 36 cts. for overhead lines; 33 cts. when using the city's cables, and 39 cts. for lights supplied over cables controlled by the bidder. The Kensington Electric Light Co., with 650 arc lights, 34 cts. for overhead wires. The Southern Electric Light Co., operating south of South St. to Washington Ave., 30½ cts.; south of Washington Ave., and between the two rivers, 32 cts., all for overhead lines; when using city cables, 29 cts. This year the company supplies 1,251 lights.

SAND AND PEBBLES.—Fort Washington, D. C.—Bids for delivering sand and pebbles at Fort Washington, D.C., were opened by Lieut.-Col. Chas. J. Allen, U. S. Engr., Washington, Oct. 10, 1898, and were as follows; (1) pebbles, (2) sand: Henry Wells, 1210 G St., N. W., Washington, D. C.—(1) 93 cts. a cu. yd.; W. A. Richards, 21 N St., N. W., Washington, D. C.—(1) 99 cts., (2) 88c. a cu. yd.; John B. Lord, 17th St. wharf, Washington, D. C.—(1) 90 cts., (2) 80 cts.

PIPE SEWERS.—Albany, N. Y.—The following contracts were let Oct. 17, 1898, for laying vitrified pipe sewers: Second St.—Contract let to Michael F. Dollard: 15-in. pipe sewer, 40 lin. ft., $1.35 a lin. ft.; 12-in., pipe sewer, 748 lin. ft., $1.32; 12-in. square box, 100 ft., 68 cts.; 6-in. pipe sewer, 1,090 lin. ft., 12 cts.; 12-in. Y's, 70 ft., $2.94; manhole, $40.00; lamphole, $12.50; trenches, 1,090 lin. ft., 45 cts. a lin. ft.; 6-in. bends, 68 ft., 40 cts.; total, $2,016. Third, Thornton and Judson Sts.—Awarded to John Doyle, Albany; 15-in. pipe, 337 lin. ft., $2.25 a lin. ft.; 12-in. pipe, 483 lin. ft., $2.00; 12-in. square wooden box, 127 ft., $1.25; 6-in. pipe, 982 lin. ft., 20 cts.; 15-in. Y's, 22 ft., $4; 12-in., 45 ft., $3; manholes, 2, each $65; lamphole, $20; trench, 982 lin. ft., 70 cts. a lin. ft.; 6-in. bends, 67 ft., 50 cts.; total, $3,173.

LEVEE WORK.—Dayton, O.—The following bids were received Oct. 3 for enlarging the Riverdale levee from Main St. to River St., etc.:

Bids Received at Dayton, O., Oct. 3, 1898, for Enlarging the Riverdale Levee.

Bidder.	Stone masonry Old, 472 perches.	Stone masonry New, 200 perches.	Slope-wall masonry, 77 perches.	F'ndat'n timber, 30,887 ft. B.M.	Filling, 13,720 cu. yds.	Lump bid. Filling.	Lump bid. Masonry, etc.	Total.
Geo. R. Hively	$7.00	$4.00	$3.00	$20.00	$0.16¾	$2,308	$4,953	$7,261
E. Brentlinger	6.40	6.40	3.00	15.00	.24½	3,361	4,995	8,357
Bruno Ritty	6.50	6.50	4.00	20.00	...	.....	5,294	.....
O'Connor & Kirchner	8.00	3.00	4.00	25.00	.24½	3,361	5,456	8,818
Armantrout & Spohr.	...	...	...	.....	.15½	2,127	.....	.....
Reid & Co.	...	...	...	.....	.17½	2,401	.....	.....
David Beard	...	...	...	.....	.23½	3,224	.....	.....

IRRIGATION CANAL—Salt Lake City, Utah.—The letting of the contract for building the dam of the Davis and Weber Counties Canal Co. was noted in our issue of Sept. 1. Since then the Andrews Bridge Co., of Salt Lake City, has withdrawn from the contract, and Perham Bros. & Parker, of Montana, have signed the bonds for the contract and are actively at work. Following are the contract prices: Excavating and placing rock in the body of the dam and face wall, 80 cts. a cu. yd. in place; funnel, $8 a cu. yd. excavated; asphalt concrete, $10 a cu. yd.; Portland cement concrete, $8 a cu. yd.; rough rubble masonry in cement mortar, $10 a cu. yd. The steel core and other work was let in a lump sum. The total amount of the contract is $27,910. The dam is located in a solid rock gorge, 52 ft. between walls at the bottom and 90 ft. at the top, and it is to be 68 ft. high.

LEVEE WORK—Port Allen, La.—Donovan & Daley submitted the lowest bid, Sept. 21, 1898, at 22.90 cts. a cu. yd., for constructing the Allendale levees, in West Baton Rouge. The bids were rejected.

LEVEE WORK—New Orleans, La.—The following bids were received by the U. S. Engineers, Sept. 22, 1898, for levee work in the districts of Lafourche and Atchafalaya: Lafourche Levee—Hymella to Killona—Hayes & Bros., 11.75 cts. a cu. yd.; Donovan & Daley, 12.70 cts.; J. A. Andrews & Sons, 15.50 cts. Pelican to Flagtown—Hayes & Bros., 12.75 cts.; Donovan & Daley, 16.90 cts.; J. A. Andrews & Sons, 16 cts. Lone Star—Hayes & Bros., 18 cts.; J. A. Andrews & Sons, 23 cts. Louisa—Hayes & Bros., 16 cts.; Donovan & Daley, 13.90 cts.; J. A. Andrews & Sons, 14 cts. Coopersville—Hayes & Bros., 18 cts.; Donovan & Daley, 17 cts.; J. A. Andrews & Sons, 14.75 cts. Atchafalaya Levee—Hermitage—B. O'Brien, 33 cts.; Donovan & Daley, 35 cts. Beaulieu to Antonio—M. L. Linan, 10.97 cts.; Thomas Whelan, 14 cts.; I. R. Bobbit, 13.50 cts.; B. O'Brien, 14 cts.; George Byrne, 12.40 cts.; Donovan & Daley, 13.70 cts.; Hearn & O'Connor, 12.95 cts.; J. A. Andrews & Sons, 19 cts. Missouri—I. R. Bobbit, 14.50 cts.; B. O'Brien, 15 cts.; G. Byrne, 16.50 cts.; Donovan & Daley, 14.90 cts.; J. A. Andrews & Sons, 19.50 cts. Australia—M. L. Linan, 10.95 cts.; G. Bryne, 16.50 cts.; Donovan & Daley, 17.90 cts.; J. A. Andrews & Sons, 16.50 cts.

LEVEE WORK—New Orleans, La.—The following bids were received by the State Engineers, Sept. 23, 1898, for levee work in the Grand Prairie district, etc., (1) being for the Grand Prairie district and (2) for the Rosehill Highland: Thos. B. Cleary (1), 12.90 cts.; M. Michell (1), 13¾ cts.; Geo. Jurgen and P. Lyon (1), 13.75 cts.; Donovan & Daley (2), 16.39 cts.; I. R. Bobbitt (2), 16⅜ cts.; Jos. Hingle, Jr. (1), 11⅓ cts.; Felix S. Hingle (1), 13½ cts.; Cosse & Schavot (1), 11.99 cts.

LEVEE WORK—New Orleans, La.—The U. S. Engineers received the following bids, Sept. 28, 1898, for certain levee work: Esperanza, sections 1 to 4—B. O'Brien, 19.90 cts.; Bush Bros., 23.125 cts. Ashley, sections 1 to 3—John Scott & Sons, 11.36 cts.; H. J. Loonan, 12.70 cts.; Donovan & Daley, 13.70 cts.; B. O'Brien, 13.73 cts.; Bush Bros., 12.74 cts.; Jos. R. Marlou, 11.94 cts. Ashley, sections 4 to 6—John Scott & Sons, 11.36 cts.; Donovan & Daley, 13.70 cts.; B. O'Brien, 12 cts.; Bush Bros., 12.74 cts. Ashley, sections 7 to 10—John Scott & Sons, 11.36 cts; Donovan & Daley, 13.70 cts.; B. O'Brien, 13.98 cts.; Bush Bros., 13.90 cts. Ashley, sections 11 to 13—John Scott & Sons, 11.36 cts.; Donovan & Daley, 13.70 cts.; B. O'Brien, 11.98 cts.; Bush Bros., 12.90 cts.

BRICK PAVING—Erie, Pa.—The following contract has been let to John McCormick & Son for brick paving, etc., in 17th St.: Mack No. 1 plain brick, $1.72 a sq. yd. complete, including grading, foundation and curbing, and $30 each manhole; 30 cts a sq. ft. 6-in. pipe. Other materials: Park No. 1 vitrified, $1.75; Mack, repressed, $1.75, and Canton, repressed, red granite, $1.72.

BRICK PAVING—Toledo, O.—Geo. H. Cole submitted the lowest bid, Oct. 12, 1898, for brick paving in Scott St., at $1.44; total, $3,000. H. J. Jenneson submitted the lowest bid for paving in Oak St. at $1.47 a sq. yd. The high bid on this work was at $2 a sq. yd. Total for Jenneson's bid, $5,000. H. P. Streichen was lowest bidder at $1.34 for the paving of Sixth St., from Main St. to Kelsey Ave.; total, about $5,500.

LEAD PIPE—St. Paul, Minn.—Crane & Ordway have been awarded the contract for furnishing seven tons of lead pipe at $4.50 a 100 lbs.

ASPHALT PAVING—Schenectady, N. Y.—We are informed that the contract for 2,000 sq. yds. of asphalt paving, etc., in Summit Ave. has been let to the Metropolitan Paving & Construction Co., Schenectady, at $2.27½ a sq. yd.; curbing, 60 cts. a ft. The same company has the contract for 14,000 yds. of asphalt paving in Franklin St. at $2.27.

ASPHALT PAVING.—Independence, Mo.—The Columbia Construction Co., Syracuse, N. Y., has been awarded the contract for 8,500 sq. yds. of asphalt paving at $1.85 a sq. yd. Mayor, S. H. Woodson; Cy. Engr., M. Pendleton.

SIDEWALKS.—Toledo, O.—James H. Horan has been awarded contracts by the sidewalk committee of the council for laying plank walks at 23½ cts. a ft. for 6-ft. walks and 15½ cts. for 4-ft. walks. C. Peck & Son were awarded contracts for stone walks at 12⅜ cts. a sq. ft.

BRICK PAVING.—Council Bluffs, Ia.—Wickham & Co. have been awarded the contract for paving certain streets with Council Bluff brick in top and bottom courses at $1.098 a sq. yd.

BRICK AND CEDAR BLOCK PAVING.—Detroit, Mich.—Henry Merdian has been awarded the contract for Trimble brick paving in Second St. at $1.57 a sq. yd.; Liphardt & Winterhalter have the contract for paving in Stanley Ave. with cedar blocks at $1.46 a yd.

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INDUSTRIAL NOTES.

THE OHIO BRASS CO., Mansfield, O., has just opened an office at 39 Cortlandt St., New York, in charge of Mr. R. A. Byrns, formerly with the Walker Co., Cleveland.

THE JEANESVILLE IRON WORKS, Jeanesville, Pa., has an order, according to report, for an electric power mine pump of 600 ft. lift for the Moon Anchor Gold Mining Co., Cripple Creek, Colo.

THE HARRISBURG FOUNDRY & MACHINE WORKS, Harrisburg, Pa., will soon begin work, it is reported, on a large contract for steam engines and boilers for a woolen mill at Tien-Tsin, near Pekin, China.

THE NATIONAL TUBE WORKS CO., McKeesport, Pa., is announced to have contracted to furnish about 35 miles of pipe to the Kentucky Oil & Pipe Line Co., for its new line from Slick Ford to Somerset, Ky.

THE PLAYFORD STOKER CO., Cleveland, O., has the contract for six 250-HP. automatic stokers for the Apollo Iron & Steel Co., Vandergrift, Pa., and for two 250-HP. stokers to be installed in the Allegheny, Pa., water-works.

THE UTICA ELECTRIC MFG. & SUPPLY CO., Utica, N. Y., has a contract from the New York Mills Co., New York Mills, N. Y., for a light dynamo, switchboard and 11 arc and 200 incandescent lamps, according to report.

HALLSTED & McNAUGHER, civil engineers and inspectors of iron and steel for structural purposes, and Robert W. Hunt & Co., associates, have removed their offices from 80 Broadway to the Empire Bldg., 71 Broadway, New York.

THE SNOW STEAM PUMP WORKS, Buffalo, N. Y., has the contract for the pumps for the new Russian battleship, Russian cruiser and the American battleship "Maine." Mr. Lewis S. Silva, 126 Liberty St., New York, is Eastern representative of the company.

WM. B. SCAIFE & SONS, Pittsburg, have the contract to build a new steel frame shop building and other extensions to the plant of the Pennsylvania Car Wheel Co. The firm also has the contract to erect a steel tipple building and engine house for the Washington Coal & Coke Co., near Dawson, Pa.

THE ITHACA GUN CO., Ithaca, N. Y., is reported to have purchased the entire plant of the Wilkesbarre Arms Co., Wilkes-Barre, Pa., manufacturers of the Wilkesbarre and Parry guns, and will move the plant to Ithaca, making the former company's plant, it is said, one of the largest of its kind in the world.

THE RICE & SARGENT ENGINE CO., Providence, R. I., recently supplied to the Brown & Sharpe Mfg. Co., of the same city, a 350-HP. cross-compound condensing Rice & Sargent engine for use in the main machine shop. This engine takes the place of two non-condensing Corliss type engines, built in 1872, and it is claimed that the change will effect a saving of 10 tons of coal a week.

THE CLONBROCK STEAM BOILER CO., Brooklyn, N. Y., has been successful in its suit against Thos. J. Lawler, of the Columbian Steam Boiler Works, for infringement of its patents on the Climax boiler. In an opinion handed down by Judge Thomas in the U. S. Circuit Court for the Eastern District of New York, on Oct. 6, the patents of Morrin & Scott 309,727 and Morrin's patents 463,307 and 463,308 covering the construction adopted in the "Climax" boiler were sustained. The boilers constructed by the Columbian Works for the Brooklyn Edison Co. were declared infringements.

THE DELAWARE ELECTRIC & SUPPLY CO., Wilmington, Del., has the following orders: A 60-HP. boiler and a 25-HP. engine for J. E. Rhoades & Son; two large pumps, several hydrants and two 40-HP. boilers for the water-works at Pocomoke City, Md,; a 15-HP. boiler to go to Hockessin, Del.; a 25-HP. boiler for the Fibre Specialty Co., Hockessin, Del.; 2,150 ft. of 2½-in. fire hose for the Eddystone Mfg. Co., Eddystone, Pa.; 500 ft. of the same for the Jackson & Sharp Co., Wilmington, Del.; 200 ft. of the same for the Diamond Ice Co., and 400 ft. of the same for the Harlan & Hollingsworth Co., Wilmington.

THE FEDERAL STEEL CO., Cleveland, O., is announced in press reports to have completed its organization by the election of its permanent officers and is to establish a large shipbuilding plant in or near New York for the construction of steel merchant vessels and battleships, cruisers and other war vessels. The new company has a capital of $200,000,000, and has been formed by the consolidation of the Minnesota Iron Co., the Illinois Steel Co., the Elgin, Joliet & Eastern R. R. Co. and the Lorain Steel Co. The officers are: Pres., Mr. E. H. Gary, Chicago, and Secy. and Treas., Mr. Richard Trimble, New York.

THE VULCAN IRON WORKS, Chicago, has received orders from the Chicago, Burlington & Quincy R. R. Co. for the steam operating machinery for its new bridge at Quincy, Ill.; from the Chicago & Northwestern Ry. Co. for the gasoline operating machinery and the turntable machinery for its bridge over the Kinnickinnic River, at Milwaukee, Wis., and also from the latter company for the hand-operating machinery and turntable for its bridge at Oshkosh, Wis. The Vulcan Iron Works has about finished seven sluice gates for the Cincinnati Water-Works, and has an order from the city of Chicago for a 7-ft. tunnel-gate.

THE ABENDROTH & ROOT MFG. CO., 28 Cliff st., New York, manufacturers of Root's spiral riveted pipe, reports a number of large orders recently for this pipe for water-works. Among recent shipments are the following: Sheely & O'Shee Co., contractors, Lincoln, Neb., 12,000 ft., which will be used in extending the water-works at Lanesboro, Minn.; about 10,000 ft. to Milledgeville, Ill., and 15,000 ft. to the city of Augusta, Wis. The U. S. Water & Steam Supply Co., contractors, Kansas City, Mo., has placed an order for about 5,000 ft. of pipe to be used at Concordia, Mo., and 6,500 ft. have been ordered by J. L. White, contractor, Wyoming, Ill.

THE KENNEY CO., 72 Trinity Place, New York, reports that the War Department has ordered the installation of 63 Kenney flushometers in the transport "Mohawk," now being overhauled at the Bath Iron Works, Bath, Me. The Navy Department has also given the company a second order for flushometers to be used in its building in Washington, D. C. The company also reports that the Philadelphia Board of Health, after a thorough investigation, has amended the building laws so as to permit the installation of the Kenney system, by which one tank is used to supply one or more water-closets. instead of requiring individual tanks.

THE NEW BRITAIN MACHINE CO., New Britain, Conn., has just furnished two 25-HP. steam engines of the Case type for the United States Government, to be direct connected to C. & C. dynamos. One of the smaller sizes of these engines is now being used at Santiago, Cuba, for driving a search light dynamo on a tug, by means of which the salvage work in charge of Naval Constructor Hobson is being expedited. The company has recently shipped several of its chain saw mortises to the Navy Yard, at Brooklyn, N. Y., and Mare Island, Cal., and at present is engaged in completing an order for similar machines for government dock yards at Devenport and Chatham, England.

THE GOUBERT MFG. CO., New York, manufacturer of the Goubert feed-water heater, states that it is exceedingly busy at present and that it has the following orders: One 3,000-HP. heater for a pulp mill of the New York & Pennsylvania Co.; one 3,000-HP. heater for the Cleveland Ry. Co., Cleveland, O.; one 5,000-HP. auxiliary heater for the Metropolitan St. Ry. Co., New York, making 35,000 HP. now being built for that company alone; a 3,000-HP. heater has just been delivered to the People's Electric Light Co., Newark, N. J. These orders are in addition to regular calls for heaters of smaller sizes, among the latter being 1,000 HP. for the Schenectady Ry. Co., Schenectady, N. Y., and 1,800 HP. for the Citizens' Light & Power Co., Houston, Tex.

THE EDWARD P. ALLIS CO., Milwaukee, Wis., reports that among recent orders are two vertical cross compound direct-connected engines, with cylinders 38 and 76×48, for the Metropolitan West Side Elevated Ry. Co., of Chicago, which company for several years has been using four Allis engines of similar design. The Metropolitan Sewage Commission of Boston has recently ordered three more sewage pumping engines, similar to those supplied the commission during the past few years. The shops of the company are very busy, and among the orders in hand are four pair of vertical cross compound blowing engines with steam cylinders 42 and 80×60, air cylinders 87×60. It is also building two pair of similar blowing engines for the Carnegie Steel Co., with steam cylinders, 5 and 96×60; air cylinders, 100×60. The company states that it has recently had to decline a number of orders offered, as it was unable to meet the delivery desired.

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO., St. Louis, Mo., has removed its general eastern office from Philadelphia to the Washington Life Bldg., New York, in addition to having also just taken more commodious quarters in Philadelphia. The company is making a specialty of crushers and pulverizers for reducing limestone, cement, clinker, phosphate rock, shale, clays, bones, etc., in addition to making a bark mill for tanners and extract manufacturers. The company has recently installed mills in the following plants: Lawrence Cement Co., Siegfried, Pa.; Kelly Island Lime & Transport Co., Kelly Island, O.; Vanner Cement Co., Louisville, Ky.; Portland Cement Co. of Utah, Salt Lake City; Virginia & Carolina Chemical Co., Richmond, Va.; Bradley Fertilizer Co., Boston; Philadelphia and Boston Face Brick Co., Boston; Standard Flint & Spar Co., Frenchtown, N. J., and Cleveland Dryer Co., Cleveland, O. Swift & Co., of Chicago, has just placed orders for three more mills for bone grinding, and the Philadelphia Hydraulic Press Brick Co., Philadelphia, has ordered three pulverizers. The company has also recently sold mills to the following tanners: A. T. Prindle & Co., Hornellsville, N. Y.; J. S. Young Co., Baltimore, Md. (two mills); Smoot & Co., Alexandria, Va. Additions to its works, made necessary by the increasing demand for these machines, have just been completed by the Williams company. The officers are: Pres., Milton F. Williams; Vice-Pres., Hoyt H. Green; Secy. and Treas., Geo. F. Cottrill.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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PERSONAL.

Mr. Clarence Goldsmith, of Andover, Mass., has been appointed Superintendent of the Water-Works system of North Andover.

Mr. Russell Harding, General Superintendent of the Great Northern Ry., it is reported, will soon assume the Vice-Presidency of the Cotton Belt System.

Mr. E. Sherman Gould, M. Am. Soc. C.E., is still in Cuba. His present address is "Hotel Pasaje, Habana, Cuba," instead of "Hotel Inglaterra," as previously noticed.

Mr. Eustace Oxley, formerly with the United States Electric Light Co., Washington, D. C., is now associated with the engineering staff of the General Electric Co., Schenectady, N. Y.

Capt. W. W. Peabody, Vice-President of the Baltimore & Ohio Southwestern Ry., has been forced to retire from active work on account of his eyesight, and will present his resignation.

Lieut.-Colonel John Biddle, M. Am. Soc. C. E., Corps of Engineers, U. S. A., has been ordered to join the First Army Corps, located at Lexington, Ky., to act as chief engineer officer.

Messrs. R. S. Hale, Assoc. M. Am. Soc. M. E., and J. S. Codman have formed a partnership for the practice of steam, electrical and general consulting engineering, with offices at 31 Milk St., Boston, Mass.

Mr. William M. Greene, General Manager of the Baltimore & Ohio R. R. Co., it is reported, will resign on Nov. 1 to become Vice-President and General Manager of the Baltimore & Ohio Southwestern Ry. Co.

Mr. Jesse M. Smith, M. Am. Soc. M. E., consulting mechanical and electrical engineer, of Detroit, Mich., has removed to New York City, and opened an office in the St. Paul Bldg. He will also retain his Detriot office.

Mr. Frank H. Olmstead, of Los Angeles, Cal., who is associated with Mr. J. B. Lippincott, the consulting engineer of the Pasadena Water-Works, received the Republican nomination for City Engineer of Los Angeles.

Prof. Francis B. Crocker, of Columbia University, New York city, President of the American Institute of Electrical Engineers, has started on a tour of the world which, it is expected, will occupy most of a year's leave of absence which has been granted him.

Mr. Chas. F. Walker, of the business department of Engineering News, was married on Oct. 20 to Miss Jennie Van Name Dodd, at the residence of her father, Mr. Marvin Dodd, in East Orange, N. J. Mr. Walker was formerly a student in the School of Mines, Columbia University.

Col. Geo. E. Waring, Jr., late Commissioner of Street Cleaning of New York, arrived at New York, on Oct. 25, on the steamer "Yucatan" from Cardenas and Havana. Colonel Waring was suffering from malaria, but expects to be in Washington in a few days, when he will present to the President his report regarding the means necessary to put Havana in a healthy condition.

Mr. Wm. P. Bates, Superintendent of the J. H. Somers Fuel Co.'s mine No. 2, at Belle-Vernon, Pa., was very seriously injured on Oct. 13 by a land slide at the entrance to the mine. Mr. Bates, in company with his brother, Mr. Albert D. Bates and Mr. Chas. W. Somers, General Manager of the company, started to inspect some improvements at the entrance. Mr. Somers noticed the slide and called to the others. Messrs. Somers and A. D. Bates escaped with slight injury.

OBITUARY.

Mr. Mark M. Cohn, President of the Board of Water Commissioners of Saratoga. N. Y., died at his residence on Oct. 22.

Mr. Wm. H. Case, mining and civil engineer, died at his home in Brooklyn, N. Y., on Oct. 24. Mr. Case was born in New York state April 27, 1841. In 1866 he was graduated from Union College. From that time on he was actively engaged in the practice of engineering in New York and the Southern States.

Capt. Philip Inch, Chief Engineer, U. S. N., who was retired last August, died at Saratoga, N. Y., on Oct. 18, aged 62 years. His appointment to the navy was from the District of Columbia on Nov. 21, 1857. He became a chief engineer in 1863. At the time of his retirement he was the senior officer of the Engineer Corps of the Navy.

Mr. Louis De Blois Bartlett, of Fitchburg, Mass., died suddenly on Oct. 19. Mr. Bartlett was born in 1825, at Marblehead, and started his career of mechanical engineering under the late Otis Tufts, of Boston. In 1859 he moved to Fitchburg, Mass., where he became successively director, treasurer and president of the Putnam Machine Co. In 1885 he retired from the company.

Mr. Horace B. Miller, formerly President and General Manager of the "American Machinist," died on Oct. 25, at Napa, Cal. Mr. Miller was born in Philadelphia about 60 years ago. In partnership with Messrs. Jackson and Bailey he founded the "American Machinist," of which he was president and general manager for 16 or 17 years. Later he sold out his interest and went to New Mexico for his health.

Mr. John H. Dialogue, of Camden, N. J., senior member of the firm of Dialogue & Son, iron shipbuilders. died at his home in Camden on Oct. 23, after a brief illness. He was born in Philadelphia, Pa., in 1828. In 1850 he started a small machine shop in Camden, which grew to its present proportions as a result of his untiring industry. The firm has within recent years built many government craft, the latest vessel being the "Princeton."

Mr. Frank C. Doran, M. Am. Soc. C. E., died on Oct. 15 at his home at Englewood, Ill. Mr. Doran was born in Eastern Indiana in 1850. His first engineering work was on the old Panhandle R. R. Later he settled in Indianapolis, where he became associated with Mr. George Epsy and built the Union Station of that city. From Indianapolis he went to Omaha to build a union railway station, which was not completed owing to litigation between the railways and the city. Leaving there he went to Chicago to take charge of the construction of the new Chicago Belt R. R., upon which he was engaged at the time of his death.

Col. A. P. Robinson, one of the pioneer civil engineers of the country, died at Conway, Ark.. on Oct. 12. He was born in 1822 in Hartford county, Conn. He began engineering work as a rodman on the first section of the Erie R. R., west of the Hudson River. After the civil war he made an exploration from the Missouri River as far as Denver, under government escort. Following this he was engaged by the Missouri, Kansas & Texas R. R. until 1869, when he went to Little Rock, Ark., and became connected with the St. Louis, Iron Mountain & Southern R. R. and the Little Rock & Fort Smith R. R., as chief engineer. He also laid out the government reservation at Hot Springs. In 1871 Col. Robinson located on a tract of 640 acres which he had previously purchased from the Little Rock & Fort Smith R. R. Co. Around him grew up the city of Conway, of which he was several times elected mayor.

Mr. John Gjers, whose death occurred in the week ending Oct. 15, has for years been a prominent figure in the iron industry of England. He was born in Gothenburg, Germany, in 1830, and went to Manchester, England, at the age of 21, where he was engaged in drafting and machine designing. In 1854 he went to Middlesborough, where he built the Ormesby blast furnaces. In 1855 he became the manager of these works and from this time on developed many improvements in blast furnace apparatus. Among his inventions may be mentioned a type of vertical blowing engine, an improved soaking pit, a system for granulating blast furnace slag, a process for manufacturing steel rails, etc. In 1870 Mr. Gjers founded the firm of Gjers, Mills & Co., of which he was principal partner until his death. He was one of the founders of the Iron and Steel Institute, and received in 1894 the Bessemer gold medal.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN INSTITUTE OF ARCHITECTS.
Nov. 1-3. Annual meeting, Washington, D. C. Secy., Alfred Stone, Providence, R. I.
WESTERN SOCIETY OF ENGINEERS.
Nov. 2. "Construction of Retaining Walls for the Sanitary District of Chicago," James W. Beardsley; "Berthier Method of Coal Calorimetry," Chas V. Kerr; "Brakes for Electric Cars," William G. Price. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 2. Discussion on "Roads and Road Making." Secy., C. W. Hunt, 220 W. 57th St., New York city.
ENGINEERS' CLUB OF ST. LOUIS.
Nov. 2. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
BROOKLYN ENGINEERS' CLUB.
Nov. 3. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 4. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Nov. 4. Illustrated Lecture, T. C. Martin. Secy., Henry I. Weed. Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.
CHICAGO ELECTRICAL ASSOCIATION.
Nov. 4. "The Electrical Equipment of a Model Printing Establishment," Geo. A. Damon. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
ENGINEERS' CLUB OF COLUMBUS.
Nov. 5. Secy., H. M. Gates, 12½ North High St., Columbus, O.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Nov. 7. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 7. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.
NEW ENGLAND RAILROAD CLUB.
Nov. 8. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.
DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 8. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 8. Secy., Wm. H. Searles, Case Library Building, Cleveland, O.
RAILWAY SIGNALING CLUB.
Nov. 8. Secy., Earl M. Seitz, Signal Engineer, C. & N. W. Ry., Chicago, Ill.
FRANKLIN INSTITUTE.
Nov. 9. "Mining and Minting of Gold and Silver," A. E. Outerbridge, Jr. Secy., Wm. Wahl, 15 South Seventh St., Philadelphia, Pa.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 10. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 10. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.
ST. LOUIS RAILWAY CLUB.
Nov. 11. "The Performance of a Four-Cylinder Compound Locomotive." Discussion. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
CENTRAL RAILWAY CLUB.
Nov. 11. Secy., H. D. Vought, 114 Fifth Ave., New York city.
MONTANA SOCIETY OF ENGINEERS.
Nov. 12. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
ENGINEERS' CLUB OF KANSAS CITY.
Nov. 14. "Rectification of the Red and Atchaflaya Rivers," A. F. Woolley, Jr. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
THE LOUISIANA ENGINEERING SOCIETY.
Nov. 14. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
NORTHWEST RAILWAY CLUB.
Nov. 15. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 15. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Nov. 16. Secy., Frank H. Olmsted, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 16. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Nov. 16. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
NEW YORK RAILROAD CLUB.
Nov. 17. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 17. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.
ENGINEERS' CLUB OF CINCINNATI.
Nov. 17. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 19. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
TECHNICAL CLUB OF OMAHA.
Nov. 21. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 21. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 21. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

BROOKLYN INSTITUTE.—A meeting of the Department of Mineralogy was held on Oct. 13, to listen to a lecture of Prof. W. G. Levison, on "Luminescent Minerals."

MONTANA SOCIETY OF ENGINEERS.—At the last meeting of this society, held Oct. 12, a committee was appointed to select a place of meeting for the annual convention. Helena was chosen and the time fixed as the second Saturday in January.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.—The regular meeting of this association was held Oct. 24. The paper of the evening was by Dr. R. Moldenke, Pittsburg, Pa., on "The Melting Point of Cast Iron," and is given in full elsewhere in this issue.

WESTERN RAILWAY CLUB.—A regular meeting of this club was held Oct. 18 in the Auditorium Hotel, Chicago. Mr. P. H. Peck presented a paper on "The Adoption of a Standard Knuckle," which was followed by a topical discussion on "What is the Best Disposition to be Made of the Exhaust from the Air Pump?"

NEW YORK ELECTRICAL SOCIETY.—The 190th regular meeting of this society and the first meeting of the fall of 1898 will be held by the courtesy of the Edison Electric Illuminating Co., at the Pearl St. sub-station, Brooklyn, N. Y., at 7:30 p. m., on Oct. 27. Mr. W. S. Barstow, Chief Engineer, will give a brief address, after which special trolley cars will be boarded and a flying visit made to sub-station "A" and the large Union Central Station at Bay Ridge.

NEW YORK ACADEMY OF SCIENCES.—The geological and mineralogy section of this association held a meeting on Oct. 17, at which Prof. J. F. Kemp, of Columbia University, read a paper on "The Copper Mines at Ducktown, Polk County, Tenn." A number of views of the mines and samples of ores were exhibited. This was followed by papers entitled "Notes on Glacial Phenomena of Staten Island," by Prof. Arthur Hollick, Columbia University, and "The Sedimentary Formations of Northern South America," by Francis C. Nicholas.

ENGINEERS' CLUB OF PHILADELPHIA.—At the last meeting of this club, held Oct. 15, Mr. George S. Webster, Chief of the Bureau of Surveys, read a paper on the "Pennsylvania Avenue Subway." This was a statement of the conditions which necessitated a change in the system of carrying the traffic of the Reading R. R. to the Terminal station and the various remedies suggested. The plans adopted and the difficulties encountered in carrying them out were explained. The work was described in Engineering News of April 16, 1896.

FRANKLIN INSTITUTE.—At the last meeting of the Institute, held at the Institute Hall on the evening of Oct. 8, three papers were presented and discussed, as follows: "The Johnson-Lundell Surface-Contact System of Street Railway," Edward H. Johnson, Vice-President and General Manager of the Sprague Electric Co., New York; "An Improved Form of Marine Boiler," Edward J. Moore, Philadelphia, Pa.; "Chimneys for Incandescent Gas Lamps," Ernest M. Moore, Philadelphia; "Some Observations on Scientific and Technical Matters, Gleaned During a Recent Visit Abroad," Prof. Joseph W. Richards, Bethlehem, Pa.

At the meeting of the mining and metallurgical section of the Institute, held Oct. 12, Mr. William Griffith presented a paper, entitled "Anthracite Coal in Peru."

This was a description of the two main coal fields in Northern Peru which produce coal equal in quality to the average of Pennsylvania anthracite. In the first of these, if surface indications are as reliable here as elsewhere, there are very large quantities of coal which are entirely above the water level and can be mined by simply running drifts or tunnels. This enormous coal supply is only 300 miles from the navigable part of the Amazon and 150 miles from the Pacific Ocean. The other, about 100 miles from the first, is on the Chicama River, about 30 miles southwest from Huama Chuco. At this point coal can be traced over a large area. In quality it is also very good, fully equal to the Pennsylvania coal. This bed is only about 100 miles from the Pacific coast.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The regular meeting of this society was held at the Society House, New York city, Oct. 19, at which a paper by Mr. Arthur L. Adams, on "Stave Pipe—Its Economic Design and the Economy of Its Use," was read. This is abstracted elsewhere in this issue.

After the discussion, the secretary, Mr. Chas. W. Hunt, read a letter from the American Architectural League, inviting the society to attend a meeting of the League to be held on Nov. 1, at 8:30 p. m., at which the question of proper schemes and designs for recreation piers, viaducts and public baths for New York city would be discussed.

The discussion upon "Roads and Road Making," begun at the first fall meeting, will be resumed at the meeting of Nov. 2.

CENTRAL RAILWAY CLUB.—The next meeting of this club will be held at the Hotel Iroquois, Buffalo, N. Y., on Nov. 11, at 2 p. m.

The morning will be devoted to visiting the shops of the New York Central R. R., and the Lackawanna shops at East Buffalo.

Reports will be received from committees on the following subjects: "Perfection of Top-Hinged Oil-Box Lids, so as to more completely exclude dust from journal-boxes, and the relation of a tight-fitting lid to cost of lubrication and number of hot boxes;" "The Most Desirable Material for Diving Boxes, and Should They be Solid or Have a Shell Bearing?" There will also be a discussion on the subject "Which is the more economical, a single nozzle or a double nozzle, and what should be the ratio between height of nozzle and radius of boiler?'

ENGINEERS' CLUB OF ST. LOUIS.—The 447th meeting of this club was held on Oct. 19, with 35 members and visitors present.

A motion directing the representatives of the Engineers' Club of St. Louis on the Board of Managers of the Association of Engineering Societies to bring before the board the question of publishing annually in the Journal a list of all the members of all the clubs belonging to the association was carried. The paper of the evening, by Mr. B. H. Colby, was entitled "Repairs to the Mill Creek Sewer." The section of this sewer is 20 × 15 ft. and its present length is about 25,000 ft. The present dry weather flow is about 40,000,000 gallons. It was begun in 1860 and has been built by piecemeal. The sewer was originally built on a timber bottom and the weight of the side walls has forced up the timber under the center of the sewer. The timber is now being replaced by a concrete inverted arch and the methods employed to effect these repairs were described. Richard McCulloch, Secy.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—This society held a regular meeting Oct. 18, at the society's house, 410 Penn Ave., Pittsburg, Pa.

The paper of the evening, on "Transportation of Iron Ore," was read by Mr. E. B. Taylor, Superintendent of Transportation on Pennsylvania Lines West of Pittsburg. This was the first of a series of papers which will be read at the Engineers' Society during this and next year. The subjects of the other papers are as follows: "Manufacture of Pig Iron;" "Foundry Practice;" "Malleable Castings;" "Wrought Iron Making;" "Bessemer Steel, Acid and Basic;" "Open-Hearth Steel, Acid and Basic;" and "Crucible Steel." The authors of these papers will be the chief authorities in each branch, and it is expected that the series of papers will be one of the most valuable ever published on the subject of iron manufacture.

Mr. Taylor's paper contained a great deal of valuable statistical information and was illustrated with numerous drawings, blue prints, and photographs of docks and machinery used in handling the ore.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.—This association held its 7th annual convention at Scranton, Pa., on Oct. 19.

Two papers were read, one on "Parks and Amusements," by E. H. Davis, Williamsport, Pa.; the other, "A System of Collection of Fares and Checking Employees," by A. F. Walter, Allentown. The secretary then read a report on "Standing Rules for Government of Conductors and Motormen," which had been prepared by a committee of the American Street Railway Association. Reports of officers and committees followed, and the meeting closed after selecting Lebanon as the next place of meeting. The afternoon was spent in trolley rides over the local lines, and the evening in enjoying the usual convention banquet.

The officers elected for the ensuing year were Pres., Frank Silliman, Jr.; First Vice-Pres., William B. Given, Lancaster; Second Vice-Pres., Dallas Sanders, Schuylkill Traction Co.; Secy., S. P. Light, Lebanon & Annville Street Railway Co.; Treas., W. H. Lanius, York; Executive Committee, Messrs. Silliman, Light and Lanius, E. C. Felton, Harrisburg, and C. P. King, Pottsville.

AMERICAN INSTITUTE OF ARCHITECTS.—The 32d annual convention of the Institute will be held at the Arlington Hotel, Washington, D. C., on Nov. 1-3.

The programme announced is as follows:

Nov. 1—The consideration of committee reports, reports of officers and the annual address of the President. The afternoon session will be a continuation of that of the morning, luncheon being served in the convention hall during a brief intermission.

In the evening the entire party will inspect the Congressional Library under the direction of Mr. Bernard R. Green, who had charge of its construction.

Nov. 2—morning—"Acoustics," Prof. W. B. Sabine, Harvard University; a communication upon the same, Adolf Cluss, Washington, D. C.; "Some Peculiarities of Timber," Prof. B. E. Fernow, Cornell University; "Some Characteristics of Building Stones," Prof. G. P. Merrill, Washington, D. C. These papers will be followed by committee reports, unfinished business, etc.

Evening—"The Place to be Assigned to Jewish People in Architectural History," Dr. Cyrus Adler, Smithsonian Institute; "General Practice in Regard to the Employment of Electrical, Heating and Sanitary Engineers," H. G. Bradlee, Boston, Mass.

Nov. 3—morning—Reports of committees, unfinished business, election of officers, etc.

A very interesting schedule of excursions has been arranged to occupy the afternoons of the convention days.

WESTERN SOCIETY OF ENGINEERS.—On Oct. 15 there was a second trip to inspect the track elevation work now in progress in Chicago. A special train on the Pittsburg, Fort Wayne & Chicago Ry. carried the party over that line as far as Colehour. On returning, stops were made to enable the party to see the style of masonry and type of bridge floors adopted, and at Englewood some time was spent in examining the work where the road crosses (at grade) the track elevation of the Chicago, Rock Island & Pacific Ry. and Lake Shore & Michigan Southern Ry. As the yard will be raised at this point, it was desired to avoid the obstructions of bridge girders, and there will be a large area of flat steel floors, the plates being riveted to Z-bars resting upon I-beams, supported by masonry walls and steel columns. The P., Ft. W. & C. Ry. uses a ballasted trough floor, and the ballast deadens the noise of trains, so that in the subway underneath only a slight rumbling is heard when a heavy train passes. Near 16th St. a number of the party left the train and walked over to inspect the progress of work at the 16th St. crossing.

A special train for the Omaha exhibition left Chicago on Friday night, Oct. 14, returning Monday morning.

On Oct. 21 there was a "ladies evening," an informal meeting at which Mr. Geo. S. Morison, M. Am. Soc. C. E., delivered a popular lecture on "Masonry," illustrated by excellent stereopticon views of ancient structures in Rome, Egypt and Mexico, temples and reservoir dams in India, and ancient and modern churches, monuments, bridges, etc.

THE AMERICAN GAS LIGHT ASSOCIATION.—The 26th annual meeting of this association was held last week at Niagara Falls, N. Y.

At the opening session, Oct. 19, a committee on nominations was appointed, and later presented the following list: Pres., A. C. Humphreys, New York; Vice-Presidents, G. G. Ramsdell, Philadelphia; E. G. Platt, Des Moines, and W. R. Beal, New York; Secy. and Treas., Alfred Forstall, Montclair, N. J.; Members of the Council, Rollin Norris, Philadelphia; Malcolm S. Greenough, Cleveland, O.; C. H. Dunbar, Elgin, Ill., and S. J. Fowler, Springfield, Mass. These gentlemen were elected.

The address of the President, Mr. J. B. Crockett, San Francisco, was a lengthy treatment of the subject of municipal encroachment upon private enterprise and the damage to gaslight property by electric street railway companies. The afternoon session was occupied by papers on "How Can We Make the Use of Gas More Universal," by H. L. Doherty, Madison, Wis., and "The Loss of Illuminating Power of 25 to 30-Candle Gas When Mixed with Air," by Dr. E. G. Love.

The morning session of the second day of the convention was well occupied in attending to a paper by J. M. Rusby, Jersey City, N. J., on "Depth of Fire in a Water Gas Set," and one entitled "Notes on Mains and Main Laying," by Walton Forstall, Philadelphia. The session closed after selecting New York as the next place of meeting.

At the afternoon meeting two "topics" were considered: "A Gas Engine in a Blowing Plant," H. L. Rice, Norfolk, Va., and "An Experiment with the Shadbolt Self-Enriching Process," Irwin Butterworth, Columbus, O. Mr. A. E. Forstall, the secretary, also read a paper, "Can We Make All Our Business Pay?" and Mr. A. R. Foote closed the meeting with remarks of interest to those present.

The closing day, Oct. 21, was largely given up to excursions and sightseeing trips.

The attendance was large, there being fully 250 present.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Oct. 27.	Macadamizing, etc., Findlay, O.	Oct. 20
Oct. 27.	Building, Central Islip (L.I.), N. Y.	Oct. 20
Oct. 27.	Heat'g, plumb'g, etc., Ward's Isld., N. Y. H.	Oct. 20
Oct. 27.	Building substructure, Boise, Mont.	Oct. 20
Oct. 27.	Stone, Brooklyn, N. Y.	Oct. 20
Oct. 27.	Asphalt paving, Winnipeg, Man.	Oct. 20
Oct. 27.	U. S. building, Camden, N. J.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Oct. 27.	Paving, Camden, N. J.	Sept. 29
Oct. 27.	Electrical machinery, Hull, England.	Oct. 13
Oct. 27.	Brick sewer, Peoria, Ill.	Oct. 27
Oct. 28.	Army post buildings, Ft. Caswell, N. C.	Oct. 27
Oct. 28.	Asphalt paving, Niagara Falls, N. Y.	Oct. 27
	Advertised, Engineering News, Oct. 27.	
Oct. 28.	Brick paving, Church St., Troy, N. Y.	Oct. 27
Oct. 28.	Heating plant, Genoa, Neb.	Oct. 13
Oct. 28.	Pipe sewer, Monticello, Ind.	Oct. 13
Oct. 28.	Asphalt, brick or stone, Atlanta, Ga.	Oct. 6
Oct. 28.	Brick paving, etc. (7 Sts.), Cleveland, O.	Oct. 6
Oct. 28.	Brick and stone wall, Atlanta, Ga.	Oct. 6
Oct. 28.	Stone wall, San Francisco, Cal.	Oct. 6
Oct. 28.	Grading and paving, New Orleans, La.	Oct. 20
Oct. 28.	Cement sidewalks, Chicago, Ill.	Oct. 20
Oct. 28.	Pipe sewers, Chicago, Ill.	Oct. 20
Oct. 28.	Laying water mains, Chicago, Ill.	Oct. 20
Oct. 29.	Brick paving, Olean, N. Y.	Oct. 20
	Advertised, Engineering News, Oct. 20.	
Oct. 28.	Macadam, curb, etc., Warren, O.	Oct. 20
Oct. 28.	Drill hall, Kingston, Ont.	Oct. 20
Oct. 29.	Electric traveling crane, Norfolk, Va.	Oct. 20
Oct. 29.	Steam tender, Louisville, Ky.	Oct. 6
Oct. 29.	Grading and brick paving, Cleveland, O.	Oct. 13
Oct. 29.	Grading and cement walks, Irvington, Ind.	Oct. 13
Oct. 29.	Tools, etc., Norfolk, Va.	Oct. 27
Oct. 29.	Graveling streets, Memphis, Tenn.	Oct. 27
Oct. 29.	Flagstone walks, Wilkes-Barre, Pa.	Oct. 27
Oct. 29.	Electric light plant, Herkimer, N. Y.	Oct. 27
Oct. 29.	Electric plant, Brementon, Wash.	Oct. 27
Oct. 30.	Church building, Lewiston, Pa.	Oct. 27
Oct. 30.	School building, Chehalis, Wash.	June 16
Oct. 31.	Metal work, Mobile, Ala.	Oct. 13
	Advertised, Eng. News, Oct. 13 and 20.	
Oct. 31.	Pumping engine (3,000,000 galls.), Marietta, O.	Oct. 20
Oct. 31.	Electric bonds, Winnebago City, Minn.	Oct. 20
Oct. 31.	Heating, etc., New York.	Oct. 27
Oct. 31.	City hall superstructure, Freeport, Ill.	Oct. 27
Oct. 31.	Smoke preventers (3), St. Paul, Minn.	Oct. 27
Oct. 31.	Sewers, New Haven, Conn.	Oct. 27
Oct. 31.	Sewers, Toledo, O.	Oct. 27
Oct. 31.	Paving and curbing, Dayton, O.	Oct. 27
Oct. 31.	Macadamizing, etc., Findlay, O.	Oct. 27
Oct. 31.	Buckeye paving, Toledo, O.	Oct. 27
Oct. 31.	Brick paving, etc., Ottumwa, Ia.	Oct. 27
Oct. 31.	Armory building, Brooklyn, N. Y.	Oct. 27
Oct. 31.	Railway supplies, London, England.	Oct. 27
Oct. 31.	Heating and plumbing, Barre, Vt.	Oct. 27
Nov. 1.	Sewers (8-in.), Saratoga Springs, N. Y.	Oct. 27
Nov. 1.	Capitol building, Phoenix, Ariz.	Oct. 27
Nov. 1.	Water pipe, etc., Lancaster, O.	Oct. 27
Nov. 1.	Bridge, Lincoln, Cal.	Oct. 27
Nov. 1.	Road bonds, Utica, N. Y.	Oct. 20
Nov. 1.	Water pipe (20,000 ft.), Spring Lake, N.J.	Oct. 20
	Advertised, Engineering News, Oct. 20.	
Nov. 1.	Pipe sewers (4,600 ft.), Spring Lake, N.J.	Oct. 20
	Advertised, Engineering News, Oct. 20.	
Nov. 1.	Arc lighting, Hull, Que.	Oct. 20
Nov. 1.	Hospital plans, New York, N. Y.	Oct. 13
Nov. 1.	Bridge, Corydon, Ia.	Oct. 13
Nov. 1.	Artesian well, Jamestown, N. Dak.	Oct. 13
Nov. 1.	Sidewalks, Terre Haute, Ind.	Oct. 13
Nov. 1.	Court house, Garner, Ia.	Sept. 8
Nov. 1.	School building, St. Louis, Mo.	Sept. 22
Nov. 2.	Heating, etc., Baltimore, Md.	Oct. 20
Nov. 2.	Electric lighting, etc., Baltimore, Md.	Oct. 20
Nov. 2.	Harbor work, Stockton, Cal.	Oct. 20
Nov. 2.	Garbage crematory, Fort Thomas, Ky.	Oct. 27
Nov. 2.	Fire department building, New York	Oct. 27
Nov. 2.	Temporary sewer, New York, N. Y.	Oct. 27
Nov. 2.	Electric plant, Winnebago City, Minn.	Oct. 27
Nov. 3.	Repairing asphalt, Scranton, Pa.	Oct. 27
Nov. 3.	Electric light fixtures, Hudson, N. Y.	Oct. 27
Nov. 3.	U. S. building, Chicago, Ill.	Oct. 20
	Advertised, Eng. News, Oct. 20 and 27.	
Nov. 3.	Roads, walks, etc., Fort Hancock, N. J.	Oct. 20
Nov. 3.	Highway work, Pittsburg, Pa.	Oct. 20
Nov. 3.	Repairing sidewalks, Cincinnati, O.	Oct. 13
Nov. 4.	Piers and abutments, Coshocton, O.	Oct. 13
Nov. 4.	Buckeye paving, etc., Dayton, O.	Oct. 27
Nov. 4.	Railroad grading (35 mls.), Denmark, N. C.	Oct. 27
	Advertised, Eng. News, Oct. 27 and Nov. 3.	
Nov. 4.	Roof of armory, New York, N. Y.	Oct. 27
Nov. 5.	Ocean Ave. improvement, New London, Conn.	Oct. 27
Nov. 5.	Substructure, Center St., Cleveland, O.	Oct. 13
Nov. 5.	Sewers, East Cleveland, O.	Oct. 13
Nov. 5.	School building, Marion, O.	Oct. 20
Nov. 5.	Wells and shafts, Gila County, Ariz.	Oct. 20
Nov. 7.	Bridge at Curtis' Ford, Wilkesboro, N. C.	Oct. 20
Nov. 7.	Viaduct superstructure, Cincinnati, O.	Oct. 13
Nov. 7.	Bridge, Webster St., Oakland, Cal.	Oct. 13
Nov. 7.	Plank sidewalks, (1 year), Cincinnati, O.	Oct. 13
Nov. 7.	Wooden bridge (190 ft. long), Magnolia, Miss.	Oct. 13
Nov. 7.	Brick paving, Toledo, O.	Oct. 13
Nov. 7.	Improving electric plant, Topeka, Kan.	Sept. 22
Nov. 7.	Sewers, Albany, N. Y.	Oct. 27
Nov. 7.	Sewers, Wabash, Ind.	Oct. 27
Nov. 7.	Boilers for water-works, St. Paul, Minn.	Oct. 27
Nov. 7.	Water flume, New Whatcom, Wash.	Oct. 27
Nov. 7.	Water-works franchise, San Bernardino, Cal.	Oct. 27
Nov. 7.	Arc lighting, Lebanon, Pa.	Oct. 27
Nov. 8.	Electric plant, etc., Wynne, Ark.	Oct. 20
Nov. 8.	Water-Works, etc., Wynne, Ark.	Oct. 20
Nov. 8.	Surveys, Olympia, Wash.	Oct. 20
Nov. 9.	Paving, etc., Cohoes, N. Y.	Oct. 20
Nov. 9.	Improving drawbridge, Camden, N. J.	Oct. 20
	Advertised, Engineering News, Oct. 20.	
Nov. 9.	School building, Fort Sill, Okla.	Oct. 20
Nov. 9.	Electric light plant, Toronto, Ont.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Nov. 9.	Electric energy, Toronto, Ont.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Nov. 9.	Bridge, Sable Creek, San Jose, Cal.	Oct. 13
Nov. 9.	Electric light franchise, Visalia, Cal.	Oct. 27
Nov. 10.	Water supply, Belem, Brazil	Sept. 22
Nov. 10.	Water bonds, ($30,000), New Richmond, O.	Oct. 20
Nov. 10.	College building, Cincinnati, O.	Oct. 20
Nov. 10.	Court house bonds, Doniphan, Mo.	Oct. 20
Nov. 10.	Fish hatchery, etc., Spearfish, S. Dak.	Oct. 20
Nov. 10.	Electric bonds, New Richmond, O.	Oct. 20
Nov. 11.	Bridges, (3), Olivet, S. Dak.	Oct. 13
Nov. 11.	Bridges (2), Colfax, Wash.	Oct. 27
Nov. 12.	Water bonds ($130,000), Reno, N. Mex.	Oct. 13
Nov. 12.	Buildings ($106,250), Mare Island, Cal.	Oct. 20
Nov. 12.	Dredging, Port Royal, S. C.	Oct. 20
Nov. 12.	Road work, Cincinnati O.	Oct. 27

Nov. 14. Grading a road, Santa Barbara, Cal. ...... Oct. 27
Nov. 14. Steel bridge (100 ft.), Houston, Tex. .... Oct. 20
Advertised, Eng. New, Oct. 20 to Nov. 3.
Nov. 14. Removing wreck, Rockland Harbor, Me..... Oct. 13
Nov. 15. Industrial school, Ellendale, N. Dak....... Oct. 13
Nov. 15. Water-works addition, Seattle, Wash...... Sept. 22
Advertised, Eng. News, Sept. 22 to Nov. 10.
Nov. 15. Jail work, San Saba, Tex................. Sept. 29
Nov. 15. Electric lighting, Greensboro, N. C. ...... Oct. 6
Nov. 15. Dredging bay, Coos Bay, Ore. .... Oct. 20
Advertised, Eng. News, Oct. 20 to Nov. 10.
Nov. 15. Water-works, Rock Hill, S. C............. Oct. 27
Advertised, Eng. News, Oct. 27 and Nov. 3.
Nov. 16. Reformatory building, Mansfield, O. .... Oct. 27
Nov. 16. Electric plant, Knowle, England.......... Oct. 27
Nov. 16. Electrical machinery, Cleveland, O......... Oct. 20
Nov. 16. Electric lighting, Camden, N. J........... Oct. 13
Advertised, Eng. News, Oct. 13 to 27.
Nov. 17. Hospital building, Siletz, Ore. .... Oct. 27
Nov. 17. Road in Sage Canyon, Cal. .... Oct. 27
Nov. 21. Brick sewers, Toledo, O. .... Oct. 27
Nov. 21. Naval supplies, St. Augustine, Fla. .... Oct. 27
Advertised, Eng. News, Oct. 27 to Nov. 17.
Nov. 21. Government bldgs (8), Sophia, Bulgaria.... Sept. 29
Nov. 22. U. S. building, Norfolk, Va. .... Oct. 27
Advertised, Eng. News, Oct. 27 and Nov. 3.
Nov. 25. Water pipe, etc., Honolulu, H. I. .... Oct. 27
Nov. 26. Crane, Port Royal. S. C. .... Oct. 27
Nov. 26. Boat shelter roof, Mare Island, Cal. .... Oct. 20
Nov. 28. Removing wreck, Portchester Harbor, N. Y. Oct. 27
Nov. 30. Dry dock, Algiers, La. .... Oct. 20
Nov. 30. Bridge, etc., and plans, Moline, Ill.......... Oct. 6
Advertised, Eng. News, Oct. 6 and 13.
Dec. 1. Electric lighting, Sumter, S. C. .... Oct. 6
Dec. 1. Electric light plant, Clinton, Ill. .... Oct. 13
Dec. 2. Arc lighting, Asheville, N. C. .... Oct. 13
Dec. 5. Pumping engine, Oil City, Pa. .... Oct. 27
Advertised, Eng. News, Oct. 27 to Nov. 10.
Dec. 7. Changing Van Buren St. bridge, Chicago, Ill. Oct. 20
Dec. 15. Storm sewers, Denver, Colo................ Oct. 13
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn.......... Aug. 18
Jan. 2. Bridge, Quebec, Que. .... Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Jan. 2. Arc lighting, Vincennes, Ind. .... Oct. 27
Jan. 6. Water-gas plant, Johannesburg, So. Africa.. Oct. 27
Jan. 6. Extension, electric plant, Johannesburg, S. Af. Oct. 27
Feb. 10. Jail building, Keyser, W. Va. .... Sept. 29
No date. School building, Somerville, N. J.......... Oct. 20
No date. Memorial hall, Detroit, Mich............... Oct. 27

RAILWAYS.

ALABAMA & FLORIDA.—P. J. Gantt, River Falls, Ala., informs us that all of the grading is about completed and ready for track-laying on this proposed line from Georgiana to River Falls, a distance of 30 miles. The capital necessary for completion has been secured. R. M. Quigley & Co., of St. Louis, Mo., are the contractors. Pres., E. L. Moore, River Falls, Ala.; Ch. Engr., Charles Seymour, Georgiana, Ala.

ALLEGHENY JUNCTION.—This company was incorporated in Pennsylvania, Oct. 19, with a capital stock of $5,000, to construct a connecting link of steam railway in Pittsburg. The incorporators are: A. H. Keith, Pres.; V. L. Crabble and W. P. Potter, of Pittsburg; J. W. Anderson, Allegheny, Pa.

ATCHISON, TOPEKA & SANTA FE.—Press reports state that this company has purchased a controlling interest in the San Francisco & San Joaquin Valley Ry., and that a new line will be built from Mojave to Bakersfield, Cal., parallel to the Southern Pacific Ry., and thus obtain an entrance into San Francisco. If this project be carried out, it is thought that the construction of the proposed line between Bakersfield and Los Angeles will be abandoned. Robert Watt, 1st Vice-Pres., San Francisco & San Joaquin Valley, San Francisco, may give further information.

ATLANTIC COAST LINE.—Bids are asked by this company until Nov. 4 for the grading and trestle work on the extension of the Charleston & Western Carolina branch from Denmark to Robbins, N. C., a distance of 34.7 miles, as stated in our advertising columns. F. Gardner, Ch. Engr., Wilmington, N. C.

CANTON, ABERDEEN & NASHVILLE.—C. D. Smith, Birmingham, Ala., informs us that all the surveys have been made and practically all of the right of way obtained for this new line between Aberdeen, Miss., and Winfield, Ala., via West Point, a distance of 68 miles. C. D. Smith & Co., of Birmingham, have the contract for the bridging and ties for the first ten miles, which has been sub-let; good progress is being made on the work. David Sloan, Ch. Engr., Chicago, Ill.

CHARLESTON, CLENDENNIN & SUTTON.—Press reports state that $3,000,000 of this company's bond have been disposed of to an English syndicate, and the proposed extension will be built at once. The projected route is from Clay Courthouse to Sutton, W. Va., a distance of about 48 miles. J. Wainwright, Gen. Mgr., 14 South Broad St., Philadelphia, Pa.

DALLASTOWN.—D. F. Lafean, Pres., York, Pa., informs us that a preliminary survey has just been completed for this proposed 1 1-10-mile line of railway near Dallastown, Pa., and that the location will probably be made this week and the work then rushed to completion. The incorporation of this comapny was noted in our last issue.

EASTMAN & OCMULGEE RIVER.—This company has been organized, according to reports, with a capital stock of $25,000, to construct about 18 miles of railway from Eastman to a connection with the Georgia & Alabama Ry. J. B. Caldwell, Eastman, Ga., is interested.

ENGLAND.—Bids are asked until Oct. 31 for supply of (a) Fairlie engines, (b) flexible buffers and screw couplings, for the Burma Railways Co., Ltd. Address the company at 76 Gresham House, Old Broad St., E. C., London.

FLORIDA.—Strickland & Wesley, Point Washington, Fla., inform us that nothing has yet been done towards constructing a railway through their timber lands, but that they are willing to give a free right of way and to assist in building such a line.

GREAT NORTHERN.—Reports state that work has been commenced at Cambridge, Minn., on the Eastern Minnesota cut-off intended to shorten the distance between St. Paul and Duluth by about 30 miles. It is expected that about 60 miles of new track will be built for use next year.——Surveys have been made for a possible extension of this line from a point near Wanatchee, Wash., to Lakeside, at the southern end of Lake Chelan. N. D. Miller, Ch. Engr., St. Paul, Minn.

GUADALOUPE VALLEY.—It is announced that the stockholders of this company have authorized the issuance of $16,000 in bonds to the mile, and that track-laying will commence from O'Connersport, Tex., within 30 days. The line will pass through Yoakum, Tex., which has granted the required bonus. Pres., Uriah Lott, Victoria, Tex.

GULF, TEXAS & NORTHERN.—L. W. Lloyd, Vice-Pres., Marshall, Tex., informs us that the surveys have been made and the right of way procured and completed from Orange to Marshall. Capital for construction has been secured, but no contracts have yet been awarded. The proposed route is from Orange to Marshall, via Jasper, San Augustine, Center, Tenaha and Carthage, a distance of 200 miles. Pres., D. C. Plumb, Marshall; Ch. Engr., C. S. Breckenridge, Orange.

HAWKINSVILLE, FITZGERALD & GULF.—Reports state that an application will be made to the next legislature of Georgia for a charter for this proposed railway from Hawkinsville to the Gulf of Mexico, via Rochelle and Fitzgerald, Ga. R. V. Bowen, of Lulaville, Ga., and P. H. Fitzgerald, of Indianapolis, Ind., are said to be interested.

HOLLY RIVER & ADDISON.—George A. Hechmer, Palmer, W. Va., informs us that surveys have been completed for the present, and that all the right of way has been practically obtained. The work is being done by the company, which has completed from ten to twelve miles of grading and two miles of track-laying. The projected route is from Palmer to Addison, via Holly, Removal, Diana and Jumbo, a distance of 23 miles. Pres., John T. McGraw, Grafton, W. Va.; Ch. Engr., T. G. Baylor. Palmer, W. Va.

JONESBORO, LAKE CITY & EASTERN.—W. H. Stevens, Audr., Jonesboro, Ark., informs us that 20 miles of this proposed line from Nettleton to Monette, via Jonesboro and Lake City, Ark., 30 miles, have been completed, and that the ten remaining miles are under construction. All the work is being done by the company. Pres., J. E. Jones; Ch. Engr., C. M. Ferguson, both of Jonesboro.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—Thomas Greene, Ch. Engr., Minneapolis, Minn., informs us that this company has just completed an extension from Kulm, La Moure county, to Hebard, at the north line of Emmons county, a distance of 77 miles. The new line was to be opened for traffic on Oct. 17. Pres., Thomas Lowry, Minneapolis.

MONROE.—Wm. B. Reily, of the Monroe Ry. & Construction Co., Monroe, La., informs us that the locations have been completed for this proposed line from Monroe to Nachitoches, via Winnfield, La., a distance of 80 miles. The capital for construction, however, has not yet been secured, and until it has been, work will not be commenced. Pres., L. D. McLane, Monroe; Ch. Engr., Ira W. Sylvester, Alexandria, La.

NASHVILLE, CHATTANOOGA & ST. LOUIS.—Contracts have been let, according to reports, for constructing a 6-mile extension of this line on its Middle Tennessee & Alabama division. This company has reballasted about 100 miles of road and rebuilt about four miles of trestle work.

NATCHEZ & GULF.—L. N. Dalgarn, Natchez, Miss., informs us that, at the last meeting of this company, the president was authorized to issue bonds and to place mortgages on the road for the construction of the same. Surveys have all been made and considerable right of way obtained, and there are fair prospects of the line being built at once. The route is from Natchez via Lumberton, Miss., to a connection with Gulfport, over the Gulf & Ship Island R. R. Pres. Hardy, Meridian, Miss., may be addressed.

NEW YORK & OTTAWA.—F. D. Anthony, Ch. Engr., Cornwall, Ont., informs us that the track on the 15-mile extension of this line from Moira, N. Y., north to the St. Lawrence River, has been laid and was put in operation on Oct. 17. The bridge over the north channel of the river lacks only the north cantilever to complete it, and the work of removing the wrecked spans of the south channel bridge is being pushed with a view to the earliest restoration possible; each bridge is 1,125 ft. in length. In addition to the old line between Moira, on the Ogdensburgh & Lake Champlain Ry., and Tupper Lake, 56½ miles, the company now operates the above extension to the St. Lawrence River and, on the Canadian side, a new line from Cornwall to Ottawa, Ont., 53 miles. An extension from Tupper Lake to North Creek, a distance of about 50 miles through the Adirondack region is also contemplated, as a connection with New York can thus be made via Saratoga, rather than as at present via Utica.

NORTON BAY & YUKON RY. & NAVIGATION.—F. A. Hill, Ch. Engr., National Bank Bldg., Seattle, Wash., informs us that a preliminary survey line for the 76-mile railway which this company proposes to build in the Yukon district has been run from a point 45 miles northeast of St. Michael, Alaska, to the Yukon River, 35 miles below Nulato. The United States government gives right of way. An English syndicate has promised to furnish necessary capital so as to construct the line in 1899. Pres., E. A. Gardner, Seattle.

OHIO.—We are informed that the following bids were received by the commissioners of water-works of Cincinnati, Oct. 18, for the construction of a railway track and delivery of track material on the water-works grounds; all local bidders; Clk., Chas. S. Roth:

Quantities.		Edw. W. White.	Louis Drach.	J. J. Smith.
Track on graded roadbed	4,200 lin. ft.	$6,048	$7,560	$8,610
On viaduct	650 " "	787	748	878
Switches, complete	2 sets	390	125	347
Steel rails	4 tons	88	100	102
Joints	15 pairs	18	9	7
Spikes	300 lbs.	9	6	6
Cross ties	75	37	75	59
Total		$7,378	$8,623	$10,008

OKLAHOMA.—A charter has been received by C. Richards, S. James, T. H. Martin and W. W. Gregory, of Tonkawa, Okla., and C. F. Leech, of Arkansas City, Kan., to organize a construction company to extend the railway from Braman to Tonkawa, by way of Kay Center. It is understood that the work of building will begin soon. The new road will open to outside trade a large wheat belt, which, heretofore, was compelled to haul its product by wagon to the Atchison, Topeka and Santa Fe Ry., a distance of 45 miles.

OMAHA BRIDGE & TERMINAL.—Reports state that this company is planning to extend its lines to complete connection with all of the other roads entering Council Bluffs, Ia. J. A. L. Waddell, Ch. Engr., Kansas City, Mo.

PORTSMOUTH & YORKTOWN.—This company has been incorporated, with a capital stock of $25,000, to construct a railway from Portsmouth to Yorktown, O. The incorporators are L. D. York, B. F. Vincent, and others, with offices at Portsmouth.

RICHMOND, PETERSBURG & CAROLINA.—Gen. Jas. S. Negley, Vice-Pres. and Gen. Mgr., 141 Broadway, New York, informs us that the first 20 miles south of Petersburg, Va., has just been completed and will be operated as a freight and passenger line without delay. Along this new route there is much valuable timber land, and it is reported that a number of new saw mills have already been established. The completion of the entire line, to a connection with the Seaboard Air Line at Ridgeway, N. C., will be pushed with energy.

ST. LOUIS, KANSAS & SOUTHWESTERN.—Reports state that this railway was sold at auction at Arkansas City, Kan., Oct. 22, to Samuel Baker, of Hamilton, O., representing the creditors, at $150,000. The line is 60 miles long, running from Arkansas City to Anthony. Francis S. Eaton, Gen. Mgr., Arkansas City.

TACOMA & COLUMBIA RIVER.—This company was reorganized in Tacoma, Wash., Oct. 21, according to reports, with the folowing officers: Pres. and Gen. Mgr., William Bailey, 66 Broadway, New York; First Vice-Pres., and Asst. Gen. Mgr., Samuel Collyer; Secy., E. G. Dorr; Treas., Calvin Phillips; Ch. Engr., W. O. Holliday; Supt., E. G. Dorr. It is said that new capital has been secured and that construction work will be rushed at once.

WILMINGTON & NORTHERN.—It is announced that this railway has been bought by the Philadelphia & Reading Ry. Co., and not the Baltimore & Ohio R. R. Co., as previously stated.

STREET AND ELECTRIC RAILWAYS.

CARIBOU, ME.—Reports state that a preliminary survey is being made for the location of an electric railway from Caribou to Van Buren, and that John P. Donworth, of Caribou, is interested.

WESTBORO, MASS.—The Westboro, Hopkinton & Milford St. Ry. Co. has been organized with a capital stock of $80,000, to construct an electric railway eight miles in length, via Woodville and Hopkinton. It is expected to obtain the necessary franchises and to begin work in time to operate the line next summer. The temporary board of directors comprise Melvin H. Walker, Westboro; Frank W. Wood, Hopkinton; Edgar K. Ray, Franklin; Wm. S. Reed, Leominster, Mass.; Wm. H. Tylee, Worcester, Mass.; William S. Reed, Leominster; Joseph G. Ray, and Edgar K. Ray, Franklin, Mass.

BRISTOL, R. I.—We are informed that the surveys have been completed, the right of way obtained and the contract awarded to the Lap Joint Railway Track Co., 11 Broadway, New York, on Oct. 11, for the construction of the proposed 4-mile electric railway from Ferry Fall River, Mass., to Mount Hope, and from Mount Hope to Bristol, for the Bristol Land & Investment Co. Work is to be completed and road equipped by May 1. Pres., W. B. D'Wolf, Bristol; Ch. Engr., J. A. Latham, Providence, R. I.

CATSKILL, N. Y.—The board of trustees has granted permission to the Catskill Electric Ry. Co. to lay tracks on the village streets provided that a 70-lb. T-rail 4½ inches in height be used.

MARION, N. Y.—We are informed that the surveys have been made for the proposed Wayne Central R. R., between Marion and Palmyra, six miles. The company has not yet been incorporated, but will probably be soon. Electric motive power will be used. Le Grand Brown, Ch. Engr., Rochester, N. Y.

MOUNT VERNON, N. Y.—It is reported that the electric railway between this city and Yonkers will be double tracked at once, owing to greatly increased traffic over the line. This line is said to be under the control of the Union Traction Co. of New York.

NEW YORK, N. Y.—Reports state that compressed air, and not the underground system of electricity, will be used as the new motive power on the 28th and 29th St. lines of the Metropolitan St. Ry. Co.

NYACK, N. Y.—B. F. Sweeten & Son, Camden, N. J., are reported to have been awarded the contract for the necessary track-laying, trestle work and excavation for the proposed line of the Nyack Traction Co., to cost about $35,000. W. G. Mendenhall & Co., Philadelphia, Pa., received the contract to furnish the cars and rails, to cost about $40,000. Other contracts were to be awarded. The power house will be a brick structure, having an engine room, 60 × 55 ft., and a boiler room, 30 × 55 ft., and two 300-HP. engines will be installed. The general contract is held by Isaac A. Walker & Son, Stephen Girard Bldg., Philadelphia, Pa. Pres., Henry C. Howard, Chester, Pa.

ROME, N. Y.—A plan is under consideration for the organization of a new corporation to supplant the Rome City St. Ry. Co. and to build and operate an electric railway system in and about the city on an extensive scale. The old line is 6.7 miles in length and is operated by horse power. J. G. Lieper, G. W. Chance and T. Blume, all of Philadelphia, Pa., are said to be interested. Pres., John S. Wardell, 115 John St., Rome.

PERTH AMBOY, N. J.—The Perth Amboy R. R. Co. was incorporated in New Jersey, Oct. 24, with a capital stock of $30,000, with all paid in, to construct a railway in this town. The incorporators are: Leonard Lewisohn, Adolph Lewisohn, Charles J. Hittenberg, of New York; James C. McCoy, Geo. J. Haney, Wm. E. Tobey, C. P. Sells, and Wesley J. Havell, of Perth Amboy. Principal office at 258 Smith St., Perth Amboy.

WOODBURY, N. J.—The National Park Association is said to be about to award contracts for the construction of a trolley line from the railway station to National Park.

ALLENTOWN, PA.—We are informed that no arrangements have yet been made for the construction of the proposed electric railway of the Inland Traction Co., whose incorporation was noted in our last issue, from Sellersville to Landsdale, via Telford, Souderton and Hatfield, a distance of 12 miles. Pres., John H. Pascoe, of Allentown. Address J. B. Aldefer, Souderton, Pa.

FREEMANSBURG, PA.—Warren R. Roberts, of Freemansburg, informs us that Pascoe & Crilly, contractors, of Allentown, Pa., have made an application for the right of way through this town. If granted, it is expected to build an electric line to connect with that of the Allentown Traction Co., at South Bethlehem. The ordinance has passed its first reading.

JOHNSTOWN, PA.—N. F. Thompson, Secy. of Board of Trade, informs us that the right of way for the proposed 8-mile electric railway of the Johnstown & Somerset Traction Co. has been secured for that portion outside of the city limits. Capital for construction has been secured and work will commence as soon as city franchise has been granted, which is expected within the next 30 days. Pres., Morris Wolf, Johnstown, Pa.

PHILADELPHIA, PA.—It is announced that the construction of the Philadelphia, Castle Rock & West Chester Electric Ry. is being pushed forward with all haste, and tracks are now laid right up to Milltown. Within three or four weeks it is expected that the rails will have been laid right to the terminus at Gay and Matlack St., West Chester.

RICHMOND, VA.—G. E. Detwiler, Chn., of Truxillo, Va., informs us that the proposed Richmond & Tidewater Ry. will be owned largely by the counties through which it is expected to pass, and in consequence no election will be held to appoint officers until the subscriptions required are voted by the counties at the November elections. The length of the line will be about 120 miles, though permanent surveys have not yet been made; motive power will be electricity.

ALLIANCE, O.—Hugh Berkley and C. W. Kieff, of Alliance, are said to be interested in the construction of an electric railway to be built between Alliance and Akron, which is to enter Akron over the lines of the Akron St. Ry.

CLEVELAND, O.—E. G. Tillotson, of the Cleveland Trust Co., Cleveland, informs us that the Cleveland & Eastern R. R. Co. has secured 20 miles of private right of way and has eight additional miles promised for its proposed electric line from Cleveland to Charden, Burton and Chagrin Falls, via Fullertown, O., a distance of 43 miles. Grading has been completed for 12 miles, and 14 miles are under construction. There have been 50,000 ties ordered, delivery to commence Nov. 1, also the rails, rail connections and spikes. Pres., H. P. McIntosh, the Guardian Trust Co.; Ch. Engr., W. C. Jones, Wade Bldg., of Cleveland.

PORTAGE, O.—The council has granted a franchise for the proposed electric railway which is to be built at once by Contractor Leach, Monroe, Mich.

CARTHAGE, MO.—Frank E. Moore, of Carthage, informs us that the controlling interest in the Southwest Missouri Electric Ry. Co., amounting to $336,200, has been sold to Pennsylvania parties. The new directors are, A. H. Rogers, Pres., Joplin, Mo.; E. Z. Wallower, A. G. Kniseley, E. C. Felton, H. L. Hershey, and others, of Harrisburg, Pa.

BEAUMONT, TEX.—The city council on Oct. 18 passed an ordinance granting to John C. Ward and others a 50-year franchise for an electric railway on the streets of Beaumont.

VICTOR, COLO.—Reports state that the motive power on the Gold Belt Line, now about eight miles in length, will soon be changed from steam to electricity, power to be derived from the power plant in course of construction at Goldfield.

SANTIAGO, CUBA.—Press reports state that a franchise for building an electric railway from Santiago to the cemetery and to El Caney has been granted by General Wood to prominent local business representatives.

HONOLULU, HAWAII.—The Honolulu Rapid Transit & Land Co. has recently been organized, according to reports, for the construction of an electric railway. Pres., L. A. Thurston; Vice-Pres., J. B. Castle; Secy., J. A. Gilman; Gen. Mgr., C. G. Bellentyne.

PERTH, WESTERN AUSTRALIA.—We are informed that J. G. White & Co., Engineers and Contractors, 29 Broadway, New York, are preparing plans for a car barn and power house for a company with offices at London, England, which proposes to construct electric tramways at Perth. J. G. White & Co. will also superintend the construction work, and will purchase for the company rails and other necessary materials for track construction and equipment. Babcock & Wilcox will furnish the boilers; the Robb Engineering Co., Amherst, N. S., tandem compound condensing engines; J. G. Brill & Co., cars and trucks. The rails and special work will be of American manufacture, but have not yet been purchased; the rails will be 6-in. and 9-in. girder sections; the special work will be 9-in. girder sections. Part of the road will be paved with Jarrah wood blocks. Contracts for the structural work, including roof trusses for buildings, will be let in the United States as soon as plans have been prepared. Ten miles of single track, with turnouts, will be built at once. The extensions. amounting to over ten miles additional of single track, will then be built, and additional cars and power house equipments will be shipped. The single track will be laid with a view of double tracking a large part of the system in the near future.

ELECTRIC LIGHT AND POWER.

WINN, ME.—M. F. Scott, Clk. Winn Water & Power Co., recently incorporated, writes us that nothing has been done as yet in regard to the proposed plant.

BEVERLY, MASS.—Luther S. Herrick, Cy. Clk., writes us that a report for a municipal plant has been made to one branch of the council. It will have to be accepted by both branches of the council for two successive years and then submitted to the voters.

BOSTON, MASS.—We are informed that the following bids were received Oct. 22 for furnishing the machinery and installing the electric plant at Grover's Cliff, Mass., and at Nantasket Head, Mass.: all bidders, of Boston, except N. J. Foundry and Machine Co.; U. S. Engr., Col. S. M. Mansfield, Boston:

Bidder.	Grover's Cliff.	Nantasket Head.
Electric Storage Battery Co., 60 State St*	$1,468	$1,468
General Electric Co., 180 Sumner St	3,295	3,650
G. M. Angier & Co., 64 Federal St.†	2,385	2,610
	2,315	2,540
Bibler-White Co., 49 Federal St	3,659	3,434
	3,709§	3,484
Almon, Sargent & Conant, Equitable Bldg.	3,925	4,175
N. J. Foundry & Machine Co.,New York‡	3,549	3,772
	3,395	3,620
Lord Electric Co., 181 Tremont St.‖	3,972	4,392
	4,074	4,494
	3,875	4,295

*Incomplete; storage battery only. †Electric storage battery and Hatch storage battery, respectively. §Cell terminals connected by burning lead. ‡Steam engine and oil engine, respectively. ‖Westinghouse apparatus and Hatch apparatus, respectively.

SALEM, MASS.—The council is considering the question of building a municipal plant. The present contract expires at the end of the year.

SOMERVILLE, MASS.—Councilman Jas. F. Davlin writes us that the matter of constructing a municipal plant has been advanced one stage by its being adopted by one branch of the council. If it passes next year's board it will go to the legislature, and if favored there it will be submitted to the voters for their approval.

CROMWELL, CONN.—We are informed that nothing definite has yet been done in regard to the proposed plant. A little later a plant may be established in connection with the water-works of the Cromwell Water Co. Engrs., Shedd & Sarle, Providence, R. I., and Cromwell, Conn.

CHARLOTTE, N. Y.—We are informed that the following bids were received Oct. 15 for furnishing the machinery for the electric plant, as advertised in Engineering News: Westinghouse Electric & Mfg. Co., Pittsburg, Pa., with Atlas engines, Fairbanks belting and shafting, 16,000 alternations incandescent dynamo, $8,050; 7,200 alternations incandescent dynamo, $8,200; Machinist Supply Co. belting and shafting, 16,000 alternations, $8,300; 7,200 alternations, $85,450; Machinists' Supply Co., Rochester, N. Y., belting and shafting only, $998; Fort Wayne Electric Corporation, Fort Wayne, Ind., station equipment (dynamo No. 7) and arc lamps, $3,562; and F. P. Little Electric Construction & Supply Co., Buffalo, N. Y., engines, $1,325; belting and shafting, $1,070; dynamo and lamps, $3,975; line work, $3,850; total, $10,220. The contract was let to the Westinghouse Co. Engrs., Stanwix Engineering Co., Rome, N. Y.

CHATHAM, N. Y.—We are informed that J. M. Klingelsmith, Pres. Chatham Electric Light, Heat & Power Co., has purchased the mill and water power of H. C. Spengler on Kinderhook Creek and will develop about 1,500 HP. for power purposes and will operate his plant in Chatham from there.

HERKIMER, N. Y.—Bids are asked until Oct. 29 for installing an incandescent light plant, to cost about $13,000. The plant will be completed Dec. 20. Clk. Municipal Comn., E. W. Sluyter; Pres., C. R. Snell.

HUDSON, N. Y.—Bids are asked until Nov. 3 for furnishing and installing electric light and gas fixtures at the state armory building. State arch., I. G. Perry, Albany and Binghamton, N. Y. Address J. Rider Cady, 10 South 4th St., Hudson.

MIDDLEPORT, N. Y.—Our correspondent informs us that the village trustees have decided to contract for a plant. A new law authorizes them to arrange for an annual expenditure to a certain limit, and it is believed that the lights can be supported within this limit.

OXFORD, N. Y.—The Binghamton Electrical Construction Co., Binghamton, N. Y., has been awarded the contract for wiring the dormitory to be erected at the Woman's Relief Corps Home.

TRENTON ,N. J.—John T. Dryden, Pres. Prudential Insurance Co., Newark, N. J.; Col. A. R. Kuser and Judge R. S. Woodruff, Trenton, are reported as interested in the proposed power plant on the Delaware River. Certain rights have to be purchased from the Trenton Water Power Co. and the Delaware River Improvement Co. The proposed wing dam will cost about $100,000.

LEBANON, PA.—Bids are asked until Nov. 7 for furnishing the city with 125 2,000-c. p. arc lights for a term of five or ten years from June 1, 1899. Chn. Police Com., Geo. B. Schock.

PHILADELPHIA, PA.—Wm. Dougherty, 1604 Sansom St., is reported as receiving bids for a 2-story addition to a power house.

BALTIMORE, MD.—We are informed that bids for putting in the proposed subways and conduits for the electric wires, except those of the trolley lines, will be asked in about two weeks; estimated cost, $1,000,000. Asst. Engr., Chas. G. Edwards; Ch. Engr., Chas. E. Phelps, Jr.

BALTIMORE, MD.—Local papers state that the court-house commission on Oct. 19 awarded the contract for dynamos, engines, etc., needed for lighting and electric power in the new court-house to Cohen & Staughton, Baltimore, at $12,226. Col. Theo. F. Lang, Supt. of Bldgs., has recommended that a plant be put in the basement of the city hall; estimated cost, about $30,000.

NEWPORT NEWS, VA.—The sale of the Newport News, Hampton & Old Point Ry. to the Newport News & Old Point Ry. Co., involving about $750,000, was arranged last week, and the title will pass in a few days. The new company recently purchased the electric light plant at Hampton and recently secured a franchise for the erection of a plant at Newport News also, and it is understood will purchase some electric light and power machinery.

HARPERS FERRY, W. VA.—John A. Liners, Gettysburg, Pa., has been granted a franchise. The plant will be completed in December.

ASHEBORO, N. C.—John T. Moffit is reported as interested in the proposed plant.

DURHAM, N. C.—V. Ballard, Mgr. Durham Electric Lighting Co., writes us that the company will put in additional 1,200-light alternator and 30-light arc dynamo; present light-house will be enlarged. The dynamos have already been purchased and the work begun at once. One plant furnishes both arc and incandescent lights, but no power.

GREENSBORO, N. C.—B. S. Johnson, J. H. Lee and H. P. Jones, Baltimore, Md.. and R. R. King, Greensboro, propose to build a plant in this place.

RALEIGH, N. C.—Geo. Allen, Secy. Chamber of Commerce, writes us that the matter of improving the plant is awaiting the subscription of about $50,000 before any work can be done. The property has 5,000 HP. ready for use.

SALISBURY, N. C.—The council has granted a franchise for a plant to F. E. Boordman, Salisbury. The power will be secured from the proposed power plant to be built on the Yadkin River, near Salisbury. The Baltimore Loan & Trust Co., Baltimore, Md., it is stated, will furnish the capital.

ORANGEBURG, S. C.—J. G. Wannamaker writes us that it will probably be 30 days before the council will be ready to receive bids for constructing the plant and water-works, to cost about $40,000.

PORT ROYAL, S. C.—We are informed that the following bids were received by the bureau of yards and docks, Washington, Oct. 22, for constructing a plant at the naval station:

J. F. Buchanan, Philadelphia, Pa.	(1) $18,888
McCay Engineering Co., Baltimore, Md.	(2) 20,979
Ft. Wayne Electric Corporation, Fort Wayne, Ind.	19,700
J. P. Hall, New York, N. Y.	19,900

(1) Also 11 conditional bids ranging from $19,181 to $21,633; (2) also three conditional bids ranging from $19,650 to $21,760.

KEY WEST, FLA.—J. L. Watrous, it is stated, has asked for a franchise for a plant, street-way and telephone plant.

MIAMI, FLA.—The question of building a plant is being considered, according to reports. J. A. McDonald may furnish information.

YAZOO, MISS.— The question of building a plant, water-works, etc., is being discussed, according to reports.

FRANKLIN, TENN.—D. F. Gardner is reported to have purchased a site for a power house and light plant.

WOODSFIELD, O.—This place voted Oct. 22 on the question of building a plant.

WOOSTER, O.—An election will be held Nov. 8 to vote on the question of issuing $25,000 in bonds for a plant.

VINCENNES, IND.—Bids are asked until Jan. 2 for lighting the streets and public places with 2,000-c. p. arc lights for a period not to exceed 20 years from Dec. 25, 1900; also to furnish commercial and private lighting. Mayor, Geo. E. Greene.

JONESVILLE, MICH.—W. M. Wetmore, Village Clk., writes us that this place voted Oct. 10 to issue $10,000 in bonds for a plant and $18,000 for water-works. The plant will be operated in connection with the water-works. The pole line of the present lighting company was purchased. Up to Oct. 22 no engineer had been engaged to prepare plans and specifications.

ST. JOSEPH, ILL.—It is reported that the contract for the construction of the new electric lighting plant at St. Joseph, to furnish 500 incandescent lights, has been awarded to T. C. Reed, of St. Louis, Mo., at about $5,000. It is stipulated that the plant shall be completed and turned over to the village authorities in 90 days.

BALDWIN, WIS.—The Baldwin Electric Light Co. has been granted a 10-year franchise. The plant will be built at once. Arthur Peabody and Andrew Sabley are interested.

GREEN BAY, WIS.—The council will probably soon ask for bids for lighting the city with electricity, according to reports. The present contract with the Green Bay Gas & Electric Light Co. expires in May. Cy. Clk., W. Kerr.

TOWER, MINN.—The council has granted a 10-year extension to the franchise of the Tower Electric Light & Telephone Co. It is stated that a new plant will be built. Pres., Geo. H. Clayton.

WINNEBAGO CITY, MINN.—Bids are asked until Nov. 2 for installing a plant, to cost $8,000. Engr., W. J. Bonwell, 1013 Pioneer Press Bldg., St. Paul, Minn.; Pres. Council, A. C. Dunn.

EMMETSBURG, IA.—L. Stanhiner, Mayor, writes us that this city voted Oct. 20 to grant a franchise for a plant to John McNamara, Fulton, Ill.

HERINGTON, KAN.—J. T. Chapell, of Sherman, Tex., is reported to have leased the plant owned by this place.

WICHITA, KAN.—The council has been petitioned to call an election to vote on the question of issuing bonds for a plant. Mayor Roos may be addressed.

MARYVILLE, MO.—The question of a municipal plant and water-works is reported as being considered.

CREDE, COLO.—Press reports state that the plant, recently burned, will soon be rebuilt.

SHERIDAN, MONT.—The council is reported to have decided to build a plant.

BREMERTON, WASH.—Bids are asked until Oct. 29 for installing a plant at the naval station, Puget Sound, Bremerton; appropriation, $9,800. M. T. Endicott, Ch. Bureau Yards and Docks, Washington. D. C.

BAKERSVILLE, CAL.—Press reports state that the Kern-Rand Co. has filed on 10,000 ins. of water at the lower end of the Manache meadows, where a site for a dam has already been located. It is the intention to put in a 50-ft. dam, and impound the waters of Kern River, using the meadow as a reservoir and carrying the waters out by means of ditches, flumes, etc. The principal use to which the water will be put will be the generating of electricity. Electric power so developed will be conducted to Randsburg and Los Angeles and intermediate points.

VISALIA, CAL.—Bids are asked until Nov. 9 for the purchase of a franchise for operating wires along the roads of Tulare county. Clk., Wm. H. Hammond.

PROVO, UTAH.—J. B. Keeler, Chn. Com., writes us that R. M. Jones, Salt Lake City, is preparing plans and specifications for the proposed plant. It will have a capacity for about 80 2,000-c. p. arc lights and will be operated by water power. Bids will be asked in about a month.

OTTAWA, ONT.—Press reports state that the Metropolitan Electric Co., recently incorporated, has purchased a water power at Britannia, six miles above the city, for about $20,000. The capacity is understood to be 40,000 HP. Work will be completed next spring, but the company will not wait till then to sell light in the city, for it intends to use another power inside of two months to begin operations. A. B. Broderick, and T. Linsay, Ottawa, and Jas. Robinson, Montreal, Que., are interested.

CAMBELLTON, N. B.—Bids are asked until Oct. 26 for furnishing the machinery and installing a plant. Chn. Com., W. W. Doherty.

MONTREAL. QUE.—Barry, Ross & McRae, of Niagara Falls, Ont., are reported to have been awarded the contract for building the dams, canal, etc., for the proposed plant at the falls on the Jacques Cartier River, at the outlet to Lake St. Joseph, about 20 miles from Quebec. Work has already been begun and it is stated that it will be completed by March 15. A company, composed of New York capitalists has been organized, with a capital stock of $500,000.

TEPEC, JALISCO, MEX.—The city authorities are reported as negotiating for a plant for this city; population (1895), 12,000.

KNOWLE (FAREHAM), ENGLAND.—Bids are asked until Nov. 16 for furnishing and installing two engines and dynamos, equal to an output of 24,000 watts each, together with all necessary washing machinery, lathe, drill, motors, lamp installations, etc., required in connection with the centralization and increase of the light, heat and power generating plant at the County Lunatic Asylum, Knowle, Fareham. W. J. Taylor, County Surv., The Castle, Winchester.

QUITO, ECUADOR.—It is stated that Mr. Riendenburg, Consul for Ecuador, in Cincinnati, is securing information about motors and electrical machinery in general.

JOHANNESBURG, SOUTH AFRICA REPUBLIC.—Bids are asked by the general manager of the lighting department until Jan. 6 for furnishing a complete carbureted water gas plant. Specifications may be secured from Robt. Whyte & Co., 22 Bury St., St. Mary Axe., E. C., London, England.——Press reports state as follows regarding work in South Africa: A contract for the electric lighting installation for the Pretoria Theater has been placed with an American firm, the Johannesburg town council having been empowered to raise $750,000 for electric lighting purposes, two-thirds of which sum will be devoted to the purchase of new machinery, street extensions and other works; thus opportunity for the securing of some valuable orders should be afforded. A company with a capital of $25,000 has been formed at Ledysmith, Natal, for promoting the electric lighting of the town. Everything is required for this plant, and American competition will be considered. The electric lighting and tramway installation for East London and the electric lighting of the Grahamstown exhibition, besides the installation of an electrical equipment of a large building in Johannesburg and the electric plant for the Bank of Africa's branch at Lorenzo Marquez, are to be carried out by the firm of Reunent & Leuz, of Johannesburg.

NEW COMPANIES.—Northwestern Electric Heat & Power Co., Macon, Mo.: $30,000; F. W. Blees, John F. Schafer, Charles E. Roehl.

Electric Current Co., Brooklyn, N. Y.; $3,000; John W. Cleary, 186 Remsen St., Brooklyn.

Lake City Power Co., Lake City, Colo.; $50,000; David K. Lee, B. Gibson, Frank C. Gaudy.

Waterbury Battery Co., Waterbury, Conn.; $10.000; C. M. Platte, Lewis A. Platte, Chas. B. Schaemuchl.

Council Bluffs Gas & Electric Co., 60 Grand St., Jersey City, N. J.; $250,000, of which $1,000 is paid in; Hunter Wykes, Victor Cumberson, Wm. B. Hord.

Northern Development Co., Bangor, Me.; $1,000,000; to furnish Indian townships, Nos 1 and 2, Penobscot county, with water, electric lights and heat and of supplying electric power for factories and other industries; Henry M. Prentiss, Bangor; Chas. W. Mullen, Old Town, Me.

Darby-Lansdowne Electric Co., Darby, Pa.; $1,000, with $100 paid in; Treas., T. P. Street; Edwin B. Lewis, Lansdowne.

Clifton-Lansdowne Electric Co., Clifton Heights, Pa.; $1,000, with $100 paid in; Treas., T. P. Street, Lansdowne; N. Y. Mitchell, Philadelphia, Pa.

Yeadon-Lansdowne Electric Co., Yeadon, Pa.; $1,000, with $100 paid in; Treas., Edwin B. Lewis, Lansdowne.

Standard Electric Construction Co., Rochester, N. Y.; $5,000, with $500 paid in; Edgar H. Freeman, Walter H. Tobey, Burton A. Vandy, Rochester.

Wyoming Valley Electric Light, Heat & Power Co., Wilkes-Barre, Pa.; $500; Eugene W. Milligan, Wilkes-Barre; Will P. Billings, Kingston, Pa.; Edward C. Jones, New York.

BRIDGES.

BENNINGTON, VT.—The Vermont Construction Co., St. Albans, Vt., has been awarded a contract for constructing two or three iron bridges, 140 × 16 ft. at $9,706 each. There are also four smaller bridges that will have to be built. Col. J. H. Walbridge, First Selectman.

ALBANY, N. Y.—Reports state that plans are being prepared by the New York Central & Hudson River R. R. Co. for the construction of bridges at Livingston Ave. and at Spencer St.

HOOSICK, N. Y.—Dean & Westbrook have submitted the lowest bid to the town board, at $1,492, for constructing an iron bridge at North Hoosick, with a 110-ft. span.

McKEES ROCKS, PA.—The city clerk informs us that no steps have yet been taken toward the construction of a bridge at Turners Station and Pittsburg & Lake Erie R. R.

HAMILTON, O.—The county commissioners have resolved to construct an iron bridge across Seven-Mile Creek, on Oxford Road, near Somerville, to cost about $40,000.

GRAND HAVEN, MICH.—The county supervisors voted Oct. 21 on the question of constructing two bridges across the Grand River, to cost about $10,000 each.

MUSKEGON, MICH.—The question of constructing a new bridge over the Muskegon River on the North Muskegon Road is being considered by Mayor Balbirnie and the board of aldermen.

OSHKOSH, WIS.—It is reported that Adolph Green, Green Bay, Wis., has been awarded a contract by the Chicago & Northwestern Ry. for constructing the substructure of the new double-tracked steel drawbridge to be built across the Fox River.

ST. PAUL, MINN.—The county commissioners have notified the Minneapolis, St. Paul & Sault Ste. Marie Ry. Co. to construct a bridge at the Vaduals Park crossing of Rice St.

WICHITA, KAN.—W. Q. Church, Gen. Mgr., Wichita Ry., Light & Power Co., informs us that the construction of the bridge across the Big Arkansas River, will be included in the contract for rebuilding the street railway lines, plant, etc.

ST. JOSEPH, MO.—A contract for a plate girder viaduct over the railway track has been awarded to E. H. Connor, Fullerton Bldg., St. Louis, Mo. It consists of seven 51-ft. spans and two 34-ft. spans, 25 ft. wide.

OMAHA, NEB.—Andrew Rosewater, Cy. Engr., has completed plans for the new viaduct at South Sixth St. The structure will be about 1,573 ft. long, of stone and steel, and will cost between $150,000 and $200,000.

MISSOULA, MONT.—W. F. Hughes, informs us that it is proposed to construct a wooden and iron bridge, to cost about $7,500.

PALOUSE, WASH.—The county commissioners, Colfax, Wash., have rejected the bids for a 140-ft. span steel bridge across the Palouse River at this place; estimated cost $5,000. It is stated that the bridge will probably not be constructed until next year.

TACOMA, WASH.—The council has decided to reconstruct the Tacoma Ave. bridge, which was burned some time ago, according to reports.

COLFAX, WASH.—Bids are asked until Nov. 11 for furnishing plans and materials and constructing two bridges 60 ft. long each. John Tobin, County Audr.

LINCOLN, CAL.—Bids are asked until Nov. 1 for constructing a bridge in District No. 2. J. S. Mariner, Supervisor.

STOCKTON, CAL.—Geo. A. Atherton, County Surveyor, is preparing plans for a How truss wooden bridge across the Middle River, to be 199 ft. long. The plans will be submitted at the meeting of the board in November, according to reports.

LEWISTON, IDAHO.—The contract for a new cantilever bridge over Snake River at this place has been awarded to the Pittsburg Bridge Co., Pittsburg, Pa. It will be 1,500 ft. long, with a channel span of 374 ft., and 22-ft. roadway.

VICTORIA, B. C.—Reports state that bids will soon be asked by the council for a bridge between Bay St. and Rock Bay Ave.

BUILDINGS.

BARRE, VT.—Bids are asked by the city council until Oct. 31 for heating and plumbing the new city hall building. Burt H. Wells, Cy. Treas.; Geo. G. Adams, Arch., Lawrence, Mass.

FITCHBURG, MASS.—Sketch plans have been accepted, according to reports, for a brick, stone and iron hospital building for this city, to cost about $100,000. Rodney Wallace, Chn. Bldg. Com.; Kendall, Taylor & Stevens, Archs., 87 Milk St., Boston, Mass.

PITTSFIELD, MASS.—Harrington & Robinson, of Boston, are said to have been awarded the contract for erecting the steel work and roofing of the car-house and offices of the new street railway company.

BROOKLYN, N. Y.—Bids are asked until Oct. 31 for erecting additions and improvements to the state armory building for 47th Regiment, N. G. N. Y., in Brooklyn. Address Charles W. Tillinghast, Adj.-Gen., Albany, N. Y.——The lowest formal bid received by the bureau of yards and docks, Washington, D. C., Oct. 15, for constructing a steel storehouse at the navy yard in this city was that of Cooper & Wigand, 1133 Broadway, New York, at $38,977. The appropriation made for the work was $30,000.——It is reported that plans have been approved by the state board of charities for the proposed $100,000 addition to the county hospital, at Flatbush.

BUFFALO, N. Y.—Plans have been filed for the new hospital building, 114 × 50 ft., to be erected on Jefferson St., near Genesee St., for the German Hospital Association, to cost $47,000.

CENTRAL ISLIP (L. I.), N. Y.—The state commission on lunacy, Oct. 20, awarded the contract for erecting and finishing the cottage colony buildings at Central Islip, which are to form a part of the Manhattan State Hospital, to Miles Leonard, of Binghamton, N. Y., at $697,707. The contract calls for semi-fireproof construction, involving fireproof corridors and a fireproof main cottage.

NEW YORK, N. Y.—Bids are asked by the department of education, at 585 Broadway, until Oct. 31, for improving the sanitary condition of public schools 4 and 18, Borough of Richmond; also for supplying heating and ventilating apparatus and electric lighting plant for public school 159, Borough of Manhattan.——Bids are asked by the fire department, 157 East 67th St., until Nov. 2, for constructing and erecting a building for the fire department on Scofield Ave., east of Main St., at City Island; two sureties, $4,000 each.——Bids are asked by the armory board, at the City Hall, until Nov. 4, for furnishing an alteration and improvement to the roof of the 22d Regiment armory building, at Columbus Ave. and 67th and 68th St.; two sureties, $2,000. Address Thos. L. Feitner, Secy., 280 Broadway.——Plans are being prepared, according to reports, for a 10-story fireproof business building to be erected on Broad and Beaver Sts. for Edward Kemp. Arch., Robt. W. Gibson, 18 Wall St.——Plans have been filed by Barnett Cohen, 58 Forsyth St., for a 6-story brick flat and store building at South and Jackson Sts., to cost $50,000. Arch., Samuel Sass, 23 Park Row; by Charles Naarden, for three 5-story brick flat and store buildings on 125th St., near Amsterdam Ave., to cost $72,000. Archs., Schneider & Herter, 48 Bible House; by Mark E. Stevens, for four 5-story brick flat buildings, on 89th St., near Columbus Ave., to cost $76,000. Arch., C. C. Manning, 58 East 86th St.; by Zimmerman & Valente, 1804 Madison Ave., for three 5-story brick flat buildings on 122d St., east of 8th Ave., to cost $240,000. Arch., Geo. F. Pelham, 503 5th Ave.; by Teichman & Potter, 181 Broadway, for a 6-story brick flat building on 91st St., near Central Park West, to cost $90,000. Arch., Geo. F. Pelham; by Henry Hanlein, 401 East 103d St., for five 5-story brick tenement buildings on 95th St., near 2d St., to cost $90,000. Arch., Franklin Baylies, 52 Bible House.——The bid received by the fire department Oct. 19 for a building on Main St., Borough of Bronx, was that of Ryan & McFerran, 106 East 23d St., at $7,828.

PERRY, N. Y.—David Andrus, of Perry, has been awarded the contract for erecting a new 2-story brick block on Main St., 65 ft. in length, for T. H. Bussey.

SYRACUSE, N. Y.—Ray B. Smith, 618 Kirk Block, Chn. of Com., informs us that the plans and bids for the proposed penitentiary building for Union county have been received, but that no further steps can be taken until the meeting of the board of supervisors in November.

ATLANTIC CITY, N. J.—It is reported that a 5-story hotel building will soon be erected on South Carolina Ave., near the beach, for Clarence M. Busch, to cost $50,000.

JERSEY CITY, N. J.—It is reported that plans have just been completed for the new railway station to be built in this city for the Pennsylvania R. R. Co. The main waiting room will be 80 × 97 ft., and the train shed will be extended by an addition 125 × 256 ft.

NEWARK, N. J.—Charles Marsh is reported to have received the contract for erecting the new building at 158 and 160 Market St. for the New York & New Jersey Telephone Co., 18 Bridge St., Brooklyn, N. Y., at $71,990. Arch., Jeremiah O'Rourke, 756 Broad St., Newark.

NEWARK, N. J.—A. B. & W. J. Westervelt, of New York, have been awarded the contract for erecting the bookstacks for the Free Public Library, made under the Stikeman patents, at $17,500.

LEWISTON, PA.—Bids are asked until Oct. 30, according to reports, for a brick and stone Methodist Church building, to cost $25,000. Archs., W. O. Weaver & Son, 1125 North 3d St., Harrisburg, Pa.

McKEESPORT, PA.—Plans are being considered for a new building for the Central High School, to cost about $80,000.——The erection of a new $60,000 city hall building is also contemplated.

PHILADELPHIA, PA.—William Stille & Son are reported to have been awarded the contract for rebuilding the Dobson Building, on Chestnut St., near 8th St.; work will begin as soon as plans have been approved.——A building permit has been granted to Charles McCaul, Contractor, for erecting a 15-story office building, 40 × 50 ft., at Broad St. and South Penn Square, for the West End Trust & Safe Deposit Co.; estimated cost, $300,000. Work is to be completed by May 1, 1899.——A building permit was granted Oct. 19 for the new 20th Ward school building to be erected on Friendship Ave., near Roup St., to cost $105,000.

SHIPPENSBURG, PA.—G. R. Dykeman, of Shippensburg, informs us that the contract for heating the building of the Cumberland Valley State Normal School; also for pipe work, radiators, power house and stack complete, has been awarded to Henry F. Murphy & Co., 27 North 7th St., Philadelphia, Pa.; and the contract for 600-ft. pipe tunnel to Frank Hafer, of Shippensburg. Engr., Robt. C. Clarkson, 641 Drexel Bldg., Philadelphia.

YORK, PA.—The following bids were received by the county commissioners, Oct. 20, for apparatus to heat the courthouse: Broomell, Schmidt & Co., York, Pa., $19,466; Evans, Almirall & Co., New York, $19,361, and McGinnes, Smith & Co., Pittsburg, Pa., $19,287.

BALTIMORE, MD.—The following bids were received by the police board, Oct. 19, for work on the new police station to be erected in the Northern Annex; Arch., Henry Brauns: William Ferguson & Bro., $60,618; J. J. Walsh & Son, $60,000; Edward D. Preston, $65,986; D. W. Thomas, $59,600; Morrow Bro., $64,975; John Stack & Son, $60,989; George Mann, $58,023; G. Sheehan & Sons, $58,285; J. Henry Miller, $59,917; Henry Smith & Sons, $77,140; John Gill & Son, $61,271, and B. F. Bennett, $66,552.

NORFOLK, VA.—Bids are asked by the supervising architect, Washington, D. C., until Nov. 22, for the construction (except heating apparatus, elevator and electric wire conduits) of the U. S. building in this city, as advertised in Engineering News. Archs., Wyatt & Nolting, 4 East Lexington St., Baltimore, Md.

HUNTINGTON, W. VA.—Gresham & Boyd, Charleston, W. Va., are reported to have been awarded the contract for erecting the first of 15 buildings for the State Asylum for Incurables; total estimated cost, $200,000. Arch., Harrison Albright, Charleston.

FORT CASWELL, N. C.—Bids are asked until Oct. 28 for constructing one temporary set of officers' quarters, one mess building and two barrack buildings, at this post. Harry G. Bishop, 2d Lt. and Q.-M.

COLUMBUS, GA.—The following bids were received by the supervising architect, Washington, D. C., Oct. 13, for the interior finish, plumbing, and approaches of the U. S. building at Columbus: Peter Schumahl, Savannah, Ga., $2,358, Jan. 1; John F. Dalton, Savannah, Ga., $1,988, 30 working days; J. S. Henley, Columbus, Ga., $2,068, 60 days.

SHEFFIELD, ALA.—Reports state that the contract has been let for erecting the new union station, to cost $12,000, for the use of the Nashville, Florence & Sheffield, the Northern Alabama and the Southern Rys.

FRANKFORT, KY.—S. C. Cryer, of Frankfort, has the contract for enlarging the hospital at the Frankfort prison, at $4,000.

LEXINGTON, KY.—The proposition to issue $100,000 in bonds for erecting a new court house to replace the one destroyed by fire will be voted upon in Fayette county on Nov. 8.

LOUISVILLE, KY.—W. N. Haldeman, Pres. of the Courier-Journal Co., has been granted a permit to make improvements to the Courier-Journal building at 4th and Green Sts., to cost $45,000.

SHELBYVILLE, KY.—The erection of a new $50,000 court house is said to be contemplated. Mayor Willis is interested.

WASHINGTON C.-H.,O.—Plans have been accepted for the new $50,000 masonic temple to replace the one destroyed by fire.

MANSFIELD, O.—Bids are asked by the managers of the Ohio State Refermatory, until Nov. 16, for the erection of the east cell and lateral wing roof of the reformatory building. Secy., D. J. Gibson, Jr.; Archs., Weary & Dole, both of Mansfield.

DETROIT, MICH.—Bids are asked by the board of public works, a readvertisement, for the erection of a new G. A. R. memorial hall to cost not more than $38,000.

CHICAGO, ILL.—The Hennessy Bros. & Evans Co. has been awarded the mason work contract for W. D. Stein's 10-story building, at 303 and 305 Dearborn St. Arch., S. B. Eisendrath, 1439 Marquette Bldg.——Bids are being received, according to reports, for erecting a 3-story apartment building, 100 × 227 ft., on Graceland Ave., to cost about $90,000. Address Engstrand, Lothgren & Co., Builders, 6327 South Peoria St.; A. G. Lund, Arch., 602 West 63d St.

DANVILLE, ILL.—The following were the lowest bidders Oct. 12 for work at the National Home for D. V. S.: L. J. Mueller Furnace Co., Milwaukee, Wis., for heating apparatus, $2,156; the Prox & Brinkman Mfg. Co., Terre Haute, Ind., for plumbing and gas piping, $1,360; the Warren Electric Mfg. Co., Sandusky, O., for laundry machinery, shafting, at $6,943.

FREEPORT, ILL.—Bids are asked until Oct. 31 for erecting the superstructure, etc., of the proposed city hall building. The bids received in response to the former call were all too high, so plans have been altered. Address Geo. H. Tandy, Cy. Clk.; D. S. Schureman, Arch., 215 South Church St., Rockford, Ill.

DECORAH, IA.—The proposition of erecting a new $75,000 court house for Winneshiek county will be voted upon on Nov. 8.

ORANGE CITY, IA.—The erection of a new $35,000 court house will be voted upon at the next election.

ST. PAUL, MINN.—Bids are asked by the board of school inspectors, B. Zimmerman, Pres., until Oct. 31, for furnishing three smoke preventers at the Madison school.

FORT LOGAN, COLO.—H. W. Michael, of Denver, has been awarded the contract for a heating apparatus at Fort Logan, at $3,471.

SILETZ, ORE.—Bids are asked by the office of Indian affairs, Washington, D. C., until Nov. 17, for erecting at the Siletz Agency boarding school a frame hospital building. Comr., W. A. Jones.

SACRAMENTO, CAL.—It is reported that Samuel Ginsberg contemplates the organization of a stock company to erect a 5-story hotel and theatre building, to cost $200,000.

SAN JOSE, CAL.—T. and C. D. Mechell and W. Schuh are said to have been awarded the contract for the marble work on the new building to be erected here for Mrs. Jane L. Stanford, at $13,208.

UKIAH, CAL.—Contracts have been let for the constructing of the Mendocino State Hospital, at Ukiah, as follows: Rhody Ringrose, for masonry, $25,490; W. L. Prather, Jr., for iron and steel work, $4,269; Andrew Wilkie, carpentry work, $15,441; J. J. Grannis & Co., for heating and ventilating, $3,450; total cost, $55,034.

PHOENIX, ARIZ.—Bids are asked until Nov. 1 for erecting the territorial capitol building in this city, to cost about $100,000. Secy., F. H. Parker; Arch., J. M. Creighton.

WATER-WORKS.

OAKLAND, ME.—Wm. T. Harris, Waterville, Me., writes us that the proposed works will have a 1,000,000-gallon Worthington duplex pump, a 1,000,000-gallon reservoir, 30 hydrants, 6 miles of 6, 8 and 10-in. pipe; estimated cost, $50,000.

PLYMOUTH, N. H.—F. H. Rollins writes us that nothing has yet been done toward securing municipal works. A preliminary survey only has been made.

BUFFALO, N. Y.—The question of extending the water mains to Depew is being considered by the aldermen. The Depew end of the matter is being promoted by Henry W. Box, White Bldg., Buffalo.

CHARLOTTE, N. Y.—We are informed that the following bids were received Oct. 15 for building works, etc., as advertised in Engineering News; Engrs., Stanwix Engineering Co., Rome, N. Y.:

Birdseye & Lewis (accepted), Herkimer, N. Y.	$24,600
Jones & Luddington, Charlotte, N. Y.	25,544
Thos. Holohan, Rochester, N. Y.	25,900
Hill & Norton, Rome, N. Y.	26,375
Chambers & Casey, Rochester, N. Y.	26,572
Wm. Fuller, Rochester	29,075
S. M. Neff, Newark, N. J.	29,276
Jno. Dunfee & Co., Syracuse, N. Y.	32,300

COPENHAGEN, N. Y.—This place voted Oct. 18 to clean the springs, looking to the establishment of works.

FISHKILL-ON-THE-HUDSON, N. Y.—C. E. Spaight, trustee, writes us that something definite will soon be known in regard to the proposed new water supply. The city is in communication with several parties looking to a new supply, or for the reconstruction of the old works.

MIDDLETOWN, N. Y.—The question of a filtration plant at the water-works is again being considered by the water board.

SIDNEY, N. Y.—E. J. Patten, Supt., writes us that a committee has been appointed to investigate the question of putting in a new power pump to force the water from a new spring to the camp grounds.

WINDSOR, N. Y.—It is stated that this place has voted to spend $20,000 for works, the construction to be begun in the spring. Clk., M. A. Tompkins.

GLOUCESTER, N. J.—The council has awarded the contract for furnishing a 2,500,000-gallon pump to Robt. Wethill & Co., Chester, Pa., at $10,500.

IRVINGTON, N. J.—The residents of Manhattan Park have petitioned the council of this place to extend the water mains to that borough.

NEWARK, N. J.—The board of works has asked the council for $65,000 with which to construct a new feeder main in the annexed district.

KNOXVILLE, PA.—The following have been awarded contracts for furnishing the materials and for constructing works, as advertised in Engineering News: Pipe and specials, R. D. Wood & Co., Philadelphia, Pa.; hydrants, valves, boxes, check valves, relief valves, etc., Rensselaer Mfg. Co., Troy, N. Y.; building reservoir, laying pipe, etc., Chas. Wilson, Philadelphia. Engr., Howard Murphy, Philadelphia; Clk.. H. A. Ashton.

NORRISTOWN, PA.—The council proposes to build municipal works, at a cost of about $250,000. Councilman Frank Smith may be addressed.

OIL CITY, PA.—Bids are asked, until Dec. 5 for furnishing one vertical cross compound crank and fly wheel pumping engine, of 3,300,000 gallons capacity, as stated in our advertising columns. Park C. Porter, Clk., Water Bd.

READING, PA.—A. B. Dundor, Pres. Bd. of Health, writes us that the question of securing a loan for constructing a water filtration plant will be voted on by the citizens Nov. 8.

LAUREL, MD.—D. G. Adelsberger, 722 Pennsylvania Ave., Baltimore, Md., has submitted a report for works, to cost about $33,000.

WHEELING, W. V.—The question of a water supply for the 8th ward is being considered. H. F. Jones, Pres. Water Bd.

ROCK HILL, S. C.—Bids are asked until Nov. 15 by the Rock Hill Water, Light & Power Co. for furnishing the materials and for constructing the proposed works, as stated in our advertising columns, Engr., J. L. Ludlow, Winston, N. C.; Pres., J. M. Cherry.

ATLANTA, GA.—Alderman Woodward has introduced an ordinance calling for another election to vote on the question of issuing $200,000 in bonds for extending the water mains.

WOODLAWN, ALA.—The question of building works for this place, a suburb of Birmingham, is being considered; estimated cost, about $20,000. J. S. Kennedy and John T. Hook, Woodlawn, may be addressed.

LAKE PROVIDENCE, LA.—This place will vote about Nov. 30 on the question of issuing bonds for works. R. L. Hill may be addressed.

SUMMIT, MISS.—It is stated that the date set for receiving bids for the construction of water-works was postponed until Oct. 25, owing to quarantine restrictions.

YAZOO CITY, MISS.—Information is wanted for works, a sewerage system and electric light plant for this place, according to reports. L. G. Montgomery may be addressed.

FAYETTEVILLE, TENN.—This place voted Oct. 15 to issue bonds for works.

ROCHESTER, KY.—It is reported that this place will build works, at a cost of about $2,000.

LANCASTER, O.—Bids are asked until Nov. 1 for furnishing and laying or setting cast-iron pipe, valves and hydrants. Secy. Water Bd., Louis J. Snyder.

YOUNGSTOWN, O.—Press reports state that the waterworks trustees have presented a proposition to the effect that if the board of health will condemn the use of water from the Mahoning River it will arrange to secure a supply of water from Mill Creek, issue bonds to pay for the improvements, and pay principal and interest. The proposition will probably be accepted.

ANDERSON, IND.—Superintendent Lowell has submitted estimates for extending the mains to Shadeland, at a cost of $3,150.

BOYNE, MICH.—It is stated that this place will soon have works, the water supply to be secured from springs.

IRONWOOD, MICH.—We are informed that new works will be built by the Citizens' Water-Works Co. The works will be built in conjunction with the electric light company. There will be electric pumps with a capacity of 1,000,000 gallons. The company is also in the market for 36,000 ft. of pipe and a standpipe. Population, 10,000. E. D. Nelson may be addresed.

JONESVILLE, MICH.—W. M. Wetmore, Clk., writes us that on Oct. 10 this place voted to issue $18,000 in bonds and $10,000 for a light plant, to be operated in connection with the works. Up to Oct. 22 no engineer had been engaged.

BELLEVILLE, ILL.—The Deep Well Water-Works has been granted permission to lay five miles of pipe to connect the new works with the old.

UTE, IA.—J. P. Harker, Mayor, writes us that an election will be held Oct. 31 to vote on the question of issuing $3,000 in bonds for works; population, 450.

ST. PAUL, MINN.—Bids are asked until Nov. 7 for furnishing two 18-ft. × 54-in. tubular boilers, and also for setting the same at Como Park pumping station. Matt Jensen, Cy. Clk.

WEST DULUTH, MINN.—Alderman Krumrieg has introduced an ordinance authorizing an appropriation of $100,000 for the purchase of the works of the West Duluth Water Co., or for building a new plant.

CARTHAGE, MO.—E. B. Jacobs, Secy. Carthage Water Co., writes us that this company succeeds the original company, which was sold out under mortgage. The plant is complete and is being operated by a receiver until the new company is organized. No extensions or improvements will be made to the works. Mgr., H. C. Messenger.

LAMAR, MO.—Press reports state that M. T. Davis has been appointed receiver of the water and electric light company of this city. Indebtedness amounting to over $80,000 has been filed against the company. Jerry Guinney, Pres. and Mgr., has temporary charge.

WACO, TEX.—E. S. McKenney, Secy. Bell Water-Works, writes us that the company has not yet decided what will be done towards securing a new standpipe, but it is probable something will be done soon. Pres., J. D. Bell.

NEW WHATCOM, WASH.—Bids are asked until Nov. 7 for constructing 8,600 ft. of 24-in. wooden stave water main, at a cost of about $30,000. Cy. Clk., F. B. Graves.

THE DALLES, ORE.—The Pacific Bridge Co. has been awarded the contract for furnishing the materials and for building the works, at $9,433.

COLTON, CAL.—Press reports state that the recent bond issue amounting to $20,000 for works has been declared illegal.

LOS ANGELES, CAL.—The Cienega Water Co., has been incorporated, with a capital stock of $150,000. Incorporators: S. A. Stowell, B. T. Allen, Westwood H. Collins, George F. Platt and William Bowring.

SAN BERNARDINO, CAL.—Bids are asked until Nov. 7 for the purchase of a franchise for putting in works. Clk., J. B. Parazette.

STENT, CAL.—It is stated that arrangements are being made for the proposed works.

WHITTIER, CAL.—J. J. Jessup, Cy. Engr., writes us that the proposition before the city is to buy the works of the old company for $18,500, and also to build a new pumping station, the water supply to be secured from a new source, estimated to cost about $21,500. An election will soon be called to vote on the question of issuing $40,000 in bonds. Engr., Burr Bassell, Los Angeles, Cal.

TEMPE, ARIZ.—G. W. Hoadley, Phoenix, Ariz., has been granted a franchise for works.

GRAND MERE, QUE.—This place is to have works at once at a cost of about $40,000, according to reports.

LEVIS, QUE.—It is stated that the council has voted to build works at once.

PORT ARTHUR, ONT.—Edward S. Jennison, Arch., 134 Van Buren St., Chicago., Ill., has submitted a proposition to furnish this place with 500,000,000 gallons of water a year for a term of 99 years. This water supply will be in connection with the electric power plant.

HONOLULU, H. I.—Bids are asked by Jas. B. King, Minister of the Interior, Honolulu, or by the Hawaiian Consulate, 65 Wall St., New York, until Nov. 25, for furnishing cast-iron water pipe and connections.

SAN LUIS POTOSI, MEX.—Press reports state that an American company is negotiating with the authorities of San Luis Potosi regarding the construction of a waterworks for this city. The water is to be taken from the Matehuala River. Population, 70,000.

JALAFA, VERA CRUZ, MEX.—It is stated that the work of constructing new works for this city has commenced. The estimated cost will be $800,000, of which amount $500,000 is borne by the state government. Population (1895), 10,000.

SEWERAGE.

NEW HAVEN, CONN.—Bids are asked until Oct. 31 for constructing sewers in certain streets. Cy. Engr., C. W. Kelley.

ALBANY, N. Y.—Bids are asked until Nov. 7 for constructing 15 to 6-in. pipe sewers in two streets; two sureties of $1,200 each and two of $500 each.

COHOES, N. Y.—Frank S. Ablett, of Cohoes, has been awarded the contract for building the first section of the system, at $29,734. The bids are given under Contract Prices.

FULTON, N. Y.—Bids will be wanted at once by the manager of the Fulton Worsted Mills Co., Oswego Falls, N. Y., for constructing a system for the buildings, according to reports.

GLENS FALLS, N. Y.—The sewer commissioners are considering the question of building a system.

NEW YORK, N. Y.—Bids are asked until Nov. 2 for constructing a temporary private sewer in 18th Ave., from 57th to 75th St. Comr. of Sewers, Jas. Kane, 267 Broadway.

ROCHESTER, N. Y.—It is proposed to build a 48 to 30-in. brick sewer this winter on East Ave.; estimated cost, $28,000.

SARATOGA SPRINGS, N. Y.—Bids are asked by the village trustees until Nov. 1 for the construction of an 8-in. sewer in State St., from Greenfield Ave. to Alger St. Jesse S. Mott, Village Engr., 420 Broadway, Saratoga Springs.

SYRACUSE, N. Y.—The following bids were received by the council Oct. 17 for constructing a 24 to 15-in. pipe sewer in West Fayette St.: G. W. Dakin, $6,542; James Swift, $6,528; C. T. Hookway, $6,147; F. S. Spasato, $7,035; Thomas Marnell, $6,972; Matthew Dillon, $6,224; P. J. Mack, $6,343; P. H. Lyons, $7,471; Martin & Sullivan, $7,426; Gleason & Kiely, $8,480; Richard Barrington, $6,989; T. F. Moore, $6,878; Martin Lavelle, $6,437; L. D. Hulbert, $6,721; J. W. Bustin, $6,916; E. C. Gay Co. (accepted), $5,573.

SOMERSET, PA.—At the election Nov. 8 this place will vote on the question of issuing $24,000 in bonds for a system.

WASHINGTON, PA.—The question of building sewers for East Washington is being considered by the council of that borough; estimated cost, $9,000. St. Comr., Wm. West.

WILLIAMSPORT, PA.—It is proposed to build sewers in certain streets. Councilmen Bennett and Cauldwell may be addressed.

MOBILE, ALA.—The following submitted bids to the council Oct. 17 for constructing sewers, as advertised in Engineering News: J. B. Neely & Co., Chattanooga, Tenn.; Van Sandt & Meed, Cincinnati, O.; M. T. Lewman & Co., Louisville, Ky.; Greenville Construction Co., Greenville, O.; Dowdle & Dungan, Chicago; Thos. J. Shea, Quincy, Ill.; St. John & Co., Mobile, Ala.; Guild & Co., Chattanooga; Blackmer & Post, St. Louis, Mo. (pipe only). The contract was let to T. J. Shea, Oct. 19, at $186,273.

YAZOO CITY, MISS.—The question of building a system. water-works, etc., is under consideration, according to reports.

DAYTON, O.—Local papers state that the following bids were received by the board of city affairs for building a 36-in. pipe or brick sewer in Main St.: James Reid & Co., $3,859 and $3,607, for brick and pipe sewer, respectively; E. Brentlinger, $4,365 and $4,101; J. J. Smith, $5,475 and $4,983. The contract was let to Reid & Co., at $3,607.

TOLEDO, O.—Bids are asked until Oct. 31 for building a 15-in. pipe sewer in Champlain St., and until Nov. 21 for building an 84 to 60-in. brick sewer in Paine St. L. P. Harris, Cy. Clk.

TOLEDO, O.—Bids are asked until Nov. 21 for the construction of a cylindrical brick sewer with a 13-in. and a 9-in. shell along the center line of Paine Ave., from the Maumee River to Woodford St., 84 ins. inside diameter, from the Maumee River to Genesee St., and 66 ins. inside diameter from Genesee St. to Woodford St. Lem. P. Harris, Cy. Clk.

EVANSVILLE, IND.—Michael Weber has been awarded the contract for building a main sewer in Washington Ave. from Garvin St. to Linwood Ave.

WABASH, IND.—Bids are asked until Nov. 7 for building sewers in two streets. Cy. Clk., Fremont McLees.

PEORIA, ILL.—Bids are asked until 2 p. m. Oct. 27 for building 700 ft. of brick tunnel sewer and about 2,000 ft. of pipe sewers for the Illinois Asylum for the Incurable Insane. F. W. Menke, 22 Arcade Bldg., Peoria.——The board of local improvement proposes to build a main sewer in Persimmon St.

DAVENPORT, ILL.—The question of building an intercepting sewer and certain other sewers at a cost of about $150,000 is being agitated by the Business Men's Association.

QUINCY, ILL.—Peter Simons submitted the lowest bids Oct. 10 for building sewers in four streets, at a total cost of about $7,000.

VALLEY JUNCTION, IA.—The council is reported as arranging to put in a system.

KENOSHA, WIS.—Reports state that Hanson & Co., of Racine, Wis., have been awarded the contract for building sewers on Naida St., in Kenosha.

ST. CLOUD, MINN.—Clarence L. Atwood, Pres. Council, writes us that the city engineer is preparing plans for a main sewer in the lower ravine to drain about 800 lots, and to extend from Lake George to Mississippi River. The main sewer will be built of granite or brick and tile pipe will be used for laterals. No time has yet been set for opening bids.

TOPEKA, KAN.—The council has decided to build a sewer in the First Ward, North Topeka.

SHERMAN, TEX.—Press reports state that work on the proposed system will begin within a few months; estimated cost, $100,000. The system will be built by Geo. W. Puch & Co., 2851 Hutchinson St., Philadelphia, Pa.; Mayor, A. A. Fielder.

SAN BERNARDINO, CAL.—Bids are asked until Oct. 26 for caring for and disposing of the sewage of this city for one year. Clk. Bd. Trustees, A. W. Clark.

TORONTO, ONT.—C. H. Rust, Cy. Engr., has submitted a report for the sewage disposal of the city. Two systems are suggested, each to cost about $1,500,000.

GARBAGE DISPOSAL—STREET CLEANING

NEW ROCHELLE, N. Y.—G. H. Crawford, Pres. Bd. of Health, writes us that it is probable that a plant will be built here not later than spring. Frederick Lorenzen, Chn. Com.

JERSEY CITY, N. J.—The Thackeray Incinerating Co., of New Jersey, has been incorporated with a capital stock of $100,000. Charles B. Thurston, Jersey City; F. W. Montgomery, New York, and Lewis Perrine, Trenton, N. J.

ORANGE, N. J.—Mayor Stetson is urging the council to consider better methods of disposing of the city garbage than by dumping it into vacant lots.

NORRISTOWN, PA.—C. R. Weaver, Health Officer, writes us that no appropriation has yet been made for a garbage crematory. The question of garbage disposal has been discussed for years by the board of health. The borough council is just beginning to take some interest in the matter.

ATLANTA, GA.—The board of health is in favor of building two garbage crematories in the central portion of the city. The committee is composed of Lewis H. Jones, Chn.; Dr. C. F. Benson and John A. Miller.

FORT THOMAS, KY.—Bids are asked until Nov. 2 for the construction of a garbage crematory at Fort Thomas, Ky. Address Capt. Chas. D. Palmer, Acting Ch. Q. M., 415 Pullman Bldg., Chicago, Ill.

LOUISVILLE, KY.—Health Officer Allen has written to about 15 cities for information as to their methods of disposing of the city garbage, and also for detailed information of the crematories in use. A plant for this city is estimated to cost about $40,000.

EAST LIVERPOOL, O.—The question of a better method of garbage disposal is considered.

TOPEKA, KAN.—Bids will probably be asked at once by the city clerk for the removal of dead animals.

SAN FRANCISCO, CAL.—The supervisors have delayed the awarding of the garbage contract, noted last week, until Nov. 11.——Efforts are to be made to show that the 50-year franchise recently granted to Sanitary Reduction Works is illegal.

SAN JOSE, CAL.—A company has applied for a franchise for a plant.

STOCKTON, CAL.—J. W. Northrup, of San Francisco, is reported to have applied for a franchise.

HAMILTON, ONT.—W. E. Gowe, Montreal, Que., has been awarded the contract to build an incinerator at the sewage disposal works, at $3,700, according to reports.

STREETS AND ROADS

ATHOL, MASS.—It has been voted to appropriate $2,500 for the purchase of a stone crushing plant.

SUDBURY, MASS.—A contract has been awarded to White & Gaffney, Medford, Mass., at $5,325, for a section of State highway.

PAWTUCKET, R. I.—Samuel H. Roberts, Cy. Clk., informs us that a resolution has been introduced appropriating $9,000 for paving. Nothing has been done toward preparing plans, etc.

NEW LONDON, CONN.—Bids are asked until Nov. 5 for improving Ocean Ave. Geo. K. Crandall, Cy. Surveyor; Peleg Williams, Chn. Com.

ALBANY, N. Y.—A contract was awarded Oct. 20 to E. A. Matthews, Binghamton, N. Y., at $7,200. C. W. Adams, State Engr., Albany.

BUFFALO, N. Y.—A petition has been presented to the council to pave Court St. with asphalt, between Main St. and Delaware Ave.

GOSHEN, N. Y.—A proposition to appropriate $1,000 for a stone crusher will be submitted to a vote at the coming election, according to reports.

NIAGARA FALLS, N. Y.—Bids are asked until Oct. 28 for paving on Second St. and Cherry Ave., with asphalt, about 8,190 sq. yds., as stated in our advertising columns. Walter Jones, Cy. Engr.; S. F. Arkush, Clk.

ROCHESTER, N. Y.—The following bids have been received for paving: North Clinton St.—Warren-Scharf Asphalt Paving Co. (accepted), $60,638; Rock Asphalt Pavement Co., $62,309; Rochester Vulcanite Pavement Co., $62,483. Glenwood Park—Rock Asphalt Pavement Co., $10,137; Rochester Vulcanite Pavement Co., $10,503; Warren-Scharf Asphalt Paving Co., $10,539. The Highlands—Rochester Vulcanite Pavement Co., $6,040; Rock Asphalt Pavement Co., $6,281; Warren-Scharf Asphalt Paving Co., $6,213.

TROY, N. Y.—Bids are asked until 11 a. m., Oct. 28, for brick paving on Church St., from Ferry to Division St. E. Ogden Ross, Secy. Contracting Bd.

PLAINFIELD, N. J.—Andrew J. Gavett, Engr. and Comr., 152 Park Ave., writes us that it is proposed to pave 13,180 sq. yds. with asphalt or brick; estimated cost, $31,000.

READING, PA.—The park board is preparing to construct a section of the new addition to the Mt. Penn Boulevard, for which plans have been completed. The addition will add over a mile to the drive, although only about 1,300 ft. of this is to be built this fall.

SCRANTON, PA.—Bids are asked by the council until Nov. 3 for repairing asphalt pavements, according to reports.

WILKESBARRE, PA.—Bids are asked until Oct. 29 for excavating, furnishing material and laying about 2,000 lin. ft. of 8-ft. flagstone sidewalks on Carlisle St. Fred. H. Gates, Cy. Clk.

TAMPA, FLA.—Harry Levick has been awarded a contract to construct a new road six miles long, from this city to the Hillsboro River, according to report.

LOUISVILLE, KY.—The board of public works has rejected the bids received for asphalt paving on Chestnut St., to cost about $75,000, on account of being too high.

MEMPHIS, TENN.—Bids are asked until Oct. 29 for hauling, spreading, breaking and rolling gravel on certain streets. D. P. Prescott, Secy. County Comrs.

CINCINNATI, O.—Bids are asked until Nov. 12 for drain pipe, masonry, fill, broken stone, gravel and lumber on the Shepherd Creek Road. E. L. Lewis, County Audr.

CLEVELAND, O.—The following bids were received by the park board for constructing a drive through Wade Park: Northern Ohio Paving & Construction Co. (accepted) $28,259; Blanan & Baisch, $29,498; M. I. De Celle, $29,626; Spence Bros., $30,749; John E. O'Brien, $32,121; Condon & Blasberg, $32,334; William Wachs, $34,957.

DAYTON, O.—Bids are asked until Oct. 31 for 5,000 sq. yds. of Buckeye block paving, 3,250 lin. ft. of curb, etc., on Sycamore St. from Perry St. to the boulevard; until Nov. 4 for 2,631 sq. yds. of Buckeye block paving and 2,380 lin. ft. of curbing on Charter and Council Sts. J. L. Baker, Pres. Bd. Cy. Affairs.

FINDLAY, O.—Bids are asked until Oct. 31 (postponement from Oct. 27) for macadamizing, etc., on East Hardin St. A. W. Ray, Clk. Bd. Improvements.

TOLEDO, O.—Bids are asked until Oct. 31 for Buckeye block paving on Potter St. and one alley. L. P. Harris, Cy. Clk.

QUINCY, ILL.—F. A. Grover, County Surveyor, informs us that the committee has accepted the plans for the proposed Missouri Road, to cost $12,000, and that bids will soon be asked.

OTTUMWA, IA.—Bids are asked until Oct. 31 for brick paving, etc., on South Green St. Thos. F. Keefe, Chn. Com.

LOS ANGELES, CAL.—J. H. Dockweiler, Cy. Engr., has prepared plans for the proposed improvements on Boyle Ave., from 5th St. to Stephenson St., estimated cost about $6,500, according to reports.

NAPA, CAL.—Bids are asked until Nov. 17 for constructing a road in Sage Canyon. N. W. Collins, County Clk.

SANTA BARBARA, CAL.—Bids are asked until Nov. 14 for grading section No. 3 of the Refugio Road. H. H. Doyle, Clk. Supervisors.

MANUFACTURING PLANTS.

MILTON, VT.—McCaghey & Lineham, general contractors, of Milton, have been awarded the contract to build a large pulp mill on the Lamoille River, at Milton, for the International Paper Co., of New York, and will commence the work at once.

ANSONIA, CONN.—It is reported that the Harris Rubber Co. has just been formed and that it will erect a large factory building in Beacon Falls, a suburb of this city, in order to commence business by March 1. The contract for the entire equipment of machinery has been given to the Farrell Foundry & Machine Co., of Ansonia. The principal stockholders are J. H. Wettimore, Harris Wettimore and A. D. Warner, all of Naugatuck, Conn.

COHOES, N. Y.—The old Weed & Becker axe factory on the Champlain Canal was destroyed by fire Oct. 17, causing a loss on the building of $10,000 and a total loss of about $50,000.

DEXTER, N. Y.—Reports state that the Sulphite Co. is about to erect a new boiler house, 60 × 80 ft., to contain six large boilers. Contractors, Foster & Reed; Arch., Charles Eaton, Carthage, N. Y.

TROY, N. Y.—Plans have been prepared for a new steel storage building, 70 × 70 ft., to be erected on 7th Ave. for Conway Bro. & Kane, near their present brewing plant; estimated cost, $25,000. Archs., M. F. Cummings & Son, Troy.

WATERVLIET, N. Y.—The Troy Malleable Iron Works Co. expects to erect an annex to its plant in this city, to cost about $15,000. Arch., M. F. Cummings & Son, Troy.

HOBOKEN, N. J.—Press reports state that an artesian well 300 ft. deep has been discovered on property on the Palisades, in West New York, owned by Wm. H. Schmidt, and that an ice plant will be erected thereon at a cost of about $100,000.

AVONMORE, PA.—Bids have been asked, according to reports, for the erection of two of the six mills which the newly incorporated Alcania Tin & Terne Co. expects to build here. Engr., S. Diescher, of Pittsburg. Among the directors are W. H. Hilliard and M. M. Garland, Collector of Internal Revenue of Pittsburg, Pa.

BRADFORD, PA.—The Aschman Steel Casting Co., of Sharon, Pa., is said to be negotiating for the erection of a new steel foundry near this place.

PITTSBURG, PA.—A fire in this city, Oct. 19, destroyed the machine shop and the copper and brass rolling mills of C. G. Hussey & Co. at 2d Ave. and Murphy St., causing an estimated loss on machinery, etc., of about $25,000.—— Reports state that the Riter-Conley Mfg. Co. will soon erect a blacksmith and paint shop building, 250 × 75 ft., for the Schoen Pressed Steel Co.

PRICEBURG, PA.—A new silk mill is being erected in this borough on the old Crippen estate, to cost about $25,000. There will be one main building 100 × 150 ft., an engine room 30 × 60 ft., and a boiler house 30 × 60 ft.

SEIGFRIEDS BRIDGE, PA.—James Stewart & Co., Engineers and Contractors, Prudential Bldg., Buffalo, N. Y., have secured the contract for erecting six brick and steel fireproof buildings for the Lawrence Cement Co. at Siegfried. They consist of a kiln building 120 × 126 ft., mill building 63 × 285 ft., engine bbuilding, 75 × 105 ft., boiler house 42 × 105 ft., stock house 120 × 462 ft., and fuel building 50 × 60 ft.; estimated cost when completed about $225,000. There were 20 bidders.

SHARON, PA.—The contract for erecting an addition 215 × 70 ft. to the P. L. Kimberly rolling mill, at Sharon, has been awarded to the Shiffler Bridge Co., of Pittsburg. Work will be started at once.

WILMINGTON, DEL.—Megary & Son will soon erect a 6-story brick building, 154 × 100 ft., at Orange and 6th Sts., to be occupied as a warehouse and furniture factory.

SALISBURY, MD.—It is reported that J. H. Tomlinson has purchased a tract in Salisbury and will move his crate and basket factory here and enlarge his plant, now situated at Hebron.

HAMILTON, GA.—Beers Bros., of this city, contemplate the erection of a large machine shop opposite the Columbus & Rome Ry. station.

ROCKMART, GA.—Col. J. D. Waddell is reported to have just completed arrangements with New England parties for the erection of a cotton factory here to employ about 200 hands.

BIRMINGHAM, ALA.—A fire in the plant of the Hood Machine Co. Oct. 17, at 1st Ave. and 15th St., caused damage to property valued at about $15,000. It is said that the plant will be rebuilt at once.

LOUISVILLE, KY.—Hoffman, Ahlers & Co., of Louisville, are said to have been awarded the contract for erecting the building and copper work for the new distillery to be run in connection with the works of the White Mills Distilling Co. at 18th and Howard Sts. The owners will be Hoffheimer Bros., of Cincinnati, O., and the cost about $50,000.

ELYRIA, O.—A fire at this place, Oct. 18, damaged the linseed oil works, owned by the C. H. Price Co., of Cleveland, O., causing a reported loss of $40,000.

INDIANAPOLIS, IND.—A part of the plant of the T. B. Laycock Mfg. Co., on 10th St., was damaged by an explosion Oct. 12, which originated in the foundry; estimated loss $20,000 to $25,000.

CHICAGO, ILL.—Pendergast & Clarkson, 161 La Salle St., are said to have the mason contract for the proposed brewery to be erected at Elston Ave. and Snow St. for Virgil M. Brand, 1251 Elston Ave. and Snow St. for $150,000. Arch., Louis Lehle, Schiller Bldg.

MILWAUKEE, WIS.—Plans have been completed, according to reports, for a cooperage plant, 164 × 141 ft., to be built at 9th and Winnebago Sts., for the Pabst Brewing Co.; estimated cost $70,000.

LEHI CITY, UTAH.—The directors of the Utah Sugar Co. Oct. 17 decided to make additions to the present plant next year so as to permit of a capacity of from 50,000 to 60,000 tons of beets a season.

GAS PLANTS.

GOWANDA, N. Y.—Gaenssler, Fisher & Co. are making arrangements to construct a pipe line to furnish the town with natural gas.

SYRACUSE, N. Y.—The Syracuse Gas Co. is preparing to put in a system of flues for the purpose of condensing odors. The west side of the plant will be remodeled.

PITTSBURG, PA.—Reports state that the Bellevue & Glenfield Natural Gas Co., which supplied Bellevue, Glenfield, Emsworth, Ben Avon, Avalon and Coraopolis, has been purchased by the Manufacturers' Natural Gas Co. for $250,000. It is reported that the mains will be extended to Allegheny.

BRIDGEWATER, VA.—Reports state that the Bridgewater Acetylene Gas Co. is being organized to manufacture an improved acetylene gas generator.

CHARLOTTE, N. C.—We are informed that the purchase of the Charlotte Gas Light Co. was made by the United Gas Improvement Co., Philadelphia, Pa., instead of the Consolidated Gas Co., Philadelphia, as stated in our last issue; also that the price paid was considerably in excess of $50,000.

RALEIGH, N. C.—It is reported that Baltimore capitalists have purchased a controlling interest in the Raleigh Gas Light Co. and will increase the capacity of the plant about 100%. An electric dynamo may also be put in. B. P. Williamson, Pres.; W. T. McGee, Secy.

FOSTORIA, O.—Howard Swartz, Secy., informs us that the City Heat & Light Co. is arranging for the construction of a gas plant with a capacity of 1,000,000 cu. ft. per day. A building 200 × 40 ft. will be erected. Samuel R. Bullock, Des. Engr., Philadelphia, Pa.

JOHANNESBURG, SOUTH AFRICAN REPUBLIC.—Bids are asked by the council until Jan. 6 for a complete carburetted water-gas plant, according to reports. Address Robert Whyte & Co., 22 Bury St., St. Mary-Axe, E. C.

NEW COMPANIES.—Council Bluffs, Ia.; $25,000; to establish acetylene gas plants. W. H. Harris, R. J. Hart and T. A. Harris.

Winnisimmet Gas Co., Revere, Mass.; $50,000; to furnish gas to Revere, Winthrop and vicinity. Scott F. Bickford, Pres.

New York Gas & Coke Co., New York, N. Y.; $500,000; P. H. Childs, J. A. Hawes and F. E. Mygott.

MISCELLANEOUS CONTRACTS.

FIRE ALARM SYSTEM.—Perth, Ont.—Reports state that bids will probably be asked soon for a fire alarm system.

TELEPHONE SYSTEM.—Mamaroneck, N. Y.—The board of trustees has granted a franchise to the Phoenix Telephone Co.

WATER TOWER.—Atlantic City, N. J.—The council has decided to purchase a water tower for the fire department, to cost about $1,000.

FIRE APPARATUS.—St. Marys, N. B.—It is reported that the question of purchasing more fire apparatus is being considered by the council.

TELEPHONE WORK.—Flint, Mich.—The Saginaw Valley Telephone Co. will issue $70,000 in bonds for the improvement and extension of the plant.

TELEPHONE SYSTEM.—Lyons, N. Y.—S. E. Bishop and Alvin B. Bishop, Clyde, N. Y., have been awarded a franchise to construct a telephone exchange.

TUNNEL REPAIRS.—Troy, N. Y.—Holbrook, Cabot & Daly, Boston, Mass., have been awarded a contract to repair the 6th Ave. tunnel between Ferry and Congress Sts.

TOOLS, ETC.—Norfolk, Va.—Bids are asked until Oct. 29 for furnishing condenser tubes, lathes and one boring and drilling machine, for the navy yard. Edwin Stewart, Paymaster-General, Washington, D. C.

CRANE.—Port Royal, S. C.—Bids are asked until Nov. 26 for furnishing a jib crane of 40 tons capacity for the navy yard; estimated cost, $45,000. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

HARBOR WORK.—Wilmington, Del.—A contract has been awarded to the New York Dredging Co. for removing the dirt and mud, and to John J. Fitzpatrick, Plattsburg, N. Y., for removing rock, for the improvement of Wilmington Harbor, to cost about $200,000.

REMOVING WRECK.—Portchester Harbor, N. Y.—Bids are asked until Nov. 28 for removing a wreck and cargo in Long Island Sound, off Portchester Harbor, as stated in our advertising columns. Major H. M. Adams, U. S. Engr., Army Bldg., New York.

NAVAL SUPPLIES.—St. Augustine, Fla.—Bids are asked until Nov. 21 for furnishing cement, stone, steel beams, anchor bolts, ammunition trolley systems, hoists and cranes, as stated in our advertising columns. Lieut.-Col. W. H. Benyaurd, U. S. Engr., St. Augustine.

CANAL.—Saratoga County, N. Y.—N. O. Belyea, Civil Engr., 547 State St., Hudson, N. Y., informs us that T. D. Welch & Co., Nassau, N. Y., were awarded a contract Oct. 24 to construct a canal 2,000 ft. long in Saratoga county, requiring about 10,000 cu. yds. of rock, and 22,000 cu. yds. of earth to be excavated.

PIERS, ETC., BURNED.—Brooklyn, N. Y.—A fire Oct 24 destroyed a number of piers and warehouses on the waterfront between Vandyke and Walcott Sts., estimated loss, about $650,000. Among the losers are Geo. L. Hammond, the Brooklyn Wharf & Warehouse Co. and E. F. & W. Roberts, Liverpool, England.

ARCH WORK.—Hamilton, O.—The following bids have been received by the board of control for arching the hydraulic from 4th to Front Sts.: Jos T. Guillaume, No. 1, brick, $15,191; No. 2, paving brick, $15,745. S. E. Irwin, $16,560. W. H. Louthan, $16,731; Louis Drach, $16,660, with own specifications, $15,391.

NAVAL STATION.—Goat Island, Cal.—Reports state that bids will soon be asked by the navy department, Washington, for constructing a barracks and dock for the proposed naval training station, at this place, to cost about $100,000.

CONTRACT PRICES.

SEWERS.—Marietta, O.—The following bids were received by the council Oct. 15, 1898, for constructing sewers in the 5th District:

Items.	F. A. Irvine, Greenville, O.	C. & Z. T. Darrow.	Ulrich, Nissley & Williams, Springfield, O.	Adams Bros., Zanesville, O.	John Wilking.
15-in. pipe......	$1.40	$1.13	$1.25	$1.25	$0.68
8-in. "	.65	.22	.80	.66	.31
6-in. "	.18	.20	.35	.315	.29
4-in. "	.10	.12	.80	.29	.22
Manholes, each.	30.00	25.00	35.00	28.00	30.00
Lampholes, each	4.00	5.00	10.00	5.00	5.00
Flushtanks each	27.00	25.00	40.00	30.00	30.00
Total	$4,962	$2,987	$5,963	$5,214	$3,107

BRIDGES.—Chicago, Ill.—The following bids were received by the board of trustees of the Chicago Drainage Canal Oct. 5, 1898, for building certain bridges; Wire Mills road bridge:

Substructure.

Quantities.		Hayes Bros., Janesville, Wis.	McArthur Bros. Co. and Winston & Co., Chicago.	Griffiths & McDermott, Chicago.	Fred'k. W. Brown, Chicago.
Excavation	170 cu. yds.	$0.50	$0.40	$1.00	$1.50
Lumber (trestle)	112 M. ft...	18.00	18.00	22.00	16:50
Masonry removed	132 cu. yds.	.40	2.00	1.00	2.50
Cement concrete..	465 " "	7.50	8.00	6.95	7.95
Raising old span...........		176.00	200.00	275.00	500.00
Total		$5,816	$6,268	$6,273	$6,630

Superstructure.

		Extra,	
Bidder.	Complete.	Medium or soft st'l a lb., cts.	Lumber a 1,000 ft. B.M.
Wis. Bridge & Iron Co., Milwaukee	$8,945	2.8	$30.00
Pittsburg (Pa.) Bridge Co.	9,130	2.9	25.00
Toledo (O.) Bridge Co.	9,469	3.0	25.00
Penn Bridge Co., Beaver Falls, Pa.	9,617	2.95	23.00
J. G. Wagner Co., Milwaukee, Wis.	9,298	3.0	26.00
Joliet (Ill.) Bridge & Iron Co......	9,701	3.2	25.00
Massillon (O.) Bridge Co.	9,600	3.0	25.00
King Bridge Co., Cleveland, O....	9,700	3.0	30.00

Lockport Highway Bridge—The itemized bids were the same as those submitted for the Wire Mills Bridge. The total bids for the Lockport bridge were as follows: Wisconsin Bridge & Iron Co., $10,954; Pittsburg Bridge Co., $11,235; Toledo Bridge Co., $11,880; Penn Bridge Co., $11,965; Wagner Co., $11,967; Massillon Bridge Co., $12,400; King Bridge Co., $12,500. Substructure—236 cu. yds. of excavation, and 460 cu. yds. Portland cement concrete: Griffiths & McDermott, $3,523; Hayes Bros., $3,613; McArthur Bros. Co. and Winston Co., $3,810; Frederick S. Brown, $3,820.

GRADING.—Brooklyn, N. Y.—The following bids were recently received by the bureau of yards and docks, U. S. N., Washington, for grading in the New York navy yard: Michael J. Curley, Jersey City, N. J., 45 cts. a cu. yd., $135,400; Ambrose F. Dudley, 100 Broadway, New York, 49 4-10 cts.; Eugene Lentilhon, 11 Broadway, New York city, 79½ cts.; Maurice Fitzgerald, 219 Havemeyer, Brooklyn, N. Y., 30 cts.; Frank J. Gallager, 534 Park Place, New York, 44 cts.; The F. W. McNeal Co., 80 Reade St., New York, 55 cts.; Nicholas Ryan, 491 Smith St., New York, 49 cts.; Washington Buckly, 94 Emerson St., Brooklyn, N. Y., 48 cts.; R. H. Hood Co., New York, 42 4-10 cts.; Charles Hart, 531 3d St., Brooklyn, N. Y., 48 cts.; Geo. H. Aspinwall, 136 Liberty St., New York, 49⅝ cts.; Johnson & Reynolds, Girard Bldg., Philadelphia, 59¾ cts.; Wm. Beard, 13 William St., New York, 45 cts.

MACADAM PAVING.—Janesville, Wis.—A. E. Badger, Cy. Clk., writes us that the contract for macadamizing a portion of South Hogler St. and of Dodge St. has been let to J. H. Watson at 29¼ cts. a sq. yd. Chn. Com., J. B. McLean.

LEVEE WORK.—Columbus, O.—John Keeler and Foley Bros. submitted bids Oct. 11, 1898, at 28 cts. and 29 cts. a cu. yd., respectively, for 28,000 cu. yds. of levee work between Mound St. and Green Lawn Ave.

HAULING WATER PIPE, ETC.—West Springfield, Mass.—The water commissioners received the following bids Oct. 17, 1898, for hauling and laying the pipe for a water main on the Holyoke Road, from the First Church to the Holyoke line. The contract calls for 17,300 ft. of 10-in. pipe: F. T. Ley & Co., Springfield, Mass., (accepted), 12¾ cts. a foot; R. D. Maynard, 16½ cts.; A. H. Wright & Son, 17 cts.; M. L. Tourtellotte, West Springfield, 17 cts.; Sackett Bros., 13 cts.; J. K. Barber, 16 cts.; O'Connell & Son, Chicopee, 14¾ cts.; Monson Granite Co., Monson, 16.95 cts.; Atkins & Co., Palmer, 14 cts.; Lane & Co., Syracuse, 18 cts. The contract for hauling pipe was awarded to M. J. Shinkwin, of Springfield, at 45 cts. a long ton. There were 10 bids ranging from 45 cts to 80 cts.

LEVEE WORK.—Memphis, Tenn.—We are informed that Bodkin Bros., Little Rock, Ark., have been awarded the contract at 15 cts. a cu. yd. for 2,193,000 cu. yds. of levee embankment from mile $\frac{127}{28+00}$ to mile $\frac{151}{28+00}$; total, $330.000. Geo. Arnold, Memphis, submitted a bid at 16 cts. a cu. yd. for field work and at 18 cts. for woods work, beginning at Frenchtown and working south to the amount of $50,000. There will be eight miles in Lee county from Kent's north to Frenchtown. This bid covers about five of the eight miles. It has been held for further consideration. Ch. Engr., Harry N. Parr, 49 Southern Express Bldg., Memphis.

STREET CLEANING.—Buffalo, N. Y.—Henry B. Bayard, Contractor, Prudential Bldg., writes us that he has been awarded the contract for street cleaning of the whole city for five years from Aug. 1, 1898, to Aug. 1, 1903, as follows: Brick, 23½ cts. a great square; asphalt, 23½ cts.; stone, 33½ cts. The work will be done with rotary brooms and Furnas' suction sweepers. Supt. of Sts., Jno. H. Schifferens.

WOODEN WATER PIPE.—Pueblo, Colo.—The contract for furnishing 34-in. wooden water pipe has been let to Holmes & Allen, of Denver, Colo., at $1.20 a ft.

SEWERS.—Cohoes, N. Y.—The following bids were received Oct. 12 for constructing sewers in Section No. 1 of the sewerage system, as advertised in Engineering News; Harrison & Sons' figures for the sewers are the total bids for the various streets; Engr., Edward Hayes:

Bids Received at Cohoes, N. Y., Oct. 12, 1898, for Constructing Sewers in Section No. 1.

Streets and items.	Size of sewer.	Quantities.	Thos. F. Moore, Syracuse, N. Y.	R. H. Strong, Albany, N. Y.	Edw. H. Post, Wilkes-Barre, Pa.	Frank Pidgeon, Saugerties, N. Y.	P. H. Harrison & Sons, St. Paul Bldg., N. Y.	E. R. Patteson, Hartford, Conn.	F. S. Ablett, Cohoes, N. Y.
Saratoga St.: Stock y'd to Mohawk	30-in.	765 lin. ft.	$1.94	$1.95	$3.38	$4.00	$1,607	$2.76	$2.18
Mohawk to Oneida	20-in.	2,300 " "	2.38	1.45	2.91	5.30	6,555	3.15	2.18
Mohawk St.: Saratoga to Columbia	24-in.	390 " "	1.78	1.65	3.00	6.50	565	1.98	1.51
Oneida to St. John's	12-in.	150 " "	2.91	1.13	2.30	6.50	375	3.98	2.61
St. John's to Seneca	10-in.	150 " "	1.76	3.00	1.76	6.50	322	2.80	1.26
Remsen to Oneida	15-in.	670 " "	2.94	1.20	3.00	7.00	1,675	3.24	2.29
Canvass St.: Ontario to Pine	12-in.	270 " "	1.71	1.13	1.72	4.25	400	2.47	1.14
Ontario to Oneida	12-in.	380 " "	1.66	1.13	.82	4.25	380	1.43	.95
Remsen St.: Mohawk to Courtlandt	10-in.	285 " "	2.73	1.10	3.16	9.00	712	2.92	1.63
Factory to Courtlandt	10-in.	125 " "	1.59	1.10	1.58	4.00	230	2.28	1.40
Factory to Oneida	10-in.	150 " "	2.12	1.10	1.56	4.00	225	2.16	1.18
Oneida to St. John's	12-in.	140 " "	1.87	1.13	1.30	4.00	200	2.20	1.10
St. John's to Ontario	10-in.	240 " "	1.75	1.10	1.21	4.00	325	1.97	1.09
Ontario to Newcomb	12-in.	220 " "	1.73	1.13	1.30	4.00	400	2.00	1.17
Main St.: Trojan Alley to Columbia	12-in.	910 " "	2.53	1.13	1.86	4.50	1,450	2.40	1.34
Bemis Alley: Oriskany to Ontario	12-in.	420 " "	.60	1.13	.67	3.00	315	.92	.57
Van Vechten to Factory	10-in.	360 " "	.50	1.10	.68	3.00	200	.88	.43
Sargent St.: Van Vechten to White	10-in.	885 " "	1.18	1.10	1.37	3.50	1,000	1.68	.85
Columbia St.: Mohawk to Erie Canal	24-in.	1,320 " "	2.34	1.65	3.69	6.00	1,100	2.70	1.96
White St.: Oriskany to Sargent	10-in.	125 " "	1.40	1.10	.91	3.50	100	1.30	.85
Main to Remsen	12-in.	250 " "	1.33	1.13	1.75	3.50	240	1.27	.95
Newcomb St.: Remsen to West	8-in.	230 " "	.86	1.07	1.24	3.00	300	2.00	.95
Ontario St.: Remsen to Canvass	12-in.	540 " "	1.83	1.13	2.20	6.00	1,100	2.96	1.66
Seneca St.: Mohawk to Remsen	10-in.	260 " "	1.20	1.10	1.38	3.50	380	2.34	1.10
St. John's St.: Mohawk to Remsen	10-in.	240 " "	1.53	1.10	1.03	3.50	275	1.68	.76
Oneida St.: Mohawk to Remsen	12-in.	340 " "	2.44	1.13	1.65	5.00	360	1.43	1.03
Mohawk to Saratoga	18-in.	820 " "	3.33	1.27	3.12	5.00	1,530	3.74	2.28
Factory St. Al.: Remsen to Erie	8-in.	308 " "	1.81	1.07	1.66	4.00	450	2.05	.80
Factory St.: Remsen, east	12-in.	85 " "	1.85	1.13	2.31	4.00	160	2.84	1.76
Rock Alley: White, north	12-in.	210 " "	1.40	1.13	1.22	4.00	300	2.00	1.03
Pine St.: Saratoga, west	8-in.	185 " "	1.36	1.07	.99	4.00	150	1.44	.80
Power canal: Courtlandt to Mohawk St.			500.00	150,00	100,00	2000.00	2000.00	250.00	200.00
Oneida to Van Rensselaer St.			187.00	100.00	100.00	2500.00	2000.00	350.00	200.00
Oneida to Saratoga St.			187.00	175.00	100.00	50.00	10.00	50.00	100.00
Factory St. Alley			130.00	100.00	100.00	200.00	150.00	150.00	93.00
Champlain Canal at Peach St.			300.00	700.00	.....	350.00	1000.00	700.00	608.00
Outfall sewer: Peach St. to Mohawk River			2875.40	1800.00	2191.00	1500.00	1350.00	1500.00	1267.00
Relaying 12-in. sewers		880 lin. ft.	885.00	1.13	775.60	3.00	772.00	.90	457.60
Manholes: 10 ft. deep or less		50 each	32.00	70.00	60.00	65.00	30.00	32.50	47.00
More than 10 ft. deep		16 "	37.00	85.00	70.00	85.00	38.00	40.00	55.00
Outfall sewer under Champlain Canal to Mohawk River			.....	500.00	1641.00	600,00	500.00	580.00	377.00
Trench to Mohawk R. (4 ft. wide, 3 ft. deep.		100 lin. ft.	400.00	500.00	144.00	450.00	100.00	150.00	200.00
Drop manholes, 10 ft. deep or less		2 each	37.00	40.00	70.00	90.00	40.00	45.00	50.00
More than 10 ft. deep		10 "	40.00	40.00	80.00	110.00	40,00	60.00	55.00
Lampholes, 10 ft. deep or less		23 "	4.00	15.50	8.00	25.00	2.50	2.50	4.00
More than 10 ft. deep		2 "	5.00	15.50	9.00	35.00	2.50	3.00	4.50
Y-connections: 6-in. for 8-in. pipe		15 "	.32	2.32	.23	2.00	.20	.25	.24
6-in. for 10-in. pipe		200 "	.51	2.62	,33	2.00	.25	.40	.40
6-in. " 12-in. "		260 "	.64	2,62	.43	2.25	.30	.50	.52
6-in. " 15-in. "		40 "	1.00	2,88	.78	2.75	.50	.60	.74
6-in. " 20-in. "		150 "	1.50	3.22	1.41	3.00	1.00	1.25	1.28
6-in. " 24-in. "		20 "	2.00	4.62	2.04	4.00	3.00	1.70	1.82
12-in. cast-iron pipe, for ravine sewer		12 lin. ft.	24.00	18.00	.....	50.00	25.00	20.00	20.00
20-in. vitrified pipe for overflow		175 " "	300.00	1.45	1.78	2.50	200.00	300.00	350.00
Total			$37,068	$30,577	$42,261	$85,617	$34,499	$42,109	$29,734

DREDGING.—Pensacola Bay, Fla.—Capt. C. A. F. Flagler, U. S. Engrs., Montgomery, Ala., informs us that the following bids were received Oct. 22 for dredging at the entrance of Pensacola Bay, as advertised in Engineering News: The National Dredging Co., Wilmington, Del., 17 4-10 cts. a cu. yd., capacity of dredge, 2,300 yds. a day; Rittenhouse-Morse Dredging Co., Mobile, 15 cts. a cu. yd., capacity of dredge, 8,000 cu. yds. a day (maximum).

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INDUSTRIAL NOTES.

THE NATIONAL FOUNDRY & PIPE WORKS, Scottdale, Pa., has changed its Pittsburg office from 402 Lewis Block to 403-404 Murtland Building.

CURRAN & HUSSEY, Pittsburg, Pa., engineers and contractors, have removed their offices from 347 Fifth Ave. to 703-4-5 Hussey Bldg.

THE COLUMBIA CONSTRUCTION CO., 2 Warner Bldg., Syracuse, N. Y., has removed its New York offices from 1210 Lord's Court Building, to 1205 Exchange Court Bldg.

THE WELLMAN-SEAVER ENGINEERING CO., Cleveland, O., has the contract for eight electric traveling cranes for the new plant of the Leechburg Foundry and Machine Co.

THE MORGAN ENGINEERING CO., Alliance, O., is said to have just received an order from Austria for a complete open hearth steel mill, and also a large order from Russia for cranes, etc.

THE SAFETY APPLIANCE CO., LTD., Wentworth Bldg., Boston, Mass., is equipping all the coaches and baggage cars of the Dayton & Union R. R. with its brake equilizer, and dead lever "take-up," and states that during the past month it has received orders to equip over 900 cars.

THE CONSOLIDATED CONSTRUCTION CO., 1007 Neave Bldg., Cincinnati, O., has been formed by E. H. Moorman and F. G. McMahon, to carry on a general contracting business. Mr. Moorman is a young architect of Cincinnati, and Mr. McMahon has for the past six years been located in Cleveland as the Ohio representative for G. W. G. Ferris & Co., Pittsburg.

THE PITTSBURG BRIDGE CO., Pittsburg, through its New England agents, Collins & Norton, Springfield, Mass., has recently secured the contract for five iron highway bridges, varying from 18 to 35 ft. in length, over Mill River, at Plainfield, Mass. The company has also the contract for an iron bridge over the Chicopee River, at Red Bridge, between Wilbraham and Ludlow, Mass., consisting of two spans of 65 and 75 ft. respectively.

THE JOLIET BRIDGE AND IRON CO., Joliet, Ill., shipped Oct 14 two bridges each of 100-ft. span, to Honolulu, by rail to Seattle, Wash., and thence by steamship to Honolulu. The bridges are for the Hawaiian Government on road improvements in the vicinity of Honolulu, and are of a good, serviceable type, being built in accordance with "Cooper's Standard Specifications for Highway Bridges." The company has at present enough orders to keep it running full for several months to come, and is sending work to several States.

THE JOHN STEVENSON CO., LTD., New York, has had Albert A. Wilcox, Paterson, N. J., and Louis Stern, New York, appointed temporary receivers, upon application of Chas. H. Davis, the President; Leander M. Delamater, Secretary and Treasurer; A. L. Phillips and B. P. Flint, directors. The assets of the company are $1,175,776, which is said to be considerably in excess of the liabilities. It is claimed that obligations aggregating over $200,000 will fall due within four months, and that these cannot be met. The company has recently erected a large plant at Bayway, N. J., and has not as yet been able to sell its New York property. The company will probably be reorganized.

NEW COMPANIES.—Waldberg Brewing Co., Boston, Mass.; $100,000, commencing with $100; M. H. Cobe, Geo. E. Cobe, M. S. Cobe, J. L. Frouck and A. I. Morris, all of Boston.

Knapp Shop, Incorporated, Boston, Mass.; $20,000, commencing with $125; to manufacture mechanical devices, etc.; Harry W. Bates, John D. Huhn, W. H. Brown and R. L. Stedman, of Boston; E. D. Luxton, of New York.

Southern Carbon Co., Warren, Pa.; $50,000, commencing with $500; to manufacture and sell carbon black and its products; Olive W. McNutt, Jefferson, O.; H. M. Preston, F. M. Knapp and John B. Cable, all of Warren, Pa.; Wm. S. Hoskins, Mount Jewett, Pa.

McCaull-Webster Elevator Co.; $100,000, commencing with $1,000; to construct and operate grain elevators and warehouses; Jas. L. McCaull, Douglas Webster and Chas. W. Crowl, all of Minneapolis, Minn.; Geo. H. Webster, Chicago, Ill.; John M. Siberz, Aberdeen, S. Dak.

American Motor Co., Kenova, W. Va.; $25,000, commencing with $10; to manufacture pumps, iron specialties, etc.; Wm. C. Reh, H. A. Schlingman, E. R. Deming, all of Toledo, O.; C. C. Coe and John P. Reh, of Kenova.

American Drilling Tool Co., St Mary's, W. Va.; $50,000, commencing with $500; to manufacture all kinds of oil and gas well machinery; W. P. Kingsbury, Parkersburg, W. Va.; H. P. Boyd, Pittsburg, Pa.; R. J. Boyd, Spencerville, O.; D. W. Reynolds and M. D. Hanes, of St. Mary's.

West Indies Plant Co., Boston, Mass.; $1,000,000, commencing with $1,520; to build and operate railways, vessels, etc., in connection with the transportation of plants; Thos. F. Galvin, J. De L. Galvin and Jas. H. McManus, of Boston; Louis Ross, New York; Geo. H. Wood, Winthrop, Mass.

Terrapin Knob Improvement Co., Parkersburg, W. Va.; $50,000, commencing with $1,250; to mine for oil, gas and minerals; H. H. Moss, C. H. Shattuck, H. P. Moss, Edward McCreary and J. M. Carfer, all of Parkersburg.

National Motor Carriage Co., 259 Washington St., Jersey City, N. J.; $500,000, commencing with $1,000; to manufacture vehicles of all descriptions, and motors operated by steam, vapor, etc.; Arthur W. Winslow, 44 Manhattan Ave., and Thos. D. Merrigan, 1987 Amsterdam Ave., both of New York; Chas. W. Parker, Jersey City.

New England Rubber Tire Wheel Co., Charleston, W. Va.; $50,000, commencing with $50; to place steel on iron channels on wheels in connection with rubber tires by a patent process; Dudley H. Bradlie, A. C. Gunther, M. H. Straughan, D. M. Black and J. M. Caldwell, all of Charleston, W. Va.

Continental Construction Co., 243 Washington St., Jersey City, N. J.; $250,000, commencing with $10,000; to construct railways, bridges, wharves, etc.; Henry N. Bates, Warren Hunt and Chas. N. King, 243 Washington St., Jersey City.

Choctaw Construction Co., 765 Broad St., Newark, N. J.; $600,000, commencing with $1,000; to build and equip a railway or railways in Arkansas; Francis I. Gowan, Chas. E. Ingersoll and Robert H. McCarter, all of Philadelphia.

Hartford & Springfield Railway Construction Co., Flemington, N. J.; $100,000, commencing with $1,000; to build and equip railway lines, electric light and power plants, etc.; George W. Dunham, Flemington, N. J.; Henry Seligman, Edward R. Gilman and Thos. A. Lee, of New York.

Iron Clad Resistance Co., Westfield, N. J.; $25,000, commencing with $1,000; to conduct a business of electrical and mechanical engineers; Arthur W. Berresford, August P. Munning and Horace M. Williams, all of Westfield.

Hevner Roadbed Construction Co., 419 Market St., Camden, N. J.; $250,000, commencing with $10,000; to construct and equip roads and roadbeds; Justus Straub, Jos. L. Dailey and John P. Batt, of 419 Market St., Camden.

Federal Steel Co., 60 Grand St., Jersey City, N. J.; $200,000,000, commencing with $3,000; to conduct a general mining and manufacturing business; Chas. C. Cluff, Chas. MacVeagh and Benj. C. Van Dyke, all of Jersey City.

Rudman Iron Foundry Co., 49 Hermon St., Newark, N. J.; $25,000, commencing with $2,100; to conduct a general foundry and casting business; Charles Rudman, John Ortman, John Kern and John B. Oelkers, all of Newark.

Standard Light & Heat Co., Philadelphia, Pa.; $1,000,000, commencing with $1,000; to manufacture and sell gas machines, etc.; R. M. Robinson, Wm. L. Teter, E. C. Wharton and Henry Robertson, of Philadelphia; Jos. W. Irwin, Govanstown, Md.

Baechtold Electric Co., 1 Montgomery St., Jersey City, N. J.; $50,000, commencing with $33,000; to manufacture dynamos, electric lamps, etc.; Christian Baechtold, 194 Cornelia St., and John P. Bonney, 1302 Jay St., both of Brooklyn, N. Y.; Dennis B. Ryan, 1 Montgomery St., Jersey City.

Briquette Coal Co., New York; $600,000, commencing with $63; to manufacture or deal in artificial and natural fuel; Geo. A. McGlone, Harry E. Swan, F. G. Corning, T. J. Hurley and J. F. Ryan, all of New York.

Alconia Co., Pittsburg, Pa.; $150,000, commencing with $4,200; to manufacture iron and steel; W. H. R. Hillard, M. M. Garland and Wm. S. Collier, Pittsburg; Oliver Wylie, Wilkinsburg, Pa.; T. H. Jeremiah, Youngstown, O.

Tudor Co., Charleston, W. Va.; $12,000, commencing with $3,000; to quarry stone and to operate lands for oil and gas; Alfred Ely, H. D. Macdona, Alfred Monierre, Harold Binney and H. H. Porter Jr., all of New York.

Ecuador Development Co., 19 West 8th St., Bayonne, N. J.; $200,000, commencing with $112,500; to construct and maintain all kinds of public works, including railways, water-works, etc.; Archer Harman, 30 Broad St.; M. F. McLanahan, 27 Pine St., and C. H. Sherrill, 30 Broad St., all of New York; T. C. Wellman and Hugh Sivell, both of Bayonne.

General Equipment Co., 301 Market St., Camden, N. J.; $100,000, commencing with $1,000; Edward Dudley, G. G. Browning, Benj. C. Reeve, Wm. S. Scull and E. A. Armstrong, all of Camden.

Lewiston & Greene Telephone Co., Lewiston, Me.; $10,000, commencing with $30; to build and operate telephone lines in Androscoggin and Kennebec counties; Pres., William Williams, Monmouth; Treas., Walter H. Brown, Lewiston.

Ottumwa Long Distance Telephone Co., Ottumwa, Ia.; $60,000; to construct and operate telephone lines in Iowa and Missouri; Pres., Jay C. Goddard; Vice-Pres., P. E. Wilcox, both of Ottumwa.

Bryan Telephone Co., Bryan, O.; $40,000; Wm. W. Morrison, I. C. Gardner, E. E. Barber, Jas. S. Bailey, Jr., and R. C. Starr.

Allen County & Smith Grove Telephone Co., incorporated in Kentucky; $2,400; G. W. Motley and P. H. Beckham.

Atlanta Telephone Co., Atlanta, Macon county, Mo.; $2,700; H. H. Abbott, S. H. Nash, R. B. Turner and others.

Silver Creek Telephone Co., Yazoo City, Miss.; $1.000; R. M. Beaman, Smith & McDonnell, T. W. Fisher, J. P. Moore, J. D. Upshaw, Campbell & Stubblefield, Commercial State Bank.

Huntingdon County Telephone Co., Saltillo, Pa.; $25,000; C. Kapp, John Kapp, G. Sleeman.

Mentor Telephone Co., Mentor, O.; $25,000; to construct and operate a telephone line in Lake county; J. W. Lowe, Carl Hogenberger, A. I. Ingersoll, P. M. Fuller and others.

North Park Telephone Co.; $15,000; to operate a telephone line between Walden, Colo., and Laramie, Wyo.; Monte Blevins, J. S. Mosman, G. F. Scott, C. E. Mosman, M. A. Ward.

Montowese Brick Co., New Haven, Conn.; $12,000, with $2,400 paid in; to manufacture and sell all kinds of brick, terra cotta and tiling; William Spitter and Frederick Westermann, of New Haven; Henry Born and Edward Boehm, North Haven.

Automatic Air Coupler Co., Pierre, S. Dak.; $500,000; A. H. Van Camp, Highmore, S. Dak.; William J. Pugh and J. H. Vail, Muscatine, Ia.

Universal Mfg. Co., Portland, Me.; $10,000, commencing with $30; to manufacture automatic gas valves of every description; Pres., William J. Ross, Chelsea, Mass.; Treas., Edward L. Rand, Jamaica Plains, Mass.

Schilicht Combustion Process Co., Jersey City, N. J.; $1,000,000; for the development and introduction of systems of generating and supplying heat, light, power and ventilation; Frank M. Doane and Walter T Kase, Jersey City, and Joseph W. Connelly, Caldwell, N. J.

Hoosier Cement Co., Clark county, Ind.; $35,000; to manufacture cement; John H. McQuiddy, Emmet Cuddy, Augustus H. Gray and others.

John Howland Construction Co., Rolla, Mo.; $100,000; W. C. Johnson, Herman Dowd, E. A. Johnson and F. E. Dowd.

American Iron & Steel Co., 60 Grand St., Jersey City, N. J.; $1,000,000, commencing with $2,100; to do a mining and manufacturing business; to build ships, railways, etc.; Wm. Fillingham, Kenneth K. McLaren and Harry W. Meen, 60 Grand St., Jersey City.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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PERSONAL.

Mr. Lawrence F. Lewis, city commissioner in charge of the streets and sewers of Baltimore, Md., has resigned from the position.

Mr. J. H. Dockweiler, City Engineer of Los Angeles, Cal., has been renominated for that office by the city Democratic convention.

Mr. C. P. Gilbert, general manager of the Sacramento Electric, Gas & Ry. Co., has been forced to resign owing to continued ill health.

Mr. H. H. Rosseau, Civil Engineer, U. S. N., has been ordered to the New York Navy Yard, as an assistant to the civil engineer of that yard.

Mr. Albert S. Crane, of New York city, has entered the civil engineering corps of the Michigan Lake Superior Power Co., Sault Ste. Marie, Mich.

Mr. William J. Richards has been promoted to the position of General Superintendent of the Lehigh & Wilkes-Barre Coal Co., Wilkes-Barre, Pa.

Mr. Samuel Insull, President of the Chicago Edison Co., gave a complimentary dinner, on Oct. 15, to the employees of that company who volunteered in the war.

Capt. Mason M. Patrick, Corps of Engineers, U. S. A., has been assigned to duty as temporary secretary and disbursing officer of the Mississippi River Commission.

Lieut.-Colonel William R. Livermore, Corps of Engineers, U. S. A., will act as Chief Engineer Officer of the Army of Occupation of Cuba, on the staff of Gen. Lee.

Mr. E. D. Jameson has been appointed assistant master mechanic of the Grand Trunk Ry., in charge of the Western division. His office will be at Battle Creek, Mich.

Mr. Charles F. Huber, formerly engineer in charge of the Honeybrook Division of the Lehigh & Wilkes-Barre Coal Co., now occupies the position of mining engineer of the company.

Mr. S. Oi, electrical engineer for the Japanese Government, having in charge the Department of Communication of Tokio, is in this country, studying American telephone and telegraph systems.

Mr. H. L. Noyes, civil engineer, 846 Ellicott Square, Buffalo, N. Y., has accepted the position of mechanical engineer of the Union Carbide Co., Niagara Falls, N. Y., and **has removed to the latter city.**

Mr. Fred. H. Burdick, of Pittsburg, Pa., and Miss Katherine C. Mueller, of Saginaw, Mich., were married at the home of the bride's parents, on Oct. 19. Mr. Burdick is connected with the firm of Riter & Conley.

Mr. I. W. von Leer, civil and hydraulic engineer, 1201 Stephen Girard Bldg., Philadelphia, Pa., sailed for Cuba on Oct. 29. Mr. von Leer will be connected with engineering work to be undertaken by the U. S. Government.

Mr. Frank B. Ward, Secretary and General Manager of the Michigan Brass & Iron Works, Detroit, Mich., resigned his position on Oct. 1. Mr. Ward was at one time the resident engineer of the Pittsburg Testing Laboratory, with headquarters in Chicago. On Oct. 22, the employees of the Michigan Brass & Iron Works gave Mr. Ward a farewell dinner, at which they presented him with a silver punch bowl and ladle.

Mr. Charles A. Schott, Chief of the Computation Division of the Coast and Geodetic Survey, has been awarded the "Wilde" prize by the Academy of France. This prize is awarded by a committee consisting of some of the best-known scientists in France for remarkable discoveries or writings in the field of astronomy, chemistry, geology, physics or mechanics. It was awarded to Mr. Schott for his discussion of terrestrial magnetism.

Lieut.-Colonel Robert Craig, Signal Corps, U. S. A., has been ordered to proceed to Santiago and thence to Guantanamo, Baracoa and Sagua de Janamo, Cuba, to examine and report upon the extent and condition of the telegraph lines in the Department of Santiago, the availability of timber supplies in the country for their construction and other essential points connected with the reconstruction of such lines as are necessary for military purposes.

Mr. D. S. Hough, M. Am. Soc. C. E., who enlisted in the First Volunteer Engineers, U. S. A., has been promoted to be Captain. In a personal letter from Ponce, Porto Rico, dated Oct. 5, to Mr. John Thomson, President of the Engineers' Club, Mr. Hough writes that a large number of promoters already have agents in Porto Rico looking for opportunities for investments. While many wild-cat schemes will probably cause loss to those who invest in them, he believes that capital invested on a large scale and carefully looked after should yield good returns in sugar, coffee and tobacco plantations and in electric railways. Mr. Merritt H. Smith, Jun. Am. Soc. C. E., with the same regiment, in another letter to Mr. Thomson, from which we are permitted to quote, writes that a syndicate has purchased a street railway in San Juan and is securing right of way for an extension to Ponce.

OBITUARY.

Mr. W. H. Brodhead, civil and mining engineer, died at Hailey, Idaho, on Oct. 21.

Mr. E. C. Palmer, secretary and general manager of the Standard Tool Co., Cleveland, O., died on Oct. 13.

Mr. John Hare, for many years assistant superintendent of the Troy, N. Y., Water-Works, died on Oct. 22.

Mr. William J. Brodrick, Vice-President of the Los Angeles City Water Co., died at his home, on Oct. 18.

Mr. Charles Meredith Du Puy, formerly a railway operator and civil engineer, died on Oct. 7, at his home in New York city.

Mr. James Carmichael, superintendent of the machinery department of the Harlan & Hollingsworth Co., Wilmington, Del., died recently.

Mr. Thomas S. Blair, of Pittsburg, Pa., formerly of the firm of Shoenberger, Blair & Co., iron manufacturers, died in Pittsburg, on Oct. 22, at the age of 73.

Mr. Arthur R. Sweet, for many years City Engineer of Pawtucket, R. I., and later of Woonsocket, R. I., died at the former place, on Oct. 23, at the age of 47.

Mr. Clarence G. Davenport, for several years an electrical expert of the General Electric Co., died of typhoid fever in Puerto Rico during the past week. Mr. Davenport was a corporal in the First Volunteer Engineer Regiment, now in Puerto Rico.

Mr. Andrew D. Smith, President of the La Belle Steel Co., Manchester, Pa., died at his home in Allegheny, Pa., on Oct. 21. Mr. Smith was a prominent business man, and besides being President of the La Belle Co., was a director in several banking institutions.

Mr. Thos. R. Hewson, of the firm of Tyrrell & Hewson, civil engineers and surveyors, of Sudbury, Ont., died on Oct. 22. Just previous to his death Mr. Hewson was in the employ of the Dominion Government surveying townships in the Nipissing district, where he contracted typhoid fever, which disease caused his death.

M. Camille A. Faure, whose name is well known in connection with the improvement of the storage battery, died on Sept. 14. M. Faure was born in Vizille, France, May 21, 1840. He was largely self-taught, and early evinced a taste for physics and mechanics and his early work as mechanical draftsman and constructing engineer in France and England, gave him a wide experience. In 1878 he discovered the value of employing spongy metallic lead for the negative plates of storage batteries, and it was this and his later discoveries in the same field that brought him into prominence. He was also the inventor of a number of chemical processes, and during the latter part of his life devoted his energies to improving gas engines and to developing apparatus for the propulsion of wagons and carriages.

Capt. Henry E. Waterman, Corps of Engineers, U. S. A., died on Oct. 26. Captain Waterman was born in Minnesota, from which State he was appointed to West Point, July 1, 1878. Upon graduation he was appointed to the Engineer Corps, and was for three years assistant to Lieut.-Colonel Barlow. He then served on various boards in connection with river improvement work in the Ohio valley, and later as assistant to Major Chas. E. L. B. Davis, engaged on river and harbor improvement work on Lake Michigan. He was a member of the Board of Engineers appointed to establish harbor lines at Pittsburg, Pa., was in charge of portions of the work of Ohio River improvement, and assisted Major Lockwood in the improvement of the Kentucky River. His final office and the one held at the time of his death was secretary and disbursing officer to the Mississippi River Commission.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

BROOKLYN ENGINEERS' CLUB.
Nov. 3. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Nov. 4. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Nov. 4. Illustrated Lecture, T. C. Martin. Secy., Henry I. Weed. Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.

CHICAGO ELECTRICAL ASSOCIATION.
Nov. 4. "The Electrical Equipment of a Model Printing Establishment," Geo. A. Damon. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

THE ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 5. "Notes on Recent Progress in Electrical Engineering," Carl Hering; "Coal Handling Machinery," Charles Piez. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Nov. 5. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Nov. 7. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Nov. 7. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.

NEW ENGLAND RAILROAD CLUB.
Nov. 8. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

DENVER SOCIETY OF CIVIL ENGINEERS.
Nov. 8. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 8. Secy., Wm. H. Searles, Case Library Building, Cleveland, O.

RAILWAY SIGNALING CLUB.
Nov. 8. Secy., Earl M. Seitz, Signal Engineer, C. & N. W. Ry., Chicago, Ill.

FRANKLIN INSTITUTE.
Nov. 9. "Mining and Minting of Gold and Silver," A. E. Outerbridge, Jr. Secy., Wm. Wahl, 15 South Seventh St., Philadelphia, Pa.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 10. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 10. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.

ST. LOUIS RAILWAY CLUB.
Nov. 11. "The Performance of a Four-Cylinder Compound Locomotive." Discussion. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

CENTRAL RAILWAY CLUB.
Nov. 11. Secy., H. D. Vought, 114 Fifth Ave., New York city.

MONTANA SOCIETY OF ENGINEERS.
Nov. 12. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

ENGINEERS' CLUB OF KANSAS CITY.
Nov. 14. "Rectification of the Red and Atchaflaya Rivers," A. F. Woolley, Jr. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

THE LOUISIANA ENGINEERING SOCIETY.
Nov. 14. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

NORTHWEST RAILWAY CLUB.
Nov. 15. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 15. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

WESTERN RAILWAY CLUB.
Nov. 15. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Nov. 16. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 16. Secy., S. E. Tinkham, City Hall, Boston, Mass.

ENGINEERS' CLUB OF ST. LOUIS.
Nov. 16. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Nov. 16. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS.
Nov. 16. "The Manchester Ship Canal," Elmer L. Corthell. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 16. "Launhardt Formula and Railroad Bridge Specifications," H. B. Seaman. Secy., C. W. Hunt, 220 West 57th St., New York city.

NEW YORK RAILROAD CLUB.
Nov. 17. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 17. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

ENGINEERS' CLUB OF CINCINNATI.
Nov. 17. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

TECHNICAL CLUB OF OMAHA.
Nov. 21. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 21. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 21. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.

ROCHESTER ENGINEERING SOCIETY.—A regular meeting of this society was held on Oct. 21, at which Mr. H. A. Nicholl, read a paper describing the storage battery equipment of the Rochester Ry. Co. This battery plant consists of 248 cells, weighing together 150 tons, and when complete will have a capacity of 700 ampere hours.

THE KANSAS GAS, WATER AND ELECTRIC LIGHT ASSOCIATION.—This is the name of a new association, recently formed at Topeka, Kan., for the promotion of mutual interests and for mutual benefit and protection of the gas, water and electric light interests of the State of Kansas.

The following officers were elected to serve during the ensuing year: Pres., L. T. Palmer, Leavenworth; First Vice-Pres., E. Willis, Atchison; Second Vice-Pres., A. T. Rogers, of Beloit; Third Vice-Pres., F. D. Alev, Wichita; Secy. and Treas., James H. Foley, Leavenworth; Executive Committee, Geo. B. Wing, R. C. Johnston and Jacob Mulvane.

NEW YORK ACADEMY OF SCIENCES.—The Astronomy and Physics Section of this society held a meeting at the house of the American Society of Mechanical Engineers, on Oct. 31, at which Prof. George W. Blodgett, Electrical Engineer of the Boston & Albany R. R., delivered an interesting illustrated lecture, entitled "Railroad Signalling, Past and Present." The lecture presented a large number of stereopticon views, illustrating the development of railways from early and primitive forms of roadbed and rolling stock to those at present in use. The subject of railway signalling was treated in a historical way, the complex interlocking systems of the present time were described in detail, and a model of the Hall system was shown in operation.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.—This new association, which is now being organized, is an outcome of the action of the Roadmasters' Association of America in voting down a very wise proposition to change its name to the Railway Maintenance of Ways Association. Mr. A. Torrey, Chief Engineer of the Michigan Central R. R., is provisional chairman, and Mr. L. C. Fritch, Division Engineer of the Baltimore & Ohio Southwestern Ry., is Secretary of the new society. At a meeting held in Chicago, on Oct. 21, the chairman was instructed to appoint a committee to draft a constitution and a set of by laws. This committee will report at the next meeting, which is to be held in Buffalo, in March, 1899.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—The semi-monthly meeting of this club was held on Oct. 25, with 41 members and visitors present.

The paper of the evening, entitled, "The Electric Motor in Shop and Mine," by Mr. Clarence M. Barbor, member, was read by the Secretary.

The paper treated of the development of the electric motor in its different forms, and of the different industries to which it has been applied. A comparison was made of the economics of steam and electric installations in manufacturing concerns, and the advantages and disadvantages of each pointed out. The advantages gained in the coal mining industries by the introduction of electricity were referred to. The efficiencies of electric and pneumatic drills were compared, the advantage still remaining with the pneumatic drill where percussion work is required.

W. H. Searles, Secy.

NEW ENGLAND WATER-WORKS ASSOCIATION.—The Secretary of this association, Mr. J. C. Whitney, announces that at the meetings to be held this winter, only one subject will be considered at each meeting. The subjects are as follows: Dec., "Pumping Engines"; Jan., "Street and Force Mains of Cast Iron, Wrought Iron, Steel and Wood"; Feb., "Filtration, Slow Sand and Mechanical"; Mar., "Organisms Which Cause Unpleasant Taste and Odors in Water Supplies."

At each of these meetings one or more leading papers will be given by some members of the association who are competent to treat the subject, after which it is expected that the members will freely discuss the subject, and also read short papers, giving facts and figures and their experiences which relate to the subject under consideration. This notice is given at this early date that all may have time to make ample preparation for the winter meetings.

ARCHITECTURAL LEAGUE OF NEW YORK.—A meeting of this association was held at the Art League building, New York city, on Nov. 1, to consider the question of "The Water Front of New York and Its Future Embellishment." Invitations to be present and take part in the discussion had been extended to the American Society of Civil Engineers and the Engineers' Club, and both societies were well represented.

The proceedings took the form of a verbal discussion, the stereopticon being used to illustrate the various schemes suggested. In general there were only two plans; one, to widen the marginal streets along the North and East River fronts, and the other to build some form of elevated structures. The pros and cons of these were briefly discussed, as were also the good points and defects of recreation piers. The question of the wisdom of emptying the city sewage into the rivers near to the recreation piers was broached and the ultimate necessity of a large intercepting sewer surrounding the city was pointed out.

Perhaps the most instructive talk of the evening was given by Geo. S. Morison, M. Am. Soc. C. E., who said that the development of the water front of New York was a commercial matter, and hence one for the civil engineer, with his utilitarian views, rather than the architect. Regarding the idea of laying out some extensive scheme for all time to come, he considered it far preferable to follow the custom of the Anglo-Saxon race and meet the special problems as they arose. In other words, it was impossible to anticipate the needs of 25 years from now, and what we might build to-day would be entirely unsuited for that time.

NEW YORK ELECTRICAL SOCIETY.—The 190th regular meeting of this society was held, as announced in our last issue, on Oct. 27, at the Pearl Street Station of the Brooklyn Edison Electric Illuminating Co. The meeting proper was very brief, owing to the considerable amount of ground to be covered in carrying out the inspection trips. The meeting was largely attended, and the total number, some 175, was divided into parties, which, under the guidance of men from the Edison Company, made the round.

The Pearl Street Station, the first inspected, was designed and erected in 1889, with a capacity of 3,000 HP. It has since been enlarged, and now has 5,000 HP., with an ultimate capacity of 15,000. Except at maximum load, this station is supplied from the Union Station, which was visited later, with three-phase current at 6,000 volts. This is stepped down, and transformed by means of rotary converters to direct low tension current for use upon the Edison three-wire mains. The various points of interest in this station were examined, after which special cars were boarded, and the entire party proceeded to the great Bay Ridge Station, which, in many respects, is the most remarkable in the country.

The present building, designed to contain 15,000 HP., is only one-quarter the contemplated size of the final plant, which, it is expected, will be 60,000 HP. At present there are only two units installed. These consist of a Hamilton-Corliss 1,500 HP. engine connected to a 1,000 K-W. General Electric three-phase generator, furnishing, at full load, current at 6,600 volts, and a 3,000 HP. McIntosh, Seymour & Co. tandem, twin compound horizontal side crank engine, and a 2,000 K-W. general electric, three-phase generator, stationary armature type, also of 6,600 volts.

Current from these generators passes to the switch-board on a gallery at one end of the immense engine-room, thence out on the underground cables to the various substations, where it is transformed by rotary converters or induction motors, driving arc machines into the proper current for lighting, either incandescent or arc lamps.

One of the substations, Station "A," was next visited. This was formerly a steam plant. It is now a combination of storage batteries and arc light machines driven by 100 K-W. General Electric induction motors, directly on the 6,000 volt circuits, each motor driving two 120-lamp Brush machines, or 24 machines in all. This battery plant has 14,000 ampere hours' capacity, with regulating end switches, which are used in charging or discharging to adjust the voltage.

On an upper floor of this station the members and visitors were treated to a luncheon, after which the special cars were again boarded, and all carried back to the Brooklyn Bridge, where the parties disbanded.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The last regular meeting of the Institute was held Oct. 26, at the House of the American Society of Mechanical Engineers, New York city. Previous to the paper of the evening, the President, Dr. A. E. Kennelly, announced that the committee of seven appointed by the council to arrange for a co-operation between the Institute and the various colleges having testing laboratories had held its first meeting. This committee was appointed with an idea of creating a closer relation between the Institute and the colleges, so that any engineering problems arising in the minds of the members which needed laboratory apparatus and work for their proper solution, could be given to advanced students at the various engineering colleges.

A circular letter, giving a list of such problems, would in the near future be sent to the colleges, and it was hoped that all members would take advantage of this to submit all the problems that had occurred to them. They would then be forwarded to the various institutions, and when solved the solutions would be printed in the Transactions of the Institute, where they would be available to all. At the same time, the work could be printed in any other place.

Mr. A. A. Knudson then read a paper entitled "An Electrical Survey in the Borough of Manhattan, New York City," the substance of which will be given in our next issue. The discussion was limited almost entirely to a communication from Mr. William Maver, of the Empire City Subway Construction Co., New York city, which was read by the Secretary, Mr. R. W. Pope. Mr. Maver had inquired of the managers of the various gas companies regarding electrolysis of gas mains, and had received the general reply that there were no indications of any such action. In connection with his work, he had examined many conduits and cables in the city, and could, as a result, say positively that there was no evidence, at least up to the present, of electrolytic action.

NEW PUBLICATIONS.

REPORT, MASTER CAR BUILDERS' ASSOCIATION.—Secy., John W. Cloud, 974 Rookery, Chicago, Ill. Cloth, 6×9 ins.; pp. 452; illustrated.

This volume of the Association's annual report contains in full the proceedings of the conventions held at Saratoga, N. Y., June 15, 16 and 17, 1898, besides the usual plates of designs adopted as standards or recommended practice.

REPORT OF THE IOWA STATE RAILROAD COMMISSION.—Wm. W. Ainsworth, Secretary, Des Moines, Ia., Pub. Doc. Cloth, 6×9 ins.; pp. 419; map.

The report proper of the Commission occupies only ten pages, and is a brief resume of the year's work, containing very little of general interest. The remainder of the volume is devoted to a digest of decisions of the Iowa Supreme Court, relating to railways; operating statistics, railway laws; decisions of the Commission; complaints, and other routine matters, and concludes with a general index covering 53 pages, of all the volumes of reports of the Commission from 1878 to 1897, inclusive.

SOFT COAL BURNING.—By C. M. Higginson. 5th edition. The Railway Master Mechanic, Chicago. Pamph., 6×9 ins.; pp. 18.

This pamphlet treats of smokeless and economical combination of soft coal, but so far as we can discover the author advances nothing new or important on the subject. Much of the matter is of the same kind that may be found in all the books on the subject of combustion that have been published within the past 50 years, such as the theory of combustion, the value of introducing air above the grate, at or behind the bridge wall, etc. The author tells how smokeless combustion can be accomplished, naming as essential conditions, a good draft, open grate bars, an air supply over the fire, an intimate mixture of air with the burning coal gases, and distance in which to complete the combustion of the mixed air and gas, but he fails to mention one condition without which all the others combined will give only partial success, that is a large and highly heated combustion chamber lined with fire brick, in which the admixture of gas and air shall take place before it is allowed to touch the heating surface. The book contains also several old fallacies, copied from earlier writers, no doubt, such as that "smoke once formed cannot be done away with," and that a draft of ½-in. of water column is necessary with any kind of coal in all conditions of weather. The facts are that smoke can be burned, by passing it through a bed of incandescent coal, as is done in the Hanley down draft furnace, and that good bituminous and semi-bituminous coal may be burned with ¼-in. draft, with some boilers, in which the grate surfaces and the draft are as large in relation to the amount of coal to be burned. No mention is made of automatic stokers, without which any treatise on soft coal burning is incomplete.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

BROWN UNDERGROUND ELECTRIC SYSTEM.—The Johnson Co., Johnstown, Pa. Pamph., 9⅜ × 6¾ ins.; pp. 34; illustrated.

In this pamphlet is given a description of the Brown surface contact electric street railway and also a number of illustrations of details of the contact blocks, car shoe, etc.

SOCKETS, SWITCHES AND CUT-OUTS.—The Bryant Electric Co., Bridgeport, Conn. Pamph.; 6×3¾ ins.; pp. 90.

This is a convenient list of the products of the Bryant Co., which include a variety of incandescent lamp fittings, switches, cut-outs, fuses, etc., and, in fact, everything pertaining to interior house wiring.

IMPROVED BRUSH ARC LAMPS.—General Electric Co., Schenectady, N. Y. Pamph; pp. 40.

In this attractive little pamphlet attention is called to the well-known "Brush" arc lamp in what may be termed its up to date form. The principle upon which these lamps operate is briefly given, together with some of the salient points of improvement over the old forms.

FIRE HOSE BRIDGES FOR CROSSING STREET RAILWAYS.—Rochester Hose Bridge Co., Rochester, N. Y. Pamph.; 8½×6 ins.

This pamphlet describes a device for use where fire hose must cross a street railway track. With this bridge the car runs up a very slight incline over the hose and down another incline. The length over all is 16 ft., and the greatest height 5 ins.

ROOF DRAINER.—Safety Appliance Co., Ltd., Wentworth Building, Boston, Mass. Pamph.; 9×6 ins.

This pamphlet calls attention to a device for use on open street cars, which adds to the comfort of passengers. It consists of a gutter arranged to catch the water shed from the car roof and hollow side handles through which the water passes to the ground.

MACHINE TOOLS.—Patterson, Gottfried & Hunter, Limited, 146-150 Centre St., New York. Paper; 9×6 ins.; pp. 32; illustrated.

This catalogue illustrates and gives the dimensions, weights and capacity of engine lathes, tool-grinders, polishing machines, tapping machines, etc., dealt in by this firm. These tools are made by the Springfield Machine Tool Co., Whitney Mfg. Co. and Builders' Iron Foundry.

BRIDGES AND DREDGING.—San Francisco Bridge Co., San Francisco, Cal.; New York Dredging Co., World Building, New York. Paper; 9×6 ins.; pp. 56; illustrated.

In this pamphlet are illustrated and described some of the bridges, piers, lighthouses, etc., built by the bridge company and work in excavation, dredging and filling performed by the dredging company, along with views of the dredgers and their fittings.

U. S. MAIL CHUTES.—Cutler Mfg. Co., Rochester, N. Y. Paper; 12½×9½ ins.; pp. 15; 10 photogravures.

This is a reprint of "Classical Architecture on the Shores of the Mediterranean." by Russell Sturgis, the well-known architect, illustrated by 10 photographic views of examples of Greek and Roman architecture. It is an interesting article and handsomely illustrated; and as it is a thing to be preserved, the Cutler Co. is to be congratulated upon its enterprise and good taste.

STREET LAMPS FOR ALTERNATING CURRENT CONSTANT POTENTIAL CIRCUITS.—Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Circular; 7×10 ins.

This circular, numbered 88, calls attention to an improved street lamp for use on alternating circuits which permits the use of high tension currents and stepdown transformers, with the resulting saving in copper cost. The individual converters and fuse blocks accompanying each lamp are also illustrated and described.

GENERATORS AND ROTARY TRANSFORMERS FOR ELECTROLYTIC WORK.—This is circular number 55 of the Westinghouse series. It describes briefly the special forms of generators and rotary converters constructed by this company for use where large currents at low voltage are required. The text is accompanied by a number of excellent illustrations of several such machines and outline drawings and table giving the dimensions of parts.

SWITCHES, FROGS AND INTERLOCKING.—The Weir Frog Co., Cincinnati, O. Cloth, 8¾ × 5 ins.; pp. 323.

This catalogue includes a varied list of switches, frogs and crossings, built up of T and girder rails, for use on steam, cable, electric and horse railways. Switchstands, slip switches and movable-point crossings are also included, while among the track accessories are bridge guards, expansion joints, rail braces, and foot guards. Derailing switches for sidings and for the crossings of street railways with steam railways are also shown, the latter requiring the car conductor to cross the railway track and operate a lever closing the switch. Several pages are devoted to industrial tracks of light rails on steel ties, and to special street railway work in the way of crossings, curves and junctions. There are also diagrams of switch layouts and tables of switch timbers. A new department in the company's catalogue is that of electric signaling and interlocking, in which is described a system covered by the patents of F. C. Weir, Joseph Ramsey, Jr., and others. The special feature of this system is that it employs electricity for operating the signals and switches, as well as for the locking movements.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Nov. 3	Electric light fixtures, Hudson, N. Y.	Oct. 27
Nov. 3	U. S. building, Chicago, Ill.	Oct. 20
	Advertised, Eng. News, Oct. 20 and 27.	
Nov. 3	Roads, walks, etc., Fort Hancock, N. J.	Oct. 20
Nov. 3	Highway work, Pittsburg, Pa.	Oct. 20
Nov. 3	Repairing sidewalks, Cincinnati, O.	Oct. 13
Nov. 3	Ditch drain, New Castle, Ind.	Nov. 3
Nov. 3	Viaduct substructures, Nashville, Tenn.	Nov. 3
Nov. 4	Steel bridges (2), Tilbury, Ont.	Nov. 3
Nov. 4	Macadamizing, Boston, Mass.	Nov. 3
Nov. 4	Asphalt and brick paving, Chicago, Ill.	Nov. 3
Nov. 4	Water mains, Chicago, Ill.	Nov. 3
Nov. 4	Piers and abutments, Coshocton, O.	Oct. 13
Nov. 4	Buckeye paving, etc., Dayton, O.	Oct. 27
Nov. 4	Railroad grading (35 mls.), Denmark, N. C.	Oct. 27
	Advertised, Eng. News, Oct. 27 and Nov. 3.	
Nov. 4	Roof of armory, New York, N. Y.	Oct. 27
Nov. 5	Ocean Ave. improvement, New London, Conn.	Oct. 27
Nov. 5	Sewers, East Cleveland, O.	Oct. 13
Nov. 5	School building, Marion, O.	Oct. 20
Nov. 5	Wells and shafts, Gila County, Ariz.	Oct. 20
Nov. 5	Electric lighting, Newtown, Pa.	Nov. 3
Nov. 5	Sewers, Palo Alto, Cal.	Nov. 3
Nov. 5	Street bonds, Woodsville, N. H.	Nov. 3
Nov. 5	Brick and granite paving, Waterbury, Conn.	Nov. 3
Nov. 7	Electric plant, New York, N. Y.	Nov. 3
Nov. 7	Truss bridge, Seattle, Wash.	Nov. 3
Nov. 7	Drainage, etc., Albany, N. Y.	Nov. 3
Nov. 7	Paving, Montgomery, Ala.	Nov. 3
Nov. 7	Tower lights, Rock Island, Ill.	Nov. 3
Nov. 7	Sewer, St. Paul, Minn.	Nov. 3
Nov. 7	Granite monument, Providence, R. I.	Nov. 3
Nov. 7	Sewers, Sheridan, Ind.	Nov. 3
Nov. 7	Pipe sewers, Helena, Mont.	Nov. 3
Nov. 7	Sewers, Santa Ana, Cal.	Nov. 3
Nov. 7	Paving, Jersey City, N. J.	Nov. 3
Nov. 7	Brick paving, Lawrenceburg, Ky.	Nov. 3
Nov. 7	Brick paving and curbing, Dayton, O.	Nov. 3
Nov. 7	Reservoir covering, Doylestown, Pa.	Nov. 3
Nov. 7	Bridge at Curtis' Ford, Wilkesboro, N. C.	Oct. 20
Nov. 7	Viaduct superstructure, Cincinnati, O.	Oct. 13
Nov. 7	Bridge, Webster St., Oakland, Cal.	Oct. 13
Nov. 7	Plank sidewalks, (1 year), Cincinnati, O.	Oct. 13
Nov. 7	Wooden bridge (190 ft. long), Magnolia, Miss.	Oct. 13
Nov. 7	Brick paving, Toledo, O.	Oct. 13
Nov. 7	Improving electric plant, Topeka, Kan.	Sept. 22
Nov. 7	Sewers, Albany, N. Y.	Oct. 27
Nov. 7	Sewers, Wabash, Ind.	Oct. 27
Nov. 7	Boilers for water-works, St. Paul, Minn.	Oct. 27
Nov. 7	Water flume, New Whatcom, Wash.	Oct. 27
Nov. 7	Water-works franchise, San Bernardino, Cal.	Oct. 27
Nov. 7	Arc lighting, Lebanon, Pa.	Oct. 27
Nov. 8	Surveys, Olympia, Wash.	Oct. 20
Nov. 8	Levee work, New Orleans, La.	Nov. 3
Nov. 8	Sidewalks, Kansas City, Mo.	Nov. 3
Nov. 9	Grading and draining, Cleveland, O.	Nov. 3
Nov. 9	Hospital building, etc., Ward's Island, N. Y.	Nov. 3
Nov. 9	Paving bonds, Lansingburg, N. Y.	Nov. 3
Nov. 9	Repair of arc lamps, Chicago, Ill.	Nov. 3
Nov. 9	School building (2), Buffalo, N. Y.	Nov. 3
Nov. 9	Cement sidewalks, Indianapolis, Ind.	Nov. 3
Nov. 9	Grading, graveling, etc., Union City, Ind.	Nov. 3
Nov. 9	Water mains, Cincinnati, O.	Nov. 3
Nov. 9	Grading and draining, Cleveland, O.	Nov. 3
Nov. 9	Paving, etc., Cohoes, N. Y.	Oct. 20
Nov. 9	Improving drawbridge, Camden, N. J.	Oct. 20
	Advertised, Engineering News, Oct. 20.	
Nov. 9	School building, Fort Sill, Okla.	Oct. 20
Nov. 9	Electric light plant, Toronto, Ont.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Nov. 9	Electric energy, Toronto, Ont.	Oct. 6
	Advertised, Engineering News, Oct. 6.	
Nov. 9	Bridge, Sable Creek, San Jose, Cal.	Oct. 13
Nov. 9	Electric light franchise, Visalia, Cal.	Oct. 27
Nov. 10	Water supply, Belem, Brazil	Sept. 22
Nov. 10	Water bonds, ($30,000), New Richmond, O.	Oct. 20
Nov. 10	College building, Cincinnati, O.	Oct. 20
Nov. 10	Court house bonds, Doniphan, Mo.	Oct. 20
Nov. 10	Fish hatchery, etc., Spearfish, S. Dak.	Oct. 20
Nov. 10	Electric bonds, New Richmond, O.	Oct. 20
Nov. 10	Building repairs, Brooklyn, N. Y.	Nov. 3
Nov. 10	Summit Ave. improvement, St. Paul, Minn.	Nov. 3
Nov. 10	Boiler house, Morris Plains, N. J.	Nov. 3
Nov. 10	Electric plant, Wynne, Ark.	Nov. 3
Nov. 10	Steel and iron bridges, Savannah, Ga.	Nov. 3
Nov. 10	Gas well, Buffalo, N. Y.	Nov. 3
Nov. 10	Macadam road, Enfield, Mass.	Nov. 3
Nov. 10	Water-works, Wynne, Ark.	Nov. 3
Nov. 11	Dredging the Erie basin, Buffalo, N. Y.	Nov. 3
Nov. 11	Pipe sewers, Troy, N. Y.	Nov. 3
Nov. 11	Bridges, (3), Olivet, S. Dak.	Oct. 13
Nov. 11	Bridges (2), Colfax, Wash.	Oct. 27
Nov. 12	Water bonds ($130,000), Reno, N. Mex.	Oct. 13
Nov. 12	Buildings ($106,250), Mare Island, Cal.	Oct. 20
Nov. 12	Dredging, Port Royal, S. C.	Oct. 20
Nov. 12	Road work, Cincinnati O.	Oct. 27
Nov. 12	Fire alarm system, Lancaster, O.	Nov. 3
Nov. 14	Bridge over Cedar River, Waverly, Ia.	Nov. 3
Nov. 14	Repairing pumping engines, Boston, Mass.	Nov. 3
Nov. 14	Grading a road, Santa Barbara, Cal.	Oct. 27
Nov. 14	Steel bridge (100 ft.), Houston, Tex.	Oct. 20
	Advertised, Eng. New, Oct. 20 to Nov. 3.	
Nov. 14	Removing wreck, Rockland Harbor, Me.	Oct. 13
Nov. 15	Industrial school, Ellendale, N. Dak.	Oct. 13
Nov. 15	Water-works addition, Seattle, Wash.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Nov. 10.	
Nov. 15	Jail work, San Saba, Tex.	Sept. 29
Nov. 15	Electric lighting, Greensboro, N. C.	Oct. 6
Nov. 15	Dredging bay, Coos Bay, Ore.	Oct. 20
	Advertised, Eng. News, Oct. 20 to Nov. 10.	
Nov. 15	Water-works, Rock Hill, S. C.	Oct. 27
	Advertised, Eng. News, Oct. 27 and Nov. 3.	
Nov. 15	Machinery and tools, Norfolk, Va.	Nov. 3
Nov. 15	Electrical machinery, Portsmouth, N. H.	Nov. 3
Nov. 15	Bridge (131 ft. long), Canal Fulton, O.	Nov. 3
Nov. 15	Well, Elburn, Ill.	Nov. 3
Nov. 16	Rebuilding sewers, New York, N. Y.	Nov. 3
Nov. 16	Reformatory building, Mansfield, O.	Oct. 27
Nov. 16	Electric plant, Knowle, England	Oct. 27
Nov. 16	Electrical machinery, Cleveland, O.	Oct. 20
Nov. 16	Electric lighting, Camden, N. J.	Oct. 13
	Advertised, Eng. News, Oct. 13 to 27.	
Nov. 17	Hospital building, Siletz, Ore.	Oct. 27
Nov. 17	Road in Sage Canyon, Cal.	Oct. 27
Nov. 17	School building, Passaic, N. J.	Nov. 3
Nov. 17	Water-works, McComb, Miss.	Nov. 3
Nov. 18	Building materials, Chemawa, Ore.	Nov. 3
Nov. 19	Local sewers, Evansville, Ind.	Nov. 3
Nov. 19	Water bonds ($22 000), Bainbridge, N. Y.	Nov. 3
Nov. 21	Iron fence, etc., Cleveland, O.	Nov. 3
Nov. 21	Brick sewers, Toledo, O.	Oct. 27
Nov. 21	Naval supplies, St. Augustine, Fla.	Oct. 27
	Advertised, Eng. News, Oct. 27 to Nov. 17.	
Nov. 21	Government bldgs (8), Sophia, Bulgaria	Sept. 29
Nov. 22	U. S. building, Norfolk, Va.	Oct. 27
	Advertised, Eng. News, Oct. 27 and Nov. 3.	
Nov. 22	Bridge foundations, Washington, D. C.	Nov. 3
	Advertised, Engineering News, Nov. 3.	
Nov. 24	Brick sidewalk, Huntington, W. Va.	Nov. 3
Nov. 25	Water pipe, etc., Honolulu, H. I.	Oct. 27
Nov. 26	Crane, Port Royal, S. C.	Oct. 27
Nov. 26	Boat shelter roof, Mare Island, Cal.	Oct. 20
Nov. 26	Sawmill, chimney, etc., Mare Island, Cal.	Nov. 3
Nov. 28	Removing wreck, Port Chester, N. Y.	Nov. 3
	Advertised, Eng. News, Oct. 27 to Nov. 17.	
Nov. 28	Water-works, Florence, Colo	Nov. 3
	Advertised, Eng. News, Nov. 3 and 10.	
Nov. 28	Sewers, North Bend, Ind.	Nov. 3
Nov. 28	Heating plant, Henderson, Colo.	Nov. 3
Nov. 28	Tubular boilers, (2), San Francisco, Cal.	Nov. 3
Nov. 28	Removing wreck, Portchester Harbor, N. Y.	Oct. 27
Nov. 29	Water-works, Ft. Berthold, N. Dak.	Nov. 3
Nov. 30	Dry dock, Algiers, La.	Oct. 20
Nov. 30	Bridge, etc., and plans, Moline, Ill.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Dec. 1	Electric lighting, Sumter, S. C.	Oct. 6
Dec. 1	Electric light plant, Clinton, Ill.	Oct. 13
Dec. 2	Arc lighting, Asheville, N. C.	Oct. 13
Dec. 5	Pumping engine, Oil City, Pa.	Oct. 27
	Advertised, Eng. News, Oct. 27 to Nov. 10.	
Dec. 6	Street bonds, Springfield, O.	Nov. 3
Dec. 7	Changing Van Buren St. bridge, Chicago, Ill.	Oct. 20
Dec. 8	Lease of water power, Indianapolis, Ind.	Nov. 3
Dec. 10	Intercepting sewers, Washington, D. C.	Nov. 3
	Advertised, Engineering News, Nov. 3.	
Dec. 15	Storm sewers, Denver, Colo.	Oct. 13
Dec. 21	Court house annex, Atlanta, Ga.	Nov. 3
Dec. 22	Superstructure, Lorain, O.	Nov. 3
Dec. 31	Plans for station, etc., Stockholm, Sweden	June 23
Jan. 1	City hall plans, Bridgeport, Conn.	Aug. 18
Jan. 2	Bridge, Quebec, Que.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Jan. 2	Arc lighting, Vincennes, Ind.	Oct. 27
Jan. 6	Water-gas plant, Johannesburg, So. Africa.	Oct. 27
Jan. 6	Extension, electric plant, Johannesburg, S. Af.	Oct. 27
Feb. 2	Electric lighting, New Orleans, La.	Nov. 3
Feb. 10	Jail building, Keyser, W. Va.	Sept. 29
No date	Missouri road, Quincy, Ill.	Nov. 3
“	Brick, Esquimault, B. C.	Nov. 3

RAILWAYS.

ALLEGHENY & WESTERN.—The work of boring the tunnel on this line through the Simpson Hill has been completed by Bennett, Talbott & Smith, of Greensburg, Pa. The tunnel is 2,317 ft. in length, and has been under construction for five months. J. M. Floesch, Ch. Engr., Kittanning, Pa.

ALLEGHENY JUNCTION.—A. H. Keith, Pres., Pittsburg, Pa., informs us that this company was incorporated merely to construct one mile of railway in Pittsburg to connect the Allegheny Valley Ry. with the Pittsburg Junction R. R. and this with the Baltimore & Ohio and the Pittsburg & Western Rys. The greater portion of the line has been constructed and is in operation. J. W. Patterson, Ch. Engr., Pittsburg.

BISMARCK & POTOMAC VALLEY.—This company is said to have been incorporated in West Virginia, with a capital stock of $100,000, by C. R. Herr and Samuel Mason, of Philadelphia, Pa. F. M. Howard, Forest Bldg., Philadelphia, may be addressed.

BRITISH COLUMBIA.—It is announced that D. Vincent and I. Thompson will apply to the legislature for the granting of a charter to a company, which proposes to construct a railway from Midway, B. C., along the valley of Kettle Creek to a point near the mouth of Beaver Creek.——A charter has been granted to the Cariboo-Omenica Charter Co. for the construction of a railway from some point on the Canadian Pacific Ry. between Kamloops and Aschroft, B.C., to a point near Barkersville. Under the charter, work must commence on the line before May next.

CARP, ALMONTE & LANARK.—Reports state that the construction of this proposed railway from the Ottawa, Arnprior & Parry Sound branch of the Canadian Atlantic Ry., at Carp, Ont., to the Canadian Pacific Ry., at Madoc, via Almonte. The line is designed to open up a new section of Ontario, and also to form a shorter connection between Toronto and Ottawa. William Stafford and Andrew Bell, of Almonte, Ont., are said to be interested.

CHATTAHOOCHEE VALLEY.—L. Lanier, Pres., West Point, Ga., informs us that a company composed of Z. Hagedorn, L. S. Turner and N. L. Atkinson, proposes to build a line from Riverview to Columbus, Ga.

CHICAGO, SIOUX FALLS & PACIFIC.—Reports state that this company, formerly known as the Sioux Falls & Pacific, has been incorporated with a capital stock of $8,000,000, to build a line from Sioux Falls, S. Dak., to the Wyoming state line.

CLEVELAND & NEW CASTLE.—Work is reported to have stopped on this proposed extension of the Lake Erie & Western, between Akron, O., and New Castle, Pa. The roadbed was nearly completed, and about $1,000,000 has been expended on the line in the last three months. It is said that the company has secured control of the Pittsburg & Western Ry., which runs over part of the same field. Pres., J. H. McVey; Ch. Engr., J. H. Pirkey, of Youngstown, O.

COLORADO VALLEY.—Mr. Sloan, of Trammel & Co., Sweetwater, Tex., has been appointed receiver of this company, and intends to complete the line from Sweetwater to San Angelo, a distance of about 75 miles. A further extension is also projected from San Angelo to a connection with the Atchison, Topeka & Santa Fe at Sugden. Geo. S. Moore, Ch. Engr., Sweetwater.

CRYSTAL RIVER.—Orman & Crook, of Pueblo, Colo., have the contract for the construction of a portion of this railway, which is now being completed from Carbondale, Colo., to Redstone, a distance of about 34 miles. Surveys are in progress for additional lines. The work is said to be quite heavy. J. A. Kebler, Gen. Mgr., Denver, Colo.

DAVENPORT, ROCK ISLAND & NORTHWESTERN.—Reports state that J. W. Gates, Pres. Illinois Steel Co. Chicago, and others, intend to revive the project of constructing this proposed short line, designed to connect the trunk lines passing through Davenport, Ia., and Rock Island and Moline, Ill.

DETROIT & LIMA NORTHERN.—Press repors state that a new line will be built by this company from Peoria, Ill., to Columbus, O., thus providing a continuous system from Chicago to Norfolk. J. R. Megrue, Gen Mgr., 120 Griswold St., Detroit, Mich.

FLORIDA EAST COAST.—Bids are asked until Nov. 10 for furnishing this company with 200,000 all heart-pine cross-ties. For specifications and information address E. Ben Carter, Roadmaster, St. Augustine, Fla.

GREAT EASTERN.—Surveys have been made and bonds will be issued so as to begin work soon on this proposed railway from Selma to Goldsboro, and thence to the coast, a distance of 130 miles; estimated cost, $2,700,000. Pres., J. W. Lynch, Kinston, N. C.; Gen. Mgr., J. H. Macleary, Suffolk, Va.

ILLINOIS CENTRAL.—This company is to push the work of constructing its proposed Fort Dodge & Omaha division, to be about 200 miles in length; grading will be done along the line as fast as it is located.——The 5-mile branch from Fort Dodge to Tara, Ia., is being double-tracked, requiring the construction of bridges across the Lizard and Des Moines rivers.——The grading of the line between Otto and Gilman, Ill., a distance of 21 miles, is said to be in progress. The work is light with a maximum grade of 26 ft. The American Bridge Works will erect one iron bridge about 96 ft. in length. D. Sloan, Ch. Engr., Park Row, Chicago, Ill.

KEOKUK & WESTERN.—A. C. Goodrich, Gen. Mgr., Keokuk, Ia., informs us that nothing further has been done towards the construction of this railway from Cainesville to Pattonsburg, Mo., than the completion of surveys. There has been trouble over securing the right of way.

KELLYTON & ROCKFORD.—J. P. Batson, Rockford, Ala., informs us that the preliminary survey of this proposed line from Kellyton to Rockford, 15 miles, was made on Oct. 25. It is expected that contracts will be let in January or February. John L. Cowan, Opelika, Ala.

LOUISVILLE, HENDERSON & ST. LOUIS.—A movement is on foot at Hartford, Ky., looking to a new line of railway to connect that city with the Fordsville branch of this system, at Mitchell's Station, via Dundee and Sulphur Springs, a distance of about 19 miles. Jas. F. Carson, Secy. of Hartford Commercial Club, of Hartford, is interested.

MISSISSIPPI RIVER, HAMBURG & WESTERN.—L. A. Cole, Pres., 100 William St., New York, informs us that 20 miles of this proposed railway have been completed and put in operation, and that capital has been secured, and all the contracts let for completing the line from Hamburg, Ark., to Lima Landing, on the Mississippi River, a total distance of 40 miles. Mgr., J. M. Parker, Hamburg, Ark.

MISSOURI PACIFIC.—Press reports state that this company will build at once an extension to its St. Louis, Iron Mountain & Southern branch, from Little Rock to Fort Smith, Ark., on the south side of the Arkansas River. Surveys are said to have been started. C. G. Warner, Vice-Pres., St. Louis, Mo.

NASHVILLE & KNOXVILLE.—A. J. Crawford, Pres., Terre Haute, Ind., informs us that surveys have been completed for the proposed extension from Monterey to Glen Mary, via Glades, Tenn., 35 miles, but that work has not yet been commenced.

NEW MEXICO & WESTERN.—G. M. Latimer, Pres., East Las Vegas, N. Mex., informs us that work will not be started until next spring on this proposed railway from Maxwell City to Taos, N. Mex., a distance of 100 miles. J. B. Latimer, Ch. Engr.

NEW YORK, WYOMING & WESTERN.—It is announced that this company, which is to build an outlet to tidewater, has just completed an important agreement with the Erie & Wyoming Valley R. R., running from Scranton, Pa., to Hawley, and to Port Blanchard, south of Pittston, by which the new road can use the Erie & Wyoming tracks. This gives it connections with nearly every coal mine not belonging to the railway corporations. The present purpose of the new concern is to build its line from Jersey City to the village of Wimmers, on the Erie & Wyoming Valley line.

NORTHERN PACIFIC.—This company is considering plans for the construction of a new cut-off from Missoula, Mont., to Pasco, Wash., over a pass in the Rocky Mountains, thus shortening the distance by about 100 miles.

OHIO.—Edward W. White, Vice-Pres. Cincinnati, Georgetown & Portsmouth R. R., Cincinnati, O., has been awarded the contract for the construction of a railway track for the water-works commission to the eastern pumping station at California, at $7,378. Full bids on the work were published in our last issue.

PECOS VALLEY.—The railway has been completed to Summerfield, Castro county, Tex., and all the necessary material for the bridges over the Spring, Berrendoes and Pecos rivers is now at Roswell, N. Mex.

PENNSYLVANIA.—As a result of the recent inspection of this line, it is said that double-tracking will be undertaken between Chicago and Logansport Ind., involving the expenditure of about $1,000,000; also that a number of curves will be removed. Pres., Frank Thomson, Broad St. Station, Philadelphia.

POINT HARBOR & TERMINAL JUNCTION.—This company was incorporated in New York, Oct. 29, with a capital stock of $100,000, to build a steam surface railway for the transportation of freight only, from a junction of the Terminal Ry., of Buffalo with the Lake Shore & Michigan Southern Ry, at Smoke's Creek, to Buffalo Harbor at Stony Point, in West Seneca, Erie county, a distance of four miles. The directors are: Edward T. Hingston, Stephen Lockwood, S. Munch Keilander, Herbert Meldrum, Stephen T. Lockwood, William E. Hingston, Harry L. Lockwood, Charles McAllester and John H. Lockwood, of Buffalo, N. Y.

RUTLAND-CANADIAN.—A bill has been introduced in the legislature of Vermont providing for the incorporation of the Rutland-Canadian R. R. Co., with a capital stock of $1,000,000. The proposed incorporators are Dr. W. Seward Webb, Frank R. Wells, Wallace C. Clement, H. E. Smith, Frederick W. Wilder, W. W. Stickney, George Pottum, John W. Stewart and Percival W. Clement. Another bill was introduced allowing the Rutland R. R. Co. to buy or control any railway in the county or elsewhere.

SABINE PASS & NORTHWESTEN.—This company is reported to have been incorporated in Texas with capital stock of $400,000, to construct a railway from Sabine Pass to Bonham, Tex., a distance of about 300 miles. W. H. Brooker, San Antonia, Tex.; R. M. Lusk, Bonham, and others, are interested.

ST. LOUIS, PEORIA & NORTHERN.—This company contemplates, according to reports, the extension of its system from Clinton to Chicago, via Peoria, Ill., requiring the construction of about 250 miles of track; estimated cost, $13,000,000. Pres. and Gen. Mgr., W. E. Guy, St. Louis, Mo.

UNION, COVE & VALLEY.—G. E. Howe, Ch. Engr., Union, Ore., informs us that the surveys have all been made and right of way obtained for this new line from Cove to Union, a distance of 11.15 miles. The company is doing its own work and has the grading completed; no iron has yet been laid. Pres., E. P. McDaniel, Cove, Ore.

WYOMING.—E. H. Saltiel, Pres. of Wyoming Land, Iron & Coal Co., Rawlins, Wyo., informs us that the only railway that will probably be built from the main line of the Union Pacific R. R. into the Seminoe mining district, will run from Grenville station, six miles west of Fort Fred Steele, to the iron and coal mines and limestone quarries of this company at Iron City, 24 miles distant. This company will also construct new blast furnaces, etc.

STREET AND ELECTRIC RAILWAYS.

BOSTON, MASS.—The railroad commissioners have approved of the location of new street railway tracks on Walnut and Humboldt Aves.

EXETER, N. H.—At the annual meeting of the Exeter St. Ry. Co. an issue of $50,000 of new stock was authorized for track extension, as was a 10-year lease of the Hampton & Amesbury line, the construction of which will be begun at once. Pres., William Lee; Ch. Engr., J. S. Adams.

BABYLON (L. I.), N. Y.—Preparations are under way for the construction of the New York and North Shore Ry. from Babylon to Northport, a distance of 16 miles. Surveys have been made and the consent of the property owners is being secured. This company is also reported to have let the contract for grading the road from the Sanford Ave. tracks in Flushing to Jamaica, to Thos. J. McKenna, of Flushing. The contracts for laying the ties and steel rails has been let to Hogan Bros.

BUFFALO, N. Y.—It is reported that the Buffalo & Lockport Ry. Co. proposes to double-track its roadbed from Tonawanda to Lockport during the next six months; also that a new power station will be built midway between these cities.

GLEN FALLS, N. Y.—The Green sawmill on the canal between Glen Falls and Sandy Hill will be fitted up as a reserve power station, according to reports, for the Glen Falls, Sandy Hill & Fort Edward St. R. R. Ch. Engr., E. A. Clark.

KINGSTON, N. Y.—The Colonial City Traction Co., of Kingston, has certified to the Secretary of State that it proposes to extend its line from Strand and Gill Sts. to Bath Beach. Pres., C. M. Preston, 22 East Strand St.

NIAGARA FALLS, N. Y.—The Niagara Falls & Suspension Bridge Ry. Co. has stated its intention to lay a 94-lb. rail on 2d St., next spring.

NYACK, N. Y.—We are informed that the track-laying and overhead construction work on the proposed electric railway to be built at Nyack, for the Nyack Traction Co., has been let to B. F. Sweeten & Son, Camden, N. J., as stated in our last issue. The length of the line will be nine miles, and the motive power, 700 HP. Isaac A. Walker & Son, Girard Bldg., Philadelphia, Pa., are the general contractors.

CAMDEN, N. J.—An ordinance was introduced in the council, Oct. 27, granting the right of way for a double-track elevated railway for an electric line projected between Philadelphia and Atlantic City. The applicants are Walter N. Boyer, Frederick S. Dickinson, Lewis W. Moore and Daniel Caldwell.

NEW BRUNSWICK, N. J.—It is announced that the Brunswick Traction Co. has completed the purchase of the New York & Philadelphia Traction Co.'s property in New Jersey. The only line that has been completed by this latter company is that running from Bound Brook to Raritan, a distance of about seven miles, which is part of the main line projected from New York to Philadelphia. Pres., G. Krueger, New Brunswick.

PHILADELPHIA, PA.—W. Caldwell, Stephen Girard Bldg., is said to have completed plans and specifications for a car barn and power house for the Southwestern Traction Co., at Penrose Ferry, Schuylkill River. It will be of brick and iron, 200 × 50 ft., with slag and tin roofing.

NEWPORT NEWS, VA.—Reports state that Alexander Brown & Sons, of Baltimore, Md., and others have purchased a controlling interest in the Newport News, Hampton & Old Point Ry. Co., and that a general consolidation of this company, the Newport News & Old Point Ry. & Electric Co. and the Chesapeake Light & Power Co. will be effected. Extensive improvements are contemplated. Pres., W. J. Payne, Richmond, Va.; Treas., H. L. Schmelz, Hampton, Va.

NEW ORLEANS, LA.—It is reported that the Orleans & Jefferson Ry. Co. has made arrangements for the grading of its proposed street railway. Engr., Robert R. Zell, 708 Union St.

VICKSBURG, MISS.—The Vicksburg Electric St. R. R. Co. is stated to have awarded a contract for the construction of four miles of electric railway, to be ready for operation by Dec. 1. Secy., M. J. Mulvihill, of Vicksburg.

CINCINNATI, O.—The Cincinnati, Lawrenceburg & Aurora Electric St. Ry. Co. was incorporated, Oct. 24, with a capital stock of $10,000, with headquarters at Aurora, to construct a line which will be a continuation of the system of electric railway which was built from Dayton, O., to Hamilton last year, and completed from the latter city to Cincinnati this year. The incorporators are, J. C. Hooven, George H. Helvey, G. A. Rentchler, C. E. Hooven and Fred D. Schafer.——The Mill-Creek Valley St. Ry. Co. is said to have contracted with the International Construction Co., of Detroit, New York and London, to construct its line from Cincinnati to Hamilton, for about $1,000,000, before June 1, 1899. A power house will be built at Hartwell. The main line will go direct up the Springfield Pike, right of way over which is assured. A Corliss engine will be furnished by the Arbuckle-Ryan Co., of Toledo; boilers by A. Lewis, of Cincinnati, and electric apparatus by the Simmons-Holske Co., of Chicago.

CLEVELAND, O.—The board of control has granted permission to the Little Consolidated St. Ry. Co. to extend its Superior St. cable line from Doan St. to the easterly city limits. Supt., G. G. Mulhern, Western Reserve Bldg.

COLUMBUS, O.—The Columbus Central St. Ry. Co.'s property has been ordered to be sold, according to reports, in order to terminate the receivership.

DAYTON, O.—The Dayton & Eastern Traction Co. has been incorporated, with a capital stock of $10,000, to operate an interurban electric railway. The directors are Henry B. Pruden, George E. Wright, H. O. Cox, William A. Mays and W. S. McConnaughey.——The Dayton & Xenia Traction Co. has also been incorporated to build an electric railway; capital stock, $300,000. The directors are J. M. Wilson, O. O. Ozias, F. D. Bittinger, Isaac G. Kennedy and Philip A. Kemper.

LANSING, MICH.—L. C. Chase, Dansville, Mich., informs us that the surveys have been made and the right of way obtained for the proposed Lansing, Dexter & Ann Arbor Electric Ry. from Lansing to Ann Arbor, via Holt, Mason, Dansville, Pinckney and Dexter, a distance of 61 miles. A contract has been made with John F. Wilmot, 516 Union Trust Bldg., Detroit, Mich., to construct and equip the lines, and he is now sub-letting the work. The route is through a productive portion of Michigan, connecting the Huron lakes. Pres., C. A. Mapes, Lansing.

VERNON, MICH.—The Vernon township board has granted a franchise to the Long Lake, Durand & Corunna Electric Ry. Co. The company now has a clear right of way, and expects to begin work next April.

CHICAGO, ILL.—The Illinois Traction Co. has been incorporated, with a capital stock of $100,000, by Augustus Kelly and others, connected with the law firm of Matz, Fisher & Boyden, 107 Dearborn St. The proposed route is from the terminus of the Chicago City Ry. at 75th St. and South Chicago Ave., and thence to Houston Ave. and 93d St., South Chicago.

KENOSHA, WIS.—The Milwaukee, Racine & Kenosha Ry. Co. has been granted a franchise by this city, and it is said that work will begin soon, so that the line could be operated before winter sets in.

ST. LOUIS, MO.—We are informed that Enright & Tiernan, 7th and Cerre Sts., St. Louis, contractors for the St. Louis & Belleville Electric Ry., have about completed their contract between East St. Louis and Belleville, Ill., but that they will have 45 miles additional to sub-let in a few days. The grades on this road are 3%, curves 30°, gage 4 ft. 10 ins., and the line is expected to provide both a freight and passenger service.

HAMILTON, ONT.—W. I. Degear, Grimsby, Ont., is said to have been awarded the contract for the construction of the Hamilton Radial Electric Ry., to Port Nelson. Pres., A. Turner, 90 James St., North.

BURNLEY, ENGLAND.—We are informed that the town clerk of Burnley is asking for information as to the relative values of the overhead trolley wire system and the underground conduit system. Burnley has just taken over the tramway system and is thoroughly reconstructing it, so the matter may be of financial importance to those interested in electrical tramways. Further information may be obtained from Milo R. Maltbie, Secy. of Reform Club, 52 William St., New York.

RHEIMS, FRANCE.—Press reports state that La Compagnie de Tramways de Rheims, Sharbeck, Brussels, Belgium, is about to change the motive power of the passenger railways of this city from horse power to the electric trolley system. Contractors and furnishers of material in the United States will probably have an excellent opportunity to compete. The city authorities have given permission to make the change.

BERLIN, GERMANY.—Press reports state that Wandruzska & Co., Engineers and Contractors, of Berlin, have secured a concession for a projected electric railway between Erkner and Rudersdorf, and that they are negotiating for the purchase of material in the United States in order to get early deliveries.

WARSAW, RUSSIA.—Bids are asked by the municipal council of Warsaw for the exploitation of the tramways of Warsaw under municipal control. It is intended to replace the present horse car system by electric traction. For information address the president of the city.

ELECTRIC LIGHT AND POWER.

PORTLAND, ME.—J. W. Fogg writes us that the plans for the proposed plant are not sufficiently mature to furnish details as yet.

PORTSMOUTH, N. H.—Bids are asked until Nov. 15 for furnishing a switchboard, a dynamo, five motors and one block and dead-eye machine for the navy yard. Edwin Stewart, Paymaster-Gen., U. S. N., Washington, D. C.

BRANDON, VT.—Local papers state that E. D. Blackwell, formerly treasurer of the Neshobe Electric Co., has secured control of the entire water power of Sucker Brook west of the Goshen line and will form a company to develop the power and bring it to Brandon. The water power is the fall which is known as Llana Cascade, and with the falls immediately above and below the cascade Mr. Blackwell has a fall of something over 350 feet, and it is said he will bring to Brandon about 1,000 HP.

LAWRENCE, MASS.—Local papers state that plans are being considered for removing the electric plant of the Lawrence Gas Co. from the present location to a site near Butler's Mills, South Lawrence, where better water power may be secured. Treas. and Mgr., C. J. R. Humphreys.

SALEM, MASS.—J. Clifford Entwisle, Cy. Clk., writes us that the city does not anticipate building a municipal plant, as reported last week.

WORCESTER, MASS.—The county commissioners received the following bids Oct. 25 for furnishing and installing a plant for the new court house:

Armington & Sims, Boston, Sims engine	$3,525
Dick & Church, Boston	3,770
American Engine Co., Boundbrook, N. J.	3,587
Edwin C. Lewis, Boston	3,647
Plummer, Ham & Richardson, Worcester	3,353
Page Electric Co., Worcester	3,245
Walworth Supply & Construction Co., Boston	3,177
Ridgeway Dynamo & Engine Co., Boston	3,250
Bibbee, White & Co., Boston	3,745
Columbia Electric Co., Worcester	3,318
Charles D. Parker, Worcester	3,525

ANSONIA, CONN.—It is stated that the E. A. Perkins Electrical Co. has increased its capital stock from $5,000 to $20,000. The company has purchased the lands and buildings thereon, which were owned by Edison Perkins.

AKRON, N. Y.—The board of trustees will probably soon ask for bids for constructing the proposed plant, according to reports.

ALBANY, N. Y.—The question of a municipal plant is being considered. Alderman Geo. H. Stevens may be addressed.

CANANDAIGUA, N. Y.—M. D. Munger writes us that nothing can be done in regard to building a plant until the franchise has been granted, it having already been asked for by Mr. Munger and Thos. H. Bennett. The plant proposed will have a 2,000 light alternator, an engine of about 175 HP, and, possibly, an arc light dynamo of 65 lights.

GENEVA, N. Y.—Mayor Herendeen has vetoed the second light contract. His objections are that the company does not agree to furnish 2,000 c. p. lights; that the contract does not require 3,500 hours of lighting before offered; that a franchise would be given away, while parties have offered to pay for it and that the contract is for five years, whereas the city cannot let one for more than one year.

MALONE, N. Y.—J. F. Wright, Malone, informs us that the proposed water power plant to be built by Messrs. Kilburn, Abbott & Wright will have a capacity for 80 2,000-c. p. arc and 2,000 16-c. p. incandescent lights. The plans are not far enough advanced for further information. The franchise was granted Oct. 24.

NEW YORK, N. Y.—Bids are asked until Nov. 7 for furnishing a plant for school building No. 17, Richmond. Address the building committee, board of education, 585 Broadway, Manhattan.

SKANEATELES, N. Y.—The question of building a municipal plant at a cost of about $30,000 is being considered, according to reports.

WHITESBORO, N. Y.—This place voted Oct. 24 to light the streets with 29 2,000-c. p. arc lights at a cost of $2,100 a year. The present company will make an addition to its plant at once.

CAMDEN, N. J.—The Citizens' Light, Heat & Power Co., 317 Market St., has applied for a franchise. A. Stewart Scull, Camden, may be addressed.

CAPE MAY CITY, N. J.—The question of the municipal ownership of the plant is being considered.

LANCASTER, PA.—Gustavus Groezinger has assigned the franchise for building a plant and the contract for lighting the city to the Lancaster Electric Plant, Heat & Power Co. The plant will cost about $100,000.

NEWTOWN, PA.—Bids are asked until Nov. 5 for lighting the streets for one year from Jan. 8, with privilege of renewing from year to year. Secy. Council, M. A. Buckman.

PHILADELPHIA, PA.—J. E. & A. L. Pennock, 305 Walnut St., have been let the contract to build the power house for the Commercial Museums in West Philadelphia. It is to be one story high, 60 × 224 ft., and will be built of rock face stone, and will cost about $50,000. Work will be begun in a few days.

WRIGHTSVILLE, PA.—It is stated that the Walter Bradley Co., Oswego, N. Y., has been awarded the contract for building a dam and excavating at Wrightsville, for the Martic Water & Power Co., at about $100,000. Ch. Engr., Jas. H. Harlow, Wrightsville.

ROANOKE, VA.—Estimates are reported as being received by C. L. Moses & Co. for a plant of 500 incandescent lights.

ASHBORO, N. C.—M. O. Hammond, Mayor, writes us that the city has no plant, but the board of commerce is in communication with a company in Norfolk, Va., with a view to putting in a plant. Pres. Bd. of Commerce, Jno. T. Moffitt.

DALTON, GA.—It is stated that this city is arranging for the construction of a plant and sewers to cost $30,000.

FORSYTH, GA.—The question of issuing $8,000 in bonds for a plant will be voted upon Nov. 26. Cy. Clk., W. A. Pye.

MILLEDGEVILLE, GA.—L. C. Hall, E. T. Alling, B. B. Adams, Jr., and T. J. Crowley are on the committee to investigate the question of a municipal plant. The council has refused to renew the contract with the Milledgeville Electric Light Co. The proposed plant will have a capacity for 50 arc and 1,000 incandescent lights. Mayor Horne may be addressed.

WOODLAWN, ALA.—Jno. T. Hood writes us that the town is considering the question of building a plant in connection with the proposed water-works. The works will cost about $25,000. Population, 3,200.

NEW ORLEANS, LA.—Councilman Felix J. Dreyfous writes us that the city will advertise for bids for lighting the upper districts (6 and 7) by electricity, gas or vaporized oil. Bids will probably be opened Feb. 2. The city is now paying $35,000 a year for lighting these districts. Conduits will be laid in the commercial portion of the city by the several wire companies within the next year.

FRANKLIN, KY.—The council is reported to have awarded the contract for public lighting to B. F. Gardner, Bowling Green, Ky.

BELLE CENTER, O.—The question of building a plant is being considered.

GIRARD, O.—Estimates are wanted for a plant for lighting this place; population, 3,000. Frank Pringle, Chn. Com.

WOODSFIELD, O.—T. A. Way, Mayor, writes us that it is proposed to build a plant for street lighting; estimated cost $7,000.

HUNTINGBURG, IND.—Information is being secured for a municipal plant of 500 incandescent and 35 arc light capacity. J. W. Schwartz, Mayor; Councilmen Henry Prior and Bretz are on the committee.

INDIANAPOLIS, IND.—Bids are asked until Dec. 8 for the lease for 30 years of the water power, etc., belonging to the Indianapolis Water Co., 113 Monument Place. F. A. W. Davis, Vice-Pres.

GRAND RAPIDS, MICH.—The Grand Rapids Electric Light and Power Co. propose to build a storage battery plant and make other changes to its plant. Jos. W. Spooner, Secy.

GRAND RAPIDS, MICH.—Geo. Lohman, Arch., has completed plans for the building for the municipal plant, the contract for which has been let to the Chase Construction Co., Detroit.

KALAMAZOO, MICH.—Press reports state as follows: Work on the construction of a dam on the Kalamazoo River by the Kalamazoo Valley Electric Co., has been begun, and construction will be completed by the middle of January. The dam proper will cost $125,000. It will be located about four miles southwest of here in Trowbridge township. It is estimated that about 13,500 HP. will be developed. Four water wheels will be put in. The company proposes to furnish both electric lighting and power, and it is probable that Allegan, Kalamazoo, Oswego, Plainwell and other towns will be lighted by the company. It is said that considerable of the machinery has already been purchased. H. C. Hoagland, Supt. Kalamazoo Electric Co., and J. D. Foote are interested.

CHICAGO, ILL.—Bids are asked until Nov. 9 for arc lamp repairs. Edward B. Ellicott, Cy. Electrician.

CLINTON, ILL.—Harry Swigart has been granted a 20-year franchise for a plant. Press reports state that bids will soon be asked by the council for lighting the city, the contract with the Clinton Electric Light Heat & Power Co. expiring in a few months.

EDWARDSVILLE, ILL.—Press reports state that the plant of the Edwardsville Electric Light & Power Co., which was destroyed by fire Oct. 24, will be rebuilt at once. The loss was $30,000. Dudley Pogul, Mgr.; C. H. Fischer, Pres.

ELBURN, ILL.—The question of building a plant in connection with the proposed water-works is being considered. Councilman A. W. Collins may be addressed.

LITCHFIELD, ILL.—The Decatur Light Co., Decatur, Ill., it is stated, is considering estimates for a plant for this place.

MORGAN PARK, ILL.—Bids were asked until Nov. 1 for building a power house for the water-works and the electric light plant. The building will be 50 × 66 ft. Arch., N. N. Waterman, 925, 218 La Salle St., Chicago; M. H. King, Pres. Bd. Local Improvements.

ROCK ISLAND, ILL.—Bids are asked by the city clerk until Nov. 7 for a combination system of high and low lights. There is to be one tower in each ward, and six lights on each tower, the tower to be at least 100 ft. high. The elevation of the low lights is to be 28 to 35 ft. Bids are asked for one-year, two-year and three-year contracts, and for lighting according to the Philadelphia schedule, or all night, the council to choose when the bids are opened.

COLUMBUS, WIS.—The question of building a private plant is being considered. Mayor Leitsch may give information.

GREEN BAY, WIS.—The city clerk writes us that bids were received Oct. 21 for building a plant, but up to a late date the contract had not been let.

FOUNTAIN CITY, WIS.—It is stated that H. & F. Roettiger have been granted a franchise.

MERRILL, WIS.—Plans are being prepared for rebuilding the burned plant of the Merrill Ry. & Light Co. The new plant will be larger than the old one, which cost $10,000. J. N. Cotter and E. S. King, of Merrill, and F. P. Hixon, of La Crosse, Wis., are interested.

DES MOINES, IA.—The Des Moines Edison Light Co. has increased its capital stock from $130,000 to $450,000. Plans are prepared for the improvement of the water power plant at Center St., where a building is being constructed. It will be equipped with water wheels. R. H. Frazer, Supt.

CLARENCE, MO.—It is stated that this place has voted to issue $5,000 in bonds for a plant.

INDEPENDENCE, MO.—W. T. Felton, of Kansas city, Mo., has applied for a 20-year franchise for a plant.

SARCOXIE, MO.—This place has voted to grant a franchise for a plant to the Sarcoxie Electric Co.

SENECA, MO.—The question of building a plant is being considered, according to reports. J. E. Schreiner may be addressed.

ARKADELPHIA, ARK.—The Brown Electric & Machinery Co., Little Rock, Ark., has been awarded the contract for a plant for the Arkadelphia Lumber Co.'s mills.

WYNNE, ARK.—Bids are asked until Nov. 10 for furnishing the materials and for building a plant and water works (postponed from Nov. 8). Engr., Owen Ford, Security Bldg., St. Louis; Chn. Com., W. M. Kennedy.

HOUSTON, TEX.—L. J. Luffly, Chn., writes us that the committee has selected the site for the proposed municipal plant to cost about $100,000. Up to Oct. 26 no engineer had been engaged.

BUTTE CITY, MONT.—Judge Lindsay has ordered Fred. J. Sterling, Missoula, Mont., Receiver Montana Power Co., to proceed to repair the Big Hole dam at a cost of about $67,000, in order to preserve the property. It is said that $470,000 has so far been spent on building the power plant. The expenses of all the necessary work is placed as follows: Repairing dam, $31,000; drain tunnel, $7,500; penstock and gates, $12,500; Wise River dam, $8,000; power house, $8,000; total, $67,000.

DENVER, COLO.—Press reports state that the construction of a part of the plant of the Denver Power & Irrigation Co. has been begun by building the reservoir on the Platte River. This reservoir will cost about $1,000,000. The entire plant and system will cost about $3,000,000. Alderman Robt. M. Golder has introduced an ordinance authorizing the granting of the franchise. Jas. E. Rhodes and Walter Rhodes, of Denver, are interested.

LEADVILLE, COLO.—Dr. M. J. Rickoff, London, England, will submit a report to an English syndicate in regard to the construction of a power plant at Malta, the power to be secured from the Lake Park reservoir. T. W. Jaycox, R. E. Goodell and Dr. Law may give information.

COLFAX, WASH.—Fanning & Brown are considering the cost of a plant for this place.

REDLANDS, CAL.—It is stated that F. C. Finkle, Engr. Electric Light & Power Co., is making surveys for extending the plant at Mill Creek.

MAGOG, QUE.—The question of issuing $10,000 in bonds for a plant will probably soon be voted upon, according to reports.

ACTON, ONT.—It is stated that this place will soon vote on the question of building a plant.

BOTHWELL, ONT.—This place is reported to have voted to issue $4,000 in bonds for a plant.

BRADFORD, ONT.—This place is considering the question of putting in a plant.

HAMILTON, ONT.—Percy Domville, Hamilton, has submitted his report on the proposed municipal plant. Estimated cost, from $40,516 to $97,130.

ST.THOMAS, ONT.—J. A. Bell, Cy. Engr., is reported as preparing plans for a municipal plant.

THOROLD, ONT.—An election will be held in January to vote on the question of building a plant to cost about $7,000, according to reports.

WINNIPEG, MAN.—The question of building a municipal plant is being considered by the council. Aldermen Bell, Chn., Mitchell and Martin are on the committee.

ROSSLAND, B. C.—The council has accepted the offer of the West Kootenay Power & Light Co. to provide five arc lights to be used in the city at a cost of $96 a year.

JAPAN.—The New York "Journal of Commerce" states that Shizuo Kondo, Pres. Japan-American Commercial & Industrial Association, Times Building, New York, has received data from Japan regarding the construction of new power plants wherein American machinery may be installed provided the manufacturers here take steps toward getting the work. There are at present but two electric railways in operation in Japan. They are the Kioto Electric Ry. Co., with a capital of 3,000,000 yen, and the Nagaya Electric Ry. Co., with 250,000 yen as capital. Both of these roads are earning good dividends, and consequently have proved quite an incentive toward the construction of other roads. Abundant waterfalls furnish additional inducements, and there are at present either in course of construction or in contemplation 27 new roads, of which but 10 will require steam plants. There are also in course of construction 31 electric light stations, of which 21 will receive their power from waterfalls. There are 17 water-power plants about to be built for manufacturing purposes and three steam plants. Mr. Kondo has the names and commercial standing of the concerns who are building these plants.

NEW COMPANIES.—Dundas Electric Co., Ltd., Dundas, Ont.; $40,000; Geo. H. Harper, R. T. Wilson, Jas J. Grafton, John Bertram.

Sutton-Steele Electrical Co., Dallas, Tex.; $20,000; Walter L. Steele, Henry M. Sutton, Emmett A. Ellis, J. L. Sale.

Kansas Gas, Water & Electric Light Association, Topeka, Kan.; for mutual protection and benefit; Pres., L. T. Palmer, Leavenworth; First Vice-Pres., E. Willis, Atchison; Second Vice-Pres., A. T. Rogers, Beloit; Secy. and Treas., Jas. H. Foley, Leavenworth.

Electric Heat & Power Co., Chicago, Ill.; $5,000; Chas. B. Coffeen, Alvah S. Hopkins, Howard B. Cook.

Edison Junior Electric Light & Power Co., New York; $100, with the privilege of increasing the same to $500,000; Thos. A. Edison, Jr., Valentine Robinson, H. C. Hepburn, E. A. Drake, C. S. Henry, R. M. Jordan, J. G. Batterson, Jr., F. J. Stone, New York city.

Tonawanda Cataract Power Co., North Tonawanda, N.Y.; $100,000; to distribute electricity for light, heat or power within Wheatfield, North Tonawanda, Niagara county, and Tonawanda, Erie county; Chas. A. Sweet, 1040 Delaware Ave.; Lincoln A. Grow, Buffalo; Edwd. D. Adams, Francis Lynde Stetson, Edward A. Wickes, William B. Rankine, Engr., Mills Bldg., New York.

Warsaw Electric Co., Warsaw, Ind.; $30,000; Noah J. Clodfelter, A. T. Spencer, Chas. J. Lohman, J. C. Hamilton, Monroe George.

Montezuma & Oglethorpe Light Co., Montezuma, Ga.; $3,000; Jule Felton, V. O. Brown.

South McAllister Electric Light Co., South McAllister, Ark.; $25,000; Pres., L. J. Graham.

BRIDGES.

BOSTON, MASS.—The following bids were received Oct. 27 for constructing the draw foundation and drawfender piers of the new bridge on Summer St. extension. William Jackson, Cy. Engr.: William L. Miller and William N. Ellis, $38,896; John Cavanagh & Co., $46,400; William H. Keyes & Co., $44,980; J. N. Hayes & Co., $52,000; William J. Lawlor, $33,460; Ross & Fowler, $51,000.

ASHTON, R. I.—An iron bridge, to cost about $10,000, is to be constructed over the Blackstone River, to connect Lincoln and Cumberland. Chas. N. Robertson, Chn., Lincoln, and Dennis Shea, Secy., Cumberland, of the committee, John E. Judson, Engr., Pawtucket, R. I.

BUFFALO, N. Y.—A hearing will be given Nov. 15 by the park board, the authorities of West Seneca and the Buffalo, Rochester & Pittsburg R. R. Co., to consider a proposition to change the grade crossing at the Ridge Road to an overhead crossing, to cost about $6,000.

LEYDEN, N. Y.—The towns of Lyonsdale and Leyden have voted to build a new iron bridge across Black River, according to reports.

CHESTER, PA.—A bridge will be constructed at Lloyd St. by the Philadelphia, Wilmington & Baltimore R. R. Co.

WASHINGTON, D. C.—Bids are asked until Nov. 22 for constructing foundations for bridges across Rock Creek on the lines of Massachusetts and Connecticut Aves. extension, as stated in our advertising columns. Address the District Commissioners.——Plans and estimates have been submitted by the engineering department for the proposed memorial bridge across the Potomac River, with masonry piers and steel superstructure, of three fixed spans and one draw span, 60 ft. wide, and with approaches, estimated cost, $1,385,000; for a bridge over the eastern branch of the Potomac River, in line with Massachusetts Ave., having a total length of 2,517 ft. and 52 ft. wide; estimated cost, $441,208; with swing span on pivot pier, $476,843; for a stone arch bridge over Rock Creek, on Massachusetts Ave., estimated cost, $568,545, or for a steel bridge, $199,204.

CUMBERLAND, MD.—A bridge on the Pittsburg division of the Baltimore & Ohio R. R., over Wills' Creek, has been destroyed.

SAVANNAH, GA.—Bids are asked until Nov. 10 for constructing steel and iron bridges, according to reports. Jas. W. McIntyre, County Clk.

NASHVILLE, TENN.—Bids are asked by the council until 3 p. m., Nov. 3, for constructing the substructure of the Broad and Church Sts. viaducts. The bids received Oct. 25 were rejected; they ranged from $18,000 to $26,000.——W. M. Leftwich, Jr., Cy. Engr., informs us that the following bids were received Oct. 25 for the approaches of the Broad and Church Sts. viaducts, advertised in Engineering News, Oct. 13:

Groton Bridge & Mfg. Co., Groton, N. Y.	$32,345
Virginia Bridge & Iron Co., Richmond, Va.	36,325
King Bridge Co., Cleveland, O.	46,820
Indiana Bridge Co., Muncie, Ind.	43,820
Geo. E. King Bridge Co., Des Moines, Ia.	38,000
Youngstown Bridge Co., Youngstown, O.	34,449
Gude & Walker, Atlanta, Ga.	34,975
Louisville Bridge & Iron Co., Louisville, Ky.	43,248

CANAL FULTON, O.—Bids are asked until Nov. 15 for constructing a bridge, 131 ft. long and 32 ft. wide, capacity 150 lbs. per sq. ft., over the Tuscarawas River. Wm. M. Reed, County Andr., Canton, O.

CLEVELAND, O.—Plans are being prepared and bids will soon be asked for the superstructure of the Center St. bridge, over Cuyahoga River, to cost about $130,000. M. E. Rawson, Ch. Cy. Engr.

COLUMBUS, O.—Henry Maetzel, County Surveyor, has reported to the county commissioners that a number of steel and iron bridges are in need of immediate repair.

LORAIN, O.—Bids are asked until Dec. 22 for furnishing plans and for constructing the superstructure of either a swing or lift bridge over the Black River; estimated cost, $150,000. Osborne Co., Engrs., Osborne Bldg., Cleveland, O.

EAU CLAIRE, WIS.—A contract was awarded Oct. 28 to the Milwaukee Bridge & Iron Works, Milwaukee, Wis., at $26,175, for building the superstructure only and taking down the old bridge at Kelsey St. T. P. Cochrane, Cy. Clk.

WAVERLEY, IA.—Bids are asked by the county supervisors until Nov. 14 for a bridge over Cedar River, according to reports.

DULUTH, MINN.—R. E. McFarlane, 1811 West First St., informs us that plans have been prepared for the proposed steel bridge at Garfield Ave. E. J. Duffies, Des. Engr., City Hall, Duluth.

SEATTLE, WASH.—Bids are asked until 2 p. m. Nov. 7, for furnishing the material and constructing a combination truss bridge across Green River and approaches. E. H. Evenson, County Clk.

CORNING, CAL.—Reports state that a bridge 200 ft. long, will be constructed over Thomas Creek. W. F. Lunning, County Surveyor, Red Bluff, Cal.

TILBURY, ONT.—Bids are asked until 12 m., Nov. 4, for furnishing the material and constructing two steel highway bridges, over Big Creek, in Tilbury West township. Wm. Newman, Engr., Windsor, Ont., or Thos. Anderson, Comber, Ont., may be addressed.

BUILDINGS.

BRISTOL, VT.—A fire in the Union Block, on Main St., Oct. 26, caused damage estimated at $50,000.

HAVERHILL, MASS.—Two 4-story buildings, owned respectively by Herbert B. Newton and C. H. Tarleton, were destroyed by fire Oct. 27, causing a loss of about $50,000.

NATICK, MASS.—W. L. Bullard, E. W. Marsden and others have been appointed as a committee to erect a new library building in this town, to cost about $30,000.

ALBANY, N. Y.—The board of aldermen has passed an ordinance providing for the erection of a $30,000 public bath at 665 Broadway.

AMSTERDAM, N. Y.—A fire in this city, Oct. 23, destroyed the clothing store of Suri & Wilkie, on East Main St., causing a loss of about $50,000.

BINGHAMTON, N. Y.—Contracts have been awarded by the Binghamton State Hospital, subject to the approval of the State lunacy commission, as follows: For the general reconstruction of the north building, Ford Brothers, of Oswego, N. Y., $19,400; steam heating and ventilating, Gaylord & Eitapence, Binghamton, $10,900; electric light wiring, Gaylord & Eitapence Electric Co., $1,495; plumbing, D. J. Malane, Binghamton, $1,794.

BROOKLYN, N. Y.—Bids are asked by the department of public buildings, etc., 346 Broadway, New York, until Nov. 10, for certain repairs and alterations to the municipal building of the Borough of Brooklyn, City of New York.

BROOKLYN, N. Y.—We are informed that Eugene Lentilhorn, 11 Broadway, New York, was the lowest bidder for the erection of a steel store house at the Navy Yard, at $38,500, and not Cooper & Wiegand, 1133 Broadway, as stated in our last issue. The contract has been awarded to Mr. Lentilhorn, on revised plans, at $30,000.——Plans are being prepared, according to reports, for twenty-five 2-story brick dwellings, to be erected on 50th St., near 5th Ave., by Charles Hamilton, 271 57th St., at a cost of about $150,000. Arch., Thomas Bennett, 1267 3d Ave.——The contract for erecting a 4-story brick and stone apartment building in Flatbush for M. L. Hamilton, has been let to C. F. Bond, 136 Liberty St., New York, at about $34,000. Arch., J. J. Petit, 186 Remsen St., Brooklyn.

BUFFALO, N. Y.—Bids are asked by the department of public works, until Nov. 9, for the erection of a 20-room school building in District No. 16, on Delaware Ave., near Bryant St. (work to be begun May 1); also for the erection of a 24-room school building in District No. 19, at Delavan and West Aves. (work to be begun May 1). Secy., R. G. Parsons.

NEW YORK, N. Y.—It is reported that an 8-story office and theatre building will be erected at 29th St. and Broadway next May by Weber & Fields.——Plans have been filed by Frederick Haas, 514 East 162d St., for six 5-story brick tenement buildings, at 149th St. and Amsterdam Ave., to cost $95,000. Arch., W. O. Tait, 1236 Madison Ave.; by Mary McNamee, 217 West 125th St., for seven 5-story brick flat buildings, on 139th St., near St. Ann's Ave., to cost $202,000. Arch., John C. Burne, 101 West 42d St.; by Henry Miller, 100 Broadway, for an 8-story brick store and loft building, on 13th St., near West Broadway, to cost $90,000. Arch., Henri Fouchaux, 162d St. and 11th Ave.; by Ellen Eden, 403 St. Nicholas Ave., for eight 5-story brick flat buildings, on 183d St., near 12th Ave., to cost $160,000. Arch., A. Spence, 56 West 135th St.; by Samuel Russell, 458 East 169th St., for four 5-story brick flat buildings, at 100th St. and Park Ave., to cost $88,000. Arch., Thomas Graham, 1231 Madison Ave.; by Marasco & Abbate, 8 Spring St., for two 6-story brick flat and store buildings, at 164 and 166 Elizabeth St., to cost $80,000. Arch., A. G. Rechlin, 722 3d Ave.; by Peter Talbot, 828 St. Nicholas Ave., for four 5-story brick flat buildings, on 163d St., near Amsterdam Ave., to cost $92,000. Arch., Henry Anderson, 1,180 Broadway.

SYRACUSE, N. Y.—The supervisors' special penitentiary committee has received bids from the following for the construction of a new county jail and penitentiary: M. D. Makepeace, The Van Dorn Iron Works, Champion Iron Works, Preston B. Seaman, Jeffrey & Umbrecht, Merrick & Randall, and M. C. Conway. The cost of the work will be about $175,000.

SYRACUSE, N. Y.—Bids were received by the board of education, Oct. 26, for supplying the heating and ventilating apparatus for the proposed Washington Irving school building. The Northcott Warming & Ventilating Co. was the lowest bidder, at $1,300, for the regular apparatus and $630 for closets, a total of $1,930. The other bidders were: The International Heater Co., $2,183, and the Peck-Williamson Heating & Ventilating Co., $2,400.

WARD'S ISLAND, N. Y.—Bids are asked by the Manhattan State Hospital, until Nov. 9, for erecting and finishing a detached building, also for warming, ventilation and hot-water supply, plumbing and drainage, and electric wiring and fixtures for said detached building at Ward's Island, New York. Hon. Henry E. Howland, Pres. Bd. of Mgrs., 1 Madison Ave., New York.

CAMDEN, N. J.—The following bids were received by the supervising architect, Washington, D. C., Oct. 27, for the construction (except heating and ventilating) of the U. S. building in this city, as advertised in Engineering News; a, marble; b, deducted for use of limestone; c, deducted for use of sandstone: Girard Construction Co., Philadelphia, a, $159,400, Lee marble; b, $25,500; c, $23,250; time, 15 mos. D. W. Thomas, Baltimore, Md., a, $171,500 South Dover or Beaver Dam; 20 mos. B. F. Sweeten & Son, Camden, a, $159,900, Lee; b, $23,000; c, $23,000; 15 mos. Roydhouse, Grey & Co., Philadelphia, a, $164,000, Proctor Vermont; b, $24,465; c, $26,000; 18 mos. Hyram A. Miller & Son, Philadelphia, a, $162,500. Lee; b, $23,000; c, $21,500; 1 yr. R. C. Ballinger & Co., Philadelphia, a, $164,750. Lee; b, $25,500; c, $23,250; 18 mos. William Steel & Son, Philadelphia, a, $160,653, Lee; b, $25,000; c, $23,000; 17 mos. Bennett & Rothrock, Williamsport, Pa., a, $156,000, Lee; b, $25,500; c, $23,250; 18 mos. M. P. Wells & Co., Philadelphia, a, $167,777, Lee; b, $25,815; c, $23,565; 11 mos; no check. Joseph J. Churchyard, Buffalo, N. Y., a, $167,374, Vermont; b, $23,000; 18 mos. P. J. Carlin & Co., Brooklyn, N. Y., a, $157,490, Beaver Dam or South Dover; b, $25,500; c, $23,250; 18 mos. John Gill & Sons, Cleveland, O., a, $159,400, Dover or Ashley, $163,750, Beaver Dam or Lee; b, $21,000; c, $21,000; 18 mos. Prescott, Buckley & Callman, Keeseville, N. Y., a, $176,740, West Rutland, Vt.; b, $26,390; c, $29,000; 18 mos. McIlvain, Unkerfer Co., Pittsburg, Pa., a, $160,690, Vermont Marble Co.; b, $21,500; c, $16,000; 14 mos. Charles McCall, Philadelphia, a, Adams Co., $149,975, Lee, $157,699; b, $23,649; c, $25,208.

MORRIS PLAINS, N. J.—Bids are asked until Nov. 10 for the construction of a stone boiler house and iron smokestack, at the New Jersey State Hospital, at this place. Arch., Robert C. Walsh Savings Bank Bldg., Morristown.

PASSAIC, N. J.—Bids are asked until Nov. 17, according to reports, for erecting an 8-room school building to cost about $16,000. S. J. Post, Chn. of Com.

PATERSON, N. J.—Ackerman & Ross have been selected as architects for the new building for School No. 3, on Main St., to cost about $45,000.

CHAMBERSBURG, PA.—The trustees of Wilson College, Oct. 25, decided to erect a new $75,000 building. Pres., S. A. Martin, D. D.

BALTIMORE, MD.—George Mann has been awarded the contract for the erection of the new Northern police station, at $58,023.

CHARLESTON, S. C.—Plans are asked until Nov. 15 for an auditorium building, with a seating capacity of about 7,500 to cost not more than $20,000. Address the Auditorium Committee, Confederate Veteran Reunion, care of South Carolina Loan & Trust Co., Charleston.

ATLANTA, GA.—Bids are asked until Dec. 21 for erecting a 4-story brick and stone annex for the Fulton county court house, to be 116 × 156 ft. Arch., Grant Wilkins, 9½ Peachtree St.; Clk. of Comrs., A. L. Kontz, of Atlanta.

CHICAGO, ILL.—Reports state that the Edward Hillman Dry Goods Co., has secured a lease of the building at 112 to 116 State St., and that improvements will be made thereto, to cost about $40,000.——A permit has been granted to C. E. Bartley for the erection of an apartment building, 46 × 98 ft., at 4015 and 4017 Grand Boulevard, to cost $35,000. Arch., John Duncan.——Plans have been prepared for a 3-story school building for St. Francis' Roman Catholic Church, on St. Louis Ave., near Douglas Boulevard, to cost about $25,000. Archs., Burtar & Gassman, 1081 West 12th St.

PEORIA, ILL.—We are informed that the bids received for the construction of a steam tunnel for the Asylum for Incurable Insane, at Peoria, were those of the Crescent Stone Co., at $7,424, and Jobst Bros., at $6,800. Engr., Jacob A. Harman, Arcade Bldg., Peoria.

DULUTH, MINN.—Bids are being received, according to reports, for the erection of a freight station, 45 × 504 ft., for the Eastern Minnesota branch of the Great Northern Ry. N. D. Miller, Ch. Engr., St. Paul, Minn.

HENDERSON, COLO.—Bids are asked by the commissioners of Arapahoe county, at Denver, until Nov. 28, for the installation of a complete heating plant in the new county poor farm near Henderson. The contract for the erection of the buildings has been let to Frank Taylor, at $21,493.

CHEMAWA, ORE.—Bids are asked by the U. S. Indian Service, until Nov. 18, for building materials, including 66,500 ft. of assorted lumber, etc. Supt., Thos. W. Potter.

BOISE, IDAHO.—The following bids were received by the supervising architect, Washington, D. C., Oct. 27, for the foundations, etc., of the public building in this city: H. D. Mitchell & Co., $11,346; John S. Jellison, $9,800; Finnegan & Eastman, $8,244.

WATER-WORKS.

LAMOINE, ME.—The Lamoine Beach Water Co. has been incorporated with a capital stock of $5,000, of which $50 is paid in; H. E. Hamlin, Pres., Ellsworth, Me.; John A. Peters, treas., Ellsworth.

BERLIN, VT.—The council of Montpelier has asked for permission from the legislature to furnish this place with water. Another bill is also before the legislature authorizing the incorporation of the Berlin Aqueduct Co., which proposes to build works; capital stock, $40,000.

HAMPTON, N. H.—Chas. M. Lamprey, Clk., writes us that parties in Boston are making arrangements to make a survey for the proposed works, with a view to making an offer for constructing the works. The water supply will be secured from springs.

BOSTON, MASS.—Bids are asked until Nov. 14 for repairing the pumping engines at the station, Calf Pasture, Dorchester; check, $1,000. E. D. Leavitt, Mech. Engr., 2 Central Square, Cambridgeport, Mass.; Benj. W. Wells, Supt. Sts.

SWAMPSCOTT, MASS.—M. D. Porter, Town Clk., writes us that no contracts will be let for changing the source of water supply to the Metropolitan water-works. The pipe is already laid and only connections are to be made. The town voted Oct. 24 to secure water from the Metropolitan works.

PROVIDENCE, R. I.—The question of a filtration plant at the water-works is being investigated.

HARTFORD,CONN.—A new reservoir is to be built in Granby for the Hartford works. Jno. S. Hunter, Pres.

ALDEN, N. Y.—Reports state that Jacobs & Co., Bellaire, O., have been awarded the contract for building the works, at $14,323. The contract for the brick power house has been let to Wm. Witty, of Alden. J. F. Witmer, Engr., Buffalo, N. Y.

BAINBRIDGE, N. Y.—J. C. Scott, Clk., writes us that the following contracts have been let for furnishing the materials and for building the works: Chas. Millar & Son, Utica, N. Y., pipe and special castings; Lewis & Birdseye, Herkimer, N. Y., labor; Eddy Valve Co., Waterford, N. Y., valves, etc. The water will be supplied by gravity from a creek; estimated cost of works, $22,000. The contract for building the reservoir was not let up to Oct. 27. J. Warren Lamb, Des. Engr., Cooperstown, N. Y. Bids for the purchase of $22,000 of water-works bonds are asked by the trustees until Nov. 19.

LEWISTON, N. Y.—The trustees have granted J. Boardman Scovell and others a right to organize a company and supply the village with water. The supply will probably be taken from the lower Niagara River.

NIAGARA FALLS, N. Y.—City Engineer Jones has submitted to the board an estimate for laying a 6-in. main, to cost about $3,600.

ORCHARD PARK, N. Y.—It is stated that Dr. Frank P. Vandenbergh, Erie County Bank Bldg., Buffalo, and others are interested in the proposed works, for which a franchise was recently granted.

VALLEY STREAM, N. Y.—It is stated that the Valley Stream Water Co. is to be organized to supply this place and Lynbrook with water. E. Delavan Smalley, Engr., Syracuse, N. Y., is interested.

WINDSOR, N. Y.—T. N. Furman, village pres., writes us that the contracts for building the new works, voted for in August, will be let about May 1. The water will be secured from springs 1½ miles distant. There will be about six miles of pipe, a reservoir 30 × 100 ft., etc. Up to Oct. 26 the engineer had not been selected. Population 800.

HIGHBRIDGE, N. J.—The council is reported to have decided to build works, for which estimates are being prepared; estimated cost, $12,000. H. Latimer, Clk.

MILFORD, N. J.—The Spring Mills Water Co. has been incorporated to construct and maintain water-works; capital stock, $55,000; incorporators, Michael T. Lynch and H. T. Wuchter, of Phillipsburg, N. J.; J .William Flad and E. W. Evans, of Easton, Pa.

PENNGROVE, N. J.—The question of building works is being considered, according to reports.

DOYLESTOWN, PA.—Bids are asked by the water committee until Nov. 7 for a wooden or metal covering for the water-works basin. The question of securing an increased water supply is being considered. The committee will probably sink test wells. Councilman Wilson, Chn. Com.

NEW KENSINGTON, PA.—The National Foundry & Pipe Works, Scottsdale, Pa., has been awarded the contract for furnishing 39,000 ft. of cast iron water pipe. The contract for laying the pipe has been let to Chandley Bros. & Co., Beaver Falls, Pa. These improvements to the works will cost about $25,000.

BALTIMORE, MD.—We are informed that Clendennin Bros., 111 South Gay St., have been awarded the contract for furnishing such pig lead as may be required, in all about 150 tons, at about $11,000.

DENTON, MD.—Harry A. Roe, Howard Melvin, and Jas. H. Nichols have applied for a franchise for works to cost about $8,000.

NORFOLK, VA.—Press reports state that the water board opened bids Oct. 26 for constructing dams, waste wier and canals in the utilization of the Little Creek addition to the water supply. The lowest bid, that of John Lavelle, of Cleveland, O., at $105,000, work to be completed within seven months, will probably be accepted. The water board is also considering the question of filtration, for which it is estimated that it will require about $50,000 to begin the work. H. L. Smith, Supt.

KEYSTONE, W. VA.—Bids are wanted within 90 days by R. Elsinger, Chn. Com. for building works, to cost about $2,500. J. K. F. Steele, Recdr.

WASHINGTON, GA.—It is stated that the council is again considering the question of issuing bonds for the proposed works, estimated to cost $5,000.

SUMMIT, MISS.—We are informed that the contract for building the works has been let to P. H. Porter, Columbia Bldg., Louisville, Ky. The itemized bids are given under Contract Prices. Alber & Byrne, Engrs., 1821 Second Ave., Birmingham, Ala.

WOODLAWN, ALA.—Jno. T. Hood writes us that the works will cost about $25,000. Population, 3,200.

McCOMB CITY, MISS.—Bids are asked until Nov. 17 for building works to cost about $40,000. Sanders & Porter, Engrs., Columbia Bldg., Louisville, Ky.; J. D. Harrell, Cy. Clk.

GEORGETOWN, KY.—At the election Nov. 8 this place will vote on the question of issuing $12,000 in bonds for municipal works, according to reports. N. H. Sinclair, Mayor.

WEST COVINGTON, KY.—Arrangements are reported as being made by a company to build works at once. Mayor Moser may give information.

BEREA, O.—T. J. Quay, Mayor, writes us that the town will vote at the next election on the question of issuing $30,000 in bonds for works. No plans have yet been prepared. Population, 3,000.

CINCINNATI, O.—Bids are asked until No. 9 for laying water pipe on Baltimore Ave. G. H. Spellmire, Clk. Bd.

IRONTON, O.—The council has appointed a committee to consider the question of putting in a filtration plant.

ZANESVILLE, O.—The water trustees have been asked by the Harris Brick Co. to extend the water mains for better fire protection. Frank Myers, Secy. water-works trustees.

FORT WAYNE, IND.—The following bids were received by the trustees Oct. 20 for furnishing a new pump: Holly Mfg. Co., $20,500, 18 × 32 × 24 × 32—110 million duty; Henry R. Worthington, $22,660, 18 × 36 × 22 × 36—115 million duty; $16,580, 13 × 21 × 34 × 22 × 36—100 million duty; Blake Mfg. Co., $21,555, 18 × 36 × 16 × 36—110 million duty; $16,310, 11 × 19 × 33 × 22 × 36—75 million duty; $12,796, 15 × 30 × 22 × 36—60 million duty.

CHEBOYGAN, MICH.—At the election Nov. 8 this place will vote on the question of issuing $7,000 in bonds for extending the works.

DETROIT, MICH.—The matter of securing a pure water supply for Detroit, and all the other cities that can be reached by tunnel from Lake Huron for a distance of 60 miles, has been referred by the state board of health to a committee. Benj. F. Bush, Grand Blanc, Mich., is preparing maps and estimates. An enabling act will have to be passed by the legislature, which meets in January, to establish a sanitary district.

TRAVERSE CITY, MICH.—Mayor Smith has appointed Perry Hannah, H. S. Hull and Alderman Lardie a committee to take active steps towards securing the proposed municipal works.

CHICAGO, ILL.—Bids are asked until 3:30 p. m., Nov. 4, for laying water pipe in a number of streets.

ELBURN, ILL.—Bids are asked until Nov. 15 for sinking a 10-in. well about 200 or 300 ft. for a water supply. H. D. Hallet, Engr., 108 Grand Ave., Aurora, Ill.; A. W. Collins, Chn. Water-Wks. Com.

MELROSE PARK, ILL.—The contract for building the works has been let to Isharg, Miller & Co., at $45,000. W. B. Ewing, Engr., Marquette Bldg., Chicago; Wm. Leeseberg, Clk.

MILLEDGEVILLE, ILL.—The contract for building works has been let to J. L. White, of Chicago. The pump, tanks and engine will cost about $4,000, and the two miles of piping and laying will cost about $4,000. This also includes 25 hydrants.

APPLETON, WIS.—Herman Erb is reported to have been appointed receiver for the Appleton Water-Works Co.

IRETON. IA.—Allen & Co., Hawarden, Ia., have been awarded the contract for works for this place, at $5,500.

KENWOOD PARK, IA.—At the election, Nov. 8, this place will vote on the question of granting a 25-year franchise for works to the Kenwood Park Water & Light Co.

BURLINGAME, KAN.—Preliminary surveys for works to cost $20,000 have been made by H. V. Hinckley Topeka.

MANKATO, KAN.—The question of building municipal works, to cost about $21,000, is being considered. H. V. Hinckley, Engr., Topeka.

ST. MARYS, KAN.—H. V. Hinckley, Topeka, Kan., has made surveys, etc., for works, to cost $28,000.

WAMEGO, KAN.—An election will be held Nov. 15 to vote on the question of issuing $25,000 in bonds for the proposed works. H. V. Hinckley, Engr., Topeka; F. S. Haacke, Cy. Clk.

FORT BERTHOLD, N. DAK.—Bids are asked until Nov. 29 for constructing works at the Indian Agency here. Address the U. S. Indian Warehouse, 1602 State St., Chicago, Ill., or the Commissioner of Indian Affairs, Washington.

MARYVILLE, MO.—The question of the municipal ownership of the works of the Maryville Water Co. is being considered, according to reports.

TEXARKANA, ARK.—Press reports state that a number of improvements will be made to the works of the Water Co. of Texarkana, including a 30,000,000-gallon reservoir, etc. R. A. Munson, Supt.; Wm. M. Paul, Pres., Moorestown, N. J.

WYNNE, ARK.—Bids are asked until Nov. 10 for furnishing the materials and for building the works. (Postponement from Nov. 8, on account of election.) Owen Ford, Engr., Security Bldg., St. Louis, Mo.; Wm. McKennedy, Chn. Bd.

FLORENCE, COLO.—Bids are asked until Nov. 28 for furnishing the materials and for building works, as described in our advertising columns. Hiram Phillips, Des. Engr., 306 Oriel Bldg., St. Louis, Mo.; P. T. McGuire, Mayor.

DALLAS, ORE.—It is stated that this place has voted to issue $25,000 in bonds for works.

BREMERTON, WASH.—The following were the only bids received Oct. 22 by the bureau of yards and docks, Washington, D. C., for extending the works at the naval station: Taylor & Youngs, Seattle, Wash., $3,987, and Pacific Heat & Power Co., Seattle, $3,668.

ANAHEIM, CAL.—E. A. Honey, Orange, Cal., is reported to have purchased the works of this place, owned by the A. T. & S. Fe Ry. Co., and will at once improve it.

SANTA BARBARA, CAL.—The city engineer is making surveys for a 5,000,000-gallon reservoir, to cost about $7,000, according to reports.

OAKLAND, CAL.—Bids are asked by the supervisor until Nov. 7 for laying water pipe in Dacoto township.

PASADENA, CAL.—The Pasadena & Lake Vineyard Water Co. has decided to build a cover to Reservoir No. 2, at a cost of about $7,000.——The Pasqual Land & Water Co. has been incorporated.

SACRAMENTO, CAL.—City Tapper Watts has estimated the cost of constructing the proposed additional water mains at $95,000. Engineer Wolf estimates that a vertical triplicate pumping engine, incidental to the proposed new water mains, will cost about $30,700. The corporation counsel has been instructed to prepare an ordinance embodying the proposition calling for an election to vote on the issuing of bonds for the construction of a sewerage system, for a high school and for improving the water-works at the next regular meeting of the board.

SAN LUIS OBISPO, CAL.—J. A. Gardish, Cy. Clk., writes us that the city is negotiating for the purchase of the works of the San Luis Obispo Water Co.

SAN MATEO, CAL.—R. H. Jurg, Cy. Clk., writes us that the proposition to issue $80,000 in bonds for works failed to receive the two-thirds vote at the election Oct. 22.

WHITTIER, CAL.—An election will be held Nov. 22 to vote on the question of issuing $40,000 of 5% bonds for improving the works, noted last week. W. E Butler, Cy. Clk.

SALT LAKE CITY, UTAH.—A. A. Robertson writes us that F. C. Kelsey, Cy. Engr., is making investigations for a better water supply. Nothing will be done until he makes his report, which is not likely to be submitted for six months.

COALVILLE, UTAH.—This place voted Oct. 24 against issuing $8,000 in bonds for works.

GANANOQUE, ONT.—Geo. Taylor, M. P., writes us that the town has works for fire protection. This place wants complete works, to cost about $60,000. It prefers to build its own works, but may decide to grant a franchise for both water and electric lighting. The question is only being considered at present. Population, 4,000.

ROSSLAND, B. C.—The question of securing works and a light plant, to cost about $85,000, is still being considered, according to reports.

VANCOUVER, B. C.—T. H. Tracy, Cy. Engr., has submitted estimates for improving the works, as follows: A new flexible jointed main across the narrows, to cost about $8,000; 300 tons of iron pipe, for general extensions throughout the city, $12,000; new 22-in. main on the north side of the Narrows, as far as the rock tunnel, $50,000; hydrants and miscellaneous supplies, $3,000; total cost, $83,000.

BILLINGS BRIDGE, ONT.—James Perry, Contractor, has submitted a proposition to build works and a light plant for this place and Ottawa East.

SEWERAGE.

SOUTHBRIDGE, MASS.—Local papers state that the city will soon adopt plans for the proposed sewerage system and sewage disposal. C. W. Hill, Clk. Com., and Selectman J. M. Olney may be addressed.

BUFFALO, N. Y.—R. E. Parsons, Secy. Bd. Pub. Wks., writes us that the following bids were received Oct. 20 for building a brick sewer in Bryant St. and Ashland Ave.: W. G. Smith, $3,793; F. J. Martin, $4,970; Geo. Parks & Sons, $5,150; L. Ritzman, $4,444; John Harrer, $5,000; Henry Harter, $4,271; Andrew Beaser, $4,217, and Wm. Franklin, Jr., $3,950.

FISHKILL LANDING, N. Y.—D. S. Merritt, Tarrytown, N. Y., is preparing plans for a separate system for this place. C. E. Spraight, trustee, may be addressed.

KINGSTON, N. Y.—The borough engineer has submitted specifications for a system. Councilmen Reynolds, Shepheard and Lynn may be addressed.

NEW YORK, N. Y.—Bids are asked until Nov. 16 for rebuilding sewers in Ward No. 3 (Jamaica) Queens. Jas. Kane, Comr. of Sewers, 265 Broadway, Manhattan.

PATCHOGUE (L. I.), N. Y.—We are informed that bids will be opened in the first week of November for constructing 1,050 ft. of 18 to 12-in. storm water pipe sewer; average cut, 7 ft. Emmett F. Smith, Engr.,Patchogue; J. M. Pierce, Village Pres.

ROCHESTER, N. Y.—It is proposed to build sewers in several streets, at a cost of about $63,000. Peter Sheridan, Cy. Clk.

TROY, N. Y.—Bids are asked until Nov. 11 for constructing pipe sewers in two streets. E. O. Ross, Secy. Contracting Bd

PLAINFIELD, N. J.—We are informed that ordinances for 1,140 ft. of 24-in. storm pipe sewers will be passed within a month; average cut, 10 ft.; estimated cost, $2 200. Andrew J. Gavett, Engr. and Comr.; E. T. Barrows, Chn. Com.

SOUTH ORANGE, N. J.—The joint sewerage committee held a meeting Oct. 26, when a report was received from Alex. Potter, Engr., 137 Broadway, New York, in which he submitted the following figures showing what the cost would be to each of the municipalities interested in the joint outlet sewer to Staten Island Sound: South Orange village, $44,672; South Orange township, $21 824; Irvington, $28,220; Milburn, $21,764; West Orange, $56,834; Newark, $29,319; Vailsburg, $21,941. It is stated that the work will be pushed forward as rapidly as possible. It will be necessary for West Orange and South Orange townships and Milburn to take a vote on the question before the municipalities can legally do anything. South Orange village, Irvington, Vailsburg and Newark are practically ready to go on with the improvement.

NORTH BRADDOCK, PA.—The question of building the system, now partly constructed,wholly independent of Braddock, without using the main of Braddock as outlets, for a proper consideration; or, whether mains shall be extended for several miles to get around Braddock to its eastern and western limits, is now being considered.

GROVE CITY, PA.—Owens & Robinson, Meadville, Pa., have been awarded the contract for building sewers in this place.

WASHINGTON, D. C.—Bids are asked by the district commissioners until Dec. 10 for constructing the northerly portion of the Tiber Creek and New Jersey Ave. high-level intercepting sewer, as stated in our advertising columns.

SALISBURY, N. C.—The South Main Sewer Co. has been incorporated with a capital stock of $2,000 by D. L. Gaskill, W. C. Coughenour and O. D. Davis.

MOBILE, ALA.—The contract for building the system has been let to T. J. Shea, of Quincy, Ill., at $186,273. T. W. Nicol, Supervising Engr., informs us that the following are the total bids for the work, the bids being received Oct. 17; the work will be through sand and clay, and the average cut will be 5 ft.:

J. B. Neely & Co., Chattanooga, Tenn.	$216,644
T. J. Shea, Quincy, Ill	186,273
Greenville Con. Co., Greenville, O.	193 290
Dowdle & Dungan, Chicago, Ill.	234,161
Van Sandt & Meeds, Cincinnati, O.	316,817
Guild & Co., Chattanooga, Tenn.	277,645
M. T. Lewman & Co., Louisville, Ky.	285,506

NEW ORLEANS, LA.—Councilman F. J. Dreyfous writes us that the city wants bids for building a system on the basis of so much for each connection.

YOUNGSTOWN, O.—The question of making improvements to the sewers in certain streets is being considered.

EVANSVILLE, IND.—Bids are asked until Nov. 19 for constructing local sewers in certain streets. George W. Swearingen, Clk. Bd. Pub. Wks.

SHERIDAN, IND.—Bids are asked until Nov. 7. for building sewers. W. E. Clements, Town Clk.

SOUTH BEND, IND.—Bids are asked until Nov. 28 for constructing certain sewers. L. A. Hull, Cy. Clk.

DETROIT, MICH.—Bids are asked until Nov. 7 for constructing certain pipe sewers. D. W. H. Moreland, Pres. Bd. Pub. Wks.

LAKE LINDEN, MICH.—The question of issuing bonds for a system will soon be voted upon, according to reports.

PEORIA, ILL.—We are informed that the following bids were received Oct. 27 for sewers for the Illinois asylum for the incurable insane: John Woods & Co., 514 Weber St., Peoria—Plan No. 1, $1,763; plan No. 2, $3,109; plan No. 3, $4,339; and Crescent Stone Co., Peoria—Plan No. 1, $1,935; plan No. 2, $3,205; plan No. 3, $5,438.

MADISON, WIS.—The Reichert Construction Co., Racine, Wis., has been awarded the contract for building sewers in the Livingston and Lake St. districts at $9,050. The other bidders were as follows: Harding & Nelson, Racine, $9,380; Fetter & Crosby, $12,938; Nicholas Quinn, $10,373; Gottfried Moery, $12,550. Plans and specifications for the completion of the sewage disposal plant—the building, machinery, etc.—have been submitted by Engineers Dodge and Nader. It is proposed to put the plant in operation Jan. 1. John Corscot, Sewerage Comr.

ST. PAUL, MINN.—Bids are asked until Nov. 7 for constructing a sewer in Earl St. C. H. Bronson, Clk. Bd. Pub. Wks.

NEWTON, KAN.—Local papers state that a company will be organized to build a sewer in the south side. The capital stock will be $2,000. The Newton Milling & Elevator Co. may be addressed.

CARROLLTON, MO.—This place voted Oct. 25 to issue $50,000 in bonds for a system and for paving.

HELENA, MONT.—Bids are asked until Nov. 7 for building a pipe sewer in State St. Edward Horsky, Cy. Clk.

SHERMAN, TEX.—E. M. Kearney, Cy. Secy., writes us that a franchise has been granted to Geo. W. Ruch, 2851 Hutchinson St., Philadelphia, Pa., for the system on the plans of the Pennsylvania Sanitation Co. A. A. Fielder, Mayor; C. P. Gregory, Chn.

GRAND JUNCTION, COLO.—W. P. Ela, Mayor, writes us that no definite steps have yet been taken in regard to a system.

PUEBLO, COLO.—The city engineer has submitted plans for the proposed sewer for Bessemer. It is stated that about $7,500 will be spent at once.

GRANT'S PASS, ORE.—The question of building a sewer to cost about $5,000, is being considered.

PALO ALTO, CAL.—Bids are asked until Nov. 5 for building the system, $40,000 in bonds for which were voted Oct. 28. The bonds have been sold to E. H. Rollins & Son. C. E. Moore, Engr., Santa Clara, Cal.; H. W. Simkins, Clk.

SANTA ANA, CAL.—Bids are asked until 5 p. m., Nov. 7, for furnishing the materials and building the lateral sewers, about 18 miles in all; manholes, etc. Edward Telford, Cy. Clk.

SANTA MONICA, CAL.—J. C. Steel, Cy. Clk., writes us that it is proposed to construct at once three-quarters of a mile of 8-in. pipe sewer, at a cost of 58 cts. a ft. E. Carrillo, Cy. Engr.

PEMBROKE, ONT.—Plans for a system are reported to have been submitted to the council.

WALKERTON, ONT.—Bids are asked until 3 p. m., Nov. 7, for building about 5,000 ft. of 9 to 6-in. pipe sewers. R. H. McKay, Chn. Bd. of Wks.

GARBAGE DISPOSAL—STREET CLEANING

CAMDEN, N. J.—The Utilization Co., 3d and Market Sts., has been incorporated, with a capital stock of $300,000, by Kennedy Crossan, Philadelphia, Pa., Jno. T. Dyer, Morristown, N. J., Horace J. Subers, Ashborne, Pa., and Jas. E. Hays, Camden.——Street Commissioner Mohrman has submitted a report stating that it will cost about $1,000 to repair the garbage crematory.

NEW ORLEANS, LA.—Councilman Felix J. Dreyfous writes us that the city wants bids for garbage incinerators on the basis of so much a ton.

CHICAGO, ILL.—The Supreme Court has handed down a decision against the city's awarding 5-year garbage disposal contracts. The following were the contracts awarded last January: First district—Mulcaire & Burke, $350,000; Second district, Dowdle & Chamberlain, $790,000; Third district, Hanrahan & Downey, $349,312; Fourth district, Mulcaire & Burke, $384,509. Local papers state that in view of the Supreme Court's decision, it is proposed by Commissioner L. E. McGann to revive the garbage commission established last year to consider the question of building municipal crematories and letting contracts annually for the removal of refuse to those reduction plants. The commission consists of Mayor Harrison, Commissioner McGann, Superintendent of Streets Doherty, Alderman Powers and ex-Alderman John Maynard Harlan. The cost of the crematories is estimated at over $100,000.

DALLAS, TEX.—The council has received bids for building a garbage disposal plant for $10,000. Councilmen Barry and Hahn may be addressed.

SAN FRANCISCO, CAL.—H. C. Farquharson, Deputy Clk., writes us as follows, in regard to the contract for collecting and removing the garbage and refuse: The board of supervisors, Sept. 26, 1898, by resolution, directed the clerk to advertise for bids for the removal of house refuse and garbage for a period of two years, from January 1, 1899. On Oct. 10, the clerk caused a notice to be published, inviting bids to be received on Oct. 17. After publishing the notice for one day, the board directed that further publication be stopped, and postponed further action on the whole matter until Nov. 11. The present method of disposing of house refuse and garbage is by cremation, a franchise for which having been granted the Sanitary Reduction Works, 8th Floor, Mills Bldg., San Francisco, for a period of 50 years. In the matter of street cleaning, Mr. Farquharson states that the work is let by contract for a period of two years; the present contractor is the City Street Improvement Co., Rooms 10, 11 and 45 Mills Bldg., 5th Floor, whose term of contract expires Dec. 1, 1898.

MEXICO, MEXICO.—Local papers state that Lauro Arizcorreta, the concessionary, has succeeded in raising the capital necessary for the building and equipment of a crematory for the city offal, which is to be established in the Zoquipan Square, where now all the sweepings, garbage, etc., of the city is piled. It is the plan of the concessionary to use the heat of the crematory for steam purposes and to establish in its immediate vicinity a number of factories.

STREETS AND ROADS

WOODSVILLE, N. H.—Bids are asked until Nov. 5 for the purchase of $12,000 of 4% paving bonds, according to reports. F. W. Baird, Treas.

BOSTON, MASS.—Bids are asked until Nov. 4 for macadamizing on Harold, Francis and Astor Sts. B. W. Wells, Supt. Sts.——The Boston Transit Commission has allowed the street department $17,000 for repaving Tremont St.

ENFIELD, CONN.—Bids are asked until Nov. 10 for building a section of road on High and Enfield Sts. Henry D. Alden, First Selectman.

WATERBURY, CONN.—Bids are asked until 5 p. m., Nov. 5, for 1,000 sq. yds. of granite block and 130 sq. yds. of brick paving, on Bank St. R. A. Cairns, Cy. Engr.

BUFFALO, N. Y.—The German Rock Asphalt & Cement Co., Ltd., has submitted the lowest bid for asphalt paving on Mechanic St., at $3,988, and Hydraulic St., at $2,981. ——The council has decided to pave portions of Clinton St., Ferry St., Morgan St., and Lafayette Ave., with asphalt.

DEERFIELD, N. Y.—C. W. Adams, State Engr., Albany, has awarded a contract for constructing two miles of road, extending from Deerfield Corners to the Herkimer county line, to James J. Dwyer & Co., Utica, at $13,806.

RIVERHEAD (L. I.), N. Y.—The county commissioners are considering the question of constructing new gravel and macadam roads.

LANSINGBURG, N. Y.—Bids are asked by the council until Nov. 9 for the purchase of $30,000 of paving bonds.

PATCHOGUE (L.I.), N.Y.—Emmet F. Smith, Cy. Engr., informs us that a contract has been awarded to the Eastern Paving Brick Co., Catskill, N. Y., at $3,460 for 2,300 sq. yds. of brick paving.

SYRACUSE, N. Y.—The following bids have been received for paving Jefferson St. with sheet asphalt from South Clinton St. to Lemon St. Russell R. Stuart, Cy. Engr: Columbia Construction Co., $39,906; Syracuse Improvement Co., $37,993; Warren-Scharf Asphalt Paving Co., $41,720; Asphaltina Construction Co. (asphalt), $39,748; (asphaltina sheeting), $37,185; Empire Contracting Co., $40,042.

JERSEY CITY, N. J.—Bids are asked until Nov. 7 for about 750 sq. yds. of Belgian paving, 3,700 sq. yds. of macadam, curbing, etc., on Greenville, Ave. Geo. T. Bouton, Clk. St. and Water Bd.

NEW BRUNSWICK, N. J.—The county freeholders have purchased the toll road from New Brunswick to Old Bridge, at $3,000. The road will be improved.

PHILADELPHIA, PA.—An ordinance is being considered by the council to pave several hundred small streets, to cost about $500,000. E. W. Patton, Chn. Com.

READING, PA.—The board of public works has awarded a contract to the Pennsylvania Asphalt Paving Co., at $9,365 for paving Fifth St., between Laurel and Canal Sts.

HUNTINGTON, W. VA.—Bids are asked until Nov. 24 for laying a brick sidewalk with gutter on Seventh St., between Fourth and Fifth Aves. F. L. Doolittle, Clk.

MONTGOMERY, ALA.—Bids are asked until Nov. 7 for paving Washington St., from Bainbridge to Lawrence St., with brick; also sidewalks of hexagon block. R. H. Sommerville, Treas.

JACKSONVILLE, FLA.—Chairman Stockton, Chn. Bd. Pub. Wks., has directed City Engineer Priolieu to prepare estimates for the proposed brick paving on Main St.

SHREVEPORT, LA.—The council is considering the question of issuing $40,000 in bonds for paving, according to reports.

LAWRENCEBURG, KY.—Bids are asked until Nov. 7 for brick paving, according to reports. J. W. Waterfill, Cy. Clk.

CLEVELAND, O.—Bids are asked until Nov. 9 for grading and draining about 1½ miles of the Berea Road. J. C. Dorn, Clk. County Comrs.

DAYTON, O.—Bids are asked until Nov. 7 for about 1,927 sq. yds. of brick paving and 1,478 lin. ft. of curbing. J. E. Gimperling, Cy. Comptroller.

ELYRIA, O.—The question of county road improvements will be submitted to a vote at the election in April, 1899.

HAMILTON, O.—The following bids have been received for paving Second St. with asphalt, from Central Ave. to Black St. L. A. Dillon, Cy. Engr.:

	With l'mstone curb & gutr.	With cement curb & gutr.
Block Asphalt.		
August J. Heinkle	$59,934	$57,149
J. M. Quill	59,136	56,862
Sheet Asphalt.		
David Folz Asphalt Paving Co.	$52,669	$49,245
Warren-Scharf Asphalt Paving Co.	51,178	46,598
Columbia Construction Co.	47,552	45,298

SPRINGFIELD, O.—Bids are asked until Dec. 6 for the purchase of $5,000 of 5% street improvement bonds, according to reports. Philip Huonker, Cy. Clk.

TOLEDO, O.—Joseph Hofman, County Surveyor, writes us that the engineer's report on the proposed stone road has been submitted to the county commissioners. No final action has been taken yet. Plans and surveys will probably be ordered sometime after Jan. 1.

FORT WAYNE, IND.—A petition will be presented to the board of public works by the residents of Lakeside for asphalt paving on several streets.

INDIANAPOLIS, IND.—Bids are asked until Nov. 9 for laying cement sidewalks on McLean Place, between Meridian and Illinois Sts. M. A. Downing, Chn. Bd. Pub.Wks.

UNION CITY, IND.—Bids are asked until Nov. 9 for grading, graveling and constructing walks on North Howard St. G. A. Rosenbush, Clk.

CHICAGO, ILL.—Bids are asked until 3.30 p. m., Nov. 4 for curbing and paving with asphalt on Vernon Ave. and curbing, grading and brick paving on Illinois St. and La Salle Ave. L. E. M'Gann, Pres. Bd. Local Improvements, 212 City Hall.

GALESBURG, ILL.—Two blocks of South Chambers St. will probably be paved in the spring.

QUINCY, ILL.—Bids are asked for the construction of the Missouri stone road to Taylor, 12,100 ft. long and 21-ft. roadway; estimated cost, $12,000. N. Heintz, Chn. Com., 523 Maine St., Quincy; F. A. Grover, County Engr.

FORT MADISON, IA.—Bids will soon be asked for macadamizing on the Burlington Road. J. R. Robertson, Cy. Engr.

KEOKUK, IA.—Plans and estimates have been submitted to the council for two blocks of brick paving.

ST. PAUL, MINN.—L. W. Rundlett, Cy. Engr., has estimated the cost of the proposed paving of 10th St. with asphalt, at $40,220; brick, $34,560; sandstone, $42,110. The paving between the tracks by the street railway company will cost $19,970 with asphalt, $17,120 with brick and $12,920 with sandstone.

ST. PAUL, MINN.—Bids are asked by the board of public works until Nov. 10 for improving Summit Ave., from Dale to Lexington Ave.

CARROLLTON, MO.—It has been voted to issue $50,000 in bonds for paving and constructing sewers.

KANSAS CITY, MO.—Bids are asked until Nov. 8 for furnishing the material and constructing brick, hexagon block and granitoid sidewalks on certain streets. Henry A. Wise, Cy. Engr.

BOULDER, COLO.—The council is considering a proposition to pave the main streets of the city, according to reports.

SIOUX FALLS, S. DAK.—Reports state that bids will be asked at the next meeting of the council for constructing several miles of sidewalks.

BEAUMONT, TEX.—L. E. Beadle, Galveston, Tex., is preparing plans and specifications for paving. D. P. Wheat, Mayor.

SANTA BARBARA, CAL.—The council has passed an ordinance for the extension of the Plaza del Mar Boulevard; estimated cost, $20,000. A. Crane, Cy. Clk.

MANUFACTURING PLANTS.

CAMBRIDGE, MASS.—Plans have been filed for the construction of a new plant for the Boston Bridge Works on 6th and Binney Sts. The building will be of brick, 275 × 162 ft., and the height, one and two stories, in sections.——The lumber mill of Geo. W. Gale, on Albany St., Cambridgeport, was destroyed by fire, Oct. 26, causing a reported loss of $30,000, fully insured. The building was a 2-story wooden structure, 60 × 30 ft.

MILLBURY, MASS.—Reports state that H. L. Bowden & Co., of Boston, have purchased the plant of the C. D. Morse Mfg. Co., in Millbury, and intend to equip it at once with about $35,000 worth of new machinery.

WALLINGFORD, CONN.—Reports state that an addition will soon be built to the Simpson, Hall, Miller & Co.'s factory, adjoining the west end of the brick factory.

JAMAICA (L. I.), N. Y.—The Diogenes Brewing Co., of which John Badenhoop is president, has filed plans for the erection of a new 4-story brick brewery, at Wyckoff Ave. and Decatur St., to cost $30,000. It will have all modern machinery, and will be built by Theodore Engelhardt, of Brooklyn. The contract for the mason work has been awarded to Dietrich Cook, Brooklyn, N. Y.

ONEONTA, N. Y.—It is announced that the Sidney Novelty Co. has increased its capital stock to $100,000, and will at once build a new shop 125 × 60 ft., which will double the present output of the plant.

OSWEGO, N. Y.—The plant of the Tonkin Boiler & Engine Works was destroyed by fire Oct. 28. The buildings were erected four years ago by J. J. Tonkin, of Oswego, and others, at a cost of $105,000, including the equipment; insurance $45,000.

BEAVER FALLS, PA.—It is reported that the Beaver Falls Enamel Iron Works Co. is making preparations to enlarge its plant. Owner, M. W. Gillespie, of Pittsburg.

ERIE, PA.—The American Meter Co., which has recently bought the Metric Metal Co.'s plant on East 10th St., will erect an addition to the factory, for use as a brass foundry, at a cost of $20,000.

JOHNSTOWN, PA.—The American Specialty Co. expects to erect a new plant in this city for the manufacture of earthenware; estimated cost, $5,000.

WHEELING, W. VA.—Plans are being prepared for a 5-story brick and stone factory building to be erected on 19th St., for the Exley & Watkins Co., manufacturers of spices and preserves, to cost about $15,000.——Plans are also under way for a 40-ton ice plant, to be erected on 28th St., South Side, for the People's Ice & Storage Co. It is said that contracts will soon be let. Pres., Chas. B. Lemmon.

BALTIMORE, MD.—It is reported that Hubbard & Co. have leased a tract of land on the water front, and that they will erect a large fertilizer plant thereon.

ORANGEBURG, S. C.—The Enterprise Cotton Mills will issue $75,000 in bonds in order to purchase at once a complete equipment for the manufacture of cotton yarns. The mill as planned will contain 11,200 spindles and 350 looms. Electric lighting plant will also be included in the mill, according to reports.

SALEM, O.—The Standard Pottery Co., of East Liverpool, O., contemplates the erection of a new pottery plant in this city.

WELLSVILLE, O.—This town expects to give a bonus of $10,000 to A. Plumer and others, who are to erect at this place a window glass factory to cost $60,000.

FORT WAYNE, IND.—C. E. Moellering & Co. have recently been awarded the contract for erecting a 3-story addition 50×80 ft., to the factory of the Fort Wayne Organ Co., on Fairfield Ave.

MERRILL, WIS.—A fire in this city Oct. 19 damaged the large sawmill of the T. B. Scott Lumber Co., causing a reported loss of $60,000; insurance, $35,000.

MARE ISLAND, CAL.—Bids are asked until Nov. 26 for the construction of a sawmill, boiler house and steel chimney, at the navy yard, Mare Island. Address Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Washington, D. C.

VANCOUVER, B. C.—A fire in this city Oct. 25 destroyed the Hastings sawmill, owned by the Royal City Planing Mill Co., which had a capacity of 90,000,000 ft. a year. Estimated loss, about $200,000.

GAS PLANTS.

BUFFALO, N. Y.—Bids are asked until Nov. 10 for sinking a gas well in South Park. G. H. Selkirk, Secy. Park Comrs.

GREEN BAY, WIS.—The A. M. Sutherland Co., of New York, has purchased the bonds of the Green Bay Gas & Electric Light Co., and also one-quarter of the capital stock. An improved Lowe water gas plant will be put in at a cost of $50,000, and about 13 miles of new iron pipe will be laid and all the wooden mains will be taken up.

MANITOWOC, WIS.—E. R. Davis, Chicago, Ill., submitted a proposition to the council Oct. 17 to construct a gas plant in this city to cost about $40,000, provided the city should grant him a 50-year franchise. Many of the residents of Manitowoc are anxious to have a gas plant built here for both fuel and lighting.

TOPEKA, KAN.—Bartlett Hayward, Baltimore, Md., has been awarded a contract by the gas company of this place for constructing a gas holder 82-ft. in diameter and 68 ft. high, capacity about 300,000 cu. ft. It is reported that 8 and 10-in. mains will be laid in a number of streets and that other improvements will be made, at a cost of about $50,000. C. K. Holliday, Jr., may be addressed.

NEW COMPANIES.—Jerome Oil Co., Cleveland, O.; $150,000, with $500 paid in; to bore for oil and gas; Edward Bushnell, A. Fostler, J. H. Sampline, T. H. Bushnell, Cleveland, O.; C. A. Neff, Glenville, O.

Empire Oil Co., Cleveland, O., $100,000, with $1,700 paid in; to produce and deal in oil; W. C. Wood, H. S. Miller, Henry Wilkes, O. A. Treiber, L. A. Wood, Cleveland, O.

Chester Light & Heating Co., Middletown, N. Y.; Pres., William A. Lawrence; Secy., Charles W. Kerner; Treas., George M. Roe; Trustees, W. A. Lawrence, C. W. Kerner, G. M. Roe, Joseph Board, Jonas D. Millspaugh, Dr. C. P. Smith, Frank Durland and R. H. Marvin.

MISCELLANEOUS CONTRACTS.

FIRE ALARM SYSTEM.—New Orleans, La.—A resolution has been passed by the council to rebuild the fire alarm system, according to reports.

BRICK.—Esquimalt, B. C.—Bids are asked by the officer in charge at H. M. naval yard, Esquimalt, B. C., for furnishing 600,000 building brick.

DREDGING.—Buffalo, N. Y.—Bids are asked until Nov. 11 for dredging a portion of the Erie basin. Geo. W. Aldridge, Supt. Pub. Wks., Albany.

DRAIN.—New Castle, Ind.—Bids are asked until 11 a. m., Nov. 3, for constructing a ditch drain in Harrison township. Henry Fadely, Drainage Comr.

CULVERT. — Cleveland, O. — The county commissioners have awarded a contract to Joseph Carabelli, at $3,829, for constructing the Nine-Mile Creek culvert.

PARK LANDS.—Cincinnati, O.—A proposition to issue $2,000,000 in bonds for the purchase of additional park lands will be voted upon at the coming election.

DREDGING.—Baltimore, Md.—The Northern Central Ry. Co. has awarded a contract to Sanford & Brooks for dredging the docks to a depth of 30 ft. at low water, at Canton.

POLICE SIGNAL SYSTEM.—Los Angeles, Cal.—Bids will soon be asked by the council for installing a complete police signal system of 50 alarm boxes; estimated cost, about $10,000.

MACHINERY AND TOOLS.—Norfolk, Va.—Bids are asked until Nov. 15 for furnishing machinery and tools for the navy yard. Edwin Stewart, Paymaster-Gen., Washington, D. C.

DRAINAGE, ETC.—Albany, N. Y.—Bids are asked until Nov. 7 for furnishing material and for work at the Knox St. viaduct for improving the drainage near Central Ave. and Sherman St.

MONUMENT.—Providence, R. I.—Bids are asked until Nov. 7 for furnishing and erecting a soldiers' and sailors' granite monument. Stone, Carpenter & Willson, Archs., 49 Westminster St.

IRON FENCE, ETC.—Cleveland, O.—Bids are asked until Nov. 21 for furnishing 600 ft. of iron fence and two iron gates for West Park Cemetery. Wm. J. Akers, Dir. Charities and Correction.

WHARF AND PARK.—Vancouver, B. C.—Reports state that the question of appropriating $12,000 for constructing a wharf, and $150,000 for laying out a park, will soon be submitted to a vote.

TELEPHONE SYSTEM.—St. Joseph, Mo.—An ordinance has been introduced in the council to grant a franchise to the Hanamo Telephone Co. to operate in this place. Alderman Garvey, Chn. Com.

PARK.—Scranton, Pa.—The council is considering the question of appropriating about $75,000 in the bond ordinance, for a proposed park for West Scranton. Address Park Commissioner Bedford.

DOCKS AND PIERS.—Cleveland, O.—The board of control has approved the contracts with L. P. & J. A. Smith for the construction of docks and piers between Seneca and Erie Sts., on the lake front.

SUBWAY.—McKeesport, Pa.—J. J. Bedell, Councilman, will introduce an ordinance for the increase of the municipal debt to the amount of $100,000, to construct a subway for electric wires and erect a city hall.

FIRE ALARM SYSTEM.—Lancaster, O.—Bids are asked until Nov. 12 for installing a complete electrical fire alarm system, to contain four circuits of No. 12 copper wire and 28 alarm boxes. H. T. Mechling, Cy. Clk.

PIERS.—Brooklyn, N. Y.—The department of docks and ferries has decided to construct two new piers, 650 × 65 ft. and 640 × 90 ft., respectively, at the Wallabout basin, estimated cost, about $70,000. J. A. Bensel, Ch. Engr.

LEVEE WORK.—Pueblo, Colo.—Frank Taylor has submitted the lowest bid for constructing the levees from Union to Victoria Aves. at $10,495 for the south side and $13,496 for the north side levee. Mayor Orman may be addressed.

TUBULAR BOILERS.—San Francisco, Cal.—Bids are asked until Nov. 28 for installing two return tubular boilers of the Scotch type, for the light-house tender "Madrona," surety, $1,500. Capt. Geo. N. Coffin, 404 Safe Deposit Bldg., San Francisco.

REMOVING ROCK.—Athens, N. Y.—T. D. Welch & Co., Nassau, N. Y., have been awarded a contract to remove about 7,000 cu. yds. of rock at Four Mile Point, Hudson River, four miles north of this place. N. O. Belyea, Engr., 547 State St., Hudson, N. Y.

TUNNEL.—Dunkirk, N. Y.—The construction of a tunnel at this place, to be 800 ft. long, and cost about $20,000, is being considered by the Lake Shore & Michigan Southern, the Western New York & Pennsylvania and the New York, Chicago & St. Louis Ry. Cos.

LEVEE WORK.—New Orleans, La.—Bids are asked by the board of state engineers until Nov. 8 for work on the William levee, on the Red River, in Rapides parish, about 165,000 cu. yds., and the De Lee enlargement, on the Atchafalaya River, in Avoyelles parish, about 30,000 cu. yds.

TELEPHONE LINE.—Augusta, Ga.—Local papers state that Thomas Barnard, of the American Telephone Co., New York, has been receiving bids at Arlington, Ga., for the construction of a telephone line between Augusta and New York, via Lynchburg, Va., Danville, Va., Greensboro, N. C., Charlotte, N. C., Columbia, S. C., and Aiken, S. C. The line will be about 500 miles long, and require about 35,000 25-ft. poles, to be completed by April 1.

MINING.—San Francisco, Cal.—The California Debris Commission, having received application to mine by the hydraulic process from the Excelsior Mining Co., in the Excelsior Mine at Lowell Hill, Nevada county, to deposit tailings in the North Fork of Steep Hollow; from Toy Kee, in the Fair Play Mine near Scales, to deposit tailings in Fair Play Ravine; from S. F. Bullard and A. M. Gray, in the Gravel Hill or McCutchean Placer Mine, near Nevada City, to deposit tailings in Little Deer Creek; and from Elmore Rutherford, in the Plumas Bonanza Gravel Mine, near Buck's Ranch, Plumas county, to deposit tailings in Sherman Ravine, gave notice that a meeting will be held in the Flood Building, San Francisco, Nov. 7.

CONTRACT PRICES.

SHELL.—Washington, D. C.—The Chief of Ordnance, U. S. A., received the following bids Oct. 21, 1898, for furnishing shell; (1) being for 1,500 7-in. common steel mortar shell; (2) for 1,000 5-in. common shell; and (3) for 1,500 7-in. common shell for howitzers: Midvale Steel Co., Philadelphia, (1) $10.69 each; (2) $3.85 each; (3) $8.98 each. U. S. Projectile Co., 1st Ave. and 53d St., Brooklyn, (1) $11.50, (2) $5.50, (3) $10.50; American Ordnance Co., Washington, (1) $12, (2) $5.70, (3) $11.25; Taylor Iron & Steel Co., Highbridge, N. J., (1) $13.30, (2) $5.49; (3) $12.85.

SHOT AND SHELL.—Washington, D. C.—It is stated that the following bids were received by the Chief of Ordnance, U. S. A., Oct. 17, 1898, for furnishing (1) 5-in. armor-piercing shot and (2) shell: U. S. Projectile Co., Brooklyn, (2) $16 each; Midvale Steel Co., Philadelphia, (1) $18.43, (2) $11.93; Benjamin Atha & Illingsworth Co., Harrison, N. J., (1) $22; Carpenter Steel Co., Reading, Pa., (1) $22, (2) $20; Firth Sterling Steel Co., Pittsburg, Pa., (1) $22; (2) $20.

DREDGING, ETC.—Wilmington, Del.—Maj. W. F. Smith, U. S. Engr., has awarded the contract for removing the rock in the Christiana River to John J. Fitzpatrick, Plattsburg, N. Y., at $7.13 a cu. yd.; the work to be completed by July 1. The contract for dredging in the river has been let to the New York Dredging Co., New York, at 12⅗ cts. a cu. yd., the plant to have a capacity of 3,500 yds. a day. The bids for this work were given in our issue of Oct. 20.

GRADING AND DREDGING.—Boston, Mass.—The following bids were received Oct. 24, 1898, by Benj. W. Wells, Supt. of Sts., for grading Columbia Road, South Boston, between I and Atlantic Sts., and dredging and filling in, for a beach, in all about 188,000 cu. yds.: Eastern Dredging Co., 48⅘ cts. a cu. yd., total, $91,744; Perkins, White & Co., 53 cts., $99,640; S. J. Donovan, 46½ cts., $87,420; John W. Hensby, 53 cts., $99,640.

SIDEWALKS.—Toledo, O.—C. Peck & Sons have been awarded the contract for laying a stone sidewalk at 12⅛ cts. a sq. ft; M. J. Goulden has been awarded the contract for plank walks at 24 cts. a ft. for those 6 ft. wide, and 19 cts. a ft. for those 4 ft. wide.

DREDGING.—Narragansett Bay, R. I.—Maj. D. W. Lockwood, U. S. Engr., Newport, received the following bids Oct. 26, 1898, for dredging Providence River and Narragansett Bay, R. I., on the basis that there are to be removed about 2,036,491 cu. yds., giving a channel with a mean depth at low water of 25 ft. 400 ft. wide from the ocean to Providence Harbor through the West Passage; the government specifies that the work shall begin by March 1, 1899, and be completed by July 1, 1902:

Bidder.	A cu. yd. cts.
Wm. H. Taylor, Jr., Jersey City, N. J.	14⅜
W. H. Beard Dredging Co., New York, N. Y.	20¼
The International Contract Co., Syracuse, N. Y.	12½
Frank H. Brainard, 24 State St., New York	24
Perkins & O'Brien, 256 Broadway, New York	10⅘
R. C. & J. S. Packard, New York	21
J. Clements Shafter, Richmond, Va.	21½
Morris & Cumings D. Co. and P. S. Ross, Jersey City	15⅕
Rittenhouse-Moore Dredging Co., Mobile, Ala.	21
McDonald Dredging Co., 33 Wall St., New York	16¾

ASPHALT PAVING.—Niagara Falls, N. Y.—S. F. Arkush, Cy. Clk., informs us that the following bids were received Oct. 28, 1898, for asphalt paving in two streets:

Quantities.		Barber Asp. Pvg Co., New York.	H. P. Burgard, Buffalo.
Asphalt pavement	7,015 sq. yds.	$2.29	$2.05
Excavation	150 cu. yds.	.50	.40
Rock	30 " "	3.50	3.00
Overhaul	100 " "	.02	.01
Connections: Sewer.	100 lin. ft.	1.50	1.00
Water	100 " "	.95	1.00
Gas	100 " "	.25	.50
Catchbasins	3 each	50.00	40.00
Brick gutters	60 sq. yds.	2.40	2.05
Total		$16,808*	$15,025

*Overhaul not included in total of this bid. Curbing is included in price per sq. yd. of pavement in both bids.

Cherry Ave., 1st to Main St., Barber Asphalt Paving Co., pavement, 1,175 sq. yds., $2.43; total, $3,233; H. P. Burgard, Prudential Bldg., Buffalo, $2,20 a sq. yd., total, $2,926. The bids for the other parts of the work are the same as in the 2d St. bid, although in some cases the quantities are a little less.

WATER-WORKS.—Summit, Miss.—We are informed that the following contract was let Oct. 25, 1898, to P. H. Porter, of Porter & Sanders, Columbia Bldg., Louisville, Ky., for furnishing the materials and building the works; Engr., Albert Byrne, 1821 Second Ave., Birmingham, Ala.:

Items.	Cost. Piece.	Cost. Total.
Cast-iron pipe, a ton	$20.60	$4,573.20
Special castings, a ton	40.00	160.00
Fire hydrants, each	20.50	410.00
8-in. gate valves, each	13.75	26.50
6-in. " " "	10.00	40.00
4-in. " " "	6.25	37.50
Valve boxes, each	2.25	24.00
Laying 8-in. pipe, a lin. ft.	.14	84,00
" 6-in. " "	.12	671.04
" 4-in. " "	.10	1,062.00
Furnishing and laying, 2-in. vit. pipe	.15 }	
" " " 1½-in. pipe	.12 }	483.00
" " set'g pump & heater		975.00
" " " 2 boilers		1,150.00
" " " stand-pipe		2,603.76
Building power-house		450.00
Sinking well, 6-in. casing		600.00
Deep-well pump and pumping basin		525.00
Total		$13,875.00

SEWER PIPE, CEMENT, ETC.—Newtown, Mass.—Chas. W. Ross, St. Comr., West Newtown, informs us that the following bids were received Oct. 21 for furnishing about 90,000 ft. of 24 to 4-in. sewer pipe, about 4,700 bbls of American cement, etc.; the bids for the sewer pipe were rejected:

Bidder.	Sewer pipe, discount.	Cement. American, 4,700 bbls.	Cement. Portland, 800 bbls.
Fiske, Hames & Co., Boston, Mass.	78%	$0.75	$2.15
Berry & Ferguson, Boston	77½%	.82	...
Waldo Bros., Boston	77½%	.81	2.15
Ham & Carter, Boston	80%	.80	...
Portland (Me.) Stone Ware Co.	78%	...	...
W. G. Nash, Boston	..	.82	...
Smith-Green Co., Worcester, Mass.	..	.82	2.03

	Manhole covers, 200, each.
A. Russell & Sons, Newburyport, Mass.	$5.98
Concord Foundry Co., Concord, N. H.	4.95
Portland (Me.) Stone Ware Co.	4.87
Chelmsford Foundry Co., Boston,	4.69
Osgood & Hart, Charlestown, Mass.	4.65
Mechanics' Foundry Co., Boston,	4.59
Sessions Foundry Co., Bristol, Conn.	4.44
Somerville Foundry Co., Somerville, Mass.	4.47
Le Baron Foundry Co., Middleborough*	4.28

*Awarded contract.

STATE HIGHWAY.—Sudbury, Mass.—The following contract was let Oct. 20, 1898, to White & Gaffney, Medford, Mass., for building in state highway in this city for the Massachusetts State Highway Commission; Secy., A. B. Fletcher, Boston: Excavation, 1,375 cu. yds., at 25 cts. a cu. yd.; excavation, borrow, 200 cu. yds., 50 cts.; ledge excavation, 100 cu. yds., $2.00; rubble masonry—laid dry, 38 cu. yds., $2.75, laid in cement, 100 cu. yds., $7.00; gravel, 425 cu. dys., 50 cts.; Telford, 100 sq. yds., 30 cts. a sq. yd.; shaping, 6,778 sq. yds., 2½ cts.; broken stone in place, 1,743 tons, $1.50 a ton; 12-in. cast-iron pipe, 50 lin. ft., $1.50 a lin. ft.; 20-in. cast-iron pipe, 34 lin. ft., $3.00; fencing used as guard rail, 500 lin. ft., 17 cts.; side drains, 300 lin. ft., 35 cts.; stone monuments, 14, each $1.50; catchbasins, 2, each $20.00; superstructure of bridge, lump sum, $450; total, $5,353.

SEWER, ETC.—Hamilton, O.—The following bids were received by the board of control Oct. 16, 1898, for constructing a sewer in 4th St., and for arching the hydraulic: S. E. Irwin—12-in. single strength sewer pipe, 40 cts. a lin ft.; manholes, each $15.00; inlet basins, each $21.00; brick sewer, $9.49 a lin. ft.; Jos. T. Guillaume—12-in. single strength sewer pipe from street crossings, 40 cts.; manholes, $11; inlet basins, $13; brick sewer, exclusive of first three items, $9.13; Gus Drach—12-in. single strength sewer pipe, 50 cts.; manholes, $2; inlet basins, $22; brick sewer, $9.51; Louis Drach—Concrete conduit, complete, $8 a lin. ft. (this bid is on separate plan of the bidder); W. H. Louthan—12-in. single strength, 25 cts.; manholes, $10; brick sewer, A, $9.80; 20-in. single strength, 34 cts. a lin. ft.; 18-in., 27 cts.; 15-in., 21 cts.; 12-in., 16 cts.; less than 6 ft. deep, 12 cts.; 6 ft. deep and over, 12 cts.; manholes, $15; inlet basins, $15; iron pipe laid with lead joints, $25. Total, about $17,000. Jos. T. Guillaume is the lowest bidder.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—
- New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.70 cts.
- Chicago—Angle bars, 1.10 cts.; spikes, 1.55 cts. to 1.60 cts.; track bolts, hexagonal, 1.90 cts. to 2.00 cts.; square, 1.80 cts. to 1.90 cts.

RAILS, STEEL—
- New York, new, $18.00 to $19.00; old iron, $11.00 to $11.50; old steel, $9.00.
- Chicago, new, $20.00 to $22.50; old iron, $12.50 to $13.25; steel, $8.00 to $10.00.
- Pittsburg, new $18.00 to $20.00; old iron, $13.50 to $13.75; steel, $10.00.

STRUCTURAL STEEL—
- New York—Beams, 1.35 cts. to 1.45 cts.; channels, 1.35 cts. to 1.45 cts.; tees, 1.45 cts. to 1.50 cts.; angles, 1.25 cts. to 1.30 cts.; rivets, 1.75 cts. to 1.85 cts.
- Chicago—Beams, 1.35 cts. to 1.50 cts.; channels, 1.35 cts. to 1.50 cts.; tees, 1.40 cts. to 1.50 cts.; angles, 1.30 cts. to 1.35 cts.
- Pittsburg—Beams, 1.20 cts. to 1.30 cts.; channels, 1.20 cts. to 1.30 cts.; tees, 1.20 cts. to 1.25 cts.; angles, 1.10 cts. to 1.15 cts.

PLATES AND SHEETS—
- New York—Universal mill plates, 1.25 cts. to 1.30 cts.; tank, 1.35 cts. to 1.40 cts.; shell, 1.40 cts. to 1.45 cts.: flange, 1.60 cts. to 1.70 cts.; firebox, 2.25 cts. to 2.50 cts.
- Chicago—Universal mill plates, 1.30 cts. to 1.35 cts.; tank, 1.25 cts. to 1.30 cts.; shell, 1.55 cts. to 1.65 cts.; flange, 1.30 cts. to 1.50 cts.; firebox, 1.75 cts. to 4.00 cts.; sheets, 2.00 cts. to 2.10 cts.
- Pittsburg—Universal mill plates, 1.10 cts. to 1.15 cts.; tank, 1.10 cts. to 1.15 cts.; shell, 1.30 cts. to 1.35 cts.; flange, 1.20 cts. to 1.25 cts.; firebox, 1.50 cts. upwards; sheets, 1.85 cts. to 1.95 cts..

MERCHANT STEEL—
- Machinery, per lb., 1.60 cts. to 1.70 cts.
- Tool, per lb., 5.50 cts. to 7 cts.

IRON—
- Pig iron:
  - New York—No. 1, $11.25 to $11.50; No. 2, $10.50 to $10.75.
  - Chicago—No. 1, $11.50 to $12.50; No. 2, $11.00 to $12.00.
  - Pittsburg—No. 1, $10.50 to $10.75; No. 2, $10.00 to $10.10.
- Bar iron:
  - New York, common, 1.07½ cts. to 1.10 cts.; refined, 1.15 cts. to 1.20 cts.
  - Chicago, common, 1.05 cts. to 1.10 cts.; refined, 1.15 cts. to 1.20 cts.
- Sheets:
  - Common, American, per lb., 1.45 cts. to 2.55 cts.
  - Russia, per lb., 10½ cts. to 11.00 cts.

LUMBER—
- New York:
  - Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.
  - Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in. butts, 4 cts.
  - Spruce, special cargoes, per M, $15.00 to $17.50.
  - Yellow pine, random cargoes, $15.50 to $17.00.
  - North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.
- San Francisco:
  - Oregon pine, per M, $15.50 to $17.50.
  - Redwood, per M, $18.20 to $20.00.
  - Redwood tank stock, up to 10 ft., $24.00 to $25.00.

GENERAL MATERIALS—
- Lead, New York, $3.65 cts. to $3.70 cts.
- Nails, Pittsburg, 1.40 cts.
- Solder, per lb., 8¼ cts. to 11½ cts.
- Spelter, per lb., 3.90 cts. to 4.00 cts.
- Copper ingots, 12.40 cts. to 12.50 cts.
- Granite, rough, New York, cu. ft., 40 cts. to 50 cts.
- Limestone, New York, cu. ft., 70 cts. to 80 cts.
- Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.
- Slate, Penn., block, per square, $4.00 to $5.00.
- White lead, American, per lb., 5½ cts. to 6 cts.
- Lime, common state, per bbl., 70 cts.

INDUSTRIAL NOTES.

THE DETROIT GRAPHITE MFG. CO., Detroit, Mich., has removed its Chicago office from 1033 Marquette Building to 1564 Monadnock Block.

THE GOHEEN MFG. CO., Canton, O., has recently introduced a paint for galvanized iron. This has the trade name of "Galvanum" and will, according to claims, adhere satisfactorily to galvanized surfaces.

THE HARRISBURG FOUNDRY & MACHINE WORKS, Harrisburg, Pa., has an order for boilers and engines, as well as a complete steam plant, to be used in a large woolen mill near Pekin, China. The mill, it is said, will be the first of the kind ever erected in China.

THE RITER-CONLEY MFG. CO., Pittsburg, has a contract to build for the Mexican City Tramway Co. an engine and boiler house, a main building, a coal storage building, etc. About 300 tons of structural steel will be required, together with other material needed in structures of the kind.

THE WE FU GO COMPANY, Smith and Augusta Sts., Cincinnati, announces that the Lorain Steel Co., Lorain, O., now of the Federal Steel Co., has adopted its system of purifying water for boilers, at its new blast furnace. The plant will purify 1,200,000 gallons each 24 hours, sufficient water for 12,000 HP. water-tube boilers. This company has had live steam purifiers in use at the steel mills for some time, but it is expected that the device now adopted will give better results than the mechanical purifiers and save money.

THE RUSSELL SNOW PLOW CO., Tremont Building, Boston, Mass., reports the following recent orders: New York Central & Hudson River R. R. Co., one Russell wing-elevator snow-plow, size No. 2, and one Russell standard snow-plow, size No. 2, both for the Western division of the main line; also for two Russell wing-elevator snow-plows, size No. 2, for their Rome, Watertown & Ogdensburg line. Also an order from the Saginaw, Tuscola & Huron R. R. Co. for one Russell snow-plow, size No. 3, with air flanger, and an order for two Russell snow-plows, with hand flanger, size No. 4, and for one size No. 3 for the Washington County R. R., a new road in Maine.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., is creating a steel lattice truss about 68 ft. long for the Seamless Metal Co., Sing Sing, N. Y. The truss crosses the railway and affords access to different parts of the company's works. The company is also erecting for the United Gas Improvement Co., Waterbury, Conn., the steel work for a generator room and an engine room. These roofs are to have steel trusses, supporting the roof covering. This covering is corrugated iron lined with the Berlin Iron Bridge Co.'s patent anti-condensation fireproof lining. The engine room has a span of about 33 ft., and the span of the generator room is about 51 ft.

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies READS ENGINEERING NEWS

AVAIL YOURSELF OF THIS PAPER WHEN BIDS ARE WANTED FOR CONSTRUCTION OR FOR FURNISHING SUPPLIES.

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PERSONAL.

Lieut. Eben T. Tannatt, Second Regiment, U. S. Volunteer Engineers, has resigned.

Mr. E. Sherman Gould, M. Am. Soc. C. E., of Yonkers, N. Y., has returned from Cuba.

Mr. Abram Wing, Superintendent of the City Water Supply Co., Ottumwa, Ia., has resigned.

Mr. R. C. Gemmell, M. Am. Soc. C. E., of Salt Lake City, has been appointed State Engineer of Utah.

Mr. W. Oswald, General Manager of the Rambach Steel Co., Rambach, Germany, is visiting Birmingham, Ala.

Mr. Samuel A. Benner, of the Carnegie Steel Co., Ltd., Pittsburg, Pa., will represent that company in Mexico, with headquarters in the City of Mexico.

Brig.-Gen. Roy Stone, Chief of the Road Information Bureau of the Agricultural Department. has returned to Washington, D. C., from Ponce, Puerto Rico.

Mr. George Wash has been appointed Superintendent of the Braddock (Pa.) Wire Works of the American Steel & Wire Co., to succeed Mr. John McIllvried, resigned.

Mr. Myron Chace Clark, of the business department of the Engineering News Publishing Co., was married Oct. 5, to Miss Nell Mansfield Fogarty, of Lakewood, N. J.

Capt. Charles B. Kahler, First Regiment, U. S. Volunteer Engineers, has been honorably discharged on account of physical disability. His home is in Baltimore, Md.

Mr. F. R. Griffin has been appointed Assistant Superintendent of the Nebraska Division of the Union Pacific R. R., with headquarters at Omaha, Neb., to succeed Mr. Harry E. Flaving, transferred to Denver, Colo.

Mr. Clark W. Harrison, formerly the Vice-President and Manager of the South Pittsburg Pipe Works, South Pittsbrug, Tenn., has been appointed General Western Manager for the American Pipe & Foundry Co., Chattanooga, Tenn., and will have his headquarters at 1625 Marquette Bldg., Chicago, Ill.

Mr. Walter J. Graves, civil engineer, has been appointed Recorder on the United States Lake Survey, with headquarters in the U. S. Engineer's Office, Port Huron, Mich. Mr. Graves is a graduate of Cornell University, Ithaca, N. Y., in the class of 1898, and was formerly with the Lake Shore & Michigan Southern Ry., at Toledo, O.

Mr. Frank E. Ward, General Superintendent of the Montana Central Ry., with headquarters at Great Falls, Mont., has been appointed General Superintendent of the Great Northern Ry., with headquarters at St. Paul, Minn., to succeed Mr. Russell Harding, whose resignation to become the Vice-President of the Cotton Belt System, with headquarters in St. Louis, Mo., was noted in our issue of Oct. 27.

Mr. H. E. Wittenberger, Trainmaster of the Grand Trunk Ry., at Stratford, Ont., has been transferred to London, Ont., in the same capacity, to succeed Mr. C. S. Cunningham, who has been transferred to Montreal, Que., succeeding Mr. R. P. Dalton. Mr. H. E. Costello, formerly Trainmaster of the Columbus, Hocking Valley & Toledo R. R., at Toledo, O., has been appointed to succeed Mr. Wittenberger.

Mr. Arthur P. Davis, Assoc. M. Am. Soc. C. E., hydrographer, and Dr. C. Willard Hayes, geologist, have returned to Washington, D. C., after 11 months' absence in Nicaragua. They were detailed from the U. S. Geological Survey to service under the Nicaragua Canal Commission. Mr. Davis has been measuring the larger rivers and the outflow of Lake Nicaragua; and Dr. Hayes has had in charge the borings for bed rock at the sites of large dams.

OBITUARY.

Mr. Edward C. Nichols, Water Commissioner, of Reading, Mass., died Oct. 29, aged 66.

Mr. Thomas A. Roberts, architect, of New York city, died at Asbury Park, N. J., Nov. 6. aged 66.

Mr. Charles F. Parker, of the firm of Chas. F. Parker & Co., contractors, of New York city, died Oct. 17.

Mr. Dore Lyon, contractor and builder, of New York city, died at his home in Westchester, N. Y., Nov. 4, aged 57.

Mr. William McGregor, of the firm of William McGregor & Co., boilermakers, of Chicago, died in that city Oct. 31, aged 72.

Mr. Edward M. Garner, Sr., owner of the water-works at Luzerne and Hadley, N. Y., died in the latter place Nov. 1, aged 65.

Mr. Charles H. Summers, Chief Electrician of the Western Division of the Western Union Telegraph Co. at Chicago, died Nov. 2, in San Francisco, Cal.

Mr. A. L. Poudrier, civil engineer and surveyor, committed suicide recently while camping on one of the Queen Charlotte Islands, British Columbia.

Lieut. Thomas Randolph Sullivan, First Regiment United States Volunteer Engineers, died in New York city Nov. 3, aged 26. He returned several weeks ago from Puerto Rico, where he contracted malarial fever.

Mr. Frank C. Doran, M. Am. Soc. C. E., whose death was noted in our issue of Oct. 27, had been for some years Chief Engineer and General Roadmaster of the Chicago & Western Indiana R. R. and the Belt Ry. of Chicago, and held this position at the time of his death.

Mr. Charles H. Patterson, civil engineer, died of heart disease at Mapiui, Mex., Aug. 26. He was a native of Doylestown, Pa., and went to Brazil, about 1874, with the Collins party, to make surveys for the proposed Madeira River Ry. In January, 1881, he was engaged to make preliminary surveys for the National Construction Co., of New York, in the provinces of Tamaulipas and Nuevo Leon, Mexico, and on the line of one of the surveys a railway was afterward constructed, from Laredo to Monterey. He returned to the United States for a time, but again went to Mexico and for a long time was stationed near Lampazos in charge of railway construction.

Col. James C. Biddle, civil engineer and manufacturer, died at his home, in Philadelphia, Pa., Nov. 2. He was born in that city, Oct. 3, 1835, and graduated from the University of Pennsylvania in 1853, as a civil engineer. He followed his profession for many years, assisting in the construction of a number of Pennsylvania railways, and at the outbreak of the Civil War enlisted as a private in the Union Army. On Aug. 1, 1861, he was breveted Lieutenant-Colonel and four years later was made Colonel for meritorious services before Richmond. After the war he engaged in the manufacture of chemicals and woolens until a few years ago.

Dr. David Ames Wells, inventor, scientist, educator and political economist, died at his home, Norwich, Conn., Nov. 5. He was born in Springfield, Mass., June 17, 1828, and graduated from Williams College, Williamstown, Mass., in 1847. In 1848, while on the staff of the Springfield "Republican," he invented a machine for folding newspapers and books, and the same year entered the Lawrence Scientific School of Harvard University, Cambridge, Mass. In 1851 he became an Assistant Professor at Harvard and Lecturer on Physics and Chemistry in Groton Academy, Groton, Mass. At Cambridge, in 1849, he began with Mr. George Bliss the publication of the "Annual of Scientific Discovery," which continued until 1866. In 1856 he invented valuable improvements in the method of manufacturing textile fabrics. He was a member of the firm of G. P. Putnam & Co., publishers, of New York city, in 1857 and 1858, and compiled several scientific text-books. He came into National prominence in 1863 as a writer on economic and financial subjects, and was consulted by President Lincoln with regard to the financial policy to be adopted by the government upon the termination of the Civil War. He was appointed Special Commissioner of the Revenue, in January, 1866, an office created for him, and held this post until 1870, when he was appointed chairman of a commission to examine the tax laws of the State of New York. In 1876 he was appointed Receiver of the Alabama & Chattanooga R. R., and in 1878 he made an exhaustive report on the subject of tolls on the New York State Canals. He was in the latter year elected a member of the Board of Arbitration of the Associated Railways of the United States. Mr. Wells was elected a Foreign Associate of the French Academy of Political Science, in 1874, and was President of the American Social Science Association from 1875 to 1879.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 10-11. Annual meeting. Secy., Francis T. Bowles, 12 West 31st St., New York.
ST. LOUIS RAILWAY CLUB.
Nov. 11. "The Performance of a Four-Cylinder Compound Locomotive." Discussion. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
CENTRAL RAILWAY CLUB.
Nov. 11. Secy., H. D. Vought, 114 Fifth Ave., New York city.
MONTANA SOCIETY OF ENGINEERS.
Nov. 12. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
TECHNICAL SOCIETY OF NEW YORK.
Nov. 12. "The Breaking Up and Magnetic Cleansing of Iron Ore," C. G. Buchanan. Secy., F. H. Gottlieb, 192 Third Ave., New York city.
ENGINEERS' CLUB OF KANSAS CITY.
Nov. 14. "Rectification of the Red and Atchaflaya Rivers," A. F. Woolley, Jr. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
THE LOUISIANA ENGINEERING SOCIETY.
Nov. 14. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
NORTHWEST RAILWAY CLUB.
Nov. 15. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Nov. 15. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.
WESTERN RAILWAY CLUB.
Nov. 15. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Nov. 16. Secy., Frank H. Olmsted, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Nov. 16. Secy., S. E. Tinkham, City Hall, Boston, Mass.
ENGINEERS' CLUB OF ST. LOUIS.
Nov. 16. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Nov. 16. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
WESTERN SOCIETY OF ENGINEERS.
Nov. 16. "The Manchester Ship Canal," Elmer L. Corthell. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Nov. 16. "Launhardt Formula and Railroad Bridge Specifications," H. B. Seaman. Secy., C. W. Hunt, 220 West 57th St., New York city.
NEW YORK RAILROAD CLUB.
Nov. 17. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Nov. 17. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.
ENGINEERS' CLUB OF CINCINNATI.
Nov. 17. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
CHICAGO ELECTRICAL ASSOCIATION.
Nov. 18. "The Development of the Motor-Cycle," F. B. Rae. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
ENGINEERS' CLUB OF COLUMBUS.
Nov. 19. Secy., H. M. Gates, 12½ North High St., Columbus, O.
TECHNICAL CLUB OF OMAHA.
Nov. 21. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 21. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 21. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
FRANKLIN INSTITUTE.
Nov. 22. Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 22. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 24. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 24. Secy., C. A. McNab, 112 Mansfield St, Montreal, Canada.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Nov. 30. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Dec. 2. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Dec. 5. Secy., H. J. March, Library Bldg, Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Dec 5. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.
DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.
NEW ENGLAND RAILROAD CLUB.
Dec. 13. Secy., Edw. L Janes, P O Box 1158, Boston, Mass.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.
THE ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

CHICAGO ELECTRICAL ASSOCIATION.—At the meeting on Nov. 4 Mr. George A. Damon presented a paper on "The Electrical Equipment of a Model Printing Establishment." The plant referred to is that recently established at Hammond, Ind., by the W. B. Conkey Co. A brief abstract of the paper is given on another page of this issue.

WESTERN SOCIETY OF ENGINEERS.—At the meeting on Nov. 2, a paper on "The Construction of Retaining Walls for the Sanitary District of Chicago," by Mr. James W. Beardsley, was presented. This was illustrated by a number of views showing the walls along the line of the drainage canal. A paper by Mr. Charles V. Kerr, on "The Berthier Method of Coal Calorimetry," was also presented.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.—At the last meeting of this society, held on Nov. 4, Mr. T. C. Martin, editor of "The Electrical Engineer," presented an illustrated lecture on "Electric Power Transmission. The dangers of over estimating the minimum flow of water of streams was pointed out and attention was called to the interesting fact that the usually progressive Eastern part of the United States was only beginning to use methods of power generation and transmission that had been in use in the West for a considerable time.

FRANKLIN INSTITUTE.—A regular meeting of the Institute was held at 15 South Seventh St., Philadelphia, Pa., on Nov. 8, to listen to a paper by Mr. William A. Rosenbaum on "The Status of Electrical Invention."

In this paper the author traced the progress of electrical invention, starting with Faraday's discoveries in 1831 and pointing out successively what he terms the "mile-stones" of progress, in other words, the root inventions from which have grown up whole classes of industries.

The first of these was the telegraph, and the growth of this now great industry was traced through its successive stages of ribbon recording instruments, sound instruments, simplex, duplex, quadruplex, repeaters and finally "wireless" telegraphy. In the same way the telephone, electric light dynamo, electric machinery, chemical generation of current and electric railways were taken up and brought down to date.

ENGINEERS' CLUB OF ST. LOUIS.—The 478th meeting of this club was held on Nov. 2, with 31 members and visitors present.

Capt. F. H. Macklind gave an address upon "Roads and Roadways." He pointed out the necessity of good roads to our present civilization and showed how city streets had developed from country roads. The value of various pavements from different standpoints was discussed, and the paper closed by giving the methods used and the cost of cleaning the streets in different cities.

Prof. Kinealy then exhibited a machine for boring triangular, square, pentogonal, hexagonal and octagonal holes. The machine can be used in connection with any drill press, and bores the hole at one operation in about twice the time taken to bore a round hole. The inventor of the machine was introduced to the club, and explained the manner of operating the drill.

Richard McCulloch, Secy.

TEXAS RAILWAY CLUB.—A two days' session of this club was held at Rockport, Texas, on Sept. 15, at which the following papers were read:

"Safety in Train Air-Brake Appliances," F. Hufsmith; "Necessity of Harmony in the Departments of Railway Service," A. S. Grant; "Economy in the Increased Capacity of Cars," N. L. Smitham. There was also a discussion of two papers presented at previous meetings, "Economy in the Use of Fuel," S. R. Tuggle, and "Car Inspection," James McGee.

The next meeting will be held on April 17 at Bryan, Texas, and the following papers will be presented at that time: "The Use of Electric and Pneumatic Power and Tools as Applied to Shop Practice," William Jennings; "The Impression of a Motive Power Man as Gathered in a Trip Abroad," R. H. Soule; "The Responsibility of a Cast Chill Car Wheel Maker; Its Uses and Abuses," E. S. Marshall; "Relative Merits of Improved Metal Draft Gear," J. R. Cade. There will also be a discussion of papers presented at previous meetings.

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NEW PUBLICATIONS.

LITERARY MAGAZINES.—The war stories are still with us, as the November magazines bear witness, "McClure's" has an interesting paper in which is included most of the official dispatches which passed between the chief naval officers and the Department in West Indian waters while Cervera's fleet was being tracked to its hiding place in Santiago harbor. In the same magazine, the diary of the British consul at Santiago during the hostilities gives a realistic account of life inside the besieged city and of the suffering that came to the women, children and other noncombatants during its attack and capture. There is also a popular account of Vesuvius and its recent eruption, and of the first ascent of Aconcagua and Tupungato, two peaks of the Argentine Andes, which are said to be the highest in the Western hemisphere, their altitudes being respectively about 23,000 and 22,000 ft.

The "Nineteenth Century" for October contains a most interesting account of the life of Alfred Nobel, the inventor of dynamite. It is not generally known, we believe, that Nobel came to the United States when 16 years old, and until he was 21 was a pupil of the late John Ericsson. The story of his life with its marvellous successes reads like a romance. As our readers will remember the bulk of his fortune, amounting to $12,500,000, was left to endow a fund the interest of which will be given annually in five prizes for the most important discoveries in chemists, physics, physiology or medicine, for the highest literary work and for the greatest achievements in the promotion of universal peace.

In the October "Fortnightly" we find the first part of the diary of the late Consul Ramsden at Santiago, referred to in our review of "McClure's" above, and also an interesting account of the Congo Free State and the works of civilization which the Belgians have accomplished in Central Africa.

"Harper's" for November has a paper by Archibald Colquhoun on "The Eastward Expansion of the United States." He urges that the United States should join England in demanding "the open door" in China, and his article is one of the best presentations of the arguments for this course that we have anywhere seen. Recent geographic explorations in Central Asia and in the Arctic and Antarctic are summarized in a paper by Mr. J. Scott Keltie. Lieut. John C. Freemont, U. S. N., writes an interesting account of life on the torpedo boat "Porter" during the war, while Frederick Remington tells anew the story of the Santiago duel in such an inimitable fashion that it is a new story to the readers even though he has heard it all before.

In the November "Atlantic" Prof. Ira V. Hollis, of Harvard University, formerly an engineer in the navy, writes on "The Navy in the War with Spain." He warns against the danger of drawing too positive and broad conclusion from isolated experiences in this war. His article is on the whole about the ablest critical review of the navy's work in the present war that we have anywhere seen. President David Starr Jordan has in the same magazine a paper describing the government which the United States has given and still gives to its only colonial possession, Alaska. We know of no more effective presentation that has been anywhere made concerning the urgent need that some radical changes should be made in our system of government, if we are to have placed upon us the responsibility for the government of remote colonies.

In "The Century" for November Lieut. Bradley Fiske, U. S. N., the inventor of the Fiske range finder, describes the Battle of Manila Bay and tells the reasons which he believes explain the wonderful success of the American fleet and the complete loss of the Spanish. Capt. Sigsbee begins a story of the "Maine's" voyage to Havanna and her subsequent destruction, and a French writer tells of the methods by which the Paris Exposition of 1900 is being brought into shape.

The "Contemporary Review" for October contains an excellent article on the Soudan and its possibilities under a civilized rule. There is also a paper concerning the proposed government purchase of the telephone system in England.

"The Powers of the Interstate Commerce Commission" is the subject of a paper in the "North American Review," by Hon. Chas. A. Prouty, of the Commission, and he presents in a perfectly clear manner the reasons why the amendment of the law, giving the Commisssion authority to compel readjustment of rates, should be made. "National Public Health Legislation" is the title of another paper in the same magazine that deserves mention here.

"Appleton's Popular Science Monthly" for November contains a paper on "Possible Fiber Industries of the United States," in which the possibilities in the cultivation of flax, ramie, jute, etc., are well set forth. Mr. Edgar R. Dawson has a brief popular description of Swiss methods of river regulation, and a French Scientist discusses the causes of rain.

The article in the November "Review of Reviews" of most interest to engineers are two papers on the Nicaragua Canal, by Prof. L. M. Keasbey, author of "The Nicaragua Canal and the Monroe Doctrine," and Emory R. Johnson. The former writer discusses the internation aspect of the canal enterprise and thinks that there would be little difficulty now in securing a revision of the Clayton-Bulwer treaty which would permit us to build and control the canal without friction with England. Prof. Johnson discusses the effect of an Isthmian canal upon the commercial interests of the United States, and gives some tables of distances by various routes. He does not, however, give any figures as to the volume of traffic that might be expected to use a canal if it were built.

The November "Cosmopolitan" contains a popular account of modern methods of placer gold mining, by John E. Bennett, a paper by Joseph Leiter, describing the development of the system of purchasing, warehousing and transportation under which the wheat crop of the Northwest is now handled from the farmer to the consumer, and an account of the marvellous career of Ernest Terah Hooley, the prince of company promoters, who in the course of a couple of years made and lost the comfortable sum of $35,000,000.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

STONE SAWING MACHINES.—Lincoln Iron Works, Rutland, Vt. Pamph., 9 × 6 ins; pp. 16; illustrated.

This pamphlet describes some of the standard stone sawing machines made by the company named. The designs show machines with screw feed, gravity feed, and various patent feeding devices, straight cut gang saws, circular saws for soft stone, and various fittings and sundries.

DRAWING MATERIALS AND SURVEYING INSTRUMENTS.—Eugene Dietzgen Co., 183 Monroe St., Chicago. Paper, 4½ × 6 ins.; pp. 161.

This is a compact and comprehensive catalogue and price list of drawing instruments and supplies, surveying and optical instruments, etc. Among the drawing materials are lettering angles, which are rectangular set squares, having the upper edge slotted at the various angles for different letters of a given style. A device for printing titles, etc., on maps or drawings, is also shown.

DEPRECIATION OF CANDLE-POWER OF WELSBACH MANTLES.—General Electric Co., Schenectady, N. Y. Circular; 3½ × 5 ins.

This little circular gives a number of interesting items relative to the depreciation of candle-power of Welsbach mantles for gas lamps and of incandescent electric lamps, based upon actual tests. The conclusion drawn is that the electric lamp falls off in efficiency less rapidly than the gas lamp. Attention is briefly called to the enclosed arc lamps manufactured by the General Electric Co.

CORRUGATED STEEL WORK.—Cincinnati Corrugating Co., Piqua, Ohio. Paper; 8 × 6 ins.; pp. 9; illustrated.

This firm makes corrugated steel arches, and here gives tables setting forth thickness of sheet, loads and deflections for spans ranging from 4 to 10 ft., and with several types of corrugations. They also manufacture iron and steel roofing, steel lath, iron doors and shutters, etc. The corrugated sheets are made with a patent edge, for which great advantages are claimed in fastening, water-tight qualities, efficiency, strength and economy in metal.

SKYLIGHTS WITHOUT PUTTY.—Vaile & Young, Baltimore, Md. Pamph., 6 × 9 ins.; pp. 32; illustrated.

The special feature of this skylight construction is the sash or framework which carries the glass. This consists of an open, tubular supporting bar, which acts also as a gutter, and a cap which lies close to the glass on top. This cap is of lead, and is designed to make a water tight joint with the glass, but should leakage occur, the gutter-shaped bar carries the water away safely. The bar is usually made of galvanized iron, but copper is also employed when specified. This pamphlet describes and illustrates the various standard skylight constructions of this system, and shows views of a number of the important structures in which they have been used. Among these we note the new Library of Congress building, the works of the Maryland Steel Co., the new conservatories at Druid Hill Park, in Baltimore, Md., and several large train sheds.

METAL SKYLIGHTS AND LATHING.—George Hayes, 71 Eighth Ave., New York. Paper; 10 × 6¾ ins.; pp. 85; ilustrated.

The Hayes method of building skylights and other glazed structures was invented about 30 years ago and has been since widely applied. This pamphlet illustrates and describes the many forms in which it is used, together with the special appliances employed with it. The second part of the pamphlet treats of metal lathing and a system of fireproof construction adapted to buildings of all types. This lathing is corrugated, expanded and punctured, and has lipped and tongued apertures, and is claimed to be a perfect mortar-holding device and a brace to the wall as well. The text ilustrates and describes it as used in a multitude of forms and for many purposes, both in iron and in wood construction.

STANDARD CRABS AND WINCHES.—Brown Hoisting & Conveying Machine Co., Cleveland, O. Circular.

This circular illustrates, describes and prices the Weston patent crabs and winches, formerly made by the Yale & Towne Mfg. Co., but now manufactured by this company. The standard crabs range in lifting capacity from ½ to 2½ tons; weigh from 226 lbs. to 812 lbs., and cost, for crabs alone, from $35 to $100. The winches have a similar capacity; weigh from 215 to 864 lbs., and cost from $35 to $100. The feature of these crabs and winches is the safety-brake, which makes it impossible for the load to run down; and the load will not lower unless the cranks are turned backwards, and motion ceases when the cranks are released.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Nov. 10.	Water supply	Belem, Brazil	Sept. 22
Nov. 10.	Water bonds, ($30,000)	New Richmond, O.	Oct. 20
Nov. 10.	College building	Cincinnati, O.	Oct. 20
Nov. 10.	Court house bonds	Doniphan, Mo.	Oct. 20
Nov. 10.	Building repairs	Brooklyn, N. Y.	Nov. 3
Nov. 10.	Summit Ave. improvement	St. Paul, Minn.	Nov. 3
Nov. 10.	Boiler house	Morris Plains, N. J.	Nov. 3
Nov. 10.	Electric plant	Wynne, Ark.	Nov. 3
Nov. 10.	Steel and iron bridges	Savannah, Ga.	Nov. 3
Nov. 10.	Gas well	Buffalo, N. Y.	Nov. 3
Nov. 10.	Macadam road	Enfield, Mass.	Nov. 3
Nov. 10.	Water-works	Wynne, Ark.	Nov. 3
Nov. 10.	Electric light poles	Ottawa, Ont.	Nov. 10
Nov. 10.	Sewer bonds	Nyack, N. Y.	Nov. 10
Nov. 10.	Conduit system	Erie, Pa.	Nov. 10
Nov. 10.	Sidewalks	Findlay, O.	Nov. 10
Nov. 10.	Gas and electric fixtures	Milwaukee, Wis.	Nov. 10
Nov. 10.	Extending canal	New Orleans, La.	Nov. 10
Nov. 11.	Sewage disposal plant	Madison, Wis.	Nov. 10
Nov. 11.	Paving, etc.	Wilmette, Ill.	Nov. 10
Nov. 11.	Brick sewers	Chicago, Ill.	Nov. 10
Nov. 11.	Dredging the Erie basin	Buffalo, N. Y.	Nov. 3
Nov. 12.	Water bonds ($130,000)	Reno, N. Mex.	Oct. 13
Nov. 12.	Buildings ($106,250)	Mare Island, Cal.	Oct. 20
Nov. 12.	Dredging	Port Royal, S. C.	Oct. 20
Nov. 12.	Road work	Cincinnati O.	Oct. 27
Nov. 12.	Fire alarm system	Lancaster, O.	Nov. 3
Nov. 12.	Sewers	Jerseyville, Ill.	Nov. 10
Nov. 12.	Heating, etc.	St. Thomas, Ont.	Nov. 10
Nov. 13.	Bridges	Hoosick Falls, N. Y.	Nov. 10
Nov. 14.	Bridge over Cedar River	Waverly, Ia.	Nov. 3
Nov. 14.	Repairing pumping engines	Boston, Mass.	Nov. 3
Nov. 14.	Grading a road	Santa Barbara, Cal.	Oct. 27
Nov. 14.	Steel bridge (100 ft.)	Houston, Tex.	Oct. 20
	Advertised, Eng. New, Oct. 20 to Nov. 3.		
Nov. 14.	Removing wreck	Rockland Harbor, Me.	Oct. 13
Nov. 14.	Macadamizing	Berkeley, Va.	Nov. 10
Nov. 14.	School building, etc.	Boston, Mass.	Nov. 10
Nov. 15.	Water pipe, pumps, etc.	Havana, Cuba	Nov. 10
Nov. 15.	Naval supplies	Washington, D. C.	Nov. 10
Nov. 15.	Firemen's home	Newark, N. J.	Nov. 10
Nov. 15.	Reservoir	Irvington, N. Y.	Nov. 10
Nov. 15.	Lift bridge	Canajoharie, N. Y.	Nov. 10
Nov. 15.	Water-Works	Jonesville, Mich.	Nov. 10
Nov. 15.	Industrial school	Eilendale, N. Dak.	Oct. 13
Nov. 15.	Water-works addition	Seattle, Wash.	Sept. 22
	Advertised, Eng. News, Sept. 22 to Nov. 10.		
Nov. 15.	Jail work	San Saba, Tex.	Sept. 29
Nov. 15.	Electric lighting	Greensboro, N. C.	Oct. 6
Nov. 15.	Dredging bay	Coos Bay, Ore.	Oct. 20
	Advertised, Eng. News, Oct. 20 to Nov. 10.		
Nov. 15.	Water-works	Rock Hill, S. C.	Oct. 27
	Advertised, Eng. News, Oct. 27 and Nov. 3.		
Nov. 15.	Machinery and tools	Norfolk, Va.	Nov. 3
Nov. 15.	Electrical machinery	Portsmouth, N. H.	Nov. 3
Nov. 15.	Bridge (131 ft. long)	Canal Fulton, O.	Nov. 3
Nov. 15.	Well	Elburn, Ill.	Nov. 3
Nov. 16.	Rebuilding sewers	New York, N. Y.	Nov. 3
Nov. 16.	Reformatory building	Mansfield, O.	Oct. 27
Nov. 16.	Electric plant	Knowle, England	Oct. 27
Nov. 16.	Electrical machinery	Cleveland, O.	Oct. 20
Nov. 16.	Electric lighting	Camden, N. J.	Oct. 13
	Advertised, Eng. News, Oct. 13 to 27.		
Nov. 16.	Park work	Cleveland, O.	Nov. 10
Nov. 16.	Fire apparatus	New York, N. Y.	Nov. 10
Nov. 16.	Buildings (2)	New York, N. Y.	Nov. 10
Nov. 17.	Road gravel	Los Angeles, Cal.	Nov. 10
Nov. 17.	Hospital building	Siletz, Ore.	Oct. 27
Nov. 17.	Road in Sage Canyon	Cal.	Oct. 27
Nov. 17.	School building	Passaic, N. J.	Nov. 3
Nov. 17.	Water-works	McComb, Miss.	Nov. 3
Nov. 18.	Building materials	Chemawa, Ore.	Nov. 3
Nov. 19.	Local sewers	Evansville, Ind.	Nov. 3
Nov. 19.	Water bonds ($22 000)	Bainbridge, N. Y.	Nov. 3
Nov. 19.	Wooden wharf	Washington, D. C.	Nov. 10
Nov. 19.	Electric light plant	Concord, Mass.	Nov. 10
	Advertised, Engineering News, Nov. 10.		
Nov. 21.	Macadamizing	Plainfield, N. J.	Nov. 10
Nov. 21.	Street bonds	Norwood, O.	Nov. 10
Nov. 21.	Bridges	Los Angeles, Cal.	Nov. 10
Nov. 21.	Iron fence, etc.	Cleveland, O.	Nov. 3
Nov. 21.	Brick sewers	Toledo, O.	Oct. 27
Nov. 21.	Naval supplies	St. Augustine, Fla.	Oct. 27
	Advertised, Eng. News, Oct. 27 to Nov. 17.		

Nov. 21.	Government bldgs (8), Sophia, Bulgaria	Sept. 29
Nov. 22.	U. S. building, Norfolk, Va. Advertised Eng. News, Oct. 27 and Nov. 3.	Oct. 27
Nov. 22.	Bridge foundations, Washington, D. C. Advertised, Engineering News, Nov. 3.	Nov. 3
Nov. 22.	Electric plant, Fredericksburg, Va. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Nov. 23.	Sewers, Elkhart, Ind.	Nov. 10
Nov. 24.	Brick sidewalk, Huntington, W. Va.	Nov. 3
Nov. 25.	Water pipe, etc., Honolulu, H. I.	Oct. 27
Nov. 25.	Rebuilding wall, New York, N. Y.	Nov. 10
Nov. 25.	Rebuilding pump, Cleveland, O.	Nov. 10
Nov. 25.	Cleaning streets, Cleveland, O.	Nov. 10
Nov. 26.	Boilers, Brooklyn, N. Y.	Nov. 10
Nov. 26.	Crane, Port Royal, S. C.	Oct. 27
Nov. 26.	Boat shelter roof, Mare Island, Cal.	Oct. 20
Nov. 26.	Sawmill, chimney, etc., Mare Island, Cal.	Nov. 3
Nov. 28.	Removing wreck, Port Chester, N. Y. Advertised, Eng. News, Oct. 27 to Nov. 17.	Nov. 3
Nov. 28.	Water-works, Florence, Colo Advertised, Eng. News, Nov. 3 and 10.	Nov. 3
Nov. 28.	Sewers, North Bend, Ind.	Nov. 3
Nov. 28.	Heating plant, Henderson, Colo.	Nov. 3
Nov. 28.	Tubular boilers, (2), San Francisco, Cal.	Nov. 3
Nov. 28.	Removing wreck, Portchester Harbor, N. Y.	Oct. 27
Nov. 28.	Electric plant, Denver, Colo.	Nov. 10
Nov. 28.	Tug boat, San Francisco, Cal.	Nov. 10
Nov. 28.	Mailing platform and shed, New York. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Nov. 29.	School building, Fort Berthold, N. Dak.	Nov. 10
Nov. 29.	Condenser tubes, Mare Island, Cal.	Nov. 10
Nov. 29.	Scales, etc., Washington, D. C.	Nov. 10
Nov. 29.	Water-works, Ft. Berthold, N. Dak.	Nov. 3
Nov. 30.	Dry dock, Algiers, La.	Oct. 20
Nov. 30.	Bridge, etc., and plans, Moline, Ill. Advertised, Eng. News Oct. 6 and 13.	Oct. 6
Nov. 30.	Water-works, McKinney, Tex.	Nov. 10
Nov. 30.	Steel arch bridge, Victoria, B. C.	Nov. 10
Dec. 1.	Electric light plant, Clinton, Ill.	Nov. 10
Dec. 1.	Electric plant, Orilla, Ont.	Nov. 10
Dec. 1.	Business building, Cleburne, Tex.	Nov. 10
Dec. 1.	Seawall, S. I., N. Y. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Dec. 1.	Garbage collecting, Jersey, City, N. J.	Nov. 10
Dec. 1.	Electric lighting, Sumter, S. C.	Oct. 6
Dec. 1.	Electric light plant, Clinton, Ill.	Oct. 13
Dec. 2.	Arc lighting, Asheville, N. C.	Oct. 13
Dec. 5.	Pumping engine, Oil City, Pa. Advertised, Eng. News, Oct. 27 to Nov. 10.	Oct. 27
Dec. 5.	Removing wreck, Philadelphia, Pa.	Nov. 10
Dec. 5.	Water-works, West Tampa, Fla. Advertised, Eng. News, Nov. 10 to 24.	Nov. 10
Dec. 5.	Court house, Garner, Ia.	Nov. 10
Dec. 6.	Canal, Tampico, Ill. Advertised, Eng. News, Nov. 10 to Dec. 1.	Nov. 10
Dec. 6.	Street bonds, Springfield, O.	Nov. 3
Dec. 7.	Changing Van Buren St. bridge, Chicago, Ill.	Oct. 20
Dec. 7.	Torpedo storehouse, Fort Caswell, N. C. Advertised, Eng. News, Nov. 10 to Dec. 1.	Nov. 10
Dec. 8.	Bridge approach, Zanesville, O.	Nov. 10
Dec. 8.	Lease of water power, Indianapolis, Ind.	Nov. 3
Dec. 10.	Intercepting sewers, Washington, D. C. Advertised, Engineering News, Nov. 3.	Nov. 3
Dec. 10.	Crane (100 tons capacity), Brooklyn, N.Y.	Nov. 10
Dec. 15.	Storm sewers, Denver, Colo.	Oct. 13
Dec. 21.	Court house annex, Atlanta, Ga.	Nov. 3
Dec. 22.	Superstructure, Lorain, O.	Nov. 3
Dec. 22.	Bridge superstructure, Lorain, O. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18
Jan. 2.	Bridge, Quebec, Que. Advertised, Eng. News, Sept. 29 and Oct. 6.	Sept. 29
Jan. 2.	Arc lighting, Vincennes, Ind.	Oct. 27
Jan. 6.	Water-gas plant, Johannesburg, So. Africa.	Oct. 27
Jan. 6.	Extension, electric plant, Johannesburg, S.Af.	Oct. 27
Jan. 24.	Footway tunnel, London, England.	Nov. 10
Feb. 2.	Electric lighting, New Orleans, La.	Nov. 3
Feb. 10.	Jail building, Keyser, W. Va.	Sept. 29
No date.	Water-works, Tempe, Ariz.	Nov. 10
“	Steam heating, Augusta, Me.	Nov. 10

RAILWAYS.

ATLANTIC COAST LINE.—F. Gardner, Ch. Engr., Wilmington, N. C., informs us that bids were received from the following contractors, Nov. 4, for the grading and trestle work on the extension of the Charleston & Western branch from Denmark to Robbins, N. C., a distance of 34.7 miles, as advertised in Engineering News: A. & C. Wright Co., Richmond, Va.; M. N. Moorman, Lynchburg, Va.; Geo. W. Calahan, Knoxville, Tenn.; Abercrombie & Williams, Montgomery, Ala.; B. O. Watkins, Birmingham, Ala.; Lane Bros. & Co., Esmont, Va.; V. E. Steen, Kansas City, Mo.; L. B. Lacy, Anniston, Ala.; Walker & Oliver, Langley, S. C.; Dunn & Leland Bros., Birmingham, Ala.; Mason, Hoge & Co., Frankfort, Ky.; Douglas, Frick & Nordin, Baltimore, Md.; Batchelder & McGruder, Winston, N. C. The bid of A. & C. Wright Co. was accepted.

CLEARWATER VALLEY.—This company has been incorporated in Oregon, with an authorized capital stock of $3,000,000, to build and operate several hundred miles of railway and telegraph lines in Oregon, Washington and Idaho, the line to Clearwater being the chief of those projected. The incorporators are: W. H. Kennedy, Ch. Engr. of the Oregon River & Navigation Co., Portland, Ore., and C. W. Mulks, J. C. Haveley and Charles Steel, all of whom are connected with this same company.

CUBA.—Congressman John Dalzell is said to be one of a party of Pennsylvania capitalists which is investigating the district around Santiago with a view to the construction of a railway connecting Santiago and Havana.

DALLAS TERMINAL.—A meeting of the stockholders of this company will be held at Dallas, Tex., on Dec. 10, to take action on a proposed amendment of the charter, which will permit of an extension of the line from Dallas to Fort Worth, a distance of 32 miles. The issue of about $1,000,000 in bonds is contemplated. W. C. Connor, Pres., Dallas.

DENMARK.—Press reports state that the Danish state railway authorities, at Copenhagen, are asking for bids on 2,123 tons of steel rails, 133 tons of fish-plates, 17½ tons of fish-bolts and nuts and 66 tons of nails. Early in October many European manufacturers were trying to secure the business, and, up to that time, no American concern had made any effort to compete. Many orders for railway material from Copenhagen are going both to Germany and England. The buyers are obliged to wait a long time for delivery of goods, which would not be the case if the Americans secured the orders, a fact which is much in their favor.

DETROIT & MACKINAC.—Reports from Bay City, Mich., state that Prescott & Sons are building a branch line from Prescott, on the Detroit & Mackinac, to Hiles Lake, through a pine timbered district. J. D. Hawks, Pres. and Gen. Mgr., Detroit, Mich.

FAIRCHILD & NORTH EASTERN.—G. W. Godfroy, Ch. Engr., Fairchild, Wis., informs us that grading and track-laying is in progress on the extension of this road from Greenwood northeast to Beaver, Wis., a distance of five miles, and work will be completed by Dec. 1. Contractor, Jas. W. Gorman, Minneapolis, Minn. Pres., N. C. Foster, Fairchild.

GALETON & LEETONIA.—This company was incorporated in Pennsylvania, Nov. 1, with a capital stock of $330,000, to construct a steam railway between Germania and Leetonia, Pa., a distance of about ten miles. The incorporators are: Chas. H. Rexford, Pres.; W. A. Rexford, J. L. Snyder, J. R. Dangle and Harry J. Wilcox, all of Galeton, Pa.

GREAT NORTHERN.—This company is said to intend making application to the next session of the Canadian Parliament for a franchise to extend the Spokane Falls & Northern through Southern British Columbia. The real object is represented to be a paralleling of the Crow's Nest Pass branch of the Canadian Pacific through Southern British Columbia, in addition to the Kettle River line.——Track laying has been almost completed on the extension of the Great Northern from Cass Lake, on the new Fosston branch, south to Akely, Minn., 13 miles.——Construction is expected to be undertaken next spring on a new cut-off which has just been surveyed from Coon Creek north about 50 miles to Brook Park, via Cambridge, Minn. N. D. Miller, Ch. Engr., St. Paul, Minn.

GULF, BEAUMONT & KANSAS CITY.—Reports state that the surveyors have finished locating the line of the proposed road from Orange to Kirbyville, Tex., and that several miles of the right of way have been cut. Construction is expected to begin soon. Jas. F. Weed, Ch. Engr., Beaumont, Tex., informs us that this company has just received 1,000 tons of 56-lb. steel rails, from the Carnegie Steel Co., to be used on this 11-mile extension from Kirbyville, which will be ready for operation about Feb. 1.

HOCKING VALLEY & LAKE ERIE.—W. H. Jennings, formerly connected with the Columbus, Hocking Valley & Toledo Ry., is said to be chief engineer of this railway projected to run from Athens to Toledo, via Columbus, O., and for the construction of which contracts are said to have been let. The line must be completed by Jan. 1, 1900.

IOWA.—Reports state that L. F. Wakefield, Engr., Sioux City, Ia., is in charge of a corps of surveyors now at work in South Siuox City surveying a route for a new line of railway. There is a rumor to the effect that a syndicate has been formed to construct a line from Sioux City to Omaha which will go down on the Nebraska side of the Missouri River, and will be when surveyed about 25 miles shorter than either of the Sioux City & Pacific or the Omaha.

IOWA CENTRAL & WESTERN.—This company was incorporated in Iowa, Oct. 29, with a capital stock of $3,000,000, to construct a line from Oskaloosa to Des Moines, Ia.; also a line intersecting the Iowa Central Ry. at or near Belmont to Algona and thence northwesterly to the northern state line. The incorporators are: Pres., L. M. Martin, Gen. Mgr. of Iowa Central; George W. Seevers and C. E. Lofland, of Oskaloosa; Seth Zug and P. E. Bousquet, of Pella.

LEADVILLE MINERAL BELT.—This company has been incorporated in Colorado, with a capital stock of $100,000, to construct a belt line tapping the rich ore gulches in Lake and Park counties. The incorporators are: Frank Trumbull, Receiver of Union Pacific, Denver & Gulf Ry., Denver, Colo.; A. D. Parker, H. W. Cowan, Elmer E. Whitted and I. R. De Remer.

MICHIGAN.—The East Jordan Lumber Co., of East Jordan, Mich., expects to build a 10-mile standard-gage line this fall south to its lumber lands. Surveys are now being made. All material has been purchased for the first ten miles. A farther extension of eight miles to Antrim is contemplated.——A railway from Greenland to Houghton, Mich., 70 miles, is said to be projected by Richardson, Hill & Co., of Boston, and other firms.

MIDLAND & NOVA SCOTIA.—Reports state that this company has decided to build its line from Windsor to Truro, N. S., 60 miles, via Clifton, which town has voted a bonus of $30,000, and that work between Five Mile River and Truro would be at once vigorously undertaken. Most of the earthwork between Windsor and the Shubenacadie River has been done. Pres., William Strachan, Montreal, Que.

MUSCATINE, NORTH & SOUTH.—W. L. Willis, Ch. Engr., Wapello, Ia., is reported as saying that the road bed of this new line has been graded to the Iowa River, a distance of ten miles, and most of the heavy work done on eight miles on the other side of the river. Stirling Birmingham, Vice-Pres. and Secy., 120 Broadway, New York.

NEW YORK & OTTAWA.—The supreme court of New York, has rendered a decision which, if sustained by the higher courts, will prevent the construction of an extension of this line to a connection with the Adirondack Ry., at North Creek, N. Y., and thereby frustrate the plan for shortening the distance by rail between New York and Ottawa by 59 miles. The proposed line would run through the Adirondack Park Preserves, which is declared to be unlawful.

NORTON BAY & YUKON RY. & NAVIGATION.—Bids are being asked by the Anglo-Alaskan Syndicate, Ltd., of London, according to reports, for rails and rolling stock for this proposed 76-mile line in the Yukon district, from a point 45 miles northeast of St. Michael, Alaska, to the Yukon River, 35 miles below Nulato. F. A. Hill, Ch. Engr., National Bank Bldg., Seattle, Wash.

NORTHERN PACIFIC.—This company has filed papers in the Waterville land office asking for ten miles of right of way from Lake Chelan to the Columbia River, in Washington.

NOVA SCOTIA.—The ratepayers of Amherst, N. S., have decided to make a subsidy towards the construction of a railway from Amherst to North Point, on the Northumberland Straits, a distance of 20 miles.

OSHKOSH & STEVENS.—Albert Schaeffer, St. Paul, Minn., and J. W. Edwards, of Winneconne, Wis., are said to be the incorporators of this company, which expects to build a railway between these two cities in Wisconsin, via Almond, a distance of about 70 miles. Surveys have been commenced; a part of the line will be built at once.

PENNSYLVANIA.—Bids are asked until Nov. 12, according to reports, for constructing 5½ miles of railway to a connection with the Baltimore & Ohio Ry. at Layton, Pa., including several bridges. Engrs., Taylor & Romine, McKeesport, Pa.

PERRIS & LAKE VIEW.—This company is reported to have been incorporated in California, with a capital stock of $80,000, to construct a standard gage road from Perris in a northeasterly direction to Lakeview, Cal., 8.05 miles. The directors are: W. C. Nevins, G. Holterhoff, E. Chambers, H. J. Stevens and A. P. Maginnis.

PITTSBURG & WESTERN.—Reports state that contracts for the construction of nine miles of new track on this line near Harmony, Pa., have been let. The work is to be done on the proposed double track line between Pittsburg and New Castle, Cal., and will be completed early next year. Paul Didier, Asst. Ch. Engr., Allegheny, Pa.

RIO GRANDE, SIERRA MADRE & PACIFIC.—This company is said to have decided to build an 80-mile narrow gage railway, which will branch off from the present terminus at Casa Grande, Mexico, and traverse the mineral and heavily timbered region to the west known as the Yaqui gold country. The main line of the railway now connects El Paso and Juarez with Casa Grande, and is 150 miles long. When the narrow gage line connects with the timber region the value of the line to El Paso will be greatly increased. Work on the new railway will soon begin. Pres., A. Foster Higgins, 54 Exchange Place, New York; Ch. Engr., J. Fewson Smith, El Paso, Tex.

SPRING GARDEN CONNECTING.—The committee on corporations, of Allegheny, Pa., has favorably recommended the ordinance granting a franchise to this company. The road will be a branch of the Pittsburg & Western line, run over the tracks of the West Penn and over Ohio St., west of McFadden St., above grade, tunnel Troy Hill to Spring Garden Ave., and run thence to Valley St., so as to reach Lappe's and other tanneries in that section. The company was incorporated, Jan. 24, with a capital stock of $200,000, by William Kirkland, Frank Felkel and Jas. D. Swindell, the last named being from Allegheny, Pa.

ST. LAWRENCE RIVER & ADIRONDACK.—This company has been incorporated, with an authorized capital stock of $3,000 a mile, to construct a line from the St. Lawrence River to North Creek, following the Raquette River to its source, a distance of about 100 miles. Pres., L. S. Putney; Vice-Pres., O. E. Martin; Secy., H. G. Atwater; Treas., J. G. McLeod

VIRGINIA.—Surveys are now being made, according to reports, for a proposed railway across Frederick county, Virginia, which is designed to bring the rich coal fields and timber lands of West Virginia within easy reach of the East, North and South.

WEST VIRGINIA SHORT LINE.—Surveys have been completed for this proposed railway from Clarksburg to New Martinsville, W. Va., a distance of about 60 miles. Construction work is expected to begin shortly.

STREET AND ELECTRIC RAILWAYS.

MARLBORO, MASS.—It is reported that the power house for the Hudson, Marlboro and Framingham divisions of the street railway will be on Maple St., Marlboro. An addition to the present power house, 37 × 50 ft., is being built. A new 300-HP. engine and generator will be installed and will be utilized in addition to that already in use.

MILFORD, MASS.—The selectmen have granted a franchise to the Milford, Woonsocket & Attleboro St. Ry. Co. George W. Wiggin, of Franklin, Mass.; E. J. Whittaker, Wrentham, Mass., are interested.

MERIDEN, CONN.—The Meriden, Middletown & Waterbury R. R. Co. has been incorporated, with an authorized capital of $100,000. It is believed that electricity will be the motive power. Judge A. Heaton Robertson is said to be interested.

MIDDLETOWN, N. Y.—William B. Royce, of Middletown, has been appointed receiver of the Middletown & Goshen Traction Co., which operates an electric street railway from Middletown to Goshen, and a small park in connection therewith, by Justice Pryor, of the Supreme Court, on the application of Ferdinand McKeige, Hugh H. Douglass, W. A. Granterin, and other directors. The company had an office at 35 Nassau St., New York.

ALBANY, N. Y.—It is reported that work will be resumed on the construction of the Greenbush & Nassau Electric Ry., under new management. Surveyors are again at work on the proposed route in East Greenbush.

LITTLE FALLS, N. Y.—The council has granted an extension of one year in which work is to be commenced on the Little Falls & Herkimer Electric St. Ry. Gen. Lansing said the company would certainly build the road in the spring and all that was keeping them back now was the obstacles to completing the preliminary work.

SCHUYLERVILLE, N. Y.—An electric railway will soon be constructed between Schuylerville and Greenwich, according to reports. J. D. Powers, of Sandy Hill, N. Y., is interested in the project.

BOUND BROOK, N. J.—It is reported that the Brunswick Traction Co. has completed its trolley line between Bound Brook and Plainfield, a distance of eight miles. Pres., E. H. Radel, New Brunswick, N. J.

JERSEY CITY, N. J.—Mayor Hoos has signed the ordinance granting to the North Hudson St. Ry. Co. the privilege of changing the motive power of its Grove St. line from horses to electricity.

HATBORO, PA.—The Hatboro Ry. Co. was incorporated in Pennsylvania Nov. 1, with a capital stock of $30,000, to construct an electric street railway from Hatboro to Willow Grove. The incorporators are, James McGregg, James Van Horn, Sam. J. Garner, Jas. W. Rusling and R. Ashurst, Philadelphia, Pa.

WASHINGTON, D. C.—Permission has been granted the Capital Ry. Co. by the district commissioners for an extension of its line from Congress Heights through Pencote Woods to the Alexandria branch of the Baltimore & Ohio R. R.——O. T. Crosby, C. A. Lieb and F. A. Stevens have purchased a controlling interest in the bonds of the Washington & Anacostia Ry. It is reported to be the intention of these gentlemen to equip the line with underground electricity. They have already succeeded in getting the affairs of the Eckington Ry. and its allied lines in such shape that now, under the name of the City & Suburban, contracts have been made and the work commenced of installing the underground electric system. The installation on G St. will be kept until the last.——The district commissioners have authorized the Washington & University R. R. Co. to issue bonds and stock to the amount of $175,000 in order to build and equip their line. This road will start at Quincy St. and Wisconsin Ave., running west and north past the American University to the District line. It will be double track, about three miles long, and concrete will replace the wooden ties ordinarily employed. J. D. Croissant, Washington, D. C.——The Columbia Ry. Co. has obtained all but one parcel of land for their right of way and this is now being condemned. Construction will begin immediately.——The district commissioners have allowed the Capital Ry. Co. 60 days longer in which to experiment with the Brown system of underground propulsion.

NEWPORT NEWS, VA.—The Peninsular Ry Co., composed of W. A. Post, Frank Lee, A. L. Parker, W. E. Cottrell, L. P. Stearnes, J. A. Willett and J. G. Livezay, have applied to the council for a franchise for the construction of a new street railway in this city.

CANTON, O—The council has passed an ordinance granting the Canton & Massillon Electric Ry. Co. a franchise to build an electric railway over Navarre St. and Dueter Ave.

CAMDEN, O.—The Camden, Dunkirk & Albany Traction Co. has been incorporated with a capital stock of $150,000 to build apparently over the same route as that proposed by the Albany, Dunkirk & Camden Traction Co. The incorporators are, G. W. and J. A. Simpson, of Chicago, Ill., and Geo. W. Whittaker, Dunkirk, Ind.

DAYTON, O.—Reports state that the surveys of the Dayton, Spring Valley & Wilmington Electric Ry. have been begun under the direction of General Manager J. M. Wilson.

KENDALLVILLE, IND.—The commissioners of Noble county have granted a franchise to the Northern Construction Co. to build an electric railway through the county. The promoters of the enterprise have secured the necessary privileges to build the road from Logansport to Kendallville. Steps will be taken at once to commence work.

MARYSVILLE, O.—M. A. Wright and others have petitioned the county commissioners for a right of way for an electric railway connecting Richwood, Pharisburg and Magnetic Springs with Marysville. Work is expected to begin about April 1.

ANDERSON, IND.—N. N. Morse representing capitalists of Indianapolis, Ind., has filed a petition with the county commissioners for a franchise to build an electric railway from Anderson to Ingalls, via Pendleton.

OWOSSO, MICH.—W. H. Avery and others, of Detroit, Mich., are said to be investigating the construction of an electric railway through Owosso which will be a continuation of the line from Detroit to Pontiac.

SAGINAW, MICH.—Press reports state that Fitzgerald & Co., of Lincoln, Neb., have been awarded the contract for the construction of that part of the Saginaw Suburban Ry. between Bay City and Flint. The old right of way of the Rapid Transit Co. between Bay City and Saginaw will be used. President Swarthout, of Saginaw, may be addressed.

STILLWATER, MINN.—It is reported that Thomas Lowry, of Minneapolis, and others, contemplate the construction of a new street railway in this city to connect with the Wildwood line.

LAWRENCE, KAN.—Frank Kern, of Mattoon, Ill., has accepted the electric railway franchise granted by this city.

INDEX, WASH.—The Sunset Falls Power Co. is having a line surveyed for a proposed electric road from Index up the north fork of the Skykomish to Galena. The company's power house will be at Sunset and Eagle Falls on the Skykomish River.

LOS ANGELES, CAL.—A. B. Patton has been granted six months extension of time within which to begin the construction of the proposed electric railway to Whittier, the franchise for which was granted May 3.

TOKIO, JAPAN.—Press reports state that the Siemens & Halske Electric Co. is considering a proposition from the Japanese government to form in Chicago a syndicate with a capitalization of about $10,000,000 to install and operate all electric street car lines and incandescent lighting and electric power plants which are to be established in the domain of the mikado as another step in the modernizing of the principal cities of Japan.

ELECTRIC LIGHT AND POWER.

CONCORD, MASS.—Bids are asked until Nov. 19 for installing the steam and water piping in the light plant, as stated in our advertising columns. Stone & Webster, Engrs., 4 Post Office Square, Boston; R. F. Barrett, Chn. Bd.

MILTON, MASS.—It is stated that a controlling interest in the Milton Electric Light & Power Co. has been purchased by parties who control the Hyde Park and Dedham electric plants. The new company will probably enlarge the plant and furnish the power for the new electric road.

NORTH TONAWANDA, N. Y.—The Niagara Falls Power Co. is reported to have been granted a franchise in this city.

UNADILLA, N. Y.—D. R. Buckley, Supt. Standard Light, Heat & Power Co., writes us that the following contracts have been let for furnishing the equipment for the plant, it to have a capacity for 70 2,000-c. p. arc and 2,500 16-c. p. incandescent lights: Water-wheels, Jas. Leffel & Co., Springfield, O.; electrical work, General Electric Co., Schenectady, N. Y.; boilers, Abendroth & Root Mfg. Co., 28 Cliff St., New York.

ASBURY PARK, N. J.—The committee is reported as soliciting information for the proposed plant. T. F. Appleby, Cy. Clk.

LANCASTER, PA.—We are informed that everything is completed for the extension of the plant of the Lancaster Electric Light, Heat & Power Co. excepting a few circuits for incandescent lights.

WRIGHTSVILLE, PA.—It is stated that the Merritt-Chapman Wrecking Co., New York, has secured from the Martic Water & Power Co. the contract for rebuilding the Columbia dam.

BIG STONE GAP, VA.—The Virginia Tanning & Extract Co. is in the market for a dynamo, etc., of about 250 incandescent lights, according to reports.

FREDERICKSBURG, VA.—Bids are asked until Nov. 22 for furnishing and installing the equipment for a plant, as stated in our advertising columns. The plans and specifications are on file at the office of Engineering News, St Paul Building, New York. T. McCracken, Chn. Com.

CHARLESTON, S. C.—J. H. Dingle, Cy. Surv., writes us that the matter of an electric light plant, which the city proposes to build, is now in the courts, together with the water-works question.

MONTEZUMA, GA.—We are informed that the Montezuma & Oglethorpe Lighting Co. has its plant completed and will require nothing more, excepting general supplies.

KEY WEST, FLA.—It is stated that the plant of the Key West Gas & Electric Light Co. will be improved.

OCALA, FLA.—J. C. Norcross, Supt. electric light plant, writes us that the General Electric Co. has been awarded the contract for 2 MP. 4-pole 30-K-W. generators of 1,050 revolutions per minute, and slate panels, complete, making a total capacity for the plant of 1,200 16-c. p. incandescent lights.

ENSLEY, ALA.—Press reports state that contracts were let Nov. 1 for the erection of three electric lighting plants at Ensley. One to cost $30,000 will be used for lighting Ensley and Pratt City and the others for use at the new steel mill and by-products plants. The Ensley plant will be built by J. M. Meigham & Co. That for the steel mill will be built by the Excelsior Electric Co., Birmingham, Ala.

HENDERSON, TENN.—It is stated that a company is being organized to build a plant and an electric railway.

MEMPHIS, TENN.—Robt. Moran, Cy. Electrician, is reported by local papers as urging the city to have all electric wires, etc., placed in underground conduits. Mr. Moran recently returned from Northern cities where he secured considerable information.

WARSAW, KY.—The question of building a plant is reported as being considered.

BELLE CENTRE, O.—H. M. Cline, Mayor, writes us that the council at its last meeting passed an ordinance granting a 10-year franchise to the Belle Centre Electric Light & Power Co.

CHICAGO JUNCTION, O.—Louis Simmermacher, Clk., writes us that the following bids were received Oct. 25 for furnishing the materials and for putting in a plant:

Isaiah W. Newcomer, Lebanon, O*	$976
Chas. F. Sturtevant, St. Louis, Mo	11,215
G. P. Jacobs, Chicago Junction	11,150

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*Semi-annual payments for a term of 15 years. The contract was let to Chas. F. Sturtevant.

DAYTON, O.—Henning & Henning, Attorneys, write us that an ordinance was introduced, Nov. 3, before the board of city affairs, asking for a franchise whereby great reductions will be made in the charge for city and private lighting. No definite action has as yet been taken in regard to securing plans, specifications, etc.

LOVELAND, O.—We are informed that nothing is likely to be done in regard to an electric light plant until the spring.

FAIRMOUNT, IND.—Gilbert Larue is securing estimates for a plant to include 40 enclosed arc lamps of 220 volts, etc., according to reports.

HUNTINGBURG, IND.—We are informed that it is proposed to have a company build a plant and lease it to the city for 6% or less on the cost of construction and $1,000 a year on the principle until paid. J. W. Schwartz, Mayor.

CHARLEVOIX, MICH.—This place voted Oct. 31 to issue $10,000 in bonds to purchase the plant of the Charlevoix Electric Co.

WYANDOTTE, MICH.—The council has decided to appeal the case of the Wyandotte Electric Light Co. vs. the City, which Judge Grove recently decided in favor of the plaintiffs, thus restraining the city from interfering with the company's extension of its wires. City Attorney Marr has been instructed to take immediate steps towards carrying it to the supreme court. Alderman Gorman has proposed that the city negotiate with the light company with a view to purchasing the plant. Mayor Gartner has appointed Aldermen Clark, Kiley and Gorman a committee.

CLINTON, ILL.—Bids are asked until about Dec. 1 for constructing a plant, according to reports. Harry Swigart has been granted a 20-year franchise, as noted last week. R. E. Rock has charge of the work.

EDWARDSVILLE, ILL.—Geo. D. Pogue, of the Edwardsville Electric Light & Power Co., writes us that the company wishes to correspond with manufacturers of electrical machinery for the plant to take the place of the one destroyed by fire Oct. 24, causing a loss of about $30,000. The plant will have a capacity for 60 2,000-c. p. arc and 3,000 16-c. p. incandescent lights.

GREEN BAY, WIS.—The plant of the Green Bay Gas & Electric Light Co., it is stated, will be extended at a cost of about $50,000. Sinclair Mainland, Mgr. and Purchasing Agent.

SUN PRAIRIE, WIS.—C. B. Hayden is said to have been granted a franchise for a plant.

ST. PAUL, MINN.—New specifications for lighting have been made whereby more competition may be secured. It is intended to offer a 10-year franchise and permission to do commercial business to the successful bidder. There will be 105 additional arc lights, making a total of 375 arc lights. The contract for lighting the city for one year will be let this month.

INDEPENDENCE, MO.—We are informed that the franchise for a plant for this place applied for by W. T. Felton, Kansas City, Mo., is still pending.

DENVER, COLO.—Aldermen Robt. M. Golder writes us that the aldermen have passed the ordinance granting a franchise to the Denver Power & Irrigation Co. The supervisors will act on the franchise this week; it will probably be passed. The plant will cost about $2,000,000. Address Rhodes Bros., 639 Equitable Bldg., Denver.

DENVER, COLO.—Bids are asked until Nov. 28 for installing an electric and heating plant, etc., for certain buildings at the county poor farm near Henderson. Jos. H. Smith, County Clk.

LEADVILLE, COLO.—We are informed that information in regard to the proposed power plant at Malta, noted last week, may be secured from J. G. White, Engr. and Contractor, 29 Broadway, New York. Thos. W. Jaycox, Leadville, is interested.

COVALLIS, ORE.—Bids were asked until Nov. 4 for furnishing and installing a plant for the state agricultural college at Covallis. E. M. Lazarus, 665 Worcester Block, Portland, Ore.; W. E. Yates, Secy.

PORTLAND, ORE.—Local papers state that surveys are being made for a power plant on the Sandy River. It is supposed that the promoters intend to transmit the power to Portland and Gresham. Judge J. E. Mayo, Portland, is said to be interested.

TILLAMOOK, ORE.—It is proposed to issue $15,000 in bonds for a plant and water-works, according to reports.

CLAREMONT, CAL.—C. G. Baldwin writes us that W. H. Sanders, Pomona, Cal., has made surveys for the proposed power plant at the head of Mill Creek, near Redlands, Cal. The company expects to spend between now and June $200,000 in hydraulic work and electrical installation. The company is not ready to ask for bids. The use will be for pumping water for irrigation and mines in San Jacinto, Lake View, etc.

HEALDSBURG, CAL.—Press reports state that the Healdsburg Electric Lighting Co. has applied to the superior court for an injunction against the city to prevent the sale of $80,000 of bonds for the purpose of constructing water-works and an electric light plant, contracts for which were recently let.

REDLANDS, CAL.—A report from San Bernardina states that the Redlands Electric Light & Power Co. has filed claim to 4,000 inches of water flowing above the surface and underground in Mill Creek, the point of diversion being Aker's Narrows. The water is to be used to develop power to generate electricity and compressed air, drive machinery, produce light and heat, operate all kinds of transportation facilities, and for other mechanical purposes. The power will be transmitted from a power house up Mill Creek canon to all the important towns and cities in Riverside, Los Angeles and San Bernardino counties. The water will be diverted by means of a tunnel 4 ft. wide and 6 ft. high, and a dam 300 ft. in width and 10 ft. high.

ALAMOGORDO, N. MEX.—J. A. Eddy, Alamogordo, N. Mex. and El Paso, Tex. (P. O.), writes us that the Alamogordo Lumber Co. will put in a plant to be operated by waste fuel from the mill. Address C. P. Henderson, Scranton, Pa.

GRANGEVILLE, IDAHO.—H. Orchard, of Portland, Ore., has been granted a franchise for a plant and water-works to cost about $30,000, according to reports.

COLVILLE, WASH.—Paul Laplant has applied for a franchise for a plant and water-works. The power will be secured from the dam on Mill Creek.

OTTAWA, ONT.—Bids are asked until Nov. 10 for furnishing about 4,000 electric light line poles for the proposed electric line for the Metropolitan Electric Co., recently incorporated. The poles are to be 30 to 50 ft. long and 7 ins. in diameter at the top. Jos. Robinson, Montreal, Que., and A. B. Broderick, Ottawa, are interested.

ORILLA, ONT.— We are informed that bids for constructing the proposed plant will be received about Dec. 1. There will be a 10,000-volt transmission plant, two 600-K-W. generators, S. U. and S. D. transformers, 1,000-HP. hydraulic plant. The plant will have a capacity for 50 2,000-c. p. arc and 1,200-c. p. incandescent lights; the power will be transmitted 18 miles; estimated cost of plant, $75,000. Roderick J. Parke, Elec. Engr., Toronto, Ont.

PEMBROKE, ONT.—Estimates for a municipal plant of 50 arc and 3,000 incandescent lights are being furnished by Roderick J. Parke, Toronto.

PRESCOTT, ONT.—We are informed that plans for a plant will be considered immediately after the construction of the proposed water-works and sewerage system which will cost about $100,000. John Galt, Engr., Canada Life Bldg., Toronto; J. B. White, Town Clk.

MONTREAL, QUE.—Wm. C. McDonald, Montreal, has given McGill University $30,000 with which to furnish a department of electrical engineering.

CASCADE CITY, B. C.—It is stated that the machinery for the plant of the Cascade Water Power & Light Co. will be put in next spring. Surveys, etc., are being made by Mr. Anderson.

NEW COMPANIES.—Grand Falls Water Power & Boom Co., Fredericton, N. B., Can.; $1,000,000; to build and operate a plant and mills at Grand Falls, N. B.; Redfield Proctor, U. S. Senator, Burlington, Vt.; Russell A. Alger, Secy. Army Dept., Washington, D. C.; G. A. Hobart, Vice-Pres. U. S., Washington; Sir Wm. C. Van Horne, Pres. Canadian Pacific Ry. Co., Montreal, Que.; Lt. Hugh M. McLean, St. John, N. B.

Fort Smith Traction, Light & Power Co., Fort Smith, Ark.; $200,000; Pres., Samuel McLeod.

New Light Corporation, New York, N. Y.; to manufacture lighting machinery; $10,000; Frank M. Ashley, 97 Greene Ave., Brooklyn.

Bonham Electric Light & Power Co., Bonham, Tex.; $25,000; J. F. Heledge, J. B. Russell, J. N. Rainey, E. F. White.

Joplin Illuminating Co., Joplin, Mo.; $80,000; with three-fourths paid in; John C. Porter, Harrison J. Drummond, John J. Dunham, Francis Kuhn, Charles Nelson.

American Incandescent Lighting Co., Meriden, Conn.; $50,000; Thos. E. Webster, Bay City, Mich.; Lyman T. Lawton, Meriden; Robt. L. Doran, Nashville, Tenn.

BRIDGES.

CANAJOHARIE, N. Y.—Bids are asked until Nov. 15 for a lift bridge over the Erie Canal at Church St. Geo. W. Aldridge, Supt. Pub. Wks., Albany.

HOOSICK FALLS, N. Y.—Bids are asked by the town board until Nov. 13 for constructing the following bridges: 106-ft. span, 16-ft. roadway; 36-ft. span, 16-ft. roadway; 26-ft. span, 16-ft. roadway; 23-ft. span, 16-ft. roadway; two 18-ft. spans, 16-ft. roadway. Capacity of each bridge, 40 lbs. per sq. ft. D. M. Greene, Engr., Troy, N. Y.

HORNELLSVILLE, N. Y.—F. W. Dalrymple, Cy. Engr., has been instructed to advertise for bids for moving the present bridge on Canisteo St. to Van Scoter St., and for building a new bridge with 24-ft. roadway on Canisteo St.

SANDY HILL, N. Y.—It is reported that a new iron bridge will be constructed over the canal next winter. Meanwhile the street railway company will erect a temporary bridge east of the union hose house. Superintendent Kinmouth may be addressed.

BETHLEHEM, PA.—A hearing was to be given Nov. 9 by Jas. M. Porter, Easton, Pa.; J. B. Leith, Hellertown, Pa.; Alexander Singmaster, Macungie, Pa., and others, who have been appointed viewers by the Northampton and Lehigh county commissioners to consider the question of constructing a bridge over the Lehigh River at Main St.

READING, PA.—A resolution has been passed by the council to have S. S. Hoff, Cy. Engr., prepare estimates for both a tunnel and an overhead bridge at Spring St. and a bridge at Pike St. and Philadelphia & Reading Ry.

WILLIAMSPORT, PA.—A petition has been presented to the county commissioners by Armstrong township for a bridge over Mosquito Creek, on the road from Duboistown to Nippenose valley. F. H. Keller, Edward Eldred and John Blair have been appointed viewers.

WILMINGTON, DEL.—The Baltimore & Ohio R. R. Co. will construct a bridge at Fourth and Hawley Sts., according to reports.

NORFOLK, VA.—The council has decided to offer the bridge company $8,000 for the bridge from the first ward to Brambleton and if the offer is not accepted bids will be asked for a new bridge from Mariner to Lovitt Ave.

SALEM, VA.—Walter Watson writes us that the following bids were received Oct. 22 for two bridges:

	80-ft. span.	60-ft. span.
Wrought Iron Bridge Co., Canton, O	$1,010	$895
Champion Bridge Co., Wilmington, Del	1,045	950
Massillon Bridge Co., Massillon, O	1,070	921
Pittsburg Bridge Co., Pittsburg, Pa	1,008	875
Youngstown Bridge Co., Youngstown, O	1,025	855
Bellefontaine Br. & Iron Co., Bellefontaine, O	1,150	900
Geo. E. King Bridge Co., Des Moines, Ia	1,074	967
Canton Bridge Co., Canton, O	1,150	950
Toledo Bridge Co., Toledo, O	1,000	850
King Bridge Co., Cleveland, O	1,120	900
*Virginia Bridge Co., Richmond, Va	1,000	775

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*$1,740 for both bridges. Recommended for acceptance.

CLEVELAND, O.—Plans are being prepared by the park engineer for a proposed stone arch bridge, 60-ft. span, at the Wade Park Ave. crossing of the lower drive in Rockefeller Park.

LORAIN, O.—Bids are asked until Dec. 22 for furnishing the material and for constructing the superstructure for the Black River bridge, as stated in our advertising columns. Geo. H. Lewis, County Audr., Elyria, O.

ZANESVILLE, O.—Bids are asked until Dec. 8 for the material and for constructing the stone work for the west end approach of the Monroe St. bridge. Jas. L. Starkey, County Audr.

ELK RAPIDS, MICH.—The counties of Antrim and Kalkaska have decided to jointly construct a bridge over the Torch River, according to reports.

GRAND HAVEN, MICH.—F. F. McEachron, Dist. Clk., informs us that at the election Oct. 21 the county decided not to construct the proposed two bridges across the Grand River, to cost $10,000 each.

SAGINAW WEST SIDE, MICH.—The Flint & Pere Marquette R. R. Co. has applied to the county supervisors for permission to construct a bridge over the Tittabawassee River, in Saginaw township, according to reports.

MILWAUKEE, WIS.—The park board proposes to construct a viaduct 800 ft. long and 100 ft. wide, on the Highland Boulevard, over the Chicago, Milwaukee & St. Paul Ry.

MINNEAPOLIS, MINN.—L. A. Lydiard, Cy. Clk., informs us that this city was to vote on the question of constructing a new bridge over the Mississippi River, at 32d Ave., at the election Nov. 8.

LEXINGTON, MO.—We are informed that this place is desirous of awarding a contract for the construction of a high bridge or a low draw bridge over the Missouri River, to accommodate wagons and an electric railway, to cost about $50,000. The bridge proper will consist of three single-track fixed spans, each 420 ft. long. Frank Bowman, Secy. Com.

KANSAS CITY, MO.—The park board proposes to construct a stone arch bridge over the Kansas City Suburban Belt Ry., on the extension of Boston Boulevard, to be about 72 ft. long and 40 ft. wide.

WICHITA, KAN.—W. Q. Church, Gen. Mgr., Wichita Ry. Co., writes us that two pile bridges 200 ft. and 300 ft. long, respectively, are to be constructed over the Little Arkansas River.

SHERMAN, TEX.—Bids are asked for furnishing the material and for constructing a steel bridge over Post Oak Creek, on the Bloomer Road. J. H. Wood, County Judge; L. M. Tuck, County Clk.

LOS ANGELES, CAL.—Bids are asked until Nov. 21 for furnishing the material and constructing bridges on Ninth St., Feliz Road, Ave. 26 and Sixth St.; estimated cost, $23,000. C. H. Hance, Cy. Clk.

OAKLAND, CAL.—Bids will soon be asked by the county clerk for repairing the Alice St. bridge; estimated cost, $2,300.

VICTORIA, B. C.—Bids are asked until Nov. 30 for constructing a steel arch bridge at the gorge, Victoria Arm. W. S. Gore, Deputy Comr. of Lands and Wks.

BUILDINGS.

AUGUSTA, ME.—Bids are now being received for a steam heating plant for the Augusta House. Proprietor, H. E. Capen.

BOSTON, MASS.—Bids are asked by the school committee of this city until Nov. 14 for erecting a primary school building in Roxbury; also for furnishing and installing a heating and ventilating apparatus and a plumbing system. Arch., James Mulcahy, 60 State St., Boston.

WORCESTER, MASS.—J. T. Cahill has been awarded the contract for plumbing in the new 8-room school building on Millbury St., at $2,957; and N. J. Deady, for plumbing in the East Kendall St. school building, at $2,985. Other bidders were, O. S. Kendall & Son, F. J. Borden, A. A. McLoughlin and Maher & McGrath.

ALBANY, N. Y.—The trustees of the West Albany Y. M. C. A. have decided to erect a new $20,000 building on Watervliet Ave., near the West Albany Bridge, and has appointed a committee to secure plans and specifications.

AUBURN, N. Y.—The Lehigh Valley R. R. Co. has awarded the contract for the erection of a new passenger station in this city to A. F. Chapman & Co., 476 Ellicott Square, Buffalo, N. Y. The cost of this work, together with new railway shops at Sayre, Pa., will cost about $130,000.

BROOKLYN, N. Y.—Adiel S. Hall, of Brooklyn, was awarded the contract by the armory board, Nov. 4, for changes and improvements to the 22d Regiment Armory, at $4,600.——The state armory board, Nov. 2, awarded the contracts for a new rifle range and improvements to the drill hall of the 47th Armory in Brooklyn to John J. Gillis, of Brooklyn, at $23,065; for gallery seats, to Frank T. Barnes, of New York, at $1,650, and for steam heating plant, to Gaylord & Eitspence, of Binghamton, N. Y., at $11,700.

NEW YORK, N. Y.—Bids are asked by the fire department, 157 East 67th St., until Nov. 16, for erecting a building for the fire department on Maiden Lane, 60 ft. east of Pearl St., Borough of Manhattan; sureties, $15,000; also for constructing and erecting a building on East 12th St., west of University Place, Borough of Manhattan; sureties, $12,000.——Plans have been filed by Thos. J. McGuire, 968 St. Nicholas Ave., for a 7-story brick flat building on Central Park West, near 90th St., to cost $90,000. Arch., Henry S. Howell, 748 East 138th St.; by David Cohen, for four 4-story brick flat buildings at 147th St. and 3d Ave., to cost $86,000. Arch., R. Werner, 7 Teasdale Place; by C. L. La Grassa, 60 Liberty St., for a 7-story brick flat and store building, at 96th St. and the Boulevard, to cost $200,000. Arch., C. Steinmetz; by Peleg C. Smith, Newark, N. J., for ten 4-story brick tenement buildings on Prospect Ave., near 150th St., to cost $140,000. Arch., W. C. Dickerson, 149th St. and 3d Ave.; by William Call, 1133 Broadway, for a 6-story brick flat building on Central Park West, near 94th St., to cost $125,000. Archs., J. E. Ware & Son and H. S. S. Harde, 489 5th Ave.; by Judson Lawson, 898 West End Ave., for a 6-story brick flat building on 117th St., near Manhattan Ave., to cost $70,000. Arch., S. M. Holden; by Francis Crawford, for five 3-story brick dwellings on 118th St., near 7th Ave., to cost $80,000. Arch., A. H. Taylor, 20 West 34th St.

NEW YORK, N. Y.—Bids are asked until Nov. 25 for taking down and rebuilding the west end wall of the rear building of the U. S. Assay Office. Jas. Knox Taylor, Supervising Arch., Washington, D. C.

NEW YORK, N. Y.—Bids are asked by the supervising architect, Washington, D. C., until Nov. 28. for the mailing platform extension and shed for the post-office building in New York, as stated in our advertising columns.

ENGLEWOOD, N. J.—The congregation of St. Paul's Episcopal Church of Englewood contemplates the erection of a new church building to cost about $35,000. Herbert B. Turner is interested.

NEWARK, N. J.—Bids are asked until Nov. 15 for the erection of a home for the aged and disabled firemen. Wm. H. Brown, Chn. of Com.; Ed. A. Wurth, Arch., 748 Broad St.

PHILADELPHIA, PA.—William Steele & Son, 506 Walnut St., have been granted a permit to erect a 7-story building, 48 × 161 ft., for J. & J. Dobson, at 809 and 811 Chestnut St., to cost about $60,000.

PHILADELPHIA, PA.—Charles McCaul, of this city, was awarded the contract Nov. 5 for the erection of the new mint building, at $441,743; time, 18 mos. Mount Desert granite will be used.

WILMINGTON, DEL.—Plans have been prepared, according to reports, for a 6-story office building to be erected at Market and 10th Sts., for Peter J. Ford, to cost $65,000. Arch., E. L. Rice, 503 Equitable Bldg.

BALTIMORE, MD.—An ordinance has been proposed to the city council appropriating $40,000 for the remodeling of the City Hall in order to secure more office space.

WASHINGTON, D. C.—The following proposals have been received by the commissioners for repairing and replacing the plumbing of the Jefferson school building: S. S. Shedd & Bro., $6,377.50; John J. Nolan, $5,200; Wm. Rothwell, $5,200; Ed. J. Hannan, $4,875.

LYNCHBURG, VA.—J. P. Pettyjohn & Co. were the lowest bidders Nov. 1 for erecting the new high school building (except heating), at $18,666. All bids were rejected.

NORFOLK, VA.—Bids have been rejected for the erection of new school buildings in this city, as they all exceeded the appropriation. It is said that $40,000 more will be appropriated, and plans changed accordingly.

FORT CASWELL, N. C.—Bids are asked until Dec. 7 for the construction of a torpedo storehouse at Fort Caswell, as advertised in Engineering News. Capt. W. E. Craighill, U. S. Engrs., Wilmington, N. C.

ABBEVILLE, GA.—Bids will soon be asked, according to reports, for erecting a $20,000 court house after plans by Andrew J. Bryan & Co., of Atlanta, Ga.

ATLANTA, GA.—The Nashville, Chattanooga & St. Louis Ry. Co., lessee of the Western & Atlantic Ry., and the other companies having lines running into this city, have combined to erect a new passenger station on the present site on Wall St., to cost between $200,000 and $400,000.——Plans have been prepared for a new club house to be built by the East Atlanta Land Co. for the East Atlanta Athletic Club, on Edgewood Ave. Archs., Blakely & Tyler, Fitten Bldg.

SAVANNAH, GA.—Bids are asked until Nov. 10 for the construction of hospital wards and other buildings necessary for a general hospital for 1,000 beds, at Savannah. Capt. John W. McHarg, Asst. Q. M. of Vols.

FORT WAYNE, IND.—The trustees of the Indiana school for feeble minded youth has decided to ask for an appropriation of $100,000 to be used in building four cottages on the grounds and in building a large barn on the farm. The appropriation will be asked for in two portions.

CHICAGO, ILL.—A committee consisting of W. A. Giles, Sarah H. Stevenson and Horace Oakley, has been appointed to investigate the advisability of erecting public comfort stations in this city.——Contracts have been awarded by John Hulla, Jr., for a 4-story apartment building to be erected on Grand Boulevard, near 41st St., at a cost of about $30,000.——Permits have been granted to Stanley R. McCormick for two 7-story brick store buildings at 130 and 133 Michigan Ave., to cost $300,000, and for a 6-story brick store building at 136 Michigan Ave., to cost $100,000.——The following bids were received by the supervising architect, Washington, D. C., Nov. 3, for the construction (except heating apparatus) of the extension to the U. S. temporary post office at Chicago:

		Time
E. Earnshaw & Son, Chicago	$31,740	60 days
McEwen Bldg. & Mfg. Co., Chicago	32,400	2 mos.
W. E. Frost Mfg. Co., Chicago	26,596	75* dys
Garthwait, McCall & Co., Chicago	33 883	60 "
Wm. Mayor Co., Chicago	32,565	2 mos.
E. F. Gobel Co., Chicago	31,189	2 "
Congress Construction Co., Chicago	29,879	52* dys
Hennessee Bros. & Evans Co., Chicago	29,500	2 mos.
L. L. Leach & Son, Chicago	32,000	2 "
John C. Robinson, Chicago	31,500	2 "
W. H. & C. J. Mortimer, Chicago	33,478	2 "
Jonathan Clark & Sons, Chicago	32,390	60 days
Ledgewood & Campbell, Chicago	31,954	2 mos.
Greenbaum Construction Co., Chicago	27,973	2 "

*Working days.

CHICAGO, ILL.—The N. E. Frost Mfg. Co., of Chicago, was the lowest bidder Nov. 3, at $26,469, for constructing the temporary post-office building in Chicago; time, 75 working days. As the appropriation for the work was but $20 000, new bids will be called for.

FREEPORT, ILL.—The following bids were received Oct. 31 for erecting the superstructure of the proposed City Hall, using Portage stone; George H. Tandy, Cy. Clk.; D. S. Schureman, Arch., Rockford, Ill.: Smith & Thomas, Freeport, Ill., $33,600; W. J. McAlpine, Dixon, Ill. (accepted), $28,380; Thos. J. Winchester, Rockford, Ill., $29,345.

LA HARPE, ILL.—Carl A. Anderson, of Burlington, Ia., has been awarded the contract for erecting a new school building in the city, at $12,300. The following bids for heating apparatus were received: Pittsburg Heating & Supply Co., $1,849; Law & Barber, Mendota, Ill. (accepted), $1,270; R. Ingraham & Co., La Harpe, $1,450; H. Ewinger, Burlington, Ia., $1,574.

ST. PAUL, MINN.—The contract for placing three smoke consumers on the Madison School building has been awarded to the Northwestern Automatic Smoke Preventer Co., represented by Ralph W. Cavanaugh, at $700.

DES MOINES, IA.—Plans are being prepared for a new 6-story brick, stone and terra cotta store and office building, 66 × 133 ft., to cost about $90,000. Archs., Foster, Liebbe & Co., 8th and Walnut Sts.

GARNER, IA.—Bids are asked until about Dec. 5 for the erection of a new court house. H. V. Reed, County Audr.; Arch., F. W. Kinney, Austin, Minn.

ST. LOUIS, MO.—Daniel Evans, contractor, has been granted a permit for the erection of a new armory building on Grand Ave., near Rutger St., to cost $45,000.——A new 10-story business building, 50 × 114 ft., is to be erected at 6th and Olive Sts., for the Reliance Realty Co., to cost about $200,000. Arch., Theodore C. Link.

SPRINGFIELD, MO.—Plans have been prepared for a hospital building to be erected here for the St. Louis & San Francisco Ry. Co., to cost about $35,000. Arch., Isaac C. Taylor, 900 Columbia Bldg., St. Louis, Mo.

CLEBURNE, TEX.—Bids are asked until Dec. 1 for erecting a new business building for Evans & Hoshour, of this city, to cost about $40,000. Arch., E. H. Silver, Dallas, Tex.

FORT BERTHOLD, N. DAK.—Bids are asked until Nov. 29 for the construction of a brick school building and a water system at the Fort Berthold Agency. W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

PITKIN, COLO.—The store and bank building of R. R. Williams & Co., and many other business buildings, were destroyed by fire Nov. 7, causing a reported loss of $100,000.

SAN PEDRO, CAL.—W. A. Weldon, Chn. Bd. of Trustees, informs us that this city contemplates the erection of a new city hall building, and would like to receive plans for a suitable building. Bonds for the erection of a city hall and for water-works will probably be voted soon.

ST. THOMAS, ONT.—Bids are asked until Nov. 12 for plastering, plumbing, electric wiring, heating, etc., etc., required for the new municipal building. Alderman Sanders, Chn. Bldg. Com.; N. R. Darrach, Arch., Talbot St.

WATER-WORKS.

CHERRYFIELD, ME.—The board of trade is considering the question of building works, according to reports.

CHESTER, VT.—The Chester Water Co. has been incorporated.

ESSEX JUNCTION, VT.—The legislature is reported to have been petitioned to grant this place authority to issue $35,000 in bonds for the proposed works.

ST. JOHNSBURY, VT.—The question of securing an increased water supply is said to be under consideration.

BUFFALO, N. Y.—The Great Spring Water Co. has been incorporated with a capital stock of $10,000 by A. T. Mohr, Dr. F. P. Vandenbergh, Erie County Bank Bldg., Buffalo; J. M. Vandenbergh, John O. Adeit, J. F. Witmer, Civil Engr., 705 Ellicott Square, Buffalo; and W. J. Stanton, of Buffalo, and H. C. Vandenbergh, of New York city.

EASTHAMPTON (L. I.), N. Y.—A company has been organized to build works; capital stock, $25,000. Work will be begun at once, according to reports. Jos. S. Osborne, B. H. Van Sooy and J. T. Gardiner are interested. The works will consist of the following: Four and a-half miles of mains, a water tower 100 ft. × 12 ft., with a capacity of 85,000 gallons, to be built on a foundation of solid concrete, 20 ft. square by 9 ft. in height. Water will be secured from an artesian well 100 ft. in depth. The site chosen will be 35 ft. above the level of Main St. A gasoline engine of 15 HP. will run a triplex pump with the capacity of 8,000 gallons an hour. Twenty-six double nozzle hydrants are to be located 500 ft. apart.

EAST SYRACUSE, N. Y.—An election will be held Nov. 10 to vote on the question of issuing $3,500 in bonds for extending the works.

FISHKILL LANDING, N. Y.—Chas. A. Hague, 39 Cortlandt St., New York, is reported to have been engaged to make a survey for the proposed new works.

GREENPORT (L. I.), N. Y.—G. Corwin, Jr., Village Clk., writes us that the village is about to purchase the works of the Greenport City Water Co., built 10 years ago.

IRVINGTON-ON-THE-HUDSON, N. Y.—Bids are asked until Nov. 15 for furnishing the materials and labor for constructing the proposed reservoir, laying certain water pipe, etc. T. W. Crisfield, Clk. Bd. Trustees.

TROY, N. Y.—It is proposed to extend the mains to Albia so that borough may have a water supply. R. F. Hall, Water Comr.

CAMDEN, N. J.—The East Jersey Coast Water Co., 119 Market St., Camden, has been incorporated to construct water-works; capital stock, $100,000; incorporators, Geo. Reynolds, Ephraim Tomlinson, Peter V. Voorhees and John O. Wilson, of Camden county, New Jersey; H. Bayard Hodge, 1319 Filbert St., Philadelphia, Pa.; J. W. Hawley, Media, Pa.

IRVINGTON, N. J.—The committee has submitted a report on the proposed purchase of the works of the Irvington Water Co. The plant is valued at $49,690.

MILFORD, N. J.—J. W. Flad, Secy. and Treas. Spring Mills Water Co., writes us that the proposed works at Holland will have a reservoir of 1,500,000 gallons capacity, about 32,000 ft. of 10-in. pipe, 8,000 ft. of 3 to 6-in. service pipe, etc. The water will be secured from a spring yielding 50,000 gallons a day. L. A. Francisco, Engr., Easton, Pa.

VAILSBURG, N. J.—Eugene A. McMurray, 22 Clinton St., Newark, N. J., is preparing plans and specifications for supplying the borough with water in those streets which are not supplied by private companies. It is the intention of the borough to purchase the existing pipes and so form a supply throughout the entire borough under the control of the borough authorities. The supply is to come from the Commonwealth Water Co., of Summit.

WESTFIELD, N. J.—Press reports state as follows: A communication from the Westfield Water Co., E. C. Sergent, Pres., and W. S. Welch, Secy., has been presented to the Westfield township committee, asking that the voters of the township be given an opportunity to express their sentiments on the matter of the township owning its own water-works, and stating in substance that if the voters were not in favor of town ownership the company would then construct works.

ALLENTOWN, PA.—Mayor Lewis has signed the ordinance providing for the purchase of the Schantz spring property for $14,000, to be used as a new water supply for the city. The property is located about four miles west of the city.

ALLEGHENY, PA.—The water committee is reported by local papers as favoring the purchase of a new pump for the Montrose works. A pump of 15,000,000 gallons a day and to cost about $60,000 will be needed. J. L. Brown, Supt. Bureau of Water.

GLENSIDE, PA.—The Glenside Water Co. has been incorporated with a capital stock of $1,000 by W. T. B. Roberts, Forrest H. Roberts, J. P. P. Brown, Chester E. Albright, Charles F. Mebus.

WASHINGTON, D. C.—Plans have been made, the land bought and work about to commence on a 15,000,000-gallon reservoir on the high ground between 16th St. extended and Rock Creek Park, west of the Brightwood Driving Park. It will serve the middle high section. Estimated cost, $150,000. W. A. McFarland, Supt. Water Dept.

BALTIMORE, MD.—A company has been organized to purchase the Mount Washington (P. O. Baltimore) works. A number of improvements will be made, according to reports. Capital stock, $25,000. Edward L. Garnard, Gen. Mgr.; Arnold E. Walters, Treas.

DENTON, MD.—Nicholas S. Hill, Jr., of the water department of Baltimore, has made surveys for works to cost about $12,000. A report states that bids will be asked in about three months. Howard Melone, Jos. Nichols and Wm. D. Uhler are on the committee.

ST. MICHAELS, MD.—The town commissioners are considering the question of works, according to reports.

NORFOLK, VA.—J. Thomas Peelle, Registrar, informs us that the following bids were received Oct. 26 for building the proposed addition to the works, as advertised in Engineering News: Sanford & Brooks Co., Baltimore, Md., $124,000, in 300 days; The Degnon-McLean Construction Co., New York, $127,840, in 5 months; $122,840, in 6 months, and $117,840, in 8 months; John Lavelle, Cleveland, O., $115,000, in 4 months; $110,000, in 5 months, and $105,240, in 7 months. John Lavelle declined to comply with his bid. The contract was awarded the Degnon-McLean Construction Co., 1 Broadway, New York, at $117,840, to be completed in eight months.

RICHLAND, GA.—Press reports state that this place has voted to sink an artesian well for a water supply. A company will probably be organized. Population, 500.

GREENWOOD, MISS.—J. L. Gillespie, Cy. Clk., writes us that everything for works and a sewerage system will be wanted, if it is decided to make the improvements. The water will be secured from artesian wells. Population, 2,500. H. G. Kitchell, Engr., Greenwood.

NEW IBERIA, LA.—A. J. Cammack, Secy. and Attorney, writes us that no election has been held to decide the question of building works and light plant. It is not known when the election will be held.

WEST TAMPA, FLA.—Bids are asked until Dec. 5 for furnishing the materials and for building the proposed works, as stated in our advertising columns. J. N. Hazlehurst, Engr., Tampa; M. E. Gillette, Chn. Com.

MEMPHIS, TENN.—Mayor Williams is reported by local papers to be in favor of the city's purchasing the works of the Artesian Water Co.

TULLAHOMA. TENN.—W. H. McLemore, Cy. Clk., writes us that the city will not be ready to ask for bids for works before next spring. Population, 2,500.

CLARINGTON, O.—An election will probably soon be held to vote on the question of issuing $10,000 in bonds for works.

CLEVELAND, O.—Bids are asked until Nov. 25 for furnishing four new cylinders and otherwise repairing and rebuilding Worthington pumping engine No. 4. Geo. R. Warden, Dir. Pub. Wks.

JONESVILLE, MICH.—Bids are asked until Nov. 15 for furnishing materials and for constructing works. There will be required 2,550 ft., 64 tons of 8-in. pipe; 2,600 ft., 45 tons, 6-in. pipe; 17,000 ft., 198 tons, of 4-in. pipe; 5 tons of special castings; three 8-in. valves, three 6-in. valves and sixteen 4-in. valves; 42 fire hydrants; two steam pumps, each with capacity to pump 750,000 gallons per 24 hours; two return tubular boilers, each 60 ins. in diameter and 16 ft. long, or boilers of any other type of equivalent capacity; furnishing all other materials, including tools and labor, and laying pipe and special castings, including the setting of valves and hydrants, pump foundations, boiler settings and connections; for pipe and fittings for connection of supply wells with pumps, and making connections; also for furnishing materials and for constructing one metallic stand-pipe, 16 ft. diameter and 80 ft. high, including foundations and appurtenances. J. D. Cook, Consult. Engr., 56 Law Bldg., Toledo, O.; Chas. F. Wade, Pres.; W. M. Wetmore, Clk.

ALTON, ILL.—The council is again considering the question of building municipal works, plans for which are to be made by R. L. Brown and Geo. C. Morgan, of the Seckner Contracting Co., Chicago, according to reports.

CASEY, ILL.—The question of issuing bonds for works is reported as being considered.

CICERO, ILL.—The Cicero Water, Gas & Electric Light Co. has let a contract to L. Wilson, 53 Dearborn St., Chicago, Ill., to drill an additional artesian well at the works at Oak Park. The well is to be 8 ins. at bottom and is to be 1,600 ft. deep.

ELKHART LAKE, WIS.—An election will be held Nov. 16 to vote on the question of issuing $5,000 on bonds for works.

ALBERT LEA, MINN.—Press reports state that the council water committee has decided to purchase a new 2,000,000-gallon pump, and is considering estimates from eastern concerns.

DULUTH, MINN.—The supreme court has handed down a decision against the city's issuing bonds to purchase the works for $1,250,000.

PELICAN RAPIDS, MINN.—The council is reported as considering estimates for works to cost about $8,000. An election to vote on the question will probably soon be held.

EAST GRAND FORKS, MINN.—The question of building works and a light plant is being considered.

INDEPENDENCE, MO.—H. H. Pendleton, Cy. Engr., writes us that the Independence Water Works Co. was granted a 20-year extension to the franchise at the election Nov. 1. Extensions to the works will be made. R. D. Wirt, Supt.

MEXICO, MO.—Press reports state as follows: The fact was made public Oct. 27 that the bonds of the Mexico Water-Works Co. were recently purchased from New York parties by Samuel A. Locke and M. Butler Guthrie, of this city, who now own the works. The purchase price has not been made public, but it is supposed to be in the neighborhood of $400,000. John J. Steele, Supt. and Treas.

TEXARKANA, ARK.—R. A. Munson, Supt. Water Co. of Texarkana, writes us that no contracts will be let for improving the works; the work will be done by the company's own men.

McKINNEY, TEX.—Bids are asked until Nov. 30 for furnishing the materials and for building works to include the following: One frame pumping station, sheeted and roofed with corrugated iron; one reservoir or pump well 24 ft. in diameter and 12½ ft. deep; one double-acting deep well pump with an approximate capacity of 150,000 gallons in 24 hours and a lift of 450 ft.; one duplex compound high service pump with a capacity of one million gallons in 24 hours against a head of 160 ft.; one boiler plant of 2 tubular boilers 48 ins. in diameter and 16 ft. long, with fitting and all pipe connections, feed water pump and heater; one steel stand-pipe 20 ft. in diameter and 100 ft. high; 4,008 ft. of 12-in. cast-iron pipe with specials and valves; 704 ft. of 10-in. pipe; 3,240 ft. of 8-in. pipe; 11,880 ft. of 6-in. pipe, and 45 fire hydrants. J. M. Pearson, Mayor; W. B. Newsome, Jesse Shain, Water Comrs.

COLVILLE, WASH.—Paul Laplant proposes to build works in connection with the electric plant for which a franchise has been asked.

TILLAMOOK, ORE.—The question of the construction of municipal works and electric plant to cost about $15,000 is being considered.

FERNANDO, CAL.—The question of this place and Pocoima purchasing the works owned by J. P. Widney is being considered.

SAN PEDRO, CAL.—W. A. Weldon, Chn. Bd. Trustees, writes us that the city proposes in the near future to vote on the question of issuing bonds for works and a new city hall. The trustees were advertising Nov. 1 for a site for the works. Population, 2,000.

SONOMA, CAL.—The proposition to issue bonds for municipal works lacked four votes Oct. 24 of being carried. It is stated that another election will be held.

TEMPE, ARIZ.—Bids are asked by Geo. W. Hoadley, of Hoadley, Turnbull & Co., Phoenix, Ariz., for building a pumping plant of 100,000 gallons capacity. Payment will be in bonds.

GRANGEVILLE, IDAHO.—H. Orchard, Portland, Ore., is reported to have been granted a franchise for works and a light plant to cost about $30,000. There will be required six miles of mains.

HAMILTON, ONT.—E. G. Barrow, Engr., has submitted report, etc., on the proposed extension to the works to cost about $161,000 to $181,000. He has recommended that new distributing pipes be laid as soon as possible. About 31,000 ft. to 37,000 ft. of 20, 24 and 30-in. mains are recommended. Councilman Hannaford, Chn. Com.

STAYNER, ONT.—An election will be held in December to vote on the question of issuing $26,000 in bonds for works, according to reports. John Galt, Engr., Canada Life Bldg., Toronto, Ont.

OSHAWA, ONT.—Plans for works, a sewerage system and an electric plant are reported to have been prepared by John Galt, Canada Life Bldg., Toronto. Water will be secured from a spring about 13 miles distant. About 20 miles of mains and 100 hydrants will be needed. Estimated cost, $120,000.

PRESCOTT, ONT.—J. B. White, Town Clk., writes us that the proposed works and sewerage system will cost about $100,000. Bids will probably be asked some time during the winter. Permission to borrow $100,000 will have to be procured from the legislature. The water supply will be secured from the St. Lawrence River. John Galt, Engr., Canada Life Bldg., Toronto, Ont.; A. Whiting, I. W. Plumb and John Steel are on the committee.

SANDWICH, ONT.—This place will soon vote on the question of raising $1,500 for extending the water mains.

WATERLOO, ONT.—An election will be held Nov. 21 to vote on the question of issuing $50,000 in bonds for purchasing the works of the Waterloo Water Co. and also for improving the plant.

HAVANA, CUBA.—Bids are asked by the Quartermaster's Department, Army Bldg., Whitehall St., New York city, until Nov. 15 for furnishing for the new water-works at Havana, a 5¼ × 3½ × 5-ft. boiler feed pump, 3 duplex compound engines, 180,000 ft. of ¾ to 8-in. wrought and cast-iron water pipe, valves, faucets, bends, sleeves, tees, 14 cypress tanks, 20 tons soft lead, packing, etc. Goods to be delivered on board vessel at the wharf at Savannah, Brunswick, Ga.; Charleston, S. C.; Newport News, Va.; or New York.

VERA CRUZ, MEX.—Arrangements have been completed for works to cost about $600,000, to be paid for in 12 annual installments of $50,000 each. The water supply, it is said, will be taken from the Cotaxtla River.

LONDON, ENGLAND.—Reports state that the London county council last week decided by a large majority in favor of compulsory purchase of the works of all the London water companies, involving many millions of pounds sterling. Such a bill, however, will meet with great opposition in Parliament, where the vested interests are exceptionally strong.

COOLGARDIE, WEST AUSTRALIA.—English papers state that the government has decided to award the contracts for furnishing the pipe for the Coolgardie waterworks to G. & C. Hoskins, Sydney, New South Wales, and Mephan Fergusson, Melbourne and Perth. The two bids amount to about $5,450,000. There will be 61,832 lengths of 30-in. seamless pipe, each length 28 ft. long. A description of the proposed works was given in our issue of Feb. 10. C. Y. O'Connor, Engr.-in-Ch., Perth, Western Australia.

ST. PETERSBURG, RUSSIA.—A company is reported to have been organized to improve the works of this city and also to build a sewerage system; capital stock, $2,250,000.

IRRIGATION.

RIVERSIDE, CAL.—W. V. Covington has filed a claim to 600 ins. of water in the Whitewater and Snow Creek Junction, to be used for domestic, irrigation and mechanical purposes, according to reports.

SALT LAKE CITY, UTAH.—The council committee on irrigation is considering a proposition of the North Point Irrigation Co. to conduct the river water around White Lake, at a cost of about $5,000, or that the drain be extended to Salt Lake, which will cost about $30,000. E. W. Taylor, Arthur Parsons and T. J. Almy are interested.

McCAMMON, IDAHO.—A system to irrigate about 500,000 acres of land is about to be constructed by the Inter-State Canal & Power Co. George C. Parkinson, Pres., Preston, Idaho; Supt., Chester Call, Chesterfield, Idaho; Bishop E. G. Farmer, Treas., and James McMurris, Secy. A masonry dam will be constructed on the Bear River, south of Soda Springs, Idaho, to cost about $16,000. Surveys have been completed by John D. H. McAllister, Salt Lake City, Utah, for the canal which will tap the Bear River above the dam, and run about 11 miles in a northwesterly direction, covering about 20,000 acres.

NEW COMPANIES.—Consolidated Reservoir Co., Sheridan, Wyo.; $5,000; to construct the Martin reservoir to store water from Cross Creek in Big Horn county; W. E. Jackson, P. L. McKee, W. J. Croghan, F. M. Milligan and L. E. Martin.

Cedar-Mesa Ditch & Reservoir Co., Denver, Colo.; $1,000; to build ditches in Dela county and furnish power for irrigation, power, etc.; John W. Gallant, Daniel W. Hale, Harry E. Hale, Daniel S. Baldwin, and Harvey W. Stanley.

West Cache Irrigation Co., Trenton, Utah; $30,000; Myron W. Butler, Pres.; Charles G. Wood, Secy. and Treas.; Parley Merrill, George W. Adams, William Brigham and Joseph Wood.

Prenda Pumping Co., Riverside, Cal.; $50,000; to pump and deliver water for irrigation to the high lands above the Gage canal system. The water will be pumped from the canal by electrical power. W. G. Irving, Pres.; R. Henderson, Secy.; R. P. Winters and Robert M. Irving.

SEWERAGE.

BOSTON, MASS.—The North American Sewage Disposal Co. has been incorporated with a capital stock of $1,000,000 to build and operate sewage disposal plants and sewerage systems in cities of the United States. Perlie A. Dyar, Pres., Boston, Mass.; Henry W. Bowen, Treas., Roslindale, Mass.

MIDDLEBORO, MASS.—C. E. Grinnell and others have asked the state board of health to build a new system for this place.

SOUTHBRIDGE, MASS.—C. W. Hill, Clk. Com., writes us that plans for a system have been made, but no further action in regard to the matter has been taken.

BROOKLYN, N. Y.—The following bids were received Nov. 2 by the commissioner of sewers for building the 18th Ave. sewer for the Brooklyn Disciplinary Training School: John J. Cream, $4,591; Sigretto & Laurina, $4,585; James Jennings, $4,557; James Cacavajo & Co., $5,074; Mike Marrone, $8,635.

LIBERTY, N. Y.—Plans have been prepared for a system to cost about $32,000. A report states that other estimates make the system cost about $75,000.

NYACK, N. Y.—Bids are asked until 2 p. m., Nov. 10, for the purchase of $5,000 of 4% sewer bonds. J. M. Gesner, Village Treas.

SKANEATELES, N. Y.—Fred. Thomas, Civil Engr., is urging the board of trustees to build a system.

STAPLETON (S. I.), N. Y.—The question of issuing $238,000 in bonds for new sewers in this borough is being considered by the board of local improvements, Richmond Borough. Henry P. Morrison, Deputy Comr. of Sewers.

YORK, PA.—The York Sewer Co. has been incorporated with a capital stock of $1,000, by. D. F. Lafean, L. A. Marshall, and C. C. Frick.

HAGERSTOWN, MD.—The council is considering the question of building a system.

NASHVILLE, TENN.—The board of public works has asked for bids for building new sewers in Deluge and Grunby Sts.

HAMILTON, O.—Bids are asked until Nov. 25 for constructing storm sewers in three streets. L. A. Dillon, Cy. Engr.; M. O. Burns, Clk.

ELKHART, IND.—Bids are asked until Nov. 23 for constructing a sewer in Harrison St. D. F. Cordrey, Cy. Engr.

CHICAGO, ILL.—Bids are asked until 11 a. m., Nov. 11, for the extension of section No. 2 of the intercepting sewers as follows: About 1,370 ft. of 5-ft. brick sewer in Sheridan Road, from Pratt Ave. to Lunt Ave.; 1,365 ft. of 4½-ft. brick sewer in Sheridan Road, from Lunt Ave. to Touhy Ave.; 1,270 ft. of 3¾-ft. brick sewer in Sheridan Road, from Touhy to Bryan Ave.; length, about 4,005 ft.; estimated cost, $30,000; and also for building other brick sewers. L. E. McGann, Comr. Pub. Wks.

JERSEYVILLE, ILL.—Bids are asked until Nov. 12 for constructing a 12-in. pipe sewer in a certain district. H. H. Snell, Chn. Com.

VENICE, ILL.—The councils of Venice and Madison have decided not to join with Granite City for a proposed joint sewerage system.

MADISON, WIS.—Bids are asked until 7.30 p. m., Nov. 11, for machinery, buildings, etc., in connection with the sewage disposal works, as follows: Two buildings, 1 30-HP. dynamo, 4 motors, 1 triplex pump, 2 centrifugal pumps, 1 sludge press, 1 chemical mixer and tank, 2 gasoline engines, water wheel connections and governor, 12,000 ft. copper wire for power circuit, lamps and wiring, poles, etc., etc. Plans and specifications may be seen at the engineer's office, Madison, Wis., and at the Builders' & Traders' Exchange, Milwaukee and Chicago, Ill. O. S. Norsman, Cy. Clk.; McClellan Dodge and John Nader, Engrs.

ST. CLOUD, MINN.—The proposed system for this place will cost about $23,000, according to reports.

COLUMBUS, NEB.—C. J. Garslow, Secy. and Treas. Columbus Sewer Co., writes us that the contracts for building three miles of 10, 8 and 6-in. pipe sewers have been let to Dussell & Sale and J. W. Fouble, of Columbus. Ernest Stenger, Engr., Omaha, Neb.

CARROLLTON, MO.—Alex. Trotter, Comr., writes us that nothing has yet been done in regard to securing a system except to vote to issue bonds, as noted last week. The bonds up to Nov. 1 had not been sold.

INDEPENDENCE, MO.—H. H. Pendleton, Cy. Engr., writes us that this city voted Nov. 1 to issue $75,000 in bonds for a system.

KANSAS CITY, MO.—The South Highlands Land & Improvement Co has been incorporated with a capital stock of about $150,000 to improve what is known as Roanoke Place. It comprises about 118 acres. Sewers will be put in next year, besides considerable pavement will be laid. Edward E. Holmes, Real Estate Agent, and Jas. Haggart are interested.

SHERMAN, TEX.—The Sherman Sewerage Co. has been incorporated in New Jersey with a capital stock of $250,000 to build a system in this city. Geo. W. Ruch, Pres., 2851 Hutchinson Ave., Philadelphia, Pa., may be addressed. E. M. Kearney, Cy. Secy.

SPOKANE, WASH.—Fife & Conlan and Peter Costello submitted the lowest bids Oct. 25 for building sewers in Lincoln St., Main Ave. and Peaceful Valley, at $5,666 and at $6,882, respectively.

GRASS VALLEY, CAL.—The board of trustees is being urged to take immediate steps towards a system.

NEVADA CITY, CAL.—Press reports state that the board of trustees is considering the question of engaging an engineer to prepare plans for a system.

MONTREAL, QUE.—City Surveyor St. George has submitted specifications for a sewage disposal plant on the Fraser property at the far end of St. Denis St.

OSHAWA, ONT.—John Galt, Toronto, has prepared plans for a system and water-works to cost about $120,000, according to reports. The question of issuing the necessary bonds will probably be voted upon in January.

PRESCOTT, ONT.—J. B. White, Town Clk., writes us that the proposed system and water-works will probably cost about $100,000. Bids will be asked about March. John Galt, Engr., Toronto, Ont.

NELSON, B. C.—The aldermen have decided to build sewers in several streets. Mayor Houston and Alderman Whalley may be addressed.

VERA CRUZ, MEX.—Press reports state that Pearsons & Sons will begin the construction of the proposed system as soon as the harbor works are completed.

MORECAMBE, LANCASTER, ENGLAND.—The question of building a sewerage system and a disposal plant for this district at a cost of about $300,000 is being considered. Col. W. Langton Coke, Local District Council Board Inspector, may be addressed.

ST. PETERSBURG, RUSSIA.—Press reports state that a company has been organized to build a system and for improving the water-works of this city. Capital stock, $2,250,000.

GARBAGE DISPOSAL—STREET CLEANING

NEW ROCHELLE, N. Y.—Frederick Lorenzen, 145 Franklin Ave., writes us that there is no present expectation of building a garbage crematory. This place is under a village government with a special charter and has little or no power to raise money except by vote of the taxpayers, and a favorable vote probably cannot be secured at this time. The thickly settled part of the village is in need of a crematory but the outside taxpayers will vote the proposition down. New Rochelle has 14,000 to 15,000 inhabitants and tried to get a city charter last winter. The bill passed both houses of the legislature, but Gov. Black did not sign it. The people will make another effort this year and will probably succeed. If the city government is established one of the first things to be done is to be the building of a garbage crematory.

JERSEY CITY, N. J.—Bids will be asked by the street and water board until about Dec. 1 for collecting the ashes and garbage for one year.

CLEVELAND, O.—Bids are asked until Nov. 25 for cleaning the paved streets for the year ending Dec. 31, 1899. Geo. R. Warden, Dir. Pub. Wks.

CHICAGO, ILL.—A statement indicating that $365,526 had been expended in disposing of the city's garbage during the present year up to Oct. 1 has been submitted to Mayor Harrison. The report is to be considered in connection with the adoption of a new plan for removing garbage and ashes. The total appropriation for the year was $417,060. The unexpended balance on hand Oct. 1 was $51,534.30, and Superintendent of Streets M. F. Doherty says this sum is sufficient to continue the present service until January. It was decided Nov. 1 not to have the city build plants, but to ask for bids for collecting and disposing of the garbage according to the specifications of the five-year contract. Propositions from various companies are being considered.

WASHINGTON, D. C.—Dr. Wm. C. Woodward, Health Officer, has recommended that bids be asked not later than December, 1899, for collecting and removing the garbage, etc. The present contract expires June 30, 1900.

ST. JOSEPH, MO.—The health department is considering methods and estimates of various garbage disposal plants.

ALAMEDA, CAL.—The question of a municipal crematory is being considered.

STREETS AND ROADS.

BUFFALO, N. Y.—A resolution has been passed by the council to pave Glenwood Ave., from Main to Purdy St. ——The board of park commissioners has decided to construct a new drive on Humboldt Parkway, between Kensington and Delaware Aves.; also to issue $5,000 in bonds for the work.——A contract has been awarded to Henry C. Burgard, at $13,750, for surfacing Cherry St., between Michigan and Virginia Sts., with Alcatraz asphalt. A. H. Beyer, Chn. St. Com.

NIAGARA FALLS, N. Y.—Reports state that Henry C. Burgard, Buffalo, has been awarded a contract to lay asphalt pavements on Second and Cherry Sts., at $15,025.

PORT CHESTER, N. Y.—The highway commissioners have asked for an appropriation of $25,950 for the maintenance of the town roads.

MAY'S LANDING, N. J.—A petition was presented to the board of freeholders Nov. 2 for a road from Pleasantville to May's Landing; also for the completion of the Longport Drive through Great Egg Harbor township.

NEW PROVIDENCE, N. J.—A petition has been presented to the board of freeholders, Elizabeth, N. J., for the extension of South St. to the county line, a distance of three miles; estimated cost for macadam, about $7,750.

PLAINFIELD, N. J.—Bids are asked until Nov. 21 for furnishing the material and for macadamizing on East 9th St., East 6th St., and Franklin Place. Jas. T. MacMurray, Cy. Clk.

VAILSBURG, N. J.—Eugene A. McMurray, Borough Engr., informs us that the borough is about to close the contract for laying about 40,000 sq. ft. of cement sidewalk, with W. H. Farrell, 122 Clinton St., Newark, N. J.

PHILADELPHIA, PA.—The Fairmount Park committee has recommended the ordinance to macadamize Lincoln Ave. at a cost of $25,000.

SCRANTON, PA.—A contract was awarded Nov. 3 to the Alcatraz Co., New York, for paving Hyde Park Ave., from Lafayette to Division St.

SHARPSBURG, PA.—Booth & Flinn, Ltd., were awarded a contract Nov. 1, at $60,000, for asphalt and brick paving. The work will probably not be commenced before spring. T. R. Higgins, Clk.

SHIPPENSBURG, PA.—G. W. Wilt, Ch. Burgess, informs us that the question of issuing $10,000 in bonds for paving was to be voted upon Nov. 8. A contract for the work, if authorized, will not be let until spring.

BERKLEY, VA.—Bids are asked until Nov. 14 for curbing, guttering and macadamizing on Berkley Ave. A. H. Martin, Chn. Improvement Bd.

NORFOLK, VA.—W. T. Brooke, Cy. Engr., writes us that nothing has been done in connection with the paving of Brambleton and Park Aves. A vote will be taken at the election this fall to decide whether bonds shall be issued for the work.

PETERSBURG, VA.—N. T. Patterson, Jr., Pres. Council, writes that at the meeting of the council Nov. 1 the committee on streets asked authority to employ an expert to determine the best material to be used in paving Sycamore and other streets. At a conference of the finance and street committee it was agreed to recommend to the council that $50,000 be expended, and perhaps more, in the improvements of streets.

NEW ORLEANS, LA.—Plans will be prepared by A. C. Bell, Cy. Engr., for the paving of about 30 streets; estimated cost, about $300,000.

BRIDGEPORT, O.—John A. Fawcett, Clk., informs us that at the election Nov. 8 the question of issuing $75,000 in bonds for street improvements was to be voted upon.

FINDLAY, O.—Bids are asked until Nov. 10 for constructing sidewalks on North Main and three other streets. A. W. Ray, Cy. Clk.

NORWOOD, O.—Bids are asked until Nov. 21 for the purchase of $3,791 of 6% street improvement bonds. W. C. Wichgar, Clk.

SPRINGFIELD, O.—The board of public affairs has passed a resolution to improve Sherman Ave., from Harrison St., east.

CARTHAGE, ILL.—Reports state that the council has passed an ordinance to pave on North Main St.; estimated cost, $3,592.

WILMETTE, ILL.—Bids are asked until 7:30 p. m., Nov. 11, for grading, curbing and paving on Gregory Ave. Louis J. Pierson, Bd. Local Improvements.

WILWAUKEE, WIS.—The park board has resolved to extend the Highland Boulevard from 35th St. to the south entrance of West Park, to be 100 ft. wide. It is also planned to build a drive south from Highland Boulevard on Washington Ave. or 27th St., to the valley and across a viaduct to the south side.

CARROLLTON, MO.—Alex. Trotter, Chn. Com., informs us that the city is ready to let contracts and to employ an engineer for the proposed paving and sewers, for which $50,000 in bonds has recently been authorized.

BEAUMONT, TEX.—R. E. Kelley, Alderman, writes us that L. E. Beadle, Beaumont, is preparing plans for paving. Bids will be asked in about a month.

DALLAS, TEX.—Bids are asked until Nov. 14, for about 11,400 sq. yds. of asphalt and brick paving. I. A. Moore, Cy. Secy.

DALLAS, TEXAS.—The question of paving Main and Elm Sts. between San Jacinto St. and Washington Ave. is being considered. John H. Traylor, Mayor.

LOS ANGELES, CAL.—Bids are asked until Nov. 17 for furnishing 2,347 cu. yds. of gravel on Vernon Ave. T. E. Newlin, County Clk.

SACRAMENTO, CAL.—Plans will be prepared by J. C. Boyd, County Surv., for the macadamizing of Magnolia Ave.

TORONTO, ONT.—It is reported that the board of control has awarded the following contracts for paving: Dominion Paving & Construction Co., King St., brick paving, $6,183; Euclid Ave., cedar block, $3,107; Queen St., brick, $7,363; Construction & Paving Co., Sorauren Ave., brick, $9,018; W. F. Grant & Co., Queen St., Scoria Block, $5,432.

MANUFACTURING PLANTS.

BERLIN, N. H.—A. N. Gilbert has been awarded the contract for the construction of a bleachery, 110 × 65 ft., for the Burgess Sulphite Fiber Co.

BOSTON, MASS.—The factory building of the Trimount Mfg. Co., on Armory Ave., Roxbury, was burned, Nov. 5, damaging much machinery; reported loss, $15,000.

WINSTED, CONN.—Reports state that the M. E. Moore Bronze & Silverware Co., of New York, has decided to remove its entire plant to Winsted, near Ansonia.

GLEN COVE (L. I.), N. Y.—A fire in the National Starch Mfg. Co.'s plant, Nov. 3, caused damage estimated at $175,000.

GLOUCESTER CITY, N. J.—The Gloucester Mfg. Co. is said to be about to erect large additions to its present plant on adjoining land.

ALLENTOWN, PA.—James Nagle & Son, of Allentown, are reported to have been awarded the contract for erecting a new silk mill in this city.

BEAVER FALLS, PA.—Ground has been broken for the foundation of the large building to be erected on 3d St. for the Union Drawn Steel Co., but the contract for the building has not yet been let.

ELLWOOD, PA.—It is announced that the American Lamp & Brass Co., of Trenton, N. J., is to establish a new factory at Ellwood, at once, near the present plant of the Ellwood Tin-Plate Co.

JOHNSTOWN, PA.—It is reported that the American Specialty Enameling Co. has closed an agreement whereby it will erect a hollow-ware and enameling plant at this place.

SAYRE, PA.—A. F. Chapman & Co., 476 Ellicott Square, Buffalo, N. Y., have been awarded a contract by the Lehigh Valley R. R. Co. for the construction of new railway shops at Sayre, consisting of a cabinet shop, 75 × 200 ft.; a blacksmith shop, 75 × 200 ft., and a paint shop, 224 × 240 ft. The buildings will be of brick and stone, with iron truss roofs, with improved saw-tooth roofing on the paint shop. These contractors have also been awarded tht contract for erecting a new passenger station at Auburn, N. Y., the total cost of all the work being about $130,000.

WILKESBARRE, PA.—A new dye house, 24 × 30 ft., will soon be built for the Lee Park knitting mills. Pres., W. P. Morgan.

RICHMOND, VA.—Henry L. Valentine and others contemplate the purchase of the Haxhall mills, at a cost of $135,000, for the purpose of establishing a large paper and pulp mills.

PARKERSBURG, W. VA.—Reports state that the Oil Well Supply Co., of Pittsburg, will erect a large plant in this city for the manufacture of oil rigs and reels.

ATLANTA, GA.—Matthew and Thomas W. Prior, of Philadelphia, Pa., and others are said to contemplate the erection of a new cotton gin factory in Atlanta. W. T. Forbes, of Atlanta, is interested.

HARMONY GROVE, GA.—The erection of a new cotton mill is being contemplated by G. W. D. Harber, of Harmony Grove.

ENSLEY, ALA.—P. G. Shook, Secy. of the Alabama Steel & Shipbuilding Co., of Ensley, informs us that contracts have not yet been let for erecting the company's new plant at this place, nor has the time yet been determined when bids will be received.——Press reports state that the Alabama Steel & Wire Co. has let the contract for erecting a wire, rod and wire nail mill, with a daily capacity of 600 tons, at Ensley, to the Garrett Engineering Co. Secy., G. H. Schuler, Cleveland, O.

AKRON, O.—It is reported that the Franz Body Mfg. Co., now at Berlin, O., will remove its plant to this city. The company has just been incorporated with a capital stock of $60,000, for the manufacture of vehicle bodies.

CLEVELAND, O.—The works of the Standard Wheel Co., at 44 Bessemer Ave., were burned, Nov. 5, causing an estimated loss of $80,000.

TOLEDO, O.—Henry Speiker has been awarded the contract for erecting the Toledo Lamp Chimney Co.'s works on Detroit Ave; the building will cost about $20,000, and the machinery about $50,000.——W. H. Stewart, of Cincinnati, O., expects to erect a new building for the use of the Maumee Brewing Co. Architect Wachter may be addressed.

LAPEER, MICH.—The lumber and shingle mill of Robert King was destroyed by fire, Nov. 2, causing a reported loss of $50,000.

CHICAGO, ILL.—Contracts are said to have been let for erecting a brick, stone and iron brewery for Virgil M. Brand, at Elston Ave. and Snow St., to cost, complete, about $150,000. Arch., Louis Lehle.

SACRAMENTO, CAL.—A fire in the extensive railway shops of the Southern Pacific Ry. Co., damaged property valued at $200,000.

PORT ANGELES, WASH.—It is reported that Homer H. Swaney and others, of McKeesport, Pa., will build a new steel plant at this place, to employ about 100 hands. Work is expected to begin on the construction on Jan. 1.

SHANGHAI, CHINA.—Reports state that the Shanghai Ice, Cold Storage & Refrigerating Co., Ltd., of Shanghai, is said to be making preparations to purchase an ice-making plant of the latest and best design. American manufacturers will have an opportunity to compete. The company is capitalized at $65,000.

GAS PLANTS.

MILWAUKEE, WIS.—Bids are asked until 2 p. m., Nov. 10, for furnishing and installing gas and electric light fixtures in the U. S. building. O. L. Spaulding, Acting Secy., Treasury Dept., Washington, D. C.

NEW COMPANIES.—Clinton Gas Co., Prudential Bldg., Newark, N. J.; $100,000, with $1,000 paid in; to manufacture, sell and distribute illuminating and fuel gas throughout Essex and part of Hudson counties; Edward H. Wright, Jr., Edward J. Whitney, Nellie B. Crawford, Prudential Bldg., Newark, N. J.

Polk Creek Oil, Gas & Fuel Co., Weston, W. Va.; $50,000, with $16 paid in; to operate for oil and gas; S. E. Barrett, Andrew Edmiston, F. G. Orr, W. B. McGary, E. G. Davesson, Weston, W. Va.

MISCELLANEOUS CONTRACTS.

ELECTRIC FANS.—Dothen, Ala.—J. W. Jones asks for the address of manufacturers of electric fans.

WHARF.—Washington, D. C.—Bids are asked until Nov. 19 for constructing a wooden wharf at the naval magazine. Chas. O'Neil, Ch. Bureau Ordinance.

BOILERS.—Brooklyn, N. Y.—Bids are asked until Nov. 26 for furnishing boilers for the navy yard. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

BOILERS.—Boston, Mass.—Bids are asked until Nov. 26 for furnishing boilers at the navy yard. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

WHARF.—Bruce Mines, Ont.—The provincial government has appropriated $6,000 for the construction of a wharf at Marks St. R. E. Miller, Reeve, may be addressed.

TUG BOAT.—San Francisco, Cal.—Bids are asked until Nov. 28 for furnishing one tug boat. Lt.-Col. Oscar F. Long, U. S. Q.-M., 36 New Montgomery St., San Francisco.

TELEPHONE SYSTEM.—Paducah, Ky.—A franchise was granted Oct. 25 to the American Electric Telephone Co. The company has already secured over 400 subscribers.

CONDENSER TUBES.—Mare Island, Cal.—Bids are asked until Nov. 29 for furnishing condenser tubes for the navy yard. Edwin Stewart, Paymaster-Gen., Washington, D. C.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Nov. 15 for furnishing at the navy yard brass wire, block tin, slab zinc, pig iron, steel drill rods, etc. Edwin Stewart, Paymaster-Gen.

PARK WORK.—Cleveland, O.—Bids are asked until Nov. 16 for grading, draining, etc., of Edgewater Park, and for furnishing the materials. C. W. Pratt, Jr., Ch. Engr., Bd. Park Comrs., 185 Euclid Ave.

WHARF.—Toronto, Ont.—It has been decided to construct a wharf between Lorne and York Sts., with a frontage of 315 ft. and 500 ft. deep; estimated cost, $39,000. Address Alderman Sheppard.

SEAWALL.—Staten Island, N. Y.—Bids are asked until Dec. 1 for constructing a sea wall at the U. S. light-house depot, as stated in our advertising columns. Lt.-Col. D. P. Heap, U. S. Engr., Tompkinsville, S. I.

CRANE.—Brooklyn, N. Y.—Bids are asked until Dec. 10 for furnishing a crane of 100 tons capacity for the navy yard; appropriation, $100,000. M. T. Endicott, Ch. Bureau of Yards and Docks, Washington, D. C.

EXTENDING CANAL.—New Orleans, La.—Bids are asked until noon, Nov. 10, for cleaning and extending the Claiborne Canal, between Elysian Fields St. and Jourdon Ave. F. G. Freret, Secy. Drainage Comn., City Hall.

ENGINE AND BOILERS.—Fairmount, Ind.—Reports state that Gilbert Larue wishes to purchase one 14 × 16-ft. automatic engine and two 54 × 64-in. horizontal tubular boilers, with pipe fittings, duplex boiler feed pump, etc.

WHARF AND ROADWAY. — San Francisco, Cal.—Reports state that bids will soon be asked by the navy department, Washington, D. C., for constructing a wharf 200 ft. long and a 1,200-ft. roadway; estimated cost, $6,500.

DAMS.—Sacramento, Cal.—The commission of public works has in contemplation the construction of about 35 wing dams in regard to shoaling the Sacramento side of the river. Nothing will probably be done until next summer.

REMOVING WRECK.—Philadelphia, Pa.—Bids are asked until Dec. 5 for removing the wreck of the schooner "Joseph R. Ellis," in the Delaware River, near Tinicum Island. Lt.-Col. C. W. Raymond, U. S. Engr., 1428 Arch St., Philadelphia.

STEAMER AND FREIGHT SHEDS BURNED.—Collingswood, Ont.—The steamer "Pacific," owned by the Great Northern Transit Co., and the Grand Trunk wharves were burned Nov. 3. The steamer was valued at $65,000; insurance, $25,000.

CONDUIT SYSTEM.—Erie, Pa.—Bids are asked by the council until 5 p. m., Nov. 10, for the extension and equipment of the fire alarm, telegraph and police patrol conduit systems; appropriation, $2,500.——The bids opened Oct. 27 for electric conduits are given under Contract Prices.

CANAL.—Tampico, Ill.—Bids are asked until Dec. 6 for constructing about eight miles of feeder canal of the Illinois & Mississippi Canal, near Tampico, as stated in our advertising columns. Address Maj. W. L. Marshall, U. S. Engr., 1637 Indiana Ave., Chicago, or Asst. Engr. L. L. Wheeler, Sterling Ill.

SCALES, ETC.—Washington, D. C.—Bids are asked until Nov. 29 for furnishing for use of the Customs Service, during the period of one year from Jan. 1, 1899, such scales, beams, weights and other weighing apparatus and repairs of the same, as may be required, and to be delivered free of all charges for freight. O. L. Spaulding, Acting Secy., Treasury Dept., Washington.

TUNNEL.—London, England.—Bids the asked by the London county council until Jan. 24 for constructing a tunnel for pedestrian traffic under the River Thames, between the Poplar and Greenwich sides of the river. There will be a vertical shaft and staircase at each end of the tunnel. Plans and specifications may be secured, upon depositing $50, from the engineer's department, County Hall, Spring Gardens, S. W., London.

FIRE APPARATUS.—New York, N. Y.—Bids are asked until Nov. 16 for furnishing one double-extra first size steam fire engine, with La France pump and boilers; surety, $2,500; two double-extra first size steam fire engines, with Fox sectional water tube boilers; surety, $4,500; four first size hose wagons; surety, $1,200; 40 fire alarm boxes and 52 keyless doors for fire alarm boxes. John J. Scannell, Fire Comr., 157 East 67th St.

TRAVELING CRANE.—Norfolk, Va.—Reports state that the following bids were received Oct. 29 for furnishing a traveling crane at the navy yard: Morgan Engineering Co., Alliance, O., $14,952; William Sellers & Co., 1600 Hamilton St., Philadelphia, Pa., $11,980; Henry S. Manning, 111 Liberty St., New York, $14,221; The Wellman-Beaver Engineering Co., 1404 New England Bldg., Cleveland, O., $19.760.

FIRE ALARM SYSTEM CUT-OUTS.—Rochester, N. Y.—Local papers state that Louis W. Miller, of the Rochester Electrical Mfg. Co., which manufactures the Miller patent cut-out for protection of fire alarm and police telegraph boxes, has made a contract to equip the fire alarm and police systems of Brooklyn, N. Y., and Paterson, N. J., with the patent cut-out. There are 1,200 fire alarm boxes and 900 police boxes in Brooklyn. Rochester is the only city at present where fire alarm and police boxes are protected.

PUMPING.—San Francisco, Cal.—The executive committee of the Comstock Pumping Association has let the contract for draining the water 500 ft. below its present level (20 ft. below the Sutro Tunnel sill floor), which is as far as the present available power from water pressure for running the pumping machinery will permit, to the Risdon Iron & Locomotive Works, of San Francisco, at $30,000, payable in installments, and work guaranteed. Work will begin in a few days. The pumps are to handle about 13,000 gallons of water a minute.

TELEGRAPH LINES, ETC.—Tokyo, Japan.—We are informed that Saitaro Oi, of the Ministry of Communications, is visiting the United States to secure information in regard to telegraph lines, underground electric conduits, etc. The traffic throughout the islands has so greatly increased in the last few years that it has become necessary to extend the telegraph lines. The government will spend in all about $20,000,000 for this purpose. There are now in the country 50,000 miles of telephone lines, and many miles more are under construction. Mr. Oi will be in the United

States about a month, after which he will visit Europe, and will return to Japan by way of New York. His address while in the United States is care of S. Kondo, Pres. Japan-American Commercial & Industrial Association, Times Bldg., New York.

METAL WORK.—Mobile, Ala.—Lt.-Col. A. N. Damrell, U. S. Lighthouse Engr., Mobile, informs us that the following bids were received Oct. 31 for furnishing the metal work for six iron spindle day beacons for the Florida Reefs, Fla., advertised in Engineering News, Oct. 20:

Allentown Rolling Mills, Allentown, Pa	$2,328
Jonson & Co., Brooklyn, N. Y.	2,248
Tacony Iron & Metal Co., Tacony, Philadelphia, Pa.	2,190
Atlanta Machine Works, Atlanta, Ga	1,695
Chamblin & Scott, Richmond, Va	2,484
Emil Severin, Aurora, Ind	1,799
John P. McGuire, Cleveland, O	2,259

CONTRACT PRICES.

JETTIES.—Yaquina Bay, Ore.—Maj. W. L. Fisk, U. S. Engr., Portland, Ore., received the following bids Oct. 25 for extending jetties at Yaquina Bay, Ore., as advertised in Engineering News; the short ton is used for the two classes of stone and the rock removal, and the long ton for the rails used:

Bids Received at Portland, Ore., Oct. 25, 1898, for Jetties at Yaquina Bay, Ore.

Quantities.		Christie, Lowe & Heyworth, Chicago, Ill.	Wakefield & Jacobsen, Portland, Ore.	John Kiernan, Portland, Ore.	Daniel Kern, Portland, Ore.	Albany Contract Co., Albany, Ore.	W. L. Prather, Jr., Oakland, Cal.	Campbell & Buckman, San Francisco, Cal.	Columbia Bridge Co., P'rtl'nd, Ore.
Lumber	814,000 ft. B.M.	$15.00	$14.00	$20.00	$14.00	$22.00	$12.00	$14.00	$16 00
Piles	112,000 lin. ft.	.15	.14	.30	.17	.25	.15	.15	.23
Stone: Class A	570,000 tons	.68	.78	.81½	.82	.82	.79	.90	1.25
Class B	60,000 "	1.30	1.75	1.25	1.75	1.90	3.49	2.10	1.48
Rails: New	68 "	50.00	40.00	50.00	45.00	40.00	40.00	40.00	50.00
Relaid	122 "	5.00	5.00	10.00	5.00	3.00	20.00	8.00	10.00
Frogs and switches	5 each	30.00	50 00	150.00	40.00	35.00	15.00	83.60	50.00
Iron straps, stirrups, &c.	57,000 lbs.	.05	.05	.06	.04	.03½	.05	.06	.03
Ship spikes	6,500 "	.05	.04	.06	.04	.03½	05	.04	.05
Rock removed, channel	4,000 tons	2.50	6.00	4.00	5.00	10.00	20.00	3.00	5.00
Total		$511,945	$606,796	$614,610	$629,246	$672,792	$674,688	$686,990	$847,560

SEWERS.—Rockford, Ill.—Edwin Main, Cy. Engr., informs us that the following bids were received Oct. 25, 1898, for constructing sewers; Hardin & Nelson put in extra bid for Y's of 30 cts. for 9-in., 50 cts. for 12-in., and 75 cts. for 15-in.; other bidders did not charge extra for Y's; the contract was awarded Thomas Tole; all bidders from Rockford, Ill., except Hardin & Nelson, of Racine, Wis.:

Quantities.		Thomas Tole.	G. Maffiol'.	Hardin & Nelson.
Pipe: 9-in.	2,750 lin. ft.	$0.38	$0.55	$0.75
Pipe: 12-in.	1,200 " "	.59	.75	1.00
Pipe: 15-in.	1,200 " "	.69	.80	1.30
Manholes: Ordinary	2 each	29.00	21.00	50.00
Combined	6 "	59.00	30.00	45.00
Lampholes	6 "	10.00	3.00	9.00
Intakes	14 "	16.00	15.00	15.00
Flushtank	1	84.00	21.00	80.00
Total		$3,341	$3,844	$5,542

ELECTRIC CONDUITS.—Erie, Pa.—T. Hanlon, Cy. Clk., informs us that the following bids were received Oct. 27, 1898, for constructing electric conduits:

Items.	George B. Kelley, Corry, Pa.	Kraft & Walther, Erie, Pa.
Conduits: 6-duct, a ft.	$0.09	$0.077
8-duct, a ft.	.07½	.077
16-duct, "	.07½	.077
30-duct, "	.07	.077
Class B manholes, each	23.00	26.50
Service boxes, each	5.00	5.00
3-in. wrought iron pipe, a ft.	.25	.25

PIPE SEWER.—Monticello, Ind.—We are informed that the following bids were received Oct. 28, 1898, for constructing 1, 628 ft. of 30-in. pipe sewer; average cut, 12 ft., in loam, quicksand, yellow and blue clay; Wm. P. Bushnell, Engr.: W. M. Hamlin, Clk. Bd. Trustees; M. Woltz, Pres.:

Items.	*Greenville (O.) Constn Co.	W. W. Hatch & Son, Goshen, Ind.	Smith & Madlem, Goshen,	W. S. Fries, Greenfield, Ind.
30-in. pipe, 2¼ ins. thick	$2.25	$2.25	$2.45	$2.22
30-in. pipe, 2½ ins. thick	2.65	2.65	2.25	2 32
9-in. pipe for catchbasins	.20	1.04	.45	.32
6-in. Y's in 30-in. pipe	1.00	.75	1.75	1.50
Manholes 8 each	30.00	57.30	34.50	34.00
Catchbasins 9 "	20.00	12.00	25.50	24.00
9-in. traps, each	.....	1.25	1.50	.....
Total	$4,169	$4,561	$4,675	$4,237

*Awarded contract, with pipe 2¼ ins. thick.

WIRE AND INSULATORS.—Washington, D C.—The chief of the signal office, U. S. A., received the following bids Oct. 21 for furnishing wire and insulators:

Bids Received at Washington, D. C., Oct. 21, 1898, for Wire and Insulators.

Bidder.	50 miles of standard wire.		Galvanized iron wire.		Double petticoated porcelain insulators, 3,000
	Seven-ply.	Insulated and braided.	No. 9, 350 miles.	No. 14, 300 miles.	
Washburn & Moen Mfg. Co., Worcester, Mass.	$20.68*	$106.00*	$0.04¼	.....	$0.04⅞†
Okonite Co. (Ltd.), New York	.....	125.00§	.....	.....	.....
J. A. Roebling's Sons Co., New York‡	11.00	.....	4.14	$4.75	.....
Foote, Pearson & Co., 82 Fulton St., New York	.....	.....	.....	.....	75 00‖
Elmer P. Morris, 15 Cortlandt St., New York.°	11.00	66.50	4.14	4.75	82.50
Trenton Iron Co., Trenton, N. J.	.....	1....	3.40[1]	4.35[1]	...
Western Electric Co., Chicago, Ill.	11.00[2]	1.17[2]	13.12[3]	4.50[3]	71.00[4]
Jas. B. Barron & Co., Hudson St., New York	11.50[5]	175.00[6]	4.25[5]	.04⅞[5]	.07⅞[7]
Safety Insulated Wire & Cable Co., New York	10.00	59.50	...	...	...
Barber & Ross, Washington, D. C.	.....	115.00[8]	13.50[9]	4.72[10]	7.90[11]

*F. o. b. at Worcester; or, $108 at Washington; price per mile. †F. o. b. at Worcester. §F. o. b. at Passaic, N. J.; or, $197 at Washington; price, per mile. ‡Per 100 lbs. ‖Per M. at Washington. °All prices f. o. b. at factory. [1]A 100 lbs. f. o. b. at Trenton. [2]At Washington. [3]At Trenton, N. J. [4]F. o. b. at East Liverpool, O., or $75 at Washington. [5]At Trenton or Washington. [6]A mile at New York, or $176.50 a mile at Washington [7]Each, at New York, or 8 cts. each at Washington. [8]At Worcester, or $117 at Washington. [9]At Washington, or $12.76 at Worcester. [10]At Washington, or $3.95 at Worcester. [11]A 100 at Washington, or $7.65 at Worcester.

CAST-IRON WATER PIPE.—Boston, Mass.—The Warren Foundry & Machine Co., 160 Broadway, New York, submitted the only bid to the pauper institutions department, Oct. 17, 1898, for furnishing 127 tons of 2,000 lbs. of cast-iron water pipe, at $17.20 a ton for straight pipe.

CEMENT, STONE AND SAND.—Fort Greble, R. I.—The following bids were received by Maj. D. W. Lockwood, U. S. Engr., Newport, R. I., Oct. 28, 1898, for furnishing cement, stone and sand for the construction of mortar battery at Fort Greble, R. I., as advertised in Engineering News; (1) being for Rosendale cement, (2) for broken stone, (3) for sand, (4) for Portland cement: S. & E. S. Belden, Hartford, Conn.—(2) $1.47 and $1.62 a cu. yd., delivered alongside wharf and on carts, respectively; Lawrence Cement Co., New York—(1) 68 cts. a bbl., on carts; Calvin Tomkins, New York—(2) $1.30¾ and $1.50¾, alongside wharf and on carts, respectively; Atlas Cement Co., New York—(4) $2.15 a bbl. on carts; Newark & Rosendale Lime & Cement Co., New York—(1) 78½ cts.; J. K. Sullivan, Newport, R. I.—(3) 90 cts. and $1.35 a cu. yd. on carts and at site, respectively; E. K. Chamberlin, New York—(2) $1.70 a cu. yd., on carts, and $1.80 a yd. at site; (4) $2.10 a bbl. on carts and $2.20 at site; Newark & Rosendale L. & C. Co.—(1) 70 cts. a bbl. (Brooklyn Bridge brand).

DREDGING.—Oakland, Cal.—O. P. Johnson submitted the lowest bid Oct. 17, 1898, to the board of public works for 550,000 cu. yds. of dredging in Lake Merritt, at 6.93 cts. a cu. yd., if allowed to furnish his own dumping place; total, about $38,000. The other bids were as follows: San Francisco Bridge Co, 9.87 cts. a cu. yd., if allowed to furnish own dumping ground; dredging to be finished June 30; if work is to be finished within one year from date of contract, 14.39 cts. for first 275,000 cu. yds., and 7.87 cts. for rest; no bid submitted under specification of city to furnish dumping place. Quimby & Harrelson, 9.09 cts. a cu. yd. city to furnish dumping ground, and work to be completed by June 30; bidders stipulated dump should be within a ½-mile of lake, the money for work to be appropriated in tax levy and levees and bulkheads about dumping place built to their satisfaction. Pacific Coast Dredging & Reclamation Co., 9 cts. a cu. yd. if city furnish dumping place; 11 cts. if contractor furnish place; also stipulated that city should build bulkhead at 8th St. if decided to pump mud between 12th and 8th Sts. O. P. Johnson, 10.09 cts. a cu. yd. if city furnish dumping place and work to be completed by June 30; or, 10.55 cts. if not to be finished in a year from signing contract; if contractor furnished dumping place, 6.93 cts. a cu. yd. if finished by June 30, or 7.39 cts. if finished year from signing of contract.

STATE HIGHWAY.—Erving, Mass.—The following bids were received Oct. 27, by the Massachusetts State Highway Commission, Boston, for building a macadam road in Erving; A. B. Fletcher, Secy., Boston:

Bids Received at Erving, Mass., Oct. 27, 1898, for Building a Macadam Road in Erving.

Quantities.		Myron A. Fisk, Huntington, Mass.	J. J. Welch & Co., Salem, Mass.	Tuttle & Edgerly, Swampscott.	James D. Shea, Natick, Mass. (accepted).	Andrew Carberry, E. Walpole, Mass.	H. A. Stewart, Boston, Mass.	Fred E. Ellis, Melrose, Mass.	W. R. Brown, Lowell, Mass.	Coleman Bros., Charlestown, Mass.
Excavation	4,912 cu. yds.	$0.30	$0.24	$0.23	$0.245	$0 36	$0.35	$0.24	$0.31	$0.30
Ledge excavation	80 " "	2.00	2.00	1.50	1.10	1.75	2.00	2.00	1 15	2.00
Rubble masonry, laid dry	140 " "	3 00	4.50	5.00	2.50	3.50	5.50	3.50	1 50	4 00
Rubble masonry laid in cement	14 " "	7.00	7.00	7.00	6.50	5.00	8.00	9.00	3.75	8.00
Gravel	1,930 " "	1.00	.80	1.20	.49	.80	.75	.58	1.10	.90
Telford	100 sq. yds.	.33	.30	.30	.25	.50	.45	.25	1.25	.80
12-in. vitrified clay pipe	30 lin. ft.	.60	.60	.60	.60	.50	.60	.65	.50	.45
Fencing used as guard rail	1,950 " "	.15	.15	.18	.145	.15	.20	.14	.25	.12
Side drains	825 " "	.33	.30	.35	.26	.35	.35	.30	.30	.40
24-in. vitrified clay pipe	80 " "	.90	2.00	3.00	1.45	2.00	1.15	3 00	1.00	1.30
Stone monuments	26 each	1.00	1.50	1.50	1.50	1.50	1.50	1 50	1.00	2 00
Catchbasins	1	20.00	18.00	30.00	15.00	25.00	30.00	20.00	18.00	15.20
Total		$4,815	$4,416	$5,361	$3,388	$4,883	$5,111	$3 938	$4,999	$1,891

ELECTRIC LIGHTING.—Salina, Kan.—A five-year contract is said to have been let for electric lighting to the People's Light, Heat & Power Co., as follows: 34 2,000-c. p. arc lights, 1 50-c. p. incandescent, 1 16-c. p. incandescent and 17 lights now used in the city hall and hose house of 16 c. p. each, at $3,100 a year, payable monthly. This lighting to be furnished upon the moonlight schedule of 2,000 hours a year. Excess hours to be paid for at the rate of $3,100 for 34 lights, and if the number of hours under the moonlight schedule does not equal 2,000 hours, the corresponding reduction to be made in price. Any additional arc light to be furnished upon the same terms and conditions at $75 a light.

ELECTRIC LIGHTING.—Attica, N. Y.—It is stated that the board of trustees has closed a contract with the Maplewood Electric Light & Power Co. to furnish 26 arc lights of 2,000 c. p. each, and 35 incandescent lights of 25 c. p. each, at $10.65. The Attica Natural Gas Co. offered to furnish the lights asked for at $2 for each lamp a year and to keep the lamps lighted every night, moon or no moon.

HIRE OF DREDGE.—Mobile, Ala.—We are informed that the National Dredging Co., Wilmington, Del., submitted the following bid Oct. 13, 1898, for the hire of a dredging plant: A day, $260; number of yards to be removed a day above station 24, 300 to 1,200; below station 24, 2,875 yds.

INDUSTRIAL NOTES.

RUSSELL & CO., Massillon, O., are contemplating building a special traction engine for hauling freight.

THE MISSOURI CAR & FOUNDRY CO., St. Louis, Mo., has an order from the Baltimore & Ohio R. R. for 2,000 freight cars, according to report.

THE JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J., has added an extension to its pencil factory, 40 by 100 ft., three stories high, driven by electric power from a dynamo placed in the main factory. The company will also sink an artesian well for a supply of water for factory use, and some time next year various other additions will be built to the plant. The company was established in 1827, but no year has equaled the present for volume of business.

THE KENNEY CO., 72 and 74 Trinity Place, New York, reports that the U. S. government inspectors have decided to equip the transport "Massachusetts," now being overhauled at the John N. Robbins Co. Ship Yard, Erie Basin, Brooklyn, N. Y., with the Kenney flushometer system. In addition 69 Kenney flushometers were recently installed on the transport "Mohawk." The company also informs us that the Bourne Bldg., now being erected on Liberty St., New York, by the Singer Mfg. Co., will be equipped with the Kenney flushometer system.

THE SAN FRANCISCO BRIDGE CO., San Francisco, Cal., has excavated 1,600,000 cu. yds. of material from Mare Island Strait, under its contract, on which work was begun September, 1897. There remains 200,000 yds. to excavate, which will give a channel 28 ft. deep at mean low water and varying in width from 250 to 600 ft., from the Navy Yard to deep water in San Pablo Bay. Two hydraulic suction dredges have been employed on the work and the material has been deposited in basins on Mare Island. The greatest distance of material pumped has been 3,500 ft. The company also has a contract from Mr. R. D. Chandler to build coal bunkers on pier 15, Green St., San Francisco, at a cost of $23,688.

THE BROWN HOISTING & CONVEYING MACHINE CO., Cleveland, O., and 26 Cortlandt St., New York, has prepared plans for the New London (Conn.) coaling station for the U. S. Navy, and the contracts for the work have just been awarded by the Bureau of Yards and Docks, U. S. Navy, to J. W. Hoffman & Co., Philadelphia. The former company will furnish and erect two of its extra heavy bridge tramways, the same as those now being supplied to the U. S. Navy at Key West and Dry Tortugas, Florida. These bridges are 180-ft. span, with 92-ft. cantilever extensions and 36-ft. projections over the front of dock. J. W. Hoffman & Co. will build the necessary piers and buildings to accommodate this machinery. This is the fifth coaling station awarded so far by the Navy Department, the coal handling machinery of which is being furnished by the Brown Hoisting & Conveying Machine Co.

C. O. LUCAS & CO., Greenville, O., report that they are now making a specialty of small water-works plants. They have recently received the contract to put in the machinery for the water-works at Trotwood, O., consisting of pump, gasoline engine and tank. The pump is built so as to deliver both water and air at the same time to a tank of 5,000 gallons capacity under a pressure of about 80 lbs. The air going to the top of the tank forms a cushion and being under pressure forces the water through the mains. This forms a ready and efficient service and does not require a stand-pipe or elevated tank, and in case of fire the compressed air doing the work until the gas engine is started to keep up the supply. The cost is claimed to be less than where an elevated tank or a stand-pipe is used and at the same time such a plant is always ready for use.

THE WESTINGHOUSE AIR-BRAKE CO. authorizes the following statement in regard to the New York and Boyden companies: "The purchase by the Westinghouse Air-Brake Co. of the patents and business of the Boyden Brake Co. is the final conclusion of a long and interesting litigation relating to air-brakes. The course of these suits has been followed with interest by railway men, because to a considerable extent they involved the right of the Westinghouse people to the sole manufacture of what is known as the 'Quick Action' brake. By the purchase of the Boyden inventions, which the Supreme Court said were highly meritorious, the Westinghouse Co. still claims to control the situation, although this is contested in the U. S. Courts by the New York Air-Brake Co. The Westinghouse Co. has been successful in compelling the New York Co. to cease making three different forms of brakes, and it claims that a fourth one now being put on the market is also an infringement of its patents. This question will be finally determined by the Court of Appeals, probably in November or December, the opinion of the lower court having been favorable to the New York Co. Should the decision be favorable to Westinghouse, then the New York Co. will once more be enjoined, and prevented from making its present style of brake. In addition to this particular suit, it appears that the Westinghouse people have brought three other suits against the New York Co., and it would therefore look as if litigation between these two concerns was to be, if anything, more protracted than that between the Boyden and Westinghouse companies."

Contract Work Should Always be Advertised in a Paper Read by Contractors.

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PERSONAL.

Mr. W. M. Davis, for the past 13 years Town Engineer of Woodstock, Ont., has been appointed Town Engineer of Berlin, Ont.

Mr. Edward N. Sampson has been appointed Engineer of the Consolidated Sewer, Water and Highway Departments of Andover, Mass.

Mr. R. H. Cushing has been appointed Assistant Engineer of the Intercolonial Ry., in charge of the terminal station at St. John, N. B.

Mr. W. H. Neelands, electrical engineer, of the British Columbia Electric Ry., was married at Vancouver, B. C., Nov. 3, to Miss Ellen Alcock.

Sr. Manuel Torres Toriga, City Engineer, of the City of Mexico, Mex., is visiting Chicago, for the purpose of studying municipal improvements.

Col. Saml. M. Mansfield, Corps of Engineers, U. S. Army, has been appointed by President McKinley a member of the California Debris Commission.

Mr. Ferdinand W. Peck, United States Commissioner-General to the Paris Exposition of 1900, arrived in New York, Nov. 11, on the "St. Louis."

Mr. Nathaniel Roberts, M. Am. Soc. C. E., consulting engineer, 120 Liberty St., New York, has removed his office to 63 Ocean Ave., Jersey City, N. J.

Mr. H. S. Ayres has been appointed Secretary of the Michigan Brass & Iron Works, Detroit, Mich. He has been connected with this company for a number of years.

Mr. Edwin F. Wendt has been appointed Assistant Engineer of the Pittsburg & Lake Erie R. R., in charge of Maintenance of Way and Construction, with headquarters in Pittsburg, Pa.

Mr. Nicholas Turnbull, A. M. Inst. C. E., of the firm of Richard Johnson & Nephew, Manchester, England, is making a visit to the United States to inspect American manufacturing plants.

Mr. Edmund Alsop, civil engineer, of Philadelphia, Pa., has returned to that city from Porto Rico, where he has been for the purpose of securing a general idea of the business prospects in that island.

Mr. John Medway, formerly Superintendent of Motive Power on the Fitchburg R. R., has been appointed Master Car Builder for Swift & Co., Chicago, with headquarters at the Union Stock Yards in that city.

Mr. A. G. Menocal, M. Am. Soc. C. E., Civil Engineer, retired, U. S. Navy, has been sent to Cuba by the Navy Department to make a study of the arsenals, wharves and other accessories of the navy there.

Capt. Francis R. Shunk, Corps of Engineers, U. S. Army, has been relieved from duty at the United States Military Academy, West Point, N. Y., and has been ordered to duty at Manila, Philippine Islands.

Capt. Henry Jervey, Corps of Engineers, U. S. Army, has been ordered to New Orleans, La., for duty in charge of the Fourth District, Mississippi River Improvements, relieving Maj. Jos. H. Willard, Corps of Engineers.

Mr. Theodore Buskirk, of the engineering department of the Lake Shore & Michigan Southern Ry., has been appointed Assistant Engineer of the Track Elevation Bureau of Chicago, Ill., to succeed Mr. T. P. McDonough, resigned.

Mr. H. H. Vaughan, Mechanical Engineer of the Philadelphia & Reading R. R., and previously Mechanical Engineer of the Great Northern Ry., has accepted the position of Mechanical Engineer of the Q. & C. Co., with headquarters at its Chicago office, Western Union Building.

Mr. Friedrich Tischendorfer, Chief Engineer of the Electricitats Aktiengesellschaft, formerly Schuckert & Co., electrical manufacturers, of Nuremberg, Germany, is at the Belvedere House, New York. He is visiting this country for the purpose of purchasing electrical material and machinery.

Lieut. Clarke S. Smith, Corps of Engineers, U. S. Army, has been relieved from duty at the U. S. Engineer School, Willet's Point, N. Y., and has been ordered to New Orleans, La., for duty under Major Jas. B. Quinn, Corps of Engineers. Lieut. Amos A. Fries, Corps of Engineers, U. S. A., has also been relieved from duty at the U. S. Engineer School, and has been ordered to Portland, Ore., for duty under Maj. Walter L. Fisk, M. Am. Soc. C. E., Corps of Engineers.

Mr. W. H. Pratt has been appointed Manager of the works of the Universal Construction Co., Chicago. He was formerly Receiver and Manager of the Mount Vernon Bridge Co., Mount Vernon, O., and before that was connected with the Edge Moor Bridge Works, Edge Moor, Del.

Mr. Walter J. Sherman has been appointed Engineer of the Centennial Commission, Toledo, O., and will have charge of preparing the topographical map and plans of the reclaimed land along the water front of Bayview Park, in that city, which will be the site of the coming State Centennial.

Lieut. Frederick A. Altstaetter, Corps of Engineers, U. S. Army, has been ordered to duty at the U. S. Engineer School, Willet's Point, N. Y. Lieut. Harley B. Ferguson, Corps of Engineers, stationed at present at the U. S. Military Academy, West Point, N. Y., has also been ordered to duty at the U. S. Engineer School.

Mr. Henry Vier, for the past nine years in charge of the grade crossings work of the New York Central & Hudson River R. R., with headquarters at Buffalo, N. Y., has been appointed Chief Engineer of the Map and Survey Department, with headquarters at Syracuse, N. Y. Mr. H. C. Merriman has been appointed to succeed him.

Mr. W. E. Green, Division Superintendent of the Shreveport and Texarkana Division of the Kansas City, Pittsburg & Gulf R. R., with headquarters at Texarkana, Tex., has been promoted to be General Superintendent, succeeding Mr. F. Mertsheimer, with headquarters at Kansas City, Mo., and his former office has been abolished.

Mr. C. M. Setterwall, iron manufacturer, of Sweden, is visiting Pittsburg, Pa., for the purpose of studying American methods and comparing the relative costs of the production of iron and steel in the two countries. He is accompanied by Mr. N. Lilienborg, his New York agent, and their headquarters are at present at the Monongahela Hotel, Pittsburg.

Prof. William S. Aldrich, M. Am. Soc. M. E., of the College of Engineering and Mechanic Arts of the University of West Virginia, Morgantown, W. Va., has returned to his collegiate duties after five months of service in the Naval Engineer Corps as a Passed Assistant Engineer, with the rank of Lieutenant, on board the U. S. Repair Ship "Vulcan."

Lieut. Jas. P. Jervey, Corps of Engineers, U. S. Army, has been ordered to report at the U. S. Military Academy, West Point, N. Y., not later than Jan. 4, next, for duty in the Department of Civil and Military Engineering. Lieut. Harry Burgess, Corps of Engineers, at present stationed at Galveston, Tex., has also been ordered to the U. S. Military Academy for duty.

Mr. John Cassan Wait, M. Am. Soc. C. E., consulting engineer and attorney and counselor at law, has removed his offices from the American Surety Building, No. 100 Broadway, to the St. Paul Building, 220 Broadway, New York. Mr. Wait was formerly Assistant Professor of Engineering in Harvard University, Cambridge, Mass., and is the author of "Engineering and Architectural Jurisprudence."

Capt. E. E. Winslow, Corps of Engineers, U. S. Army, has been relieved from duty at the United States Military Academy, West Point, N. Y., and has been ordered to relieve Capt. Mason M. Patrick, Corps of Engineers, of the charge of the First and Second Districts, Mississippi River Improvements, with headquarters at Memphis, Tenn. Capt. Patrick upon being relieved by Capt. Winslow will assume the duties of Secretary and Disbursing Officer of the Mississippi River Commission, with office at St. Louis, Mo.

Mr. Claude W. Kinder, M. I. C.E., M. Am. Soc. C.E., and Chief Engineer of the Imperial Chinese Railway Administration, has the following personal record, according to "The Indian and Eastern Engineer": Mr. Kinder is the son of Major T. W. Kinder, formerly Master of the Mint in Hong Kong and later of the Japanese mint. One brother, Col. D. T. Kinder, was formerly in command in Burmah, and another brother is Commander Kinder, R. N. Mr. Claude W. Kinder began his professional career in the office of Brown & Marshall, of Birmingham, after studying in France. He later became an Assistant Engineer under Herr Basson, of the Engineering & Mining Co., of Alexandrofsky, on the Neva. In 1872 he was Assistant Engineer on the Japanese State Railways, and remained in that employ until the Satsuma rebellion. He then went to China and was Resident Engineer of the Tong colliery, and later became Engineer in Chief of the Chinese Engineering & Mining Co., and held that position until 1888, when he received his present appointment. While in the employ of the coal company he built, against great opposition, the first standard railway in China—the 7 miles between Tongshaw and the coal canal. He also improvised the first locomotive used on this line, out of a stationary engine and a platform car. In 1889 Mr. Kinder visited the United States and thoroughly inspected our railway system, and he believes generally in American railway methods.

OBITUARY.

Mr. C. H. Sutherland, mechanical engineer of the Grand Trunk Ry., died recently.

Mr. Elias Giesering, sewer contractor, of Marquette, Mich., was killed by a cave-in of a sewer trench, Nov. 3.

Mr. William H. Hand, contractor and builder, of New York city, died at his home, Nyack, N. Y., Nov. 15, aged 61.

Mr. E. A. Elder, General Superintendent of the Florida East Coast Ry., died in Toledo, O., Nov. 12, of malarial fever. His home was in St. Augustine, Fla.

Mr. Leighton Lee, Superintendent of the firm of Lee & Co., engineers and contractors, of Philadelphia, Pa., who was badly injured Oct. 14 by falling from the South Side Elevated R. R. structure, in Chicago, as noted in our issue of Oct. 20, died at the Mercy Hospital, in the latter city, Nov. 15.

Mr. Edwin A. Kimball, formerly Superintendent of the Mechanical Departments of the University of Illinois and of the Illinois Industrial Home for the Blind, Chicago, and an inventor and mechanical engineer, died in that city of pleuro-pneumonia, Nov. 15, aged 64. He was born in Orange, N. H.

The Hon. Joseph M. Rickey, of Steubenville, O., for many years County Surveyor, died in Cleveland, O., Nov. 9, aged 83. He was President of the commission which established the state line between West Virginia and Pennsylvania, and had contributed a number of articles on civil engineering to technical magazines.

Lieut. Keating (son of Mr. Edward H. Keating, M. Am. Soc. C. E., General Manager of the Toronto Ry. Co., Toronto, Ont., and formerly City Engineer of Toronto), died Oct. 26, in South Africa. Lieut. Keating graduated from the Royal Military College, Kingston, Ont., in 1888, and was assigned to the 100th Regiment, then stationed at Halifax, N. S., but which about three months ago was ordered to Africa.

Mr. J. C. Chapman, machinist and the inventor of the Chapman valve and other devices, died at his home in Boston, Mass., Nov. 4, aged 76. He was born at Newmarket, N. H., and learned the machinist's trade in Boston. He was subsequently Master Mechanic of the Charlestown Navy Yard. He resigned this position to become Superintendent of the factory of the Walworth Mfg. Co., Cambridgeport, Mass., which latter position he held until a few years ago, when he retired from active work.

Mr. John E. Dustin, Water Commissioner, of Methuen, Mass., died Nov. 2, aged 62. He was born in Derry, N. H., and learned the machinist's trade in Lawrence, Mass., under the late Aretas Blood. He was employed in locomotive works in Boston for two years, and then engaged in the manufacture of woolen machinery in Lawrence. He was master mechanic for the Brown Lumber Co., Whitefield, N. H., from 1871 until 1876, when he established a machine shop in Lawrence, which he conducted until the time of his death.

Mr. De Witt C. Cregier, formerly City Engineer of Chicago, died there, Nov. 9, aged 69. He was born in New York city and was apprenticed in an engineering establishment, where he began the study of mechanical engineering. For several years, until 1853, he was employed on steamers running between New York, Havana and New Orleans, when he went to Chicago to erect the first pumping machinery for the public water supply. He was Chief Engineer of the water-works for 28 years, and in 1861 became a member of the Board of Public Works. In 1878 he was appointed City Engineer, and four years later was made the head of the Department of Public Parks. He left this position to become Superintendent of the West Division Street Ry., and in 1889 was elected Mayor of Chicago. During his administration the territory of the city was increased by over 140 sq. miles, and he was conspicuous in the early work in the Columbian Exposition plans, being largely instrumental in securing the fair for Chicago. He designed the two largest pumping engines at the North Side Water-Works, Chicago, and was identified with the construction of the first two lake tunnels. He was also the inventor of many valuable appliances used on public works, and was a Past President of the Western Society of Engineers.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

NEW YORK ELECTRICAL SOCIETY.
Nov. 17. "Surface Contact Railways," Edward H. Johnson. Secy., George H. Guy, 120 Liberty St., New York city.
ROCHESTER ENGINEERING SOCIETY.
Nov. 18. "Trussing and Car Construction," Fred. R. Hertzog. Secy., John F. Skinner.
CHICAGO ELECTRICAL ASSOCIATION.
Nov. 18. "The Development of the Motor-Cycle," F. B. Rae. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
ENGINEERS' CLUB OF COLUMBUS.
Nov. 19. Secy., H. M. Gates, 12½ North High St., Columbus, O.
ENGINEERS' CLUB OF PHILADELPHIA.
Nov. 19. "Engine and Boiler Testing," H. W. Spangler. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
TECHNICAL CLUB OF OMAHA.
Nov. 21. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' CLUB OF MINNEAPOLIS.
Nov. 21. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Nov. 21. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Nov. 22. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.
FRANKLIN INSTITUTE.
Nov. 22. "Lightning and Lightning Arresters," A. J. Wurts; Nov. 23. Discussion, "The Micro-Structure of Bronzes,, and "Specifications on Structural Steel and Rails." Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.

TENNESSEE RIVER IMPROVEMENT ASSOCIATION.
Nov. 23. Chattanooga, Tenn.
ENGINEERING ASSOCIATION OF THE SOUTH.
Nov. 24. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Nov. 24. Secy., C. A. McNab, 112 Mansfield St, Montreal, Canada.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Nov. 30. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.
BROOKLYN ENGINEERS' CLUB.
Dec. 1. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Dec. 2. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Dec. 5. Secy., H. J. March, Library Bldg, Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Dec 5. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 6-9. Annual meeting, New York city. Secy., Prof. R. F. Hutton, 12 W. 31st St., New York city.
ENGINEERS' CLUB OF ST. LOUIS.
Dec. 7. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 7. Secy., C. W. Hunt, 220 West 57th St., New York city.
WESTERN SOCIETY OF ENGINEERS.
Dec. 7. "Electrolytic Corrosion of Underground Structures," Prof. D. C. Jackson. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
ST. LOUIS RAILWAY CLUB.
Dec. 9. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
MONTANA SOCIETY OF ENGINEERS.
Dec. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
THE LOUISIANA ENGINEERING SOCIETY.
Dec. 12. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
ENGINEERS' CLUB OF KANSAS CITY.
Dec. 12. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.
NORTHWEST RAILWAY CLUB.
Dec. 13. Secy, T. A. Foque, Soo Line, Minneapolis, Minn.
NEW ENGLAND RAILWAY CLUB.
Dec. 13. Secy., Edw. L Janes, P O Box 1158, Boston, Mass.
NEW YORK RAILROAD CLUB.
Dec. 15. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Dec. 15. Secy., F. A. Charpiot, P. O Box 13, Savannah, Ga.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Dec. 20. Secy., R. A. Fessenden. 410 Penn Ave., Pittsburg, Pa.
WESTERN RAILWAY CLUB.
Dec. 20. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 21. Secy., Frank H. Olmsted, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Dec. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

NEW YORK RAILROAD CLUB.—At the regular meeting, on Nov. 7, Mr. M. N. Forney delivered "A Short Lecture to Railroad and Supply Men on Conduct and Character."

FLORIDA GOOD ROADS ASSOCIATION.—The annual convention of this association will be held at Jacksonville, Fla., on Nov. 23. The Placide Hotel has been selected as headquarters. J. W. White, Secy.

MASSACHUSETTS STREET RAILWAY ASSOCIATION.—The regular monthly meeting of this association was held on Nov. 9, at Boston, Mass. Mr. E. Moody Boynton addressed the society upon "Rapid Transit."

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—The regular monthly meeting of this society was held at the Society House, Pittsburg, Pa., on Nov. 15. Dr. R. G. G. Moldenke read a paper on "Cast Iron."

ENGINEERS' CLUB, OF COLUMBUS.—At the meeting on Nov. 5 Mr. F. Herbert Snow, Assoc. M. Am. Soc. C. E., of the firm of Snow & Barber, Boston, Mass., delivered an address on the system of sewer assessments recently established in Boston and Brockton.

WESTERN FOUNRYMEN'S ASSOCIATION.—The regular monthly meeting of this association was held on Nov. 16, at the Great Northern Hotel, Chicago. Major Malcolm McDowell read a paper, entitled "Metalloids in Castings," after which various topics of interest to foundrymen were discussed.

ST. LOUIS RAILWAY CLUB.—At the regular meeting of this club, held on Nov. 11, Mr. Willard Beahan, M. Am. Soc. C. E., presented a paper, entitled "The Proper Organization of the Engineering Department of a Railroad." There was also a discussion of a paper by Prof. R. A. Smart presented at a former meeting.

NATIONAL MUNICIPAL LEAGUE.—Beginning Nov. 30 and continuing through Dec. 2, there will be held at Indianapolis, Ind., a conference of those interested in good city government. The intention of the organization is to make a strong effort to place municipal affairs upon a higher plane. This will be the sixth meeting so far held.

WISCONSIN STATE CHEMISTS' ASSOCIATION.—This is a new society recently organized for the purpose of advancing scientific chemical research. It is the intention to have monthly meetings. The following are the officers for the ensuing year: Pres., Dr. P. Fischer, Milwaukee; Vice-Pres., Herman Schlundt; Secy., I. Ladoff, Milwaukee; Treas., J. H. Flebing.

THE NEW JERSEY SANITARY ASSOCIATION.—The 24th annual meeting of this association will be held at the Laurel House, Lakewood, N. J., Dec. 9-10. Among the papers to be read are the following:

"The Powers, Duties and Limitations of Boards of Health," Samuel A. Patterson, Asbury Park; "Methods of Sewage Disposal," Rudolph Hering, New York city; "Public Water Supplies and the Prevention of the Pollution of the Same," James H. Fuertes, New York city.

BOSTON SOCIETY OF CIVIL ENGINEERS.—On the evening of Nov. 11 this society celebrated the 50th anniversary of its organization at the Hotel Vendome. Over 100 members were present at the reception and afterwards listened to a lecture by President Howard A. Carson on "Glimpses of Boston Fifty Years Ago." Mr. Desmond FitzGerald gave a historical review of the society, and Secretary Tinkham read a number of congratulatory telegrams from engineering societies here and abroad.

LOUISIANA ENGINEERING SOCIETY.—This society gave its first "outing" on Nov. 5 in the form of a tour of inspection of the points of especial engineering interest in the vicinity of New Orleans. This included trips to the various canals and pumping stations connected with the new drainage system which is being installed in New Orleans. Fully 200 persons, members and friends, participated in the trip. In September last the society became a member of the Association of Engineering Societies.

ENGINEERING ASSOCIATION OF THE SOUTH.—This society held its annual meeting Nov. 10 at the U. S. Engineer's Office, Nashville, Tenn. The Secretary, Mr. C. B. Wilson, submitted his report. Amendments to the constitution intended to broaden the scope of the society were discussed and other general business transacted.

The following officers were elected for the ensuing year: Pres., W. F. Foster; First Vice-Pres., W. M. Leftwitch, Jr.; Second Vice-Pres., E. E. Betts; Secy. and Treas., H. M. Jones; Directors, H. McDonald, J. S. Walker and C. B. Wilson.

RAILWAY SIGNALING CLUB.—The meeting held Nov. 8 at the Great Northern Hotel, Chicago, was an informal one, owing to the small attendance. The resignation of the Secretary, Mr. Seitz, was presented and accepted, and Mr. Tilton was appointed acting secretary for the remainder of the term.

There was a brief discussion on points connected with the use of bracket posts, showing a wide variation of opinion as to the conditions under which such posts should be used.

The next meeting will be held in New York in January. This will be the annual meeting, for the election of officers, etc.

ALABAMA SCIENTIFIC AND INDUSTRIAL SOCIETY.—This society held its semi-annual meeting, Nov. 5, at the Birmingham Commercial Club, Birmingham, Ala.

The committee appointed to consider legislative enactment looking to a more complete record of the output of the various mines and kindred institutions in the State of Alabama, reported favorably on a proposed amendment to the state mining laws, making it compulsory for every operator or lessee of underground mines, ore or coal, lime and bauxite quarries, coke works, clay works, brick works and kindred institutions, to file a monthly report of the output to the state mine inspector, and annually a consolidated report. The recommendation of the committee was adopted, and the society will be represented before the next session of the legislature.

A committee was appointed to make arrangements for the annual meeting, which will be held in January.

ENGINEERS' CLUB OF PHILADELPHIA.—At the meeting on Nov. 5, Mr. Charles Piez presented the paper of the evening upon the subject of "Coal Handling Machinery." He divided machinery for handling coal into two general classes—continuous and non-continuous; the former comprising chain and belt elevators and conveyers as ordinarily manufactured, and the latter including the various types of automatic and tub hoists, overhead bucket tramways and cable railways, each class having its own field of superior usefulness. Mr. Piez confined his remarks to a brief discussion of continuous coal-handling machinery under the two heads of elevators and conveyors, and he described the requirements which must be met in handling different kinds and sizes of coal, and some of the best mechanical devices which are now employed.

Mr. Carl Hering presented an account of recent progress in electric traction. Reference was made to the declining traffic of the various elevated roads resulting from perfected surface systems.

THE CIVIL ENGINEERS' CLUB OF CLEVELAND.—A regular meeting was held Nov. 8th, with 39 members and visitors present. Mr. Oscar Textor, member of the Cleveland Chemical Society, presented a paper, entitled "A Review of Tests of Steel Rivets." The material was basic open hearth steel, with average chemical analysis as follows: Phosphorus, 0.015; manganese, 0.46; sulphur, 0.033; silicon, 0.005; and carbon, 0.11. The rivets were tested for tensile and shearing strength, also by nicking and bending cold, and for their behavior under the hammer, both hot and cold. Tests were also made to discover crystallization under the rivet head, if any. The results were described as being very satisfactory, and the conclusion was reached that with proper manipulation and attention to temperatures, such steel rivets are fully equal to the best wrought-iron rivets and possess superior tensile strength. W. H. Searles, Secy.

THE FOUNDRYMEN'S ASSOCIATION.—The 7th annual meeting of this association was held at the Manufacturers' Club, Philadelphia, Pa.

A report was presented by the executive committee stating the condition of business to be good and improving.

Officers for the ensuing year were elected as follows: Pres., P. D. Wanner, Reading Foundry Company, Ltd., Reading, Pa.; Vice-Pres., A. C. Pessano, George V. Cresson Co., Philadelphia; Secy., Howard Evans, J. W. Paxson Co., Philadelphia; Treas., Josiah Thompson, J. Thompson & Co., Philadelphia. Executive Committee: Walter Wood, Chn., R. D. Wood & Co., Philadelphia; Thos. Glover, Glover Bros., Frankford, Philadelphia; E. E. Brown, E. E. Brown & Co., Philadelphia; Stanley G. Flagg, Jr., Stanley G. Flagg & Co., Philadelphia; Wm. F. Sauter, G. Rebmann & Co., Philadelphia.

The discussion of the topic, "Who is responsible for the cost of patterns in case of a fire in a foundry," was postponed until the next meeting.

A paper, entitled "A Modern Foundry in Europe," was read by Mr. J. A. Penton.

FRANKLIN INSTITUTE.—The schedule of meetings for November and December is as follows:

Nov. 15, "The Agricultural Possibilities of Our New Possessions," Prof. Harvey W. Wiley, Chemist to the U. S. Department of Agriculture; Nov. 16, "The Burton Electric Process of Unhairing and Tanning Skins," George D. Burton, Boston, Mass.; "The Kitson Incandescent Oil Lamp," Arthur Kitson, Philadelphia, Pa.; "A Process for Fireproofing Wood to be Used on the Woodwork of War Vessels." Dr. Chas. J. Hexamer, Philadelphia, Pa.; "The Inflammable and Explosive Properties of Smoke When Confined in a Burning Building, and its Influence Upon the Spread of Fire," Wm. McDevitt, Philadelphia, Pa.; Nov. 22, "Lightning and Lightning Arresters," A. J. Wurtz, Pittsburg, Pa.; Nov. 23, "The Micro-Structure of Bronzes" and "Specifications for Structural Steel and Rails," discussions; Dec. 6, "Reaction Velocity," Dr. R. H. Bradbury, Philadelphia, Pa.; Dec. 13, "The Kite as an Instrument in Meteorological Research," Prof. Chas. F. Marvin, U. S. Weather Bureau; "Commercial Photometers and Light Standards," Prof. A. J. Roland, Drexel Institute, Philadelphia, Pa.; Dec. 14, "Fresh Studies of Pioneer Tools," Prof. H. C. Mercer, Doylestown, Pa.

A new section to be known as the "Mechanical and Engineering Section" has recently been formed for the consideration of subjects bearing upon the mechanic arts and the engineering problems connected therewith.

At the meeting of the Mining and Metallurgical Section, held on Nov. 9, Mr. Alex. E. Outerbridge, Jr., lectured on "The Mining and Minting of Gold and Silver," giving a brief review of the coinage of the Philadelphia Mint and a description of his work in connection with the study of the spectroscopic method of analysis of gold and silver alloys.

WESTERN SOCIETY OF ENGINEERS.—A special meeting was held Nov. 9, for the reading of the remainder of the papers on track elevation. Mr. W. H. Coverdale described the work on the Pittsburg, Fort Wayne & Chicago Ry. In this case, the bridges were erected on pile bents, set far enough from the ends of the girders to allow of the masonry abutments being built under them. The floor system consists of V-shaped transverse troughs, with broken stone ballast filled in to a depth of 6 ins. above the tops of the troughs. This ballasted floor produces very little noise when trains run over the bridge.

Mr. O'Neill, Superintendent of Track Elevation, representing the city, gave an interesting review of the history of track elevation and the various ordinances that have been passed respecting this work. He also described the work at the 16th St. crossing, recently described in our columns.

Mr. H. W. Parkhurst, of the Illinois Central R. R., described the work on the St. Charles Air Line, which rises to its new grade by an incline on the lake front, and then runs west to the Chicago River, the drawbridge over which had to be raised to correspond to the track elevation. Mr. L. H. Clarke, the engineer in charge of the elevation of the Lake Shore & Michigan Southern Ry. and the Chicago, Rock Island & Pacific Ry., was not present, though he had been expected. The work, however, was described by the engineer in charge of the field work. The floor system of the bridges consists of transverse I-beams, with a deck plate to which the rails are bolted. At Englewood, however, where the yard tracks cross the subways, girders projecting above the floor have been dispensed with, and the floor consists of I-beams crossed by Z-bars, to which the deck plates are riveted.

So much time was occupied by the descriptions of the works and the exhibition of a number of stereopticon views, that it was decided to defer all discussion on the paper until the next regular meeting.

On Nov. 11 a large party of members and invited guests, including several of the University Trustees, went to Champaign, Ill., to visit the University of Illinois, and particularly the engineering schools.

NEW PUBLICATIONS.

BRITISH RAILWAY STATISTICS.—Pub. Doc., London, Eng. Five pamphs.; 8 × 13 ins.; pp. 90, 32, 41, 13 and 18.

Two of these pamphlets contain the regular returns of accidents reported to the British Board of Trade and a third gives the results of a special investigation into shunting or switching accidents which was ordered by the House of Commons on June 28, 1898. These last figures cover the period of ten years ending Dec. 31, 1897. Of the two remaining pamphlets one is a report on hours of labor of railway servants, and the other a report on the capitalization, earnings, cost of operations, etc., of British railways for the year 1897.

MANAGEMENT AND CARE OF A STEAM BOILER. Complied and published by V. G. Moulson & Co., Cleveland, O. Pamph.; 5¼ × 7½ ins.; pp. 144.

The title page says: "This work gives the opinions and experience of the best known authorities as to the proper management and care of steam boilers." The book is a compilation of articles on boilers, boiler management, fuel, construction, incrustation, corrosion, explosions, etc., together with advertisements of about 50 concerns which deal in articles needed by steam users. The advertisements are alternated with the text throughout the book. The information given in the text is of all grades of merit, good, bad and indifferent. Some of it is rather old, such as the results of Prof. Johnson's tests of fuel, made in 1844, and some of it is erroneous, such as the statements that free-burning coals rapidly lose their heat-giving power on exposure, and that the slack of anthracite is worthless on the grates of a boiler. The book is apparently gotten up to be circulated gratuitously by those who have taken advertising space in it.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

LAUNDRY MACHINERY.—American Laundry Machinery Co. Cincinnati, O. Pamph.; 11 × 7¾ ins.; pp. 72.

This is a handsomely illustrated catalogue of all the machinery used in a modern steam laundry, including washing, drying, starching and ironing machines, boilers and engines, filters, ventilating fans, etc.

CEMENT MANUFACTURING MACHINERY.—The Jeffrey Mfg. Co., Columbus, O. Pamph.; 7 × 6 ins.; pp. 8; illustrated.

The larger portion of this pamphlet is taken up with a description of the combination separator, bolter and screen for sifting cement. Many claims are made as to the especial efficiency of this machine.

FOUNDRY MACHINERY.—Whiting Foundry Equipment Co. Chicago, Ill. Pamph.; 6 × 9 ins.; pp. 52.

This catalogue illustrates a great variety of machines and appliances used in iron foundries, including cupolas, cranes, ladles, derricks, air hoists, cars, trucks, turntables, brass melting furnaces, flasks, tumbling barrels, molding machines, etc.

TRACTION ENGINES AND AGRICULTURAL MACHINERY.—Russell & Co., Massillon, O. Paper; 10½ × 7½ ins.; pp. 60.

This firm does a large business in simple and tandem-compound traction engines and portable engines for farm work, which are illustrated and described in detail. The catalogue also illustrates a variety of threshers, stackers and other agricultural machinery.

ELEVATING AND CONVEYING MACHINERY, Power Transmitting Machinery, etc.—The Aultman Co., Canton, O. Catalogue C, 1898. Pamph.; 5¼ x 7¾ ins.; pp. 135.

This pamphlet is an illustrated catalogue and price list of elevators, conveyors, pulleys, shafting, bearings, rope drives, sprocket wheels, etc. It contain many illustrations showing practical applications of hoisting and conveying machinery.

CRUSHERS, PULVERIZERS AND SHREDDERS.—The Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. Paper; 4¼ × 6 ins.; pp. 36.

These machines act by a combination of abrasion and percussion. On the shaft are a series of disks, having studs or bolts on the face, from which are suspended steel bars, each of which has a free arc of movement of about one-third of a circle. After striking a blow the hammer recoils, passing such of the material as is not shattered by the blow. The series of heavy blows reduces the material to powder. The machine has six sets of hammers, 13 to a set, and at 1,000 revolutions per minute the hammers strike 78,000 blows per minute. It has been used for grinding on clay, coal, oil cake, limestone and other material, and for shredding tan bark.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Nov. 17.	School building, Passaic, N. J.	Nov. 3
Nov. 17.	Water-works, McComb, Miss.	Nov. 3
Nov. 17.	Bridge abutments, etc., Charlemont, Mass.	Nov. 17
Nov. 17.	Stone bridge, Napa, Cal.	Nov. 17
Nov. 17.	Repairing asphalt, Scranton, Pa.	Nov. 17
Nov. 18.	Lighting fixtures, Omaha, Neb.	Nov. 17
Nov. 18.	Stone curb and gutter, Middletown,, O.	Nov. 17
Nov. 18.	Pipe sewers, Etna, Pa.	Nov. 17
Nov. 18.	Building materials, Chemawa, Ore.	Nov. 3
Nov. 19.	Local sewers, Evansville, Ind.	Nov. 3
Nov. 19.	Wooden wharf, Washington, D. C.	Nov. 10
Nov. 19.	Electric light plant, Concord, Mass.	Nov. 10
	Advertised, Engineering News, Nov. 10.	
Nov. 19.	Snow dump, Chicago, Ill.	Nov. 17
Nov. 19.	Pipe sewers, Coshocton, O.	Nov. 17
Nov. 19.	Brick paving, curb, etc., Council Bluffs, Ia.	Nov. 17
Nov. 21.	Collection of garbage, Woodmont, Conn.	Nov. 17
Nov. 21.	Ambulance, New York, N. Y.	Nov. 17
Nov. 21.	Power plant, Ottawa, Ont.	Nov. 17
Nov. 21.	Heating, ventilating, etc., New York	Nov. 17
Nov. 21.	Concrete walks, etc., New Haven, Conn.	Nov. 17
Nov. 21.	Brick and pipe sewers, Rankin, Pa.	Nov. 17
Nov. 21.	Boilers and machinery, Detroit, Mich.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Nov. 21.	Macadamizing, Plainfield, N. J.	Nov. 10
Nov. 21.	Bridges, Los Angeles, Cal.	Nov. 10
Nov. 21.	Brick sewers, Toledo, O.	Oct. 27
Nov. 21.	Naval supplies, St. Augustine, Fla.	Oct. 27
	Advertised, Eng. News Oct. 27 to Nov. 17.	
Nov. 21.	Government bldgs (8), Sophia, Bulgaria.	Sept. 29
Nov. 21.	Paving, etc., Lynchburg, Va.	Nov. 17
Nov. 21.	Paving a viaduct, Atlanta, Ga.	Nov. 17
Nov. 21.	Electric plant, Danville, Ill.	Nov. 17
Nov. 22.	Levee work, New Orleans, La.	Nov. 17
Nov. 22.	U. S. building, Norfolk, Va.	Oct. 27
	Advertised Eng. News, Oct. 27 and Nov. 3.	
Nov. 22.	Bridge foundations, Washington, D. C.	Nov. 3
	Advertised, Engineering News, Nov. 3.	
Nov. 22.	Electric plant, Fredericksburg, Va.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Nov. 22.	Chemical engine, Jersey City, N. J.	Nov. 17
Nov. 22.	Boilers (5), Boston, Mass.	Nov. 17
Nov. 22.	Hospital buildings, Brooklyn, N. Y.	Nov. 17
Nov. 23.	Sewers, Elkhart, Ind.	Nov. 10
Nov. 23.	Buildings, Buffalo, N. Y.	Nov. 17
Nov. 23.	Street bonds, Rockville, Md.	Nov. 17
Nov. 23.	Street bonds, Hyde Park, O.	Nov. 17
Nov. 23.	Park work, Newark, N. J.	Nov. 17
	Advertised, Engineering News, Nov. 17.	
Nov. 24.	Sidewalks, etc., Kansas City, Mo.	Nov. 17
Nov. 24.	Brick sidewalk, Huntington, W. Va.	Nov. 3
Nov. 25.	Water pipe, etc., Honolulu, H. I.	Oct. 27
Nov. 25.	Rebuilding wall, New York, N. Y.	Nov. 10
Nov. 25.	Rebuilding pump, Cleveland, O.	Nov. 10
Nov. 25.	Cleaning streets, Cleveland, O.	Nov. 10
Nov. 25.	Portable pump, Cleveland, O.	Nov. 17
Nov. 25.	Sewer connections, etc., N. Soldiers' Home.	Nov. 17
Nov. 26.	Court house, Danbury, Conn.	Nov. 17
Nov. 26.	Boilers, Brooklyn, N. Y.	Nov. 10
Nov. 25.	Pipe sewers, Pontiac, Mich.	Nov. 17
	Advertised, Engineering News, Nov. 17.	
Nov. 26.	Crane, Port Royal, S. C.	Oct. 27
Nov. 26.	Boat shelter roof, Mare Island, Cal.	Oct. 20
Nov. 26.	Sawmill, chimney, etc., Mare Island, Cal.	Nov. 3
Nov. 28.	Removing wreck, Port Chester, N. Y.	Nov. 3
	Advertised, Eng. News, Oct. 27 to Nov. 17.	
Nov. 28.	Water-works, Florence, Colo	Nov. 3
	Advertised, Eng. News, Nov. 3 and 10.	
Nov. 28.	Sewers, North Bend, Ind.	Nov. 3
Nov. 28.	Heating plant, Henderson, Colo.	Nov. 3
Nov. 28.	Tubular boilers, (2), San Francisco, Cal.	Nov. 3
Nov. 28.	Removing wreck, Portchester Harbor, N. Y.	Oct. 27
Nov. 28.	Electric plant, Denver, Colo.	Nov. 10
Nov. 28.	Tug boat, San Francisco, Cal.	Nov. 10
Nov. 28.	Mailing platform and shed, New York.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Nov. 28.	Street bonds, Wellston, O.	Nov. 17
Nov. 28.	Cast-iron pipe sewer, New York.	Nov. 17
Nov. 28.	Boilers, machinery, etc., Detroit, Mich.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Nov. 29.	Sewers, etc., Red Bank, N. J.	Nov. 17
	Advertised, Engineering News, Nov. 17.	
Nov. 29.	Condenser tubes, Mare Island, Cal.	Nov. 10
Nov. 29.	Scales, etc., Washington, D. C.	Nov. 10
Nov. 29.	Drain tile, Philo, Ill.	Nov. 17
Nov. 29.	Water-works, Ft. Berthold, N. Dak.	Nov. 3
Nov. 30.	Dry dock, Algiers, La.	Oct. 20
Nov. 30.	Bridge, etc., and plans, Moline, Ill.	Oct. 6
	Advertised, Eng. News, Oct. 6 and 13.	
Nov. 30.	Water-works, McKinney, Tex.	Nov. 10
Nov. 30.	Steel arch bridge, Victoria, B. C.	Nov. 10
Nov. 30.	Temporary drain, New York.	Nov. 17
Nov. 30.	Power plant, Orillia, Ont.	Nov. 17
Dec. 1.	Bonds, Madisonville, O.	Nov. 17
Dec. 1.	Suction pipe, etc., Three Rivers, Que.	Nov. 17
Dec. 1.	Electric plant, Somerville, Tenn.	Nov. 17
Dec. 1.	Water-works, Somerville, Tenn.	Nov. 17
Dec. 1.	Water-works, E. Grand Forks, Minn.	Nov. 17
Dec. 1.	Power plant, Brandon, Vt.	Nov. 17
Dec. 1.	Electric light plant, Clinton, Ill.	Nov. 10
Dec. 1.	Business building, Cleburne, Tex.	Nov. 10
Dec. 1.	Seawall, S. I., N. Y.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Dec. 1.	Garbage collecting, Jersey City, N. J.	Nov. 10
Dec. 1.	Electric lighting, Sumter, S. C.	Oct. 6
Dec. 1.	Electric light plant, Clinton, Ill.	Oct. 13
Dec. 2.	Arc lighting, Asheville, N. C.	Oct. 13
Dec. 5.	Pumping engine, Oil City, Pa.	Oct. 27
	Advertised, Eng. News Oct. 27 to Nov. 10.	
Dec. 5.	Removing wreck, Philadelphia, Pa.	Nov. 10
Dec. 5.	Water-works, West Tampa, Fla.	Nov. 10
	Advertised, Eng. News, Nov. 10 to 24.	
Dec. 5.	Court house, Garner, Ia.	Nov. 10
Dec. 6.	Canal, Tampico, Ill.	Nov. 10
	Advertised, Eng. News, Nov. 10 to Dec. 1.	
Dec. 6.	Street bonds, Springfield, O.	Nov. 3
Dec. 6.	School building, Sacramento, Cal.	Nov. 17
Dec. 7.	Changing Van Buren St. bridge, Chicago, Ill.	Oct. 20
Dec. 7.	Torpedo storehouse, Fort Caswell, N. C.	Nov. 10
	Advertised, Eng. News, Nov. 10 to Dec. 1.	
Dec. 8.	Bridge approach, Zanesville, O.	Nov. 10
Dec. 10.	Intercepting sewers, Washington, D. C.	Nov. 3
	Advertised, Engineering News, Nov. 3.	
Dec. 10.	Crane (100 tons capacity), Brooklyn, N.Y.	Nov. 10
Dec. 12.	Paving, curbing, etc., Dayton, O.	Nov. 17
Dec. 15.	Storm sewers, Denver, Colo.	Oct. 13
Dec. 19.	Tunnel sewer, Newburg, N. Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 21.	Court house annex, Atlanta, Ga.	Nov. 3
Dec. 22.	Bridge superstructure, Lorain, O.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Dec. 23.	Light station, Tompkinsville, (S.I.), N. Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 28.	Railway bridge, Chicago, Ill.	Nov. 17
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18
Jan. 1.	Draw bridge, Cathlamet, Wash.	Nov. 17
Jan. 1.	Water-works, Pasadena, Cal.	Nov. 17
Jan. 2.	Bridge, Quebec, Que.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Jan. 2.	Arc lighting, Vincennes, Ind.	Oct. 27
Jan. 6.	Water-gas plant, Johannesburg, So. Africa.	Oct. 27
Jan. 6.	Extension electric plant, Johannesburg, S. Af.	Oct. 27
Jan. 14.	Park work and plans, Philadelphia, Pa.	Nov. 17
Jan. 24.	Footway tunnel, London, England.	Nov. 10
Feb. 2.	Electric lighting, New Orleans, La.	Nov. 3
Feb. 10.	Jail building, Keyser, W. Va.	Sept. 29
Apr. 30.	Water-works, Persia, Ia.	Nov. 17

RAILWAYS.

ALABAMA.—Dunn & Lalande Bros., who have the contract to grade the right of way for the new railway to be built for the Pioneer Mining & Mfg. Co., from its furnaces at Thomas, Ala., to North Birmingham, where a new mine is being opened, began work on their contract Nov. 7. Thirty teams are at work and it is expected that the 4½ miles of road will be graded and trestles built within 60 days; estimated cost, $50,000.

ALLEGHENY VALLEY.—Plans are under consideration for the general improvement and enlargement of the yards of this company at 16th and Pike Sts., Pittsburg, Pa., the work to begin early next spring. The Low Point tunnel, 700 ft. in length, on the low grade division, is now being arched; the stone foundations for the arch have just been completed. D. McCargo, Gen. Supt., Pittsburg, Pa.

ARKANSAS & CHOCTAW.—W. H. Carson, Supt., Texarkana, Ark., is quoted as stating that grading has been completed on this road to a point 12 miles from the Arkansas line. The length of the route at present is 51 miles, and extends from Ashdown to Choctaw City, Ark.; the proposed extension is towards Anoka, Ind. Ter., where a connection will be made with the Missouri, Kansas & Texas Ry.

ATLANTIC COAST LINE.—We are informed that Abercrombie & Williams, Montgomery, Ala., and not the A. & C. Wright Co., as stated in our last issue, have been awarded the contract for constructing the extension of the Charleston & Western branch from Denmark to Robbins, S. C., 34.7 miles, including all the earth and trestle work. F. Gardner, Ch. Engr., Charleston, S. C. Abercrombie & Williams also inform us that they will have the work covered by Dec. 1.

BALTIMORE & OHIO SOUTHWESTERN.—Reports state that this company has begun its proposed series of improvements by beginning the laying of 5,000 tons of 85-pound steel rails between Chillicothe, O., and Parkersburg, W. Va.

BELLAIRE, ZANESVILLE & CINCINNATI.—As a result of the oil boom in this section of Ohio, this company is said to contemplate the changing of its road to standard gage between Woodfield and Bellaire, a distance of about 35 miles. J. K. Geddes, Recr. and Gen. Mgr., Zanesville, O.

CAPE FEAR & NORTHERN.—J. M. Bandy, Ch. Engr., Greensboro, N. C., informs us that surveys have been completed for 20 miles, and the right of way secured. Gibson & Carpenter, of Holly Springs, N. C., have graded 14 miles of the line and laid three miles of track; they expected to be at Holly Springs on Nov. 12. Work is being rapidly pushed between Apex and Williams, via Holly Springs and Blanchards, 20 miles. The length of completed line will probably be 150 miles. Pres., B. N. Duke, Durham, N. C.

CHICAGO, FORT MADISON & DES MOINES.—Press reports state that this line will be sold at Keokuk, Ia., Jan. 5, under a decree of foreclosure brought by the American Loan & Trust Co., of Boston.

CHICAGO, ST. LOUIS & TEXAS AIR LINE.—Reports state that the right of way has been obtained for this proposed railway from San Antonio to Brownsville, Tex., a distance of 280 miles, and that propositions to construct the line will now be considered. Pres., D. Griffin Gunn, San Antonio, Tex.

CHOCTAW & MEMPHIS.—We are informed that bids were to be opened on Nov. 11, and awarded Nov. 12, for the construction of this company's line from Howe, Ind. Ter., to Little Rock, Ark., a distance of 164 miles. F. A. Molitor, Ch. Engr., Little Rock, Ark.

COLUMBIA & WESTERN.—Press reports state that 5,000 men are now at work on the construction of this proposed branch of the Canadian Pacific system from Robson through the Gold Range mountains to Midway, B. C., a distance of 105 miles. No track has yet been laid. This undertaking is said to be one of the heaviest and most difficult pieces of work in the Northwest. There will be 5,300 ft. of tunnels, requiring the removal of about 66,000 cu. yds. of material, and numerous bridges and trestles. Foley Bros. & Larson are the contractors.

COLUMBUS, LIMA & MILWAUKEE.—The contract for ties, track-laying, ballasting, etc., on this line from Lima to Defiance, via Gomer and Continental, O., a distance of 40 miles, is reported to have been awarded to A. Brown, Ottawa, O. The rails will be supplied by the Johnson Steel Co., Lorain, O. Part of the roadbed and the bridges for this railway were built eight years ago, and have since lain idle. Pres., J. G. W. Cowles, of the Cleveland Trust Co., Cleveland, O.

DENVER & RIO GRANDE.—Reports state that the Veta Pass route of this line will soon be made standard gage as far as Alamosa, Colo. M. H. Rogers, Ch. Engr., Denver, Colo.

DULUTH, MISSISSIPPI RIVER & NORTHERN.—Reports state that this company will soon commence surveys for the location of a new line from Hibbing, Minn., to the Canadian boundary, and that it will build into Duluth, within a year. I. N. Gray, Ch. Engr., Swan River, Minn.

FOURTH POOL CONNECTING.—This company was incorporated in Pennsylvania, Nov. 7, with a capital stock of $150,000 to construct a steam railway between Charleroi and Jefferson township, Fayette county, Pa. The incorporators are: Samuel A. Roelofs, Pres., and H. P. Richardson, both of Ellwood City, Pa.; Albert McNamee, McKees Rocks, Pa.; Jos. F. Ryan and Chas. F. Patterson, of Pittsburg.

GALVESTON, LA PORTE & HOUSTON.—L. J. Smith, 313 American Bldg., Kansas City, Mo., has bought this Texan railway, and intends to extend it in a northerly direction.

GREAT EASTERN.—J. H. McCleary, Gen. Mgr., Suffolk, Va., informs us that contracts will be let in December for the construction of this proposed line from Selma to Leechville, on the Pungo River, via Snowhill, Lizzie, Winterville, Washington, Pantego and Fairfield, N. C., a distance of 130 miles. Surveys have been completed and the right of way and capital about secured. Pres., J. W. Lynch, Kinston, N. C.; Ch. Engr., E. F. Hurt, 41 West 74th St., New York.

GULF, BEAUMONT & GREAT NORTHERN.—Jas. F. Weed, Ch. Engr., Beaumont, Tex., informs us that a preliminary survey has just been completed on this line from Beaumont to Waskom, Tex., and the location of the same made from Waskom to Jefferson. The total distance from Beaumont to Jefferson is 210 miles.

JAMESTOWN TERMINAL.—This company was incorporated in New York, Nov. 9, with a capital stock of $50,000, to construct one mile of steam railway in Jamestown, N.Y. The directors are John W. Doubleday, of Jamestown, and others.

LOUISIANA, NORTH & SOUTH.—Reports state that this company has been incorporated to construct a rail- from New Orleans, La., to Fort Smith, Ark., via Arcadia and Hot Springs, a distance of 325 miles. A. L. Atkins, Vice-Pres., Arcadia, La.

MICHIGAN.—Reports state that the Mohawk Mining Co. has ordered steel for the extension of the Traverse Bay Ry., and will complete the line before winter. A new stamp mill, costing $150,000, will be built on Lake Superior, taking water from Tobacco River.

NORTHERN MICHIGAN.—C. A. Wright, of Hancock, Mich., is interested in a new line of railway to be built from Calumet to Watersmeet, Mich., a distance of about 90 miles, connecting with the Chicago & Northwestern Ry. at the latter place. The final survey will be made soon and construction work begun in the spring.

NOVA SCOTIA.—At a recent meeting of the ratepayers of Amherst, N. S., it was decided to grant a subsidy towards the construction of a railway from Amherst to North Port, on the Northumberland Straits, a distance of about 20 miles, which will open up coal and agricultural districts.

PITTSBURG, BRADY'S BEND & LAKE ERIE.—Harwood R. Pool, Secy., 62 Cedar St., New York, informs us that all the surveys have been made and one-third of the right of way obtained for this proposed line from Brady's Bend to Butler, Pa., a distance of 20 miles. Not all of the capital necessary for construction has yet been secured. Pres., Joseph Pool, New York; Ch. Engr., J. D. Haggerty, East Brady, Pa.

ST. LOUIS, PEORIA & NORTHERN.—The Laclede Construction Co., St. Louis, Mo., is reported to have been awarded the contract for the construction and equipment of a branch of this line from Clinton to Chicago, via Peoria, Ill., requiring about 250 miles of new track, to be known as the St. Louis & North Shore Line. Pres., W. E. Guy, St. Louis, Mo.

SANDYVILLE & WAYNESVILLE.—This company has been incorporated in Ohio, with a capital stock of $50,000, to construct a railway from Waynesville to a connection with the Cleveland Terminal & Valley R. R. at Sandyville. The directors are F. H. Goff, C. H. Gale, F. H. Bushnell, John H. Smart, John E. Morley.

SHREVEPORT & RED RIVER VALLEY.—Contracts will be let on Nov. 20, according to reports, for the construction of an 11-mile extension. Work is expected to be completed to Campti, La., by Dec. 1. Clarence Ellerbe, Pres. Louisiana Construction Co., Shreveport, La.

TALLAHASSEE & SOUTHEASTERN.—The first section of this new line has been completed as far as the Wacissa River, 20 miles from Tallahassee, Fla. It is expected to build further to Old Town, on the Suwanee River, a distance of 101 miles, where it will meet the Atlantic, Gulf & Suwanee River R. R., now in course of construction from Starke southeasterly. R. L. Bennett, Vice-Pres., Tallahassee.

TEXAS MIDLAND.—The Craney Construction Co., Paris, Tex., is reported to have been awarded the contract for the construction of the proposed Waco extension of this line, work to begin about Jan. 1. M. Duvall, Ch. Engr., Terrell, Tex.

WASHINGTON RUN.—Taylor & Romine, McKeesport, Pa., inform us that surveys have been made, the right of way and capital secured for constructing this proposed line of steam railway from Layton to Star Junction, Fayette county, a distance of five miles. Bids were closed Nov. 12. Pres., W. Harry Brown, Conestoga Bldg., Pittsburg, Pa.; Ch. Engr., E. J. Taylor, McKeesport.

WATERVILLE & WISCASSET.—President Thayer has been instructed to sign a contract for the construction of this line, with the Kennebec Construction Co., to cost about $260,000.

WYOMING & GRUNDY.—This company has been organized in California with a capital stock of $500,000, to construct a standard gage railway from a point on the Norfolk & Western Ry., near the mouth of Bull Creek, in McDowell county, W. Va., to Grundy, Va., 50 miles. The directors are: R. L. Beardslee, John M. Bonner, Herman de Laguna, E. E. Forrest, and Samuel H. Cohn, all of Stockton, Cal. S. D. Freshman, Secy. of the Sierra Co., is the treasurer.

STREET AND ELECTRIC RAILWAYS.

BELFAST, ME.—Reports state that James Mitchell, a railway contractor and promoter of Bangor, Me., will build about five miles of electric railway in the spring, between Belfast and Northport.

HAMPTON, N. H.—Soule, Dillingham & Co., Boston, Mass., are said to have been awarded the contract for the construction of the Hampton & Amesbury St. Ry., from Hampton through Hampton Falls and Seabrook to the state line, connecting with the Newburyport & Amesbury Ry., by a short link to be built. The new line will be operated by the Exeter Ry. Co.

SALISBURY, VT.—W. T. Dewey, E. D. Blackwell, of Montpelier, Vt., are among the proposed incorporators of the Lake Dunmore Power & Traction Co., which contemplates the construction of a railway through Salisbury, Leicester, Brandon, Pittsfield and Proctor to Rutland.

DEDHAM, MASS.—Work was begun on the construction of the Norfolk Western St. Ry., on High St., Nov. 7. The proposed route is from Medfield to Dedham, via Westwood, nine miles. Pres., W. W. Mitchell, Medfield, Mass.; Engrs., Hodges & Harrington, 60 State St., Boston.

NEEDHAM, MASS.—The selectmen have granted a franchise to the Needham & Boston St. Ry. Co. to lay tracks and operate a line of electric street cars between Post-office Square and the Dedham town line, via Great Plain, Dedham and Harris Aves. The road must be in operation by June 1, 1899.

NEW BEDFORD, MASS.—Reports state that the New Bedford, Middleboro & Brockton St. Ry. Co. was granted a franchise, Nov. 9, to construct and operate its line on the county road between the termination of the Union St. Ry. tracks at Lunds corner and the Freetown line. Work is to be completed before next June. A. P. Smith, of New Bedford, and Fred. C. Hinds, Newton, Mass., are members of the company.

TAUNTON, MASS.—The Taunton & Middleboro St. Ry. Co. has been organized, with a proposed capital stock of $55,000, to construct a street railway from the terminus of the East Taunton St. Ry., in Taunton, through Lakeville, to the location of the New Bedford, Middleboro & Brockton St. Ry., a distance of 5½ miles. The directors are Fred. C. Hinds, Newton; A. M. Bearse, Middleboro; A. P. Smith, New Bedford, and others.

WHITMAN, MASS.—Waldo Dyer, P. O. Box 566, Whitman, informs us that nothing will be done this winter towards building the proposed railway of the Old Colony St. Ry. Co., except to complete the organization of the company. The line will be about 12 miles in length, through a fine country, covering several coach lines, and will probably be built early next year.

NEWPORT, R. I.—The Newport St. Ry. Co. has petitioned the council for permission to extend its tracks from Broadway through Marlborough St. to the Old Colony R. R. station, etc. Pres., G. B. Reynolds, Spring and Franklin Sts.

NEW HAVEN, CONN.—It is reported that the Fairhaven & Westville R. R. Co. contemplates the extension of its lines to Seymour. Pres., H. S. Parmelee, 730 Chapel St.

WILLIMANTIC, CONN.—Report state that a syndicate represented by Jesse W. Starr, of New York, has purchased the franchise for the proposed street railway in this town, and that the construction of the line at an early date is now assured.

NEW ROCHELLE, N. Y.—The Westchester Electric R. R. Co., controlled by the Union Ry. Co., 128th St. and 3d Ave., New York, has filed with the secretary of state, at Albany, a certificate of an extension of its lines in this village.

PASSAIC, N. J.—We are informed that the directors of the Saddle River Traction Co. met, at Passaic, N. J., Nov. 11, and awarded the contract for the construction of the proposed railway from Passaic to Lodi. The line will be double track and will be operated as an extension of the Paterson Ry. Engr., Colin R. Wise, Passaic National Bank Bldg., Passaic.

PITTSTON, PA.—The Pittston & Scranton St. Ry. Co. was incorporated, Nov. 7, with a capital stock of $75 000, to construct an electric street railway from Pittston to Scranton, a distance of three miles. The incorporators are: Jas. A. Steese, Pres.; Chas. H. Mullin and D. A. Dunlevy, of Mount Holly Springs, Pa.; Lane S. Hart and W. H. Metzger, of Harrisburg, Pa.

WAYNESBORO, PA.—The Blue Ridge Electric Ry. Co. has been organized by August Beck and J. Reily Weaver, of Baltimore, Md.; Peter Rouzer, Rouzersville, Pa.; and others for the construction of a line connecting Waynesboro, Pen-Mar, Blue Mountain House, Monterey and Buena Vista.

YORK, PA.—Report state that the York Southern R. R. will convert its lines, covering 37 miles, into a trolley system. Ch. Engr., S. M. Manifold, York.

LEXINGTON, VA.—Reports state that John R Williams, of Richmond, Va., and owner of Hotel De Hart, contemplates the construction of an electric street railway to the hotel, which is in the suburbs. Engr., A. L. Johnston, of Richmond.

LYNCHBURG, VA.—The Lynchburg & Rivermont St. Ry. Co. has been granted a franchise to build a line to the Durham station and City Park, via 12th St. Pres. and Mgr., H. P. Woodson, 812 Church St.

VICKSBURG, MISS.—E. C. Collins, Supt. of Construction of the North American Ry. Construction Co., Chicago, Ill., has commenced the construction of the Vicksburg Electric St. Ry. The present contract is for the construction of four miles of track, using 60-lb. rails.

CHATTANOOGA, TENN.—Surveys are now under way and plans being prepared for the extension of the narrow gage railway on Lookout Mountain to Rock City, Lookout Inn and other points of interest. L. E. Montague, Pres of Lookout Incline & Lulu Lake Ry. Co.

EAST LIVERPOOL, O.—A syndicate composed of Chicago, Philadelphia and New York capitalists is said to propose the construction of an electric freight railway between this city and Lisbon, connecting the Erie system with the Ohio River at this point. A bonus of $60,000 is asked of East Liverpool, and of $25 000 of Lisbon. J. L Francis, of Chicago, is reported interested.

LEXINGTON, IND.—Press reports state that Benjamin Johnson, the engineer who built the Madison Electric St. Ry., has been engaged by Enoch H. Fudge and other Chicago capitalists to examine into the feasibility of constructing an electric railway from Lexington, on the Baltimore & Ohio R. R., through Hanover and Madison to Vevay, a distance of 40 miles.

HOUGHTON, MICH.—The council has granted a franchise for a street railway through this village to Wm. H. Taylor, of New York, according to reports, provided that enough franchise be secured to build a belt line about the county connecting Houghton, Hancock, Quincy, Franklin, Dollar Bay, Lake Linden, South Lake, Linden Laurium, Calumet and Red Jacket; a distance of about 20 miles.

OWOSSO, MICH.—Reports state that a party of Detroit capitalists has taken the initiative toward getting a franchise in this city and Corunna for an electric railway which will combine with the interurban road now running from Detroit to Sylvan Lake.

CHICAGO, ILL.—The United Traction Co. was incorporated at Springfield, Nov. 7, with a capital stock of $500,000, by Albert E. Wilson, Anson E. Meanor and L. J. Bean, 908 Stock Exchange Bldg., Chicago.

KANSAS CITY, MO.—A franchise has been granted by the county court to the Jackson County Electric Ry. Co for the construction of a double track electric railway on Prospect Ave., from the city limits to Dodson and Swope Park, about five miles. The company is under $1,000 bond to have the road in operation within one year. The incorporators of the company and also of the Missouri Electric Ry. Co., are: F. W. Sears, B. F. Burd, W. H. Brown, Dr. Chet McDonald, Henry Smith. The Missouri Electric Ry. Co. will operate the city end of the line: it was incorporated a month ago. A power house to cost about $40,000 will be erected at Brush Creek and Prospect Ave

EL PASO, TEX.—B. F. Hammett, Leigh Clark, J. J. Taylor and others are said to have been granted a franchise for an electric railway and electric light plant in this city.

PORTLAND, ORE.—An ordinance has been passed granting a franchise to the City & Suburban Ry. Co. to construct and operate a tramway on 22d St., from Savior St. to St. Helena County Road. Pres., H. Failing, 3d and Yamhill Sts.

LOS ANGELES, CAL.—Reports state that electricity as a motive power will be installed on the Glendale branch of the Los Angeles Terminal Ry. within 90 days. The Pasadena line will probably be equipped in the same manner as soon as the franchise can be secured. T. E. Gibbon, Vice-Pres. and Gen. Mgr., Los Angeles.

OTTAWA, ONT.—The city has taken action to compel the Ottawa Electric Ry. Co. to extend its Elgin St. line to the exhibition grounds. Pres., J. W. McRae, 337 Albert St.

VICTORIA, B. C.—William Jensen and Lawrence Goodacre have given notice of application for the incorporation of the Hardy Bay Tramway Co., to construct an 8-mile electric tramway from Hardy Bay to Cold Bay, Quatsino Sound.

CAMPECHY, MEX.—Press reports state that a street railway line is to be built in this city; population, about 16,000.

CHIHUAHUA, MEX.—It is positively stated that the Chihuahua capitalists will construct an electric railway in this city of 12,000 inhabitants.

MEXICO, MEX.—An entire new roadbed is now being constructed in this city for the new system of electric traction: it is expected to lay 26 miles of 85-lb. rails as soon as possible. The power house will contain three boilers of the Babcock & Wilcox type and three McIntosh & Seymour engines; the nominal horse power of the plant is calculated at 1 200. The General Electric Co. will furnish the electrical plant, the cars being equipped with 70 HP. motors. The J. G. Brill Co., of Philadelphia, is also said to be constructing 30 cars for the line.

HAVANA, CUBA.—Press reports state that the entire street railway system of Havana, about 25 miles in length, has been sold to an English stock company for $1 600 000. The motive power will probably be changed from horses to electricity.

TOKIO, JAPAN.—It is announced that the International Air Power Co., owning the Hoadley-Knight compressed air system for foreign shipment, has just closed a contract with Fraser & Co., 63 Wall St., New York, and Yokohama, for compressed air street cars to be installed in Tokio.

VIENNA, AUSTRIA.—The Siemens & Halske Electric Co., of Chicago, is reported to have been awarded a contract to install electricity on the tramway systems of Vienna, covering about 100 miles of road.

ELECTRIC LIGHT AND POWER.

BRANDON, VT.—E. D. Blackwell, Montpelier, Vt., and Brandon, writes us that bids will probably be received about Dec. 1 for furnishing the materials and for constructing the proposed water-power plant, to cost about $75 000. The plant will have 375-ft. head, 1,200 HP. There will be a 1,000-HP. impulse wheel, 600-K-W. alternating generator, 3,000 ft. of steel penstock, transformers, to step-up to 15,000 volts and back to 2,000 volts; 65,000 lbs. of copper wire, etc.

SANDY HILL, N. Y.—The Sandy Hill Electric Light Co. is considering estimates for additional arc and incandescent dynamos, according to reports. J. E. Howland, Pres.; H. P. Galley, Supt.

SENECA FALLS, N. Y.—Press reports state that Mr. H. H. Crowell, of Syracuse, N. Y., has been appointed receiver for the Seneca Electric Light & Power Co., embracing the plants at this place and Waterloo. The action was brought about by the Old Colony Trust Co., of Boston, as trustees of the company's bonds.

CAMDEN, N. J.—The council is reported to have granted a franchise to the Citizens Light, Heat & Power Co.

PHILADELPHIA, PA.—The Southern Electric Light & Power Co. proposes to increase its capital stock from $400,000 to $2,000,000. It is stated that the company will enlarge its plant. A meeting to decide the question will be held Nov. 23. Wm. J. Manning, Secy.

PHILADELPHIA, PA.—H. Brockelhurst, Philadelphia, has the contract for building an addition to the power house of the plant of the Midvale Steel Co., at Nicetown. The addition will be 30×115 ft.

PITTSBURG, PA.—G. H. Winslow, 339 Fifth Ave., Pittsburg, is preparing plans and specifications for an electric light plant in this vicinity for a manufacturing company.

READING, PA.—Geo. Hensher and Michael McDonough are reported as considering estimates for a plant for the building of the St. Peter T. A. B. Society.

WRIGHTSVILLE, PA.—Wm. A. Chapman & Co., 49 Westminster St., Providence, R. I., have been awarded the contract for the development of power, including the building of a concrete dam and power-house on the Susquehanna River, Wrightsville, for the Martic Water & Power Co. In our issue of Nov. 3 we incorrectly reported that this contract had been let to the Walter Bradley Construction Co., Oswego, N. Y.

PENNSBORO, W. VA.—The Collins Co. writes us that the company wants to purchase a plant of about 100 16-c.p. incandescent lights for the mill, and also an engine to run the same.

CHESAPEAKE BEACH, MD.—It is stated that a site has been located for the plant and the water-works at the Beach for the Chesapeake Beach Ry. Co., Washington, D. C. Geo. Cadogan Morgan, Engr., 808 Royal Insurance Bldg., Chicago, Ill.; Otto Mears, Pres., Washington.

HAGERSTOWN, MD.—Mayor Edwin M. Schindel writes us that the matter of a plant and a sewerage system are in the hands of the committees. No definite action will be taken for some months. Charles Webb, Chn.

WILLIAMSPORT, MD.—D. G. Adelsberger, 722 Pennsylvania Ave., Baltimore, Md., is preparing plans for a plant and water-works for this city.

PENNSBORO, W. VA.—The Collins Co. is reported as wanting estimates for a plant of 100 16 c.p. incandescent lights.

DECATUR, ALA.—R. D. Smith, of a Birmingham company, is reported as making an effort to secure permission to build a plant here.

THIBODAUX, LA.—This place voted Nov. 8 to issue bonds for a plant. F. Zermott, Mayor.

SOMERVILLE, TENN.—Bids are asked until Dec. 1 for furnishing and installing a plant and water-works, to cost about $10,000. The plant will have a capacity for furnishing about 15 2,000 c.p. arc and 750 16 c.p. incandescent lights. Geo. C. Morgan, Engr., 808 Royal Insurance Bldg., Chicago; W. D. Scruggs, Chn. Com.; E. R. Scruggs, Recdr.

LIMA, O.—We are informed that this city proposes to either build a plant or let a contract for about 300 arc lights. J. K. McClurg, Chn. Com.

MILFORD, O.—It is stated that the council is considering the question of granting a franchise.

NEW RICHMOND, O.—H. Buckley, Pres. Electric and Water-Works Trustees, writes us that plans and specifications for a plant and water-works will be completed soon and that bids will probably soon be asked. J. F. Witmer, Des. Engr., 705 Ellicott Square, Buffalo, N. Y.; Chas. R. Day, Cy. Clk.

PERRYSVILLE, O.—E. H. Vanderslice writes us that it it proposed to put in a water power plant as soon as arrangements can be completed. Estimates for a plant are now being considered.

WOOSTER, O.—W. E. Lee writes us that the city has made a contract with the old company and will therefore not build a plant, as has been reported.

CARO, MICH.—We are informed that bids will be asked next spring by the Caro Light & Power Co., just incorporated, for building a water and steam power plant, to cost about $25,000. O'Keefe & Orbison, Engrs., Appleton, Wis. J. H. Harris may be addressed.

KALAMAZOO, MICH.—The Kalamazoo Electric Co. has been granted permission to extend its plant, erect towers, and make a number of other important improvements to its plant. Work is said to have already been begun.

LANSING, MICH.—The committee has recommended that $1,200 be appropriated for the purchase of a 100-HP. engine, etc., for the light plant. Commissioner Earle, Chn. Com., may be addressed.

LANSING, MICH.—Local papers state that a company is organized to build a plant to light several blocks in the business portion of the city. C. P. Downey, of Downey's Hotel, and J. J. Baird are interested.

DANVILLE, ILL.—Bids are asked until Nov. 21 for furnishing the materials and for building a municipal plant. E. R. E. Kimbrough, Mayor; E. E. Boudinot, Chn. Com.

UPPER ALTON, ILL.—The village board is reported to have decided to change the public lighting from arc to incandescent lights.

MARSHFIELD, WIS.—John H. Thomas, Cy. Clk., writes us that the committee is considering the question of building a plant. Population 6 000. Henry Kolsched, Chn.; W. H. Kamps and P. J. Kraus are on the committee.

SUN PRAIRIE, WIS.—C. B. Hayden writes us that some bids for a plant have already been received. The plant will have a 50 HP. engine, 60 to 75 HP. boiler, a 350 to 500-light dynamo, etc. The wire has already been ordered; estimated cost of plant, $4,000.

WARRENS, WIS.—The Geo. Warren Co. has let the contract for a 300 incandescent light plant to Thos. Benson & Sons, of La Crosse, Wis.

E. GRAND FORKS, MINN.—Bids are asked until Dec. 1 for furnishing the materials and for building a plant and water-works, according to reports. W. I. Gray & Co., Engrs., Sykes Bldg., Minneapolis, Minn.

WINONA, MINN.—W. L. Raymond, Pres. Council, writes us that the committee is investigating the question of a municipal plant; it will report by Jan. 1. F. E. Gartside, Pres. Com.

OMAHA, NEB.—Bids are asked until 2 p. m., Nov. 18 for furnishing and placing combination gas and electric lighting fixtures in the court house and postoffice building of this city. O. L. Spaulding, Acting Secy., Treasury Department, Washington, D. C.

CARTHAGE, MO.—The question of issuing $25,000 in bonds for a city plant will be voted upon Nov. 22. The present light contract expires in August.

ST. LOUIS, MO.—Local papers state that it is probable that the board of public improvements will send an ordinance to the municipal assembly providing for a municipal electric plant. President McMath has expert assurances that such a plant could be erected by Jan. 1, 1900, when the present contract expires. The board is forced to this alternative by the persistency of the council in filing bills for letting a lighting contract. If the council turns down the municipal ordinance then the board will have to let a temporary contract.

WYNNE, ARK.—M. Jolly, Secy., Bd. of Improvements, writes us that G. Jaeger, Batesville, Ark., was awarded the contract Nov. 10, at $15,490, for building a plant and water-works.

EL PASO, TEX.—B. F. Hammett, Leigh Clark, J. J. Taylor and others have been granted a franchise for a light plant and street railway, according to reports.

IDAHO SPRINGS, COLO.—Press reports state that Aug R. Specht, 24 Devonshire St., Boston, Mass.; H. P. Malone, of Cleveland, and A. H. Johnson, Pres. Arkansas Midland R. R. Co., Helena, Ark., are interested in a power plant project on Clear Creek, several miles from this place. It will be used for furnishing power to mining plants. Right of way has been bought. Bids will soon be asked for furnishing machinery for developing, for 5,000 HP.

DAVENPORT, WASH.—R. H. Robinson, Arlington, Wash., it is stated, will build plants at this place and at Wilbur.

SAN BERNARDINO, CAL.—The plant of the San Berrardino Electric Co. is to be extended, according to reports.

CAMPBELLTON, N. B.—Duncan & McLellan, Campbellton, have been awarded the contract for a plant for this place, at $12,950.

HALIFAX, N. S.—The city engineer is reported to have been directed to prepare plans for a municipal plant. The committee estimates that it will cost about $54,335 to build the plant and $18,925 a year to maintain and operate it.

MAGOG, QUE.—W. W. Chalmers, Mayor, writes us that the proposed issue of bonds is to pay for the additions to the plant already made.

MONTREAL, QUE.—Prof. R. B. Owens, of the Electrical Engineering Dept., McGill University, writes us that $30,000 has been donated by W. C. McDonald, of Montreal, for the re-equipment of the department. The new apparatus includes direct and alternating current machinery, batteries, measuring instruments, etc.

ORILLIA, ONT.—Bids are asked until Nov. 30 for furnishing the materials and for building a power transmission plant at a point on the Severn River. The plant will consist of the following: Alternating current generators, two of 300 k.w. capacity each; step-up and step-down transformers, 600 k.w. capacity; transmission line and construction, 18 miles; switchboard equipment, for generating and receiving stations; hydraulic machinery, including masonry construction. The plant will cost about $75,000, as stated last week. R. J. Parke, Elec. Engr., 319 Temple Bldg., Toronto, Ont.; C. J. Miller, Chn. Com.

OTTAWA, ONT.—Bids are asked until Nov. 21 for installing a power house and electric plant for operating the locks, bridges and other structures along the Soulanges Canal, and also for lighting the canal its entire length. L. K. Jones, Secy., Dept. Rys. & Canals, Ottawa.

TORONTO, ONT.—The Anglo-American Electric & Supply Co., among others, submitted a proposition to the board of control Nov. 9 offering to supply electric power to light the city streets and supply energy for manufacturing purposes at the rate of 1 ct. a horse-power per hour. Its capital will be $5,000,000, and when the dividends reach 10% it offers to light the streets at cost price. It will also establish a manufactory for electric supplies, and the profits of this will come under the same agreement. The proposed plant will cost about $1,000,000, exclusive of site and wiring. G. P. Magann, Dr. R. A. Pyne, M. P. P., and G. S. Ransom are interested.

PUEBLA, MEX.—Press reports state that C. J. S. Hall, Arch., Puebla, is interested in a water-power project.

BRIDGES.

CHARLEMONT, MASS.—Bids are asked until Nov. 17 for constructing stone abutments and wing walls for a bridge. T. C. Mendenhall, Chn. Massachusetts Highway Comn., Boston.

WOONSOCKET, R. I.—Frank H. Mills, Cy. Engr., writes us that the proposed work at the Globe bridge consists of tearing down one stone arch and constructing a longer and wider one in its place, the extension of another stone arch, the widening of the street and the building of heavy retaining walls, with the necessary excavation, filling, etc.; estimated cost, $34,600. The work will not be done this year, and perhaps not next.

BUFFALO, N. Y.—The grade crossing commission has approved the plans submitted by Engineer Guthrie for a subway at South Division St., and for a bridge at Elk St. and Abbott Road. It is proposed to let the contracts early next spring.

CANASTOTA, N. Y.—Plans have been prepared by the state engineering department, Albany, for a hoist bridge over the Erie Canal at Peterborough St. A copy of the plans are on file at the office of Village Clerk Bell.

HOOSICK FALLS, N. Y.—The town board awarded a contract Nov. 13 to the Massillon Bridge Co, of Massillon, O., at $2,728, for constructing six small bridges.

NEW HACKENSACK, N. Y.—The town board of Wappingers has awarded a contract to the Groton Bridge & Mfg. Co., Groton, N. Y., at $1,095, for constructing a steel bridge 50 × 20 ft.

SYRACUSE, N. Y.—Reports state that $4,000 has been appropriated for the removal and placing of the old swing bridge over the Oswego Canal, at the foot of Butternut St. The city clerk has been authorized to ask bids. Russell R. Stuart, Cy. Engr.

NEWARK, N. J.—Jas. F. Kelly, Township Clk., Arlington, N. J., informs us in regard to the report of Engineer Fritcher, on the dangerous condition of the bridge over the Erie R. R. at Kearney Ave. and 4th St. The structure is 140 × 20 ft., and has at present a capacity of 35 lbs. per sq. ft. No plans have yet been made. The township committee is trying to compel the Erie R. R. Co. to put this bridge in suitable condition. The matter is in the hands of the Grand Jury.

FRANKSTOWN, PA.—The Baltimore & Ohio R. R. Co will construct a bridge across 2d Ave., for the extension of a track, which is now being built, to encircle the Pennsylvania Tube Works, to cost about $15,000, according to reports.

JACKSON, MISS.—The council has authorized the issuance of $18,400 of bonds for building bridges, according to reports.

SOMERVILLE, O.—L. A. Dillon, Surv., Hamilton, informs us that he is preparing plans for the construction of a bridge over Seven Mile Creek, near this place.

CHICAGO, ILL.—Bids are asked until Dec. 28 for furnishing the material and for constructing the substructure and superstructure of an eight-track railway bridge, over the main drainage channel. Jas. Reddick, Clk. Bd. Sanitary Trustees.

ST. PAUL, MINN.—L. W. Rundlett, Cy. Engr., is preparing plans for the widening of the south approach of the Wabasha St. bridge, by constructing a fill for 250 ft. and doing away with the last two spans. A roadway, 36 ft. wide, and two 10-ft. sidewalks will be provided; estimated cost, about $100,000.

ATCHISON, KAN.—Reports state that, provided the Atchison Bridge Co. does not submit to the terms of the railway companies by Dec. 1, an offer will be made to the Missouri Valley Bridge Co., Leavenworth, Kan., of $400,000 in bonds, for the construction of the proposed railway bridge.

CATHLAMET, WASH.—Bids are asked until Jan. 1 for building a draw bridge, according to reports. Elmer B. Cotwell, Audr.

TACOMA, WASH.—The council street committee and the county commissioners considered a proposition Oct. 29 to construct a bridge about 165 ft. long over the Puyallup River, on 11th St. It is proposed to extend the street about 1,200 ft. on the east side of the river.

NAPA, CAL.—Bids are asked until 10.30 a. m., Nov. 17, for constructing a stone bridge across Fagen Creek. N. W. Collins, Clk., Bd. Supervisors.

BUILDINGS.

BARRE, VT.—Phelps Bros. have been awarded the contract for the plumbing and heating of the city building, at $3,813.

BOSTON, MASS.—J. M. Meredith, 15 Congress St.; J. Murray Howe, 28 State St., and others, are said to be behind a project to erect a 6-story building on the site of the Old Boston & Albany R. R. station on Beach St., for the wholesale shoe trade; estimated cost, $500,000. Archs., Peabody & Stevens, 919 Exchange Bldg.——Plans have been prepared by Winslow & Wetherell, 3 Hamilton Place, according to reports, for an 8-story fireproof business building, at Essex and South Sts., for the Wm. B. French heirs.——Plans have been prepared for six brick and stone flat buildings, to be erected at Dorchester for J. J. Connell and Joseph Green, to cost about $90,000. Archs., J. F. & G. H. Smith, 13 School St.——A number of store and apartment buildings will be erected at Roxbury, according to reports, for C. F. Ayer, Lowell, Mass., to cost about $86,000. Arch., Arthur H. Bowditch, 85 Devonshire St.; contractor, Angus McDonald, 17 Otis St., Boston.

BUFFALO, N. Y.—Bids are asked until Nov. 23 for remodeling engine house No. 3 on Broadway, near Jefferson St., and for building an addition thereto. R. G. Parsons, Secy. Bd. of Pub. Wks.

SOUTH HADLEY, MASS.—A sum of $50,000 has recently become available towards the erection and equipment of a new dormitory building for Mount Holyoke College. Treas., A. L. Williamson, Northampton, Mass.

DANBURY, CONN.—Bids are asked until Nov. 26, according to reports, for the construction of a court house. Arch., Warren R. Briggs, 338 Main St., Bridgeport, Conn.

FARMINGTON, CONN.—Plans are being prepared, according to reports, for a 1½-story frame dwelling, 30 × 50 ft., for A. A. Pope, Cleveland, O., and Miss A. Pope, to cost about $50,000. Archs., McKim, Meade & White, 160 5th Ave., New York.

NEW BRITAIN, CONN.—The directors of the New Britain Institute have awarded the contract for building the proposed library, to B. H. Hibbard, of New Britain, at about $50,000. Archs., Davis & Brooks.

ALBANY, N. Y.—We are informed that plans are being prepared for a public bath to be erected on Broadway, near Orange St.; estimated cost, $30,000.

BROOKLYN, N. Y.—Bids are asked by the department of public charities, foot of East 26th St., New York, until Nov. 22, for the erection of one idiot pavilion, one nurses' home, two new wings, and materials and alterations to the central top story of the Kings County Hospital; work to be completed within 180 days.

BUFFALO, N. Y.—Bids were received by the commissioner of public works, Nov. 9, for erecting school buildings on Delaware Ave., near Bryant St., and at West and Delavan Aves., at $65,590 and $77,311 respectively.

NEW YORK, N. Y.—Bids are asked by the board of education, at 585 Broadway, until Nov 21, for supplying heating and ventilating apparatus and electric lighting plant for Public School 169, and for supplying furniture for Public School 166, Borough of Manhattan; also for supplying heating and ventilating apparatus for Public School 164, and for supplying furniture for Public School 167, Borough of Bronx; also for excavating, grading, concreting, etc., at Public School 94, Borough of Brooklyn, also for improving the sanitary condition of Public Schools 4, 17 and 18, Borough of Richmond.——Plans have been prepared, according to reports, for a 9-story theatre building, 100 × 175 ft., to be erected at 124th St. and 7th Ave., for George Blumenthal, Mgr. of Harlem Opera House, to cost about $450,000. Arch., Alfred Zucker, Decker Bldg.——Plans have been filed by Thos. McKeon, 338 East 66th St., for an 8-story brick and stone store and loft building, at 16 East 17th St., to cost $90,000. Arch., Wm. J. Dilthey, 1 Union Square; by John D. Karst, Jr., 258 West 38th St., for four 5-story brick flat buildings, at 438 to 444 West 29th St., to cost $70,000. Arch., Louis Korn, 37 Maiden Lane.

SYRACUSE, N.Y.—The Northcott Warming & Ventilating Co. has been awarded a contract for a heating apparatus for the Washington Irving school building, at $1,930.

TOMPKINSVILLE (S.I.), N. Y.—Bids are asked until Dec. 23 for metal work and erection of the West Bank light station, as stated in our advertising columns. Lieut.-Col. D. P. Heap, U. S. Engr., Tompkinsville.

ATLANTIC CITY, N. J.—Besides the new hotel building just completed for Clarence M. Busch, 606 Pacific Ave., at a cost of $55,000, reports state that extensive improvements will be made to the Hotel Rudolph, Chas. R. Myers proprietor; and also to the Scarborough, of which Aldred Wyman is proprietor, and the Wiltshire Hotel, S. S. Phoebus, proprietor.

BRIDGETON, N. J.—The Cumberland county freeholders, Nov. 8, adopted plans and specifications for a new $60,000 county insane asylum to be erected on the almshouse farm.

BRADDOCK, PA.—George Hogg, of Braddock, has been awarded the contract for erecting the new 2d Ward school building, at $47,677.

CANONSBURG, PA.—A fire in this town Nov. 14 destroyed a number of business buildings near West Pike St. and Jefferson Ave., causing a reported loss of $150,000.

PHILADELPHIA, PA.—Plans are being prepared, according to reports, for a 6-story office building, to be built at 10th and Market Sts., at a cost of about $70,000. Arch., E. L. Rice, Jr., Equitable Bldg., Wilmington, Del. ——Plans have been filed for a 17-story business building, 60 × 145 ft., to be erected for the Real Estate Trust Co., at Broad and Chestnut Sts.

PITTSBURG, PA.—A permit has been granted for the erection of the new Sterrett school building, on Lang Ave., at a cost of about $100,000.

PARKESBURG, PA.—The citizens of this borough have voted to issue $20,000 in bonds towards the immediate erection of a new school building.

SAVANNAH, GA.—The following bids were received Nov. 10 for the construction of hospital wards, etc., for a general hospital for 1,000 beds in Savannah; Capt. J. W. McHaig, A. Q. M.: William Armitage, Savannah, $129,200 90 days; Miles & Bradt, Atlanta, $93,000, 50 days; W. F. May & Co., Chattanooga, $77,934.33, 60 days; Nicholas Ittner, Atlanta, $83,323, 120 days; Woodward Lumber Co., Atlanta, $103,200, 100 days; George Moore & Co., Nashville, Tenn., $105,000, 90 days; L. W. Woodward, Augusta Ga., $92,000, 90 days; Harris & Black, Savannah, $132,176.87; Stewart Contracting Co., Savannah, Ga., $94,305; W. A. Miller, Waycross, Ga., $88,528, Feb. 1; Samuel H. Walker, Washington, D. C., $113,000, 60 days; Rezin W. Darby, Washington, $99,000, 40 days; Anderson Construction Co., Savannah, Ga., $99,900, 90 days; George Girvan, Manassas, Va., $117,000. There were nine bids for the plumbing contract, the lowest of which was that of Henry D. Roette, Baltimore, Md., at $12,679.

BIRMINGHAM, ALA.—Plans have been accepted for the new hospital building to be erected at Fountain Heights for the Sisters of Charity, to cost about $250,000 when completed. At present but one wing will be built at a cost of $60,000. Archs., T. U. Walters & Co., Birmingham.

SHELBYVILLE, KY.—L. C. Millis, Mayor, informs us that plans and proposals will probably be asked early next year for the new court house now under consideration by a joint county and city committee; estimated cost, $50,000.

EATON, O.—The following bids were received, Nov. 5, for heating, plumbing, etc., in court house, Eaton, W. A. Edison, County Auditor: Sanders & Essmein, Columbus O., $5,000; Barger Bros., Columbus, $4,925; Ware & Moodle, Dayton, $4,985; F. Desarmoux & Co., Springfield (accepted), $4,875.

PORT CLINTON, O.—The commissioners of Ottawa county have awarded the contract for the building of the new court house to Caldwell & Drake, of Columbus Ind., at $45,571. Marblehead stone will be used. Other bidders were: H. Karg, Fostoria, O., $49,000; William Doersbach, Sandusky, O., $44,900; Geo. Feick, Sandusky, $50,000; Proenn Bros., Toledo, O., $53,374; M. Rabbit, Toledo, $61,000; Eb Bursh, Port Clinton, $52,000; James Dacault, Columbus, O., $47,539.60.

DETROIT, MICH.—Robt. Y. Ogg, Secy., Bd. of Pub. Wks., informs us that Spitzley Bros. were the only bidders, on re-advertisement, for erecting the new G. A. R. memorial building, at $39,685, for Woolmith cut stone, and $39,000 for Ionia stone.

CHICAGO, ILL.—A permit has been granted to John Monk for erecting a 10-story store building, 30 × 90 ft., at 161 Market St., to cost about $60,000. Arch., H. B. Wheelock, 226 La Salle St.——It is reported that Charles Netcher, of the Boston Store Dry Goods Co., contemplates the erection of an addition to the present building on Madison St.——C. R. Cave, owner of the South Chicago department store, is also said to expect to erect the second half of his building at Indiana Ave. and 48th St., at a cost of $60,000.

SAN ANTONIO, TEX.—The large department store of T. W. Stewart was destroyed by fire Nov. 10; loss, $150,000; insurance, $40,000, according to reports.

SACRAMENTO, CAL.—Plans and specifications are asked by the board of education, until Dec. 6, for a new high-school building to cost about $80,000, excluding the site and the equipment.

SALINAS, CAL.—A special election will be held Dec. 15 to vote upon the proposition of issuing $30,000 in bonds for a new high-school building.

NASSAU, NEW PROVIDENCE, WEST INDIES.—J. A. MacDonald, builder, Miami, Fla., is said to have charge of the construction of a new 4½-story brick hotel building, to be erected here for Henry M. Flagler, 26 Broadway, New York, at a cost of about $200,000. Ingle & Almirall, Consulting Archs., 874 Broadway, New York.

WATER-WORKS.

CHESTER, VT.—We are informed that the Chester Water Co. has let the contract for building works to the C. H. Eglee Co., Boston, Mass. The water will be supplied by gravity from a brook. The works will be completed by July 1, at a cost of $40,000. L. N. Farnum, Engr., 17 Central St., Boston; J. E. Pollard, Pres.

ST. JOHNSBURY, VT.—R. S. Cheney, Supt. Water-works, writes us that no improvements or extensions to works are contemplated, as reported in our issue of last week.

BAINBRIDGE, N. Y.—T. L. Randall is reported as making surveys for extending the mains of the Bainbridge Water Co.'s works for a distance of four miles, and also for a new reservoir.

BUFFALO, N. Y.—The board of public works has selected a site for the new pumping station on the park lands. The point chosen for the shaft is 200 ft. from the street and for the building 100 ft. from Jersey St. The tunnel will be 5,800 ft. long, will run out to the Emerald Channel, and will cost about $300,000. Bids will be opened next spring and the work will take about two years. The two boards will decide upon the details of the building for the pumping plant, which is designed to be an ornament to the parks.

CHURCHVILLE, N. Y.—An election will be held Nov. 23 to vote on the question of issuing $5,500 in bonds for works. The water supply will be furnished by Sage & Potter.

DUNKIRK, N. Y.—R. L. Cary, Pres. Water Bd., writes us that the water board will undoubtedly soon purchase new pumping machinery. The capacity, cost, etc., have not yet been decided upon. No action has yet been taken toward letting the contract. C. J. Carney and Wm. Bookstaver are on the committee.

NEWBURGH, N. Y.—Jos. A. Sneed, Pres. Water Comrs., writes us that the city has a water supply from Washington Lake, but it is deemed inadequate by the engineers and the commissioners, who have recommended to the council to call an election to vote on the question of an additional water supply. The vote will not be taken before December. The estimated cost of the increase supply is $274,000. There will be required about 4½ miles of 30-in. cast iron conduit. The water will be furnished by gravity, with about 400 ft. head. Everett Garrison, Engr. Bd. Water Comrs.; John D. Van Buren, Consult Engr.

ARKVILLE, N. Y.—**H. Robinson**, of Stamford, N. Y., and Abner Morse are reported as making surveys for works for this place.

UTICA, N. Y.—The West Canada Water Co. has been granted a franchise to lay water pipe through this city to furnish New Hartford, New York Mills, etc. Water will also be supplied to this city. Work will be begun at once, the contract for building the works having been awarded to the T. A. Gillespie Co., Pittsburg, Pa., and Havemeyer Bldg., New York. Geo. L. Record, Pres. West Canada Water Co. Newark, N. J.; W. S. Bacot, Engr., 1 Broadway, New York.

ALLENHURST, N. J.—Bids were received Nov. 14, for the purchase of $60,000 of 4% 30-year gold bonds for the purchase of the property of the Coast Water & Sewer Co., voted for Nov. 4. E. P. Benjamin, Mayor.; E. H. Ward, Jr., Clk.

HIGHTSTOWN, N. J.—The New York Filter Co., New York, has been awarded the contract at $2,500 for putting in a filter at the water-works, according to reports.

BENNETT, PA.—C. W. Dankmyer, Clk., writes us that this place voted Nov. 8 to issue bonds for additional machinery, to pump water from the works of Millvale Water Co.

CANONSBURG, PA.—J. P. McNary, it is stated, is interested in the proposed works for this place.

DOYLESTOWN, PA.—J. L. Kramer, Pres. Council, writes us that the council does not think it will require a great deal of work to get an increased water supply as proposed. Population, 3,500.——The following bids were received Nov. 7 for a cover to the reservoir at the cemetery: Frederick Tibibls, $2,789; King Bridge Co, $2,100, and North Penn Iron Co., $1,900.

EPHRATA, PA.—The question of either having the Ephrata Water Co. increase its supply or of building municipal works is being considered.

BRADDOCK, PA.—The council of North Braddock is considering the question of building works. Reports state as follows: The committee, on Nov. 8, submitted to the borough council a plan for works that makes a requisition for 4.08 miles of 8-in. pipe, 6.27 miles of 6-in. pipe, 1.87 miles of 4-in. pipe, 72 hydrants, 35 8-in. valves, 18 4-in. valves, 103 boxes, a stand-pipe, 60 × 50 ft., and pumping station property; the works to cost about $80,000. The cost of operation will be about 4 cts. a 1,000 gallons on a basis of 500,000 gallons daily. The yearly revenue, after supplying the fire department, is estimated at $24,000, giving consumers a rate of 15 cts. a 1,000 gallons.

PHILADELPHIA, PA.—Plans and specifications for the proposed reservoir on George's Hill, West Philadelphia, are reported as about completed. It will have a capacity for about 100,000,000 gallons. Estimated cost, $500,000. Bids will probably soon be asked by the director of public works.——Macey, Henderson & Co., Heed Bldg., have the contract for the additions to the Shawmont Pumping Station in Fairmount Park, for the city. A flue stack, 175 ft. high, built of brick and stone, will be included.

READING, PA.—This city voted, Nov. 8, against issuing $225,000 in bonds for a water filtration plant. The vote was 2,029 for and 4,579 against the proposition.

ROBESONIA, PA.—The Robesonia Water-Works Co. has been organized to build new works. Capital stock, $15,000. Adam P. Miller, C. Z. Zimmerman and Frank Bricker are on the committee to consider sources of a water supply.

WILLIAMSPORT, MD.—D. G. Adelsberger, 722 Pennsylvania Ave., Baltimore, Md., is preparing plans for works and a light plant. There will be required cast iron water pipe, a steel water tower, valves, hydrants, pumps, etc.

BALTIMORE, MD.—D. G. Adelsberger, 722 Pennsylvania Ave., is preparing plans for works for Embla and Tuxedo Parks, suburbs of this city. Pipe, valves, hydrants, deep well pumps, gasoline engines, etc., will be required.

CHESAPEAKE BEACH, MD.—Arrangements are being made for the construction of the proposed works and electric plant at the Beach for the Chesapeake Beach Ry. Co. The water supply will be secured from artesian wells. There will be a water tower, pumping station, etc. Geo. C. Morgan, Engr., 808 Royal Insurance Bldg., Chicago; Otto Mears, Pres., Washington, D. C.

HIGHPOINT, N. C.—J. Elwood Cox writes us that there is under discussion the question of building works in the spring or summer. Population (1890), about 2,180. W. G. Bradshaw, Mayor; J. J. Cox, Secy. and Treas.

CANTON, GA.—B. F. Perry, Clk. and Treas., writes us that it is proposed to ask the legislature to grant the town authority to vote on the question of issuing $10,000 in bonds for works.

MONTICELLO, ARK.—Walter G. Kirkpatrick, Jackson, Miss., is preparing plans for works for this place.

NASHVILLE, TENN.—Local papers state that bids are wanted at once by Geo. Reyer, Supt. Water-Works, for furnishing about 340 tons of 6-in. and 60 tons of 8-in. cast-iron water pipe; 13 tons of special castings, 55 hydrants, four 8-in. and 40 6-in, gate valves, and ten tons of soft pig lead.

SOMERVILLE, TENN.—Bids are asked until Dec. 1 for constructing works and an electric plant to cost $10,000. Geo. C. Morgan, Des. Engr., Royal Insurance Bldg., Chicago, Ill.; E. R. Scruggs, Recdr.

GEORGETOWN, KY.—N. H. Sinclair, Mayor, writes us that the proposition to issue $12,000 in bonds for works did not carry at the election on Nov. 8.

MOUNT STERLING, KY.—Geo. W. Baird, Mayor, writes us that this place voted, Nov. 8, against issuing $80,000 in bonds for works.

CLEVELAND, O.—Bids are asked until Nov. 25 for furnishing and installing at the Division St. pumping station of the Cleveland water-works, a portable boiler, pulsometer pump, and carriages, complete. Geo. R. Warden, Dir. Pub. Works.

MARIETTA, O.—Press reports state that the contract for furnishing a 3,000,000-gallon pumping engine will be awarded to the Snider-Hughes Co., Cleveland, O., at $15,918.

BEREA, O.—This place voted, Nov. 8, to issue $30,000 in bonds for works.

McCONNELSVILLE, O.—Geo. Birch, Clk., writes us that bids will be asked about Jan. 1 for the purchase of $20,000 of water-works bonds, voted for in September. The bonds will be sold about Feb. 1.

NEW RICHMOND, O.—Plans and specifications for works and an electric plant are about completed by J. F. Witmer, 705 Ellicott Square, Buffalo, N. Y. H. Buckley, Pres. Trustees, writes us that bids will probably be called for next week. Bids for the bonds have been opened, but they have not yet been placed. C. R. Day, Clk.

TROTWOOD, O.—C. O. Lucas & Co., Greenville, O., have been awarded the contract for installing the machinery for the proposed works for this place. J. B. Gingry, Greenville, has the contract for the trenching and setting of hydrants.

WELLSVILLE, O.—This place voted, Nov. 8, to issue $15,000 in bonds for extending the works. D. A. Davidson writes us that no steps have been taken toward securing plans and specifications.

UPPER ALTON, ILL.—The council has granted a 25-year franchise for works to the Alton Water-Works Co.

DUQUOIN, ILL.—H. A. Keith, Redfield Ave. and Stein St., Chicago, and J. H. Thompson, 170 Washington St., Chicago, are reported to have been granted a franchise for works. In February a contract for building the works was awarded to them. Population, 5,000.

SHEBOYGAN, WIS.—The City Water Co., it is stated, will put in a new pump of 8,000,000 gallons.

PERSIA, IA.—Press reports state that bids will be wanted about May 1 for building works to cost $3,000. C. B. McColm and J. Seddon may be addressed.

ALBERT LEA, MINN.—M. M. Luce, Comr., writes us that a new pump has been purchased from the Deane Steam Pump Co., Holyoke, Mass. It will be installed either by the city or by contract. The council proposes to sink a 12-in. artesian well, to be an auxiliary to the 8-in. well.

EAST GRAND FORKS, MINN.—Bids are asked until Dec. 1 for constructing works and an electric plant, according to reports. W. I. Gray & Co., Engrs., Sykes Bldg., Minneapolis, Minn.

PERHAM, MINN.—T. M. Maguire, Minneapolis, Minn., is reported to have been awarded the contract, at $7,588, for the proposed works, excepting the tank and steel tower. Alex. Nelson, Wadena, Minn, has the contract for the power station.

NEBRASKA CITY, NEB.—The Missouri Pacific Ry. Co., it is reported, will put in works for its system in this city.

SIOUX FALLS, S. DAK.—L. M. Estabrook, City Audr., writes us that the proposition to issue $130,000 in bonds for the purchase of the works of the Sioux Falls Water Co., or for building municipal works, carried at the election Nov. 8.

STANBERRY, MO.—An election was held Nov. 15 to vote on the question of issuing $3,000 in bonds for a stand-pipe, according to reports.

WYNNE, ARK.—M. Jolly, Secy. Bd. of Improvements informs us that the following bids were received Nov. 10 for constructing works and an electric plant:

G. Jaeger, Batesville, Ark. (accepted)	$15,490
Rees Brothers, Fayetteville, Ark.	15,685
C. H. Jenks, St. Louis, Mo.	15,750

GUTHRIE, OKLA.—The council and the water commissioners are considering a proposition from John H. Havighorst for an increased supply. Mayor Berkey may be addressed.

HILLYARD, WASH.—The Hillyard Town Site Co. will spend about $10,000 for improvements to the water-works, streets, etc., at this place, according to reports. F. Lewis Clark, Pres.; A. D. Jones, Agent.

KLAMATH FALLS, ORE.—The Corona Land & Water Co. has been incorporated with a capital stock of $100,000, by Sam'l C. Trazner, A. L. Leavitt and C. L. Parrish.

PASADENA, CAL.—The San Pasqual Land & Water Co. has been incorporated with a capital stock of $500,000, of which amount $5,000 has been subscribed. The purposes of the organization are to buy and sell land and water rights, maintain water-works, etc. The directors are: P. M. Green, H. H. Markham, G. D. Patten, A. R. Dodworth and Frank S. Daggett, all of Pasadena. We are informed that the company will ask for bids about Jan. 1. The plans and specifications are not yet prepared. The water will be secured from artesian wells. Estimated cost, $100,000.

THREE RIVERS, QUE.—Bids are asked until Dec. 1 for constructing a pier and a suction pipe into the River St. Maurice. L. T. Desaulniers Secy. and Treas.

STAYNER, ONT.—This place will vote, Dec. 13, on the question of issuing $26,000 in bonds for the proposed works.

THESSALON, ONT.—The question of building works, it is stated, will be voted upon.

VAN KLEEK HILL, ONT.—The town clerk writes us that the council has abandoned for the present the idea of taking steps for building works.

SANTIAGO, CUBA.—Press reports state as follows: The main question now before Gen. Leonard Wood, Governor of the Military Department of Santiago, is that of a water supply. The rainy season is about over, and, usually, after a month or so of dry weather water has to be brought from the mountains and sold in the streets. Gen. Wood is anxious to avoid a repetition of such conditions, and has engaged the services of three engineers to report as to the best methods of supplying the city with water, whether with artesian wells or otherwise.

SEWERAGE.

BOSTON, MASS.—Local papers state that the following bids were received Nov. 14 for repairs on the pumping engines at Cow Pasture sewage pumping station, Dorchester. The items are (1) new valve gear, governor pumps, governor piping, gear guards, marking gears, jacket piping, and changes in galleries; (2) low pressure inlet cam, cam-shaft bearings clutches, clutch-lever latches and quadrants, cut-off tell-tales, crank indexes, valve-stem drip cups and valve chest drains; (3) pump-valve seats, pump valves, valve plates, valve guards, interchangeability, nuts for valve seats, pump valve patterns, packing spare valves, etc., records of pump valves and pump drain valves; (4) charge for each hour of working time of each fitter under section for scraping steam valves; (5) charge for each hour of working time for each helper in same section: I. T. Morris Co., Philadelphia, (1) $17,950, (2) $3,250, (3) $29,790, (4) 50 cts., (5) 25 cts.; Lockwood Mfg. Co., East Boston, (1) $8,300, (2) $240, (3) $21,785, (4) 60 cts., (5) 40 cts.; Atlantic Works, East Boston, (1) $14,970, (2) $2,500, (3) $25,561, (4) 60 cts., (5) 40 cts.; George F. Blake Mfg. Co., New York, (1) $6,400, from which will be deducted $450, provided it is not required to furnish any pumps with bases or attendant fitting of pump proper as covered by section 4 for governor pumps; (2) $1,600, (3) $30,000, (4) 80 cts., (5) 40 cts.; Bertelsen & Petersen, East Boston, (1) $15,178, (2) $945, (3) $23,844, (4) 50 cts., (5) 35 cts.; Builders' Iron Foundry, Providence, (1) $15,950, (2) $1,780, (3) $25,500, (4) $6, (5) $3.

WORCESTER, MASS.—Local papers state that the construction of the Water St. tunnel sewer will be begun as soon as the council passes the order. The committee has voted to recommend that $100,000 be appropriated for this work.

BROOKLYN, N. Y.—Daniel J. Creem and Edward J. Gorman have been awarded the contracts for building sewers in the East New York section, one in the Eastern Parkway, and the other in Butler St., at $20,200 and $20,700, respectively. The bids for this work were opened during the last administration.

BUFFALO, N. Y.—The city engineer is said to be considering plans for sewers for South Buffalo.

LIBERTY, N. Y.—The commissioners have adopted the plans of Wise & Watson, Passaic National Bank Bldg., Passaic, N. J., and will soon submit the question of the building of the sewers to the voters of Liberty. If the result of the election is favorable, the commissioners will at once proceed to get everything in shape for the work of construction as soon as spring opens.

NEWBURG, N. Y.—Bids are asked until Dec. 19 for constructing the First St. tunnel sewer, as described in our advertising columns. D. J. Coutant, Clk. Bd. Pub. Wks.

NEW YORK, N. Y.—Bids are asked by the department of public charities, foot of East 26th St., Manhattan, until Nov. 28, for furnishing and laying a cast-iron sewer pipe on Randalls Island, and by Jas. Kane, Comr. of Sewers, 265 Broadway, Manhattan, until Nov. 30, for constructing a temporary drain in Bronx Park.

SKANEATEALES, N. Y.—F. M. Thomas, Civil Engr., writes us that the citizens seem to be in favor of constructing a system. In making up the annual budget in February the trustees will probably include an appropriation for surveys for a system, with recommendations that the work be done in the spring.

ROCHESTER, N. Y.—It is proposed to construct a 5-ft. brick sewer in Culver road, at a cost of about $35,000.

ALLENHURST, N. J.—Bids were received Nov. 14 for the purchase of $60,000 of 4% 30-year gold bonds for the purchase of the property of the Coast Water & Sewer Co., voted for Nov. 4. E. P. Benjamin, Mayor; E. H. Ward, Jr., Clk.

RED BANK, N. J.—Bids are asked until Nov. 29 for the construction of sewers and appurtenances, as stated in our advertising columns. A. C. Harrison, Clk. Comrs.; Hedenberg & Kinsey, Engrs., 108 Fulton St., New York.

ETNA, PA.—Bids are asked until 7 p. m., Nov. 18, for constructing a certain sewer. S. E. Hanna, Chn. Com.

RANKIN, PA.—Bids are asked until noon, Nov. 21, for constructing about 1,800 ft. of brick main sewer and 3,400 ft. of pipe sewers. Trimble & Miller, Engrs., 430 Fourth Ave., Pittsburg; J. S. Sheekey, Clk.

BALTIMORE, MD.—The council has voted to build a 4-ft. brick sewer in Harris Creek at a cost of $24,000.

HAGERSTOWN, MD.—E. M. Schindel Mayor, writes us that the matter of a system is in the hands of the committee. No definite action will be taken for some months. S. M. Bloom, Chn. Com.; M. L. Byers, Cy. Clk.

NATIONAL SOLDIERS' HOME, VA.—Bids are asked until Nov. 25 for furnishing materials and constructing the underground steam, water and sewer connections with two wooden barracks in course of erection on the grounds of this Home; also, for furnishing and placing one steam pump for pumping salt water to said barracks. P. T. Woodfin, Governor of Home.

NORFOLK, VA.—Jos. L. Winston writes us that $150,000 in bonds for a system in Brambleton, and for improving the streets, voted Nov. 8, will be issued at an early date. W. L. Sterling, Secy. Local Bd. of Brambleton; W. F. Brooke, Cy. Engr.

MARIETTA, GA.—The question of issuing $20,000 in bonds for a system is being considered by the council. It will require state legislation before bonds can be issued. R. E. Lamboy, Cy. Clk.

WAYCROSS, GA.—Waring, Chapman & Farquhar, 874 Broadway, New York, have presented estimates for a system to cost about $37,262.

NEW ORLEANS, LA.—Councilman Dreyfous has introduced an ordinance asking for bids until March 27 for the purchase of a 50-year franchise for a system.

JACKSON, MISS.—Efforts are being made for the immediate construction of a system. Messrs. Milsaps Virden and John Hart may be addressed.

COSHOCTON, O.—Bids are asked until Nov. 19 for constructing about 4,000 ft. of 10 and 8-in. pipe sewer, 6 manholes, etc. F. F. Wagner, Clk.

EAST LIVERPOOL, O.—Arrangements are being made for constructing sewers in district No. 2, this winter; estimated cost, $10,000.

WELLSVILLE, O.—This place voted, Nov. 8, to issue $75,000 in bonds for a system.

MARION, IND.—It is proposed to build a portion of the South Marion storm sewer this winter, at a cost of about $21,000. The total length will be about 7,679 ft.

PONTIAC, MICH.—Bids are asked until Nov. 25 for constructing 3,180 ft. of 8 and 10-in. pipe sewers, as stated in our advertising columns. Wm. J. Fisher, Cy. Engr.

CHICAGO, ILL.—Nash & Dowdle, the contractors building the sewer on the north side, have received the contract for the intercepting sewer in Sheridan road, between Pratt and Bryan Aves., at about $30,000.

GREENVILLE, ILL.—The Chas. T. Bray Construction Co., Belleville, Ill., has been granted a twenty-year franchise for sewerage construction in this city.

JANESVILLE, WIS.—The council, according to report, is arranging for a system. Alderman Sennett may be addressed.

DENISON, TEX.—Plans and estimate of the cost of a system have been ordered by the council. It is reported that work will be begun soon. City Engineer McWillie and Mayor Lebrecht may be addressed.

BAKER CITY, ORE.—D. L. Mooman has submitted a proposition for a flume 2½ miles long for use as a sewer, to cost about $4,655.

LONG BEACH, CAL.—Thos. H. James, of Santa Monica, Cal., is to design a system for this place, for which it is proposed to vote bonds.

MONTREAL, QUE.—The contract for constructing the sewage disposal works and a ten years' lease of the St Denis Ward sewage disposal farm has been awarded to Engineer Janin, at $16,000.

PUEBLA, MEXICO.—The Puebla state legislature has passed a bill authorizing the city authorities to contract for the construction of a system to cost about $2,000,000.

GARBAGE DISPOSAL—STREET CLEANING

WOODMONT, CONN.—Bids are asked by the sanitary board until Nov. 21 for the collection and removal of the refuse and garbage of the village. C. M. Smith, Clk.

CAMDEN, N. J.—The Sanitary Street Sweeping Co. has been incorporated, to manufacture, purchase and acquire street cleaning and sweeping machines; capital stock, $100,000, with $1,000 paid in. The directors are Charles D. Nicolai, Lawrence S. Nicolai, John Fitzmorris and John H. Buscher, Washington, D. C., and James E. Hays, Camden.

RICHMOND, VA.—Thos. E. Neal, Atlanta, Ga., submitted a proposition to the health committee, Nov. 11, to construct and operate a Thackeray incinerator plant for 30 days, as an experiment. The committee was favorably impressed by the offer, and in view of the fact that about $1,200 will have to be expended on the crematory at the beginning of next year, the communication was referred to the board of health.

LOUISVILLE, KY.—The joint health committee of the council met Nov. 7 and decided that the installation of an incinerator for disposing of the garbage was necessary. Since the last meeting, Health Officer Allen has corresponded with a number of the health officials throughout the country, asking information as to the methods employed in their cities of disposing of the garbage. Committees will be appointed by the respective boards to visit the various cities where garbage is burned. The council is anxious to have the question settled within the next month, so that the new tax levy may be increased for the construction of the plant.

NEWPORT, KY.—A report on the feasibility, cost, etc., of erecting a plant to burn the garbage and other refuse of this city will be presented to the council this month by W. L. Glazier, Cy. Engr. The city has received correspondence from 11 concerns in response to advertisement in Engineering News, inviting correspondence concerning the disposal of garbage in a modern sanitary way.

CLEVELAND, O.—Health Officer Hess has completed specifications for collecting refuse other than garbage and for the construction of a disposal plant. These will be submitted to the citizens' garbage commission, and a contract will be awarded later.

FORT THOMAS, KY.—The following bids were received Nov. 2 for the construction of a garbage crematory. Capt. C. D. Palmer, Asst. Q. M., Chicago, Ill.: Joseph McDermott, Newport, Ky., $1,798; L. H. Wilson, Newport, Ky., $1,500; Dixon Garbage Crematory Co., Toledo, O. (own plans), $2,100 and $500; Henry A. Schriver, Newport, Ky, $1,777.

CHICAGO, ILL.—Bids are asked until Nov. 19 for the erection of a timber trestle snow dump on the lake front basin. L. E. McGann, Comr. Pub. Wks.

STREETS AND ROADS.

BRAINTREE, MASS.—H. L. White writes us that a contract for removing curb, screening and storing 2,500 cu. yards. of trap rock for street work, is soon to be let. Address chairman of selectmen or White & Wetherbee, Engrs.

NEW HAVEN, CONN.—Bids are asked until Nov. 21 for laying concrete walks and cobble gutters on certain streets. C. W. Kelly, Cy. Engr.

CORTLAND, N. Y.—A petition will be presented to the board of village trustees for paving Groton Ave., between Main St. and Otter Creek, a distance of 2,315 ft.

HAMILTON, N. Y.—It is reported that Dewitt S. Hadcock, Stockbridge, N. Y., has had plans prepared for a state road between Hamilton and Oneida, 18 miles long and 52 ft. wide; estimated cost, $40,000.

PITTSBURG, PA.—The following bids have been received by the county commissioners for improving portions of three roads: Streets Run Road: J. H. McQuaide, $44,116; J. M. McSpadden, $41,728; Keeling & Ridge, $32,716; Booth & Flinn (accepted), $31,919; Ott Bros., $32,196. Freeport road: Booth & Flinn, $44,315; Keeling & Ridge (accepted), $40,392; C. M. Driver, $45,336; Evan Jones, $46,395; J. C. McQuaide, $45,863; Ott Bros., $40,734. Crooked Run Road: John Dell & Dinlus Bros., $39,134; Keeling & Ridge, $47,014; J. C. McQuaide, $45,706; Booth & Flinn (accepted), $38,759.

SCRANTON, PA.—Bids are asked until 7.30 p. m., Nov 17, for repairing asphalt pavement for 10 years. M. T. Lavelle, Cy. Clk.

ROCKVILLE, MD.—Bids are asked until Nov. 23, for the purchase of $25,000 of 4% turnpike bonds. W. W. Welsh, Clk County Comrs.

LYNCHBURG, VA.—Bids are asked until Nov. 21 for furnishing and hauling about 5,000 cu. yds. of broken stone, and paving about 2,150 sq. yds. of Rivermont Ave. L. P. Rodes, Cy. Engr.

JACKSONVILLE, FLA.—Philip Prioleau, Cy. Engr., is preparing plans and estimates for about 20,350 sq. yds. of brick paving on Main St. He informs us that they will be submitted to the board of public works for approval, about Nov. 17.

OWINGSVILLE, KY.—It was voted Nov. 8 to issue $38,000 in bonds for county road improvements, according to reports.

DANVILLE, KY.—The county voted Nov. 8 to issue $40,000 of turnpike bonds, according to reports.

RICHMOND, KY.—Reports state that it was voted Nov. 8, to issue $70,000 of turnpike bonds.

MAYSVILLE, KY.—It is reported that an issue of $60,000 of bonds for county road work was authorized Nov. 8.

BOWLING GREEN, KY.—At the election, Nov. 8, the county commissioners voted to issue $140,000 of 4% turnpike bonds.

CARLISLE, KY.—The county voted, Nov. 8, to issue $40,000 of turnpike bonds.

VERSAILLES, KY.—An issue of $40,000 of turnpike bonds was authorized at the election, Nov. 8.

BRIDGEPORT, O.—This place voted, Nov. 8, to issue $75,000 for street improvements. J. A. Fawcett, Clk.

CLEVELAND, O.—An ordinance has been passed to improve portions of High and Melrose Aves. by grading, curbing, draining and brick paving. H. H. Burgess, Cy. Clk.——W. H. Searles and J. B. Davis, Engrs., have submitted a report to the county commissioners, on the proposed improvement of the Brecksville Road.

ATLANTA, GA.—Bids are asked until Nov. 21 for paving the roadway of the Mitchell St. viaduct, with asphalt, brick or wooden blocks and the sidewalks with hexagonal tiling, sheet cement or asphalt. R. M. Clayton, Cy. Engr.

DAYTON, O.—Bids are asked until Dec. 12 for furnishing the material and for paving about 7,631 sq. yds. with Buckeye block, etc., 5,630 lin. ft. of curbing and 165 ft. of circular curbing, on Sycamore, Council and Charter Sts. J. L. Baker, Pres. Bd. Cy. Affairs.

HYDE PARK, O.—Bids are asked until Nov. 23 for the purchase of $9,721 of 4½% street improvement bonds. Frank Lewis, Village Clk.

MIDDLETOWN, O.—Bids are asked until Nov. 18 for furnishing and constructing limestone curb and gutter on Main and 9th Sts. J. V. Bonnell, Cy. Clk.

TOLEDO, O.—A resolution has been passed to pave Woodruff Ave., from Ashland Ave. to Madison St., with asphalt, brick or granite. L. P. Harris, Cy. Clk.

WELLSTON, O.—Bids are asked until Nov. 28 for the purchase of $7,491 of 5% street improvement bonds. F. P. Wangler, Cy. Clk.

DECATUR, IND.—We are informed that the question of macadamizing two roads, about 17 miles, affecting the city of Decatur and Washington township, was favorably voted upon Nov. 8 by the county commissioners. The contract will soon be awarded. W. E. Fulk & Co., Engrs., Decatur.

WAUKEGAN, ILL.—City Engineer Bowen has been directed by the board of local improvements to prepare plans and estimates for the improvement of portions of 11 streets.

COUNCIL BLUFFS, IA.—Bids are asked until noon, Nov. 19, for about 27,525 sq. yds. of brick paving, and 3,737 lin. ft. of curbing, on portions of certain streets. N. C. Phillips, Cy. Clk.

FORT MADISON, IA.—J. Ross Robertson, Cy. Engr., informs us that a contract was let Nov. 10 to John Bullard, at $925, for 2,500 sq. yds. of macadam, on the Burlington Road.

ST. PAUL, MINN.—We are informed that the matter of paving 10th St., mentioned in our last issue, has been laid over until next spring, on account of the lateness of the season. L. W. Rundlett, Cy. Engr.

KANSAS CITY, MO.—Bids are asked until Nov. 24 for furnishing the material and for constructing sidewalks of hexagon block, pressed brick, stone and plank; also for furnishing the material and grading on certain streets. Henry A. Wise, Cy. Engr.

SIOUX FALLS, S. DAK.—L. M. Estabrook, Cy. Audr., informs us that sidewalks are built by special assessment. An ordinance providing for the construction of cement walks for certain districts is now being considered. No contracts will be let at present as it is too late in the season.

SEATTLE, WASH.—F. N. Little, Supt. Sts. and Parks, writes us that the council is trying to get the citizens and tax-payers interested sufficiently to appoint a committee to secure the right of way for a boulevard system of several miles, along the water front of the bay, Lakes Union and Washington.

SAN FRANCISCO, CAL.—The City Street Improvement Co. has submitted the lowest bid, at $51,000, for paving Market St. with bitumen, between Taylor St. and Van Ness Ave.

HAMILTON, ONT.—A by-law will be submitted to a vote at the next municipal election, to raise $200,000 for road improvements.

MANUFACTURING PLANTS.

BROCKTON, MASS.—Plans are completed for the enlargement of the Cobb shoe factory to be ready next June. S. L. E. Taylor Co., Brockton.

LYNN, MASS.—A fire here Nov. 7 damaged the forge shop of the American Ordnance Co., which is in a portion of the General Electric Co.'s plant; loss, about $10,000.

NEWBURYPORT, MASS.—It is reported that the Fiberloid Co. will erect an addition to its main factory and enlarge the boiler house, and install two new boilers.

SOUTHINGTON, CONN.—R. W. Cowles, Plantsville, Conn., has been awarded the contract for erecting a brick addition, 30 × 60 ft., to the factory of the Peck, Stow & Wilcox Co.

ELMIRA, N. Y.—John N. Stearns & Co., silk manufacturers, of 220 East 43d St., New York, are said to contemplate the erection in this city of a factory building, to cost $25,000, and employ about 800 hands.

SCHUYLERVILLE, N. Y.—The Liberty Wall Paper Co. has let the contract for the foundations and cellar walls of its new mill, 400 × 100 ft. Surveys are being made for a branch from the Fitchburg R. R. to the company's mill.

WHITESTONE (L. I.), N. Y.—The contract for the erection of a 2-story fireproof instrument repair shop, 100 × 26 ft., for the government at Willets Point, has been awarded; cost, $10,000.

GARWOOD, N. J.—The New Era Metal Co., according to reports, will build an addition to its plant.

BRADDOCK, PA.—It is reported that the Home Brewing Co., of this place, will build a brewery, having a capacity of 100,000 bbls. a year. P. J. Brennan, of Braddock, is interested.

FRANKLIN, PA.—The plant of the Franklin Mfg. Co., makers of asbestos materials, was destroyed by fire Nov. 7; loss, $40,000; insurance, $8,000.

PHILADELPHIA, PA.—Plans have been completed, according to reports for a 2-story brick and iron acid house, 50 × 200 ft., at Weccacoe Ave. and Delaware River, for the Pennsylvania Salt Works Co.

WILLIAMSPORT, PA.—The Lycoming Rubber Co. contemplates erecting a new building and installing new machinery in its plant; three large 72-in. tubular boilers have been ordered.

FORT PAYNE, ALA.—It is reported that E. N. Cullom, of Birmingham, purchaser of the Alabama Steel Works, will put the plant in operation soon, and that J. M. Caldwell, of Birmingham, will go East to purchase machinery for an additional rolling mill.

CLARKSVILLE, TENN.—Reports state that plans for a snuff factory, to cost $30,000, have been completed, and that contracts for erection will be awarded at once. B. F. McKeaye, Jr., is said to be interested.

BARBERTON, O.—Reports state that the Stirling Boiler Co., of Chicago, Ill., will enlarge its works at this place.

COLUMBUS, O.—A fire in this city Nov. 7, destroyed the warehouse and forge rooms, 250 × 45 ft., of the Columbus Skein & Iron Works; E. Stoneman, one of the owners, estimates the loss at $30,000; insurance, $7,000. It will probably be rebuilt at once.

STEUBENVILLE, O.—It is reported that the Riverside Iron & Steel Co. will erect a 500-ton Bessemer plant on its present site.

QUINCY, MICH.—The Michigan Portland Cement Co., according to reports, will erect a large plant at Quincy.

AVERY, ILL.—Kingman & Co., of Peoria, will remove the plant of the Wier Plow Co., at Monmouth, to this place. It is probable that buildings will be erected at once, according to reports.

JOLIET, ILL.—A fire in this city Nov. 10, destroyed the Great Western Tin Plate mills; loss, $150,000; insurance, $47,000.

JOLIET, ILL.—A fire in this city Nov. 10 destroyed the tin plate mills of the Great Western Co.; reported loss, $250,000; insurance, $47,500.

PEORIA, ILL.—The Illinois Sugar Refining Co., recently incorporated, is looking for a site in this city, for its beet sugar plant.——The Cordage Co. is preparing plans for a new 3-story brick building, 88 × 165 ft., probably not to be erected until spring.

MILWAUKEE, WIS.—The Abel & Bach Co., of this city, trunk and bag manufacturers, expects to erect a 7-story steel-frame building, 120 × 200 ft., protected by automatic sprinkler system, with a reserve water supply of 32,000 galls. in a tower, to cost $96,000, to be completed next August. Also a 2-story addition, 50 × 200 ft., to its present factory, and a new barn, 30 × 50 ft.

MINNEAPOLIS, MINN.—The plant of the Hennepin County Co-operative Barrel Co., 14th Ave. South and 5th St., was destroyed by fire Nov. 3; loss, $40,000; insurance, $20,400.

ATCHISON, KAN.—It is reported that F. J. and T. C. Thomas will erect a $25,000 artificial ice plant, capacity 20 tons daily, on the line of the Atchison, Topeka & Santa Fe Ry.

KANSAS CITY, MO.—Mr. John Kelley, of Leavenworth, Kan., according to reports, will build a barrel mill of 2,000-bbls. capacity a day, costing $40,000, and an elevator with storage capacity of 300,000 bushels, in this city.

ST. CHARLES, MO.—The plant of the Central Milling & Commission Co. was destroyed by fire Nov. 6; loss, $25,000; insurance, $11,000. J. H. Mertin, Pres., says that no definite plans for the future have been made.

ST. LOUIS, MO.—The Hamilton-Brown Shoe Co., according to reports, contemplates the erection of an additional factory to cost about $250,000.

BRANTFORD, ONT.—It is said that the Waterous Engine Works Co. contemplates the erection of an addition to its works.

TORONTO, ONT.—The T. Eaton Co. has been granted a permit for the erection of a 5-story factory building, to cost $21,000.

NANTES, FRANCE.—Reports state that capitalists here are contemplating the establishment of a large ice manufacturing plant. Edward Kerr, 3 Rue Gresset, Nantes, may be addressed.

DAGESTAN, RUSSIA.—It is reported that a cotton spinning, weaving and dye works is to be erected in Dagestan, near Petrofisk, by the Caspian Mfg. Co., with offices in St. Petersburg.

TIENTSIN, CHINA.—Press reports state that the M. A. Forbush & Son Machine Co., Philadelphia, Pa., has been awarded the contract for the construction of a woolen mill at Tientsin, the machinery to be operated by electric motors, supplied by the Westinghouse Co., of Pittsburg, Pa.; contract price, about $50,000.

MISCELLANEOUS CONTRACTS.

BOILERS.—Boston, Mass.—Bids are asked until Nov. 22 for furnishing five boilers at the navy yard. Edwin Stewart, Paymaster-Gen., Washington, D. C.

DREDGING.—Oakland, Cal.—The board of public works has awarded a contract to O. P. Johnson, at $55,500, for dredging Lake Merritt. The itemized bids were given in our last issue.

REPAIRING TRANSPORT.—Washington, D. C.—Reports state that the Bath Iron Works, Bath, Me., has submitted the lowest bid, at $94,500, for repairing and making alterations to the transport "Manitoba."

CHEMICAL ENGINE.—Jersey City, N. J.—Bids are asked until Nov. 22 for furnishing one horizontal Babcock chemical engine fitted with a rotary deluge nozzle. Chas. Esterbrook, Clk. Bd. Fire Comrs., 244 Bay St.

PARK WORK.—Toledo, O.—The Ohio centennial commission has engaged W. J. Sherman, The Nasby, for the surveying and levelling of Bayview Park for the centennial exposition of 1902 or 1903. The work of improving the park will commence at once, according to reports.

COAL STORAGE BUILDING.—Philadelphia, Pa.—A contract has been awarded by the United Gas Improvement to the Structural Iron Co., Baltimore, Md., at $20,000, for the erection of a steel building for the storage of coal.

TELEPHONE SYSTEM.—Summit, N. J.—A franchise has been granted to the New York & New Jersey Telephone Co. to lay and maintain a conduit system for telephone and telegraph purposes. Robt. J. Muldowney, Township Clk.

COALING STATION.—New London, Conn.—J. W. Hoffman & Co., Philadelphia, Pa., has been awarded a contract at $137,500, for the construction of coal storage buildings, wharves, conveyors, etc., at the navy yard. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

LEVEE WORK.—New Orleans, La.—Bids are asked by the board of state engineers until Nov. 22 for constructing the Shady Grove levee in Bossier parish, and the Bayou Pierre enlargement, each including about 50,000 cu. yds. of earthwork.

STEEL PIER.—Atlantic City, N. J.—An iron or steel pier, 130 ft. wide and 1,200 ft. long, will be constructed at States Ave.; estimated cost, about $150,000. Bids were asked Nov. 10 by G. A. Dentzel, Philadelphia, Pa., for the wooden superstructure. James A. Cathcart, Atlantic City, is also interested.

TILE.—Philo, Ill.—Bids are asked by the Embarrass River drainage district until Nov. 29 for furnishing and laying 2,700 ft. of 16-in. tile, 1,400 ft. of 15-in. tile, 1,400 ft. of 14-in. tile, 1,300 ft. of 12-in. tile, 870 ft. of 8-in. tile and 1,200 ft. of 6-in. tile. Address J. L. Ray, Champaign, Ill.

PARK WORK.—Philadelphia, Pa.—Bids are asked until Jan. 14 for furnishing plans and for the development of League Island Park, comprising about 300 acres. Prizes of $750 and $250 will be awarded for the two best designs. A. S. Eisenhower, Ch. Bureau Cy. Property, 130 City Hall, Philadelphia.

PARK GRADING.—Newark, N. J.—Bids are asked until Nov. 23 for about 200,000 cu. yds. of earth excavation and 100 cu. yds. of rock excavation, in the middle division of Branch Brook Park, surety $20,000, as described in our advertising columns. A. Church, Secy. Essex County Park Comn., 800 Broad St., Newark.

BOILERS, MACHINERY, ETC.—Detroit, Mich.—Bids are asked until Nov. 21 for furnishing the boilers and machinery for four steam fog signals, and until Nov. 28 for furnishing the boilers, machinery, etc., for four complete steam fog signals, as described in our advertising columns. Lieut.-Col. M. B. Adams, U. S. Engr., Detroit.

CONDUIT.—Dorchester, Mass.—The following bids have been received for constructing a brick conduit 10 ft. in diameter, in Callender St., between Don and Lyons Sts., including 4,000 cu. yds. of rock excavation. Benj. W. Wells, Supt. Sts., Boston: J. P. O'Connell, $20,159; C. E. Trumbull & Co., $21,442; D. F. O'Connell, $20,134; M. Russe & Co., $25,311; Jones & Meehan, $25,613; T. H. & G. M. Bryne, Hyde Park, Mass., $21,299; R. J. Malone (accepted), $16,395; John C. Coleman & Son, $20,851; George W. Judd, $24,639; H. P. Nawn, $20,039; H. A. Hanscom & Co., $35,170.

CONTRACT PRICES.

RIVER WORK.—Sacramento, Cal.—Geo. M. Randle, Asst. Engr. Pub. Wks., informs us that the following bids were received Nov. 2 for cutoffs in the San Joaquin River and Stockton Channel:

Bidder.	Levee work, cut-off No. 3, 45,000 cu. yds. cts.	Dredging, cut-offs, No. 3, 55,000 cu. yds. cts.	Dredging, cut-offs, No. 4, 40,000 cu. yds. cts.
J. D. McDougald, Stockton	9½	15½	15½
T. B. Loodal, Broderick, Cal.	9½	..	..
San Francisco (Cal.) Bridge Co.	10	13⅞	13⅞
John Hackett, Oakland	9½	12½	12½

PIPE SEWER.—Spring Lake, N. J.—We are informed that the following bids were received Nov. 1, for constructing pipe sewers and an ocean outlet; contract was awarded to P. H. Harrison & Sons, St. Paul Bldg., New York; H. C. Van Arsdale, Borough Clk.

Bids Received at Spring Lake, N. J., Nov. 1, 1898, for Constructing Pipe Sewers and an Ocean Outlet.

	Building outlet basin, etc.	Building jetty, etc.	Section ocean outlet, 640 ft.	18-in. pipe, 810 ft.	15-in. pipe, 3,156 ft	12-in. pipe, 50 ft.	8-in. pipe, 767 ft.	Junction manholes, 10 each.	Ordinary manholes, 2 each.	Inspection holes, 4 each.	Ventilators, 12, each.	Total.
A. P. Hamblin, E. Orange, N. J.	$950	$1,300	$2,700	$0.88	$0.79	$0.72	$0.65	$[illegible]5.00	$30.00	$[illegible].00	$[illegible].00	$9,1[illegible]5
P. H. Harrison & Sons, New York	900	1,350	1,900	.60	.55	.40	.26	25.00	22.00	5.00	3.00	6,941
Callery & Murphy, Jersey City, N. J.	1,000	1,275	2,560	1.10	1.00	.89	.50	22.00	20.00	8.00	2.00	9,626
Mack Paving Co., New York, N. Y.	1,297	1,147	2,470	.95	.85	.64	.57	47.00	40.00	8.00	11.00	9,549
E. R. Patterson, New York, N. Y.	1,000	1,400	1,600	1.00	.80	.60	.50	35.00	30.00	14.00	5.00	8,234
S. L. Bartholomew, Asbury Park, N.J.	919	1,094	1,220	.74	.65	.47	.39	35.00	30.00	6.00	6.00	6,712
J. Irving Hillpot, Bound Brook, N. J.	1,093	1,660	3,300	.79	.70	.60	.42	32.00	30.00	7.50	3.50	9,706
Chandless & Dickinson	1,847	1,738	3,462	1.20	1.00	1.00	.80	35.00	30.00	10.00	17.00	12,493
Geo. W. Rogers, New York, N. Y.	...	1,300	2,350	...	...	...	...	.....	.....	....	....	.....

SHEET ASPHALT PAVING.—Hamilton, O.—The following bids were received Oct. 24, 1898, for sheet asphalt paving in 2d St., from Central Ave. to Black St.; in North 2d St., from High to Black St., and in South 2d St., from High St. to Central Ave.; the quantities are the totals for the three streets, the bids for the different streets being the same; L. A. Dillon, Cy. Engr.:

Quantities.		David Folz Asphalt Paving Co.	Warren-Scharf Asp. Pav. Co.	Columbia Construction Co.
Limestone curb	15,440 lin. ft.	$0.55	$0.65	$0.40
Limestone gutter	19,100 " "	.46	.50	.40
Old curb redrsd, &c.	11,000 " "	.15	.15	.04
Cem. gutr and curb	14,700 " "	.60	.60	.55
Cement curb	830 " "	.40	.40	.20
Cement gutter	4,600 " "	.30	.30	.25
Resetting basins	24 each	10.00	3.00	5.00
Sheet asphalt	46,600 sq. yds.	1.88[1]	1.77[2]	1.74[3]
Total limestone work		$52,669	$51,178	$47,552
Total cement work		49,245	46,598	45,298

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[1] Burmudez Lake. [2] Trinidad Lake. [3] Trinidad Lake.

ARTESIAN WELL.—Jamestown, N. Dak.—It is stated that the Rust Well Machinery Co., Ithaca, N. Y., submitted the lowest bid, Nov. 1, 1898, for sinking an artesian well 1,500 ft., at $2.45 a ft. for a 16-in. well, or at $1.95 for a 4-in. well.

ASPHALT PAVING.—St. Joseph, Mo.—The following bids were received by the council Nov. 2, 1898, for asphalt paving in 7th St., from Olive to Robidoux St.: Assyrian Paving Co., $1,78 a sq. yd.; Hugh Murphy, Omaha, $1.75; C. R. Hunt Co., $1.75; Bermuda Asphalt Co., $153; J. B. Smith & Co., Chicago, Ill., $1.42.

WATER PIPE.—Spring Lake, N. J.—H. C. Van Arsdale, Borough Clk., writes us that the following bids were received Nov. 1 for laying water pipe, as advertised in Engineering News; contract was awarded to Wm. J. Smith.

Bids Received at Spring Lake, N. J., Nov. 1, 1898, for Laying Water Pipe.

Bidder.	Pipe				Gate valves, etc., each				*Fire hydrnts, 36 each.	Setting spcls, 16000 lbs.	Pipes, 8-in., 180 ft.	Total.
	10 in., 610 ft.	8-in., 5,830 ft.	6-in., 4,307 ft.	4-in., 9,310 ft.	10-in., 1.	8-in., 7.	6-in., 5.	4-in., 19.				
Daniel C. McManus, New York	$0.78	$0.62	$0.47	$0.34	$26.00	$21.00	$14.50	$10.50	$29.50	$0.02	$1.45	$11,368
Wm. J. Smith, Spring Lake, N. J.	.64	.50	.38	.26	25.90	18.50	12.95	9.75	22.00	.02	.60	8,943
J. Irving Hillpot, Bound Brook, N. J.	.81	.63	.48	.32	25.00	18.75	11.05	9.35	22.50	.025	.60	11,193
Headley & Christie, Newark, N. J.	.78	.63	.47	.32	31.00	22.00	15.00	10.00	25.00	.025	1.00	11,082
S. L. Bartholomew, Asbury Park, N.J.	.67	.52	.39	.28	24.50	18.25	12.75	8.50	25.00	.02	1.00	9,504
P. H. Harrison & Sons, New York	.71	.55	.42	.29	25.00	18.50	12.50	10.00	23.00	.02	1.50	9,973
L. J. Richardson, Utica, N. Y.	.70	.57	.40	.27	21.00	17.00	11.00	8.25	23.50	.02	.25	9,549
S. B. Oviatt, Asbury Park, N. J.	.70	.545	.39	.30	24.00	20.00	15.00	10.00	24.00	.023	1.20	9,966
Callery & Murphy, Jersey City, N. J.	.90	.75	.61	.51	35.00	25.00	15.00	12.00	39.00	.025	4.00	15,334

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*Setting. The 8-in. pipe includes discharge and distribution pipes.

DREDGING.—Port Royal, S. C.—The following bids were received by the bureau of yards and docks, Washington, D. C., Nov. 12, 1898, for dredging at the Port Royal Naval Station: Geo. E. Field, Port Royal, S. C., item (1), $1.80 a cu. yd.; (2) $1.60; P. Sanford Ross, 277 Washington St., Jersey City, N. J., (1), $1,45; (2), $1.10; The Alabama Dredging & Jetty Co., R. Moore, Agent, Mobile, Ala., (1), $1.80; (2), $1.50. Item (1) being price a cu. yd. for material dredged and deposited on station, leveled and graded, and (2) being for material dredged and not deposited on station. The contract was let to P. S. Ross for item No. 2. The appropriation for this work is $100,000. M. T. Endicott, Ch. of Bureau, Washington.

WATER PIPE.—Vallejo, Cal.—The trustees received the following bids Oct. 24, 1898, for furnishing 1,000 ft. of 8 or 10-in., 1,000 ft. of 1-in., and 1,000 ft. of ¾-in. cast or wrought-iron water pipe: John Hellermann, 1-in. pipe, 7⅜ cts. a ft.; ¾-in., 5½ cts.; Miller, Sloss & Scott, 1-in., 6 cts.; ¾-in., 4½ cts.; 3-in., 93 cts.; Crane Co., 10-in., 60 cts.; 8-in., 45 cts.; 1-in., 5 3/10 cts.;; ¾-in., 3¾ cts.; Christin Froelich, 8-in., 77 cts.; 1-in., 6½ cts.; ¾-in., 4 6/10 cts.

STREET IMPROVEMENT.—Los Angeles, Cal.—The following bids were received Oct. 25, 1898, for improving certain streets: De Long St., between Pico and 16th Sts.—A. B. Hogan, grading, 19 cts.; curb, 17½ cts. C. W. Shafer, grading, 24 cts.; curb, 15 cts. M. S. Cummings, grading, 27 cts.; curb, 17½ cts. A. G. Strain, grading, 22 cts.; curb, 14 cts. Tryon & Coverly, grading, 26 cts.; curb, 16 cts. 22d St., from Toberman to Union Ave.—Tryon & Coverly, grading, 30 cts.; curb, 29 cts.; sidewalk, 9 cts. E. W. Durrell, grading, 20 cts.; curb, 28 cts.; sidewalk, 8 cts. P. J. Richmon, grading, 23 cts.; curb, 27 cts.; sidewalk, 8 cts. C. W. Shafer, grading, 23 cts.; curb, 27 cts.; sidewalk, 8 cts. A. G. Strain, grading, 24 cts.; curb, 27 cts.; sidewalk, 8 cts.

PAVING, SEWERS, ETC.—Tampa, Fla.—The board of public works awarded the contract, Oct. 25, 1898, for vitrified brick paving to the Coaldale Paving Co., at $1.36 a sq. yd., according to reports.

ASPHALT PAVING.—Scranton, Pa.—We are informed that the Barber Asphalt Paving Co., New York, submitted the only bid, Nov. 3, for 400 sq. yds. of paving in Forest Court, as follows: Grading and paving, $2 a sq. yd.; for furnishing and setting 6 × 12-in. curb, 53 cts. a lin. ft.; for furnishing and setting circular curb, 98 cts. a lin. ft. Curb to be set in concrete. Joseph T. Phillips, Cy. Engr.

PAVING AND SIDEWALKS.—Kansas City, Mo.—The following contracts were let Oct. 25, 1898, for paving and sidewalks: A. R. Mense—Paving alley between Grand, McGee, 11th and 12th, brick, $1.59. Tim Brosnahan—Grading alley between Mercier, Holly, 23d and 24th, 21 cts. Wm. Trehey—Grading alley between Grove, Flora, Howard and 25th, 16 cts. W. H. White—Grading alley between Forest, Tracy, 13th and 14th, 27 cts. Mason Rowland—Curbing Harrison, 19th to 23d, 39.25 cts. Sidewalks—M Schoonmaker—East side, Brooklyn, 18th to alley south, brick, 8.9 cts.; Wyandotte, 17th to Southwest Boulevard, brick, 8 cts.; west side Broadway, Ninth to Hopkins residence, granitoid, 19 cts.; east side Brooklyn, Belt railway bridge to 20th, granitoid, 17 cts. J. J. Armstrong—West side Woodland, 12th to 13th, brick, 8.3 cts.; west side Harrison, 18th to 19th, brick, 8 cts. White & Redmon—East side Penn, 21st to Southwest Boulevard, brick, 8.4 cts. Missouri Sidewalk Co.—South side 30th, Michigan to Euclid, brick, 8.99 cts. Bandera Flagstone Co.—South side 10th, Virginia to alley, west of Tracy, natural stone, 18 cts.

BROKEN STONE.—Baltimore, Md.—The following bids were received Oct. 19, 1898, by the county commissioners for furnishing and delivering broken stone f. o. b. at stations on the line of the Baltimore & Lehigh R. R. in the 11th district: B. F. Pope, 5,000 perches at points no further than Hyde's, 98 cts. a perch; I. H. Peddicord & Son, 4,000 to 6,000 perches—three sizes, Nos. 1, 2, and 3—95 cts. a perch; R. W. Pearce, 60 cts. a perch, delivered on cars, county or buyer to pay freight; Geo. F. Narden, two sizes and top dressing, $1.13 a perch; M. W. Offutt, 5,000 perches, three sizes, Nos. 1, 2, and 3, run of crusher, $1 a perch.

LEVEE WORK.—Sacramento, Cal.—E. E. Leake, Comr. Pub. Wks, and T. B. Hall, a member of the Auditing Board to the Commissioner, have awarded to F. Lowery, of Sacramento, the contract for strengthening a section of the river bank near the old Chicory ranch, as follows: 600 sandbags, 20 cts. each; 550 stakes, 20 cts. each; 200 lbs. of wire, 5 cts. a lb.; 500 cu. yds. of brush, $2 a yd.; 1,700 cu. yds. of mattress foundation, 10 cts. a yr.; 2,200 yds. of repairs to levee, 15 cts. a cu. yd.; total $1,740.

CEMENT.—Seattle, Wash.—Capt. Harry Taylor, U. S. Engr., Burke Bldg., Seattle, Wash., received the following bids Oct. 13, 1898, for furnishing cement: Balfour, Guthrie & Co., Seattle, Wash., 5,500 bbls. (Condor brand), $3.10 a bbl., if taken on arrival, duty unpaid; 7,500 bbls. (Condor) at $3.50 if delivered in 2,500 to 5,000 bbl. lots, duty paid; 13,000 bbls. (Condor), $2.85 if taken on arrival, duty unpaid. The latter bid was recommended for acceptance. Taylor, Young & Co., Portland, Ore., 5,000 bbls. (Josson brand), $2.90 a bbl. if taken in 2,500-bbl. lots, duty unpaid; 5,000 bbls. (Josson) $3.22 if taken in 2,500 lots, duty paid.

RECONSTRUCTING BOTTOM OF SEWER.—St. Louis, Mo.—The following bids were received Nov. 10, 1898, for reconstructing the bottom of the Mill Creek sewer, in all about 926 ft.; the work will include the entire cost of timber and earth excavation, the construction, maintenance and removal of all flumes and dams, and the furnishing and depositing in place of all concrete necessary to form the invert, the plastering of the invert, and every other expense which may be necessary in doing the work. B. H. Colby, Sewer Comr.; all bidders of St. Louis: Robert Wycoff, $20 a lin. ft.; Fruin-Bambrick Construction Co., $19.20; McCully Stone Mason Co., $18.50; James Black Masonry Construction Co., $18.00; R. J. McDonald & Co., $17.90; Hill-O'Meara Construction Co., $15.15; Bambrick-Bates Construction Co., $14 67; Skrainka Construction Co., $13.90; H. F. Heman, $13.50; Patrick McIntyre, $12.90; H. Ruecking & Co., $11.20; Stiefel & Ruckert, $10.90; Heman Construction Co. (accepted), $9.45.

BRICK PAVING.—Hamilton, O.—The following bids were received Oct. 24, 1898, for vitrified brick paving in a number of streets; L. A. Dillon, Cy. Engr.: J. M. Quill, Roseville block, $1.35 a sq. yd.; Harris block, $1.40; Athens block, $1.45; Bolen block, $1.50; name of brick not given, $1.30; either cement, tar or asphalt filler. Aug. J. Henkel, Athens block, $1.30, cement filler; $1.31, tar and asphalt filler. These bids are for 24,800 sq. yds. in 2d St., 15,100 sq. yds. in North 2d St., and 9,700 sq. yds. in South 2d St. Bids for remainder of work is as follows with total amount of quantities for the three streets: Limestone curb, 15,340 lin. ft., J. M. Quill, 60 cts.; A. J. Henkel, 40 cts.; old curb redressed, etc., 900 lin. ft., Quill, 10 cts.; Henkel, 10 cts.; cement crub, 16,040 lin. ft., Quill, 50 cts.; Henkel, 30 cts.; adjusting basins, 24, Quill, $8 each; Henkel, $5.

BLOCK ASPHALT PAVING.—Hamilton, O.—L. A. Dillon, Cy. Engr., informs us that the following bids were received Oct. 24, 1898, for block asphalt paving in 2d St., North 2d St., and South 2d St.: A. J. Henkel, limestone gutter, 19,200 lin. ft., 40 cts.; J. M. Quill, 40 and 45 cts.; Henkel, cement combined curb and gutter, 14,600 lin. ft., 45 cts.; Quill, 70 and 60 cts.; Henkel, cement curb, 840 ft., 40 cts.; Quill, 40 and 45 cts.; Henkel, cement gutter, 4,600 lin. ft., 30 cts.; Quill, 40 cts.; Henkel, asphalt block paving, 46,600 sq. yds., $2.27 a sq. yd; Quill, $2.17, $2.18 and $2.19; Henkel, resetting basins, 24, $5 each; Quill, $4. When not otherwise stated the quantities and bids for the other work are in most cases the same as those given for brick.

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INDUSTRIAL NOTES.

THE GENERAL ELECTRIC CO., Schenectady, N. Y., has established a sales office in the Templeton Building, Salt Lake City, Utah, in charge of Mr. B. E. Chubbuck.

WM. B. POLLOCK & CO., Youngstown, O., have the contract to furnish the steel plate work for the new blast furnaces in course of erection by the Ohio Steel Co., Youngstown, O. The contract is said to amount to about $100,000.

MACEY, HENDERSON & CO., Heed Building, Philadelphia, have the contract, it is reported, for the additions to the Shawmont Pumping Station, Fairmount Park, in that city, including a flue stack of brick and stone, 175 ft. high.

THE RICHMOND LOCOMOTIVE & MACHINE WORKS, Richmond, Va., has an order from the Canadian Pacific Ry., it is stated, for 12 special compound consolidated locomotives, duplicates of 15 others, recently delivered to the same railway.

WM. A. CHAPMAN & CO., 49 Westminster St., Providence, R. I., have the contract to build the concrete dam and power house for the development of a water power on the Susquehanna River, at Wrightsville, Pa., for the Martic Water & Power Co., Baltimore, Md.

THE HENRY DU BOIS CO., New York, has been incorporated by Messrs. Abraham Du Bois, Chas. Du Bois, Henry N. Du Bois and Edwin W. Du Bois, with $50,000 capital, to carry on the business of building, dredging and excavating on land and water.

THE ROCHESTER ELECTRICAL MFG. CO., Rochester, N. Y., has secured contracts to equip the fire alarm and police telegraph systems of Brooklyn, N. Y., and Paterson, N. J., with the Miller patent cut-outs, for the protection of the alarm and telegraph boxes. There are 1,200 fire alarm boxes and 900 police telegraph boxes, it is said, in Brooklyn alone.

THE AMERICAN REDUCTION CO., Philadelphia, and the Consolidated American Reduction Co. and the General American Reduction Co., New York, have had application made against them for the appointment of a receiver on behalf of Peoples Bros. of the former city. The allied companies have been engaged in the garbage disposal business in Philadelphia and New York, but have failed to secure municipal contracts for the same.

THE ROBB ENGINEERING CO., Amherst, N. S., is reported to have an order for two 300-HP. tandem compound engines to be direct-connected to dynamos for an electric railway in Australia. The company has also recently shipped a 300-HP. engine to England; three 250-HP. engines to the Isle of Man; three 125-HP. engines to Spain, and a 125-HP. engine to Newfoundland.

THE CARMAN-THOMPSON CO., Lewiston, Me., is reported to have the following among other contracts: Springfield (Mass.) R. R., 3,000 HP. in boilers; Providence, R. I., railway station, three large engines and piping; St. John (N. B.), St. Ry., power house; Portchester (N. Y.) St. R.R., power house; B. Peck Co., Lewiston, Me., heating system.

THE F. C. AUSTIN MFG. CO., Harvey, Ill., is applying to its bending machines or bulldozers an attachment recently invented by an employe, consisting of an adjustable form or die, by the use of which 13 sets of separate forms for bending different shapes, weigh only 166 lbs., while if applied to the machine in the old way, their weight would be many thousand pounds.

THE PITTSBURG BRIDGE CO., Pittsburg, Pa., through its New England agents, Collins & Norton, 33 Lyman St., Springfield, Mass., has received a contract from the Burgess Sulphite Paper Co., Berlin, N. H., to furnish a steel coal bunker with chutes to automatically feed its boilers, according to plans furnished by Mr. H. S. Ferguson, engineer, of Lewiston, Me. The company has also received contracts from the towns of Easton, Conn.; Williamsburgh, Mass., and Buckland, Mass., to build highway bridges.

NEW COMPANIES.—Pasteurized Water Co., St. Louis, Mo.; $3,000, with all paid in; Claude P. Crandall, Peter A. Connolly and J. M. Meyers.

Thackeray Incinerating Co., First National Bank Bldg., Jersey City, N. J.; $100,000; commencing with $1,000; to collect and incinerate ashes, garbage, etc.; Chas. B. Thurston, Jersey City; F. W. Montgomery, 52 Broadway, New York; Lewis Perrine, Trenton, N. J.

Insulated Wire Co., 60 Grand St., Jersey City, N. J.; $500,000, commencing with $1,000; to sell insulated wire and other goods; Samuel B. Lawrence, 13 Astor Place, and John B. Summerfield, 62 Wall St., New York; Burnham C. Stickney, Elizabeth, N. J.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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PERSONAL.

Mr. John M. Farley, M. Am. Soc. C.E., has been appointed Chief Engineer of the water-works at White Plains, N. Y.

Mr. A. S. Dickinson, civil engineer, of Westbrook, Mass., was married Nov. 17 to Miss S. E. Hueston, of Roxbury, Mass.

Mr. William Bradburn, civil engineer, has been elected County Surveyor of Harris County, Tex., with offices in Houston.

Mr. H. H. Vreeland, President of the Metropolitan St. Ry. Co., New York city, has been elected President of the New York Railroad Club.

Mr. Samuel McCoy, civil engineer, of Independence, Mo., has been appointed an Assistant Engineer on the Choctaw, Oklahoma & Gulf R. R.

Mr. Wallace Winter has been appointed Assistant Superintendent of the Western Division of the Omaha & St. Louis R. R., with headquarters at Omaha, Neb.

Mr. T. J. Shellhorn has been appointed Master Mechanic of the Fort Worth & Rio Grande Ry., with headquarters at Fort Worth, Tex., to succeed Mr. B. G. Plummer.

Mr. Walter Edward Irving, Jun. Am. Soc. C. E., with the firm of Lewinson & Just, engineers and contractors, of New York city, was married Nov. 9, to Miss Charlotte Adela Walker, of Troy, N. Y.

Maj. Franklin C. Prindle, M. Am. Soc. C. E., Civil Engineer, U. S. N., of Brooklyn, N. Y., has been ordered to duty in connection with the establishment of a government training station on Yerba Buena Island.

Mr. Geo. R. Bottum, of Rutland, Vt., has been appointed Chairman, and Mr. Frank Wells, of Burlington, Vt., has been appointed Secretary of the Rutland-Canadian R. R., which will be built from Burlington into Canada.

Mr. Gustave R. Tuska, Assoc. M. Am. Soc. C. E., Chief Engineer of the Panama R. R. Co., left New York, Nov. 18, for Panama, to make an examination of the company's wharves, tracks, etc. He will be absent several weeks.

Messrs. J. N. Bridges, Herbert Mattison and Andrew Rinker have been appointed as a Board of Water Commissioners of Great Falls, Mont. Mr. Rinker was City Engineer of Minneapolis, Minn., from April, 1877, to January, 1893.

Mr. Walter W. Schlecht, civil engineer, has returned to Washington, D. C., from Nicaragua, where he has been with the government surveying corps on the Nicaragua Canal. He is engaged at present plotting the surveys made by the corps.

Mr. William P. Cochran, electrical engineer, of Lancaster, Pa., has been appointed Electrical Assistant to the Chief Engineer of the Martic Water & Power Co., with headquarters at Wrightsville, Pa. He graduated last June from the Pennsylvania State College.

Mr. F. J. V. Skiff, Director of the Field Columbian Museum, Chicago, Ill., has returned to that city after a visit of several months to Europe. He was recently appointed to the management of the Department of Mines and Mining at the Paris Exposition of 1900.

Mr. Harry K. Seltzer, Jun. Am. Soc. C. E., of Ephrata, Pa., has accepted the position of Instructor in Civil Engineering in the University of Texas, Austin, Tex. He graduated from Lehigh University, South Bethlehem, Pa., in 1895, and since then has been engaged in bridge work in Missouri and Iowa.

M. Charles de Wendel, steel manufacturer, of Paris, France, is visiting the United States for the purpose of studying American steel plants, especially with reference to the method of transferring molten metal from the furnaces to the converters. He visited the plant of the Johnson Co., Lorain, O., last week.

Prof. Frederick W. Denton, M. Am. Inst. Min. E., Professor of Mining Engineering in the University of Minnesota, Minneapolis, Minn., has resigned to assume the management of a large iron mine in Michigan. He is a graduate of the School of Mines of Columbia University, New York city, and has held the above professorship for the past four years.

Mr. William W. Varney, Assoc. M. Am. Inst. C. E., of Baltimore, Md., according to local papers, is to be the next City Commissioner of Baltimore. He is a graduate of the Massachusetts Institute of Technology, Boston, and studied electrical engineering in Norfolk, Va. He is also a graduate in law of the University of Maryland, and follows that profession as well as electrical engineering. His father is Naval Constructor William H. Varney, U. S. N., of Baltimore.

Mr. Wm. S. Barstow, Assoc. M. Am. Inst. E. E., General Superintendent of the Edison Electrical Illuminating Co., Brooklyn, N. Y., has been appointed General Manager of the Kings County Electric Light & Power Co., of the same city. Mr. Edward F. Peck, Assoc. M. Am. Inst. E. E., Secretary of the latter company, has been appointed Assistant General Superintendent.

Mr. Urban H. Broughton, civil engineer, of Chicago, Ill., and Mr. H. T. Wilson, formerly City Engineer of Galveston, Tex., have been appointed arbitrators of the question of transferring the entire sewerage system of the latter city from private to municipal ownership. Mr. Broughton is the arbitrator for the city and Mr. Wilson for the Galveston Sewer Co., and they will select a third person to complete the commission.

Mr. Alfred Skitt, President of the Norfolk, Virginia Beach & Southern Ry., with offices in New York city, has been elected Vice-President of the Manhattan Ry., of that city, to succeed Mr. R. M. Gallaway. Mr. Skitt was the General Superintendent of the Fourth Ave. St. Ry., of New York, until the time that it was sold to the Metropolitan Traction Co. In this new position he will be the chief executive officer of the company.

Mr. Wm. J. Clark, Assoc. M. Am. Inst. E. E., General Manager of the Railway Department of the General Electric Co., was last month appointed by the Secretary of War, one of three members of a government commission to select camp sites, report on facilities for transporting troops, etc., in Cuba, during and after the evacuation of the island by the Spanish troops. Mr. Clark has recently published a book entitled "Commercial Cuba," to which Mr. E. Sherman Gould, M. Am. Soc. C. E., of Yonkers, N. Y., has written an introduction.

Mr. Cornelius Shields, Vice-President of the Spokane Falls & Northern Ry., with offices at Spokane, Wash., has been appointed Assistant General Superintendent of the Western District of the Great Northern Ry., with headquarters at Spokane, Wash., to succeed Mr. F. H. Britton, transferred to the Dakota Division, to succeed Mr. Jas. Russell, resigned, with office at Larimore, N. D. Mr. J. M. Davis, Division Superintendent of the Breckinridge Division, with headquarters at Breckinridge, Minn., has been transferred to the Montana Division, to succeed Mr. L. D. Button, resigned, with headquarters at Havre, Mont. Mr. L. B. Allen has been appointed Assistant Division Superintendent of the Fergus Falls Division, with headquarters at Melrose, Minn., to succeed Mr. W. T. Tyler, promoted to be Division Superintendent of the Breckenridge Division, with headquarters at Breckenridge, Minn. Mr. E. E. Lillie has been appointed Assistant Division Superintendent of the Northern Division, with headquarters at Grand Forks, N. Dak., to succeed Mr. W. D. Scott, resigned.

OBITUARY.

Mr. Chas. W. Lambee, dredging contractor, of Boston, Mass., died Nov. 19, aged 44.

Mr. Hiram T. Mirick, railway and canal contractor, of Lyons, N. Y., died Nov. 10.

Mr. John Hampden Brooks, Jr., civil engineer, died at Roselands, S. C., Nov. 13, aged 32.

Mr. Lysander Wright, builder of engines and machinery, of Newark, N. J., died Nov. 12, aged 76.

Herr Herman Heinrich Meier, founder of the North German Lloyd Steamship Co., of Bremen, Germany, and New York, died in the former city Nov. 18, aged 89.

Mr. Archie S. Miller, a civil engineer, on the Nicaragua Canal Commission's engineering corps, who had just returned from Nicaragua, died in Washington, D. C., Nov. 18, of yellow fever.

Mr. William E. Hale, President of the Toledo Traction Co., Toledo, O., and formerly President of the Hale Elevator Co., died in Chicago., Ill., Nov. 16, aged 63. He leaves a son, Mr. George E. Hale, who is an astronomer and Director of the Yerkes Observatory, Chicago.

Mr. John Field, civil engineer, of Columbus, O., died Nov. 12, aged 92. He was born in New Berlin, N. Y., and went to Ohio in 1824 as an engineer on the Ohio Canal. In 1829 he was Chief Engineer of the State Dam across the Scioto River. In more recent years he engaged in the lumber business in Columbus.

Mr. Joseph Albree, father of Mr. Chester B. Albree, of the Chester B. Albree Iron Works, Allegheny, Pa., died in London, England, Nov. 7. He was born in Pittsburg, Pa., Sept. 15, 1835, and graduated from the Western University of Pennsylvania. He engaged in the shoe business until 1887, when he became a partner with his sons, Chester B. and Ralph Albree, in the manufacture of ornamental iron work in Allegheny.

Mr. Thomas Sparks Bishop, M. Am. Soc. C. E., Engineer and Assistant Treasurer of the Russell & Erwin Mfg. Co., New Britain, Conn., until last June, died in Columbus, N. J., Nov. 13. He was born in the latter place March 12, 1846, and graduated from the Polytechnic School of Pennsylvania in 1868. In 1869 he became a civil engineer with the Camden & Amboy R. R. From 1875 to 1880 he was a civil engineer on the Pennsylvania R. R., and in the latter year went to New Britain, Conn., to become the Engineer of the Russell & Erwin factory. He was appointed Assistant Treasurer of the company in 1881, and held the position until last June, when he resigned on account of ill health.

Sir John Fowler, K. C. M. G., LL. D., and Member and Past President of the Institution of Civil Engineers, died in London on Nov. 21, in his 81st year. Sir John was born near Sheffield, and was educated as an engineer in the office and in field work. Among the early railways upon which he was engaged, was the London-Brighton line. He soon acquired a very extensive practice, and built a number of bridges, viaducts, etc., in Europe as well as in England. In 1870 he investigated the Norwegian railway system for the Indian government; he also reported upon the barrage of the Nile, and acted upon many other equally important commissions. In connection with the present Sir Benjamin Baker, he was one of the engineers of the Forth bridge. He was one of the earliest members of the Institution of Civil Engineers, having been elected on Feb. 6, 1844; he was President of that body in 1866-67. He was made a Knight Commander of the Order of St. Michael and St. George, for services in connection with the Soudan campaign.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

THE DETROIT ENGINEERING SOCIETY.
Nov. 25. "Experiences in the Engine Room of the U. S. S. 'Yosemite,'" T. H. Hinchman, Jr. Secy., Henry Goldmark, Wayne Co., Sav. Bank Bldg., Detroit, Mich.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Nov. 29-Dec. 2. Annual meeting, New York city. Secy., Prof. R. F. Hutton, 12 W. 31st St., New York city.
BROOKLYN ENGINEERS' CLUB.
Dec. 1. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 2. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Dec. 2. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.
CHICAGO ELECTRICAL ASSOCIATION.
Dec. 2. "Practical Points in Street Railway Engineering," W. A. Harding. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
ENGINEERS' CLUB OF COLUMBUS.
Dec. 3. Secy., H. M. Gates, 12½ North High St., Columbus, O.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Dec. 5. Secy., H. J. March, Library Bldg, Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Dec 5. Secy., C. L. Annan, City Engineer's Office, St Paul, Minn.
FRANKLIN INSTITUTE.
Dec. 6. "Reaction Velocity," Robert H. Bradbury; Dec. 13. "Commercial Photometers and Light Standards," Prof. A. J. Rowland; "The Kite as an Instrument in Meteorological Research," Prof. C. F. Marvin; Dec. 14. Fresh Studies of Pioneer Tools," Prof. H. C. Mercer. Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.
ENGINEERS' CLUB OF ST. LOUIS.
Dec. 7. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA.
Dec. 7. Secy., Howard Evans, Pier 45, Delaware Ave., Philadelphia, Pa.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 7. Secy., C. W. Hunt, 220 West 57th St., New York city.
WESTERN SOCIETY OF ENGINEERS.
Dec. 7. "Electrolytic Corrosion of Underground Structures," Prof. D. C. Jackson. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 8. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.
ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 8. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
ST. LOUIS RAILWAY CLUB.
Dec. 9. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
MONTANA SOCIETY OF ENGINEERS.
Dec. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
THE LOUISIANA ENGINEERING SOCIETY.
Dec. 12. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
ENGINEERS' CLUB OF KANSAS CITY.
Dec. 12. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.
NORTHWEST RAILWAY CLUB.
Dec. 13. Secy, T. A. Foque, Soo Line, Minneapolis, Minn.
NEW ENGLAND RAILWAY CLUB.
Dec. 13. Secy., Edw. L Janes, P O Box 1158, Boston, Mass.
NEW YORK RAILROAD CLUB.
Dec. 15. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Dec. 15. Secy., F. A. Charpiot, P. O Box 13, Savannah, Ga.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 16. Secy., F. H. Olmsted, Byrne Bldg., Los Angeles, Cal.
ROCHESTER ENGINEERING SOCIETY.
Dec. 16. Secy., John F. Skinner.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.
ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 19. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.

TECHNICAL CLUB OF OMAHA.
Dec. 19. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Dec. 20. Secy., R. A. Fessenden. 410 Penn Ave., Pittsburg, Pa.
WESTERN RAILWAY CLUB.
Dec. 20. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 21. Secy., Frank H. Olmsted, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Dec. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Dec. 28. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.
AMERICAN INVENTORS' AND MANUFACTURERS' ASSOCIATION.
Jan. 15. Annual meeting, Washington, D. C. Secy., Arthur Steuart, Wash. Loan and Trust Bldg., Washington, D. C.
NORTHWESTERN ELECTRICAL ASSOCIATION.
Jan. 19-21. Semi-annual meeting, Milwaukee, Wis. Secy., Thos. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.
MICHIGAN ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Lansing, Mich. Secy., F. Hodgman, Climax, Mich.
ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 25-27. Annual meeting, Champaign, Ill. Secy., Jacob A. Harman, Peoria, Ill.

WESTERN SOCIETY OF ENGINEERS.—At the meeting on Nov. 16, there was a brisk discussion on the several papers on "Track Elevation in Chicago," which were presented at the two previous meetings.

NEW YORK ELECTRICAL SOCIETY.—The 191st meeting of this society was held Nov. 17 at the College of the City of New York. Mr. Edward H. Johnson, President of the Sprague Electric Co., delivered an illustrated lecture on "Surface Contact Railways, with Special Reference to the Johnson-Lundell System."

MONTANA SOCIETY OF ENGINEERS.—A regular meeting of this society was held on Nov. 12, at Helena, Mont. The subject considered was a bill providing for the appointment of a State Engineer and defining his duties. Mr. F. W. Blackford, of the Butte & Centerville Electric Ry., read a paper on the subject.

LOUISIANA ENGINEERING SOCIETY.—The regular monthly meeting of this society was held Nov. 14. The paper of the evening, by Mr. A. F. Wooley, Jr., U. S. Assistant Engineer, was entitled "Rectification of the Red and Atchafalaya Rivers." In this the various projects recommended by several prominent engineers were explained in detail.

WESTERN FOUNDRYMEN'S ASSOCIATION.—At the meeting on Nov. 16 a paper by Mr. Malcolm McDowell on "Metalloids in Castings" was presented, and afterwards discussed. The paper was on the same line as Mr. McDowell's former paper on "The Value of Metalloids in Cast Iron." which was presented at the January meeting and published in our issue of Feb. 3.

AMERICAN ECONOMIC ASSOCIATION.—The annual meeting of this association will be held at New Haven, Conn., Dec. 27-29. The programme is as follows:

Dec. 27. President's address, "The Relation Between Economics and Politics," Prof. Arthur T. Hadley. Dec. 28. Report of Committee on the Twelfth Census; consideration of the subject of American Economic History. Dec. 29. Report of Committee on Reform of Currency; also "Some Aspects of the Recent U. S. Treasury Situation," Prof. F. F. Taussig; Discussions of—Labor Problems in France, Municipal Taxation as a Means of the Public Control of Corporations, and the Nature of Municipal Franchises.

WESTERN RAILWAY CLUB.—At the meeting on Nov. 15, Mr. F. M. Whyte read a paper on "The Framing of Cars," the object of which was to show the necessity of modifying the design, and especially the trussing, so as to transmit as much of the load as possible to the center plate and so reduce the trouble arising from the deflection of the bolsters.

The first topical discussion was on "Methods of Handling Ashes from Locomotive Ash Pits," in which there was some opposition to mechanical methods, on account of the cheapness of shoveling by hand. This was followed by a brief discussion on "Improved Means for Drying Sand and for Delivering it to the Sand Box on the Locomotive."

NEW PUBLICATIONS.

SEWERAGE AND MUNICIPAL SANITATION.—A Paper Read Before the Annual Convention of the Mayors' Association of South Carolina, held at Georgetown, S. C., May 10-12, 1898. By J. L. Ludlow, M. Am. Soc. C. E., Winston, N. C. Printed for Private Circulation. Paper; 6 × 9 ins.; pp. 15.

If there were more such conventions with more such papers, as that noted above, municipal sanitation would advance even more rapidly than it has during the last few years. The South, especially, has need of just such educational work, but no part of the country is beyond the need yet.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.—Report of the 13th Annual Meeting, held at Peoria, Ill., Jan. 26, 27 and 28, 1898. Jacob A. Harman, Secretary, Peoria, Ill. Paper; 6 × 9 ins.; pp. 198; illustrated. Price, 50 cents.

The papers and committee reports in this volume most likely to be of greatest interest to our readers are as follows: "The Purification of Sewage by the Ferozone and Polarite System," by John W. Alvord; "Deep-Well Pumping," by E. E. Johnson; "The Improvement of Transportation in Country Districts," by E. E. R. Tratman; "Brick and Macadam Country Roads," by J. Ed. Miller, Monmouth; "Proposed State Supervision of Water Supply and Sewage Disposal," by Jacob A. Harman; Reports of Committees on Public Highways, Water-Works and Paving Brick Specifications and Tests. Appended to the report is a state directory of surveyors and civil engineers.

NEW YORK WEATHER BUREAU.—Eighth Annual Report. 1896. Under the Department of Agriculture, and in co-operation with the U.S. Weather Bureau. Created and organized under the Laws of the State of New York (Chapter 148, Laws of 1889). Reorganized and placed under the Department of Agriculture (Chapter 338, Laws of 1893). Central office at Cornell University, Ithaca, N. Y. State Printers. Cloth; 9 × 5½ ins.; pp. 525. Many maps.

The central office of this bureau says that the distribution of this report has been delayed by reasons beyond the agency of control of that office. The contents cover the meteorological reports for each month in 1896, and separately summarize these for the year; the stations are described, a sample crop report is given, and a separate chapter deals with the climate of the state of New York. A generally interesting map and description is one devoted to the physical features of New York, giving elevations of the surface above sea-level, from data secured in geological and state surveys and railway levels.

TRADE PUBLICATIONS

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

POWER PUMPS.—The Goulds Mfg. Co., Seneca Falls, N.Y. Paper; 8 × 7 ins.; pp. 92; illustrated.

This is a handsome descriptive catalogue of power pumps designed, the title page states, "for every service." There are also some useful tables.

SPECIAL MUNICIPAL SUPPLIES.—Henry W. Atwater, Manager, Imperial Building, Montreal, P. Q. Paper; 8 × 10 ins.; pp. 28; illustrated.

This catalogue describes a garbage incinerator, automatic gully or catchbasin cleaner, fire hose attachment, valves, pipe couplings, etc., made under the Decorie patents.

RECENT BALDWIN LOCOMOTIVES.—Baldwin Locomotive Works, Philadelphia, Pa. Pamph.; 9 × 6 ins.; pp. 32; illustrated.

This is No. 8 of the regular series of pamphlets which are being issued by the above firm illustrating and describing briefly the locomotives built by them to fill recent orders. Altogether the present number illustrates 15 different locomotives, including, besides the regular steam railway types, a number of mining, plantation and switching locomotives. Most of the engines shown were built to foreign orders, principally from the Central and South American countries, China, Russia and Australia, but there is one from the Lynton & Barnstaple Ry., in England itself.

HISTORIC RICHMOND.—Devoe & Raynolds Co., Chicago, Ill. Leather, 8½ × 6 ins.; ten photographs, with descriptive captions.

This is a portfolio of ten handsome photographs of buildings, statues, street scenes, etc., in Richmond, Va., which are of interest for their historical associations, and has been issued by the above firm as a souvenir of the sixth annual convention of the Association of Railway Superintendents of Bridges and Buildings, held at Richmond, Oct. 18-20, 1898 (Eng. News, Oct. 11, 1898).

MINING MACHINERY AND PLANT.—Gates Iron Works, 650 Elston Ave., Chicago. Paper; 6 × 9 ins.; pp. 130.

This very handsome specimen of trade publications is the company's general catalogue, covering the wide and varied field of its manufactures. It shows the various styles of the Gates, Blake & Dodge crushers for rock, ore, etc., and also different styles of crushing rolls. Then come ore feeders, stamp mills, the Tremain steam stamp mill, rotary driers, vanners, amalgamator pans, concentrators, etc. Smelting and roasting furnaces (the latter being of the rotary type) are shown. Engines, mining hoists, mine and dump cars, conveyors, etc., are included. The catalogue is illustrated by excellent half-tone engravings of the various machines, and views showing mills which have been equipped by this firm.

COAL MINING MACHINERY.—Sullivan Machinery Co., 58 N. Clinton St., Chicago, Ill. Catalogue No. 32. Pamph.; 9 × 6 ins.; pp. 20.

This catalogue illustrates the Sullivan coal undercutting and shearing machines, driven by compressed air. The undercutter is made in four sizes, weighing from 500 to 800 lbs., and capable of undercutting from 4½ to 6 ft. The shearing machine is a new departure in coal mining machinery. It makes a vertical cut in the face of the breast 6 ins. wide, 7 to 8 ft. deep and of the height of the coal seam.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Nov. 24.	Asphalt paving, Reading, Pa.	Nov. 24
Nov. 24.	Lift bridge, Utica, N. Y.	Nov. 24
Nov. 25.	Sewer, Ballston Spa, N. Y.	Nov. 24
Nov. 25.	School building, Boston, Mass.	Nov. 24
Nov. 25.	Fire hose, Seattle, Wash.	Nov. 24
Nov. 25.	Pipe sewers, Pittsburg, Pa.	Nov. 24
Nov. 25.	Water pipe, etc., Honolulu, H. I.	Oct. 27
Nov. 25.	Rebuilding wall, New York, N. Y.	Nov. 10
Nov. 25.	Cleaning streets, Cleveland, O.	Nov. 10
Nov. 25.	Portable pump, Cleveland, O.	Nov. 17
Nov. 25.	Sewer connections, etc., N. Soldiers' Home.	Nov. 17
Nov. 26.	Court house, Danbury, Conn.	Nov. 17
Nov. 26.	Boilers, Brooklyn, N. Y.	Nov. 10
Nov. 25.	Pipe sewers, Pontiac, Mich. Advertised, Engineering News, Nov. 17.	Nov. 17
Nov. 26.	Crane, Port Royal. S. C.	Oct. 27
Nov. 26.	Sawmill, chimney, etc., Mare Island, Cal.	Nov. 3
Nov. 26.	Steam heating, etc., Bath, N. Y.	Nov. 24
Nov. 26.	Gun forgings, Washington, D. C.	Nov. 24
Nov. 26.	Lighting fixtures, etc., Bath, N. Y.	Nov. 24
Nov. 28.	Street work, New Orleans, La.	Nov. 24
Nov. 28.	Sidewalks, etc., Kansas City, Mo.	Nov. 24
Nov. 28.	Sidewalks, grading, etc., Indianapolis, Ind.	Nov. 24
Nov. 28.	Grading St. Paul, Minn.	Nov. 24
Nov. 28.	Canal work, etc., Albany, N. Y.	Nov. 24
Nov. 28.	Iron bridge, Albany, N. Y.	Nov. 24
Nov. 28.	Bell tower, New Orleans, La.	Nov. 24
Nov. 28.	Electric light plant, Reading, Pa.	Nov. 24
Nov. 28.	Removing wreck, Port Chester, N. Y. Advertised, Eng. News, Oct. 27 to Nov. 17.	Nov. 3
Nov. 28.	Water-works, Florence, Colo Advertised, Eng. News, Nov. 3 and 10.	Nov. 3
Nov. 28.	Sewers, North Bend, Ind.	Nov. 3
Nov. 28.	Heating plant, Henderson, Colo.	Nov. 3
Nov. 28.	Tubular boilers, (2), San Francisco, Cal.	Nov. 3
Nov. 28.	Electric plant, Denver, Colo.	Nov. 10
Nov. 28.	Mailing platform and shed, New York. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Nov. 28.	Street bonds, Wellston, O.	Nov. 17
Nov. 28.	Cast-iron pipe sewer, New York.	Nov. 17
Nov. 28.	Boilers, machinery, etc., Detroit, Mich. Advertised, Eng. News, Nov. 17 and 24.	Nov. 17
Nov. 29.	Sewers, etc., Red Bank, N. J. Advertised, Engineering News, Nov. 17.	Nov. 17
Nov. 29.	Condenser tubes, Mare Island, Cal.	Nov. 10
Nov. 29.	Scales, etc., Washington, D. C.	Nov. 10
Nov. 29.	Drain tile, Philo, Ill.	Nov. 17
Nov. 29.	Water-works, Ft. Berthold, N. Dak.	Nov. 3
Nov. 29.	Pipe sewers, Buffalo, N. Y.	Nov. 24
Nov. 29.	Asphalt paving, etc., Jersey City, N. J.	Nov. 24
Nov. 29.	Macadamizing, Morristown, N. J.	Nov. 24
Nov. 29.	Granolithic sidewalks, Louisville, Ky.	Nov. 24
Nov. 29.	Naval supplies, Washington, D. C.	Nov. 24
Nov. 30.	Water-works, Wamego, Kan.	Nov. 24
Nov. 30.	Dry dock, Algiers, La.	Oct. 20
Nov. 30.	Bridge, etc., and plans, Moline, Ill. Advertised, Eng. News, Oct. 6 and 13.	Oct. 6
Nov. 30.	Water-works, McKinney, Tex.	Nov. 10
Nov. 30.	Steel arch bridge, Victoria, B. C.	Nov. 10
Nov. 30.	Temporary drain, New York.	Nov. 17
Nov. 30.	Power plant, Orillia, Ont.	Nov. 17
Dec. 1.	Suction pipe, etc., Three Rivers, Que.	Nov. 17
Dec. 1.	Electric plant, Somerville, Tenn.	Nov. 17
Dec. 1.	Water-works, Somerville, Tenn.	Nov. 17
Dec. 1.	Power plant, Brandon, Vt.	Nov. 17
Dec. 1.	Electric light plant, Clinton, Ill.	Nov. 10
Dec. 1.	Business building, Cleburne, Tex.	Nov. 10
Dec. 1.	Seawall, S. I., N. Y. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Dec. 1.	Electric lighting, Sumter, S. C.	Oct. 6
Dec. 1.	Electric light plant, Clinton, Ill.	Oct. 13
Dec. 1.	Brick sewer, Buffalo, N. Y.	Nov. 24
Dec. 1.	Court-house plans, Lafayette, Ala.	Nov. 24
Dec. 1.	Street bonds, Wilkinsburg Pa.	Nov. 24
Dec. 1.	System of clocks, Troy, N. Y.	Nov. 24
Dec. 1.	Turnpike bonds, Winchester, Ky.	Nov. 24
Dec. 2.	Pine timber, New York, N. Y.	Nov. 24
Dec. 2.	Paving, Omaha, Neb.	Nov. 24
Dec. 2.	Granite stones, New York, N. Y.	Nov. 24
Dec. 2.	Pipe sewers, Mason City, Ia. Advertised, Engineering News, Nov. 24.	Nov. 24
Dec. 2.	Arc lighting, Asheville, N. C.	Oct. 13
Dec. 3.	Wooden or iron bridge, Rome, Ga.	Nov. 24
Dec. 5.	Pipe sewers, Toledo, O.	Nov. 24
Dec. 5.	Supplies, Toronto, Ont.	Nov. 24
Dec. 5.	Buckeye paving, Toledo, O.	Nov. 24
Dec. 5.	Grading, Seattle, Wash.	Nov. 24
Dec. 5.	Bridges (7), Leavenworth, Kan.	Nov. 24
Dec. 5.	Valves, pipe, etc., Toronto, Ont.	Nov. 24
Dec. 5.	Street cleaning, etc , Philadelphia, Pa.	Nov. 24
Dec. 5.	Stone heads, Newark, N. J. Advertised, Eng. News, Nov. 17 and 24.	Nov. 24
Dec. 5.	Bulkhead and filling, Boston, Mass.	Nov. 24
Dec. 5.	Wall, Boston, Mass.	Nov. 24
Dec. 5.	Pumping engine, Oil City, Pa. Advertised, Eng. News, Oct. 27 to Nov. 10.	Oct. 27
Dec. 5.	Removing wreck, Philadelphia, Pa.	Nov. 10
Dec. 5.	Water-works, West Tampa, Fla. Advertised, Eng. News, Nov. 10 to 24.	Nov. 10
Dec. 5.	Court house, Garner, Ia.	Nov. 10
Dec. 6.	Canal, Tampico, Ill. Advertised, Eng. News, Nov. 10 to Dec. 1.	Nov. 10
Dec. 6.	Street bonds, Springfield, O.	Nov. 3
Dec. 6.	School building, Sacramento, Cal.	Nov. 17
Dec. 6.	Steam heating, New Brighton (S.I.), N. Y.	Nov. 24
Dec. 6.	Water-works, East Grand Forks, Minn.	Nov. 24
Dec. 6.	Pipe sewers, St. Louis, Mo.	Nov. 24
Dec. 6.	Electric light plant, E. Grand Forks, Minn.	Nov. 24
Dec. 7.	Dredging, New York Bay, N. Y.	Nov. 24
Dec. 7.	Electric light plant, New Richmond, O. Advertised, Eng. News, Nov. 24 and Dec. 1.	Nov. 24
Dec. 7.	Water-works, New Richmond, O. Advertised, Eng. News, Nov. 24 and Dec. 1.	Nov. 24
Dec. 7.	Changing Van Buren St. bridge, Chicago, Ill.	Oct. 20
Dec. 7.	Torpedo storehouse, Fort Caswell, N. C. Advertised, Eng. News, Nov. 10 to Dec. 1.	Nov. 10
Dec. 8.	Bridge approach, Zanesville, O.	Nov. 10
Dec. 8.	Police patrol system, Youngstown, O.	Nov. 24
Dec. 9.	Fire hose, Buffalo, N. Y.	Nov. 24
Dec. 10.	Intercepting sewers, Washington, D. C. Advertised, Engineering News, Nov. 3.	Nov. 3
Dec. 10.	Crane (100 tons capacity), Brooklyn, N.Y.	Nov. 10
Dec. 12.	Paving, curbing, etc., Dayton, O.	Nov. 17
Dec. 12.	Boilers for dredges, Honolulu, H. I.	Nov. 24
Dec. 13.	School building, Washington, D. C.	Nov. 24
Dec. 13.	Purchase of power franchise, Stockton, Cal.	Nov. 24
Dec. 15.	Church building, Webster City, Ia.	Nov. 24
Dec. 15.	Court house, Austin, Minn.	Nov. 24
Dec. 15.	Storm sewers, Denver, Colo.	Oct. 13
Dec. 17.	Macadam roads (20 miles), Crown Point, Ind. Advertised, Engineering News, Nov. 24.	Nov. 24
Dec. 19.	Tunnel sewer, Newburg, N. Y. Advertised, Eng. News, Nov. 17 and 24.	Nov. 17
Dec. 20.	Revetments, Keweenaw Point, Mich. Advertised, Eng. News, Nov. 24 to Dec. 15.	Nov. 24
Dec. 21.	Court house annex, Atlanta, Ga.	Nov. 3
Dec. 22.	Bridge superstructure, Lorain, O. Advertised, Eng. News, Nov. 10 and 17.	Nov. 10
Dec. 23.	Light station, Tompkinsville, (S.I.), N. Y. Advertised, Eng. News, Nov. 17 and 24.	Nov. 17
Dec. 28.	Railway bridge, Chicago, Ill. Advertised, Engineering News, Nov. 24.	Nov. 24
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18
Jan. 1.	Draw bridge, Cathlamet, Wash.	Nov. 17
Jan. 1.	Water-works, Pasadena, Cal.	Nov 17
Jan. 2.	Bridge, Quebec, Que. Advertised, Eng. News, Sept. 29 and Oct. 6.	Sept. 29
Jan. 2.	Arc lighting, Vincennes, Ind.	Oct. 27
Jan. 3.	Steel bridge, Brookhaven, Miss.	Nov. 24
Jan. 6.	Water-gas plant, Johannesburg, So. Africa.	Oct. 27
Jan. 6.	Extension, electric plant, Johannesburg, S.Af.	Oct. 27
Jan. 9.	Repairing curb, etc., Houston, Tex.	Nov. 24
Jan. 14.	Park work and plans, Philadelphia, Pa.	Nov. 17
Jan. 24.	Footway tunnel, London, England.	Nov. 10

Feb. 2. Electric lighting, New Orleans, La. ....Nov. 3
Feb. 10. Jail building, Keyser, W. Va. ....Sept. 29
Mar. 15. Electric railway (23 miles), Shanghai, China. Nov. 24
Advertised, Eng. News, Nov. 17 to Dec. 8.
Mar. 31. Telephone concession, Shanghai, China. ....Nov. 24
Advertised, Eng. News, Nov. 17 to Dec. 8.
Apr. 30. Water-works, Persia, Ia. ....Nov. 17

RAILWAYS.

CHEROKEE MINING CO.—Reports state that this company, care of C. W. Howard, Times Bldg., Chattanooga, Tenn., will be in the market for a standard gage locomotive, a road-grading machine, and the necessary tools for railway construction.

CHICAGO, ST. LOUIS & TEXAS AIR LINE.—D. Griffin Gunn, Pres., San Antonio, Tex., informs us that the surveys have been completed, the right of way guaranteed and bonuses amounting to about $450,000 promised for this proposed railway from San Antonio to Brownsville, Tex., via San Diego, a distance of 275 miles. The cost of construction will be about $10,000 a mile. There will be but few bridges required, and no heavy grading will be met with as the route is through a prairie and small mosquito timber district. The contract for the entire work will be let to responsible parties, to be paid for in cash when completed.

CHOCTAW & MEMPHIS.—Among the bidders Nov. 12 for the construction of this company's new line from Howe, Ind. Ter., to Little Rock, Ark., a distance of 164 miles, were the following: J. H. McCarthy & Co., Little Rock; G. M. Garvey, Memphis, Tenn.; Edward A. Garvey, St. Louis, Mo.; Johnson Bros., St. Elmo, Ill.; Donald Grant & Co., Faribault, Minn.; R. M. Quigley, St. Louis; Mason Hoge & Co., Frankfort, Ky.; M. C. Hurley, Fort Worth, Tex.; J. W. Thompson, St. Louis; Corrigan & Lee, Kansas City, Mo.; St. Joe Construction Co., St. Joseph, Mo.; W. P. Chapman Co., 40 Wall St., New York; Ferguson Contracting Co., 69 Wall St., New York; J. S. Sherman, Utica, N. Y. J. H. McCarthy and Johnson Bros. are said to have been the successful bidders; estimated cost, about $2,000,000. F. A. Molitor, Ch. Engr., Little Rock.

COLORADO & SOUTHERN.—Reports state that the Union Pacific, Denver & Gulf, the Denver, Leadville & Gunnison (known as the South Park Line), and the Denver, Texas & Gulf Rys., and branch lines, are to be reincorporated, under the name of the Colorado & Southern Ry. Co., with Frank Trumbull, Denver, Colo., as President, and B. L. Winchell as General Traffic Manager.

CUBA.—Press reports state that within several weeks work will be commenced, under Col. Hecker's directions, upon a railway from Casa Blanca, on the east side of Havana Bay, to Guanabacoa, where it will connect with the tracks of the United R. R., thus facilitating the transportation of commissary supplies.

DALLASTOWN.—S. M. Manifold, of York, Pa., who is chief engineer of the York Southern R. R., is said to have been awarded the contract for the construction of this line near Dallastown, Pa., to be 1 1-10 miles in length, at $11,580. The grading work has been sub-let to John Dobblings. D. F. Lafean, Pres., York, Pa.

FLORENCE & GULF.—Interest is now being revived for the construction of this proposed railway from Florence to Mobile, Ala. Several years ago surveys were made under the supervision of the state for a line which will tap the Great Warrior coal fields at Tuscaloosa, passing through the long leaf yellow pine regions and the black lands of the southern part of Alabama. It is said to be the intention of those behind the project to build to Chicago. R. T. Simpson, Jr., of Florence, Ala., is the representative of the line for Lauderdale and Colbert counties.

FORT DODGE & OMAHA.—Jas. H. McShane, of Omaha, Neb., is stated to have been awarded the contract for grading this proposed line between Omaha and Loveland, and that he expects to have work completed in time to lay rails by April 1. This line will be an extension of the Illinois Central Ry., from Fort Dodge, Ia., to Omaha, 125 miles.

LAKE ERIE & DETROIT RIVER.—This company has been voted bonuses at St. Thomas, Ont., Dutton and other towns. It is expected to build an extension from Ridgetown to St. Thomas in the spring to a connection with its London & Port Stanley branch. Owen McKay, Engr., Windsor, Ont.

MONTEREY & FRESNO.—H. A. Greene, Vice-Pres. and Gen. Mgr., Monterey, Cal., informs us that a contract has been signed for the completion of this road as far as Hollister from Monterey; also the contract for rails, etc. A. W. Jones, Pres.; P. P. Dandridge, Ch. Engr., both of Monterey.

MUSCATINE, NORTH & SOUTH.—Grove M. Willis, Ch. Engr., Wapello, Ia., informs us that the location has been completed and entire right of way obtained for this railway, from Elrick to Muscatine, via Wapello, Grand View and Fruitland, 30 miles. Balch, Peppard & Johnson, Minneapolis, Minn., received the contract July 13, and now have 10 miles of track laid and the balance nearly graded and bridged ready for track. The station buildings have been erected. Pres., W. R. Stewart, New York.

NELSON & BEDLINGTON.—Reports from Nelson, B. C., state that Folliet & Guthrie have been awarded the contract for the construction of this new line from Bonner's Ferry, Idaho, to Nelson, a distance of about 60 days. Jas. J. Hill, Pres. of Great Northern, St. Paul, Minn., is interested.

OHIO.—The Cincinnati, Hamilton & Dayton, the Wheeling & Lake Erie and the Lake Shore & Michigan Southern Ry. Cos. are reported to be contemplating the purchase of Presque Isle, at the mouth of the Maumee River, Toledo, O., for use as a terminal during the Ohio Centennial. If the deal is consummated a large railway bridge will have to be erected.

PENNSYLVANIA.—Reports state that P. E. McGovern, Clearfield, Pa., has begun the construction of a railway for N. L. Hoover & Co., from a point near Glen Campbell, Pa., six miles west to a lumber tract owned by N. L. Hoover and John Du Bois. Mr. McGovern will employ about 100 men, and expects to have the road completed by about Jan. 15. The line will penetrate valuable timber and coal lands.

PHILADELPHIA, READING & NEW ENGLAND.—It is announced that the Poughkeepsie bridge route of this company was to be transferred to the bondholders on Nov. 15, and that the new company will be known as the Central New England. John W. Brock, of Philadelphia, will continue as president, and bids will be asked for building an extension to Springfield, Mass. C. H. Ewing, Ch. Engr., Hartford, Conn.

PORTLAND, VANCOUVER & YAKIMA.—Bids will soon be asked, according to reports, for the construction of an extension of this line to a point on the Chelatchie prairie. Plans are now in preparation. L. Gerlinger, Pres.; J. W. Coovert, Ch. Engr., both of Vancouver, Wash.

PIONEER MFG. CO.—J. H. Adams, Thomas, Ala., informs us that Dunn & Lallande Bro. are the principal contractors, as stated in our last issue, for the construction of 3½ miles of track to be built for the Pioneer Mining & Mfg. Co. from its furnaces at Thomas to coal mines at Sayreton. Edwin Thomas, Pres., Catasauqua, Pa.; P. S. Milner, Ch. Engr., Birmingham, Ala.

RUSSIA.—Press reports state that a new line is projected in Russia to run from Tscheljabinsk, the western terminus of the Trans-Siberian Ry., to Zarizyn, on the Volga, via Orenburg and Uralsk. The purpose of the road is to connect the wheat region of Western Siberia with a Black Sea port.

SUMTER & WATEREE.—R. D. Lee, Sumter, S. C., informs us that contracts to build this line are about to be let. The right of way has been secured and the surveys made. The route is from Sumter to Middleton, a distance of 15 miles. J. D. Blanding, Pres.; F. B. Beckar, Ch. Engr., both of Sumter.

TERRE HAUTE & LOGANSPORT.—J. T. Brooks, of the Pennsylvania Co., Pittsburg, Pa., is reported to have bought this line at a Master's sale, Nov. 18, at $1,060,000.

TRAIL & SALMON RIVER.—Application will be made to the legislative assembly of the Province of British Columbia for an act to incorporate this company with power to construct and operate either a standard or narrow gage railway from Trail to Sayward and to the junction of the Salmon River with the Pen D'Oreille River. Frank Fletcher, Pres.; Frank Moderly, Ch. Engr., Vancouver.

WARSAW & VIENNA.—Press reports state that this railway company will soon be in the market for a number of new locomotives, in addition to the 32 recently bought in America.

WEST BRANCH VALLEY.—This company was incorporated in Pennsylvania, Nov. 7, with a capital stock of $1,100,000, to construct a steam railway from Clearfield to Williamsport, Pa., along the Susquehanna River, a distance of about 111 miles. At Clearfield a connection will be made with the Buffalo, Rochester & Pittsburg Ry. It will have a low-water grade all the way and will therefore be the most economical route through Central Pennsylvania. It is thought that this will be part of a new trunk line through the state. A. E. Patton, Pres., of the Pennsylvania Construction Co., Curwensville, Pa.; H. B. Powell, Vice-Pres., Clearfield; F. J. Dyer, Treas., Curwensville.

WESTERN RY. CONSTRUCTION.—Bryan W. Tichenor, 27 Pine St., New York, informs us that this company proposes to construct a railway from Altata to Durango, via Culiacan and La Bajada, Mexico, 700 miles, of which 40 mile are now in operation between Altata and Culiacan. The route has been surveyed, a concession granted and negotiations for capital are pending. Further statement of facts cannot be made at present. The promoters are R. J. Hartman, Mexico City, Mex., and J. R. Newberry, Los Angeles, Cal.

WEST SHORE & EASTERN.—Press reports state that E. Woolford, of Pittsburg, is now making a permanent location for this proposed line from North Charleroi to the Youghiougheny River, near the Washington mines, via Allenport, Pa.

WISCONSIN CENTRAL.—This company has received judicial sanction to the issuance of $1,000,000 in bonds. It is said that the receivers will now purchase new equipment and buy considerable new rolling stock. H. F. Whitcomb, Recr. and Gen. Mgr., Milwaukee, Wis.

STREET AND ELECTRIC RAILWAYS.

HAMPTON, N. H.—Soule, Dillingham & Co., 8 Oliver St., Boston, Mass., contractors for the track and overhead construction work of the proposed Hampton & Amesbury St. Ry., inform us that all orders have been placed and construction work begun between Hampton and Seabrook, a distance of five miles. W. D. Lovell., Treas., 143 Federal St., Boston.

MONTPELIER, VT.—Reports state that the Hoosac Power & Traction Co. has been incorporated in Vermont.

FITCHBURG, MASS.—The council granted a franchise to the Fitchburg & Leominster St. Ry. Co., Nov. 15, to double track its Main St. line from Putnam St. to the upper common, and to build a line up Blossom and connecting streets. H. A. Willis, Pres.; A. H. Moore, Ch. Engr.

WEST SPRINGFIELD, MASS.—The selectmen of this town have granted a franchise to the Springfield St. Ry. Co., to build from the old toll bridge to the Agawan bridge, conditional upon the company constructing a line to connect the Bridge St. location with that at West Springfield Center. J. Olmstead, Pres., 1 Main St., Springfield.

WESTBORO, MASS.—The Westboro, Hopkinton & Milford St. Ry. Co., capitalized at $80,000, has petitioned this town for a franchise. Wm. H. Tylee, Worcester, Mass.; Edgar K. Ray, Franklin, Mass., are interested.

WILLIMANTIC, CONN.—Jesse Starr, Room 2, Unity Bldg., Hartford, Conn., informs us that he is in the market for material to fully equip ten miles of electric railway in this town. L. B. Wilson, of Hartford, is said to be the engineer.——The Willimantic St. Ry. Co. has recently been incorporated, with a capital stock of $1,000, by Eugene S. Boss, J. Griffin Martin and Solomon Lucas.

NEW YORK, N. Y.—The Fort George Extension Ry. Co. was incorporated at Albany, Nov. 17, with a capital stock of $10,000, to operate an electrical surface line from 172d to 185th St., on 11th Ave. The directors are: M. G. Starrett, W. F. Plummer, John Lambdon, Andrew Loughlin, D. W. Patterson and Harry Hartwell, of New York; John Kerr and Charles E. Corby, of Brooklyn; and H. A. Himely, Far Rockaway (L. I.), N. Y.——Papers were filed, Nov. 21, consolidating the North End St. Ry. Co., the Fort George & 11th Ave. R. R. Co., and the Fort George Extension Ry. Co., under the name of the Fort George & 11th Ave. R. R. Co.; capital stock, $3,000,000. Its directors are: John T. Little, Jr., Ambrose F. McCabe, Frederick C. Garrick, Frank F. Ogston and Sharon Graham, of New York; Clement M. Cumming, Yonkers, N. Y.; C. A. Gilbert, White Plains, N. Y.; W. A. Dibbs, of Brooklyn, N. Y., and D. C. Moorehead, of Jamaica (L. I.), N. Y.

ROCHESTER, N. Y.—It is reported that the Rochester & Lake Ontario Ry., leased by the Rochester & Irondequoit R. R. Co., will be double-tracked between Rochester and Lake Ontario and the motive power changed from steam to electricity. J. N. Beckley, Pres., Rochester.

SYRACUSE, N. Y.—The time for the completion of the Syracuse & Oneida Lake R. R. has been extended from Dec. 15, 1898, to Dec. 15, 1899, by resolution offered by Alderman Matty.

LODI, N. J.—Sandford & Stillman Co., Jersey City, N. J., were awarded the contract, Nov. 11, according to reports, for building a trolley line from Garfield to Lodi, at $48,000, and also for erecting a bridge, at $5,000; time, 60 days.

ERIE, PA.—It is reported that agreements have been made by the Erie Transit Co. and contractors looking to the construction of an electric line connecting Edenboro, Erie and Cambridge before June 1. All franchises are granted except in Erie City and Summit township. J. F. Downing, Pres., Erie.

IRWIN, PA.—The council has been petitioned by the McKeesport & Irwin St. Ry. Co. for a franchise to build through the town.

PITTSBURG, PA.—The Consolidated Traction Co. is said to be making extensive improvements on its Sharpsburg and Etna branches, and to be contemplating the building of several extensions up the Allegheny Valley. C. L. Magee, Pres., Times Bldg.

PITTSTON, PA.—Jas. A. Steese, Pres. Pittston & Scranton St. Ry. Co., Mount Holly Springs, Pa., informs us that this company, whose incorporation was noted in our last issue, expects to build a short line about 2½ miles in length. No surveys have yet been made.

SCRANTON, PA.—The Nay-Aug Park St. Ry. Co. was incorporated Nov. 17, with a capital stock of $50,000, to construct an electric street railway in this city. The incorporators are: Jas. L. Crawford, Pres.; Geo. F. Reynolds, Geo. E. Hill, Clarence E. Reynolds and Thos. F. Penman, all of Scranton.

CUMBERLAND, MD.—The commissioners of Allegany county have granted an extension of time to Dec. 1 for the commencement of surveys of the new line between this place and Westernport, projected by J. W. Burchinal, of Moundsville, W. Va.; Marx Wineland, of Frostburg, Md.; Hugh Scott and William Atkinson, of Lonaconing, Md. Engr., G. D. Howell, Philadelphia, Pa. Construction work will not begin until next spring.

WASHINGTON, D. C.—O. T. Crosby has bought the franchises and other property of the Belt Ry. Co., including about 16 miles of single track lines, at $350,000. The road has to be equipped with the underground electric system within one year.——The plant of the Potomac Electric Power Co. is being prepared to furnish power for the City & Suburban St. R. R. Co., formerly the Eckington & Soldiers' Home Ry. Co. O. Y. Crosby, Pres.

PETERSBURG, VA.—S. Kaufman, of Charlotteville, N. C., representing the bondholders, is reported to have bought the property of the Petersburg Electric Ry. Co., at public auction, Nov. 11, at $5,500. It is said that the system will be merged into that projected by the Piedmont Traction Co., of Charlotteville.

GADSDEN, ALA.—The Gadsden & Attala Union Ry. will soon be changed from a dummy line to an electric system, at a cost of about $10,000. The total length of the line is 11.25 miles. The power will be furnished by the Alabama Light & Power Co., W. S. McCall, Pres., which intends to begin at once the erection of a $25,000 electric light and power plant at Gadsden. J. M. Elliott, Jr., Pres., 123 North 4th St.

LOUISVILLE, KY.—Percival Moore and S. P. Myer, of this city, are interested in the proposed construction of an electric railway from Louisville to Pewee Valley, via Shelbyville Pike.

FAIR HAVEN, O.—Dr. Hugh F. Lorimer, of Fair Haven, informs us that the proposed electric railway from Hamilton, O., to Richmond, Ind., a distance of 36 miles, would run along the Richmond & Hamilton Pike lying about one-half way between the Cincinnati, Hamilton & Dayton and the Pittsburg, Cincinnati, Chicago & St. Louis Rys. The route is through a thrifty portion of the state, touching at the towns of Darrtown, Morning Sun and Fair Haven, O., and Beechy Mire and Boston, Ind., which are from three to eight miles distant from either of the above-named steam railways. Nothing has yet been done toward construction, but it is believed that the people would help capitalists with both money and a free right of way.

SANDUSKY, O.—Fred. Shumer, Norwalk, O., has been awarded the contract for the stone work, and G. A. Breckenridge, Huron, O., the contract for grading on the extension of the Sandusky Interurban Ry. through Huron. The projected route is from Sandusky to Lorain, via Huron and Vermillion, 30 miles. Thomas Wood, Gen. Mgr.; C. A. Judson, Ch. Engr., both of Sandusky.

XENIA, O.—The Dayton & Eastern Traction Co., by Henry B. Pruden, has applied to the council for a franchise to build in this city.

EVANSVILLE, IND.—Henning & Henning, of Dayton, O., are said to represent capitalists who contemplate the construction of a suburban line from Evansville to Rockport, Tell City and Cannelton. C. J. Murphy, of the Business Men's Association, Evansville, may be addressed.

CORUNNA, MICH.—The council has granted a 30-year franchise to W. E. Avery, of Detroit, and F. J. Northway, of Durand, Mich., who are promoting the projected Long Lake, Durand & Corunna St. Ry.

GRAND RAPIDS, MICH.—The Grand Rapids, Belding & Saginaw Ry. Co. has been incorporated, with a capital stock of $350,000, to build a line from Freeport, Barry county, to Greenville, Montcalm county. The incorporators are: Thomas Hefferan, George Hefferan and Charles Percell, of Grand Rapids; Samuel W. McCall and George N. Ferald, of Boston, Mass.

CHARLESTON, ILL.—The Charleston & Mattoon Electric R. R. Co., of Charleston, has been incorporated, with a capital stock of $25,000, to operate an electric or dummy line in Coles county. The incorporators are: Forbes Holton, M. R. Williams and W. R. Patton.

ALAMEDA, CAL.—Ben. F. Lamborn, Cy. Clk., informs us that he desires a full line of catalogues regarding electric railways, car construction, rolling stock, transmission plants and electric lighting. G. A. Wiese, Cy. Electrician.

LONDON, ONT.—U. A. Buchner has submitted a proposition to the council providing for the construction of seven miles of new street railway.

BEPPU, JAPAN.—Reports state that the construction work is steadily progressing on the proposed Hoshu Electric Ry. from Beppu to Oita, in Kyushu. The contract for all the materials was let to the Saiga Electric Co., of Kyoto.

SHANGHAI, CHINA.—Bids are asked until March 15 for a concession for constructing about 23 miles of electric tramways in this city, as stated in our advertising columns. Plans may be obtained from Blackall & Baldwin, 39 Cortlandt St., New York, upon a deposit of $500. J. O. P. Bland, Secy., Shanghai.

ELECTRIC LIGHT AND POWER.

EVERETT, MASS.—Perry D. Blackden has applied for a franchise to build and operate a plant in this place. It is stated that the plant will cost about $60,000. At present light is furnished by the Malden Electric Light Co. Alderman White, Chn. Com.

WOONSOCKET, R. I.—F. S. Pond, Supt. Woonsocket Electric Machine & Power Co., writes us that it is proposed to put in a new 400-HP. engine to take the place of one recently destroyed. L. C. Lincoln, Gen. Mgr.

PORT CHESTER, N. Y.—The Port Chester Electric Light Co. has purchased 100 acres of shore front from the William Purdy estate, and will locate its new plant there, according to reports.

HERKIMER, N. Y.—The Westinghouse Electric & Mfg. Co., Pittsburg, Pa., has been awarded the contract for furnishing the machinery for the plant, at about $10,500.

NIAGARA FALLS, N. Y.—The Niagara Falls Power Co., on Nov. 22, made a contract with a new company formed by the men interested in the Oldbury Electro-Chemical Co., under the provisions of which 800 HP. will be furnished the new company by March 1, for the operation of a new electro-chemical plant to be built at once on the power company's lands adjacent to the Oldbury Electro-Chemical Co.'s works. The buildings will be erected at once.

PARKERS, N. Y.—The Utica Electric Mfg. Co., Utica, N. Y., has been awarded the contract for furnishing a plant of 150 lights for the L. B. Parker Lumber Mills.

WATERTOWN, N. Y.—Plans are being considered by the Black River Power Association, of Watertown, for its plant on the Upper Black River, according to reports.

BAYONNE, N. J.—Press reports state that the electric light plant at this place belonging to the Central R. R. of N. J., was burned Nov. 20, causing a loss of $5,000.

TRENTON, N. J.—Press reports state as follows: Thos. C. Barr, Orange, and Col. A. R. Kuser, Trenton, have purchased the franchises, etc., of the Trenton Electric Light & Power Co. for $415,000. Burr and Kuser represent themselves and J. F. Dreyden, Pres. Prudential Insurance Co., Newark, and other capitalists, and it is understood that their plans look to a consolidation of the electric light company with the Trenton St. Ry. Co. and the Delaware River Improvement Co. The latter company owns a water-power franchise at Morrisville, Pa., across the river from Trenton, and is interested in the proposed damming of the Delaware River for the purpose of turning the water power into electricity to supply the Trenton Electric Co. and the railway company with power. The building of an electric railway to Philadelphia is also said to be one of the projects in view, and, if accomplished, will be one more link in the New York & Philadelphia Traction Co.'s line. The property sold Nov. 15 for $415,000 represents a money investment of $170,000 made by the People's Electric Light Co. In 1892 Frank A. Magowan organized the Trenton Light & Power Co.

BLOSSBURG, PA.—The Blossburg Electric Co. has been awarded a 5-year contract for lighting this town with 106 32-c. p. incandescent lights.

NEW HOLLAND, PA.—Eli Martin has submitted a proposition to light this place by electricity.

TIMMONSVILLE, S. C.—The light committee wishes to correspond with manufacturers of electrical machinery, pumps, etc., for a plant and water-works. D. H. Traxler, Chn. Com.

KISSIMMEE, FLA.—The council has called an election to vote on the question of granting a 10-year franchise for a plant to J. M. Bailey.

DONALDSONVILLE, LA.—A. Culberson, Supt. Electric Light Plant, has recommended the purchase of a 37½-K-W. machine, with a 60-HP. high speed engine. Paul Leche, Mayor.

MONROE, LA.—This place voted Nov. 8 to issue $60,000 in bonds for a plant and water-works, $30,000 for a sewerage system, etc.

HENDERSON, TENN.—We are informed that the contracts have been let by the Henderson Electric Light Co. for the machinery for the proposed plant, to have a capacity of 4 2,000-c. p. arc and 500 16-c. p. incandescent lights.

CLEVELAND, O.—Henry C. Eyman, Supt. State Hospital, writes us that the following bids were received Nov. 16 for furnishing machinery, etc., for extending the plant at the State Hospital: Dynamos and motors, Fort Wayne Electric Corporation, Fort Wayne, Ind., $2,070; General Electric Co., Schenectady, N. Y., $1,920; Ridgway Dynamo Co., Ridgway, Pa., dynamo and engine, $3,129; B. M. Barr & Co., Cleveland, $1,920; Triumph Electric Co., Cincinnati, $1,900; Eddy Electric Mfg. Co., Windsor, Conn., $2,056; Westinghouse Electric & Mfg. Co., Pittsburg, $1,675 (accepted); Tresher Electric Co., Dayton, O., $2,030. Engines—General Electric Co., $1,220; Buckeye Engine Co., Salem, O., $1,075; Watertown Steam Engine Co., Watertown, N. Y., $1,050; Russell & Co., Massillon, O., $950 (accepted). Wiring—A. E. Moses, Cleveland, $345, also supplementary wiring, $195, awarded contract for entire wiring. The machinery bid on was as follows: Two 50-K-W.—110 W. direct connected dynamos to operate about 300 R. P. M.—Change in present switchboard and addition thereto—connecting wires from dynamo to switchboard, and one 10-HP. motor, one 7½-HP. motor, one 4-HP. motor, or (an alternative bid) one 50-K-W. dynamo, and the balance as above. Two automatic high-speed engines, each to develop 75 HP. at ¼ cut off and 80 lbs. pressure at the throttle and foundations for same, or (an alternative bid) one engine of the above size. Wiring—From the present main to the location of motor in the serving room, laundry, and machine shop, and change in the existing wiring and wiring for two arc lamps and two 50-c. p. incandescent lamps. Engrs., E. P. Roberts & Co., Osborn Bldg., Cleveland.

NEW RICHMOND, O.—Bids are asked until Dec. 7 for furnishing the materials and for constructing a plant and water-works, as stated in our advertising columns. J. F. Witmer, Engr., Buffalo, N. Y.; L. F. White, Secy.

PAYNE, O.—H. H. Snyder, Village Clk., writes us that the contract for building the plant for the Payne Electric Light & Power Co. has been let to Rosedale & Williams.

READING, O.—Bids are asked until Nov. 28 for furnishing and erecting one alternating-current generator for incandescent lighting; exciter, switchboard, and machinery and appliances connected therewith. Henry Varleman, Clk.; F. H. Vorjohan, Chn. Com.

INDIANAPOLIS, IND.—The Chenoweth Electric Light & Power Co. has applied to the board of public works for permission to erect poles and string wires in the streets of the city.

BELLAIRE, MICH.—The council is reported to have purchased land on the Cedar River for an electric light and power plant.

NEWAYGO, MICH.—The Newaygo Transmission Co., recently incorporated, with a capital stock of $15,000, proposes to develop the water power at Newaygo, 30 miles north of Grand Rapids, and to transmit electric power to that city and others intermediate. The company has been granted a franchise to erect poles and string wires in Grand Rapids. A. C. Sekell, Elec. Engr., and Chas. F. Pike, of Grand Rapids, and John F. Barry, Civil Engr., 45 Cedar St., New York, and Allston Gerry, Contractor, 445 Produce Exchange Bldg., New York, are interested.

STURGIS, MICH.—This place has voted in favor of building a plant, according to reports.

LITCHFIELD, ILL.—The council has rejected the bids recently received for city lighting.

MILWAUKEE, WIS.—The Cassidy & Son Mfg. Co., 135 West 23d St., New York, has been awarded the contract for furnishing the lighting fixtures for the federal building in this city, at about $11,000.

STEVENS POINT, WIS.—Press reports state that J. Witter, Grand Rapids, and G. W. Paulus, of Chicago, are figuring on purchasing the plant of the Stevens Point Lighting Co., including gas and electric systems. If the deal is carried through a new water-power plant will be erected at the new dam to be built across the river in the spring by Witter, Paulus and others. The plant cost $60,000, and is now in the hands of Receiver V. P. Atwell.

EAST GRAND FORKS, MINN.—Bids are asked until Dec. 6 for constructing a combined plant and water-works to cost about $35,000. W. I. Gray & Co., Engrs., Sykes Bldg., Minneapolis; Henry Haren, Cy. Recdr.

COUNCIL BLUFFS, IA.—The J. C. Hubinger Co., Keokuk, Ia., has applied for a franchise for a plant in this city. It is stated that the contract between the city and the Council Bluffs Gas & Electric Light Co. expires Dec. 1, 1899. Under this contract the city pays the company $84 per annum for each arc light, on the Philadelphia schedule.

HUMBOLDT, IA.—A company has been organized to build a plant. T. G. White is interested.

ODESSA, MO.—A company is reported to have been organized to build a plant to cost $5,000.

NORTHPORT, WASH.—W. R. Lee and Montana capitalists are reported to have been granted a franchise. Work will be begun at once.

TILLAMOOK, ORE.—The city recorder writes us that the city is considering the question of purchasing the plant owned and operated by the Tillamook Lumber Co.

ALAMEDA, CAL.—Ben. F. Lamborn, Cy. Clk., writes us that the city wants to secure catalogues regarding electrical goods, lighting, transmission plants, etc. Bidders' blanks will be sent to those sending their names.

COLTON, CAL.—An election will be held Dec. 12 to vote on the question of issuing $20,000 in 6% bonds for a plant and water-works. G. E. Slaughter, Cy. Clk.

STOCKTON, CAL.—Bids are asked until Dec. 13 for the purchase of a 48-year franchise for building and operating a power plant in San Joaquin county. The Standard Electric Co. of California has applied for such a franchise. I. H. Robinson, Clk.

BARRIE, ONT.—The council is reported to have made an appropriation for a city plant.

LIVERPOOL, N. S.—The council has decided to build a plant and water-works, at a cost of about $31,000, according to reports. J. V. Dexter may be addressed.

HONOLULU, H. I.—It is stated that Fred. J. Cross, Elect. Engr., Buffalo, N. Y., has made a visit to the plant of the Hawaiian Fertilizer Works. Frank A. Cooke, Mgr., is figuring on the use of electricity at the place both for power and in disintegrating material brought for reduction and use. Mr. Cross will submit a report on cost, appliances, etc.

NUREMBERG, GERMANY.—Friedrich Tischendorfer, Ch. Engr. Electricaitats Aktiengesellschaft, formerly Schuckert & Co., manufacturers of electrical machinery, Nuremberg, is visiting the United States for the purpose of purchasing electrical material and machinery. His address while in New York is the Belvedere House.

NEW COMPANIES.—Washington Incandescent Light Co., Seattle, Wash.; $30,000.

Rossland Air Supply Co., Ltd., Rossland, B. C., and 183 St. James St., Montreal, Que.; $200,000; G. K. Milbouren, A. J. McMillan, Rossland; D. J. Fitzgerald, Trail, B. C.; F. Aug. Heiz, Butte, Mont.; to develop water power by the use of compressed air under what is known as the Taylor hydraulic system on Beaver Creek.

Sands Electric Co., Cleveland, O.; $10,000; L. Sands, Edward Velhagen, F. B. Skeels, C. R. Hunt, C. A. Bejcek.

Mitchell-Parsons Electric Co., Portland, Me.; electric car appliances; $150,000; Geo. A. Copeland, Revere, Mass.; Wm. E. Pearson, Winthrop, Mass.

Athens Electric Light & Power Co., Athens, N. Y.; $20,000; Jeremiah M. Shuman, Newburgh, N. Y.

Seymour Park Canal & Power Co., Omaha, Neb.; $100,000; the business of the association is to construct dams, waterways, develop water, electric or other power for private, public and municipal purposes, development of irrigating ditches and the holding and ownership of franchises for rights-of-way; Dr. Geo. L. Miller, Geo. N. Hicks, D. C. Patterson.

Standard Light, Heat & Power Co., Unadilla, N. Y.; $60,000; to furnish electricity for Unadilla, Gilbertsville, Otego, Sidney, Franklin, Bainbridge and Afton; Henry G. Canfield, Samuel E. North, J. Fred Sands, Daniel R. Buckley, Unadilla.

Rochester Electric Service Co, Rochester, N. Y.; $1,000; with $800 paid in; to manufacture electricity for light, heat and power in Rochester; John W. Cook, Jr., Frederick Fish, Miner S. Horton, George B Newman, Rochester.

Citizens' Light, Heat & Power Co., 317 Market St., Camden, N. J.; $100,000, with $1,000 paid in; A. Stewart Scull, Camden, N. J.; Wesley Bartine, Philadelphia, Pa.

Mutual Electric Co., Waco, Wash.; $10,000; W. W. Seley, S. W. Slayden, I. A. Goldstein, L. Migel.

El Porte Zuelo Light & Power Co., Chicago, Ill.; $500,000; Chester D. Crandall, William M. Carpenter, William R. Patterson.

Columbia Heat, Light & Power Co., Shenandoah, Pa.; $5,000.

American Incandescent Light Co., Meriden, Conn.; $50,000; Lyman T. Lawton, Thomas E. Webster, Bay City, Mich.; B. L. Lawton, A. S. Cody, Midland, Mich.; Robert L. Doran, Meriden.

Rocky Ford Electric Co., Puebla, Rocky Ford, Colo.; $15,000; J. B. Downey, F. A. Kittler, F. L. Cuddenback.

Fairhaven Electric Co., Fairhaven, Vt.; Delaware County Electric Light & Power Co., Chester, Pa.; $5,000,000; consolidation of companies in Delaware and Chester counties; Chas M. Wagner, Richard L. Austin, of Delaware county; John B. Hannum, Chester.

Harper's Ferry Electric Light & Power Co., Harper's Ferry, W. Va.; $15,000, with $2,500 paid in; John A. Livers, Gettysburg, Pa.; G. R. Bready, T. M. Conner, of Harper's Ferry.

Standard Water & Power Co., Golden, Colo.; $50,000; to absorb the Jefferson Water-Works Co. at Golden and to improve the works; J. M. Walker, C. C. Welch, F. W. Loveland, Henry Lee, Hugh Butler, F. G. Patterson, A. W. Tabor.

Anglo-American Electric & Supply Co., Toronto, Ont.; $5,000,000; G. P. Magann, Dr. R. A. Pyne, M. L. A.; G. S. Ransom, Toronto.

BRIDGES.

ASHTON, R. I.—Reports state that Sylvanus Mason, Pawtucket, R. I., has been awarded a contract, at $4,732, for constructing the center pier and abutments for a bridge over the Blackstone River. Chas. N. Robertson, Chn.

ALBANY, N. Y.—Bids are asked until Nov. 28 for removing and constructing an iron bridge over the Erie Canal, in the counties of Erie and Niagara. Geo. W. Aldridge, Supt. Pub. Wks.

BINGHAMTON, N. Y.—A petition, signed by about 400 taxpayers, was presented to the council Nov. 15 for the construction of a bridge over the Susquehanna River near the water-works.

BUFFALO, N. Y.—The council proposed to construct a bridge on Seneca St., over Buffalo Creek.

COHOES, N. Y.—The state railroad commission, Albany, will have plans prepared for a plate-girder bridge over the crossing on Ontario St.

MAMARONECK, N. Y.—The trustees have called an election for Nov. 28 to vote on the question of appropriating $3,000, the municipality's share of the expense of a new bridge over the railroad tracks at the Rye Neck portion of the town.

ORISKANY, N. Y.—Reports state that the Hilton Bridge Co., Albany, N. Y., has been awarded a contract to construct a bridge on the line of the Utica Suburban St. Ry. over Oriskany Creek.

UTICA, N. Y.—Bids are asked until Nov. 28 for constructing a lift-bridge over the Erie Canal at Washington St. Geo. W. Aldridge, Supt. Pub. Wks., Albany.

STARKEY, N. Y.—Reports state that a contract has been awarded to John C. Raphe, Dundee, N. Y., for constructing a bridge between this place and Barrington.

WEST SENECA, N. Y.—We are informed that the proposed overhead crossing of the parkway at this place will be contracted for in the spring. I. C. Geary, Supt. Park Bd., Buffalo, may be addressed.

BEAVER FALLS, PA.—A contract has been awarded to the Penn Bridge Co., Beaver Falls, for constructing a new bridge between New Brighton and this place.

NANTICOKE, PA.—M. L. Dreesbach, Ch. Clk. County Comrs., Wilkesbarre, informs us that the question of constructing a bridge on the Kingston flats, to cost about $6,000, will be considered next summer.

NANTICOKE, PA.—The county commissioners, Wilkesbarre, will construct a stone arch bridge. H. S. Smith, Engr., Wilkesbarre.

SCRANTON, PA.—The Grand Jury recommended Nov. 17 the proposed construction of about 10 bridges.

HOUSTON, TEX.—I. Austin Miller, Cy. Engr., informs us that the following bids were received Nov. 14 for constructing a bridge, as advertised in Engineering News Nov. 3:

Bids Received at Houston, Tex., Nov. 14, 1898, for Construction of a Bridge.

Bidder.	100 ft. high truss		100 ft. through plate-girder.		Brick abutment in lieu of one-cylinder pier.
	2 sets cylinder piers, 180-ft. steel approach.	1 set Cylinder pier, 140-ft. steel approach.	2 sets cylinder piers, 180-ft. steel approach.	1 set cylinder pier, 140-ft. steel approach.	
New Jersey Steel & Iron Co., Trenton, N. J.	$11,994	$10,171	$12,400	$10,590	$10,200
Indiana Bridge Co., Muncie, Ind.	12,520	11,820	13,732	12,032	10,227
Southern Bridge & Construction Co., Houston, Tex.	12,562	10,932	13,902	12,272	......
Missouri Valley Bridge & Iron Works, Leavenworth, Kan.	11,817	9,917	13,160	11,260	......
Wrought Iron Bridge Co., Canton, O.	14,025	13,017	......	......	......
King Bridge Co., Cleveland, O.	11,510	9,759	13,046	11,123	8,856
Gillette-Herzog Mfg. Co., Minneapolis, Minn.	11,780	11,000	12,595	11,775	......
Morgan-Rhodes Construction Co., Waco, Tex.	10,745	9,064	11,990	9,670	......
Geo. E. King Bridge Co., Des Moines, Ia.	13,897	12,624	14,998	13,846	......
A. M. Blodgett, Kansas City, Mo.	11,475	9,800	12,846	10,900	......
Groton Bridge & Mfg. Co., Groton, N. Y.	12,821	10,500	14,427	12,150	10,185
Koken Iron Works, St. Louis, Mo.	12,500	10,600	......	......	......
Hipp & Key, Houston, Tex.	14,875	13,067	16,327	14,521	9,170
H. Shurter, Houston, Tex.	......	......	......	......	9,975
W. E. Humphreyville, Houston, Tex.	......	......	......	......	8,995
Borden & Antee, Houston, Tex.	......	......	......	......	8,500

SKINNER'S EDDY, PA.—We are informed that on Nov. 12 a charter was granted to the Tuscarora Bridge Co., Traders' Bank Bldg., Scranton, Pa., capital stock, $40,000; to build a four-span iron bridge over the Susquehanna River at Skinner's Eddy; total length, 870 ft. Pres., Chas. S. Knapp, Skinner's Eddy; Secy. and Treas., W. R. Chapin, Wyoming, Pa.; directors, C. S. Knapp and James Rooney, Skinner's Eddy; R. S. Patterson, and W. S. Wilcox, Scranton, Pa.; E. G. La France, A. L. Lindsay and W. R. Chapin, of Wyoming, Pa. A. B. Dunning, Engr., 610 Mears Bldg., Scranton, Pa.

WILKES-BARRE, PA.—The Grand Jury in a report Nov. 12 appropriated $23,000 for the construction of 10 iron and 36 stone arch bridges.

ROME, GA.—Bids are asked until Dec. 3 for furnishing material and constructing a wooden or iron bridge across Bush Arbor Creek. E. P. Treadway, County Clk.

BROOKHAVEN, MISS.—Bids are asked by the county supervisors until Jan. 3 for constructing a steel bridge over the Homochitto River, according to reports. E. P. Ashbury & Son, Engrs., Houston, Tex.

CANTON, O.—The county commissioners received the lowest bids Nov. 15 for a bridge, 100 ft. long, over Nimshillen Creek, at Shack's mills, from the Wrought Iron Bridge Co., Canton, at $3,260, and for a bridge, 131 × 24 ft., at Canal Fulton, from the Penn Bridge Co., Beaver Falls, Pa., at $8,050.

COSHOCTON, O.—The Canton Bridge Co., Canton, O., has been awarded a contract, at $7,249, for the superstructure of the Denman bridge. Newton Speckman, County Audr.

MARIETTA, O.—The bridge committee has recommended the construction of a new bridge at Putnam St.

JACKSON, MICH.—Plans have been approved for a steel foot bridge to be constructed by the Michigan Central Ry. Co., between Van Dorn and Liberty Sts.; two spans 133 ft. and 88 ft., to cost about $2,700. W. S. Kinnear, Asst. Ch. Engr., Detroit.

CHICAGO, ILL.—Bids are asked until Dec. 28 for constructing the substructure and superstructure of an eight-track railway bridge, over the main drainage channel, as described in our advertising columns. James Reddick, Clk. Bd. Trustees, Sanitary Dist.

MINNEAPOLIS, MINN.—On Nov. 25 the council will decide when to ask bids for the structural iron work for the widening of the bridge from Nicollet Island to the East Side.

OLIVET, S. DAK.—J. J. Mueller, County Audr., informs us that the following bids were received Nov. 11 for constructing a 185-ft. span, with an 85-ft. approach and for 40 and 30-ft. span bridges, respectively:

Minneapolis (Minn.) Bridge and Iron Co.	$6,148
Canton (O.) Bridge Co.	6,850
Geo. C. Wise & Co., Council Bluffs, Ia.	6,678
Gillette-Herzog Mfg. Co., Minneapolis, Minn.	5,797
Starr Iron Works, Minneapolis, Minn.	6,582
L. H. Johnson, Minneapolis, Minn.	5,736
B. F. Parks & Co., Cedar Rapids, Ia.	6,426
Clinton Bridge & Iron Works, Clinton, Ia.	5,978
S. B. Howe, Sioux Falls, S. Dak.	5,890
J. B. Marsh & Co., Des Moines, Ia.	6,625
W. S. Hewett	6,920
S. M. Hewett & Co.	6,872
Joliett (Ill.) Bridge & Iron Co.	6,200
J. R. Sheeley & Co., Lincoln, Neb.	6,148
Kansas City (Mo.) Bridge Co.	6,112
Geo. E. King Bridge Co., Des Moines, Ia.	5,675

LEAVENWORTH, KAN.—Bids are asked until Dec. 5 for the construction of seven bridges. J. W. Niehaus, County Clk.

KANSAS CITY, MO.—The Northeast Electric Ry. Co. will construct a new steel bridge at Agnes Ave., to cost about $30,000, according to reports. R. R. Conklin, Vice-Pres.

OAKLAND, CAL.—The county supervisors received the two lowest bids Nov. 7 for constructing a new bridge at Webster St., from the Schmidt Construction Co., at $86,700, and Cotton Bros. & Co., at $92,500.

LEWISTON, IDAHO.—Reports state that the Pittsburg Bridge Co., Pittsburg, Pa., has been awarded a contract at $110,000 for constructing a bridge over the Snake River.

KAMLOOPS, B. C.—It is proposed to construct a bridge over the Thompson River, at the ferry.

CHIHUAHUA, MEX.—It is reported that the Chihuahua & Pacific R. R. Co., No. 80 Broadway, New York, N. Y., has awarded the Pencoyd Iron Works, Philadelphia, Pa., a contract for 36 single spans, one double span and four viaducts, in all about 1,200 tons of steel.

BUILDINGS.

AUGUSTA, ME.—Taber, Carey & Reid, of Augusta, and Alexander Duncan & Co., Boston, Mass., were awarded the contract Nov. 12 for heating the Augusta House, H. E. Capen, proprietor. Two 3,000 ft. sectional Magee steam boilers will be used, with 130 radiators.

BANGOR, ME.—It is reported that the Maine Central R. R. will soon erect a new 36-stall round house at High Head. T. L. Dunn, Ch. Engr., Portland, Me.

BOSTON, MASS.—Bids are asked until Nov. 25 for erecting a wooden school building at the Parental School in West Roxbury; bond, $4,000. H. A. Lamb, Chm., 32 Tremont St.

MIDDLETOWN, CONN.—Plans have been prepared, according to reports, for an addition and alterations to the Hospital for Insane, to cost about $75,000. Dr. C. W. Page, Supt.

BATH, N. Y.—Bids are asked until Nov. 26 for steam heating and ventilating, plumbing, electric light wiring and fixtures, at the New York State Soldiers' and Sailors' Home. O. H. Smith, Secy., Bath.

BROOKLYN, N. Y.—Reports state that George Crosby, 1140 40th St., will erect sixty-one 2-story frame dwellings, 20 × 49 ft., on 40th St., between 12th and 13th Aves.; estimated cost, $172,000. Arch., H. L. Spicer, 326 56th St.

BUFFALO, N. Y.—A new 7-story steel building will soon be erected at Main and Mohawk Sts., to cost about $70,000. Mayor & Weill, of Buffalo, are said to be interested.

EAST HAMPTON (L. I.), N. Y.—Plans are about prepared for erecting a new 3-story hotel at this place, to contain about 50 rooms, for the Maidstone Improvement Co.; estimated cost, $25,000. Rogers & Blyndenburgh, contractors, Babylon (L. I.), N. Y.; J. H. Green, Jr., Arch., Sayville (L. I.), N. Y.

LESTERSHIRE, N. Y.—A special election will be held in this village, Nov. 29, to consider the proposition of erecting a new fire station and municipal building, at a total cost of $24,000, and also of improving the waterworks system. M. S. Squires, Village Pres.

NEW BRIGHTON (S. I.), N. Y.—Bids are asked by the department of public buildings, at 346 Broadway, New York, until Dec. 6, for erecting an automatic low-pressure steam-heating apparatus in the village hall at New Brighton, Borough of Richmond.

NEW YORK, N. Y.—Sullivan & Clark, Binghamton, N. Y., have been awarded the contract for erecting a number of buildings on Ward's Island, for the Manhattan State Hospital, to cost about $110,000.——Plans have been filed by A. C. Hall, 265 West 73d St., for three 5-story brick flat buildings on 13th St., near 7th Ave., to cost $69,000. Archs., Neville & Bagge, 217 West 125th St.; by N. L. McCready, 15 Broad St., for a 12-story brick flat building at 145 and 147 5th Ave., to cost $275,000. Arch., H. Edwards Ficken, 10 West 22d St.; by the Metropolitan Investment Co., 160 Broadway, for a 7-story brick flat and store building at 103d St. and the Boulevard, to cost $150,000. Arch., David W. King, 111 5th Ave.; by Elizabeth Moore, Marmion Ave. and Fairmount Place, for three 7-story brick flat and store buildings on 116th St., near Morningside Ave., to cost $135,000. Arch., Lorenz F. J. Weiher, Jr., 125th St. and Park Ave.; by J. H. Styles, Jr., for four 5-story brick flat buildings on 163d St., near Amsterdam Ave., to cost $80,000. Arch., J. E. Styles; by Jos. & J. A. Pinchbeck, for a 7-story brick flat building at 94th St. and Central Park West, to cost $175,000. Archs., Neville & Bagge, 217 West 125th St.; by John P. Duncan, 9 East 64th St., for a 12-story brick store and loft building at Broadway and Waverley Place, to cost $175,000. Arch., C. P. Sefert, 322 West 31st St.

SYRACUSE, N. Y.—The penitentiary committee of the board of supervisors of Onondaga county has finally decided to recommend that the plans of M. D. Makepeace, of Syracuse, be accepted, having the cell construction work done by the Pauly Jail Building & Construction Co., St. Louis, Mo.; estimated cost, $156,000. Ray B. Smith, Chn. of Bldg. Com.

ATLANTIC CITY, N. J.—It is reported that John L. Young has decided to erect a 4-story brick, steel and concrete building at South Carolina Ave. and the beach. Arch., Harold Adams.

BOONTON, N. J.—David Henry, Paterson, N. J., has received the contract for remodeling the Lathrop Homestead, for aged firemen, at Boonton, for $19,776.

CAMDEN, N. J.—Charles McCaul, of Philadelphia, was awarded the contract, Nov. 15, for the construction of the new U. S. building at Camden, using Vermont marble, at $153,669. The work is to be completed within one year.

McKEESPORT, PA.—The school controllers of this city have asked ten architects to submit plans and specifications for a new 4-story high school building, to be erected on Shaw Ave.; and have also asked bids for $100,000 of bonds for the purchase of the ground and erection of the building, the latter to cost about $55,000.

PHILADELPHIA, PA.—Plans have been filed for a 7-story stone and terra cotta apartment building on 37th St., near Chestnut St., for C. H. S. Littleton, to cost about $60,000. Arch., Harry Peale, Jr., Harrison Bldg.——William R. Dougherty, 1604 Sansom St., has been awarded the contract, and has received a building permit, for the erection of a 4-story brick and iron store building at 1533 Chestnut St., for Herman E. Bonschier; to cost about $25,000. Addison Hutton, Arch.

BALTIMORE, MD.—Reports state that the directors of the Maryland Penitentiary have awarded the following contracts for work in the new penitentiary building. John F. Weyler, Warden: For steam and power plant, including four engines, four boilers, pump, feed water heater, etc., to Wallace Stebbins, $30,002; for electric equipment, including four dynamos, cables, etc., General Electric Co., $18,639; for wiring of interior, court yard, cells, etc., McKay Engineering Co., $14,789; for one Sprague passenger elevator, Morton, Reed & Co., $3,850; for heating of refectory building, Wallace Stebbins, $850; for finishing refectory, including kitchen, bake shop and dry room, J. Henry Miller, $28,824; plumbing, G. W. Walters & Co., $1,458; for interior finish of executive building and warden's residence, J. H. Miller, $9,617; for marble flooring, sills, etc., Evans Marble Co., $6,325; for extra iron work, Krug & Son, $682.

WASHINGTON, D. C.—It is reported that a 4-story building, 100 × 200 ft., will be built in this city before spring, for the Washington Milk Trust, to cost $150,000. Arch., N. T. Haller, 1216 F St., N. W.

SAVANNAH, GA.—The Sprague Elevator Co., 20 Broad St., New York, has been awarded the contract for installing one electric passenger elevator in the U. S. building in this city, at $3,735; time, 90 days.——W. F. May & Co., of Chattanooga, Tenn., has been awarded the contract for erecting the government hospital in Savannah, at $77,934; time, 60 days. For other bids see our last issue.

LA FAYETTE, ALA.—Plans and specifications are asked by the commissioners of Chambers county, until Dec. 1, for a new court house, to cost between $25,000 and $30,000. A. J. Driver, Jr., County Judge.

LEXINGTON, KY.—Fayette county has voted to issue $100,000 of 4% court house bonds.

LOUISVILLE, KY.—Reports state that a 6-story fireproof hotel building will be erected at 5th and Jefferson Sts., at a cost of about $300,000, for Louis and Otto Seelbach, 6th and Main Sts.——A fire in this city, Nov. 19, destroyed the building at 611 West Main St., occupied by the Renz-Bowles Co., wholesale druggists, causing a reported loss of about $80,000; insurance $72,000.

CINCINNATI, O.—We are informed that the University of Cincinnati has awarded the contract for erecting an additional building, to be known as Cunningham Hall, to Jas. Griffith **& Sons, at $36,525.**

LIMA, O.—The board of education has decided not to rebuild the high school building wrecked by the recent cyclone, but to erect a new 16-room building on modern designs, the work to commence at once, to cost about $30,000.

MARIETTA, O.—The people of this county have voted to issue $125,000 in bonds for the erection of a new court house and jail. L. E. McVay, Clk. of Court, informs us that no plans have yet been prepared, nor date fixed as to the receiving of the same. C. M. Grub, John Randolph and William Hadley, County Comrs.

OBERLIN, O.—James Devault, Columbus, O., has been awarded the contract for erecting the Lorain County Children's Home, at Oberlin, at $25,095, using pressed brick.

PORT HURON, MICH.—James O'Sullivan has been awarded the contract for the erection of the new Maccabee temple, to cost about $60,000.

CHICAGO, ILL.—A 3-story brick and stone office building is to be erected for the Goss Printing Press Co., at Paulina St. and 15th Place, to cost about $35,000.——The board of education has been granted a permit for the construction of a 2-story school building, 100 × 110 ft., to be erected at 4314 to 4320 North Ashland Ave., to cost $45,000.

ROCK ISLAND, ILL.—Reports state that the board of education has definitely decided to replace the old Hawthorne school building, on 8th St., with a modern 12-room building, to be erected next year. The cost will be $30,000, and F. Borgolte has been retained to prepare plans.

PEORIA, ILL.—Plans are being prepared for the new Lincoln school building, to cost $40,000. Richardson & Hotchkiss, Archs.

MINNEAPOLIS, MINN.—This city has voted to issue $200,000 in school bonds.

AUSTIN, MINN.—Bids are asked until Dec. 15 for the erection of a brick and stone court house for Hancock county; deposit, $800. H. B. Reed, County Audr.; F. W. Kinney, Arch., Austin.

DES MOINES, IA.—It is reported that the Chicago, Rock Island & Pacific R. R. Co. will erect a $200,000 station in this city.——The people of Polk county have voted to issue $400,000 in court house bonds.

MUSCATINE, IA.—The contract for erecting the new station of the Muscatine, North & South Ry. has been awarded to Magoon & Kincaid, of Muscatine, at $25,000.

PERRY, IA.—A fire here Nov. 20 destroyed a number of buildings in the business section of the city, causing a loss of about $400,000.

SHENANDOAH, IA.—The Chicago, Burlington & Quincy Ry. Co. is said to be planning the erection of a new depot, 24 × 116 ft., at this place.

WEBSTER CITY, IA.—Bids are asked until Dec. 15 for the erection of a church building for the Lutheran Church in this city. J. O. Lenning, Chn. Bldg. Com.; Omeyer & Thori, Archs., St. Paul, Minn.

NADEAU, KAN.—Bids are asked by the Office of Indian Affairs, Washington, D. C., until Dec. 13, for the materials and labor required in the erection of one frame dormitory and school building on the Kickapoo Reservation. Geo. W. James, U. S. Indian Agent, Nadeau, Kan.

YATES CENTER, KAN.—The citizens of Woodson county have voted to issue $30,000 in bonds for the erection of a new court house and jail building.

COLORADO SPRINGS, COLO.—It is reported that the Antlers Hotel, recently destroyed by fire, will be rebuilt, at a cost of about $250,000. E. Barnett, lessee, and Gen. W. J. Palmer may be addressed.

ALBUQUERQUE, N. MEX.—The people of this city are considering the erection of a $30,000 opera house.

SAN FRANCISCO, CAL.—W. H. Wilcox has completed plans for a military hospital to be erected at the Presidio by the government, to cost $170,000.——The following bids were received Nov. 12 by the bureau of yards and docks, Washington, D.C.,for the construction of 12 buildings at the Mare Island navy yard; (a) for work complete, (b) allowing for certain omissions: Dennis Jordan, San Francisco, (a) $169,000, (b) $155,000; Cameron & McDonald, Oakland, Cal., (a), $166,686, (b) $148,786; California Bridge & Construction Co., Oakland, (a) $152,890, (b) $134,370; Philip Sheridan, West Berkeley, Cal., (a) $147,232, (b) $130,708.

MONTREAL, QUE.—Plans are said to be completed for the erection of the new Grand Trunk office building on McGill St., to cost about $400,000.

PUEBLA, MEXICO.—The state legislature has appropriated $1,000,000 for the erection of a new government palace, and $500,000 for a general hospital. Plans have not yet been prepared for the former building.

WATER-WORKS.

BATH, ME.—It is reported that the New England Insurance Exchange, Boston, has recommended that the pumping machinery and that the water supply in general be improved.

ESSEX JUNCTION, VT.—E. E. Russell, Clk., writes us that nothing definite in regard to works has yet been decided upon. A bill is before the legislature to grant this village authority to build works. Population, 1,000.

ARLINGTON, MASS.—The citizens are considering the question of applying for admission to the Metropolitan water district.

BOSTON, MASS.—The council has voted to secure a loan of $200,000 for extending the water mains. John R. Murphy, Water Comr.

HOLYOKE, MASS.—Jas. L. Tighe, Engr. Water Dept., has been directed to complete plans and specifications for a filtration plant at the Whiting St. reservoir; estimated cost, $20,000.

BAINBRIDGE, N. Y.—There is a legal contest on between the Bainbridge Water-Works Co. and the city as to their respective rights. An injunction has been served on the city restraining it from building the proposed municipal works. The case will be argued at Oneonta, Dec. 3. The company claims the exclusive riparian rights to the only stream available, while the city thinks otherwise, and has commenced pipe laying. Thos. L. Randall, Afton, N. Y., has been making surveys for the company.

BINGHAMTON, N. Y.—It is proposed to lower each of the wells about 4 ft. below the present depth, at a cost of about $25,000. Darwin Felter, Supt.

IRVINGTON, N. Y.—Press reports state that the Mack Paving Co., 35 Nassau St., New York, submitted the lowest bid, Nov. 10, at $45,410, for constructing a reservoir for the water-works. The next lowest bidders were: Durkel & Jewell, Irvington, N. Y., at $49,637, and Jas. Duell, Tarrytown, N. Y., at $50,676. T. W. Crisfield. Clk.

LESTERSHIRE, N. Y.—An election will be held Nov. 29 to vote on the question of issuing $14,000 in bonds for a new pumping station. M. S. Squires, Pres. Bd. Trustees.

WATERVLIET, N. Y.—Elnathan Sweet, 13 Tenbroek St., Albany, and Chas. G. Whitbeck have submitted estimates, plans and recommendations for new works, to cost $234,493. The proposed supply will come from the Deepkill. An election will be held Dec. 12. The estimated cost in detail follows: Reservoir—Excavation, masonry, gatehouse, crib, land, $29,025. Conduit—45,400 ft. of 16-in. pipe and crossing Hudson and Mohawk rivers, $85,700. Distribution system—15,000 ft. 12-in. pipe, 25,000 ft. 8-in., 45,000 ft. 6-in., 5,000 ft. 4-in., 10,000 ft. smaller pipe, six canal crossings, rock in trenches, 80 tons of special castings, valves, hydrants, etc., $98,450; add 10% for emergencies, etc., $21,318.

WHITE PLAINS, N. Y.—We are informed that the village is making surveys for several storage reservoirs. No construction will be done before the spring. Improvements are being made in the pumping station by day labor, to render it more efficient. John M. Farley, Consult. Engr., White Plains; Fred Seymore, Supt.

ASBURY PARK, N. J.—The council by a tie vote has decided not to adopt water meters for the city. It is stated that the question may again be brought up at the next election. Councilmen Harvey and Kirkbride may be addressed.

ORANGE, N. J.—J. N. Travis, Supt. Water-Works, writes us that A. J. L. Loretz, 126 Liberty St., New York, will probably complete plans for a supply from Campbells Pond, Milburn township, in a few days. Local papers state that a new pumping station and reservoir will be built at a cost of $50,000, or about $100,000 less than by former plans.

BRADFORD, PA.—We are informed that W. Hanley,Bradford, Pa., has been awarded the contract for building a storage reservoir.

DUBOIS, PA.—Plans are being considered for increasing the water supply. Councilmen Reed, Chn. Com., and Casey may be addressed.

ROCK HILL, S. C.—Guild & Co., Chattanooga, Tenn., were awarded the contract Nov. 15 for building the works for the Rock Hill Water, Light & Power Co., as advertised in Engineering News. The contracts for the materials were let to the following: Cast iron pipe, the American Pipe & Foundry Co., Chattanooga, Tenn.; hydrants and gates, R. D. Wood & Co., Philadelphia, Pa.; stand-pipe, the Lombard Iron Works, Augusta, Ga.; pumps, Henry R. Worthington, Liberty St., New York; air lift, Bacon Air Lift Co., 100 Broadway, New York. J. L. Ludlow, Engr., Winston, N. C.

SPARTANBURG, S. C.—John B. Cleveland and John H. Montgomery are interested in the proposed new gravity works.

TIMMONSVILLE, S. C.—The committee wishes to correspond with manufacturers of machinery for electric light plants and water-works. D. H. Traxter, Chn. Com.

WALHALLA, S. C.—Capt. R. C. Strother, West Union, S. C., writes us that he has been granted a franchise for works for this place, also the privilege of securing water from the head of Cane Creek, four miles from here. The water will be furnished by gravity; only pipe and fixtures are wanted.

PRATT CITY, ALA.—W. G. Powell, Mayor, has called a public meeting to consider the question of building works.

MONROE, LA.—This place voted Nov. 8 to issue $155,000 in bonds for improvements to be used as follows: Water-works and electric light plant, $60,000; sewerage system, $13,000; streets, etc., $50,000.

ALLIANCE, O.—This city voted Nov. 8 to purchase the works of the Alliance Water-Works Co. Councilman Conger, Chn. Com.

CINCINNATI, O.—Chief Engineer G. Bouscaren has submitted to the commissioners plans and specifications for the construction of two settling reservoirs of the new works at California, and also for the laying of two lines of mains connecting the reservoirs with the pumping station. The reservoirs will have a combined capacity of about 345,000,000 gallons, affording periods of 72, 60 and 48 hours' sedimentation for daily outputs of 57,500,000, 69,000,000 and 86,250,000 gallons, respectively.

CUYAHOGA FALLS, O.—This place again voted on Nov. 8 against issuing $60,000 in bonds for works.

NEWARK, O.—The Newark Ohio Water Co. has been incorporated to operate the works of the Newark Water-Works Co., which for the last few years has been in the hands of a receiver. Capital stock, $73,500, with $50 paid in. The plant was built in 1885 by Moffett, Hodgkins & Clark, Syracuse, N. Y. Incorporators, H. C. Hodgkins, Syracuse, N. Y., and W. W. Rice, W. H. Hadcock and N. P. Wardwell, Watertown, N. Y.

NEW RICHMOND, O.—Bids are asked until Dec. 7 for furnishing the materials and for constructing works and a light plant, as stated in our advertising columns. J. F. Witmer, Engr., Buffalo, N. Y.; H. Buckley, Pres. Electric and Water-Works Trustees.

WELLSVILLE, O.—D. A. Davidson, Supt. Water-Works, writes us that the proposed extension to the works, for which $12,000 in bonds were voted Nov. 8, will consist of 6, 8, 10 and 12-in. pipe, to take the place of smaller mains.

MOUNT CLEMENS, MICH.—Henry R. Worthington, 86 Liberty St., New York, has been awarded the contract for furnishing a new pumping engine, at $6,800, according to reports.

MARKESAN, WIS.—The question of building works is being considered, according to reports.

WEST SUPERIOR, WIS.—Press reports state that the Superior Water, Light & Power Co. has decided to build a water filtration plant, etc., at a cost of about $100,000.

PERSIA, IA.—Dr. F. M. Hill writes us that the town will probably spend about $4,500 for a water tank and cast iron water mains. There will be wanted a gasoline engine of about 8 HP., 5,280 ft. of 4 and 6-in pipe, 10 or 12 hydrants, 8 valves, etc.

EAST GRAND FORKS, MINN.—Bids are asked until Dec. 6 for furnishing the materials and for building combined works and electric plant, to cost about $35,000. Population, 3,000. W. I. Gray & Co., Sykes Bldg., Minneapolis, and the Twin City Iron Works prepared the plans. Henry Haren, Cy. Recdr.

LINCOLN, NEB.—Ferdinand Bonstedt, Cy. Engr., has submitted a report and estimates for improving the water supply and replacing mains. Estimated cost, $48,000.

WAMEGO, KAN.—Bids are asked until Nov. 30 for furnishing the materials and for building works, for which $25,000 in bonds were voted Nov. 15. F. S. Haacke, Cy. Clk., writes us that the water supply will be secured from wells. H. V. Hinckley, Engr., P. O. Box 242, Topeka, Kan.

ALEXANDRIA, S. DAK.—The question of building works is being considered, according to reports.

TOPEKA, KAN.—This city voted Nov. 12 to issue $240,000 in bonds for municipal works. It is stated that the validity of the bond issue will be attacked in the courts.

GREAT FALLS, MONT.—Andrew Rinker, Secy. and Treas. Great Falls Water Power & Townsite Co., and Pres. Bd. Water Comrs., writes us that on Nov. 3 the city came into possession of the works by purchase from the Great Falls Water Co., the consideration being $375,000. The plant has a pumping capacity of 8,500,000 gallons a day, 26 miles of main and 265 hydrants. The city sold 5% bonds to the amount of the purchase price, at a premium of $10,105. The management of the works has been placed in the hands of a board of water commissioners, consisting of J. N. Bridges, Herbert Mattison and Mr. Rinker.

GUTHRIE, OKLA.—H. C. Barney, Water Comr., writes us that something will probably be done this winter in regard to a better water supply. A committee is now considering the question. Population, 10,000.

SHAWNEE, OKLA.—Chas. E. Brown, Coffeyville, Kan., is reported to have been awarded the contract for building the proposed works at $32,095. Benj. Dierker, Clk.

BOULDER, COLO.—Press reports state as follows: The plan to purchase the reservoir and rights up Boulder Canon, owned by Mr. Stephens and his associates, has been abandoned for the present, owing to the cost. Although the city recognizes the necessity of a greater water supply, it has been decided to conform to the present arrangements at least until the next municipal election, when, if necessary, bonds may be voted for the purpose.

DENVER, COLO.—J. B. Hunter, Cy. Engr., has submitted a report to Mayor McMurray that works, larger and better than that of the Denver Union Water Co., can be built for $3,700,000. The mayor has recommended the issuance of $6,000,000 in bonds for that purpose. The Denver Union Water Co. some months ago offered to sell its works to the city for $9,000,000.

GOLDEN, COLO.—The Standard Water & Power Co. has been incorporated with a capital stock of $50,000; it will take its water supply from Chicago and Echo lakes; directors, J. M. Walker, C. C. Welsh, F. W. Loveland, H. A. W. Tabor, Henry Lee, Hugh Butler and F. G. Pattison.

NEW WHATCOM, WASH.—Horne & Stone are reported to have submitted the lowest bid, Nov. 8, for building an extension to the works at $14,600.

INDEPENDENCE, ORE.—The question of building municipal works is again being considered, according to reports.

COLTON, CAL.—Another election will be held Dec. 12 to vote on the question of issuing $20,000 in 6% bonds for municipal works. G. E. Slaughter, Cy. Clk.

LAKEPORT, CAL.—An election will be held Dec. 20 to vote on the question of issuing $15,000 in bonds for works.

SACRAMENTO, CAL.—D. A. Lindsley, Pres. Chamber of Commerce, writes us that the chamber is testing the supply from wells with a view to getting the city to change from river water, if the supply from wells is demonstrated to be superior. J. W. Watt, Cy. Tapper, writes that the trustees propose to issue bonds for extending the works and sewerage system, erecting school buildings, etc. No definite plans have been made, but about $130,000 will be expended upon machinery and pipes for the water-works.

SAN FRANCISCO, CAL.—The Union Water Co. has been incorporated, with a capital stock of $390,000, by C. A. Hooper, Geo. W. Hooper, D. C. Henney, E. F. Burrell and W. G. Tibbetts.

JEROME, ARIZ.—This place is reported as considering the question of building works. John Burkes may be addressed.

PHOENIX, ARIZ.—The Arizona Water Co. was incorporated last week in Maine; capital stock, $1,500,000; incorporators, Arthur B. Leach, 2 Wall St., and Osborn W. Bright, 46 Wall St., both of New York.

BRIGHAM, UTAH.—The council is reported as considering a proposition for increasing the water supply from Bay Elder Creek.

SILVER CITY, UTAH.—The Silver City Water Co. has been incorporated, with a capital stock of $20,000. Levi E. Riter, Pres.; C. E. Loose, Vice-Pres.; C. V. Wheeler, Treas.; John W. Hatfield, Secy.

BARRIE, ONT.—This city voted Nov. 7 to issue $100,000 in bonds for the purchase of the works of the Barrie Water-Works Co., and to make certain extensions.

BRANTFORD, ONT.—It is stated that this city has approporiated $20,000 for extending the water mains.

TORONTO, ONT.—Bids are asked until Dec. 5 for furnishing for the coming year such valves, castings, pipe, lead, etc., as may be required. John Shaw, Mayor.

SANTIAGO, CUBA.—Press reports state that Gen. Leonard Wood has assigned Lieut. E. C. Brooks, of the Sixth Cavalry, and the Adjutant-General here, to make plans for new water-works. The construction will be commenced as soon as the plans are completed. The water supply of the city has always been bad, but under the present conditions the supply will be entirely inadequate for the dry season, which is just beginning, and therefore the work of procuring plenty of water will be pushed as rapidly as possible.

IRRIGATION.

SAN DIEGO, CAL.—Reports state that W. T. Gouder has filed on 10,000 cu. ft. of water of the Colorado River for irrigation and developing power in this county and lower California. A canal, 80 miles long and 200 ft. wide, will be constructed to convey water to the New River country.

PHOENIX, ARIZONA.—It is reported that L. V. Navarro, Consul of Mexico, Phoenix, states that the Hudson Reservoir & Canal Co., is arranging to construct a reservoir on Salt River about 60 miles northeast of Phoenix. Plans have been prepared for a dam about 200 ft. high and 600 ft. long at the head of the canyon. It is estimated that the reservoir will cover about 18 sq. miles at a depth of 100 to 200 ft.; estimated cost, about $2,500,000.

PROVO CITY, UTAH.—Reports state that the Telluria Power Co. is interested in an irrigation project to irrigate about 20,000 acres of land. Surveys are being made for a 30-mile ditch from American Fork Canyon to the lands west of Jordan River and north of Utah Lake.

NEW COMPANIES.—Omer Ditch Co., Fowler, Colo.; $10,000; to construct a ditch from Apishapa Creek for irrigation; C. A. Watson, C. B. Miller and G. L. Taylor.

Holbrook Land & Water Co., Provo City, Utah; $300,000; to construct canals, reservoirs, dams, etc., for irrigation, power, etc.; Lafayette Holbrook, Pres.; B. S. Hinckley, Secy. and Treas.; James A. Melville, Vice-Pres.; Joseph E. Ray, Emily A. Holbrook.

Arizona Water Co., Augusta, Me.; $1,500,000, with $500 paid in; to construct, operate and sell irrigating canals, water and water rights; Pres., Arthur B. Leach, and Treas., Osborn W. Bright, of New York.

SEWERAGE.

MIDDLEBORO, MASS.—Chas. C. Grinnell, counsellor-at-law, 30 Court St., Boston, writes us that it is expected that the state board of health will, on Dec. 1, decide the case of the alleged pollution of the Nemasket River by emptying into it the sewage of the town. Should the case be decided against the town it will have to make a number of changes in its system.

STOCKBRIDGE, MASS.—The town has appropriated $15,000, in addition to $7,500, for a system. The committee consists of Dr. Burnette, Marshall Heath, S. A. Cook and D. D. Fenn, according to reports.

BALLSTAN SPA, N. Y.—Bids are asked by the village trustees until 8 p. m., Nov. 25, for constructing the East North St. sewer.

BUFFALO, N. Y.—Bids are asked until Dec. 1 for constructing an 8-ft. 10 × 7½-ft., 7½-ft. and 5¼-ft. brick sewer in Van Rensselaer St. R. G. Parsons, Secy. Bd. Pub. Wks.

BUFFALO, N. Y.—Bids are asked until Nov. 29 for building a 12-in. pipe sewer in Moeller St. R. G. Parsons, Secy. Bd. Pub. Wks.

CATSKILL, N. Y.—Local papers state that arrangements are being made to construct the proposed Pasture Lot sewer, at a cost of about $10,000. Village Trustee Knoll may be addressed.

DEPEW, N. Y.—Press reports state that work on a second section of the proposed system, to cost about $300,000 will soon be begun. About two-thirds of the main sewer, to cost about $80,000, has been built.

JAMAICA (L. I.), N. Y.—The following were the only bids received by the sewer commissioner, 256 Broadway, Manhattan, for building certain sewers in Jamaica, now the 3d Ward of Queens: Jos. Caccavajo & Co., $6,748; Patterson Construction Co., $11,743.

WHITE PLAINS, N. Y.—Wm. B. Sutherland, Village Clk., writes us that the contract for building the addition to the sewerage disposal plant, has been awarded to Alex. S. Traub, New York, at $1,925. The contract for the boilers has been let to M. T. Davidson, 53 Keap St., Brooklyn, N. Y.

PITTSBURG, PA.—Bids are asked until 2 p. m., Nov. 25, for constructing pipe sewers in a number of streets. Edward M. Bigelow, Dir. Dept. Pub. Wks.

SOMERSET, PA.—This place voted Nov. 8 to issue $20,000 in bonds for a system.

YORK, PA.—The York Sewerage Co. has asked for a franchise to build and operate a system. D. H. Lafean and C. H. Dempwolf, of the company, and Councilman Fisher, Chn. Highway Com., may be addressed.

EAST LIVERPOOL, O.—F. H. Croxall, Secy., writes us that the city is about to ask for bids for furnishing eight miles of 12 to 4-in. sewer pipe, to be used in district No. 2. Work will be begun in the spring.

ELYRIA, O.—Bids are asked until Nov. 26 for building a sewer in West St. W. H. Park, Clk. Council.

PIQUA, O.—C. E. Martin, Piqua, has been awarded the contract for building a 4-ft. sewer in Swift St., at $4,124.

TOLEDO, O.—Bids are asked until Dec. 5 for constructing 15 and 12-in. pipe sewers in two streets. L. P. Harris, Cy. Clk.

LAKE LINDEN, MICH.—Press reports state that the citizens are in favor of a system, and it is probable that the question will be voted upon in the spring.

MILWAUKEE, WIS.—The council has been petitioned to build sewers for the Merrill Park district. Walter Stratton, Supt. Sewers; William Murphy, Chn. Com.

MASON CITY, IA.—Bids are asked until Dec. 2 for constructing 7,,060 ft. of 20 to 15-in. pipe sewers; as stated in our advertising columns. Geo. W. Brett, Mayor; W. P. Fitch, Cy. Clk.

NEWTON, KAN.—The South Side Sewer Co. has been granted a franchise to operate a system already built.

ST. LOUIS, MO.—Bids are asked until Dec. 6 for constructing 15 and 12-in. pipe sewers in several streets. Robt. E. McMath, Pres. Bd. Local Improvements.

SEATTLE, WASH.—The question of building sewers in certain streets will be considered by the council Dec. 5. Wm. H. Parry, Cy. Clk.

GRASS VALLEY, CAL.—This place voted Nov. 8 to issue $40,000 in bonds for a system. It is stated that arrangements will be made by the village trustees at once for building the system.

SANTA ANA, CAL.—Williams, Belcher & Co., San Francisco, have the contract for constructing the lateral system at about $37,000. The Los Angeles Sewer Pipe Co., Los Angeles, will furnish the pipe. Work will begin before Dec. 1.

WINNIPEG, MAN.—It is proposed to construct sewers in two streets, at a cost of about $3,500. G. J. Brown, Clk.

VANCOUVER, B. C.—The residents of the West End have petitioned the council to take immediate steps toward the construction of the proposed extension to the system in that part of the city. Aldermen Brown and McMorran may be addressed.

CALLAO, PERU, S. A.—Press reports state that the city authorities have asked the National Manufacturers' Association, Philadelphia, Pa., for specifications for a sewerage system and a drainage system.

GARBAGE DISPOSAL—STREET CLEANING

JERSEY CITY, N. J.—Bids were asked until Nov. 23 for sweeping and cleaning the streets and for removing the ashes and garbage for one year from Dec. 1. The estimate of quantities is as follows: About 1,692 miles of stone pavement swept and cleaned; about 545 miles of asphalt pavement. Jas. S. Nolan, Chn. St. Com.

PHILADELPHIA, PA.—Bids are asked until Dec. 5 for cleaning streets, inlets and public market houses, and the removal of ashes, sweepings, cut grass, household and store waste; for the removal and disposal of kitchen garbage, dead animals, etc.; also for furnishing teams and labor for removing snow from streets surrounding the city hall and the footways of highway bridges crossing the Schuylkill River during the year; and separate bids for the removal of snow from streets specified. Thos. M. Thompson, Dir. Dept. Pub. Wks.

CINCINNATI, O.—Judge Miller Outcalt has in preparation an ordinance to change the present system of handling garbage in Cincinnati. May 27, 1892, the B. of L. passed an ordinance granting to what is now known as the Cincinnati Sanitary Co. the right for ten years to dispose of all the city garbage delivered to the company. The average price per annum that the city, under the contract, is now paying the company is $21,000. The city records show that this contract was made on the recommendation of Dr. Prendergast, who at that time was Health Officer. In his ordinance, Judge Outcalt proposes to not only remove all of the vegetable garbage, but, at the same time, pay the city a sum of money for the same.

CLEVELAND, O.—Local papers state as follows: Health Officer Hess has completed specifications for the collection, removal and destruction of refuse other than garbage, in accordance with a resolution adopted by the citizens' garbage commission. There are 23 sections in the specifications, the most important being the following: Contractors may bid for the collection and removal or the reduction or destruction of the refuse separately or collectively, and no bid will be considered unless accompanied by a check for $10,000. It is estimated that the quantity of refuse to be handled annually is about 11,000 yards, and the bids must be on that basis; bidders must give a guarantee that they will build and put in working order a plant of ample capacity to dispose of the refuse each 24 hours, the work to be begun on the plant within 30 days of the execution of the contract, and to be completed within 120 days thereafter; all collections are to be made between 9 p. m. and 5 a. m.; the contractor shall not be permitted to dump any of the refuse in the lake, river, or any other stream of water within the city limits, nor shall it be disposed of by burying or used for fertilizing purposes until chemically reduced satisfactorily to the health officer; at the expiration of any contract entered into under the specifications the city shall have the right to purchase the plant for the collection, removal and destruction of the refuse.

ALAMEDA, CAL.—B. F. Lamborn, Cy. Clk., writes us that a San Francisco company has applied for a franchise for building and operating a garbage disposal plant. No action has yet been taken.

SAN FRANCISCO, CAL.—Superior Judge Cook has decided that the garbage franchise is only exclusive so far as the county is concerned, and that the scavenger men may move garbage from the county.

STREETS AND ROADS.

NEWTON, MASS.—The aldermen have appropriated $2,100 for the improvement of Walnut St., and are considering a general appropriation of $39,500 for highways.

BROOKHAVEN (L. I.), N. Y.—The county supervisors have appropriated $13,369 for highway work in this town.

HAMILTON, N.Y.—DeWitt C. Hadcock, Stockbridge, N.Y., writes us that the proposed road from Hamilton to Oneida, 18 miles long, will be covered with crushed stone 18 ins. thick and 50 ft. wide, to cost about $50,000.

ROCHESTER, N. Y.—Resolutions have been passed to pave portions of Alexander St., with asphalt; estimated cost, $8,000; Thrush St., asphalt, $26,000, and South Fitzhugh St., asphalt, $11,180. Peter Sheridan, Cy. Clk.

ELIZABETH, N.J.—The council passed an ordinance Nov. 15 for the paving of Magnolia Ave., between Spring and Division Sts., with asphalt, 20 ft. wide.

JERSEY CITY, N. J.—Reports state that Henry Byrne has been awarded a contract for the improvement of Greenville Ave., from the Old Bergen Road to the Boulevard.

JERSEY CITY, N. J.—Bids are asked until Nov. 29 for about 2,300 cu. yds. of earth excavation, 4,300 sq. yds. of asphalt, 3,060 lin. ft. of curbing, etc., on Prospect St. Geo. T. Bouton, Clk. St. Comrs.

MAYS LANDING, N. J.—We are informed that the county board of freeholders has accepted the new gravel road from Mays Landing to Egg Harbor City, a distance of 7 miles. The board, in company with State Comr. of Pub. Roads, H. I. Budd, inspected the site of a proposed new road from Atlantic City to Longport, and ordered J. J. Albertson, Magnolia, N. J., to make a survey and estimates, to be presented in January.

MORRISTOWN, N. J.—Bids are asked until Nov. 29 for macadamizing in Washington township, according to reports. M. B. Lum, Dir. Bd. Freeholders.

ALTOONA, PA.—It is reported that the question of issuing $229,000 in bonds for paving is being considered by the council.

READING, PA.—Bids are asked until 3 p. m., Nov. 24, for 1,700 sq. yds. of asphalt paving. Sam. S. Hoff, Cy. Engr.

WILKINSBURG, PA.—Bids are asked until Dec. 1 for the purchase of $30,000 of 4% street improvement bonds. Arthur Stuart, Chn. Finance Com.

SCOTTSBORO, ALA.—The county commissioners are considering the question of issuing $200,000 in bonds for new turnpike roads.

NEW ORLEANS, LA.—Bids are asked until Nov. 28 for improving Jordan Ave. W. S. Douglas, Comptroller.

LAWRENCEBURG, KY.—A contract to lay brick paving has been awarded to W. A. Newman, Lexington, Ky. J. W. Waterfill, Cy. Clk.

LOUISVILLE, KY.—Bids are asked until Nov. 29 for constructing a granolithic sidewalk on Hill St. Chas. F. Granger, Bd. Pub. Wks.——The board will soon readvertise the asphalt work on East Broadway, West Chestnut, Hepburn Ave. and Von Borries Ave., for which bids have been rejected.

WINCHESTER, KY.—Bids are asked by the county commissioners until Dec. 1 for the purchase of $50,000 of 4% turnpike bonds.

CAMBRIDGE, O.—A petition will be presented to the county commissioners Dec. 5 for the construction of a road. B. C. Johnson may be addressed.

HAMILTON, O.—New bids will be asked by the city clerk for paving on Second St., with asphalt.

SANDUSKY, O.—Reports state that it is proposed to lay 9,749 sq. yds. of paving and 5,200 lin. ft. of curb on Campbell St.; estimated cost, $17,939. I. C. Brewer, Cy. Engr.

TOLEDO, O.—Bids are asked until Dec. 5 for furnishing the material and paving Kenilworth Ave., from Fulton to Cherry St., with Buckeye blocks, etc. L. P. Harris, Clk.

CROWN POINT, IND.—Bids are asked until Dec. 17 for constructing about 20 miles of macadam roads, as stated in our advertising columns. Michael Grimmer, County Audr.

ELKHART, IND.—It is reported that a resolution is before the council for 40,000 sq. yds. of brick paving. D. F. Cordrey, Cy. Engr.

INDIANAPOLIS, IND.—Bids are asked until Nov. 28 for constructing cement sidewalks, grading, etc., on portions of ten streets. M. A. Downing, Bd. Pub. Wks.

TERRE HAUTE, IND.—At the election Nov. 8 Linton township voted to construct 14 miles of gravel roads, and Nevins township 17 miles of gravel roads; estimated cost, about $47,000.

KALAMAZOO, MICH.—The city engineer has estimated the cost of paving on certain streets, which it is desirable to have paved with brick: Main St., from Portage to Church St., $17,146; Main St., from Church to Park St., $4,533; Portage St., from East Main to South St., $5,036; West South St., from South Burdick to Rose St, $4,156, and $6,138 for asphalt. Address Alderman Westbrook.

OWOSSO, MICH.—A petition was presented to the council Nov. 14 for four blocks of asphalt paving.

MOLINE, ILL.—A petition is in circulation to pave all the streets and avenues from and including 5th Ave. to 12th Ave., and between 7th and 15th Sts.

PEORIA, ILL.—An ordinance will be presented to the council for brick paving on South Madison Ave., from Fulton to Franklin St., and Elizabeth St., from High to Main St. The board of local improvements has adopted a resolution to have the engineer submit estimates at the next meeting for brick paving on St. James St. and on 7th Ave.

ST. PAUL, MINN.—Bids are asked until Nov. 28 for grading Rondo St., from Western Ave. to St. Anthony Ave. C. H. Bronson, Clk. Bd. Pub. Wks.

TOPEKA, KAN.—A petition will be presented to the council for paving Huntoon St., 30 ft. wide, from Topeka Ave. to Fillmore St., with brick.

KANSAS CITY, MO.—Bids are asked until Nov. 28 for furnishing the material and for constructing sidewalks of brick, stone and plank, and grading, on certain streets. Henry A. Wise, Cy. Engr.

OMAHA, NEB.—Bids are asked until Dec. 2 for paving with sheet asphalt, brick or stone and curbing on 22d St. Andrew Rosewater, Chn. Bd. Pub. Wks.

HOUSTON, TEX.—Bids are asked until Jan. 9 for repairing about 2,700 lin. ft. of curbing, etc., on Main St. I. A. Miller, Cy. Engr.; P. S. Banner, Secy.

SEATTLE, WASH.—Bids are asked until Dec. 5 for grading Blanchard St., from 1st St. to Western Ave. W. H. Parry, Cy. Clk.

PERKINS, CAL.—The county surveyor will make a survey for the macadamizing of one mile of the road from Perkins to Walsh's Station.

MANUFACTURING PLANTS.

SOUTH HADLEY, MASS.—B. F. Perkins & Son, of Holyoke, Mass., contemplate improving its Stony Brook paper mill, to cost $20,000.

HARTFORD, CONN.—It is reported that a silk manufacturing concern of Lyons, France, contemplates establishing a branch factory in this vicinity, and wish to form a local company to erect a $40,000 building. Oppenheim & Co., of New York, are said to be interested.

BROOKLYN, N. Y.—A fire in this city Nov. 18 destroyed several buildings on Manhattan Ave. and Java St., Greenpoint; estimated loss, $102,900.

FALL RIVER, MASS.—It is reported that James Marshall will erect a one-story building, 165 × 85 ft., and a 4-story building, 210 × 86 ft., in this city for the manufacture of hats.

MIDDLETOWN, CONN.—The E. T. Burgess Cut Glass Co. has voted to increase its capital to $50,000, so as to enlarge its plant.

NEWBURGH, N. Y.—John P. Convery has the contract for the erection of a 2-story brick addition, 39 × 53 ft., to the factory of the Granite City Soap Co., on Liberty St.

SCHUYLERVILLE, N. Y.—The Liberty Wall Paper Co., Nov. 15, received the following bids for the erection of a 2-story building, 400 × 100 ft., with separate engine and boiler house; Archs., M. F. Cummings & Son, Troy, N. Y.:

Lee Bros., Glens Falls, N. Y.	$55,700
Acker & Sons, Glens Falls, N. Y.	55,500
T. W. Riley, Sandy Hill, N. Y.	54,900
Monty, Higley & Co., Sandy Hill, N. Y.	54,800
Ranger & Co., Holyoke, Mass.	54,790
J. H. Findley, Cleveland, O	54,850
J. C. Fuller, Mechanicsville, N. Y. (accepted)	50,600
Bulmer & Haynes, Troy, N. Y.	54,790
Chas. P. Roland, Troy, N. Y.	53,944

WEST BRIGHTON (S. I.), N. Y.—A fire on Nov. 19 destroyed the greater part of the Starin plant, which extends over 2,000 ft. on the water front of the Kill von Kull; loss on the buildings, about $30,000, and on machinery, $400,000.

NEW BRUNSWICK, N. J.—The factory of the P. Carter Bell Co., manufacturers of a rubber substitute, in Highland Park, was destroyed by fire Nov. 11.

BRADDOCK, PA.—The Braddock Wire Co., according to reports, will erect an addition to the plant, costing about $200,000.

CARBONDALE, PA.—Reports state that the Delaware & Hudson Canal Co. will erect a washery near the Racket Brook breaker culm pile.

PHILADELPHIA, PA.—It is reported that James Armstrong will erect a 2-story brick factory building, 35 × 60 ft., on Boudinot St.

HARRISBURG, PA.—Contracts will be let this week, according to local papers, by the Harrisburg Foundry & Machine Co., for a 2-story brick and stone building, 140 × 260 ft. The new plant will cost about $200,000, and is noted in another column under "Industrial Notes." Wm. R. Fleming, Gen. Mgr.

PHOENIXVILLE, PA.—David Reeves, Pres. of Phoenix Iron & Bridge Co., is reported as stating that the company will erect four open-hearth furnaces, with a capacity of 40 tons of steel at a heat, thus doubling the capacity of the present plant.

WEST READING, PA.—A fire in this city Nov. 12 destroyed the plant of the Keystone Cycle Works on 2d Ave.; loss, about $75 000; insurance, $27,000. Reports state that it will be rebuilt at once.

YORK, PA.—Gilbert & Co. have been awarded the contract for the construction of a paper factory, with a capacity of 10 tons a day. J. T. Kopp and C. F. Black, Jr., are interested.

WILMINGTON, DEL.—The Johnson Forge Co. contemplates enlarging its plant.

BALTIMORE, MD.—The factory of the Carr-Lowry Glass Co. in Westport, a suburb of this city, was destroyed by fire Nov. 15; estimated loss, $125,000; insurance $85,000. It will probably be rebuilt at once.

NORFOLK, VA.—The plow factory of S. R. White on Water St. was damaged by fire Nov. 11; loss about $50,000, covered by insurance.

WHITNEY, S. C.—The Whitney Mfg. Co. has increased its capital from $190,000 to $226,000, for the purpose of enlarging its plant.

ANNISTON, ALA.—The Hercules Pipe Co. is reported to have purchased the old bloomery plant at this place. It will be refitted and an additional building, 30 × 60 ft., erected. Chas. M. Noble is interested.

ENSLEY, ALA.—J. M. Meighan & Co., Birmingham, Ala., have been awarded the contract for erecting the new buildings for the Alabama Steel & Wire Co., at Ensley. The Garrett Engineering Co., Cleveland, O., is said to have the general contract for the entire plant. G. H. Schuler, Secy. of Alabama Steel & Wire Co., of Cleveland.

CLEVELAND, O.—Reports state that the E. R. Edson Co. will erect a new plant with double the capacity of the present one.

COLUMBUS, O.—W. A. Shaw, according to reports, will remove his shoe factory from Rochester, N. Y., to West LaFayette St., in this city.

CHICAGO, ILL.—The Illinois Steel Co., according to reports, will erect a foundry costing from $100,000 to $200,000.

GLENDIVE, MONT.—Clayton & Hagan have awarded the contract for erecting a cold storage warehouse, to John Deberge.

PORT ANGELES, WASH.—The Port Angeles Glass Co. is said to contemplate erecting a plant at this place.

MONTREAL, QUE.—Reports state that George Taylor, of Toronto, will establish a large pulp mill near this city.——The bolt and nut works of Pillow & Hersey, on Mill St. were damaged by fire Nov. 12.

MARLBANK, ONT.—Lathbury & Spackman, Philadelphia, Pa., have been engaged to remodel the old London Portland Cement Co.'s plant at this place.

NICE, FRANCE.—Consul Van Buren, at Nice, reports that two companies are being formed there for the manufacture of cement and plaster. Frederick Repossi, Commission Agent, 9 Rue d'Amerique, Nice, may be addressed.

DRESDEN, GERMANY.—O. C. Barber, Pres. of Diamond Match Co., is arranging for the erection of a factory at this place, according to reports.

GAS PLANTS.

EVERETT, MASS.—A contract has been awarded to the Riter-Conley Mfg. Co., Allegheny, Pa., for constructing the steel frame for the purifying plant, 100 × 270 ft., for the New England Gas & Coke Co., according to reports.

WATERBURY, CONN.—Reports state that the United Gas Improvement Co. has awarded a contract to the Berlin Iron Bridge Co., East Berlin, Conn., for the steel work in the construction of a new generating room and an engine room.

SOUTH NORWALK, CONN.—The Norwalk Gaslight Co. has been purchased by a syndicate of New York capitalists at $227,500 including the charter and franchise for the whole of Fairfield county, outside of Bridgeport. The new company will spend about $200,000 to $300,000 in enlarging and developing the works, according to reports.

NIAGARA FALLS, N. Y.—Plans for a new plant for the Acetylene Gas Co. have been completed, and work will be commenced about Jan. 1, according to reports.

NEWARK, N. J.—Reports state that the gas companies of Newark, Orange, South Orange, Montclair and Summit, N. J., are to be consolidated by the Union Gas Improvement Co., Philadelphia, Pa. The new incorporation will have a capital stock of about $10,000,000.

DARBY, PA.—D. J. Collins and F. H. Shelton, Philadelphia, have purchased the Darby Gas Works and franchise. A new plant will be erected and the mains extended to neighboring towns, in the spring.

CHATTANOOGA, TENN.—It is reported that C. H. Caldwell, Batavia, N. Y., and F. F. Smith, Chattanooga, propose to manufacture acetylene gas.

EAST LIVERPOOL, O.—The Alum Cliff Gas Co. has in contemplation the erection of a pumping station near Williamsport, to have a daily capacity of 1,000,000 cu. ft.

FINDLAY, O.—William A. Cutter, Buffalo, N. Y., has made a proposition to the board of city gas trustees for the purchase of the city's gas plant for $150,000 cash. The matter has been taken under advisement, according to reports.

TOLEDO, O.—A resolution has been passed by the council to lay gas and water pipes and connections on Milburn Ave. and Monroe St. L. P. Harris, Cy. Clk.

PONTIAC, ILL.—Reports state that a company has been organized, with a capital stock of $40,000, to construct and operate a gas works. Dr. J. Allen and B. F. Jones, Pontiac, and Isaac Eastman, Monmouth, Ill., are interested.

VANCOUVER, B. C.—The Vancouver Gas Co. is contemplating the extension of its system, including a new pipe line over Mount Pleasant, according to reports.

NEW COMPANIES.—Chester Light & Heating Co., West Chester, N. Y.; to manufacture acetylene gas; W. A. Lawrence, Pres.; C. W. Kerner, Secy.; Geo. M. Roe, Treas.; Joseph Board, Dr. C. P. Smith, J. D. Millspaugh, R. H. Marvin and Frank Durland.

Youngstown Acetylene Co., Youngstown, O.; $10,000; to manufacture acetylene gas for lighting purposes; Emanuel Hartzell, Pres.; John M. Davis, Vice-Pres.; Dan Jones, Secy.; William Wallace, Treas.; John Sylvanus, Mgr.

United Gas Co., Cambridge, O.; $150,000; to develop natural gas territory; George W. Crawford, E. W. Trest, F. W. Crawford, O. C. Hogan and Robert Daily.

Columbia Oil Co., Los Angeles, Cal.; $200,000; to acquire store, pipe, etc., oil and natural gas; L. E. Mosher, Harry Chandler, W. B. Scott, Los Angeles; Guy L. Hardison, W. H. Hardison, Santa Paula, Cal.

Southern Oil Co., Bradford, Pa.; $750,000, with $500 paid in; to operate for oil and gas; T. M. Barnsdall, Wm. Barnsdall, Jr., E. P. Whitcomb, Bradford, Pa.; A. W. Lewis, W. J. Burke, Pittsburg, Pa.

Central Oil & Land Co. Cincinnati, O.; $50,000, with $1,000 paid in; to bore for oil and gas; Wm. Boswell, H. A. Stewart, L. Schultz, Jr., J. H. Huxell, S. F. Boswell, Cincinnati, O.

Gallagher Oil Wells Agitator Co., Pittsburg, Pa.; $360,000, with $800 paid in; to own a patent for cleaning oil wells and to drill for oil, gas, etc.; Wm. E. Walsh, Henry F. Gilg, Allegheny, Pa.; E. W. Beach, Robt. T. Rossell, F. A. McKenry, Pittsburg, Pa.

Kitson Hydro-Carbon Light & Heat Co., Pine Bluff, Ark.; $100,000; Pres., Z. Orto; Vice-Pres., I. Dreyfuss; Secy. and Treas., J. H. Hudson; J. W. Crawford, S. Geisreiter, N. B. Truelock, J. W. Withers, H. W. Perry.

Citizens Gas & Fuel Co., Mohawk, Ind.; $1,000.

MISCELLANEOUS CONTRACTS.

BELL TOWER.—New Orleans, La.—Bids are asked until Nov. 28 for erecting a bell tower on the Second St. Market. W. S. Douglass, Comptroller.

CONDUITS.—New Rochelle, N. Y.—Reports state that the Phoenix Telephone Co. is planning to lay conduits at once. C. W. S. Wilson, Village Engr.

TELEPHONE WORK.—Greensburg, Pa.—The Bell Telephone Co., will change the exposed wires to the cable system in the near future, according to reports.

DREDGING.—New York Bay, N. Y.—Bids are asked until Dec. 7 for dredging opposite 49th St., Brooklyn. Jas. Kane, Comr. Sewers, 265 Broadway, New York.

POLICE PATROL SYSTEM.—Youngstown, O.—Bids are asked until Dec. 8 for replacing the central office outfit of the police patrol system. H. W. Calvin, Clk.

GUN FORGINGS.—Washington, D. C.—Bids are asked until Nov. 26 for furnishing 12 sets of 12-in. gun forgings. Chas. O'Neil, Chief of Ordnance Bureau, Navy Dept.

PIER IMPROVEMENTS.—Sydney, N. S.—The Dominion Coal Co. proposes to make extensive repairs and improvements at the intercolonial pier, according to reports.

CLOCKS.—Troy, N. Y.—Bids are asked until Dec. 1 for furnishing a system of clocks for the court house. M. F. Cummings & Son, Archs.; Eugene L. Demers, Comr.

TUNNEL.— Boston, Mass.—Local papers state that the transit commission is about to ask for bids for constructing the first section of the proposed East Boston tunnel.

WHARF.—Greenville, N. J.—A petition will be presented to the board of street and water commissioners for the construction of a wharf at Browns Place, New York Bay.

AMBULANCE.—New York, N. Y.—Bids are asked until Nov. 21 for building one ambulance for Bellevue Hospital. J. W. Keller, Pres. Dept. Pub. Charities, East 26th St.

FIRE HOSE.—Buffalo, N. Y.—Bids are asked until Dec. 9 for furnishing 3,500 ft. of 2½-in. and 1,000 ft. of 3½-in. cotton rubber-lined fire hose. W. S. Grattan, Fire Comr.

PARK.—Trenton, N. J.—A resolution was introduced in the council Nov. 15 providing for the laying out of a park on the ground in the rear of the State Capitol building.

PARK WORK.—Arlington, Mass.—The town voted Nov. 15 to appropriate $45,000 for the improvement of the shores of Spy Pond, and constructing a boulevard around the pond.

TELEPHONE SYSTEM.—Berea, O.—A franchise has been granted to Samuel Rawson and M. B. Brush, of the Rawson Electric Co., Elyria, O., to operate a telephnoe system.

TELEPHONE LINE.—Melbourne, Fla.—It is reported that Simmons Bros., Mountville, S. C., are securing subscribers for a telephone line to run between Ormond and Melbourne.

BOILERS.—Honolulu, H. I.—Bids are asked until Dec. 12 for furnishing two boilers for dredges. Jas. A. King, Minister of Interior. Hawaiian Consulate, 65 Wall St., New York.

PINE TIMBER.—New York, N. Y.—Bids are asked until Dec. 2 for furnishing about 1,683,872 ft. B. M., of sawed yellow pine timber. J. Sergeant Cram, Comr. Docks, Pier A, North River.

TUNNEL.—Point Edward, Ont.—Reports state that the Canadian Pacific Ry. Co. proposes to construct a tunnel under the St. Clair River, at this place. The right of way has been secured.

TELEPHONE.—Springfield, Ohio.—A 25-year franchise was granted F. R. Marsh, as trustee of a new telephone company in this city. It is stated that 256 subscribers have been secured.

DREDGING.—Buffalo, N. Y.—Jas. B. Donnelly, Buffalo, was awarded a contract Nov. 11, at $25,988, for dredging a portion of the Erie Basin. Geo. W. Aldridge, Supt. Bd. Pub. Wks., Albany.

FIREHOSE.—Seattle, Wash.—Bids are asked until 10 a. m., Nov. 25, for furnishing 4,000 ft. of 2½-in. rubber or cotton jacket fire hose, with couplings. Frank Oleson, Secy. Bd. Pub. Wks.

SUPPLIES.—Toronto, Ont.—Bids are asked until Dec. 5 for furnishing lumber, gravel, paving brick, sewer pipe, brass and bronze castings, lead pipe, iron pipe, iron and steel, etc. John Shaw, Mayor.

CONDUITS.—Newark, N. J.—A resolution has been presented to the street and water commission by Commissioner Van Duyne, to require all electric and telephone wires to be placed in underground conduits.

TELEPHONE FRANCHISE.—Duluth, Minn.—Alderman Crossweller has introduced a resolution to ask bids for a franchise for telephone service. The franchise of the Duluth Telephone Co. expires next spring.

WING DAM.—Winona, Minn.—The government has awarded a contract to John Pickley, Dubuque, Ia., at $36,000, for constructing a wing dam on the Mississippi River, below this place, according to reports.

TELEPHONE FRANCHISE.—York, Pa.—W. A. Myers, L. B. Wampler, Lionel Emdrie, R. Hawkins and John Dobbling, all of York, applied to the council Nov. 14 for a franchise to organize the York Underground Conduit Co.

CONDUITS.—Spokane, Wash.—Manager Hopkins, of the Inland Telephone & Telegraph Co., states that the company is contemplating the removal of its wires from the poles and placing them underground. It will cost about $100,000.

PARK WORK.—Chicago, Ill.—The Lincoln Park commissioners are considering the advisability of extending the park from Ohio St. to Diversey Ave., extend the shore line 1,200 ft. into the lake, build a permanent sea wall and to fill in the area between the new shore line and the present limits.

WALL.—Boston, Mass.—Bids are asked until Dec. 5 for building a wall of quarry-faced granite or seam-faced Roxbury stone at Jamaica Park; bond, $2,000. Address Chas. E. Stratton, Latan Pratt, Park Comrs., Jamaica Park, Boston.

BULKHEAD AND FILLING.—Boston, Mass.—Bids are asked for filling and building a bulkhead at the Fens, between Beacon St., and the Harbor Commissioners' line; bond, $4,000. Address Chas. E. Stratton and Laban Pratt, Park Comrs.

TELEPHONE WORK.—San Francisco, Cal.—The Peoples Mutual Telephone Co. has applied to the board of supervisors for an extension of one year's time, to expend $100,000 in improving the system, as provided in the franchise.

REVETMENTS.—Keweenaw Point, Mich.—Bids are asked until Dec. 20 for constructing pile and timber revetments for ship canals across Keweenaw Point, as stated in our advertising columns. Maj. Clinton B. Sears, U. S. Engr., Duluth, Minn.

BUOYS, ETC.—Ottawa, Ont.—Chief Engineer Anderson, Dept. Pub. Wks., has recommended that 25 additional spar buoys be placed in the St. Lawrence channel, between Montreal and Quebec, and also six range lights for which foundations are now being built.

GRANITE STONES.—New York, N. Y.—Bids are asked until Dec. 2 for furnishing about 542 headers and 543 stretchers, containing about 21,446 cu. ft., and 125 coping stones containing about 10,000 cu. ft. J. Sergeant Cram, Comr. Docks, Pier A, North River.

STONE HEADS.—Newark, N. J.—Bids are asked until Dec. 5 for furnishing and constructing stone heads to subways Nos. 1 and 2 under the driveway at Branch Brook park, as described in our advertising columns. A. Church, Secy., Essex County Park Comn., 800 Broad st.

TELEPHONE CONCESSION.—Shanghai, China.—Bids are asked by the council until March 31 for the purchase of a 30-yr. franchise to supply the community with telephone service, as described in our advertising columns. Address Blackall & Baldwin, 39 Cortlandt St., New York.

CANAL.—Lakes Superior and Michigan.—Reports state that a company has been organized by Chas. W. Parker and A. H. Parker, 58 State St., and D. C. Dennison, 78 State St., Chicago, Ill., with a capital stock of $50,000, to construct a ship canal from Lake Superior to Lake Michigan; estimated cost, about $7,000,000.

SHAFTING, PULLEYS, BRICK, ETC.—Yazoo City, Miss.—We are informed that the Yazoo Improvement Co. is putting in new boiler, Corliss engine, pump, etc. It is in the market for a line shaft, friction clutch, friction and fixed pulleys, stands, pillow blocks, belting, fire brick, cement, steam fittings, pipe covering, sewer pipe poles, etc.

PARK WORK.—Oakland, Cal.—A proposition was submitted to a vote Oct. 29 to issue bonds for park work as follows: For the purchase of Adam's Point, 62 acres, $240,000; for the improvement of the same, $50,000; for the improvement of West Oakland Park, $20,000; for the improvement of Independence Square, East Oakland, $10 000.

PARK WORK.—Detroit, Mich.—The park board has accepted plans for the improvement of Palmer Park and for constructing a new driveway leading to the park, from Woodward Ave., about one-half mile in length. ——Park Commissioner Moecker has been instructed to prepare plans for the improvement of the grounds around the pumping station, including the construction of stone bridges.

NAVAL SUPPLIES.—Washington, D. C.—Bids are asked until Nov. 29 for furnishing 10 doz. galvanized buckets, 14 qt.; 2,856 ft. of cast iron water pipe, cast iron bends, etc.; 16,400 ft. of galvanized wrought iron lap-welded water pipe, reducers, ells, tees, etc.; 38 brass globe valves; about 1,500,000 brick; 1,000 bbls. Portland cement; 100 bbls. rock lime; about 4,000 to 5,000 doz. files of various sizes, and for constructing one hydraulic glue press. Edwin Stewart, Paymaster Gen.

CANAL WORK, ETC.—Albany, N. Y.—Bids are asked until Nov. 28 for reconstructing the banks and channel of Glen Creek, at Watkins; improving the channel of Newtown Creek, Horseheads; building a dam across Saranac River, at Saranac Lake; constructing a lighthouse on Cayuga Lake, at State Pier, Cayuga; improving the Cayuga Branch of the Cayuga and Seneca Canal, from Lock No. 10 to Cayuga Lake, and for constructing vertical walls on the tow-path side, building crosswalks, pointing old masonry and building gas pipe railing at First and Oneida St. bridges, Fulton. Geo. W. Aldridge, Supt. Pub. Wks.

TELEGRAPH CABLES.—St. Louis, Mo.—Bids are asked until Nov. 28 for furnishing the materials and for installing fire alarm telegraph cables. The following are the approximate quantities of cables to be installed: 2 conductor, 48,200 ft.; 4 conductor, 3,600 ft.; 6 conductor, 4,200 ft.; 8 conductor, 2,300 ft.; 9 conductor, 1,000 ft.; 10 conductor, 2,200 ft.; 11 conductor, 500 ft.; 12 conductor, 1,200 ft.; 14 conductor, 2,000 ft.; 15 conductor, 900 ft.; 17 conductor, 2,100 ft.; 19 conductor, 2,800 ft.; 24 conductor, 1,200 ft.; 26 conductor, 1,700 ft.; 34 conductor, 1,100 ft.; 36 conductor, 1,700 ft. Silas Benedict, Supt. Fire and Police Telegraph; Isaac H. Sturgeon, Comptroller.

REMOVING WRECK.—Rockland Harbor, Me.—We are informed that the following bids were received Nov. 14 for removing the wreck of the schooner "William H. Jones," as advertised in Engineering News. Maj. R. L. Hoxie, U. S. Engr., Portland, Me.:

Enoch Townsend, Linwood, N. J.	$1,898
Wm. H. Virden & John C. Ross, Lewes, Del.	1,400
Chas. W. Johnston, Lewes, Del.	565
John F. Hamilton, Portland Me.	1,700
Solon S. Andrews, Gorham, Me.	749
Moore & Wright, Portland, Me.	1,450

CONTRACT PRICES.

WATER PIPE.—Pueblo, Colo.—The following bids were received by the north side water trustees Nov. 1, 1898, for furnishing 13,000 ft. of 12-in. and 2,600 ft. of 6-in. pipe, which will be used in constructing new water mains in the northwestern portion of the city: Colorado Fuel & Iron Co., $24 a ton; M. W. Strong, $26.75; R. D. Wood & Co., Philadelphia, $30,50; J. B. Clow & Sons, Chicago, $27.90. The bid of the C. F. & I. Co., at $24 a ton for 6 and 12-in. pipe, and $45 a ton for special pipe was accepted. The terms of payment being 25% cash and balance to be represented by the votes of the board in sums of $1,000 each due in two years.

ELECTRIC LIGHTING.—Rock Island, Ill.—The council received the following bid Nov. 17, 1898, for a combination system of high and low electric lights: People's Power Co., with 2,000-c. p. arc lights—Low lights, for a term of two years, every night and all night, $84 a year; Philadelphia schedule, $74; for three years, all night and every night, $79; Philadelphia schedule, $69; for five years, every night and all night, $75 a year; Philadelphia schedule, $64. Tower lights for a term of two years, every night and all night, $96 a year; Philadelphia schedule, $86; for three years, every night and all night, $91 a year; Philadelphia schedule, $81; for five years, all night and every night, $85; Philadelphia schedule, $74—$5 to be added to the above figures if less than 160 lights are ordered.

PUBLIC LIGHTING.—Seattle, Wash.—The board of public works received the following bids Oct. 31, 1898, for public lighting: Union Electric Co.—Arc lights, each, a month, $8.80; 15 c. p. incandescent, each, a month, $1.32; 30-c. p., each, a month, $1.95. This company, which at present has the city contract, stated in a note accompanying its bid that the reason for a slight advance in prices is caused, first, by the fact that the company raised its employees' wages from 10 to 15% during the past year, and, second, that the price of coal has advanced fully 25% since the last contract was let.

Consumers' Electric Co.—Arc lights, $9; 15-c. p. incandescents, $1.40; 30-c. p., $2.10, and for additional lights, arc, $8.75; 15-c. p., $1.30; 30-c. p., $1.90. The Seattle Gas & Electric Co. offered to put in 100 60-c. p. Welsbach lights at $2 a month. The Snoqualmie Falls Power Co. offered to furnish arc lights in the First, Fourth, Fifth and Sixth Wards, as now distributed, at $7 a month.

LEVEE WORK.—New Orleans, La.—The following contracts were let Nov. 10, 1898, by the U. S. engineers for levee work: St. Rosalie levee, 38,000 cu. yds., Wade Bros. Construction Co., St. Louis, 13½ cts. a cu. yd.; St. Ann levee, 9,900 yds., Michael Cullen, New Orleans, 13.25 cts. a cu. yd.; the Treadaway levee, 11,400 cu. yds., 11.88 cts., and the Butler levee, 1,900 cu. yds., 11.88 cts., were also awarded to Michael Cullen.

ELECTRIC LIGHTING.—Camden, N. J.—The following bids were received from the Citizens' Light, Heat & Power Co., recently incorporated, by the council, Nov. 16, 1898, for lighting the city with electricity from July 1, 1899: One year, arc and incandescent lights, according to plans and specifications; arc lights on poles or arms, 45 cts. a light a night; on underground cables, 60 cts. a night; incandescent lights on poles, 10 cts. a light; on underground cables, 12 cts. a light a night. Three years, arc lights on poles, 40 cts. a light a night; underground wires, 55 cts.; incandescent lights, overhead wires, 8½ cts. a light; incandescent lights, underground cables, 10 cts. a light. Five years, arc lights on arms, 34 cts. a night; arc lights on underground wires, 50 cts.; incandescent lights on posts or arms, 7 cts. a light a night; incandescent lights on underground wires, 9½ cts. The Camden Lighting & Heating Co. declined to put in a bid on account of an order of the court. The committee laid the bids over until after the action of the court. The bids of the Camden Lighting & Heating Co. were $138 a year for arc lights, and $20 a year, or 6 cts. a light a night, for incandescent lights. The bids of the new company, 7 cts. and 9½ cts. a light a night.

PAVING.—Dallas, Tex.—The following bids were received by the council, Nov. 14, 1898, for paving in certain streets: Gilsonite Roofing & Paving Co., St. Louis, excavating, 50 cts. a cu. yd.; remove the bois d'arc blocks, 7 cts. a sq. yd.; lay 6 ins. of concrete, 55 cts. a sq. yd.; 2 ins. of asphalt, $1.60 a sq. yd. C. W. Olcott, Dallas, vitrified brick pavement and furnish all materials, tools and labor, to remove bois d'arc blocks, 8 cts. a sq. yd.; excavation, 20 cts. a cu. yd.; lay No. 1 concrete, 63 cts. a sq. yd.; No. 2 concrete, 76 cts.; brick surface, 97 cts. Texas Construction Co., Galveston, lay 2 ins. No. 1 concrete, $1.89 a sq. yd.; No. 2 concrete, $2; No. 4 concrete, $1.74; grading, 10 cts. a cu. yd.; removing bois d'arc blocks, 8 cts. a sq. yd. Standard Light & Power Co., Dallas, grading, 35 cts.; remove bois d'arc blocks, 10 cts.; lay No. 1 concrete, 75 cts.; No. 2 concrete, 85 cts.; lay 6-in. hexagon bois d'arc blocks, $1.50 a sq. yd.; 7-in. hexagon bois d'arc blocks, $1.55, and 8-in. hexagon bois d'arc blocks, $1.60. Franklin Fireproofing Co., Dallas, asphalt pavement No. 3 on top of concrete foundations No. 1 or No. 2, $1.92. This company offered a 10 years' guarantee if paid $1.97 a sq. yd. Barber Asphalt Paving Co., New York, remove blocks, 5 cts. a sq. yd.; excavate, 5 cts. a cu. yd.; lay No. 1 concrete, 42 cts. a sq. yd.; No. 2 concrete, 50 cts.; lay No. 1 asphalt, $1.80; No. 4 asphalt mixture with No. 2 concrete, $2.12, the pavement to be 4 ins. of asphalt, 1 in. binder and 1½ ins. wearing surface. Brown & Dabney, Dallas, submitted bids on asphalt, vitrified brick and bois d'arc paving. For asphalt, grading, 30 cts. a cu. yd.; remove bois d'arc blocks, 6 cts. a sq. yd.; lay No. 1 concrete, 45 cts.; No. 2 concrete, 58 cts.; asphalt, $1.80 a sq. yd. For vitrified brick the bids for grading, removing blocks and laying concrete were the same, and to lay brick pavement, with No. 1 concrete surface, $1.82 a sq. yd.; with No. 2 concrete surface, $1.95. For bois d'arc pavement the bids for grading and removing blocks were the same. 6-in. hexagon bois d'arc blocks, $1.45; 7-in. hexagon bois d'arc blocks, $1.48, and 8-in. hexagon blocks, $1.51. They also offered to put in new bois d'arc at $1.17 and to resaw the old blocks to 6 ins. long and replace them at $1 a sq. yd. Ayers Asphalt Paving Co., Zanesville, O., excavating, 18 cts.; remove the old blocks, 10 cts. a cu. yd.; lay No. 1 concrete, 53 cts.; No. 2 concrete, 60 cts.; and No. 1 asphalt, $1.65. On pavement No. 4, being 4 ins. of concrete, 1-in. binder and 1¼ ins. top, concrete No. 1, 43 cts.; No. 2, 50 cts.; asphalt No. 4, $1.48 a sq. yd. All the bids are for a 5-year guarantee.

REPAIRING ASPHALT PAVEMENT.—Scranton, Pa.—We are informed that the following bids were received Nov. 17 in select council for repairing asphalt pavement: Jos. P. Phillips, Cy. Engr.; about 166,000 sq. yds. of asphalt pavement being out of bond at present:

	Repairing, etc., per annum, 10 yrs.	Resetting curb.	Redressing and resetting curb.	New curb.	Circular curb.	New pavement.
[1]‡Barber As. Pav. Co.	*$17,520	$0.10	$0.25	$0.53	$0.90	$2.50
[2]Penn. As. Pav. Co.	*18,700	.10	.25	.55	.88	2.60
[3]George McDonald....	0.15	.23	.28	.60	1.10	1.98
[2]Alcatraz Paving Co.	.11½	.15	.35	.57	.97	2.50

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[1]New York; [2]Philadelphia, Pa; [3]Newark, N. J.; *lump sums; ‡awarded contract by the select council but not yet by the common council.

BRICK PAVING, ETC.—Indianapolis, Ind.—The following bids were received by the board of public works, Nov. 12, 1898, for brick paving in Miami St., from Delaware to Alabama St: W. C. Allen, brick, $1.23 a sq. yd.; W. H. Abbott, Poston blocks, $1.27; Daniel Foley, brick, $1.29; and Joseph Cooper, blocks, $1.31.——The following bids were also received for laying cement sidewalks in College Ave.: W. A. Bruce, 69 3-5 cts. (accepted); J. C. Veney, 71 cts.; Julius Keller, 71 cts.; W. C. Allen, 76 9-10 cts.; Rogers & Dunlop, 78 cts.; C. M. Kirkpatrick, 78 cts.; R. B. Drake, 79 cts.

COUNTY BRIDGES.—Council Bluffs, Ia.—The county supervisors last week let the following contract for building county bridges from April 1, 1899, to April 1, 1900, to C. E. H. Campbell, Council Bluffs, who holds the contract for the present year: Wooden pile bridges, $4.75 a lin. ft.; steel spans, 40, 45, 50 ft., $9 a lin. ft.; 55, 60, 65 ft. spans, $10 a lin. ft.; 70, 75, 80 ft., $12 a lin. ft.; 85 to 100 ft., $13 a lin. ft.; for combination spans on pile piers, 40, 45, 50 ft. spans, $7.50 a lin. ft.; 55, 60, 65 ft. spans, $8.50 a lin. ft.; 70, 75, 80 ft. spans, $9.50 a lin. ft.; 85 to 100 ft. spans, $12 a lin. ft.; 36-in. wrought iron cylinders, price per four cylinders, 14 ft., $5.50; 16 ft., $6.50; 18 ft., $7; 20 ft., $7.50; 22 ft., $8; for 24-in. wrought iron cylinders piers, price per four cylinders, 14 ft., $3.50; 16 ft., $4; 18 ft., $4.20; 20 ft., $4.80; 22 ft., $5. Repairs, oak piling furnished and driven, ten miles or less from Council Bluffs, 40 cts. a lin. ft; over 10 and under 21 miles, 50 cts. a lin. ft.; 21 miles and over, 60 cts. a lin. ft. All piles 20 ft. and under are to be of red cedar.

LAYING WATER-PIPE.—Cincinnati, O.—We are informed that the following contract has been awarded to Geo. W. Murray, 531 Clinton St., Cincinnati: For laying water-pipe in Baltimore Ave, 3-in. pipe, 125 ft., 12½ cts. a ft.; 4-in. pipe, 200 ft., 12½ cts.; 6-in. pipe, 6,200 ft., 12½ cts.; total, $815.63. The highest bid was as follows, submitted by McCarren & Dowson, Hyde Park: 3 and 4-in., 24 cts.; 6-in., 25 cts.; total, $1,628. John D. Harris, Asst. Clk. Bd. Cy. Affairs; A. B. Rattermann, Pres.

CONDUIT EQUIPMENT.—Erie, Pa.—Bids were received by the council Nov. 18, 1898, for conduit equipment. The contract for underground work was awarded to Kraft & Walther, at 10½ cts., 9½ cts. and 8½ cts. a ft. of 3-in. ducts in 3, 5, and 8-in. conduits; 22 cts. for iron pipe; $34, $24, and $11 for manholes, A, B and C, and $5 for each service box. B. J. Murphy, Mayer Bros. and Geo. B. Kelley & Co., of Chicago, were the other bidders and the proposals were quite close. For poles and wires there were bids from G. B. Kelley & Co., and from Kraft & Walther. This portion of the work was awarded to Kelley & Co., at $20 for 60-ft. poles; $18 for 50-ft. poles, and $1.25 for ten-pin cross arms.

BRICK PAVING.—Sistersville, W. Va.—The following contract for 539 sq. yds. of brick in paving Hill St., was awarded to W. F. Rice, as follows: Excavation, 20 cts. a cu. yd.; curbing, 24 × 5 ins., 40 cts.; curbing, 16 × 6 ins., 30 cts.; curbing, 20 × 5 ins., 40 cts.; paving with Spilman No. 2 brick, 79 cts.

INDUSTRIAL NOTES.

THE DICKSON MFG. CO., Scranton, Pa., is reported to have an order for 10 locomotives for the Santa Fe Pacific R. R.

THE BELKNAP MOTOR CO., Portland, Me., has elected the following officers: Pres. and Gen. Mgr., Geo. W. Brown; Treas., Chas. L. Baxter; Clk., Seth L. Larrabee.

THE MORRIS MACHINE WORKS, Baldwinsville, N. Y., has an order, according to reports, for 14 double-suction, centrifugal pumps of large capacity to be used on the Siberian & Manchuria R. R.

THE SAFETY APPLIANCE CO., LTD., Wentworth Bldg., Boston, has an order from the Canadian Pacific Ry. to place on its cars the former's equalizer, which is intended to prevent the sliding of wheels, the tilting of the truck frame and the surging of the car body.

C. L. BERGER & SONS, 9 Province Court, Boston, Mass., have succeeded the former firm of Buff & Berger, manufacturers of engineering and surveying instruments, at that address. Mr. G. L. Buff, of the old firm, has withdrawn, and Mr. C. L. Berger has associated himself with his sons, Messrs. W. A. and L. H. Berger. The firm will continue the manufacture of mathematical and astronomical instruments.

THE STIRLING CO., Pullman Bldg., Chicago, has acquired all the patents, rights, etc., heretofore owned by the Cramp Co., Philadelphia, covering water-tube boilers for marine purposes, viz., the Niclausse, Yarrow and Mosher patents, and has entered into a contract with the latter company to manufacture all boilers that it may require for a period of years. The first order under the contract is for about 35,000 HP. for Russian warships, now under construction at the Cramp yards in Philadelphia. The company also proposes to introduce the boilers in merchant vessels. The manufacture and sale of marine boilers will not interfere with the regular business of the Stirling boiler, which will be made for stationary purposes as before. The officers of the company are: Pres., O. C. Barber; Vice-Pres., J. K. Robinson; Treas., E. R. Stettinius, and Supt., H. S. Pell.

THE HARRISBURG FOUNDRY & MACHINE CO., Harrisburg, Pa., is about ready to enlarge its plant. Five acres of land have been purchased between 7th and Emerald Sts., alongside of the Pennsylvania R. R., on which will be built a brick and steel building, 140 × 260 ft. Contracts for this work are about to be let, and it is expected to have a portion of the new plant occupied and in operation by March 1, 1899. The present plant, which has been occupied over 30 years, will be gradually abandoned. The new plant will contain two 200-HP. high-pressure boilers and a four-valve, tandem compound Harrisburg Standard engine of the company's manufacture, direct-connected to dynamos of 40 to 50 K-W. capacity each. The building will be arranged for the transmission of both electric and steam power, and will have two 20-ton electric cranes, one each in the machine shop and in the foundry. The foundry will be 90 × 100 ft., and the machine shop, 50 × 122 ft., adjoining a 45 × 45-ft. smithy. In the yard will be a 15-ton radial crane swinging in a 90-ft. circle. There will also be a 45 × 50-ft. pattern shop and a 30 × 75-ft. pattern storage room. The plant will be supplied with artesian wells and with a complete system of drainage. It is estimated that the plant will cost fully $200,000. The business of the company has increased 30% over 1897, the annual output aggregating about 230 engines. The company has orders at present for 40 or 50 engines, and has built since 1883 2,500 engines aggregating 300,000 HP. Mr. Wm. R. Fleming is the Vice-President and General Manager of the company.

NEW COMPANIES.—New York & New Jersey Land & Development Co., 243 Washington St., Jersey City., N. J.; $125,000, with all paid in; to improve, irrigate and reclaim lands, etc.; Chas. N. Conklin, Chas. N. King and Al McMahon, all of Jersey City.

Arion Mfg. Co., Boston, Mass.; $100,000, commencing with $200; to manufacture and sell brass, iron, nickel, etc.; A. W. Ottignon, Wm. P. Morse, Wm. S. Jones and Allen C. Goss, all of Boston; Jos. W. Green, Providence, R. I.

Supreme Stove & Furnace Co., 45 Stuben St., East Orange, N. J.; $300,000, commencing with $1,000; to manufacture furnaces, stoves, etc.; John E. Wheeler, East Orange; A. F. Denniston and Charles Warburton, of New York; Robert L. Braekett, Bensonhurst, Brooklyn, N. Y.

W. M. Pawley, 166 Main St., Asbury Park, N. J.; $25,000, commencing with $2,600; to manufacture hardware, plumbing material, etc.; Wm. M. Pawley and Elva F. Pawley, Asbury Park; Annabelle Kent, East Orange, N. J.

Columbia Filter Co., Camden, N. J.; $10,000; to manufacture water filtering apparatus; Thomas D. Finletter, Walter C. McAdoo and Thomas L. Mattson, 419 Market St., Camden, N. J.

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PERSONAL.

Mr. E. O. F. Mahr, civil engineer and surveyor, has opened an office at 10 Bruen Ave., Irvington, N. J.

Mr. Fred. Metcalf, civil engineer, was married Nov. 16, to Mrs. Mary Thornton, of Nuhda, N. Y.

Mr. William Mahlon Davis has been appointed City Engineer and Superintendent of Water-Works of Berlin, Ont.

Mr. Edward M. Boggs, civil and hydraulic engineer, has been elected a member of the Chamber of Commerce of Los Angeles, Cal.

Mr. James A. Kelley, civil engineer, of Syracuse, N. Y., Assistant Engineer on the Delaware R. R., was married Oct. 26 to Miss Frances Kelley, of Andes, N. Y.

Mr. Elmer N. Gay, civil engineer on the Pittsburg & Western Ry., of Greensburg, Pa., was married at Youngstown, O., Nov. 8, to Miss Allie Jeannette Shannon, of Evans City, Pa.

Mr. A. G. Menocal, M. Am. Soc. C. E., Civil Engineer, U. S. N., retired, has been detached from duty with the Nicaraguan Canal Commission and ordered to the naval station at San Juan, Porto Rico.

Mr. W. H. Harris, Master Mechanic of the St. Louis Iron Mountain & Southern Ry., in charge of the shops at De Soto, Mo., has resigned on account of ill-health, after 20 years' service with that company.

Mr. Frank Harris, Chief Clerk to the Superintendent of the McCook Division of the Burlington & Missouri River R. R. in Nebraska, with headquarters at McCook, Neb., has been promoted to be Assistant Superintendent.

Mr. P. M. Serdobin, a machinery dealer, of St. Petersburg, Russia, is visiting the United States for the purpose of purchasing machinery and arranging to carry additional lines. He was in Philadelphia last week.

Mr. John C. Barclay has been appointed Electrician of the Western Division of the Western Union Telegraph Co., with headquarters at Chicago, Ill., to succeed Mr. Charles H. Summers, whose death was noted in our issue of Nov. 10.

Mr. William M. Greene, General Manager of the Baltimore & Ohio R. R., with headquarters at Baltimore, Md., has been appointed General Manager of the Baltimore & Ohio Southwestern Ry., with headquarters at Cincinnati, O., to succeed Mr. I. G. Rawn.

Mr. H. T. Porter, Engineer of Maintenance of Way of the Pittsburg, Bessemer & Lake Erie R. R., with headquarters at Pittsburg, Pa., on Dec. 1, will become Chief Engineer, and his present office will be abolished. His headquarters will remain at Pittsburg.

Mr. Bernard M. Shanley, President of the North Jersey Traction Co., with headquarters in Jersey City, N. J., has been elected President of the Essex & Hudson Gas Co., a new company which has been formed by the consolidation of the gas plants in Newark, N. J. The capital stock of the company is said to be $12,500,000.

Mr. Chas. Evan Fowler, M. Am. Soc. C. E., for the past six years Chief Engineer of the Youngstown Bridge Co., Youngstown, O., has resigned his position, and, accompanied by his family, will spend the winter in Los Angeles, Cal. His address will be 1023 West 36th St. He intends to return east in the spring to engage in professional work.

Mr. August C. Christensen, consulting and contracting engineer, has recently returned from Shanghai, China, where he has been engaged in arranging a water supply system for the inland city, involving two 2,000,000-gallon high duty pumping engines, a 50,000-gallon water tower, 100 ft. high, and 15 miles of mains, including hydrants, etc. He has removed his office from 120 Liberty St. to 141 Broadway, New York city.

Mr. John Galt, M. Can. Soc. C. E., for the past three years connected with the Department of Civil Engineering in the University of Toronto, Toronto, Ont., has been appointed City Engineer of Ottawa, Ont. He is a native of Scotland and a graduate of the Universities of Glasgow and of London. He came to the United States in 1878 and engaged in railway engineering. From 1881 to 1885 he was General Manager of the Boiler Inspection & Insurance Co. of Canada. Since then he has been practicing as a consulting engineer with offices in Toronto.

OBITUARY.

Mr. Gardner P. Morey, civil engineer, of Nassau, N. Y., died Nov. 15, aged 59.

Mr. Seabury Belden, of the firm of Seabury & E. S. Belden, Hartford, Conn., contractors on government breakwaters, died Nov. 28, aged 82.

Col. W. B. Mendenhall, President of the American Sewing Machine Co., for the past 30 years, died in Atlantic City, N. J., Nov. 27, aged 70. He was a veteran of the Civil War.

Col. Chalmers Scott, civil engineer, San Diego, Cal., died Nov. 16. He was born in New Orleans, La., May 9, 1845, and graduated from the University of New York, New York city. In 1872 he was Chief Engineer of the Texas Pacific R. R. survey and in 1880 he entered the employ of the California Southern Ry.

Mr. Philip Golay, M. Am. Soc. C. E., Assistant United States Engineer in charge of Locks and Dams on the Monongahela River, died of heart failure at his home in Morgantown, W. Va., Oct. 31, aged 71. He was born at Vevey, Ind., and was an immediate descendant of the Swiss colony that settled that place. For 26 years he was engaged in railway construction in Ohio, Missouri and Kansas, and during the winter of 1881-2, he was employed on the construction of the long trestle over Lake Ponchartrain for the New Orleans & North Eastern Ry. For the past 20 years he had been employed by the U. S. Government as an Assistant U. S. Engineer, at first on the Ohio River Improvement at Grand Chain and afterwards on the Monongahela River. He was elected a Member of the American Society of Civil Engineers, Sept. 5, 1877.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Dec. 2. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.

CHICAGO ELECTRICAL ASSOCIATION.
Dec. 2. "Practical Points in Street Railway Engineering," W. A. Harding. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

THE ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 3. "Cement and Cement Testing Laboratories," R. W. Lesley. Secy., L. F. Rondinella, 1122 Grand St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Dec. 3. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Dec. 5. Secy., H. J. March, Library Bldg, Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Dec 5. Secy., C. L. Annan, City Engineer's Office, St Paul, Minn.

FRANKLIN INSTITUTE.
Dec. 6. "Reaction Velocity," Robert H. Bradbury; Dec. 13. "Commercial Photometers and Light Standards," Prof. A. J. Rowland; "The Kite as an Instrument in Meteorological Research," Prof. C. F. Marvin; Dec. 14. Fresh Studies of Pioneer Tools," Prof. H. C. Mercer. Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.

ENGINEERS' CLUB OF ST. LOUIS.
Dec. 7. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA.
Dec. 7. Secy., Howard Evans, Pier 45, Delaware Ave., Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 7. "Some Experiments on Bridges Under Moving Train Loads," F. E. Turneaure. Secy., C. W. Hunt, 220 West 57th St., New York city.

WESTERN SOCIETY OF ENGINEERS.
Dec. 7. "Electrolytic Corrosion of Underground Structures," Prof. D. C. Jackson. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 8. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 8. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

ST. LOUIS RAILWAY CLUB.
Dec. 9. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

MONTANA SOCIETY OF ENGINEERS.
Dec. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

THE LOUISIANA ENGINEERING SOCIETY.
Dec. 12. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

ENGINEERS' CLUB OF KANSAS CITY.
Dec. 12. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.

NORTHWEST RAILWAY CLUB.
Dec. 13. Secy, T. A. Foque, Soo Line, Minneapolis, Minn.

NEW ENGLAND RAILWAY CLUB.
Dec. 13. Secy., Edw. L Janes, P O Box 1158, Boston, Mass.

NEW YORK RAILROAD CLUB.
Dec. 15. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

ENGINEERS' CLUB OF CINCINNATI.
Dec. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Dec. 15. Secy., F. A. Charpiot, P O Box 13, Savannah, Ga.

AMERICAN INSTITUTE AND THE HENRY ELECTRICAL SOCIETY.
Dec. 16. "Light," William Hallock. Secy., D. R. Lovejoy, 111 W. 38th St., New York city.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 16. Secy., F. H. Olmsted, Byrne Bldg., Los Angeles, Cal.

ROCHESTER ENGINEERING SOCIETY.
Dec. 16. Secy., John F. Skinner, Reynolds Library Bldg., Rochester, N. Y.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.

ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 19. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.

TECHNICAL CLUB OF OMAHA.
Dec. 19. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Dec. 20. Secy., R. A. Fessenden. 410 Penn Ave., Pittsburg, Pa.

WESTERN RAILWAY CLUB.
Dec. 20. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 21. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Dec. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Dec. 28. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.

AMERICAN INVENTORS' AND MANUFACTURERS' ASSOCIATION.
Jan. 15. Annual meeting, Washington, D. C. Secy., Arthur Steuart, Washington Loan and Trust Bldg., Washington, D. C.

NORTHWESTERN ELECTRICAL ASSOCIATION.
Jan. 19-21. Semi-annual meeting, Milwaukee, Wis. Secy., Thos. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 20. Annual meeting. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

NATIONAL ASSOCIATION OF MANUFACTURERS.
Jan. 24-26. Annual convention, Cincinnati, O. Secy., E. P. Wilson, Room A, Chamber of Commerce, Cincinnati, O.

ENGINEERS' CLUB OF CINCINNATI.—A regular meeting of this Club was held Nov. 17. The evening was given up to a discussion of macadam road construction.

AMERICAN INSTITUTE, Electrical Section.—This Society, in conjunction with the Henry Electrical Society, held a meeting on Nov. 26, at Cooper Institute, New York city, at which Prof. Wm. A. Anthony presented a lecture on "Heat."

CONNECTICUT STREET RAILROAD ASSOCIATION.—The 4th annual meeting of this association was held Nov. 18, at New Haven, Conn. The following officers were elected for the ensuing year:

Pres., Henry S. Parmlee; Vice-Pres., E. J. Hill; Secy., B. W. Porter; Treas., E. S. Goodrich.

ENGINEERS' CLUB OF PHILADELPHIA.—The last regular meeting of this Club was held Nov. 19 with 95 members and visitors present. The paper of the evening, "Engine and Boiler Testing," by Prof. H.W. Spangler, described methods and apparatus that should be used, and precautions which must be taken, to obtain the greatest possible degree of accuracy in the results of engine and boiler tests.

ENGINEERS' CLUB OF COLUMBUS.—At the regular meeting of this Club, held on Nov. 19, Mr. E. Eysenbach read a paper, entitled "Fuel Gas." The following topics, postponed from Nov. 5, were discussed: "Mechanical vs. Natural Draft for Power Stations," "Protected Wooden Floors vs. Fireproof Steel Construction in Office Buildings," "Relative Merits of Dry and Leaded Joints in Wrought Iron Water Pipes."

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—This Society held a meeting on Nov. 23, after inspecting a device for raising street cars up "Selby Avenue Hill." This is known as the Bronsdon counterbalance system, and in this case operates for a distance of 1,000 ft.; 500 ft. of which is on a 16% grade with 200 ft. on a curve and the remainder on a slight grade.

An invitation to visit the beet sugar plant at St. Louis Park, extended by the Engineering Society of Minneapolis, was accepted.
C. L. Annan, Secy.

ENGINEERS' CLUB OF ST. LOUIS.—The 479th meeting of this Society was held Nov. 16 with 45 members and visitors present. After a committee to nominate officers for the ensuing year had been appointed, Prof. J. B. Johnson presented a paper, entitled "The Engineer as the Guardian of Public Health." The paper dealt with the various means by which the injurious bacteria found their way into the human system, and stated that it is very largely the scope of the engineer to supply means of prevention of such infection, such as the proper building and cleaning of streets, removal of sewage and the supplying of pure drinking water. The author traced some of the unsanitary arrangements of St. Louis residences and criticised some defects of its sewer system. As St. Louis is provided with surface water from the Mississippi River, itself a great natural sewer, and as the sewage from Chicago will soon be turned into this river, it will be an absolute necessity to provide a filtration plant for the St. Louis water supply.
E. R. Fish, Secy. pro tem.

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NEW PUBLICATIONS.

SLIDE-VALVE DIAGRAM CHART.—Diagram on Card 9¼ × 11 ins., and book 4 × 6 ins; pp. 24. By M. R. Conway, M. E. The Lunkenheimer Co., Cincinnati, O.

This chart is designed to provide a convenient means for following the movements of a slide-valve, with reference to the positions of the crank, and the eccentric, without the aid of formulas or drawings. It is a very ingenious contrivance, and will be appreciated by students of slide-valve motions. The chart and book may be obtained free on application.

AMERICAN STREET RAILWAY ASSOCIATION.—Report of the Annual Meeting, 1898. Secy., T. C. Penington, 2020 State St., Chicago. Paper, 8vo; pp. 255.

This volume contains a full report of the proceedings of the seventeenth annual meeting, held at Boston, Mass., in September, which were reported in our issue of Sept. 15. It includes the reports and papers presented, with the discussions thereon, and also the speeches, notes of the excursions, record of attendance and membership, etc.

NATIONAL SANITARY ASSOCIATION.—Proceedings of Meetings Held at Brooklyn, N. Y., in 1896, and Nashville, Tenn., in 1897. Capt. Thos. E. Veal, Secretary, Atlanta, Ga. Paper; 6 x 9 ins.; pp. 80.

This society was organized in 1895. The proceedings here given for 1896 occupy 65 pages and those for 1897 only 15 pages of the pamphlet. Two short papers on garbage disposal, relating principally to the experience at Atlanta, are the principal ones of possible value to engineers.

WATER SUPPLY AND IRRIGATION PAPERS OF THE U. S. GEOLOGICAL SURVEY. No. 17.—Irrigation near Bakersville, Cal., by Carl Edward Grunsky; No. 18.—Irrigation near Fresno, Cal., by Carl Edward Grunsky. Washington, D.C. Paper; 9x5¾ ins.; pp. 96 and pp. 94. Maps and views.

These two separate papers treat in detail of the hydrography, methods of irrigation adopted and the results achieved for the separate canals and ditches in the sections named. In the San Joaquin Valley the methods of irrigation cover flooding, irrigation by furrows, by saturation of subsoils and by subsurface conduits, and each is separately described. Soils and rainfall; cost of ditches and their appurtenances and maintenance; duty of water and average cost per acre irrigated; discharge of canals and loss of water, by evaporation and seepage, and effect of irrigation on the water table, are some of the subjects discussed in describing individual cases of irrigation.

BACTERIOLOGICAL EXAMINATION OF LONDON CRUDE SEWAGE. First Report. By Dr. Frank Clowes, Chemist to the London County Council. London: P. S. King & Son, Agents for the Publications of the London County Council. Paper; 8 x 13 ins.; pp. 11; table and folding plate. Price 6d. in England; 25 cts. in America.

This is a preliminary report on the bacteriological results obtained by filtering sewage through coke. It was begun before the filter was put in use and will be followed by reports on the results of examinations of the filtrate. The bacteriological work was done by Dr. A. C. Houston, at the Public Health Laboratory, St. Bartholomew's Hospital. The results here presented relate to the total number of bacteria and spores in the sewage and to similar determinations for a number of the most abundant species. The plate contains a number of photo-micographs of the bacteria found.

MEMORANDUM ON THE MINERAL RESOURCES OF THE PHILIPPINE ISLANDS.—By Geo. F. Becker. From the 19th Annual Report of the U. S. Geological Survey. Charles D. Walcott, Director. Paper, 11½ x 7¾ ins.; pp. 687 to 693.

The appearance of this memorandum as a final chapter in the last issue of the "Mineral Resources of the United States" is antedating events somewhat, but the information is timely. The memorandum is intended to cover the main discoveries of geological and economic interest, as obtained from many sources. Only about 20 of the many islands are known to contain valuable minerals. These include coal, gold, copper, lead, iron, sulphur, marble, kaoline, silver, mercury, and oil. The coal may be classed as highly carbonized lignite, and is apt to contain much sulphur. The finest known beds, in the Island of Batan, are from 2½ to 14½ ft. thick. The heating effect is about one-fourth that of Cardiff coal. Gold is found in a vast number of places, and is mostly detrital, or of the placer type; in Lepanto quartz veins are found, but these yield only from $6 to $7 per ton. Copper is also abundant in locality, and mean assays of the best mines opened show 16% of copper in the trachyte country rock. Lead is found in Cebu, with 96 grammes of silver, 6 grammes of gold, and 565.5 kilos of lead to the metric ton. Iron is abundant in many of the islands, but the lignite is unsuitable for smelting it. Sulphur deposits abound about active and extinct volcanoes in the Philippines. There is only a rumor as to the existence of mercury.

STATE BOARD OF HEALTH OF MAINE.—Report for the Two Years Ending Dec. 31, 1897. A. G. Young, M. D., Secretary, Augusta, Me. Paper; 6 x 9 ins.; pp. 395; illustrations and tables.

The bulk of this report is taken up with two exceptionally valuable papers, one being a "Bacteriological Report Upon Formaldehyde," by F. C. Robinson and B. L Bryant, of Bowdoin College, Brunswick, Me.; and the other being "Notes on Disinfectants and Disinfection," by the secretary of the board. These two papers occupy about about 250 pages. The first one is mainly devoted to an account of experiments on formaldehyde conducted by Professor Robinson, which confirm previous views, both as to the value of this new disinfectant and its limitations in the present state of the development of means for applying it. The paper on disinfectants reviews the whole subject, by agents employed and by the purposes for which disinfection is required. Ozone and electrolysis as means of purifying water and sewage are among the agents reviewed. Some German experiments with ozone appear to give promising results, but with serious limitations, while no figures bearing on the economy of the agent are given. All the so-called electrical processes are set down as being only a means of producing chemical agents, most of the evidence regarding them being unsatisfactory as to results or cost. These "Notes" form a valuable supplement, and in some measure supersede the exhaustive Report of the Committee on Disinfectants Appointed by the American Public Health Association, whose investigations extended over three years and were published in 1888.

STATE BOARD OF HEALTH OF MASSACHUSETTS.—Report for 1897. Samuel W. Abbott, M. D., Secretary; X. H. Goodnough, C. E., Engineer; State House, Boston. Cloth; 6 x 9 ins.; pp. LX. + 714; many tables.

This volume contains the usual reviews of the work of the board, including advice to cities and towns regarding water supply, sewerage and sewage disposal; analyses of the water from public supplies; studies of stream pollution; the Lawrence experiments on sewage and water purification; and results obtained at the sewage purification plants of the state. In addition there is a special report on the restoration of Green Harbor. A new line of work in the experiments on sewage purification was the study of some of the so-called English bacterial filters, the results of which seem promising if the filters continue to show the efficiency thus far maintained. Some experiments on straining sewage through coke and then passing it through two sand beds, one above the other, on a plan like that in use at Reading, Pa., were carried on. The results were poor. Information regarding these tests has been abstracted for separate publication.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

STEAM REGULATING DEVICES.—The Mason Regulator Co., 6 Oliver St., Boston. Pamph.; 3¾ x 6 ins.; pp. 40.

This catalogue describes pump governors, reducing valves, pressure and rheostat regulators, etc.

CAST-IRON PIPE, PIPE FITTINGS, ETC.—M. J. Drummond & Co., 192 Broadway, New York city. Pamph.; 9 x 6 ins.; pp. 38.

This is an illustrated catalogue of cast-iron pipe, angles, bends, valves, and other gas and water-works supplies.

"HELPS IN BRAZING."—Joseph Dixon Crucible Co., Jersey City, N. J. Pamph.; 6¾ x 5½ ins.; pp. 12.

This pamphlet describes a crucible and furnace used for liquid metal brazing, and the use of graphite as an anti-flux.

VALVES, EXPANSION JOINTS, ETC.—Coldwell-Wilcox Co., Newburg, N. Y. Pamph.; 8¾ x 5 ins.; pp. 20.

This catalogue illustrates valves for water and steam, expansion joints of various forms, water-catchers, flexible joints, etc.

INJECTORS, INSPIRATORS, ETC.—The Hancock Inspirator Co., Boston, Mass. Pamph.; 3½ x 6 ins.; pp. 32.

This is an illustrated catalogue of the various forms of the well-known Hancock "inspirator," and of the Loftus restarting injector.

ENGINES AND BOILERS.—James Leffel & Co., Springfield, O. Pamphlet "F"; 8 x 5 ins.; pp. 32.

The engines illustrated in this catalogue are of the center-crank type, sizes up to 10½ x 12 ins., with either automatic cut-off or throttling governor. The boilers are tubular, horizontal or vertical, in sizes up to 50 HP.

"MOGUL" DRAUGHT SPRINGS.—Wilson Mfg. Co., 147 Cedar St., New York city. Pamph.; 5½ x 8 ins.; pp. 24.

An illustrated catalogue of springs for use on the traces for drawing heavy vehicles by horse or other animal power, in order to avoid shocks due to starting heavy loads or to encountering rough places in the road.

STEAM SEPARATORS AND OIL ELIMINATORS.—Hoppes Mfg. Co., Springfield, O. Pamph.; 9 x 6 ins.; pp. 16.

The Hoppes Mfg. Co. is well known as the manufacturer of feed water heaters and purifiers. It has recently put on the market a steam separator and oil eliminator in two forms for horizontal and vertical pipes, which are illustrated in this catalogue.

CONCRETE MIXER.—Ransome & Smith Co., Monadnock Block, Chicago, Ill. Paper; 6½ x 5¼ ins.; pp. 16.

This little pamphlet illustrates a drum or rotary mixer, in which the concrete is fed in at the center on one side, and discharged from the center at the other side. The machine has been used on several works, and is now in use for mixing concrete for the bridge abutments on the track elevation work of the Chicago, Milwaukee & St. Paul Ry. at Chicago.

PNEUMATIC PUMPING MACHINERY.—The Merrill Pneumatic Pump Co., Bound Brook, N. J. Pamph.; 6 x 9 ins.; pp. 8.

In the pneumatic system of pumping, air is compressed at any convenient location and led by pipes to the pumps. The method of using the air varies according to depth of well or other circumstances. Several forms of apparatus are shown, including single and duplex displacement chambers, a differential piston pump, and an "inductor," which is a modification of the "air-lift" pump.

LOCOMOTIVES.—Dickson Locomotive Works, Scranton, Pa. Cloth; 6 x 9 ins.; pp. 72.

This handsome and compact volume shows a great variety of locomotives built by this firm, with lists of dimensions of the same, and there are also a few pages of information respecting hauling capacity, dimensions, HP. exerted, etc. The engines range from little four-wheel tank engines for industrial plants, and compressed air locomotives (with cylindrical reservoirs or a group of "bottles"), to ordinary passenger and freight engines, including the ten-wheel express engines for the Atchison, Topeka & Santa Fe Ry., illustrated in our issue of March 3, 1898. Engines built for Japan and Honduras are also shown. The firm also builds two-cylinder compound locomotives, under the patents of Mr. F. W. Dean, these engines having either an automatic starting valve or one which can be operated at will by the engineman, according to the preferences of the purchasers.

GATE VALVES AND HIGH-PRESSURE FITTINGS.—The Kennedy Valve Mfg. Co., 75 John St., New York. Pamph.; 7 x 10½ ins.; pp. 32.

This is an illustrated catalogue and price-list of a variety of gate-valves and other fittings for high steam pressures.

DUMP CARTS FOR GARBAGE AND ASHES.—U. S. Sanitary Co., 618 Pennsylvania Ave., N. W., Washington, D. C. Paper; 7 x 5 ins.; pp. 19; illustrated.

This catalogue describes not only the semi-cylindrical carts made by the company for some years past, but also a new style of carts with a flat bottom and inclined ends.

TRAPS.—National Sanitary Supply Co., 273 Pearl St., New York city. Paper; 6 x 3 ins.; pp. 19; illustrated.

Under the trade name of Sanos, this company is manufacturing back pressure traps of various sorts, to be used alone or in combination with U-shaped traps to guard against sewer air or water. The device is simply a flap valve, seated on a knife edge to guard against leakages by fouling.

HYDRAULIC TOOLS.—The Watson-Stillman Co., 210 East 43d St., New York. Catalogue No. 50. Pamph.; 6 x 9 ins.; pp. 70.

This is an "assortment of illustrated sheets" selected from a large catalogue issued by the same company. It contains descriptions and price lists of hydraulic machinery especially adapted for railroad work, including a great variety of jacks, punches, etc.

CORLISS ENGINES, ETC.—The Rarig Engineering Co., Columbus, O. Pamph.; 8 x 5¼ ins.; pp 56.

The Rarig-Corliss engine seems to be especially designed for the heaviest class of work, such as rolling mills, street railways, etc. The pamphlet also illustrates blowing engines, hoisting engines, condensers, etc. So far as may be judged from the illustrations in the catalogue, the engines built by this company are of excellent design, but we cannot say as much for the catalogue itself. The engravings are poor, the page is too small, and even the spelling is bad.

STEAM ENGINES.—Chandler & Taylor Co., Indianapolis, Ind. Pamph.; 9 x 6 ins.; pp. 24.

This is an illustrated catalogue of single cylinder automatic cut-off horizontal engines. The Rites inertia governor is used in this engine. An interesting feature of one of the styles shown is a self-contained side-crank engine, the "out-board" bearing being cast in the bed plate and the governor wheel, of unusually small diameter, being between it and the main bearing. The catalogue is a fine example of the printer's and engraver's art, and gives the reader a favorable impression of the engine, which is enhanced by the fair and modest claims made in the text.

WATER-WHEEL GOVERNORS.—Lombard Water-Wheel Governor Co., 61 Hampshire St., Boston, Mass. Pamph.; 9 x 5¾ ins.; pp. 32.

The Lombard water-wheel governor consists essentially of a hydraulic piston which applies its thrust in either direction, through a rack, to the water-wheel gates. The travel of the hydraulic piston is controlled by a very sensitive balanced valve, which in turn is controlled by the position of centrifugal balls driven from the water-wheel shaft. The pamphlet contains photographic illustrations of several styles of the governor, and also of automatic records of speed recorders, showing the close regulation obtained by the governor.

PUNCHING AND PRESSING MACHINERY.—The Works of E. W. Bliss Co., Brooklyn, N. Y. Pamph.; 12 x 9 ins.; not paged; 20 full-page photographic views, with numerous advertisements.

This bulky pamphlet contains two pages of an introduction giving the history of the E. W. Bliss Co. since the business was started in 1866, and a long list of articles for the making of which its machinery is adapted. Then follows three pages of small cuts of presses, 20 full-page half-tone cuts of views of different portions of the works interleaved with advertisements of fifty or more manufactures of various specialties. The pamphlet seems to have been gotten up by some advertising solicitor. It is handsomely printed on heavy plate paper and some of the photographic views are interesting, but it has no other merit, and no good reason for existence. It has no index, and its size and shape are such that few would care to keep it, even if it were worth keeping.

BOILER TUBE CLEANERS.—The Lagonda Mfg. Co., Springfield, O. Pamph.; 9 x 6 ins.; pp. 8.

This circular describes the "Weinland" tube cleaners for removing scale from the inside of water-tubes. Several varieties are shown, one of which is a power cleaner, driven by a small turbine wheel, forming part of the tool itself. The circular contains, as do nearly all circulars of scale cleaners, the false statement that "it has been proved" that a tube with 1-16-in. of scale requires 15% more fuel than a clean tube; ¼-in., 66% more; ½-in., 150% more, etc. No one has ever proved it, but the old "fake" will probably continue in print for the next century.

OCTOPUS ANTI-INCRUSTATOR.—American Octopus Co., 120 Liberty St., New York city. Pamph.; 4½ x 6¾ ins.; pp. 32.

The "octopus" is a disk-shaped brush of some sort of fibers, enclosed between washers and rings of different metals. It is claimed that when the octopus is placed inside of a steam boiler containing scale-forming water, an electric action is set up, and the impurities of the water are deposited upon the fibers. The claim may be true, but if so, it is likely that an old scrubbing brush, to which is attached wires of copper and a plate of zinc would be quite as effective. We find here also the time-worn statements os to the loss of fuel due to scale, but the figures are different from those in the case previously noticed, viz.: 1-16-in. causes a loss of 13%, ¼-in. of 38%, and ½-in. of 60%.

THE TROPENAS STEEL PROCESS.—Powell & Colne, Agents for the United States, 111 Broadway, New York city. Pamph.; 6 × 9 ins.; pp. 21.

This pamphlet is a reprint of a paper read by Mr. Alexander Tropenas at the Cincinnati meeting of the American Foundrymen's Association, in June. The Tropenas process is the most recent of the so-called "little Bessemer" processes, with surface blow. The converters are usually of 2 tons capacity. Several of them are in use in Europe.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Dec. 1.	Business building, Cleburne, Tex.	Nov. 10
Dec. 1.	Seawall, S. I., N. Y.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Dec. 1.	Electric lighting, Sumter, S. C.	Oct. 6
Dec. 1.	Electric light plant, Clinton, Ill.	Oct. 13
Dec. 1.	Brick sewer, Buffalo, N. Y.	Nov. 24
Dec. 1.	Court-house plans, Lafayette, Ala.	Nov. 24
Dec. 1.	Street bonds, Wilkinsburg, Pa.	Nov. 24
Dec. 1.	System of clocks, Troy, N. Y.	Nov. 24
Dec. 1.	Turnpike bonds, Winchester, Ky.	Nov. 24
Dec. 1.	Public lighting, St. Paul, Minn.	Dec. 1
Dec. 1.	Repairing asphalt paving, Buffalo, N. Y.	Dec. 1
Dec. 1.	Sewers, Scranton, Pa.	Dec. 1
Dec. 2.	Sewers, Denver, Colo.	Dec. 1
Dec. 2.	Asphalt paving, etc., Louisville, Ky.	Dec. 1
Dec. 2.	Pine timber, New York, N. Y.	Nov. 24
Dec. 2.	Paving, Omaha, Neb.	Nov. 24
Dec. 2.	Granite stones, New York, N. Y.	Nov. 24
Dec. 2.	Pipe sewers, Mason City, Ia.	Nov. 24
	Advertised, Engineering News, Nov. 24.	
Dec. 2.	Arc lighting, Asheville, N. C.	Oct. 13
Dec. 3.	Wooden or iron bridge, Rome, Ga.	Nov. 24
Dec. 3.	Shell road, Annapolis, Md.	Dec. 1
Dec. 5.	Stone, Toronto, Ont.	Dec. 1
Dec. 5.	School building, New York, N. Y.	Dec. 1
Dec. 5.	Sewers, Syracuse, N. Y.	Dec. 1
Dec. 5.	Power plant, Brandon, Vt.	Nov. 17
Dec. 5.	Pipe sewers, Albany, N. Y.	Dec. 1
Dec. 5.	Macadamizing, San Rafael, Cal.	Dec. 1
Dec. 5.	Stone bridge, Sarcoxie, Mo.	Dec. 1
Dec. 5.	Pipe sewers, Toledo, O.	Nov. 24
Dec. 5.	Supplies, Toronto, Ont.	Nov. 24
Dec. 5.	Grading, Seattle, Wash.	Nov. 24
Dec. 5.	Bridges (7), Leavenworth, Kan.	Nov. 24
Dec. 5.	Valves, pipe, etc., Toronto, Ont.	Nov. 24
Dec. 5.	Street cleaning, etc., Philadelphia, Pa.	Nov. 24
Dec. 5.	Stone heads, Newark, N. J.	Nov. 24
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 5.	Bulkhead and filling, Boston, Mass.	Nov. 24
Dec. 5.	Wall, Boston, Mass.	Nov. 24
Dec. 5.	Pumping engine, Oil City, Pa.	Oct. 27
	Advertised, Eng. News, Oct. 27 to Nov. 10.	
Dec. 5.	Removing wreck, Philadelphia, Pa.	Nov. 10
Dec. 5.	Water-works, West Tampa, Fla.	Nov. 10
	Advertised, Eng. News, Nov. 10 to 24.	
Dec. 5.	Court house, Garner, Ia.	Nov. 10
Dec. 6.	Canal, Tampico, Ill.	Nov. 10
	Advertised, Eng. News, Nov. 10 to Dec. 1.	
Dec. 6.	Street bonds, Springfield, O.	Nov. 3
Dec. 6.	School building, Sacramento, Cal.	Nov. 17
Dec. 6.	Steam heating, New Brighton (S.I.), N. Y.	Nov. 24
Dec. 6.	Water-works, East Grand Forks, Minn.	Nov. 24
Dec. 6.	Pipe sewers, St. Louis, Mo.	Nov. 24
Dec. 6.	Electric light plant, E. Grand Forks, Minn.	Nov. 24
Dec. 6.	Machinery and tools, Brooklyn, N. Y.	Dec. 1
Dec. 6.	Machinery and tools, Washington, D. C.	Dec. 1
Dec. 6.	Machinery and tools, Portsmouth, N. H.	Dec. 1
Dec. 6.	Iron bridge, etc., Rensselaer, N. Y.	Dec. 1
Dec. 6.	Combination bridges (2), Milan, Mo.	Dec. 1
Dec. 6.	Brick paving, Cincinnati, O.	Dec. 1
Dec. 7.	Placing hydrants, Louisville, Ky.	Dec. 1
Dec. 7.	Cleaning catchbasins, Cleveland, O.	Dec. 1
Dec. 7.	Timber bulkheads, Boston, Mass.	Dec. 1
Dec. 7.	Repairing steamboat, New York, N. Y.	Dec. 1
Dec. 7.	Dredging, New York Bay, N. Y.	Nov. 24
Dec. 7.	Electric light plant, New Richmond, O.	Nov. 24
	Advertised, Eng. News, Nov. 24 and Dec. 1.	
Dec. 7.	Water-works, New Richmond, O.	Nov. 24
	Advertised, Eng. News, Nov. 24 and Dec. 1.	
Dec. 7.	Changing Van Buren St. bridge, Chicago, Ill.	Oct. 20
Dec. 7.	Torpedo storehouse, Fort Caswell, N. C.	Nov. 10
	Advertised, Eng. News, Nov. 10 to Dec. 1.	
Dec. 8.	Bridge approach, Zanesville, O.	Nov. 10
Dec. 8.	Police patrol system, Youngstown, O.	Nov. 24
Dec. 8.	Electric light plant, Litchfield, Ill.	Dec. 1
Dec. 8.	Sale of floating dock, Havana, Cuba.	Dec. 1
Dec. 8.	Park work, New York, N. Y.	Dec. 1
Dec. 8.	Water pipe, boilers, etc., New York.	Dec. 1
Dec. 9.	Laundry machinery, Boston, Mass.	Dec. 1
Dec. 9.	Bridge work, Fort Scott, Kan.	Dec. 1
Dec. 9.	Bridge work, Minneapolis, Minn.	Dec. 1
Dec. 9.	Removal snow, New York, N. Y.	Dec. 1
Dec. 9.	Fire hose, Buffalo, N. Y.	Nov. 24
Dec. 10.	Intercepting sewers, Washington, D. C.	Nov. 3
	Advertised, Engineering News, Nov. 3.	
Dec. 10.	Crane (100 tons capacity), Brooklyn, N.Y.	Nov. 10
Dec. 10.	Sterilizing apparatus, New Haven, Conn.	Dec. 1
Dec. 10.	Storehouse, New York, N. Y.	Dec. 1
Dec. 12.	Hospital building, Bridgeton, N. J.	Dec. 1
Dec. 12.	Armor plate plant, St. Petersburg, Russia.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 12.	Extending water-works, Orange, N. J.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 12.	Sewers (8,400 ft.), Little Rock, Ark.	Dec. 1
Dec. 12.	Water bond, Reno, Nev.	Dec. 1
Dec. 12.	Paving, curbing, etc., Dayton, O.	Nov. 17
Dec. 12.	Boilers for dredges, Honolulu, H. I.	Nov. 24
Dec. 13.	School building, Washington, D. C.	Nov. 24
Dec. 13.	Purchase of power franchise, Stockton, Cal.	Nov. 24
Dec. 13.	Tunnel, Boston, Mass.	Dec. 1
Dec. 13.	Pier and tunnel, Philadelphia, Pa.	Dec. 1
Dec. 13.	Hospital building, Brooklyn, N. Y.	Dec. 1
Dec. 13.	Sewer bonds, ($75,000), Independence, Mo.	Dec. 1
Dec. 13.	Sewers, etc., Philadelphia, Pa.	Dec. 1
Dec. 13.	Bridge work, Philadelphia, Pa.	Dec. 1
Dec. 14.	Gravel roads (19 miles), Brazil, Ind.	Dec. 1
Dec. 14.	Water pipe, hydrants, etc., Vancouver, B.C.	Dec. 1
Dec. 15.	Paving (3 streets), Beaumont, Tex.	Dec. 1
Dec. 15.	Court house, Garner, Ia.	Dec. 1
Dec. 15.	Steam heating, Flandreau, S. Dak.	Dec. 1
Dec. 15.	Railway work, New York, N. Y.	Dec. 1
	Advertised, Eng. News, Dec. 1 and 8.	
Dec. 15.	Water-works, Somerville, Tenn.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 15.	Electric plant, Somerville, Tenn.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 15.	Bridges (9) and viaduct, Valatie, N. Y.	Dec. 1
Dec. 15.	Brick paving, Jacksonville, Fla.	Dec. 1
Dec. 15.	Church building, Webster City, Ia.	Nov. 24
Dec. 15.	Storm sewers, Denver, Colo.	Oct. 13
Dec. 17.	Macadam roads (20 miles), Crown Point, Ind.	Nov. 24
	Advertised, Engineering News, Nov. 24.	
Dec. 17.	Heating, ventilating, etc., Cincinnati, O.	Dec. 1
Dec. 19.	Asphalt or brick paving, Hamilton, O.	Dec. 1
Dec. 19.	Tunnel sewer, Newburg, N. Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 20.	Revetments, Keweenaw Point, Mich.	Nov. 24
	Advertised, Eng. News, Nov. 24 to Dec. 15.	
Dec. 20.	Electric plant, Mount Pleasant, Mich.	Dec. 1
Dec. 20.	Macadamizing, Cincinnati, O.	Dec. 1
Dec. 21.	Street work, Hoboken, N. J.	Dec. 1
Dec. 21.	Glass for electric lamps, Cleveland, O.	Dec. 1
Dec. 21.	Court house annex, Atlanta, Ga.	Nov. 3
Dec. 22.	Bridge superstructure, Lorain, O.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Dec. 23.	Light station, Tompkinsville, (S.I.), N. Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 23.	Cement and seawall, Fort Morgan, Ala.	Dec. 1
	Advertised, Eng. News, Dec. 1 to 22.	
Dec. 28.	Steel bridge, Norfolk, Va.	Dec. 1
	Advertised, Eng. News, Dec. 1 to 15.	
Dec. 28.	Railway bridge, Chicago, Ill.	Nov. 24
	Advertised, Engineering News, Nov. 24.	
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Jan. 1.	City hall plans, Bridgeport, Conn.	Aug. 18
Jan. 1.	Draw bridge, Cathlamet, Wash.	Nov. 17
Jan. 1.	Water-works, Pasadena, Cal.	Nov. 17
Jan. 1.	Electric plant, Pasadena, Cal.	Dec. 1
Jan. 2.	Bridge, Quebec, Que.	Sept. 29
	Advertised, Eng. News, Sept. 29 and Oct. 6.	
Jan. 2.	Arc lighting, Vincennes, Ind.	Oct. 27
Jan. 3.	Steel bridge, Brookhaven, Miss.	Nov. 24
Jan. 3.	Water-works, Gaffney, S. C.	Dec. 1
Jan. 5.	Macadam roads (17½ miles), Decatur, Ind.	Dec. 1
Jan. 6.	Water-gas plant, Johannesburg, So. Africa.	Oct. 27
Jan. 6.	Extension, electric plant, Johannesburg, S.Af.	Oct. 27
Jan. 9.	Repairing curb, etc., Houston, Tex.	Nov. 24
Jan. 10.	Capitol building, Phoenix, Ariz.	Dec. 1
Jan. 10.	Sewer bonds ($50,000), Grass Valley, Cal.	Dec. 1
Jan. 14.	Park work and plans, Philadelphia, Pa.	Nov. 17
Jan. 15.	Sewers and drainage, Callao, Peru.	Dec. 1
Jan. 24.	Footway tunnel, London, England.	Nov. 10
Feb. 1.	School building, Peoria, Ill.	Dec. 1
Feb. 2.	Electric lighting, New Orleans, La.	Nov. 3
Feb. 7.	Sale of canal, Annapolis, Md.	Dec. 1
Feb. 10.	Jail building, Keyser, W. Va.	Sept. 29
Mar. 15.	Electric railway (23 miles), Shanghai, China.	Nov. 24
	Advertised, Eng. News, Nov. 17 to Dec. 8.	
Mar. 15.	Purchase of water-works, Belem, Brazil	Dec. 1
Mar. 31.	Telephone concession, Shanghai, China.	Nov. 24
	Advertised, Eng. News, Nov. 17 to Dec. 8.	

RAILWAYS.

BISMARK & POTOMAC VALLEY.—Surveys are being made for this new line, according to reports, to run from Davis through Tucker, Grant and Hardy counties to a point on the state line in Hampshire county, W. Va.; the route is through a coal and lumber region. F. M. Howard, Forest Bldg., Philadelphia, is said to be interested.

CALIFORNIA.—Bids are asked by A. S. Kenagy, Clk. of Ventura county, until Dec. 17, for the purchase of a franchise to construct a standard gage line of steam railway along the public highways from Montalvo to Oxnard.

CAPE FEAR & YADKIN VALLEY.—Notice is given that the property of this company will be sold on foreclosure, at Fayetteville, N. C., Dec. 29, by E. S. Martin and Clement Manly, Master Comrs. The length of the system is 342 miles. John Gill, Recvr., Baltimore, Md.

CHICAGO & NORTHWESTERN.—Reports state that McDougall & Duffy have left Kent, O., for Wall Park, Ia., where they have a contract for 70,000 cu. yds. of grading for this company. J. E. Blunt, Ch. Engr., Chicago, Ill.

CHOCTAW & MEMPHIS.—We are informed that Johnson Bros. & Faught, St. Elmo, Ill., and J. H. McCarthy & Reichardt, Little Rock, Ark., have been awarded the contract for constructing this company's line from Little Rock to Howe, Ind. Ter. Work is to begin at once and be completed before next fall. F. A. Moliter, Ch. Engr., Little Rock, Ark.

CLEARWATER SHORT LINE.—This company was incorporated in Montana, Nov. 9, with a capital stock of $10,000, to build a line for the Northern Pacific Ry. Co. from the main line at Ainsworth, Wash., up Snake and Clearwater rivers over the Bitter Root Range and connecting with the main line near Missoula.

COLORADO & NORTHWESTERN.—Reports from Boulder, Colo., state that Day & Ryan have been awarded the contract for building a branch line to the B. & M. mine, and that work would be commenced at once. Work on the Bloomerville branch is also being actively pushed. J. S. Frankeberger, Ch. Engr., of Boulder.

COLUMBIA & KLICKITAT.—This company was incorporated in Oregon, Nov. 16, with a capital stock of $300,000, to construct a railway from Lyle to Goldendale. The incorporators are: E. E. Lyttle, D. C. O'Reilly and A. E. Hammond; principal office, Wasco, Ore.

COLUMBUS, LIMA & MILWAUKEE.—Andrew Bruon, Ottawa, Ohio (not A. Brown), informs us that he is the principal contractor for the construction of 40 miles of railway for this company between Lima and Defiance, via Gomer, Kalida and Continental, O. This piece of work will be completed this fall, but extensions are contemplated to bring the total mileage up to 314 miles. Between Lima and Defiance the rights of way have all been obtained and paid for and the grading practically completed; bridges and telegraph lines are also erected. A 70-lb. rail of 60-ft. length, furnished by the Lorain Steel Co., Lorain, O., is now being laid. The only work that Mr. Bruon wishes to sub-let is the loading of 50,000 to 60,000 yds. of gravel on cars with steam shovels, at his gravel pit, four miles east of Ottawa; proposals for doing this work are solicited. J. G. W. Cowles, Pres., Cleveland, O.; C. T. Hobart, Ch. Engr., Defiance, O.

DETROIT & LIMA NORTHERN.—The receivers of this company are said to have asked the U. S. Court for authority to spend $500,000 for the purchase of new rolling stock and the building of terminal and other improvements around Detroit. C. H. Roser, Ch. Engr. and Purchasing Agt., Detroit, Mich.

ESCANABA & LAKE SUPERIOR.—This company is reported to have been incorporated in Michigan, Nov. 17, to construct 60 miles of railway. Isaac Stephenson, Pres.; J. A. Van Cleve, Vice-Pres., both of Marinette, Wis.; W. E. Wells, Supt., Wells, Mich. This is apparently the same project as that promoted by the Escanaba River Ry. Co., which is at work building from Escanaba, Mich., to Republic, Minn., 60 miles, through a hard-wood and farming district.

GREAT NORTHERN.—Work has been commenced by Foley Bros., St. Paul, Minn., on the new cut-off from Coon Creek to Brook Park, thus shortening the distance between St. Paul and Duluth by 30 miles. The new line will be about 55 miles in length, and is expected to be completed by June 1.

GULF & SHIP ISLAND.—Reports state that construction work will begin on the extension of this road north of Hattiesburg, Miss., as soon as locations have been made. S. S. Bullis, Gen. Mgr.; J. B. Hatch, Ch. Engr., both of Gulfport, Miss.

INDO-CHINESE.—Press reports state that the French government has decided to authorize a loan of 27,000,000 francs for the purpose of establishing an Indo-Chinese railway system in connection with the Chinese systems.

IOWA CENTRAL & WESTERN.—L. M. Martin, Pres., Marshalltown, Ia., has stated that this branch company of the Iowa Central will construct a new line from Oskaloosa to Cordova, via Pella, Ia., and also a branch from Belmont to Algona, via Cornwith, Ia. Surveys have been begun.

MINNESOTA & IOWA VALLEY.—This company was incorporated in Minnesota, Nov. 14, with a capital stock of $50,000, to build from a connection with the Winona & Western Ry. at Sanborn, Minn., through Brown, Cottonwood, Watonwan and Martin counties, to the southern state line, a distance of about 70 miles. The incorporators are: J. M. Whitman, J. B. Redfield, Chicago; Edward C. Carter, Evanston, Ill.; W. A. Scott, John C. Stuart, St. Paul, Minn.

MINNESOTA & SOUTHERN.—This company was incorporated in Iowa, Nov. 19, to build a line from Sauk Center, Minn., south through Iowa, to connect the Great Northern with the Kansas City, Pittsburg & Gulf Ry. Pres., John S. Thompson, New York; Vice-Pres., William T. Smith, Des Moines; Treas., Robert M. Snyder, New York.

NEW YORK.—Bids are asked until Dec. 15 for work on the extension of the old Kinderhook & Hudson Ry., including 220,000 cu. yds. of earth excavation, 11,800 cu. yds. of rock excavation, 40 miles of track laying, 9 steel plate girder bridges, one steel viaduct, 1,900 ft. long, etc., as described in our advertising columns. Wm. G. Smith, Ch. Engr., Valatie, N. Y.

NEW YORK, WYOMING & WESTERN.—The Lackawanna Iron & Steel Co., of Scranton, is reported to have received a contract to furnish 7,000 tons of 95-lb. rails to be laid on this new line between Wimmers and the Delaware River. From Wimmers to Scranton, 12 miles, the tracks of the Erie & Wyoming Valley R. R. will be used. E. B. Sturges, Pres.; Edw. L. Jenks, Ch. Engr., both of Scranton, Pa.

RUTLAND-CANADIAN.—The directors of this company organized Nov. 21 by electing Frank R. Wells, of Burlington, Vt., president, and H. G. Smith, of Rutland, Vt., treasurer. Official action was taken authorizing the president to obtain surveys of different routes from some point in or near Burlington to the Canadian line, and report such surveys to the board for further action.

OREGON R. R. & NAVIGATION.—Reports from Portland, Ore., state that Seims & Coykendahl are the contractors for a 140-mile extension of this line from Wallula Junction up Snake River to Lewiston, Idaho. The Great Northern Ry. and the Northern Pacific Ry. Cos. are also said to contemplate new extensions in this locality as a result of competition. W. H. Kennedy, Ch. Engr., Portland.

ST. LAWRENCE & ADIRONDACK.—This new company proposes to build a line from the St. Lawrence River to North Creek, N. Y., following the Raquette River to its source, 100 miles. Dr. L. S. Putney, Pres.; H. G. Atwater, Secy.; J. G. McLeod, Treas., all of Norfolk, N. Y.

ST. LOUIS & OKLAHOMA CITY.—J. F. Hinckley, Ch. Engr., Sapulpa, Ind. Ter., informs us that this company has now completed its line between Sapulpa and Oklahoma City, a distance of 103.23 miles, and that regular train service is in operation between Oklahoma City and St. Louis, Mo., via St. Louis & San Francisco Ry.

SOUTHERN.—This company has had a survey made for an extension from Stevenson, Ala., to Chattanooga, Tenn., a distance of 28 miles. The latest survey contemplates a tunnel under Lookout Mountain to gain an entrance to Chattanooga without bridging the Tennessee River. It is said that the extension will be built at once. This will give the Southern an unbroken line between Chattanooga and Memphis.

WASHINGTON RUN.—Bennett & Talbott, Greensburg, Pa., are stated to have been awarded the contract for the construction of this railway, from Dayton station to Washington Run, Fayette county, Pa., 5½ miles, for the Washington Coal & Coke Co. The contract price is about $400,000, which includes the completion of the road ready for the rolling stock. Work will be commenced at once. W. H. Brown, Pres., Conestoga Bldg., Pittsburg.; E. J. Taylor, Ch. Engr., McKeesport, Pa.

WEST BRANCH VALLEY.—A. E. Patton, Pres., Curwensville, Pa., informs us that locations have been made for this proposed line of railway, from Clearfield to Williamsport, Pa., 111 miles. Contracts have not yet been let and will not be ready for some time. The incorporation of this company was noted in our last issue. A. V. Hoyt, Ch. Engr., Philipsburg, Pa.

WHITE PASS & YUKON.—John Hislop, Box A, Skagway, Alaska, informs us that this company, operating the lines of the Pacific & Arctic Ry. & Navigation Co. and of the British Columbia, Yukon & British Yukon Ry. Transportation & Navigation Co., has completed the final location for the first 50 miles from Skagway and has made a preliminary survey from Skagway to Fort Selkirk. Most of the rights of way have been obtained, and the necessary capital for construction secured. The company does the grading under the supervision of the Pacific Contract Co., Ltd., and the employment agent is J. Heney, Seattle, Wash. Track is laid for 14 miles and will be at the summit of White Pass, 20 miles, by Dec. 1. The proposed route will be 312 miles in length. S. H. Graves, Pres., 1016 Chamber of Commerce Bldg., Chicago, Ill.; E. C. Hawkins, Ch. Engr., Dexter-Horton Bank Bldg., Seattle, Wash.

WISCONSIN, MICHIGAN & NORTHERN.—This company was incorporated in Michigan Nov. 17, with a capital stock of $130,000 and headquarters at Menominee, Wis. It is proposed to operate that portion of the Wisconsin & Michigan Ry. in Michigan, and to extend the line 16 miles through Menominee and Dickinson counties, the Wisconsin & Michigan not being able to take advantage of the Michigan law for the condemnation of property for its right of way. A map of the proposed extension has been filed with Railroad Commissioner Wesselius.

STREET AND ELECTRIC RAILWAYS.

RUTLAND, VT.—E. D. Blackwell, Montpelier, Vt., informs us that a charter has just been granted to the Lake Durand Power & Traction Co., but that the organization has not yet been completed. It is proposed to construct 25 miles of railway from Lake Durand to Brandon, Pittsford, Proctor and Rutland. Plans and specifications will be ready about Dec. 5.

HOLBROOK, MASS.—E. E. Chapman and others have petitioned this town for a franchise to construct a railway between Holbrook and South Weymouth, a distance of three miles.

QUINCY, MASS.—The council has passed an ordinance granting a franchise to the Boynton Bicycle Ry. Co. to build to West Quincy. Councilman Badger may be addressed.

LOCKPORT, N. Y.—It is reported that surveys have been completed for the proposed electric railway from Lockport to Olcott, and that some construction work will be done this winter if the weather permits.

MAMARONECK, N. Y.—The highway commissioners of Harrison, Nov. 23, granted to the Port Chester Electric Ry. Co. a franchise through that part of the town lying between Rye and Mamaroneck. The question of a franchise in Mamaroneck will be discussed at a public meeting held by the trustees on Dec. 7.

NEW YORK, N. Y.—Applications have been made to the city councils by the Third Ave. R. R. Co., 1119 3d Ave., and the Metropolitan St. Ry. Co., 621 Broadway, for franchises to build on the Boulevard, from Manhattan St. to 182d St., both companies using the same tracks but different slots. The Third Ave. R. R. Co. also applies for a line from 181st St. and Amsterdam Ave., east over Washington Bridge to Boscobel Ave., to Jerome Ave., there to connect with the Union R. R. Co.'s trolley, and for a line from 135th St. to Amsterdam Ave., also east over the viaduct to McComb's Dam Bridge, across the bridge to Jerome Ave., to connect with the Union Ry. Co.'s line. The Metropolitan St. Ry. Co. asks for extensions in the Boulevard from Manhattan St. to 182d St., and in 135th St., from Madison Ave. to 8th Ave.; also in 145th St., from the Harlem River to the Boulevard.—— The Union Ry. Co. asks for extensions over the Southern Boulevard and Boston Road to 200th St., to Jerome Ave.; also from 230th St. and Bailley Ave., to 231st St., to McComb's St.; also over Cedar Ave. and Sedgwick Ave. to Fordham Landing Road. A public hearing will be given on Dec. 2.

OSWEGO, N. Y.—Reports state that George B. Leonard and others are interested in the construction of a trolley line between Oswego and Syracuse.

ROME, N. Y.—Grading is reported to have been commenced on the proposed Utica Suburban St. Ry., a branch of the Utica Belt Line St. R. R. Co., which is to be built from Oriskany to Rome, about seven miles. Frank K. Baxter, Ch. Engr.

TROY, N. Y.—A public hearing will be given Dec. 12 to consider the application of the Troy City Ry. Co. for a franchise to extend its tracks on Mill St. C. Cleminshaw, Pres., 361 River St.

CAMDEN, N. J.—Press reports state that Walter N. Boyer, representing the promoters of the projected elevated electric railway to run from Atlantic City into Camden, has requested the council to withdraw the application for a franchise, and that the request has been granted.

IRVINGTON, N. J.—The North Jersey St. Ry. Co. proposes to extend its line from the present terminus in this place to the Hilton & Maplewood line. Extensions to Millburn are also projected. J. K. Corbiere, Pres., Newark, N. J.

LODI, N. J.—We are informed that the Sandford & Stillman Co., 26 Exchange Place, Jersey City, N. J., will commence work at once on the construction of the proposed line of the Saddle River Traction Co. from Passaic to Lodi, via Garfield, a distance of 2½ miles. Gilbert D. Bogart, Pres.; Wise & Watson, Engrs., both of Passaic.

PLAINFIELD, N. J.—The Plainfield St. Ry. Co. has petitioned the council for a franchise to extend its lines to Scotch Plains. T. Nevins, Pres.

JOHNSTOWN, PA.—The councils have granted a franchise to the Johnstown & Somerset Traction Co. to build through this city. The proposed route is from Johnstown to Geistown, Scalp Level and Windber, a distance of about eight miles. Morris Wolf, Pres., Johnstown.

WASHINGTON, D. C.—The Columbia R. R. Co. is now considering propositions for grading and equipment of a new section of overhead trolley line along Benning Road to the District line. The underground electric system will also be substituted for the cable on that portion of the road within the city. R. F. Baker, Pres., 1509 Florida Ave., N. E.

BIRMINGHAM, ALA.—Bids are being received by the Birmingham Traction Co., according to reports, for rails, cross-ties and other material for its proposed extension from Woodlawn to East Lake. A. T. London, Pres., 1st Ave. and 21st St.

VICKSBURG, MISS.—It is reported that S. R. Hughes, of Vicksburg, and J. C. Schaffer, of Chicago, have bought the electric plant in this city and that improvements to the same will be made, and an electric railway built, to cost about $100,000.

CARROLLTON, KY.—Press reports from this place state that a company has been incorporated, with $50,000 capital, to build an electric line from Warsaw to Milton and from Carrollton to English Station. Myron O. Baxter, Pres.; Jas. M. Gaumt, Vice-Pres.; Jas. S. Jett, Treas.

RICHMOND, KY.—Frank Adair and D. J. Hauss, Cincinnati, O., are said to be negotiating with the city for the privilege of constructing a system of electric street railways.

ZANESVILLE, O.—Press reports state that William Christy, Special Master, will sell this company's property in this city on Jan. 3.

DAYTON, O.—J. M. Wilson, Ch. Engr., Dayton, informs us that the surveys have been completed for the Dayton & Xenia Traction Co.'s proposed line from Dayton to Xenia, via Alpha and Trebeins, a distance of 16 miles, 3½ miles of which will be double tracked. Levi Weiskopf, Cincinnati, O.

EVANSVILLE, IND.—C. J. Murphy, of the Business Men's Association, informs us that nothing definite has yet been done towards the construction of the proposed line from Evansville to Tell City, etc., referred to in our last issue.

GREENFIELD, IND.—Chas. L. Henry, Anderson, Ind., and Nathaniel N. Morris have petitioned the commissioners of Hancock county for a franchise to build an electric line from Greenfield west to the county line, and thence to Indianapolis, to be known as the Indianapolis, Greenfield & Eastern Ry.——It is reported that the county commissioners have granted to Wm. C. Dudding and F. G. Banker, of Greenfield, a franchise to construct and operate an electric railway through the county. The promoters of the enterprise are said to contemplate running a line from Anderson to Indianapolis by way of this place.

JACKSON, MICH.—W. B. Joslyn, Supt., 223 River St., Ypsilanti, Mich., informs us that the Jackson, Clarks Lake & Brooklyn Ry. Co. has been incorporated, with a capital stock of $200,000, to construct an electric railway from Jackson to Brooklyn, via Vandercooks Lake, Eldred Station and Clarks Lake, a distance of 21 miles. Surveys have been made as far as Vandercooks Lake, 4½ miles, and the capital has been partly secured. Contracts will be let in the spring or before. Clark Cornwell, Pres., Jackson, Mich.

OWOSSO, MICH.—The Long Lake, Durand & Corunna St. Ry. Co. was incorporated Nov. 17, with a capital stock of $50,000, with $12,000 paid in; the main offices and large power station will be located in this city. F. J. Northway, of Durand; I. D. H. Ralph, of Owosso, and M. P. Nickels, of Corunna, Mich., are the stockholders.

CHARLESTON, ILL.—Henry Rawie, Ch. Engr., Anderson, Ind., informs us that the preliminary survey has been made and the right of way is now being secured for the proposed Charleston & Mattoon Electric R. R., from Charleston to Mattoon, via Loxa, 12½ miles. Forbes Holton, Pres., Anderson, Ind.

CHICAGO, ILL.—The proposition to make permanent the trolley system now in operation in the business district of the city was defeated in the council, Nov. 28.

KENOSHA, WIS.—J. M. Blatt, Supt. of Milwaukee, Racine & Kenosha Elec. Ry., Racine, informs us that this company intended to extend its line through this city, but as the franchise was vetoed the tracks now extend only to the north city limits, awaiting a franchise.

WICHITA, KAN.—The Wichita Ry. & Illuminating Co. was incorporated Nov. 19, with a capital stock of $500,000. The directors are: Ernest Rambeck, E. L. Martling, H. G. Landis, W. O. Church and George E. Spalton.

DENVER, COLO.—Reports state that the Denver City Cable and West End electric lines will be sold by United States Commissioner Hinsdale on Dec. 15.

KANSAS CITY, MO.—It is reported that the Central Electric Ry. Co., owned by the North American Trust Co. of New York, has surveyed a route for an underground trolley system to be operated in connection with the Northeast electric line. Roland R. Conklin is interested.

LOS ANGELES, CAL.—The Los Angeles Traction Co. has petitioned the council for a franchise to build a new line of street railway on 11th, Georgia, Sentous and Hoover Sts. W. S. Hook, Gen. Mgr.

SAN FRANCISCO, CAL.—Reports state that the San Francisco & San Mateo Electric Ry. Co. contemplates the construction of its 30th St. line, and also of extensive improvements to the power house. R. Baxter, Ch. Engr.

CUTNARA, VENEZUELA.—Press reports state that a French company has secured a concession from the Venezuelan Government to construct an electric railway 43½ miles in length between Cutnara and Cumanacad. This line is projected to open up Venezuela and British Guiana to commerce.

AUCKLAND, NEW ZEALAND.—W. Gentry Bingham, an English engineer, is reported to have received a concession to build an electric railway in the city of Auckland.

ELECTRIC LIGHT AND POWER.

BEVERLY, MASS.—Press reports state as follows: The committee, to whom was referred the matter of a change of electric-light contract and the matter of a municipal plant, will recommend the abrogation of the present contract, which has three years to run, and the adoption of a new contract for five years, which has been offered by the Beverly Gas & Electric Co., providing for 175 arc 1,200-c. p. lights to burn all night and every night, at 30 cts. a night. For lights over 175 a discount of 5% is to be allowed.

NEWPORT, R. I.—The Newport Illuminating Co. has applied for permission to furnish light, heat and power for seven years. The plant has been in operation for some time.

AKRON, N. Y.—Surveys have been made for a plant to cost about $5,000, inclusive of arc lights.

ONONDAGA VALLEY, N. Y.—The question of electric lighting is being considered by the Village Improvement Society. Elmer Clark, Pres.

ROMULUS, N. Y.—It is proposed to organize a company to build a plant for this place.

ST. REGIS, N. Y.—J. W. Webb writes us that H. E. O'Neil is to put in a plant. It is thought that the materials have not yet been purchased.

SEABRIGHT, N.J.—The Seabright Electric Light Co. has purchased a lot near the South Shrewsbury River upon which it will build the new power house.

MILL HALL, PA.—Arrangements are reported as about completed for a plant in this place. S. T. Henderson, Houtzdale, Pa., and Councilman Aaron Kyler may be addressed.

NEW HOLLAND, PA.—Eli M. Martin writes us that nothing will be definitely settled upon with regard to a plant before spring.

FREDERICKSBURG, VA.—T. McCracken, Chn. Com., writes us that the following bids were received Nov. 22 for furnishing and installing a plant of 80 2,000-c. p. arc and 75 double carbon arc lights, and 75 HP. water-wheel: Fort Wayne Electric Corporation, Fort Wayne, Ind., $11,649, and Samuel Kingsbury & Co., Baltimore, $11,944. No award will be made until the question of building a plant is voted upon by the people.

GAINESVILLE, GA.—James P. Edwards, Elec. Engr., Augusta, Ga., proposes to build a plant in this place. The plant will have a capacity for 1,000 incandescent lights. Arrangements for the construction will be begun as soon as 500 lights are subscribed for.

LAKE PROVIDENCE, LA.—An election will be held Dec. 15 to vote on the question of issuing $17,500 in 5% bonds for a plant and water-works.

SOMERVILLE, TENN.—Bids are asked until Dec. 15 for furnishing the materials and for constructing works and an electric light plant as stated in our advertising columns. Geo. C. Morgan, Royal Insurance Bldg., Chicago; E. R. Scruggs, Recdr.

OWENTON, KY.—J. M. Riley, of Bracken county, Ky., and W. E. Arnold, of Dayton, O., are reported as making arrangements for a plant.

RICHMOND, KY.—Frank Adams and D. J. Hamss, of Cincinnati, have been granted a franchise. Work will be begun at once, the plant to be completed in 90 days.

BRADFORD, O.—The electric light plant here, which has been shut down for some time, has been purchased and will be put in immediate operation by L. A. Dyer, of Bellefontaine, O., according to reports.

CLEVELAND, O.—Bids are asked until Dec. 21 for furnishing glass, etc., for 878 electric lamps for one year. Geo. R. Warden, Dir. Pub. Wks.

DRESDEN, O.—Thos. McGovern, of Sarahsville, O., it is stated, has received the contract for lighting the streets with arc lights.

NEW RICHMOND, O.—Bids are asked until Dec. 7 for furnishing the materials and for constructing a plant and water-works, as stated in our advertising columns. The plans and specifications are on file at the office of the Engineering News Publishing Co., 220 Broadway, New York. J. F. Witmer, Engr., Buffalo, N. Y.; L. F. White, Secy. Trustees.

GREENFIELD, IND.—The council has purchased the plant of the Greenfield Electric Light & Power Co. for $16,000.

FLINT, MICH.—It is stated that the People's Electric Light Co. will increase the capacity of its plant from 3,000 to 8,000 lights, at a cost of about $25,000.

MOUNT PLEASANT, MICH.—Bids are asked until Dec. 20 for furnishing and installing a plant at the Indian Industrial School here. R. S. Graham, Supt., Mount Pleasant; W. A. Jones, Comr. Indian Affairs, Washington.

ROYAL OAK, MICH.—Wm. Hilzinger, of Royal Oak, has submitted a proposition to light this town.

LITCHFIELD, ILL.—Bids are asked until 10 a. m., Dec. 8, for electric lighting or for furnishing the material and for constructing a municipal plant; population, 5,900. O. D. W. Gooch, Clk.

WINNETKA, ILL.—It is stated that the question of building a plant is being considered.

SAUK RAPIDS, MINN.—The question of granting a franchise for a water power plant to C. M. Hertig, St. Cloud, Minn., is being considered by the committee, according to reports. E. Cross, Chn. Com.

ST. PAUL, MINN.—Bids for lighting the streets and public places with 395 arc, 2,600 gas, and about 3,500 gasoline lights will be considered by the assembly Dec. 1 and by the aldermen Dec. 6. Matt. Jensen, Cy. Clk.

OCONTO, WIS.—The plant and planing mills of the Citizens' Water, Light & Fuel Co., were destroyed by fire Nov. 24 causing a reported loss of about $50,000. T. A. Pamperin, Mgr.

PIERRE, S. DAK.—The council is reported to have decided to put in a plant.

CARTHAGE, MO.—Chas. O. Harrington, Mayor, writes us that this place voted Nov. 22 in favor of issuing $25,000 in bonds for a plant. Bids will be asked as soon as plans and specifications are completed. The plant will have a capacity of 50 2,000-c. p. arc and 150 50-c. p. and 2,000 16-c. p. incandescent lights. Owen Ford, 710 Security Bldg., St. Louis.

LINCOLN, WASH.—The question of building a plant and water-works is being ronsidered.

RITZVILLE, WASH.—The council is reported to have granted a franchise for a plant and water-works.

COLTON, CAL.—Bids are asked until Dec. 19 for furnishing and installing lighting fixtures at the new court house. J. B. Parazette, County Clk.

PASADENA, CAL.—Bids are asked by the city trustees until Jan. 1 for furnishing the machines, etc., for installing a plant. The city will want to use about 105, 2,000 and 1,200 c. p. arc lights, etc.

SAN FRANCISCO, CAL.—Superior Judge Seawell has handed down a decision granting the Mutual Electric Co. permission to erect poles and to extend its lines upon the same terms granted to the San Francisco Gas & Electric Co.

HULL, QUE.—The committee has recommended the council to direct the city engineer to prepare plans for a water power plant.

ACTON, ONT.—This place has voted to build a plant at a cost of $6,000. The council will at once arrange for building the plant.

ST. THOMAS, ONT.—Percy Domville, Hamilton, Ont., it is stated, has been engaged to prepare plans, etc., for a municipal plant.

LINDSAY, ONT.—J. Alex. Culverwell and A. E. Ames, stock broker, Toronto, are interested in the proposed power plant at Fenelon Falls. Power will be furnished to this town, which has a population of about 7,000.

TORONTO, ONT.—C. H. Rust, Cy. Engr., writes us that no contract has yet been awarded for the proposed power plant, bids for which were opened Nov. 9. It is likely that the matter will remain in abeyance for some time.

WINNIPEG, MAN.—The aldermen are considering an ordinance authorizing the submission to the voters of the question of issuing $50,000 in bonds for a municipal plant.

CASCADE CITY, B. C.—We are informed that plans are not sufficiently advanced to give information regarding the proposed water power plant at this place. The head of water will be 150 ft.; available HP., 10,000. Wm. Anderson, Engr., P. O. Box 81, Cascade City.

SANTIAGO, CHILI, S. AM.—Press reports state that a syndicate composed of English and German capitalists is to take charge of the electric lighting of Santiago and of the electric railways in that city. Power is to be taken from the River Maipo. About $6,200,000 is invested in the enterprise, and work has already been commenced. The purchases for the undertaking are to be made in England, Germany and the United States at an early date.

BRIDGES.

RENSSELAER, N. Y.—Bids are asked until Dec. 6 for extending and laying out Washington St. and constructing an iron bridge over Mill Creek. C. A. Ryan, Cy. Clk.

BROOKLYN, N. Y.—Bridge Commissioner Shea was authorized Nov. 23 to advertise for bids for building two stone abutments for the Hamilton Ave. bridge, at a cost of $30,000. He has also been authorized to prepare plans, etc., for the construction of a bridge over the East River between the boroughs of Manhattan and Bronx.

OWEGO, N. Y.—The town board voted Nov. 19 in favor of constructing an iron bridge across Owego Creek to cost about $10,000. It is proposed to have an engineer prepare plans and to ask bids. The contract will probably not be let before spring.

STONY POINT, N. Y.—Geo. W. Aldridge, Supt. Pub. Wks., Albany, will soon ask bids for a new bridge across Minisceongo Creek, according to reports.

VALATIE, N. Y.—Bids are asked by Wm. G. Smith, Ch. Engr., Valatie, until Dec. 15 for the construction of nine plate girder bridges and one viaduct 1,900 ft. long, on the extension of the Kinderhook & Hudson Ry., as stated in our advertising columns.

CAPE MAY, N. J.—Wildwood, Anglesea and Holly Beach have subscribed $4,500 toward the building of a new bridge and turnpike from Five-Mile Beach to the mainland, according to reports.

BUTLER, PA.—Reports state that the grand jury has recommended the construction of a bridge over the Counoquenessing Creek. F. E. McQuistion, County Surv.

HARRISBURG, PA.—We are informed that a subway at Market St. is most likely to be constructed. The plans are yet in the hands of the committee. John E. Bickel, Chn. Citizens' Com.

PHILADELPHIA, PA.—Bids are asked until Dec. 13 for certain bridge work. Thos. M. Thompson, Dir. Dept.

WILKESBARRE, PA.—We are informed that the Grand Jury granted 46 bridges in various parts of the county: eight iron, and 38 stone arch, the cost varying from $2,000 to $90 and aggregating $23,235. The commissioners of Luzerne county have charge of the advertising. The contracts will probably be let about May or June of next year. H. S. Smith, Engr., 70 Coal Exchange Bldg., Wilkesbarre.

BALTIMORE, MD.—An ordinance is before the council to authorize the Old Bay Line to construct a bridge over Light St. from the wharf. John W. Sherwood, Mgr.

NORFOLK, VA.—Bids are asked until Dec. 28 for building the sub and superstructure for a steel highway and draw bridge over Smith's Creek, as stated in our advertising columns. W. T. Brooke, Cy. Engr.; J. D. Hofheimer, Chn.

DECATUR, ALA.—The county commissioners have awarded a contract to the Canton Bridge Co., of Canton, O., to erect a steel bridge over Town Creek, near Somerville, to cost $5,000.

CINCINNATI, O.—The county commissioners have received the lowest bids for a bridge over the Big Miami River from the King Bridge Co., Cleveland, O., at $49,900 for the superstructure, 465 ft. long, and from A. J. Wellman, at $34,798, for the substructure. Frank S. Krug, Engr.

CLEVELAND, O.—Steps will soon be taken for the construction of a bridge across the hollow between Kinsman and Holton Sts., to cost about $10,000; also necessary culverts to cost $3,000. Geo. R. Warden, Dir. Pub. Wks.

MUSKEGON, MICH.—The plans for the bridges over the Chicago & West Michigan Ry., at Myrtle and Amity Sts., submitted by the railway company, have been adopted by the council.

CHICAGO, ILL.—The sanitary district trustees have decided to build two bascule bridges to take the places of the Taylor St. city swing bridge an dthe Northern Pacific Ry. swing bridge between Taylor and 12th Sts. The estimated cost of replacing the old bridges with the bascule structures is $314,000. The moving of the tracks and equipment, with the interlocking switches, will cost $78,000, and of this the sanitary district will pay $60,000. The Scherzer Rolling Bridge Co. will sell the designs for the two bridges and will agree to superintend their construction for $38,000. When the designs are completed bids for the structures will be advertised for. The trustees propose to issue bonds up to the 1898 limit. They have authority to issue $190,000 more in bonds this year and it has been practically agreed by the committee to make the issue, according to reports.

MINNEAPOLIS, MINN.—Bids are asked until Dec. 9 for furnishing iron and steel work f. o. b. cars Minneapolis, for widening the stone arch bridge over the East channel of the Mississippi River; surety $1,000. F. W. Cappelen, Cy. Engr.; L. A. Lydiard, Cy. Clk.

ONSLOW, IA.—Bids are asked until Dec. 6 for constructing a steel bridge over the Maquoketa River in Washington township, according to reports. F. J. Sokol, Chn. Com.

GRAND ISLAND, NEB.—The county surveyor has measured the distance across the Platte River south of this city with a view to constructing a bridge between Hall and Hamilton counties. The bridges over the four streams will have to be about 300, 400, 600 and 700 ft. long, respectively.

FORT SCOTT, KAN.—Bids are asked until Dec. 9 for furnishing and constructing the stone work, excavation and fill for a bridge in Osage township. H. Frankenburg, County Clk.

MILAN, MO.—Bids are asked until Dec. 6 for constructing a combination bridge over Yellow Creek, Morris township, and for a combination township line, according to reports. Chas. W. Reeves, County Surveyor.

SARCOXIE, MO.—Bids are asked until Dec. 5 for furnishing the material and constructing a stone bridge on Center St. A. T. Houghton, Cy. Clk.

FOLSOM, CAL.—We are informed that plans have been prepared for repair of three bridges on the county road near this place, Sacramento county, and the construction of an alternate roadway, hillside work, at the same locality; estimated cost, $3,000. J. C. Boyd, Engr., Sacramento, Cal.

OAKLAND, CAL.—The board of supervisors awarded a contract Nov. 17 to Cotton Bros., at $92,500, for constructing the Webster St. bridge.

REDBLUFF, CAL.—We are informed that a contract has been awarded to the Pacific Construction Co., at about $20,488, for the construction of three bridges. Wm. F. Luning, County Surveyor.

WALNUT GROVE, CAL.—We are informed that J. C. Boyd, Sacramento, Cal., has been instructed to prepare plans for a draw bridge near this place.

CHATHAM, ONT.—Owen McKay, Ch. Engr., Lake Erie & Detroit River Ry Co., Walkerville, Ont., writes us that a contract for the substructure of the new bridge on the Erie & Huron Ry. Division, over the Thames River, has been awarded to the Engineering Contract Co., New York, N. Y. It will consist of two abutments and three piers built of concrete masonry on pile foundation. The superstructure will consist of two girder spans each 75 ft. in length and a draw span of 278 ft.; estimated cost, $25,000. Benjamin Douglass, Engr., Detroit, Mich.

PORTAGE DU FORT, QUE.—Reports state that the span between the piers of the Ontario end of the bridge crossing the Ottawa River at this place has been destroyed.

NEW WESTMINSTER, B. C.—Reports state that the Great Northern will bridge the Frazer River at this place on the extension of a line to Vancouver.

BUILDINGS.

BOSTON, MASS.—Bids are asked until Dec. 9 for furnishing laundry machinery for the Boston City Hospital; bond, $2,000. A. Shuman, Pres.

MANCHESTER, CONN.—A fire in this city, Nov. 29, destroyed the Cheney block causing an estimated loss of $50,000. W. B. Cheney and Harry Cheney are interested.

AUBURN, N.Y.—J. C. Stout and D. W. Barnes & Son, of Auburn, are reported to have been awarded the contract for the erection of a new 2-story freight house, 180 × 67 ft., at Clark and Washington Sts., for the Lehigh Valley R. R. Co.

BROOKLYN, N. Y.—The following contractors bid for the erection of an idiot pavilion, a nurse's home, two new wings, and alterations to the central top story of the King's County Hospital, Nov. 22; total cost about $150,000: L. A. Burke & Co., 401 West 59th St., New York; P. S. Carlin & Co., 289 4th Ave., New York; B. Gallagher & Son, New York; M. Gibbons & Sons, Brooklyn; F. J. Kelly & Sons, 220 Broadway, New York; Leonard Bros., Brooklyn; Wm. P. McGarry; Newman & Co., 355 Adams St., Brooklyn; Wm. H. Port, Brooklyn; Ryan & McFerran, 106 East 23d St., New York; T. B. Rutan; J. Wagner, New York.

BROOKLYN, N. Y.—Bids are asked by the department of public charities, foot of East 26th St., New York, until Dec. 13, a readvertisement, for the erection of one idiot pavilion, one nurses' home, two new wings and materials and alterations to the central top story of the Kings County Hospital, in this city. L. H. Voss, Arch., 65 De Kalb Ave., Brooklyn.

NEW YORK, N. Y.—Bids are asked by the bureau of yards and docks, Washington, D. C., until Dec. 10, for erecting a storehouse for equipment materials at the Navy Yard, New York. Mordecai T. Endicott, Ch. of Bureau.——Reports state that the Roman Catholic Orphan Asylum has purchased a large site at Fordham Heights and that new buildings will be erected thereon at a cost of about $1,000,000.——Plans have been filed by David R. Todd, 700 West End Ave., for a 6-story brick flat building at the Boulevard and 102d St., to cost $300,000. Archs. Neville & Bagge, 217 West 125th St.; by Emilio Vigna, 338 East 114th St., for a 6-story brick flat building on 92d St., near the Boulevard, to cost $75,000. Archs., Neville & Bagge; by Rosamond Herter, 503 Manhattan Ave., for four 5-story brick flat buildings at 145 to 153 East 54th St., to cost $120,000. Arch., F. W. Herter; by Kate C. Brown, 60 Liberty St., for a 7-story brick flat building on 95th St., near the Boulevard, to cost $90,000. Arch., C. Steinmetz.——The New York Steam Fitting Co., 211 Centre St., was awarded the contract, Nov. 21, for installing a ventilating and heating plant in Public School 164, at $17,147; and the Wells & Newton Co., 235 Eldridge St., for a ventilating, heating and electric lighting plant for Public School 169, at $29,952. Other bidders were: Baldwin Engineering Co., 103 Beekman St.; Frank Dobson, 218 East 42d St.; E. Rutzler, 178 Centre St.; Evans, Almirall & Co., 44 Dey St.; Blake & Williams, 262 Broadway.

NEW YORK, N. Y.—Bids are asked by the board of education at 585 Broadway, until Dec. 5, for alterations, repairs, etc., at Public Schools 79 and 121, Borough of Manhattan.

NORTH TARRYTOWN, N. Y.—The voters have decided to replace the present school building by a new structure, to cost about $50,000.

WHITE LAKE, N. Y.—John E. Gray, of White Lake, has the contract for erecting three new extensions, 32 × 50 ft., 24 × 50 ft., and 24 × 32 ft., to the Arlington Hotel. R. J. Nellis, Owner; Dodge & Morrison, Archs., 41 Wall St., New York.

BRIDGETON, N. J.—Bids are asked until Dec. 12 for erecting a brick and stone county hospital building for the insane. George Reeves, Chn. of Com., Millville, N. J.

ORANGE, N. J.—James Moran & Son, Newark, N. J., were awarded the contract, Nov. 28, for erecting the new 5th Ward school building at $31,991; and Norman S. Kellogg, Newark, for heating and ventilating, at $4,695.

PHILADELPHIA, PA.—Plans are being prepared by Harry Peale, Jr., Harrison Bldg., according to reports, for an 8-story brick, stone and steel building for Walter E. Herring, at 114 North 12th St., to cost about $50,000.——Plans are being prepared for alterations to the St. Paul's Roman Catholic school building on Christian St. Edwin F. Durang, Arch., 1200 Chestnut St.——Preliminary plans are under way for a new public school building to be erected at 8th and Fitzwater Sts. Arch., J. D. Arnschutz, 713 Filbert St.

NORFOLK, VA.—McIlvain, Unkefer & Co., Pittsburg, Pa., were the lowest bidders for the construction (except heating apparatus, etc.) of a new public building at Norfolk, at $171,900; time, 16 months. Twenty-one other bids were received.

BIRMINGHAM, ALA.—Bids will soon be asked, according to reports, for the erection of a new hospital building for the Hillman Hospital at 4th Ave. and 18th St., to cost $30,000. Mrs. J. Morgan Smith, Chn. of Com.

CLEVELAND, O.—Bids are asked by the board of control, City Hall, until Dec. 27, for furnishing the heating and ventilating apparatus and also one horizontal tubular boiler and setting, for the Children's Hospital at the City Infirmary on Scranton Ave. Wm. J. Akers, Director of Charities.

INDIANAPOLIS, IND.—The building of the Indiana Medical College, a department of the University of Indiana, was burned, Nov. 25, causing a reported loss of $40,000; insurance, $50,000.

CHICAGO, ILL.—Reports state that Marshall Field & Co. have plans prepared for a 7-story brick warehouse at Polk and Ellsworth Sts., to cost about $100,000. D. Burnham & Co., Archs., The Rookery.——Bids will soon be asked for erecting a new building, 115 × 90 ft., for the Second Congregational Church at Oak Park, to cost about $30,000. Patton, Fisher & Miller, Archs.——Four apartment buildings will be erected on Congress St., near Albany Ave., to cost about $45,000. Chas. W. Van Keuren, Arch., 84 La Salle St.——The Chicago Canal & Dock Co. expects to erect a 6-story building on Illinois St., near St. Clair St., to cost about $50,000.

EVANSTON, ILL.—Volney W. Foster is said to contemplate the erection of a 3-story building at Evanston, to cost $40,000. Harvey L. Page, Arch., 918 La Salle St.

PEORIA, ILL.—Bids are asked until about Feb. 1 for erecting a 12-room school building, 130 × 82 ft., in the 4th Ward; estimated cost, $40,000. Richardson & Hotchkiss, Archs., Dime Savings Bank Bldg.

SPRINGFIELD, ILL.—Sangamon county has voted to appropriate $100,000 towards remodeling the court house in this city. County Clerk Piper may be addressed.

JANESVILLE, WIS.—The Rock county board of supervisors has voted to erect a new jail building, at a cost of about $25,000. Plans and specifications will be ready in January.

GARNER, IA.—Bids are asked until Dec. 15 for the erection of a brick and stone court house for Hancock county; deposit, $800. H. B. Reed, County Audr., Garner; F. W. Kinney, Arch., Austin, Minn.

FLANDREAU, S. DAK.—Bids are asked until Dec. 15 for the construction of a steam heating plant at the Flandreau Indian Industrial School. W. A. Jones, Comr. of Indian Affairs, Washington, D. C.

KANSAS CITY, MO.—A fire in this city, Nov. 28, damaged the furniture establishment of Robert Keith & Co., at 11th and Grand Aves. Reported loss, $150,000 on the stock and $40,000 on the building.

ST. LOUIS, MO.—Building permits have been granted to the board of education for a 3-story school building at Hogan and Madison Sts., to cost about $69,000; a 2-story building at 4234 St. Louis Ave., to cost about $30,000; and for a building at Billon St. and New Manchester Road, to cost $15,000.

MENA, ARK.—Jos. P. Landes, Chn. of Comrs., informs us that bids are asked until Dec. 1 for the erection of a new court house for Polk county, to cost $8,000. Joseph Heidrick, Arch., Mena.

SEARCY, ARK.—The Galloway Female College building, at this place, was destroyed by fire, Nov. 27; estimated loss, $60,000; insurance, $30,000.

SAN FRANCISCO, CAL.—A fire in this city, Nov. 23, destroyed the Baldwin Hotel, at Market and Powell Sts., owned by E. J. Baldwin; reported loss, about $1,500,000; insurance, $50,000. The formation of a company to rebuild the block is contemplated.

PHOENIX, ARIZ.—We are informed that bids are asked until Jan. 10 for the erection of a capitol building for Arizona, to cost about $100,000; deposit, $5,000. F. H. Parker, Secy. of Bldg. Comn.; Jas. Reily Gordon, Arch., San Antonio, Tex.

BROCKVILLE, ONT.—Reports state that Geo. T. Fulford, of the Pink Pill Co., has let the contract for erecting a new residence, to cost about $75,000.

ST. THOMAS, ONT.—The following bids have been let in connection with the new city hall building: For metal work, A. B. Ormsby & Co., Toronto, $990; for heating, Charles Buell, $2,394; for plumbing, K. J. Allison, Toronto, $1,097. Arch., N. R. Darragh.

TORONTO, ONT.—It is announced that improvements will be made to the Rossin Hotel, to cost about $150,000. J. H. Chewitt, Pres. of Rossin Hotel Co.

WATER-WORKS.

HAMPTON, N. H.—Wm. T. Ross, Engr. Hampton Water-Works Co., it is stated, will make surveys for works at once.

AMESBURY, MASS.—The Powow Hill Water Co. proposes to build a new reservoir. A report states that there is some discussion of the town buying the works, the present contract for supplying water expiring in a few years.

GRANVILLE, MASS.—The question of building works is again being considered.

CHURCHVILLE, N. Y.—The election called for Nov. 23 to issue bonds for works was declared illegal.

DOBB'S FERRY, N. Y.—The question of calling an election to vote on the proposition to build a reservoir at a cost of about $50,000 is being considered.

MONTGOMERY, N. Y.—The Greene County Water Co. has been incorporated with a capital stock of $20,000, by W. H. Cowan and Geo. Keesler, of Montgomery; W. R. Brook, of Almeda, N. Y., and C. A. Crowell, of Stamford, N. Y.

HEMPSTEAD (L. I.), N. Y.—A. R. Hart, W. S. Work and J. N. Williamson have applied for a charter for the Nassau Water Co

JAVA, N. Y.—It is proposed to build works here, according to reports.

STRYKERSVILLE, N. Y.—Tests for a water supply, it is stated, are being made.

NEW YORK, N. Y.—Bids are asked until Dec. 8 for furnishing for Brooklyn cast-iron water pipe, branches and special castings, and for Manhattan two new boilers at the 97th St. boiler house and for taking out four old boilers. Wm. Dalton, Comr. Water Supply, 150 Nassau St.

NORTH TONAWANDA, N. Y.—The aldermen have been petitioned to extend the water mains to the Ironton district.

ORANGE, N. J.—Bids are asked until Dec. 12 for constructing a dam, reservoir, engine, boilers, building, etc., in Millburn township, as described in our advertising columns. John J. Cuddy, Chn. Com.

CONNELLSVILLE, PA.—Press reports state that the question of purchasing the works at this place, owned by the American Water-Works & Guarantee Co., Pittsburg, Pa., will probably soon be voted upon by the people. The opportunity to purchase the works expires this year.

DARBY, PA.—The contest between this place and the Spring Water Co., Swarthmore, Pa., in regard to whether the town may build works will be called in the court in January. Population (1890), 2,972.

PITTSBURG, PA.—The Harman Water Co. and the Springdale Water Co. were incorporated Nov. 28, each with a capital stock of $1,000 of which $100 is paid in. The former company will operate in Harman township and the latter in Springdale township, Allegheny County. Incorporators, John F. Miller, Treas., East Pittsburg, Pa.; C. W. Michael, Pittsburg; J. S. McGinley, Springdale, and C. A. Rowan, Parnassus, Pa.

WEST UNION, W. VA.—Press reports state as follows: On Nov. 17, J. V. Blair, attorney for the town in the water-works case, received notice from J. A. Holley, clerk Supreme Court of Appeals, that the decision of the lower court had been confirmed in that case. This is a victory for those who favor water-works. Bids for building the works to cost about $6,000, were asked for a year ago, at which time G. W. Bland was Mayor. Population, 600.

SPARTANBURG, S. C.—J. M. Connor, it is stated, has been appointed receiver for the Spartanburg Water-Works Co.

GAFFNEY, S. C.—Bids are asked until Jan 3 for building the proposed works, according to reports. Frederick Minshall, Engr., 150 Nassau St., New York. In June, 1897, the Mountain View Land & Water Co. was incorporated to build works; capital stock, $4,500. Chas. M. Smith was interested. A. N. Wood may be addressed.

M'COMB CITY, MISS.—J. Dock Harrell, Cy. Clk., writes us that the Ruemmeli & Seibert Refrigerating Machine Co., St. Louis, Mo., was awarded the contract for building the works at $88,929.

LAKE PROVIDENCE, LA.—An election will be held Dec. 15 to vote on the question of issuing $17,500 in 5% bonds for works and an electric light plant. R. L. Hill may be addressed.

HILL CITY, TENN.—It is stated that the Chattanooga Co., Ltd., Chattanooga, Tenn., is reconsidering the feasibility of building works, the construction to be begun in a short time. It is proposed to bring the water from Stringer's Ridge. The stand pipe will be built on a hill near Vallombrosa. Estimated cost, $25,000. H. C. Beck, of the company, Chattanooga, may be addressed.

GALLATIN, TENN.—Walter G. Fitzpatrick, Jackson, has been engaged to prepare plans for works. The water supply will be from the Cumberland River, with filter, elevated tank and distribution system. J. W. Blackmore, Chn.

FAYETTEVILLE, TENN.—It is reported that W. G. Fitzpatrick, Jackson, Miss., has been awarded the contract for building the proposed works. The supply will be received from Wells Hill four miles distant. Pipe laying, etc., will not begin before next year.

SOMERVILLE, TENN.—Bids are asked until Dec. 15 for furnishing the materials and for constructing the proposed works and electric plant, as stated in our advertising columns. G. C. Morgan, Engr., Chicago; T. B. Yancey, Mayor; E. R. Scruggs, Recdr.

LOUISVILLE, KY.—Bids are asked until Dec. 7 for placing six 6-in. hydrants. T. P. Craig, Secy. Bd. Pub. Wks.

GALLIPOLIS, O.—The trustees of the State Hospital have awarded the following contracts for works at the hospital here: Pumps, Henry R. Worthington, New York, $4,864; air compressors, Ingersoll-Sergeant Drill Co., New York, $785; air lifts, the same, $940; reservoir of 800,000 gallons, Geo. M. Snyder, Columbus, O., $7,998. Dr. H. C. Rutter, Gallipolis, and Geo. McCook, Steubenville, O., are trustees.

YOUNGSTOWN, O.—Press reports state as follows: The trustees on Nov. 22 took the initial steps in a project that will, if indorsed by the people, cost about $250,000 within the next year in securing purer water. The present source of supply is the Mahoning River, into which is drained the sewage of a number of towns together with a considerable portion of the sewage of this city. It is now proposed to acquire certain territory constituting the water shed of Mill Creek, and by a series of connecting storage reservoirs utilize its water hereafter. The proposition for the issuance of bonds for the purpose will be submitted to the voters in April. D. N. Simpkins, Sec., writes us that it is not known when anything will be done. W. S. Hamilton, Supt.

CHEBOYGAN, MICH.—At the election Nov. 8 this place voted to issue $7,000 in bonds for a 3,000,000 gallon air compressor, sinking a 10-in. well, etc., for a better water supply. Estimates, etc., for these improvements are wanted at once. Geo. N. Case, Cy. Clk.

SAGINAW, MICH.—Local papers state that the aldermen have voted to put in five miles of cast-iron water pipe in place of the wooden pipe in the West Side. Alderman Auschutz and Superintendent Weale may be addressed.

BOWEN, ILL.—The question of building works is being considered, according to reports.

ELKHART LAKE, WIS.—At the election Nov. 16 this place voted in favor of issuing $5,000 in bonds for works.

SHEBOYGAN, WIS.—W. D. Cockburn, Supt. City Water Co., writes us that the Nordberg Mfg. Co., Milwaukee, Wis., is building the new 8,000,000 gallon pump.

MARKESAN, WIS.—H. P. Friday writes us that no steps have yet been taken toward securing works, reported last week. Population, 550.

OSAGE, IA.—G. H. Merridith, Cedar Rapids, Ia., has completed plans for works at Osage, to cost $28,000. The works, it is stated, will have a 1,000,000-gallon pump, operated by gasoline, a 250,000-gallon reservoir and an 80,000-gallon tank, set on a steel tower 110 ft. high. There will be $16,000 worth of piping, of which 1,420 ft. will be 10-in., 4,320 ft. 8-in., 17,290 ft. 6-in. and 6,000 ft. 4-in.

DUBUQUE, IA.—C. N. Berg, Mayor, writes us that nothing has been done towards purchasing the works, except to give the Dubuque Water Co. the required six months notice of intention to purchase.

BERMIDJI, MINN.—An election will be held Dec. 6 to vote on the question of issuing $7,000 in bonds for works, according to reports.

CHILLICOTHE, MO.—The pumping station of the Chillicothe Water, Gas & Electric Light Co., it is stated, was partly destroyed by fire Nov. 18.

STANBERRY, MO.—W. A. Erwin, Mayor, writes us that this place has voted to issue $3,000 in bonds for a wooden tank and steel tower for the works.

DENVER, COLO.—We are informed that J. B. Hunter, Cy. Engr., has made a report to the council on the feasibility of constructing new works. The report is now in the hands of the board of public works, whose duty it is to take the initiatory in recommending the issuance of bonds.

LINCOLN, WASH.—The question of building works and an electric light plant is being considered.

NEW WHATCOM, WASH.—J. H. Thomas is reported to have been awarded the contract for constructing a supply main from Lake Whatcom to this city at $19,881.

RITZVILLE, WASH.—The council is reported to have granted a franchise for works and a light plant. The city already has municipal works.

SEATTLE, WASH.—The council on Nov. 23 accepted the bid of Gahan & Byrne, 4209 South Halsted St., Chicago, Ill., for the construction of the Cedar River water-works addition at $1,238,622, according to reports. The following comprise the bid: Certified check, $62,000; constructing headworks on Cedar River, $31,692; constructing pressure pipe from headworks, $812,292; High service reservoir at city park, $113,913; Low service reservoir, Nagle's Addition, $122,656; Metal work for 30 × 60 ft. stand-pipe on Queen Anne Hill, $7,867; concrete work for Queen Anne standpipe, $13,007; pumping main, $34,874; wooden stave and steel pipe line to reservoirs, $16,249; waste pipe from high service reservoir to Lake Union, $5,437; connections of low service reservoir distribution system and Tenth Ave. sewer, $33,161; changing Cedar River channel and connecting with Swan Lake, $47,476.

TACOMA, WASH.—The question of securing an increased water supply from the Maplewood Springs is being considered.

WALLA WALLA, WASH.—The supreme court, Washington, D. C., has affirmed the decision of the district court in Walla Walla against the city's building municipal works. The case has been in the courts since 1893, in which year the city voted to issue $160,000 in bonds for works.

SANTA BARBARA, CAL.—The committee has recommended that the city postpone issuing $50,000 in bonds for extending the works. N. B. Smith and J. B. Wentling are on the committee.

SAUSALITO, CAL.—It is stated that a new water supply will be secured for this city by a company, now being organized, from Lake Lagunitas, belonging to the Marin County Water Co. A. Borel and A. W. Foster, Pres. Marin County Water Co., are interested. John H. Dickinson and A. Sylva, Town Trustees.

WHITTIER, CAL.—Walter E. Butler, Cy. Clk., informs us that bonds were carried at the election on Nov. 22 by a vote of 235 to 33. About $20,875 will be used to buy the wells and the old system, and $19,225 to construct new works. Preliminary plans have been made by Burr Bassell, Los Angeles, Cal.

RENO, NEV.—Bids are asked until Dec. 12 for the purchase of $130,000 of 6% bonds for the proposed works. (Postponement from Nov. 12). F. B. Porter, Clk.

LIVERPOOL, N. S.—The council has decided to build works and an electric light plant at a cost of about $31,000, according to reports. I. V. Dexter may be addressed.

BRANTFORD, ONT.—Fred. W. Frank, Secy. Bd. Water Comrs., writes us that the city may want to purchase in the near future a new 5,000,000-gallon pump and extend the galleries for collecting water from springs. T. Harry Jones, Cy. Engr.

WINNIPEG, MAN.—Mayor Andrews is reported to have received a cablegram from the London owners of the Winnipeg water-works accepting the offer of the city to purchase the works for $237,500.

VANCOUVER, B. C.—Bids are asked until Dec. 14 for furnishing cast-iron water pipe, steel riveted pipe, hydrants, valves, etc., for extending the works, according to reports; estimated cost, about $75,000. Thos. McGuigan and T. H. Tracy, Cy. Engr., may be addressed.

VICTORIA, B. C.—The council is reported to have appropriated $12,000 for extending the water mains in Pandora St.

HAVANA, CUBA.—Jas. B. Clow & Son, Lake and Franklin Sts., Chicago, Ill., have been awarded the contract for furnishing the materials and for extending the water-works in this city at $29,523.

BELEM (PARA), BRAZIL.—Bids are asked until March 15 for the transfer by the government of the state of Para of the exclusive right for 60 years (to be extended under certain conditions for further term of 10 years) to supply Belem, the capital, with potable water. The transfer will include certain lands, machinery, plant and other material in use in the present works or in stock. (Postponement from Nov. 10.) Population, 60,000. Further information may be had on application to the Brazilian Consulates and Vice-Consulates at London, Eng.; at Berlin, Germany; and at Washington, D. C., and 22 State St., New York.

SEWERAGE.

NEW BRITAIN, CONN.—Samuel M. Gray, Providence, R. I., has submitted a report for improving the system of this city. Aug. Voigt, S. H. Stearns and Edgar H. Beach, Comrs.

ALBANY, N. Y.—Bids are asked until Dec. 5 for constructing 15 and 10-in. pipe sewers in two streets. T. J. Lanahan, Clk. Bd. of Contract.

JAMAICA (L. I.), N. Y.—The department of arrears and assessments is to prepare a map for the assessment of this district for the purpose of building a sewage disposal plant to cost about $50,000. About 26 miles of sewers have been built but they cannot be used until the disposal plant is constructed.

SYRACUSE, N. Y.—Bids are asked until Dec. 5 for constructing a 15-inch pipe sewer in Renwick Place from Almond St. to Renwick Ave., a 15-inch pipe sewer in Ulster St. from Avery Ave. to Myrtle St., and a 12-inch pipe sewer in Avery Ave. from Ulster St. to Schuyler St. M. Z. Haven, City Clerk.

PHILADELPHIA, PA.—Bids are asked until Dec. 13 for constructing main and branch sewers, etc. Thos. M. Thompson, Dir.

SCRANTON, PA.—Bids are asked until 7:30 p. m., Dec. 1, for constructing sewers in Section C, Fifth District. M. T. Lavelle, Cy. Clk.

STEELTON, PA.—The construction of a system is proposed, according to reports. H. H. Campbell, Pres. Council, and Councilman Freeland may be addressed.

WILLIAMSPORT, PA.—The committee to which was referred the ordinance for the relief of Grafius Run has decided to report negatively to councils the project to build a 5-ft. sewer in Laurel St. to the river, at a cost of $20,000. Instead it was decided to recommend to build a 10-ft. sewer in Locust St. to the river.

ALEXANDRIA, VA.—The council has directed the mayor to appoint a committee to investigate the question of making changes in the sewers emptying into Hunting Creek, near which the water supply is received.

NEWNAN, GA.—This place is reported to have asked the legislature for permission to build a system.

NEW ORLEANS, LA.—An election will be held to vote on the question of a tax of 2½ mills for a system and other permanent improvements. The system, it is estimated, will cost about $6,000,000. Councilmen Sidney Story, Brittin and Dreyfous may be addressed.

INDEPENDENCE, IA.—It is stated that the council has voted to have plans for a system prepared. A. D. Gurnsey, Cy. Engr.

TOLEDO, O.—The sewer committee of this city is arranging for the construction of a sewer in several streets. L. P. Harris, Cy. Clk.

NEWTON, KAN.—The Newton Improvement Co. is making surveys for extending the system.

ST. LOUIS, MO.—An ordinance authorizing the Rocky Branch Sewer District No. 1 was approved by the Board of Public Improvements Nov. 22. The district is bounded by Natural Bridge Road, Kossuth, Fair and Taylor Aves., and is estimated to cost $37,000.

BISMARCK, N. DAK.—Press reports state that a system will be built in the spring.

INDEPENDENCE, MO.—Bids are asked until Dec. 13 for the purchase of $75,000 in bonds for the proposed system. Population, 8,000. S. H. Woodson, Mayor; S. A. Sullivan, Cy. Clk.; H. H. Pendleton, Cy. Engr.

MACON, MO.—An election will be held Dec. 6 to vote on the question of issuing bonds for a system to cost about $23,000.

LITTLE ROCK, ARK.—Bids are asked until Dec. 12 for the construction of 8,400 ft. of sewers in this city. W. R. Griffith, Secy. of Sewer District No. 25.

CLEBURNE, TEX.—Jack Steele, of Williamson county has been awarded the contract for constructing and maintaining for 50 years, a system for the court house, jail and market place at $5,000.

DENVER, COLO.—Bids are asked by the board of public works until 1 a. m., Dec. 2, for constructing the North Denver sewer; check, $500.——H. C. Lowrie, Engr. Bd. Pub. Wks., writes us that a bill for an ordinance ordering Capitol Hill Storm Sewer District No. 1, to cost about $1,000,000, on plans, etc., previously adopted by the board of public works, was unanimously passed by the Supervisors Nov. 8, and now goes to the Board of Aldermen requiring 12 out of 15 votes. It then must be advertised (for bids) at least 10 days locally. The first letting will be for about $400,000 worth of the work.

SEATTLE, WASH.—The City Engineer is preparing plans and specifications for two sewers. The first is known as the East Republican sewer and is estimated to cost $29,000. The second is known as the East Denny Way system and is to cost about $44,000.

SPOKANE, WASH.—Councilman A. W. McMorrain, of the 4th Ward, is urging the construction of sewers in that ward.

BAKERSFIELD, CAL.—It is proposed to construct a system at a cost of about $100,000.

GRASS VALLEY, CAL.—Bids are asked by the clerk of the board of trustees until Jan. 10 for the purchase of $50,000 of bonds for the proposed system. Mayor Parsons and Trustee Pattison may be addressed.

NEVADA CITY, CAL.—T. H. Carr, Cy. Clk., writes us that the city is taking the first steps towards submitting to the voters the question of issuing bonds for a system.

SAN FRANCISCO, CAL.—The Sunset District Improvement Club has asked the supervisors to build certain sewers in Sunset District at a cost of $35,000.

HULL, QUE.—Press reports state as follows: The Stadacona Water, Light & Power Co., of Montreal, has submitted to the council the following propositions with regard to the construction, maintenance and working of a system for the city: The company asks for a franchise to maintain such a system for 40 years and an exemption of taxation; after 40 years the system to belong to the city. If Hull should desire to purchase the system before that time the company would be willing to turn it over provided the city pay an additional cost of 20%. If the corporation is willing to adopt the proposition the work can be completed before Dec. 1, 1899.

HONOLULU, H. I.—It is stated that bids for $500,000 of Hawaiian Government bonds, authorized by the last legislature for the purpose of making public improvements, were recently opened. It was expected that the amount would be subscribed for, but the event proved otherwise. There were bids for less than $200,000 worth. All of these were at par or higher, however, and it is believed that the whole amount can be yet disposed of. W. G. Irwin bought $100,000 worth. The government is anxious to proceed with the sewerage and drainage systems of Honolulu, which was authorized by the last legislature. Plans for it have already been made. The entire cost will be about $250,000.

CALLAO, PERU, S. AM.—Bids are asked by the municipal council until Jan. 15 for furnishing the materials and for constructing the proposed system. The system will consist of 4,819 ft. of main sewer, 5,945 ft. of secondary sewers, and 35,642 ft. of drains; also a cast-iron outlet pipe into the sea and a number of inspection wells, etc. The estimated cost is $126,042. It must be completed within three years. A bonus will be given for earlier completion, and a fine incurred if the stipulated period be exceeded. Materials for construction will be admitted into the country duty free. We are informed that the work is to be paid for in three annual instalments, secured secondary upon the whole revenue of the city, and primarily upon the proceeds from the new sewerage tax, which is estimated as producing about $30,000. Plans and specifications, in Spanish, may be seen at the office of the National Association of Manufacturers, The Bourse, Philadelphia, Pa.

GARBAGE DISPOSAL—STREET CLEANING

NEW YORK, N. Y.—Bids are asked until Dec. 9 for the removal of snow and ice from the streets, avenues and public places in Manhattan and Bronx and the unloading and discharge of same at the several dumps or other places, designated by the commissioner of street cleaning, during the period between the date of execution and April 15. F. M. Gibson, Deputy Comr. of Street Cleaning, 346 Broadway, Manhattan.

CAMDEN, N. J.—M. V. Blackwell has contracted to haul all garbage from the crematory here to a place in Pensanken township at $6.00 per week.

ERIE, PA.—The American Reduction Co. has made a proposition to this city for the erection and equipment of a garbage plant. Kraft & Walther also submitted one in regard to entering into an extensive contract for the collection of its garbage.

SAVANNAH, GA.—Commissioner of Public Works Wilink, it is stated, has asked that an appropriation of $46,248 for a new crematory, $63,714 for the street department, $26,873 for the scavenger department and $8,420 for an odorless excavating machine, be made for next year.

CLEVELAND, O.—Bids are asked until Dec. 7 for clearing the catchbasins in the city for one year. Geo. R. Warden, Dir. Pub. Wks.——No bids were received by the board of control Nov. 21 for street cleaning. New specifications are to be received at once and new bids asked.

SAN FRANCISCO, CAL.—Reports state that the garbage from this city will be taken into San Mateo county and consumed by the California Reduction Works.

STREETS AND ROADS

CHATHAM, MASS.—At the town meeting, Nov. 21, it was voted to appropriate $20,000 for the improvement of roads and for the purchase of a stone crushing plant.

SHARON, MASS.—The town board has voted to appropriate $2,000 for road work.

ROCHESTER, N. Y.—Edwin A. Fisher has about completed plans for the paving and sewering of South Fitzhugh St. from West Main to Spring St., estimated cost, $11,000. Bids will be asked some time next week, according to reports.

BUFFALO, N. Y.—Bids are asked by the park commissioners until Dec. 1 for repairing and maintaining about 132,347 sq. yds. of asphalt pavement, for five years.

SYRACUSE, N. Y.—A contract for paving Seymour St., from Oswego to South Geddes Sts., has been awarded to the Asphaltina Construction Co. at $19,459.

ONEIDA, N. Y.—A proposition is before the village trustees to pave Main St., from Lenox Ave. to Seneca Ave., to have a 42-ft. roadway, to cost about $60,000.

HOBOKEN, N. J.—The council has awarded a contract to the Utica Asphalt Co., at $13,008, for paving on Fifth St. and Park Ave., and to the New Jersey Mexican Asphalt Co., at $10,262, for paving on three streets.

HOBOKEN, N. J.—Bids are asked until Dec. 21 for the improvement of Court St. between Ferry and Seventh Sts. M. V. McDermott, Cy. Clk.

OAKLAND, N. J.—A special election will be held Dec. 6 in Franklin township to vote upon the question of bonding the township for $75,000 for the construction of macadam roads.

ANNAPOLIS, MD.—Bids are asked until Dec. 3 for building shell roads. Alton R. Arnold, Road Comr.

BALTIMORE, MD.—Chas. E. Wright, Councilman, has introduced an ordinance to pave O'Donnell St. with sheet asphalt, between Boston and Pautuxent Sts., at a cost of $22,000, and from Pautuxent St. to the eastern city limits, to cost $25,000.——An ordinance to pave Bush St. and appropriate $20,000 for the work has been approved by the board of estimate.

BALTIMORE, MD.—The council committee on highways has favorably reported the measure for paving with sheet asphalt and binder, Gough St. from Broadway to Patterson Park; the present cobblestone surface to be used as a base instead of concrete; estimated cost, $20,000.

JACKSONVILLE, FLA.—Bids are asked by the board of public works until Dec. 15 for furnishing and constructing about 22,000 sq. yds. of brick paving or about 1,250,000 brick, curbing and constructing sidewalks on Main St., for a distance of 4,290 ft.

NEW ORLEANS, LA.—The Belden & Seely Asphalt Paving Co. has been awarded a contract for paving Canal St. The itemized bids were given in our issue of Oct. 20.

CARLISLE, KY.—Geo. R. Martin, County Surveyor, writes us that no steps have yet been taken to award contracts for constructing pike roads, for which $40,000 was authorized Nov. 8. John W. Henry, County Road Comr.

LOUISVILLE, KY.—Bids are asked until noon Dec. 2 for grading, curbing and asphalt paving on portions of 11 streets. Chas F. Grainger, Bd. Pub. Wks.

BOWLING GREEN, KY.—The Warren County fiscal court has adopted a resolution providing for the purchase of the pikes of the county, from the stockholders, by Dec. 10. The roads will cost about $80.000.

BRIDGEPORT, O.—John A. Fawcett, Village Clk., writes us that the village will in the spring lay about $60,000 worth of paving. There will be about two miles of paving to be laid on old macadam. The necessary curbing including about three miles of old curb to be reset, will be put down this winter. Engrs., Hoge & Hicks, Wheeling.

CINCINNATI, O.—Bids are asked until Dec. 6 for brick paving on Marquis Ave. and until Dec. 20 for macadamizing on Paradrome St. Geo. H. Spellmire, Clk. Bd.

TOLEDO, O.—The council has awarded a contract to Geo. H. Bodette, at $4,740, for paving on Eastern Ave. with Nelsonville blocks and to W. J. & J. J. McMahon, at $2,832, for paving 21st St. with Buckeye blocks.

DECATUR, IND.—Bids are asked until Jan. 5 for constructing about 17½ miles of macadam roads in Washington township. We are informed that the work will be let in three separate contracts. W. E. Fulk, County Surveyor.

HAMILTON, O.—Bids are asked until Dec. 19 for paving Second St., from Central Ave. to Black St., with asphalt or brick. M. O. Burns, Cy. Clk.

ST. JOSEPH, MO.—The question of paving Clinton Ave. for three blocks, at a cost of about $10,000, is being considered by the council. F. A. Travis, Mayor.

BRAZIL, IND.—Bids are asked until Dec. 14 for constructing about 19 miles of gravel roads in Brazil, Jackson and Posey townships. Geo. Siegelin, County Comr.; Thos. Philips, Audr.

QUINCY, ILL. — The bids received Nov. 22 for constructing the proposed Missouri Road; estimated cost, $12,000, have been rejected on account of being too high. F. A. Grover, County Engr.—The board of local improvements has decided to construct about eight miles of paving next year, on portions of 20 streets.

TERRE HAUTE, IND.—The county commissioners awarded a contract Nov. 22 to W. C. Dorsey, Terre Haute, at $37,555, for constructing 16 miles of gravel roads in Nevins township and to Joseph E. Hart, Vevay, Ind., at $29,000 for 14 miles of gravel roads in Linton township.

GRINNELL, IA.—The question of paving the principal business streets is being considered.

BEAUMONT, TEX.—Bids are asked until Dec. 15 for paving portions of Travis, Crockett and Pearl Sts., about 12,000 sq. yds., with brick, asphalt and creosoted blocks, on 6-in. concrete foundation. D. P. Wheat, Mayor. L. E. Beadle, Engr.

AUBURN, CAL.—County Supervisors Hayford and Mariner have been appointed a committee to investigate the cost of purchasing a traction engine and rock crusher.

SACRAMENTO, CAL.—J. C. Boyd, County Surv., writes us that he has prepared plans for the macadamizing of 15,000 sq. yds. at an estimated cost of $7,000; including the grading of a roadway 50 ft. wide, constructing drains, and macadamizing a central strip 16 ft. wide by 8 ins. deep.

SAN RAFAEL, CAL.—Bids are asked until Dec. 5 for macadamizing. Geo. L. Richardson, St. Supt.

MANUFACTURING PLANTS.

EAST CAMBRIDGE, MASS.—A fire, Nov. 21, destroyed the pork packing establishment of John P. Squire & Co.: loss, $80,000.

NORWICH, CONN.—It is reported that J. B. Martin & Co., silk manufacturers, Lyons, France, will establish a branch factory at this place.

BROOKLYN, N. Y.—Reports state that the Kings County Refrigerating Co. will erect a 7-story cold storage warehouse and refrigerating plant, costing about $200,000, on Hall St., near Flushing Ave. Robert Hewitt, Ethan Allen Doty, Jas. J. Phelan, Allen F. Cook and Edward L. Nicoll are said to be interested.

COXSACKIE, N. Y.—It is reported that a new collar and shirt manufacturing company will erect a factory here; capital, $25,000. Edward J. Miller and William P. Hall, of Troy, and E. W. Williams and Thos. F. Gary, of Hoosick Falls, N. Y., are interested.

TROY, N. Y.—Enigh & Lobdell, of this city, according to reports, will erect a 5-story stone factory building, 90 x 110 ft., on Center Island, Green Island, to cost from $40,000 to $50,000.

UTICA, N. Y.—The Capron Knitting Mill Co., of New Hartford, N. Y., contemplates erecting a 4-story brick mill on Whitesboro St.

HOBOKEN, N. J.—Lehmann & Raudnitz will erect a large factory building at Ferry St. and Willow Ave., according to reports.

ELWOOD CITY, PA.—Reports state that L. F. Smith and S. H. Marks, Beaver, Pa., will erect a glass factory here. ——The American Weldless Tube Co. contemplates the erection of a billet piercing plant at this place or Greenville, Pa.

PHILADELPHIA, PA.—The Baldwin Locomotive Works, at 15th and Hamilton Sts., are said to be receiving bids for a 2-story brick and iron building, 100 × 170 ft.

PITTSBURG, PA.—Jones & Laughlins, according to report, will make extensive improvements to their plant at Brownstown. Willis L. King, Gen. Mgr.

READING, PA.—The Cold Storage Co., according to reports, will erect a plant on 9th St., near South St.

BALTIMORE, MD.—The Carr-Lowrey Glass Co., of Baltimore, informs us that it is receiving bids for the construction of a new plant, but have done nothing as yet towards awarding contracts. Jackson C. Scott, Arch., Baltimore.

CLARKSBURG, W. VA.—The Consumers' Ice Co. will erect a refrigerating plant, costing about $15,000, at this place. F. M. Staunton, Charleston, W. Va., and Camden Thompson, Huntington, W. Va., are interested.

FLORENCE, ALA.—Eugene Zimmerman, Cincinnati, O., and B. F. Nichols, Bessemer, Ala., are reported to have purchased the Philadelphia furnace at this place; work will begin soon.

COLUMBUS, O.—The Wolfe Bros. Shoe Co., of this city, has increased its capital stock from $150,000 to $200,000, in order to enlarge its factory. R. F. Wolfe, Pres.; H. P. Wolfe, Secy.

SALEM, O.—Plans have been completed for a $40,000 pottery. Morris French, Cy. Engr., may be addressed.

NILES, O.—The Thomas Furnace Co. has been reorganized with a capital of $100,000 by J. M. Thomas, Patrick Sheehan and others. It is said that the old Thomas plant will be enlarged.

ANDERSON, IND.—Reports state that the American Plate Glass Co. has appropriated $100,000 for erecting additions to its plant.

INDIANAPOLIS, IND.—T. B. Laycock has let the contract for the erection of a 5-story brick and stone building, 135 × 195 ft., on St. Clair St., to cost between $30,000 and $35,000. Thos. A. Winterwood, Arch.

NEW ALBANY, IND.—Reports state that the New Albany Mfg. Co. contemplates enlarging its plant.

MONROE, MICH.—It is reported that a $500,000 beet-sugar plant will be erected here. Prof. E. Salick, of Chicago, is interested.

ODESSA, MICH.—A. C. Hager will erect a 4-story cold storage building, 36 × 60 ft., a 1-story machine and boiler house, 36 × 44 ft., to cost about $15,000. Fred. W. Wolf Co., Archs., Chicago, Ill.

CHICAGO, ILL.—Reports state that Armour & Co. are about to erect a 7-story brick warehouse, to cost $100,000, and a fertilizing plant, to cost $35,000.——Fire here Nov. 24, destroyed the 6-story soap factory building of the Allen B. Wrisley Co., at 479-485 Fourth Ave.

ASHLAND, WIS.—O'Keefe & Orbison, of Appleton, Wis., have been awarded the contract for the erection of a paper mill at this place.

MILWAUKEE, WIS.—Reports state that the Kieckhefer Bros. Co. will erect a series of 5-story buildings, on St. Paul Ave., to cost about $150,000. Ferdinand Kieckhefer, Pres.

OCONTO, WIS.—A fire here Nov. 24, destroyed the planing mills of the Citizens' Electric Light & Fuel Co.; loss, $50,000; insurance, $18,000.

RACINE, WIS.—The plant of the Belle City Malleable Iron Works was destroyed by fire Nov. 22; loss, $100,000; insurance, $40,000.

WAUKESHA, WIS.—W. M. Gleeson, according to reports, states that $15,000 of the $25,000 necessary for the location of a threshing machine factory has been subscribed.

DES MOINES, IA.—It is stated that William Tarkington, of Chicago, Ill., contemplates the organization of a company at this place for the purpose of rolling steel and wrought iron.

DUBUQUE, IA.—The Scriber & Couchar Co., according to reports, will erect a foundry at this place.

COLORADO SPRINGS, COLO.—A fire Nov. 20 destroyed the boiler-house and erection-house of the Colorado Midland R. R.; loss, $25,000.

ROCKLAND, TEX.—William Cameron & Co., whose plant was destroyed by fire, will erect a new building, 240 × 120 ft.

TACOMA, WASH.—Reports state that the London Exploration Co. will invest $300,000 in enlarging the Tacoma smelter. D. O. Mills, of New York, is interested.

PINOLE, CAL.—A fire, Nov. 29, destroyed several buildings of the California Powder Co., causing a reported loss of $25,000. They will probably be rebuilt.

SACRAMENTO, CAL.—The shops of the Southern Pacific Co., recently destroyed by fire, will be rebuilt, according to reports.

WOODSTOCK, N. B.—H. P. Baird, of this city, informs us that the company has not yet been organized for erecting the new pulp mill. Capital is being sought principally from among the owners of paper mills. Experts say that this is a good location for the manufacture of pulp at a low cost.

TORONTO, ONT.—Reports state that a company with a capital of $400,000 is being organized by the Roger Brown Co., of Tonawanda, N. Y., to erect a plant at this place. J. G. Miller, Mgr., of Buffalo, N. Y.

ST. PETERSBURG, RUSSIA.—Bids are asked by the Naval Attache, Imperial Russian Embassy, D. T. Mertvago, 818 18th St., N. W., Washington, D. C., until Dec. 12, for furnishing the set of machinery, and putting it in place complete, for rolling the armor plates, near St. Petersburg. Steam pressure of 7½ atmospheres is ready, and the engine to be used should be of the reversing type. The length of the rolling cylinders should be 4,000 mm., and the maximum weight of ingot to be rolled, 60 tons, with maximum thickness of 900 mm. The rolling machinery must be provided with two regenerative furnaces, each with movable bottoms, but the furnaces themselves are proposed to be built by local means, as stated in our advertising columns.

GAS PLANTS.

BAYONNE, N. J.—It is stated that the United Gas & Improvement Co., of Jersey City, will lay a new pipe line from Lafayette, N. J., to this place.

TOLEDO, O.—Reports state that Thacher & Shirey will lay the 24-in. pipe under the Maumee River for the Toledo Gas Light & Coke Co.

CONVERSE, IND.—Reports state that the Converse Natural Gas & Pipe Line Co. has sold its system to S. S. Murdock, Gen. Mgr. Logansport & Wabash Valley Gas Co.

SPRINGFIELD, ILL.—The Provident Gas Co., according to reports, will erect a plant here. F. W. Tracy, R. D. Lawrence and Stuart Brown may be addressed.

NEW COMPANIES.—Elmira Light, Heat & Power Co., Elmira, N. Y.; $10,000; to produce natural gas. John B. Rathbone, Howard H. Hallock, John A. Reynolds, Thomas S. Flood and Chas. B. Swartwood, Elmira.

Toledo Co-operative Oil Co., Toledo, O.; $12,500.

MISCELLANEOUS CONTRACTS.

TELEPHONE FRANCHISE.—Janesville, Wis.—The council granted a franchise to the Rock County Telephone Co. Nov. 21.

FIRE ALARM SYSTEM.—Philadelphia, Pa.—The council has appropriated $8,000 for the extension of the fire alarm system.

TELEPHONE FRANCHISE.—Doylestown, Pa.—The Standard Telephone Co. has been granted a franchise in this town, according to reports.

REVETMENT.—Toledo, O.—The harbormaster has been authorized to advertise for bids for the revetment work on Ash St., according to reports.

STONE.—Toronto, Ont.—Bids are asked until Dec. 5 for furnishing 75 to 100 toise of stone, at the house of industry. John Shaw, Chn. Bd. Control.

TELEPHONE FRANCHISE.—Plymouth, O.—The Norwalk Telephone Co. has been granted a franchise and will construct an independent exchange.

ELECTRIC HOISTS.—Cripple Creek, Colo.—It is stated that the demand for electric hoists in the Cripple Creek mining district exceeds the supply.

DOCK SALE.—Havana, Cuba.—Bids are asked by the Spanish Admiralty until Dec. 8 for the purchase or lease of the floating dry-dock at this place.

TIMBER BULKHEADS.—Boston, Mass.—Bids are asked until Dec. 7 for constructing timber bulkheads on Summer St. extension. Wm. Jackson, Cy. Engr.

TELEPHONE FRANCHISE.—Long Branch, N. J.—The New York & New Jersey Telephone Co. obtained a franchise Nov. 21 and will lay underground conduits.

BREAKWATER.—London, Ont.—At a meeting of the council Nov. 22 a proposition to construct a breakwater at London West, to cost $75,000, resulted in a tie vote.

SULPHATE OF COPPER.—La Rochelle, France.—Information is wanted by C. Lefort, 10 Cours des Dames, La Rochelle, for furnishing sulphate of copper, according to reports.

DRAIN.—Burlington, Ia.—Bids will soon be asked for the construction of a drain about 8,300 ft. long in Louisa and Des Moines counties. M. P. Sharts, County Audr., Burlington.

CONDUIT.—Syracuse, N. Y.—Manager Nicholson of the Central New York Telephone Co. is reported as arranging for the removal of the telephone wires from the poles to the subway.

TELEPHONE SYSTEM.—Peoria, Ill.—Reports state that the Citizens' Telephone Co. was receiving bids Nov. 18 for the construction of a system. Manager Farwell may be addressed.

REPAIRING STEAMBOAT.—New York, N. Y.—Bids are asked until Dec. 7 for repairs of the steamboat "Franklin Edson." M. C. Murphy, Comr. Dept. of Health, Criminal Court Bldg.

STERILIZING APPARATUS.—New Haven, Conn.—Bids are asked until Dec. 10 for constructing a sterilizing apparatus. Ward Bailey, Clk. Bd. Health, 12 Police Bldg.

CANAL SALE.—Annapolis, Md.—Bids are asked until Feb. 7 for the purchase of the state's interest in the Chesapeake & Ohio Canal; bond for $100,000. Richard Dallam, Secy. of State, Annapolis.

CANAL.—Port Arthur, Tex.—The supreme court has granted the Kansas City, Pittsburg & Gulf R. R. Co. the right to complete the Port Arthur ship canal between Port Arthur and Sabine Pass.

TELEPHONE WORK.—Moline, Ill.—The Central Union Telephone Co. proposes to expend from $35,000 to $40,000 in reconstructing its lines, switchboards, etc., in Moline, Rock Island, Ill., and Davenport, Ia.

SUBWAY.—Harrisburg, Pa.—The council is considering a proposition to construct a subway under the Pennsylvania R. R. and Philadelphia & Reading Ry. at Market St., to cost about $100,000. M. B. Cowden, Cy. Engr.

TELEPHONE SYSTEM.—Snow Hill, Md.—Reports state that Dr. Geo. W. Bishop, Clayton J. Purnell, John P. Moore, Thos. M. Purnell, W. S. Powell and others, are organizing the Worcester County Telephone Co.

TELEPHONE FRANCHISE.—Ludington, Mich.—Fuller & Perkins have applied to the council for a franchise to operate in this place. They also propose to extend the system throughout Mason, Oceana and Manistee counties.

TELEPHONE LINE.—Shamokin, Pa.—The North & West Branch Telephone Co. awarded a contract Nov. 22 for the construction of a line between Williamsport, Montoursville and Montgomery, to cost about $100,000. M. H. Kulp, Pres.

PIER AND TUNNEL.—Philadelphia, Pa.—Bids are asked until Dec. 13 for constructing the superstructure of the Chestnut St. pier, and for constructing the Pennsylvania Ave. subway and tunnel. Thos. M. Thompson, Dir. Dept. Pub. Wks.

TUNNEL.—Los Angeles, Cal.—Plans for the proposed Third St. tunnel, 1,059 ft. long and 32 × 20 ft., of brick and cement; estimated cost, $100,000; were submitted to the council Nov. 21, according to reports. J. H. Dockweiler, Cy. Engr.

CEMENT AND GRAVEL.—Fort Morgan, Ala.—Bids are asked until Dec. 23 for furnishing hydraulic Portland cement and gravel at Fort Morgan, as stated in our advertising columns. Maj. Wm. T. Rossell, U. S. Engr., Mobile, Ala.

PARK WORK.—Buena Vista Springs, Md.—Reports state that W. W. Patterson, Philadelphia, Pa., and the Western Maryland R. R. Co. propose to expend about $25,000 for the construction of a lake and drives near this place for a summer resort.

TUNNEL.—Boston, Mass.—Bids are asked until Dec. 13 for constructing section A of the East Boston tunnel, consisting of about 139 ft. of open incline and 233 ft. of two-track subway. Geo. G. Crocker, Chn.; H. A. Carson, Ch. Engr., Boston Transit Comn.

PIER WORK.—New York, N. Y.—A hearing will be given by the New York Harbor Line Board Dec. 7 for the proposed modification of the pier head line between 31st and 54th Sts., East River, as stated in our advertising columns. Col. Henry M. Robert, U. S. Engr., Pres.

TELEPHONE WORK.—Springfield, O.—The Central Union Telephone Co. will construct a system of underground conduits in the fire district, bounded by Spring, Columbia, Mechanic and Washington Sts. L. G. Richardson, Gen. Solicitor; E. M. Jackson, Engr.

STEEL WORK.—Pago Pago, Samoa.—Reports state that the Carnegie Steel Co., Pittsburg, Pa., has been awarded a contract to furnish the steel work for the U. S. coaling station, to be 150 × 100 ft., for which the contract for the construction was awarded Sept. 13 to Healy, Tibbits & Co., San Francisco, Cal.

PARK WORK.—New York, N. Y.—Bids are asked until Dec. 8 for furnishing 500 cu. yds. of blue limestone screenings, 12,000 cu. yds. of top soil, 800 cu. yds. of gravel screenings and for constructing an iron fence 4,100 ft. long, at Prospect Park, Brooklyn. Geo. C. Clausen, Comr. Parks, Arsenal, Central Park.

LEVEE.—East St. Louis, Ill.—A levee is to be constructed along the banks of the Mississippi River in the northern portion of Prairie du Pont township. A dike will be built 30 ft. high, beginning at Forest Lawn, 4 miles from East St. Louis, to cost about $75,000. Edward Kehr, Julius Pitzman, Adam Karr and others, of St. Louis, Mo., are interested.

PARK SYSTEM.—Chicago, Ill.—A resolution has been presented to the West Park board by S. D. Attridge, of Cicero, and C. W. Juergens and W. F. Quick, of Riverforest, authorizing the committee on public grounds to confer with the West Park board and the village boards of River forest, Harlem, Maywood and Riverside, for the laying out of a combined park system.

CRANE.—Port Royal, S. C.—The following bids were received by the navy department, Washington, D. C., Nov. 26 for furnishing a crane for the naval station:

E. M. Bailey & Co., Charleston, S. C.	$12,500
Wm. Sellers & Co., Philadelphia, Pa.	42,368
Morgan Engineering Co., Alliance, O.	49,687
American Hoist & Derrick Co., St. Paul, Minn.	39,950
Brown Hoisting & Conveying Co., Cleveland, O.	44,500

MACHINERY AND TOOLS.—Washington, D. C.—Bids are asked until Dec. 6 for the following machinery and tools at the navy yard: One combination hand and power feed surfacing machine; one pedestal tenoning machine; two wood-turning lathes, each to swing about 24 ins.; one universal horizontal drilling and boring machine; one 24-in. screw-cutting engine lathe, with 8-ft. bed; one 18-in. screw-cutting engine lathe, 20-ft. bed. Edwin Stewart, Paymaster-General.

RAILWAY EQUIPMENT.—New York, N. Y.—Reports state that the New York Central R. R. Co. is about to award a contract for 5,000 freight cars and proposes to purchase from 30 to 50 new locomotives.——The Seaboard Air Line is considering the question of purchasing new equipment.——The Northern Pacific Ry. Co. will order new passenger cars.——The Oregon Short Line R. R. Co. will order about 10 passenger cars.——The Chicago & West Michigan Ry. Co. is in the market for 100 flat cars.

REMOVING WRECK.—Portchester, N. Y.—The following bids for removing wreck were received Nov. 28 by Maj. H. M. Adams, U. S. Engr., Army Bldg., New York:—

C. W. Johnston, Lewes, Del.	$359
Lynton S. McNeal, Brooklyn, N. Y.	450
Virden & Ross, Lewes, Del.	395
Enoch Townsend, Linwood, N. J.	700
John F. Baxter, New York	185
Merritt & Chapman Derrick & Wrckg Co., New York	150
R. G. & J. S. Packard, New York	500
William Weil, New York	640
H. D. Pausch, Port Chester	425

MACHINERY AND TOOLS.—Portsmouth, N. H.—Bids are asked until Dec. 6 for furnishing the following machinery and tools, at the navy yard: One bolt cutter; one shaping machine, with planes 16 ins. long and 17 ins. wide; one universal brass lathe, Fox type; one 4-in. pipe machine; one engine lathe, 24 ft. long; one full universal radial drill; two 21-in. manufacturer's wheel and lever drills; six combination chucks; one self-acting planing machine; one No. 6a universal trimmer; one universal trimmer, bed 40 ins. long, 21 ins. wide, with one extra set of knives; one No. 3 combined rip and cross-cut saw. Edwin Stewart, Paymaster-General, Washington, D. C.

MACHINERY AND TOOLS.—Brooklyn, N. Y.—Bids are asked until Dec. 6 for furnishing the following machinery and tools at the navy yard: One horizontal boring and drilling machine, 10 ft. long; one 15-in. pillar shaper; one 16-in. screw-cutting engine lathe; one screw machine; one wet tool grinder; one 72-in. universal radial drill machine; one 24-in. swing wood turning lathe; one twist drill grinder; one hydraulic copper pipe bender; 20 dudgeon hydraulic jacks, from 4 to 30 tons; one vertical milling machine; one combined cutting-off lathe and nut and bolt head facing machine; one vertical wood-boring machine; one machine for threading and cutting off steam and gas pipes with lever; one pipe threading and cutting machine. Edwin Stewart, Paymaster-General, Washington, D. C.

BOILERS, MACHINERY, ETC.—Detroit, Mich.—We are informed that the following bids were received Nov. 21 for furnishing the boilers, machinery, etc., for four complete steam fog signals, advertised in Engineering News, Nov. 24; bid of Optenberg & Sonneman recommended for acceptance; Thomson Kingsford put in an alternative bid of $1,603; Lieut.-Col. M. B. Adams, U. S. Engr., Detroit:

Bidder.	Boilers with engines complete.	Boilers with attachments for use With Crosby machine.	Boilers with attachments for use With siren machin'ry
Optenberg & Sonneman, Sheboygan	$2,266	$1,816	$1,726
Fulton Iron & Eng. Works, Detroit	2,398	1,705	1,603
John P. McGuire, Cleveland, O.	2,500	2,100	1,950
D. Connelly, Cleveland, O.	2,596	1,910	1,795
Thomson Kingsford, Oswego, N. Y.	.....	.....	1,813

CONTRACT PRICES.

WATER PIPE, VALVES, ETC.—Niagara Falls, N. Y.—Our correspondent informs us that the following contracts were let Nov. 22, 1898, for valves, pipes, etc.; the amounts are the lump sums for the work: Lake Shore Foundry Co., Cleveland O.—Pipe, 6-in., 92 tons, $1,460; special castings, 4,828 lbs., $84.49. R. D. Wood & Co., Philadelphia—Valves, ⅝-in., $52.50; valve boxes, ⅝-in., $12.50; hydrants, 13, $551. Labor—W. W. Read & Co., Niagara Falls, laying 5,600 ft. 6-in. pipe, $952; setting ⅝-in., valves and boxes, . . . setting 13 hydrants, $13; rock excavation, 20 cu. yds., $50.

FORTIFICATION SUPPLIES.—St. Augustine, Fla.—We are informed that the following bids were received Nov. 21, 1898, for furnishing materials on (A) Mullet and Egmont Keys, and (B) at Tampa, Fla.; as advertised in Engineering News: (1) Portland cement, (2) rock, (3) I-beams, etc., (4) trolley systems, (5) anchor bolts, (6) ammunition hoists, (7) ammunition cranes: New Jersey Foundry & Machine Co., Havemeyer Bldg., New York, (A—3) 1.96 cts.; (4) Egmont Key, $953; Mullet Key, $1,736; (A—5) 3.54 cts., (6) $1,024, (7) $94.50; Dallett & Co., 201 Walnut Place, Philadelphia (B—3) 2.53 cts., (B—5) 7.88 cts.; Stewart Contracting Co., Columbia, S. C. (A—2) flagstone, $2.55; granite, $2.99. Southern Lumber & Supply Co., Tampa (B—1) $2.75; T. C. Gill & Co., Philadelphia (A—5) 3.22 cts., (B) 2.95 cts.; Carnegie Steel Co., Pittsburg (A—3) 1.78 cts., (B) 1.73 cts.; Phillips & Fuller, Tampa, Fla. (A—1) $2.59; Wm. F. Bowe, Augusta, Ga. (B—2) $4.96; George Wolff, New York (A—1) $2.79, (B) $2.79; Southeastern Lime & Cement Co., Charleston, S. C. (A—1) $2.62, (B) $2.32; Atlas Cement Co., 143 Liberty St., New York (A—1) $2.70, (B) $2.50; E. M. Bailey Co., Charleston, S. C. (A—1) $1.00 (B) 99 cts., (A—2) 26½ cts., (B) 25 cts; (A and B—3) $1.85 each, (A and B—4) $4.75 each; (A and B—5) $1.85 each; (6) $5.21, (7) $240; Brown Hoisting & Conveying Machine Co., Cleveland, O. (A—4) $1,200, (B) $1,876; Commercial Wood & Cement Co., 156 5th Ave., New York (A—1) $2.85; Alpha Portland Cement Co., The Bourse, Philadelphia (A—1) $2.34, (B) $2.44; W. C. Spotswood (A—2) $4.95.

BRIDGE FOUNDATION.—Washington, D. C.—A. J. Lakenaw, Ch. Clk., writes us that the following bids were received Nov. 22, 1898, for constructing foundations for bridges across Rock Creek at two avenue extensions; as advertised in Engineering News:

Bidder.	Connecticut Ave. Excavation, 6,500 cu.yds.	Connecticut Ave. Conc'te foundation, 3,000 cu.yds.	Massachusetts Ave. Excavation, 6,000 cu.yds.	Massachusetts Ave. Conc'te masonry, 2,500 c.yds.
J. F. McCabe, Baltimore	$0.65	$6.50	$0.65	$6.50
T. B. Jones & Co., Baltimore.	.85	6.90	.70	6.20
Engineering Con. Co., N. Y.	.45	7.35	.45	7.35
D. F. Mockaber, Washington	.65	7.70	.50	6.60
Cranford Pvg Co., Washington	.55	5.75	.60	5.65
John Jacoby, Wilmington, Del.	.50	6.00	.50	6.00
Lyons Bros., Washington, D.C.	.72	6.50	.67	6.25

BRICK PAVING.—Lancaster, O.—The following bids were received Nov. 16, 1898, for brick paving in West Union St.: C. W. Parido—Curbs, material, 14 cts.; labor, 5 cts.; excavation, 12 cts.; Fultonham block, 40 cts., labor, 17 cts.; Bolen's brown granite, 50 cts., labor, 17 cts.; Buckeye block, 51 cts., labor, 17 cts.; Nelsonville block, 50 cts., labor, 17 cts.; Hallwood block, 50 cts., labor 17 cts.; resetting old curb, a ft., 8 cts.; limestone backing, a ft., 15 cts., labor, 5 cts.; catchbasins, each $20.00, labor, $7; two elbows, $2.50, labor, 25 cts.; sewer pipe, 18 cts., labor, 2 cts. Fricker & Clovert—Curbs, a ft., 10 cts., labor, 10 cts.; excavation, 20 cts., a cu. yd.; Logan block—material 39 cts., labor, 10 cts.; Fultonham block, 43 cts., labor, 10 cts.; Nelsonville block, 50 cts., labor, 10 cts.; resetting old curb, a ft., 10 cts; sewer pipe, 7 cts., labor, 6 cts.; limestone backing, a ft., 30 cts.; 2 catchbasins, $30.00 each, labor, $6.50. James Whissel—Curbs, 10 cts., labor, 15 cts.; excavation, 15 cts.; Nelsonville S. P. Co. block, 44 cts., labor 22½ cts.; resetting old curb, 10 cts.; limestone backing, 15 cts., labor, 10 cts.; catchbasins, each, $17.50; sewer pipe, 15 cts., labor, 20 cts.

STREET CLEANING.—Jersey City, N. J.—The street and water board received bids Nov. 23, 1898, for cleaning streets and removing ashes and garbage. The standard fixed by the chief engineer was for sweeping streets, $11 a mile; sweeping asphalt streets, $8 a mile, and for removing ashes and garbage for the year, $17,000. Thomas Harrington's offer was 91½% of the standard prices, and Henry Byrne, who will get the contract, bid 83% of the standard figures.

DREDGING.—Coos Bay, Ore.—Maj. W. L. Fisk, U. S. Engrs., Portland, Ore., writes us that the following bids were received Nov. 15, 1898, for dredging in Coos Bay, as advertised in Engineering News: Wakefield & Jacobson, Portland, Ore., 29 cts. a cu. yd.; W. N. Concanon, 40 New Montgomery St., San Francisco, Cal., 19⅞ cts.; San Francisco Bridge Co., San Francisco, Cal., 23½ cts.

CONDUITS.—Erie, Pa.—F. Hanlon, Cy. Clk., writes us that the following bids were received Nov. 17, 1898, for extending the conduit system:

Quantities.		B. J. Murphy, Erie.	*Kraft & Walther, Erie.	Mayer Bros., Erie.	G. B. Kelly & Co., Chicago.
Conduit:					
2 or 3 duct	500 lin. ft.	$0.15	$0.105	$0.135	$0.09
4 " 5 "	1,600 "	.135	.095	.09	.09
6 " 8 "	1,200 "	.12	.085	.08	.09
3-in. wrt. i. pipe	1,000 "	.28	.22	.24	.23
Manholes: Class A	1	35.00	34.00	25.00	30.00
Class B	6 each	26.50	24.00	30.00	22.50
Class C	4 "	20.00	11.00	18.00	18.00
Service boxes	2 "	3.00	5.00	4.50	5.00
Total		$1,777	$1,813	$1,791	......

Certain Conduit Equipments.

Bidder.	Price for each. Poles erected 60-ft., 5.	Price for each. Poles erected 50-ft., 15.	Price for each. 10-pin cross-arms Single, 50.	Price for each. 10-pin cross-arms Double, 150.	Tot'l.
*G. B. Kelly & Co.	$20.00	$18.00	$1.25	$1.00	$583
Kraft & Walther	36.00	20.00	1.00	2.00	830

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*Awarded contracts.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—

New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.70 cts.

Chicago—Angle bars, 1.10 cts.; spikes, 1.55 cts. to 1.60 cts.; track bolts, hexagonal, 1.90 cts. to 2.00 cts.; square, 1.80 cts. to 1.90 cts.

RAILS, STEEL—

New York, new, $17.50 to $19.00.

Chicago, new, $20.00 to $24.00; old iron, $12.75 to $13.00; steel, $8.00 to $11.00.

Pittsburg, new $17.50 to $20.00.

STRUCTURAL STEEL—

New York—Beams, 1.35 cts. to 1.45 cts.; channels, 1.35 cts. to 1.45 cts.; tees, 1.45 cts. to 1.50 cts.; angles, 1.20 cts. to 1.25 cts.; rivets, 1.75 to 1.85 cts.

Chicago—Beams, 1.35 cts. to 1.50 cts.; channels, 1.35 cts. to 1.50 cts.; tees, 1.40 cts. to 1.50 cts.; angles, 1.30 cts. to 1.35 cts.

Pittsburg—Beams, 1.20 cts. to 1.30 cts.; channels, 1.20 cts. to 1.30 cts.; tees, 1.20 cts. to 1.25 cts.; angles, 1.10 cts. to 1.15 cts.

PLATES AND SHEETS—

New York—Universal mill plates, 1.30 cts.; tank, 1.35 cts. to 1.40 cts.; shell, 1.40 cts. to 1.45 cts.; flange, 1.60 cts. to 1.70 cts.; firebox, 2.25 to 2.50 cts.

Chicago—Universal mill plates, 1.30 cts. to 1.35 cts.; tank, 1.12 cts. to 1.15 cts.; shell, 1.30 cts. to 1.35 cts.; flange, 1.25 cts. to 1.45 cts.; firebox, 1.75 cts. to 4.00 cts.; sheets, 2.00 cts. to 2.10 cts.

Pittsburg—Universal mill plates, 1.10 cts. to 1.15 cts.; tank, 1.125 cts. to 1.15 cts.; shell, 1.30 cts. to 1.35 cts.; flange, 1.20 cts. to 1.25 cts.; firebox, 1.50 cts. upwards; sheets, 1.85 cts. to 1.95 cts..

MERCHANT STEEL—

Machinery, per lb., 1.60 cts. to 1.70 cts.

Tool, per lb., 5.50 cts. to 7 cts.

IRON—

Pig iron:

New York—No. 1, $11.25 to $11.50; No. 2, $10.50 to $10.75.

Chicago—No. 1, $11.50 to $12.50; No. 2, $11.00 to $12.00.

Pittsburg—No. 1, $10.50 to $10.75; No. 2, $10.00 to $10.10.

Bar iron:

New York, common, 1.10 cts. to 1.15 cts.; refined 1.50 cts. to 1.60 cts.

Chicago, common, 1.05 cts. to 1.10 cts.; refined, 1.15 cts. to 1.20 cts.

Sheets:

Common, American, per lb., 2.15 cts. to 2.85 cts.

Russia, per lb., 10½ cts. to 11.00 cts.

LUMBER—

New York:

Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.

Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in. butts, 4.25 cts.

Spruce, special cargoes, per M, $15.00 to $17.50.

Yellow pine, random cargoes, $15.50 to $17.00.

North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.

San Francisco:

Oregon pine, per M, $15.50 to $17.50.

Redwood, per M, $18.20 to $20.00.

Redwood tank stock, up to 10 ft., $24.00 to $25.00.

GENERAL MATERIALS—

Lead, New York, $3.67 cts. to $3.72 cts.

Nails, Pittsburg, 1.40 cts.

Solder, per lb., 8¼ cts. to 11½ cts.

Spelter, per lb., 3.90 cts. to 4.00 cts.

Copper ingots, 12.85 cts. to 13.00 cts.

Granite, rough, New York, cu. ft., 40 cts. to 50 cts.

Limestone, New York, cu. ft., 70 cts. to 80 cts.

Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.

Slate, Penn., block, per square, $4.00 to $5.00.

White lead, American, per lb., 5½ cts. to 6 cts.

Lime, common state, per bbl., 70 cts.

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INDUSTRIAL NOTES.

THE PITTSBURG LOCOMOTIVE & CAR WORKS, Pittsburg, has an order for 50 consolidated locomotives, with 22 × 28-in. cylinders, for the Baltimore & Ohio R. R.

THE CHATTANOOGA CAR & FOUNDRY CO., Chattanooga, Tenn., asks us to contradict the statement that has appeared in several other papers that the plant of the company has been or is to be sold.

THE RITER-CONLEY MFG. Co., Pittsburg, has a contract, according to report, from the Boston Gas Co., Boston, for a steel gas purifier house, 100 × 275 ft., containing two 35-ton traveling cranes.

THE SCHOEN PRESSED STEEL CO., Pittsburg, has an order for 1,000 steel coal cars of 100,000 lbs. capacity each, for the Baltimore & Ohio R. R., to be used in the seaboard trade. They are expected to be placed in service during the early part of 1899.

REESE, HAMMOND & CO., Bolivar, Pa., have opened an office in the Bissell Block, Pittsburg, with Mr. Thomas McConville in charge of the paving brick department. This company was established in 1867 to manufacture fire brick, and its annual capacity is now 30,000,000. It also manufactures paving brick and blocks. It reports its works as being operated to full capacity, with prospects for an unusually good trade in paving brick next year.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, is reported to have the following orders from England for electric railway apparatus: Hull Tramway Corporation, 92 motors to equip 45 cars and one track sweeper; Halifax Tramway Corporation, 12 motors to equip six cars; Bradford Tramway Co., 48 motors to equip 24 cars; Norwich City Corporation, 80 motors to equip 40 cars, and four dynamos to be installed in the power house of the Norwich Tramway Corporation; City of Coventry, 20 motors to equip 10 cars and two power dynamos; City of Plymouth, 10 motors and two power dynamos for electric railways.

HEALY, TIBBITTS & CO., San Francisco, Cal., are reported to have the contract for the construction of a coal shed and wharf at the U. S. Coaling Station at Pago Pago, Tutuila, Samoa. The coal shed will be 100 × 150 ft., of structural steel, covered with corrugated galvanized iron, resting on steel piles, 6 and 8¾ ins. in diam., made in sections 24 ft. long, weighing about 5,000 lbs. The piles rest on a coral formation from 50 to 70 ft. below water. About 2,800,000 lbs. of steel will be required for the coal shed. The approach will be 256 ft. long and the wharf 336 ft. long, and about 350,000 lbs. of iron will be used. The total cost of the work is estimated at $200,000. Mr. John. B. Leonard, of San Francisco, is the Chief Engineer for Healy, Tibbitts & Co.

NEW COMPANIES.—Noble Water Clarifying Co., St. Louis, Mo.; $20,000; Jay Noble, Charles Mullikin and L. E. Davison.

Baltimore Filter Co., Baltimore, Md.; $1,000; to manufacture filters for filtering waters and all kinds of oils; Robert M. Spedden, Robert H. Smith, Joseph E. Henderson, Lucien B. Carpenter and Z. Franklin Potter.

Clinton Boiler Works, Clinton, Ia.; $10,000; J. T. Cullen and D. J. Murphy.

American Reduction Co., of Jersey City, N. J.; $1,000,000, commencing with $500; to reduce, manufacture and deal in aluminum and other metals, etc.; F. C. Truslow, Henry Austin Adams, James A. MacElhinney, Charles B. Hobbs and Anson McCook Beard, of New York.

Porto Rico Prospecting & Development Co., New York; $400,000, commencing with $500; to lease and otherwise acquire real estate; to prospect for minerals and to do a general mining business; James A. Pearce, Edward A. Corder, D. George Thompson, M. Grose and J. Harvey Jones, all of New York.

Healy Construction Co., 60 Grand St., Jersey City, N. J.; $100,000, commencing with $20,000; to construct, equip and improve public or private works; Wm. M. Laws, of Jersey City; Austin S. Healy, 64 5th Ave., New York; Daniel W. Beach, Washington, D. C.

Kilbourn Construction Co., 211½ Market St., Camden, N. J.; $10,000, commencing with $1,000; to construct ice-making machinery, engines, etc.; Hannibal W. Rappleye, Philadelphia, Pa.; Walter C. McCurdy, Riverton, N. J.; John T. Woodhull, Camden.

Sand Filter & Construction Co., 35 North 2d St., Camden, N. J.; $100,000, commencing with $1,000; to construct all kinds of filters; Jesse S. White, Merchantville, N. J.; Augustine T. Lynch, Philadelphia, Pa.; John O. White, Camden.

Lincoln Foundry Co., 1 Railroad Ave., Lincoln, N. J.; $2,000, commencing with $1,000; to conduct a foundry business; Wm. H. Kenyon, Howard B. Tapscott and Daniel J. Pierce, of Lincoln.

Mohawk Construction Co., 167 Main Ave., Passaic, N. J.; $30,000, commencing with $1,000; to construct and repair railways, etc.; C. Walter Artz, Roselle, N. J.; Geo. D. Patten, Plainfield, N. J.; Fred. H. Mollenhauer, Jersey City, N. J.; Thos. E. O'Shea, New York.

American Motor Co., Augusta, Me.; $250,000, all paid in; to do a general manufacturing business; Pres., Alexander Fischer, New York; Treas., Frederick R. Blount, New York.

E. R. Patteson Construction Co., New York; $10,000; to do a general contracting business; E. R. Patteson, James F. O'Rourke and George E. Robinson, of New York.

Automatic Trip Railroad Gate Co., 234 Union St., Elizabeth, N. J.; $100,000, commencing with $10,000; August D. Turner, 63 5th Ave., and F. C. Von Heydebrand, 17 West 99th St., of New York; Thos. H. Smith, 234 Union St., Elizabeth.

Empire Rail Co., 60 Grand St., Jersey City, N. J.; $1,000,000, commencing with $3,000; to mine and manufacture iron and steel goods; Wm. Fillingham, Kenneth R. McLaren and Harry W. Meen, Jersey City.

Manufacturers and Producers Supply Co., Pittsburg, Pa.; $50,000, commencing with $50; to manufacture and deal in oil wells, railway and other supplies; Henry G. Wasson, Geo. M. Cote and Burt C. Wasson, Pittsburg, Pa.; J. P. Brownlee, Allegheny, Pa.; H. H. Patterson, Beaver Falls, Pa.

Pridham Fertilizer & Chemical Commercial Co., 781 Broad St., Newark, N. J.; $100,000, commencing with $1,000; to manufacture fertilizers, collect, sterilize and dispose of sewerage, water and other liquids; Paul Buchanan, Marshall Pridham, Samuel S. Pridham, L. D. H. Gilmour, of Newark.

Manning Signal Lamp Co., Des Moines, Ia.; $100,000; L. D. Rood, W. D. Sheehan, E. S. Manning, S. Compton and H. T. Mills.

Automatic Machine Mfg. Co., Baltimore, Md.; $300,000, commencing with $50; to carry on a general manufacturing business; J. I. A. Haughton, Dover, Del.; Geo. W. Smith, Chas. B. Penrose, Geo. C. Morrison, and F. D. Morrison, of Baltimore.

Tyler Hydrant & Valve Co., New York; $1,000,000, commencing with $100; to manufacture and sell all kinds of machinery; E. Ellery and H. L. Jouffrion, Brooklyn; J. A. Simmons and Wm. H. Llewellyn, New York; Wm. P. Ellery, Hackensack, N. J.

Standard Gas Machine Co., New Haven, Conn.; $15,000; Jas. Graham, Israel A. Kelsey and Chas. E. Graham, of New Haven.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

Nearly Every Prominent Contractor and Manufacturer of Contractors' Supplies READS ENGINEERING NEWS

AVAIL YOURSELF OF THIS PAPER WHEN BIDS ARE WANTED FOR CONSTRUCTION OR FOR FURNISHING SUPPLIES

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PERSONAL.

Mr. Gillett Gordon has been appointed Superintendent of the water-works at Connersville, Ind., to succeed Mr. Daniel Castleman, who has resigned.

Lieut. Arthur S. Carswell, Second Regiment, U. S. Volunteer Engineers, at present stationed at Willet's Point, N. Y., has been ordered to duty at Huntsville, Ala.

Mr. Andrew Bryson, M. Am. Soc. C. E., of 29 Broadway, New York, has gone to Central America to report upon an enterprise for a syndicate of capitalists of that city.

Mr. William Murdock has been appointed Assistant Engineer of Maintenance of Way of the Toledo Division of the Pennsylvania Lines west of Pittsburg, with headquarters at Toledo, O.

Capt. Archibald O. Powell, Second Regiment of U. S. Volunteer Engineers, has been ordered to duty at St. Paul, Minn., under Maj. Frederick V. Abbot, Corps of Engineers, U. S. Army.

Mr. M. Roberts, Master Mechanic of the St. Louis, Iron Mountain & Southern Ry., has been appointed Master Mechanic of the whole system in Arkansas and Missouri, with headquarters at Argenta, Ark.

Mr. Albert S. Cheever, M. Am. Soc. C. E., of Cleveland, O., has been appointed Chief Engineer of the Fitchburg R. R., with headquarters at Fitchburg, Mass., to succeed Mr. Frank O. Melcher, M. Am. Soc. C. E., promoted.

Mr. James P. Nelson, civil and mechanical engineer, recently Professor of Civil Engineering in the Kentucky State College, has entered upon his duties as office assistant to the Chief Engineer of the Choctaw & Memphis R. R., with headquarters at Little Rock, Ark.

Mr. Willis S. Jones, formerly Chief Engineer of the Chicago & Northern Pacific Ry., has been appointed General Manager of the Q. & W. Co., with headquarters in the Owings Building, Chicago. This company is introducing a new form of tie-plate.

Mr. Charles B. Price, Division Superintendent of the Allegheny Valley Ry., with headquarters at Pittsburg, Pa., has been promoted to be Acting General Superintendent, to succeed Mr. David McCargo, who has been incapacitated on account of an attack of paralysis several months ago.

Mr. L. L. Dawson, Master Mechanic of the Illinois Central R. R., with headquarters at Memphis, Tenn., has been appointed Master Mechanic of the New Orleans Division, with headquarters at McComb City, Miss., to succeed Mr. W. B. Baldwin, who was recently killed by jumping from an engine.

Mr. C. H. Doebler, Division Master Mechanic of the Wabash R. R., with headquarters at Fort Wayne, Ind., has been transferred in that capacity to Springfield, Ill., to succeed Mr. G. W. Mudd. Mr. Geo. W. McKee, Master Mechanic of the Shops at Moberly, Mo., will succeed Mr. Doebler at Fort Wayne.

Mr. William R. Greene, of Baltimore, Md., has been elected Vice-President of the Baltimore & Ohio Southwestern Ry., with headquarters in Cincinnati, O., to succeed Mr. W. W. Peabody. He was formerly General Manager of the Cleveland, Cincinnati, Chicago & St. Louis Ry., and later of the Cincinnati, Hamilton & Dayton Ry.

Messrs. A. Dutrex, P. Mossot, T. Ballryder and F. Lurmann, mechanical engineers, of Mont Lucon, France, are visiting the United States for the purpose of studying American methods of manufacturing steel and iron. They are connected with the large iron works at Mont Lucon, and will return there in about three weeks. They were in Cleveland, O., on Dec. 4.

Mr. P. J. Harrigan, General Foreman of Car and Locomotive Repairs, with headquarters at Connellsville, Pa., has been promoted to be Master Mechanic of the Middle Division of the Baltimore & Ohio R. R., with headquarters at Cumberland, Md., to succeed Mr. D. C. Courtney. Mr. David Witherspoon has been appointed to succeed Mr. Harrigan, at Connellsville.

Mr. J. H. Payne, formerly in the office of the Division Engineer of the Union Pacific R. R., with headquarters in Denver, Colo., has been appointed Assistant Engineer on the Denver & Gulf system, succeeding Mr. H. A. Woods, who has resigned to accept the appointment of Assistant Chief Engineer of the Grand Trunk Ry., with headquarters at Detroit, Mich.

Mr. De Clermont Dunlap, M. Am. Soc. C. E., civil and consulting engineer, of Chicago, Ill., has been appointed Engineer of Location and Construction of the new lines of the Chicago & Northwestern Ry., with headquarters at Wall Lake, Ia. Mr. C. A. Lichty, Assistant Engineer of the Madison Division, with headquarters at Baraboo, Wis., has been transferred to Wall Lake as assistant to Mr. Dunlap.

Mr. Austin A. Lister, of the firm of R. A. Lister & Co., Ltd., of Dursley, Gloucestershire, England, dairy and agricultural engineers and manufacturers, is at the Gibson House, Cincinnati, O. He is visiting the United States for the purpose of studying the manufacture of malleable castings, and upon his return his firm will establish a foundry in England for the manufacture of malleable castings according to American methods.

OBITUARY.

Mr. James Nolan, civil engineer, of Plainfield, N. J., died Dec. 4, of pneumonia.

Mr. Edward Kilpatrick, contractor and builder, of New York city, died Dec. 5, aged 69.

Mr. George D. Inks, Street Commissioner, of McKeesport, Pa., died Nov. 24, aged 78.

Mr. Morris P. Janney, mechanical engineer, of Pottstown, Pa., died Nov. 30, aged 49.

Mr. David Campbell, builder and contractor, of Mount Vernon, N. Y., died Nov. 27, aged 73.

Major Joseph H. Francis, for many years Manager of the Metropolitan Telephone Co., of New York city, died at his home in Passaic, N. J., Nov. 28.

Mr. P. J. Carr, a civil engineer on the surveying corps of the Illinois Central R. R., which has been locating a new line to Omaha, Neb., was killed in an accident, Nov. 29, at Sioux City, Ia. He was an Englishman, and had only been in this country a short time.

Mr. R. B. F. Pearce, General Manager of the Indiana, Decatur & Western Ry., with offices in Indianapolis, Ind., died Dec. 5, aged 55. He was also the Receiver of the Toledo, St. Louis & Kansas City R. R., with offices in Toledo, O., until a few days ago, when he resigned on account of ill-health.

Mr. James G. Lindsley, Superintendent of the Newark Lime & Cement Mfg. Co., Newark, N. J., died at his home in Kingston, N. Y., Dec. 4. He was born in Orange, N. J., March 19, 1819. Mr. Lindsley was elected the first Mayor of Kingston, in 1872, serving several years, and was a Member of Congress in 1884, representing Ulster, Greene and Delaware counties. He was well known as a geologist.

Col. James Francis, M. Am. Soc. C. E., Consulting Engineer of the Locks & Canals Co., on the Merrimac River, Mass., and son of the late James Bicheno Francis, Hon. M. Am. Soc. C. E., who was President of the society in 1881, died Dec. 1, aged 58. He was a veteran of the Civil War and in 1866 was appointed Assistant Engineer for the Locks & Canals Co., in 1885 becoming its Agent and Engineer. He was appointed General Agent in 1896.

Mr. John Taylor Gause, President of the Harlan & Hollingsworth Co., Wilmington, Del., ship and car builders, died of pneumonia, Dec. 1, aged 75. He was born in Chester, Pa., and went to Wilmington in 1843, entering the office of the above company as an errand boy. In 1858 he was admitted to the firm as an equal partner with Mr. Samuel Harlan. In 1867 the firm became a company, and Mr. Harlan its President. Mr. Gause succeeded him as President in 1883, holding the office until 1896, when Mr. Henry G. Morse succeeded him. In August last Mr. Morse retired, and Mr. Gause again became the President of the company.

Mr. Freeman Godfrey, formerly a railway contractor and later a manufacturer of plaster, of Grand Rapids, Mich., died Nov. 25. He was born in Varshire, Vt., Sept. 5, 1825, and in 1845 went to Lowell, Mass. In 1851 he was a contractor on the Terre Haute & Alton R. R., and in the following years built a portion of the Illinois Central R. R. In 1856 he began the construction of the Detroit & Milwaukee R. R., which was completed two years later. He built a considerable portion of the Grand Rapids & Indiana R. R. in 1859-60, and was also interested in the construction of the Grand River Valley R. R., now a part of the Michigan Central R. R. He was also prominent in the organization of the Grand Rapids & Holland R. R. Co., of which he was elected President.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ST. LOUIS RAILWAY CLUB.
Dec. 9. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.
NEW JERSEY SANITARY ASSOCIATION.
Dec. 9-10. Annual meeting, Lakewood, N. J. Secy., James A. Exton, Arlington, N. J.
MONTANA SOCIETY OF ENGINEERS.
Dec. 10. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.
THE LOUISIANA ENGINEERING SOCIETY.
Dec. 12. Secy., J. F. Coleman, 712 Union St., New Orleans, La.
ENGINEERS' CLUB OF KANSAS CITY.
Dec. 12. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.
DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 13. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 13. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.
NORTHWEST RAILWAY CLUB.
Dec. 13. Secy, T. A. Foque, Soo Line, Minneapolis, Minn.
NEW ENGLAND RAILWAY CLUB.
Dec. 13. Secy., Edw. L Janes, P O Box 1158, Boston, Mass.
FRANKLIN INSTITUTE.
Dec. 13. "Commercial Photometers and Light Standards," Prof. A. J. Rowland; "The Kite as an Instrument in Meteorological Research," Prof. C. F. Marvin; Dec. 14. Fresh Studies of Pioneer Tools," Prof. H. C. Mercer. Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.
NEW ENGLAND WATER WORKS ASSOCIATION.
Dec. 14. Quarterly meeting, Boston, Mass. Secy., J. C. Whitney, Newton, Mass.
NEW YORK RAILROAD CLUB.
Dec. 15. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
ENGINEERS' CLUB OF CINCINNATI.
Dec. 15. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Dec. 15. Secy., F. A. Charpiot, P. O Box 13, Savannah, Ga.
AMERICAN INSTITUTE AND THE HENRY ELECTRICAL SOCIETY.
Dec. 16. "Light," William Hallock. Secy., D. R. Lovejoy, 111 W. 38th St., New York city.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 16. Secy., F. H. Olmsted, Byrne Bldg., Los Angeles, Cal.
ROCHESTER ENGINEERING SOCIETY.
Dec. 16. Secy., John F. Skinner, Reynolds Library Bldg., Rochester. N. Y.
NORTHWESTERN TRACK AND BRIDGE ASSOCIATION
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.
CHICAGO ELECTRICAL ASSOCIATION.
Dec. 16. "Wireless Telegraphy," Arthur V. Abbott. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.
THE ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
ENGINEERS' CLUB OF COLUMBUS.
Dec. 17. Secy., H. M. Gates, 12½ North High St., Columbus, O.
ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.
ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.
ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 19. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.
TECHNICAL CLUB OF OMAHA.
Dec. 19. Secy., J. Harry Lawrie, Omaha, Neb.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Dec. 20. Secy., R. A. Fessenden. 410 Penn Ave., Pittsburg, Pa.
WESTERN RAILWAY CLUB.
Dec. 20. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.
ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 21. Secy., Frank H. Olmsted, Los Angeles, Cal.
BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.
WESTERN FOUNDRYMEN'S ASSOCIATION.
Dec. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.
ENGINEERS' CLUB OF ST. LOUIS.
Dec. 21. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.
AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 21. "Building Laws" Discussion. Secy., C. W. Hunt, 220 West 57th St., New York City.
WESTERN SOCIETY OF ENGINEERS.
Dec. 21. "Foundations for Railroad Bridge Across the St. Lawrence River at Cornwall, Ont.," George E. Thomas. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.
CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 22. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.
ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 22. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Dec. 28. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.
ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Jan. 2. Secy., H. J. March, Library Bldg., Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 2. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.
FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA.
Jan. 4. Secy., Howard Evans, Pier 45, Delaware Ave., Philadelphia, Pa.
BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Jan. 6. "The Electro-Metallurgy of Copper," John B.F. Hereschoff. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.
AMERICAN INVENTORS' AND MANUFACTURERS' ASSOCIATION.
Jan. 15. Annual meeting, Washington, D. C. Secy., Arthur Steuart, Washington Loan and Trust Bldg., Washington, D. C.
NORTHWESTERN ELECTRICAL ASSOCIATION.
Jan. 19-21. Semi-annual meeting, Milwaukee, Wis. Secy., Thos. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 20. Annual meeting. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
NATIONAL ASSOCIATION OF MANUFACTURERS.
Jan. 24-26. Annual convention, Cincinnati, O. Secy., E. P. Wilson, Room A, Chamber of Commerce, Cincinnati, O.
INDIANA ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Indianapolis, Ind. Secy., J. B. Nelson, 61 Baldwin Block, Indianapolis, Ind.
MICHIGAN ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Lansing, Mich. Secy., F. Hodgman, Climax, Mich.
ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 25-27. Annual meeting, Champaign, Ill. Secy., Jacob A. Harman, Peoria, Ill.

ENGINEERS' CLUB OF PHILADELPHIA.—At the special meeting of this club, held Dec. 3, officers were nominated for the ensuing year as follows: Pres., Francis Schumann; Vice-Presidents, Dr. Henry Leffmann and William C. L. Eglin; Secy., L. F. Rondinella; Treas., George T. Gwilliam; Directors, Harrison Souder. W T.

Webb, Charles Riez, Dr. H. M. Chance, Wilfred Lewis, William P. Evans, Clark Dillenback, Richard L. Humphrey, C. H. Ott and Edwin L. Smith. The annual election will occur on the third Saturday in January. Mr. R. W. Lesley read an interesting paper on "Cement and Cement Testing Laboratories."

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.—This society will hold its 46th annual meeting at the House of the Society, 220 West 57th St., New York city, on Jan. 18 and 19.

ROCHESTER ENGINEERING SOCIETY.—A special meeting of this society was held on Dec. 1 to consider the proceedings of the recent Washington Convention of the Society of Municipal Improvements.

NEW ENGLAND WATER WORKS ASSOCIATION.—The quarterly meeting of this association will be held at Tremont Temple, Boston, Mass., on Dec. 14. The following papers will be read:

"Possibilities of Economy in Pumping Engines, as based on the latest accomplishments," George H. Barrus, Boston, Mass.; "The Advantages of Triple Expansion Pumping Engines," J. M. Betton, Brooklyn, N. Y.; "The Latest Designs in Pumping Machinery, comparing same with practice of Twenty Years Ago," representative of the E. P. Allis Co., Milwaukee, Wis.; "The Latest Designs in Pumping Machinery, comparing same with practice of Twenty Years ago," representative of Henry R. Worthington, Brooklyn, N. Y.; "The Application of Oil and Gasoline Engines to Pumping Machinery," Freeman C. Coffin, Boston, Mass.; "Comparison between Low and High Duty Pumping Engines on a Small Water Works Plant," John E. Smith, Andover, Mass.

In addition an excursion will be made to the Chestnut Hill Pumping station.

ROADMASTERS' ASSOCIATION OF AMERICA.—At a meeting of the Executive Committee, held in Chicago on Nov. 22, subjects were selected and committees appointed to report thereon at the next annual convention. The subjects, and the chairmen of the several committees, are as follows:

1. "Advisability of Increasing the Length of Rails and Using Miter Joints; and the Difference in Expansion of Light and Heavy Rails," V. T. Douglas, Chesapeake & Ohio R. R., Richmond, Va.

2. "Track Joints; the Results Obtained from the Use of Various Devices," P. Rockwell, Missouri, Kansas & Texas Ry., Sedalia, Mo.

3. "Standard Fences for Right of Way," J. A. Prentice, Lake Shore & Michigan Southern Ry., Toledo, O.

4. "Best Method of Tamping Ties in Various Kinds of Ballast" (A, tamping all ties with shovels; B, tamping joint ties with picks and all others with shovels; C, tamping all ties with picks; D, tamping all ties with bars); W. H. Courtney, Keokuk & Western R. R., Osceola, Ia.

5. "Embellishment of Station Grounds." M. Sullivan, Michigan Central R. R., Miles, Mich.

There will also be a paper by F. R. Coates, New York, New Haven & Hartford R. R., Stamford, Conn., and a paper on "Standard and Compromise Cars, in Relation to Their Effect upon the Track," by C. C. Dunn, Supervisor Atlantic Coast Line, Wilmington, Del.

J. B. Dickson, Sterling, Ill., Secy.

THE NATIONAL MUNICIPAL LEAGUE.—The 6th national conference for good city government was held, beginning Nov. 30 and continuing until Dec. 2, at Indianapolis, Ind., with fully 250 persons present. Mr. Clinton R. Woodruff presided at the opening meeting and delivered an address on "The Advance of Municipal Reform in the United States." This was followed by the "Report of the Committee on Municipal Program," which was reviewed editorially in our last issue. In the evening addresses by Mr. Samuel B. Capen, "The Final Work of the Nineteenth Century," and Mr. Wm. D. Foulke, were presented, the latter confining his remarks chiefly to a review of the report of the Committee on Municipal Reform. A large part of the two convention days was devoted to the consideration and discussion of the subject of model municipal system based upon a careful study of actual conditions. At the second day's session Mr. Horace E. Deming read a paper entitled "The Municipal Problem in the United States," which met with general approval in the discussion that followed.

The afternoon session opened with a paper entitled "The Place of the Council and of the Mayor in the Organization of Municipal Government—The Necessity of Distinguishing Legislation from Administration," by Dr. Frank J. Goodnow. This paper was also fully discussed.

The paper of the forenoon of the last day on "The City in the United States—The Proper Scope of its Activities," was read by Dr. Albert Shaw. In the afternoon Mr. Charles Richardson read a paper entitled "Municipal Franchises."

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NEW PUBLICATIONS.

METEOROLOGICAL OBSERVATIONS IN COLORADO IN 1897. Bulletin No. 49, The Agricultural Experiment Station of the State Agricultural College, Ft. Collins, Col. By L. G. Carpenter and R. E. Trimble. Paper; 6 x 9 ins.; pp. 71; illustrations and tables. Address Director of the Experiment Station, Ft. Collins, Col.

The various instruments used at the station are described in this report, and the records for 1897 are presented in tabular and graphical form. One of the most interesting diagrams is a sunshine chart, showing by black lines the amount of sunshine for each day of the year and the part or parts of the day during which sunshine occurred.

HISTORY OF THE SPANISH-AMERICAN WAR.—With handy atlas, maps and full descriptions of recently acquired United States territory. Published by the Lawrenceville Cement Co., makers of Beach's Rosendale Cement. 26 Cortlandt St., New York city. Paper, 14 x 11 ins. Maps and portraits.

This useful publication, issued with the compliments of the company to its patrons, contains very good maps of the Philippine Islands, Hawaii, Cuba, Porto Rico, and Alaska, and also portraits of the President, and the chief military and naval commanders. The events of the war are briefly recorded in chronological order, and the new possessions of the United States are statistically described.

SOME EXPERIENCE WITH AN INTERNAL COMBUSTION MOTOR.—By W. L. Garrels, 4531 West Pine Boulevard, St. Louis, Mo. Pamph.; 6 x 9 ins.; pp. 11.

Mr. Garrels recently bought a 14-HP. oil engine, of a make which was extensively advertised a few years ago and was highly recommended by many well-known engineers. "It proved to be afflicted with almost every disease that such an engine can be afflicted with." He experimented with it for about five months, and succeeded in getting it to run a few hours. The makers "sent on a man" who did not succeed any better. "They stopped answering our letters altogether and finally sent us an impertinent answer to a registered letter."

Instead of bringing suit against the makers, as any ordinary man would have done, Mr. Garrels, who is an extraordinary man, spent a great deal of time and money in hunting up other people who had had similar difficulties with the same make of engine and then wrote up the whole story and sent it to a "well-known Eastern technical paper" (name not given), which after a while returned it with the following statement:

> The case is extremely interesting, to put it very mildly, but we feel here that in publishing it we should run a decided risk of a libel suit.

Mr. Garrels therefore publishes the article, together with his reflections on the "snobbishness" of newspapers and their failure to "follow Truth though she leads to Hades," in pamphlet form. We know of no end which he attains by this that he might not have better secured by suing the company for damages. Whether or not his pamphlet is libelous, it would take a judge and twelve jurors to decide, but it is certainly of too little interest to permit any reputable technical journal to publish it, as its author desired.

ASSESSMENT, TAXATION AND MUNICIPAL FRANCHISES IN KANSAS.—Extract from the Annual Report of the Kansas Bureau of Labor and Industrial Statistics for 1897. Paper; 6 x 9 ins.; pp. 115; folding plates and tables.

The portion of this pamphlet which relates to taxation shows most forcibly the gross inequalities in assessed valuations prevailing in Kansas, as all over the United States. The statutes of Kansas provide that all property shall be assessed at its full value; it also authorizes the local assessors in each county to "agree upon an equal basis of valuation of such property as they may be called upon to assess." This clause is interpreted to mean not only values for specific objects, as wheat or cows, but the percentage of the true value to be used by the assessors. The detailed results of these agreements show the evident variations in specific values and percentages of actual values, while records of real estate transfers and the taxes levied on the property involved show that the local assessors do not live up to their agreements. Thus the assessors collectively may be said to conspire to disobey the law, and individually to vie with each other in reducing the actual percentages of valuation still lower, both lines of action being prompted largely by the desire to evade state taxes. Figures are also presented which, it is claimed, show discrimination on the part of the assessors in favor of large property owners.

The second part of the pamphlet gives the results of an investigation of the "private and municipal ownership of water, gas and electric-light plants," agreed upon by the National Association of Officials of Bureaus of Labor Statistics at Albany, in 1896. While there are many interesting and valuable facts and figures in this section, they are hardly conclusive, so far as they relate to the relative advantages of the two kinds of ownership. The reason for this is very largely the fact that the attempt to present the comparative cost of service under the two plans ignores most of the local conditions affecting cost. For instance, the cost of water-works plants and the meter charges for water are each given per 1,000 gallons of water consumed, without reference to the factors governing cost of construction and operation in the several localities. Undoubtedly the bureau would have done more and better work had it had an ample appropriation and staff, but money was lacking and the staff is hardly large enough to conduct the ordinary routine of a small office, to say nothing of elaborate investigations. The bureau therefore deserves praise for its courage in attempting the work and credit for its results. The schedules of inquiries for the second part of the pamphlet, it should be said, were not prepared by the Kansas bureau and were elaborated by it because they were considered inadequate.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

LAWN SPRINKLERS.—Pleuger & Henger Mfg. Co., St. Louis, Mo. Pamph., 6 x 9¼ ins.; pp. 20.

ENCLOSED ARC LAMPS.—General Electric Co., Schenectady, N. Y. Pamph., 5¼ x 7¾ ins.; pp. 58.

This neat pamphlet describes the various types of enclosed arc lamps put upon the market by the General Electric Co. The pamphlet contains excellent half tone illustrations of the interior and exterior of several forms of these lamps.

STOW-FLEXIBLE SHAFT.—Stow Flexible Shaft Co., 26th and Callohill St., Philadelphia, Pa. Pamph.; 6 x 9 ins.; pp. 55.

This pamphlet contains a series of illustrations and descriptions of drills, boring machines, countershafts, transfer pulleys, and various other apparatus and parts manufactured by this company for use in connection with the well-known Stow Flexible shaft, which it also manufactures.

WIRE ROPE.—A. Leschen & Sons' Rope Co., St. Louis, Mo. Paper, 6 x 9¼ ins.; pp. 72.

This is a catalogue and price list of ordinary and special makes of wire rope, including those having flattened and triangular strands, as used for elevators and hoisting purposes. There are also rope clamps, thimbles, hooks, hoisting and power transmission sheaves, lamp ropes, etc. The company also handles Carr's grip for endless rope haulage in wires and builds cableways, wire rope tramways (Finlayson's patent), and logging machinery.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Dec. 8.	Bridge approach, Zanesville, O.	Nov. 10
Dec. 8.	Police patrol system, Youngstown, O.	Nov. 24
Dec. 8.	Electric light plant, Litchfield, Ill.	Dec. 1
Dec. 8.	Sale of floating dock, Havana, Cuba	Dec. 1
Dec. 8.	Park work, New York, N. Y.	Dec. 1
Dec. 8.	Water pipe, boilers, etc., New York	Dec. 1
Dec. 8.	Pipe sewers, Wilkinsburg, Pa.	Dec. 8
Dec. 9.	Bridge approach, E. Grand Forks, Minn.	Dec. 8
Dec. 9.	School building, Boston, Mass.	Dec. 8
Dec. 9.	Pipe sewers, Detroit, Mich.	Dec. 8
Dec. 9.	Pipe sewers, East St. Louis, Ill.	Dec. 8
Dec. 9.	Laundry machinery, Boston, Mass.	Dec. 1
Dec. 9.	Bridge work, Fort Scott, Kan.	Dec. 1
Dec. 9.	Bridge work, Minneapolis, Minn.	Dec. 1
Dec. 9.	Removal snow, New York, N. Y.	Dec. 1
Dec. 9.	Fire hose, Buffalo, N. Y.	Nov. 24
Dec. 10.	Intercepting sewers, Washington, D. C.	Nov. 3
	Advertised, Engineering News, Nov. 3.	
Dec. 10.	Crane (100 tons capacity), Brooklyn, N.Y.	Nov. 10
Dec. 10.	Sterilizing apparatus, New Haven, Conn.	Dec. 1
Dec. 10.	Storehouse, New York, N. Y.	Dec. 1
Dec. 10.	Bridge, Independence, Ky.	Dec. 8
Dec. 12.	Hospital building, Bridgeton, N. J.	Dec. 1
Dec. 12.	Armor plate plant, St. Petersburg, Russia.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 12.	Extending water-works, Orange, N. J.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 12.	Sewers (8,400 ft.), Little Rock, Ark.	Dec. 1
Dec. 12.	Water bond, Reno, Nev.	Dec. 1
Dec. 12.	Paving, curbing, etc., Dayton, O.	Nov. 17
Dec. 12.	Boilers for dredges, Honolulu, H. I.	Nov. 24
Dec. 12.	Levee work, New Orleans, La.	Dec. 8
Dec. 12.	Heater, etc., Boston, Mass.	Dec. 8
Dec. 12.	Plumbing, Washington, D. C.	Dec. 8
Dec. 13.	Power plant, Boston, Mass.	Dec. 8
Dec. 13.	Paving, Buffalo, N. Y.	Dec. 8
Dec. 13.	Grading, Pittsburg, Pa.	Dec. 8
Dec. 13.	Electric lighting, Middleport, N. Y.	Dec. 8
	Advertised, Engineering News, Dec. 8.	
Dec. 13.	School building, Washington, D. C.	Nov. 24
Dec. 13.	Purchase of power franchise, Stockton, Cal.	Nov. 24
Dec. 13.	Pier and tunnel, Philadelphia, Pa.	Dec. 1
Dec. 13.	Hospital building, Brooklyn, N. Y.	Dec. 1
Dec. 13.	Sewer bonds, ($75,000), Independence, Mo.	Dec. 1
Dec. 13.	Sewers, etc., Philadelphia, Pa.	Dec. 1
Dec. 13.	Bridge work, Philadelphia, Pa.	Dec. 1
Dec. 14.	Gravel roads (19 miles), Brazil, Ind.	Dec. 1
Dec. 14.	Water pipe, hydrants, etc., Vancouver, B.C.	Dec. 1
Dec. 14.	Fire apparatus, New York.	Dec. 8
Dec. 15.	Bridges (9) and viaduct, Valatie, N. Y.	Dec. 1
	Advertised, Eng. News, Dec. 1 and 8.	
Dec. 15.	Dikes, etc., Portland, Ore.	Dec. 8
Dec. 15.	Electric lighting, Sherbrooke, Que.	Dec. 8
Dec. 15.	Grading, paving, etc., Pittsburg, Pa.	Dec. 8
Dec. 15.	Paving (3 streets), Beaumont, Tex.	Dec. 1
Dec. 15.	Court house, Garner, Ia.	Dec. 1
Dec. 15.	Steam heating, Flandreau, S. Dak.	Dec. 1
Dec. 15.	Railway work, New York, N. Y.	Dec. 1
	Advertised, Eng. News, Dec. 1 and 8.	
Dec. 15.	Water-works, Somerville, Tenn.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 15.	Electric plant, Somerville, Tenn.	Dec. 1
	Advertised, Engineering News, Dec. 1.	
Dec. 15.	Brick paving, Jacksonville, Fla.	Dec. 1
Dec. 15.	Church building, Webster City, Ia.	Nov. 24
Dec. 15.	Storm sewers, Denver, Colo.	Oct. 13
Dec. 16.	Light bonds, Little Falls, Minn.	Dec. 8
Dec. 16.	Piles, planks, etc., New York.	Dec. 8
Dec. 16.	Paving, sewers, etc., Meadville, Pa.	Dec. 8
	Advertised, Engineering News, Dec. 8.	
Dec. 16.	Water-bonds, Little Falls, Minn.	Dec. 8
Dec. 17.	Electric plants, etc., Brooklyn, N. Y.	Dec. 8
Dec. 17.	Macadam roads (20 miles), Crown Point, Ind.	Nov. 24
	Advertised, Engineering News, Nov. 24.	
Dec. 17.	Heating, ventilating, etc., Cincinnati, O.	Dec. 1
Dec. 19.	Asphalt or brick paving, Hamilton, O.	Dec. 1
Dec. 19.	Tunnel sewer, Newburg, N. Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 19.	Paving bonds, Lima, O.	Dec. 8
Dec. 19.	Reformatory building, Lexington, Ky.	Dec. 8
Dec. 20.	Water pump, Dunkirk, N. Y.	Dec. 8
	Advertised, Eng. News, Dec. 8 and 16.	
Dec. 20.	Electric plant, Royal Oak, Mich.	Dec. 8
Dec. 20.	Revetments, Keweenaw Point, Mich.	Nov. 24
	Advertised, Eng. News, Nov. 24 to Dec. 15.	
Dec. 20.	Electric plant, Mount Pleasant, Mich.	Dec. 1
Dec. 20.	Macadamizing, Cincinnati, O.	Dec. 1
Dec. 21.	Street work, Hoboken, N. J.	Dec. 1
Dec. 21.	Glass for electric lamps, Cleveland, O.	Dec. 1
Dec. 21.	Court house annex, Atlanta, Ga.	Nov. 3
Dec. 21.	Bridge, Charlottetown, P. E. I.	Dec. 8
Dec. 22.	Brick paving, etc., Jacksonville, Fla.	Dec. 8
	Advertised, Engineering News, Dec. 8.	
Dec. 22.	Bridge superstructure, Lorain, O.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Dec. 23.	Light station, Tompkinsville, (S.I.), N. Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 23.	Cement and seawall, Fort Morgan, Ala.	Dec. 1
	Advertised, Eng. News, Dec. 1 to 22.	
Dec. 23.	Auditorium, Charleston, S. C.	Dec. 8
Dec. 26.	Electric lighting, Waterloo, N. Y.	Dec. 8
	Advertised, Engineering News, Dec. 8.	

Dec. 26. Pipe sewers, South Bend, Ind. .... Dec. 8
Dec. 27. Electric plant, Woodsfield, O. .... Dec. 8
Dec. 28. Steel bridge, Norfolk, Va. .... Dec. 1
Advertised, Eng. News, Dec. 1 to 15.
Dec. 28. Railway bridge, Chicago, Ill. .... Nov. 24
Advertised, Engineering News, Nov. 24.
Dec. 29. Street bonds, Georgetown, Ky. .... Dec. 8
Dec. 30. Sewers, East Cleveland, O. .... Dec. 8
Dec. 31. Plans for station, etc., Stockholm, Sweden. June 23
Jan. 1. City hall plans, Bridgeport, Conn. .... Aug. 18
Jan. 1. Draw bridge, Cathlamet, Wash. .... Nov. 17
Jan. 1. Water-works, Pasadena, Cal. .... Nov. 17
Jan. 1. Electric plant, Pasadena, Cal. .... Dec. 1
Jan. 2. Bridge, Quebec, Que. .... Sept. 29
Advertised, Eng. News, Sept. 29 and Oct. 6.
Jan. 2. Arc lighting, Vincennes, Ind. .... Oct. 27
Jan. 2. Storm sewer, etc., Hamilton, O. .... Dec. 8
Jan. 3. Water-works bonds, Gaffney, S. C. .... Dec. 8
Jan. 3. Steel bridge, Brookhaven, Miss. .... Nov. 24
Jan. 3. Water-works, Gaffney, S. C. .... Dec. 1
Jan. 3. Bath plans, Albany, N. Y. .... Dec. 8
Jan. 5. Macadam roads (17½ miles), Decatur, Ind. .. Dec. 1
Jan. 6. Water-gas plant, Johannesburg, So. Africa. . Oct. 27
Jan. 6. Extension, electric plant, Johannesburg, S. Af. Oct. 27
Jan. 7. Gravel road, Valparaiso, Ind. .... Dec. 8
Jan. 9. School building, Wilmington, Del. .... Dec. 8
Jan. 9. Repairing curb, etc., Houston, Tex. ...... Nov. 24
Jan. 10. Capitol building, Phoenix, Ariz. .... Dec. 1
Jan. 10. Sewer bonds ($50,000), Grass Valley, Cal. .. Dec. 1
Jan. 14. Park work and plans, Philadelphia, Pa. .... Nov. 17
Jan. 15. Sewers and drainage, Callao, Peru. .... Dec. 1
Jan. 16. Sale of telephone franchise, Duluth, Minn. Dec. 8
Advertised, Eng. News, Dec. 8 to Jan. 12.
Jan. 24. Footway tunnel, London, England. .... Nov. 10
Feb. 1. School building, Peoria, Ill. .... Dec. 1
Feb. 2. Electric lighting, New Orleans, La. .... Nov. 3
Feb. 7. Sale of canal, Annapolis, Md. .... Dec. 1
Feb. 10. Jail building, Keyser, W. Va. .... Sept. 29
Mar. 15. Electric railway (23 miles), Shanghai, China. Nov. 24
Advertised, Eng. News, Nov. 17 to Dec. 8.
Mar. 15. Purchase of water-works, Belem, Brazil .. Dec. 1
Mar. 31. Telephone concession, Shanghai, China. .... Nov. 24
Advertised, Eng. News, Nov. 17 to Dec. 8.
No date. Water pump, etc., Albuquerque, N. Mex. .. Dec. 8

RAILWAYS.

BELLAIRE, ZANESVILLE & CINCINNATI.—J. K. Geddes, Receiver and Gen. Mgr., Zanesville, O., informs us that no arrangements have yet been completed for the standard gaging of this line between Woodsfield and Bellaire, O. There has been a project on foot for some time for making the whole line a standard gage system and for the building of some additional track for the purpose of developing the coal fields of southeastern Ohio, but probably nothing will be done in the matter until the coal situation in Ohio is considerably improved.

BLACK DIAMOND.—Sir Thomas Tancred, an engineer sent to this country by English capitalists, has completed his reconoissance of the route for this proposed railway from Columbus, O., to Port Royal, S. C., penetrating the coal fields of east Tennessee and Kentucky, and it is said that he will recommend that the line be built. We are further informed that Col. Albert E. Boone, Zanesville, O., the promoter of the project, will let contracts next January for the construction of the branch between Vincennes, Ind., and Cynthiana, Ky. A map of the proposed route, 822 miles in length, may be seen in the office of Engineering News, 220 Broadway, New York.

CHICAGO, IOWA & DAKOTA.—Reports state that this company will probably extend its lines in the spring. The route now contemplated is northwest from Alden, the present terminus, through Britt to Elmore, Minn., where the road taps the Chicago & Northwestern, which now operates the Chicago, Iowa & Dakota. This would give the Northwestern a shorter line to its main track at Tama by 30 or 40 miles than by the present route via Eagle Grove, Webster City and Jewell.

CHICAGO & NORTHEASTERN.—We are informed that this company has at present two lines under construction in western Iowa; one from Denison to Wall Lake, 26 miles, and the other from Moundamin to Odebolt, 55 miles. Surveys are also about completed for a line from Sac City to Rolfe, Ia. D. C. Dunlap, Engr. of Location and Construction; C. A. Lichty, Asst. Engr., both of Wall Lake, Ia.

COCHITI & RIO GRANDE.—This company is stated to have been organized for the purpose of building a line from Thornton, Colo., on the Atchison, Topeka & Santa Fe Ry., to the head of the Cochiti district. The establishment of refining and smelting works at Bland is also projected. H. Claussen is said to be interested.

COLOMBIA.—This company was incorporated in West Virginia, Nov. 28, with a capital stock of $6,000,000, of which $50 is paid in, to construct and operate a railway from Puerto Llevano to Bogota, Colombia. Principal place of business, Philadelphia, Pa. The inorporators are: Ed. M. Heermans, J. M. Caldwell, T. C. Hall, Wm. C. Leonard and H. H. Martin, all of Charleston, W. Va.

CUBA.—We are informed officially that the American Indies Co., associated with the Drake & Stratton Co., both of 100 Broadway, New York, has received a contract from the U. S. government for the construction of a wharf at Triscornio, on Havana Harbor, and of a line of railway from that place to a connection with a branch of the United Rys. of Cuba, at Matanzas, Cuba. The length of the line will be about 7 miles; near Havana it will be double-tracked, with a single track towards the eastern end. It is said that the work will be prosecuted as rapidly as possible. E. Sherman Gould, of Yonkers, N. Y., Engr. of American Indies Co.; Col. Frank J. Hecker, Ch. Bureau of Transportation, Washington.——Secretary of War Alger, in his annual report, recommends that a substantial railway, practically the whole length of Cuba, with branches, be built by the U. S. government; estimated cost, $20,000,000.

FARMINGTON & IRONDALE.—This company was incorporated in Missouri, Nov. 26, with a capital stock of $200,000, to build and operate a line of standard gage railway from Irondale, Washington county, to Farmington, St. Francois county, a distance of 20 miles. The incorporators are: H. J. Cantwell, William Carter, J. W. Evans, A. N. Sager and E. H. Wagner.

GULF, LOUISIANA & GREAT NORTHERN.—We are informed that a contract for the construction and equipment of this railway, in Louisiana, has been awarded to Wheeler & Boody, Westmoreland Bldg., 222 South Third Street, Philadelphia, Pa. The total length of line will be 270 miles, and it has been arranged by the contractors to commence work within the next three weeks. A force of at least 400 Italians will be put on the work, and this number increased from time to time, as required. Certain portions of the work will be sub-let upon a cash basis, all financial arrangements having been perfected. Joseph J. Waitz, Pres., Alexandria, La.

GULF & SHIP ISLAND.—The promoters of this railway are considering the advisability of putting 200 convicts to work during the winter months in order to assist in grading the gap on this line between Hattiesburg and Pontotoc, Miss. S. S. Bullis, Gen. Mgr., Gulfport, Miss.

IDAHO NORTHERN.—This company has been incorporated in Idaho, with a capital stock of $2,500,000, to build a railway from the mouth of Coeur d'Alene River, in Idaho, to the headwaters of Bear Gulch. The incorporators are, W. Thos. Hart, Weiser, Idaho; B. Robb, Portland, Ore.; J. Perrault and A. Eoff, of Boise, Idaho.

KENTUCKY.—The Southern Construction Co., of St. Louis, Mo., is reported to have made a proposition to the people of Bath county providing for the construction of a railway from Owingsville to Olympia, Ky., if $20,000 bonus be granted.——The construction of other lines is also said to be projected from Carrollton and from Cadiz, Ky., in which J. A. Donaldson, of Carrollton, and J. G. Terry, of Cadiz, are said to be interested, respectively.

MINNEAPOLIS RY. TERMINAL.—This company has been incorporated, with a capital stock of $100,000, to construct a railway starting from 10th Ave. and Camden Place. The incorporators are: John S. Pillsbury, Pres. of Minneapolis Eastern Ry. Co.; Mart B. Koon, of Minneapolis, St. Paul & Sault Ste. Marie Ry. Co., both of Minneapolis, Minn.; W. D. Washburn, Curtis H. Pettit and Wm. D. Hale.

MOORE COUNTY & WESTERN.—W. B. Eekhout, Supt. of Construction, Aberdeen, N. C., informs us that the surveys have been completed and location made for 40 miles on this proposed line from Aberdeen to Concord, N. C., a distance of 85 miles. Part of the necessary capital has been secured, and part of the work let to J. R. Erwin & Co. and W. F. Neal Co. About 14 miles have been built and 9 miles graded. George M. Clarke, Vice-Pres., P. O. Box 836, Providence, R. I.; H. L. Thurston, Ch. Engr., Aberdeen, N. C.

NELSON & BEDLINGTON.—Press reports state that Foley Bros., Larson & Halverson, have received the contract for the construction of this proposed railway from Bonner's Ferry, Idaho, to Bedlington, on Lake Kootenay, B. C., a distance of about 53 miles. P. Foley, Pres., of St. Paul, Minn., is quoted as saying that surveys have all been made, and that a camp will be established at Bonner's Ferry and another near Kushanook, and work be commenced at once; there is considerable heavy rock work on the line.

NEW YORK & PENNSYLVANIA.—Reports state that Theodore Cobb, Spring Mills, N. Y., has been awarded the contract to build the 6-mile extension of this line from Oswayo to Millport, N. Y., at the rate of $10,000 a mile, the road to be built before Jan. 1. More than one-half of the work had been done before the signing of the contract.

NICARAGUA.—Press reports state that the Atlas Steamship Co., of Liverpool, has withdrawn its negotiations for the purchase of the control of this country's railway and steamboat line.

NORTH SHORE TERMINAL.—This company was incorporated in Pennsylvania, Nov. 30, with a capital stock of $100,000, to construct five miles of steam railway in Allegheny, Pa., to a connection with the Pittsburg, Fort Wayne & Chicago R. R. and the Pittsburg & Western R. R. Chas. T. Schoen, Pres., Bryn Mawr, Pa.; F. N. Hoffstat, Allegheny, Pa.; E. A. Schoen, Sewickley, Pa.; W. H. Schoen, Jr., and Geo. T. Hildebrand, both of Pittsburg, Pa.

OGDENSBURG & LAKE CHAMPLAIN.—This company was incorporated in New York, Dec. 1, with a capital stock of $4,400,000. It is a reorganization of the old Ogdensburg & Lake Champlain R. R. Co., whose line runs from Ogdensburg to Rouse's Point, N. Y. The directors are: Frank R. Becker, Ogdensburg; William A. Heady, Elmsford, N. Y.; William H. Platt, Brooklyn, N. Y., and Charles Parsons, George Parsons, George Sherman, Clarence S. Day, Charles G. Burnham and others, of 15 Broad St., New York.

PECOS VALLEY & NORTHEASTERN.—Work is now said to be proceeding slowly on the extension of this line from Roswell, N. Mex., to Amarillo, near Texline, on the Texas line of the Colorado & Southern, as the Union Pacific, Denver & Gulf Ry. will be called. The total distance is 208 miles, and track has been laid about to the boundary line between New Mexico and Texas. It is expected that all the work will be completed by Jan. 1.

PENNSYLVANIA.—Press reports state that Drake & Stratton, Pittsburg, Pa., have received the contract for building an additional track and removing a curve east of Kinzers, near Harrisburg, Pa., at $212,000. Also that contracts have been let for laying a new track from half a mile west of Elizabethtown and extending 4½ miles east of the place, and for building a new track and roadbed from Johnstown bridge to Sheridan, and relaying track and removing curves between Sang Hollow and Conemaugh. Work will be commenced at once. W. H. Brown, Ch. Engr., Philadelphia, Pa.

PENSACOLA & NORTHWESTERN.—The city council of Pensacola, Fla., has granted a franchise to this company to construct a railway over certain streets of Pensacola. Mayor Northrup may be addressed.

RUTLAND-CANADIAN.—H. G. Smith, Treas., Rutland, Vt., informs us that the surveys have not yet been completed for this proposed line from Burlington, Vt., to the Canadian line; nor has the route been positively decided upon. Frank R. Wilk, Pres., Burlington; John W. Burke, Ch. Engr., Rutland, Vt. The Champlain Construction Co. has been incorporated to build the line, the incorporators being W. Seward Webb, Shelburne, Vt.; Edgar Harding and G. H. Bull, of Boston; P. W. Clement and H. G. Smith, of Rutland.

ST. LAWRENCE RIVER & ADIRONDACK.—H. G. Atwater, Secy., Norfolk, N. Y., informs us that the organization of this company has not been perfected, and that there is no certainty about the matter as yet.

TERRE HAUTE & LOGANSPORT.—This company was incorporated in Indiana, Nov. 30, with a capital stock of $2,000,000, to operate the lines formerly in the hands of a receiver. James McCrea and J. T. Brooks, of the Pennsylvania Co., Pittsburg, Pa., are among the directors of the new company.

WASHINGTON RUN.—Bennett & Talbott, Greensburg, Pa., inform us that they expected to start work Dec. 6 on this 5½-mile line from Perryopolis to Layton, Pa., for the Washington Coal & Coke Co. The contract includes grading, tunneling, bridging, track laying, ballasting and furnishing of ties. P. J. Cochran, Pres., Dawson, Pa.; E. J. Taylor, Ch. Engr., McKeesport, Pa.

WISCONSIN CENTRAL.—H. F. Whitcomb, Gen. Mgr., Milwaukee, Wis., informs us that this company has recently purchased 1,000 box, 250 flat and 100 furniture cars.

STREET AND ELECTRIC RAILWAYS.

BELLOWS FALLS, VT.—Surveys are being made, according to reports, for the proposed Bellows Falls & Saxton's River Electric Ry., from Bellows Falls to Rockingham, via Westminster, a distance of six miles. J. H. Holton, Pres., Burlington, Vt.; V. K. Nash, Ch. Engr., Woonsocket, R. I.

SWANTON, VT.—An act has passed the state legislature incorporating the Swanton Electric Ry. Co.

COHASSET, MASS.—Reports state that it has been decided to extend the third-rail electric system on the New York, New Haven & Hartford R. R. as far as Cohasset on the Plymouth Division. Chas. P. Clark, Pres., New Haven, Conn.

WARE, MASS.—The selectmen have granted a franchise to the Palmer & Monson St. Ry. Co., which provides for the construction of the line from Palmer before Jan. 1.

WINTHROP, MASS.—The Winthrop & Revere St. R. R. Co. has been organized to operate about eight miles of lines in Revere, Winthrop and East Boston. The directors are: J. O. Wetherbee, S. B. Pearmain and S. B. Hinckley, Jr., of Boston; S. B. Hinckley, Newton; W. M. Bacon, Winthrop; Geo. S. Forbush, Brookline, Mass.; Thomas Martin, Chelsea, Mass.

BUFFALO, N. Y.—The Buffalo & Lockport Electric Ry. Co., which recently acquired the Buffalo, Kenmore & Tonawanda line, is said to be negotiating to secure a franchise which will enable it to build another track along Delaware St., Tonawanda, from the North Tonawanda city line to the Buffalo city line. As it is the expressed intention of the company to run the Lockport cars over this line, a double-track system will be a necessity.

LOWVILLE, N. Y.—The people of this place contemplate the construction of an electric railway to nearby villages, taking power from the Wetmore Electric Co., and also the erection of a new opera house.

NEW ROCHELLE, N. Y.—The village trustees, Dec. 5, granted franchises to the Westchester Electric Ry. Co. to build on Main St. and Winyah Ave., work to be completed by May 15.

OSWEGO, N. Y.—Press reports state that the Oswego Electric St. Ry. will be sold on foreclosure about Jan. 11.

PARIS, N. Y.—It is announced that Michael Gaffney, Comr. of Highways, Town of Paris, has granted a franchise to the Sauquoit Valley Electric St. Ry. Co.

ROME, N. Y.—We are informed that the right of way has been obtained for the Utica Suburban branch of the Utica Belt Line St. R. R., from Rome to Oriskany, nine miles, and that a start was made to grade when work was stopped by an injunction. As soon as injunction has been decided, work will be continued. John W. Boyle, Pres., of Utica, should be addressed; F. K. Baxter, Ch. Engr., Utica.

HAMMONTON, N. J.—The council is considering the petition of W. I. Garrison, Smith Conover and Samuel Riley and others, of Atlantic City, N. J., for a franchise to build through this town in connection with the proposed line between Camden and Atlantic City.

ALLENTOWN, PA.—The Allentown & Slatington St. Ry. Co. was incorporated in Pennsylvania, Dec. 2, with a capital stock of $200,000, to construct an electric street railway between Allentown and Slatington, a distance of 17 miles. The incorporators are: Francis J. Crilly, Pres.; John L. Schwartz, P. F. Cannon and Walter J. Saeger, all of Allentown; Francis A. Krutz, of Slatington.

EAST PITTSBURG, PA.—The Wilkinsburg & East Pittsburg St. Ry. Co.'s ordinance, asking for right of way over certain streets of East Pittsburg borough, was passed at a special meeting of the council Dec. 3.

ERIE, PA.—The select council has recently passed four ordinances providing for street railway extensions in this city.

PHILADELPHIA, PA.—Reports state that the Central Electric Ry. Co., of Philadelphia and Delaware county, has filed a resolution of the company in Media, providing for an extension of its line to Philadelphia, via Yeadon, Cardington, Lansdowne, Media, etc.

WILMINGTON, DEL.—Work is said to be progressing on the Wilmington & Chester Traction Co.'s new line between Wilmington and Chester, Pa., which, when completed, will connect with the line from Darby to Chester, and thus provide a continuous route between Wilmington and Philadelphia. Operations will probably begin about Jan. 1. C. M. Clark, Pres., Philadelphia.

BALTIMORE, MD.—The Baltimore Consolidated Ry. Co. has had ordinances introduced into the council asking for a franchise to build a double-track line on Chase and Bond Sts. and Hopkins and Ashland Aves. W. A. House, Mgr.

HAMPTON, VA.—This town has granted a franchise to the Peninsula Ry. Co. John G. Livezy, of Newport News, Va.; and Francis F. Causey, of Hampton, are interested.

DAHLONEGA, GA.—J. W. Adams, Pres. of Dahlonega Gold Mining Co., and J. H. Smith, Findlay, O., are said to be interested in the construction of an electric line from the company's mines to the Southern Ry.

KEY WEST, FLA.—The board of aldermen has granted a franchise to the Messrs. Laflin, according to reports, for the construction of an electric railway and electric light plant.

GADSDEN, TENN.—J. M. Elliott, Jr., Pres., Gadsden, informs us that complete arrangements have been made to convert the Gadsden & Attala Union Ry. into an electric line, 11 miles in length. Work will be done by W. S. McCall, Chattanooga, Tenn.

CARROLLTON, KY.—It is reported that the Carrollton Electric Ry. and Bridge Co. has been organized, and has had surveys made for the construction of an electric railway from Carrollton to Warsaw requiring a new bridge over the Kentucky River. M. J. Barker, Pres.

CLEVELAND, O.—J. J. Stanley, Mgr. of Cleveland Electric Ry., is said to have stated that this company contemplates the erection of an addition to its power house on Cedar St., and the installation of a new 3,800 HP. generator.

BATTLE CREEK, MICH.—George W. Bullis, Ann Arbor, Mich., is promoting a project to build an electric line between this city and Hastings next spring. Mr. Bullis is said to represent Boston capitalists.

BIRMINGHAM, MICH.—Almeron Whitehead, Frank Hagerman, George E. Daines, of this place; George T. Hendrie, of Detroit, and Michael F. Lillis, of Pontiac, were granted a franchise, Nov. 26, by the township board to build and operate an electric railway from Circle, 2¼ miles north of Birmingham, through the township of Bloomfield. The route, when finished, will reach Orchard Lake, and cars are to be running within 18 months from the time the franchise was granted.

FLINT, MICH.—R. M. Luton, Grand Rapids, Mich., is interested in the construction of an electric line between Flint and Long Lake.

LAKE BLUFF, ILL.—The Chicago & Fox Lake Electric Ry. Co., which contemplates building a cross-country line from Fox Lake to the lake shore, was granted a 20-year franchise for a right of way into Lake Bluff by the village board, Nov. 28. The company wanted a 50-year franchise in Scranton Ave., but this was not granted.

OREGON, ILL.—Fred S. Jones, of Oregon, contemplates the construction of an electric railway between Oregon and Rockford. Preliminary surveys have been made.

BARABOO, WIS.—The council, Nov. 25, granted a franchise to the Baraboo, Kilbourn & Devil's Lake Electric Ry. Co. Construction work is expected to begin next spring.

LONGVIEW, TEX.—It is reported that the Longview St. Ry. Co. contemplates the extension of its line. O. H. Methrin, Mgr.

ST. LOUIS, MO.—Chas. E. Carroll, Pres. of Mississippi Valley R. R. Co., St. Louis, informs us that this company is now having its prospectus written up, and expects to be ready for action about Feb. 1. Much work has been done in securing rights of way, and in making surveys. August Holthans, 1449 North 6th St., St. Louis.

ST. LOUIS, MO.—Press reports state that C. H. Spencer and others, of the Southern Electric Ry. Co., 4041 South Broadway, will become owners of the lines of the National Ry. Co., including 80.37 miles of electric and 14.67 miles of cable street railway.——It is also announced that the entire Lindell Ry. system, E. Whitager, Pres., has been sold to a syndicate at $8,500,000. The company operates 60 miles of electric lines.

EUREKA SPRINGS, ARK.—The council is reported to have granted a franchise for the construction of an electric line in this city.

ASTORIA, ORE.—A 75-year street railway franchise is reported to have been awarded to Mr. Knettner.

REDLANDS, CAL.—It is reported that the horse car system in this city will soon be converted into an electric line. The railway is three miles in length, and the estimated cost is $35,000.

AURORA, ONT.—The Metropolitan St. Ry. Co., of Toronto, address Deer Park, Ont., has made arrangements with the York county council for the construction of an extension of the company's lines through Aurora.

HAMILTON, ONT.—It is reported that the Cataract Power Co. has asked Engineer Hillman to survey two direct lines to Guelph and Berlin for a fast electric railway service. The proposed line will run from a point on James St., to and along Burlington Heights, thence over the old canal, and will follow in some respects the original radial railway survey to the top of the Flamboro escarpment. No bonuses will be asked for, and the most direct lines will be used.

PARRY SOUND, ONT.—The board of trade is said to be interested in the construction of a line of electric railway, to connect Parry Sound and Depot Harbor.

VANCOUVER, B. C.—Press reports state that the British Columbia Electric Ry. Co. has decided to erect a new power house, with a 3,000-HP. generator. The construction of a branch along Davie St. to English Bay is also said to be projected. J. Buntzen, Mgr.

ELECTRIC LIGHT AND POWER.

BOSTON, MASS.—Bids are asked until Dec. 13 for a power plant for rope manufactory, two horizontal tubular boilers; also a quantity of iron pipe and specials, machine-set screws, files, leather belting, pipe fittings and valves. Edwin Stewart, Paymaster-General, U. S. N., Washington, D. C.

EVERETT, MASS.—P. D. Blackden, Mech. Engr., 170 Summer St., Boston, writes us that he has not yet received the franchise for a plant recently asked for, the matter still being in the hands of the city government. The plant will be operated by steam.

SOUTHBRIDGE, MASS.—Reports state that it is proposed to form a company to buy C. W. Weld's water privilege below Sandersdale, and utilize it for transmitting power to the center of the town. There is a fall of about 10 ft.

SPRINGFIELD, MASS.—The committee has instructed the United Electric Light Co. to replace 100 of the present open arc lights with enclosed ones. H. S. Anderson, Supt.

WINTHROP HEAD, MASS.—The Walworth Construction & Supply Co., 100 Pearl St., Boston, Mass., has been awarded the contract for the electric plant at the mortar battery at this place at $1,424.

EAST HARTFORD, CONN.—Jos. O. Goodwin, Town Clk., writes us that the town will probably let a contract for electric lighting to either a Hartford or a Manchester company. About 300 incandescent lights will be wanted by the fire district.

BROOKLYN, N. Y.—Bids are asked until Dec. 17 for building a new plant and for extending the old one at the New York navy yard, and also for enlarging the wiring system. M. T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C.

MIDDLEPORT, N. Y.—Bids are asked until Dec. 13 for furnishing about 25 arc lights of 2,000 c. p. each, for five years, as stated in our advertising columns. Thos. P. Hammond, Village Clk.

ROCHESTER, N. Y.—Mayor Warner is urging the council to consider the question of a municipal plant. The lights for this year cost the city about $230,000.

TUPPER LAKE, N. Y.—Press reports state that parties from Utica, N. Y., are considering the advisability of building a plant in this place.

WATERLOO, N. Y.—Bids are asked until Dec. 26 for electric lighting of the streets, for five years, as stated in our advertising columns. W. A. Gibson, Clk.; I. G. Gregory, Pres.

WILDWOOD, N. J.—Abraham Anderson, Camden, N. J., writes us that he purchased last November the property of the Seacoast Electric Light & Power Co. under foreclosure of mortgage. Mr. Anderson wishes to resell the plant for $10,000.

COATESVILLE, PA.—It is stated that the council has asked for bids for lighting the town with electricity for next year. If the contract is satisfactory a 5-year contract will be let.

LEBANON, PA.—Councils have rejected the bids received for a 5-year contract. New bids for a shorter term will probably be asked.

PHILADELPHIA, PA.—The Southern Electric Light & Power Co. has increased its capital stock from $400,000 to $2,000,000 for the proposed extension to its plant. In addition to the company's contract with the city for the lighting of that section of the city lying south of South St., between the Delaware and Schuylkill rivers, it furnishes current to many large business and manufacturing enterprises for incandescent lights and power. At present the main power house, which was erected in 1895, is 204 × 174 ft., and is so constructed that it can be almost indefinitely extended without alteration of the work already done. The structure is of steel throughout, and the walls and chimney are of brick. The plant is located near the Schuylkill River. The supply of water, of which the company uses 12,000 gallons a minute for condensing purposes, is obtained through a round brick-and-stone conduit 48 ins. in diameter, which extends from the plant to the bottom of the river, a distance of 1,300 ft.

PITTSBURG, PA.—Local papers state that Capt. W. B. Rodgers, of the Tide Coal Co., has let the contract for a complete electric haulage plant to be put in his mines. The machinery will cost about $10,000.

CHESAPEAKE BEACH, MD.—We are informed that plans and specifications for a plant, water-works, sewers and an ice plant are being prepared by Geo. Cadogan Morgan, 808 Royal Insurance Bldg., Chicago, for the Chesapeake Beach Ry. Co. It is not known when the contracts will be let. Otto Mears, Pres., Washington, D. C.

HAGERSTOWN, MD.—The council has passed an ordinance providing for the construction of a municipal plant, to cost about $60,000.

LONACONING, MD.—The Lonaconing Electric Light & Power Co. has decided to extend its plant. Local papers state that there shall be required two 120-HP. engines, a boiler, two alternating dynamos of 2,000 voltage each, with the numerous fixings necessary to operate them. These will be purchased at once. Supt., H. Scott.

HINTON, W. VA.—Arrangements have been completed for the development of the water power of the Kanawha Falls, near Hinton, and the work is now progressing rapidly under the direction of John W. Hayes, of Petersburg, Va., who prepared the plans. The power is being developed by the Wilson Aluminum Co., 97 Cedar St., New York. Buildings will be erected and plants established for the manufacture of calcium carbide, for the making of acetylene gas. The falls have about 6,000 to 12,000 HP.

BRUNSWICK, GA.—W. F. Greene, Civil Engr. and Receiver, Brunswick Light & Water Co., writes us that all contracts for furnishing machinery for a new plant have been let. Estimated cost, $18,000. E. F. Baker, Des. Engr., 1601 North Calvert St., Baltimore, Md.

FORSYTH, GA.—W. A. Pye, Cy. Clk., writes us that it is not yet decided whether to have a plant or not.——A report states that this place voted Nov. 26 to issue bonds for electric lights.

GAINESVILLE, GA.—Jas. P. Edwards, Elec. Engr., Augusta, Ga., and Gainesville, writes us that the proposed plant will be as follows: Plant operated by water power, water-wheel 150-HP., under 9 ft. head wanted to furnish power to the municipal arc lighting plant at the shaft (without transmission); one generator, two-phase alternating 2,400 volts, 100 K-W. wanted; about 16 miles No. 5 B and S. weatherproof line wire wanted (probably part used bare instead of insulated); plant will supply light and power, and generator is expected to run 24 hours a day. Probability of using a storage battery for lighting purposes; in addition the present horse-car line wishes to use electricity if it can be secured cheaply enough.

SPARTANBURG, S. C.—J. T. Johnson and others, of Spartanburg, propose to build a water-power plant and several mills at Ware Shoals. The plant will furnish about 10,000 HP.

KEY WEST, FLA.—Messrs. Laflin have been granted a franchise to operate a plant and street railway.

RICHMOND, KY.—We are informed that a plant will be built for the Richmond Electric Light Co. at a cost of $15,000. The plant will have a Warren-Medbery alternator, 50 arc lamps, etc. The engines and boilers have not yet been purchased. D. J. Hauss, Elec. Engr., Pike Bldg., Cincinnati, O., and Frank Adair may be addressed.

CLEVELAND, O.—Director of Law Norton is reported to have stated that ordinances are being prepared to authorize the construction of underground conduits for the electric wires, etc.

ROCKFORD, O.—A. G. Stewart, one of the incorporators of the new electric company, writes us that bids will probably be asked in about two weeks for building the plant to have 800 incandescent lights. It is expected that the plant will be operated in connection with the water-works. There will be required an engine and dynamo, overhead wires, etc.

SPRINGFIELD, O.—It is stated that the Springfield Light & Power Co. will extend its plant at a cost of about $10,000. J. N. Waterman, Pres., Boston, Mass.

WOODSFIELD, O.—Bids are asked until Dec. 27 for constructing a plant, according to reports; estimated cost, $7,000. T. A. Way, Mayor.

GREENFIELD, IND.—John F. Egan, Mayor, writes us that the council has purchased the plant for $16,000.

FLAT ROCK, MICH.—This city is to have a plant, according to reports.

GROSSE POINTE, MICH.—The village of Grosse Pointe Farms, it is stated, has voted against issuing bonds for a plant.

ROYAL OAK, MICH.—Bids are asked until Dec. 20 for constructing a plant to cost $3,000. Gas engines will be used. It will have a capacity for furnishing 16 1,500-c. p. arc and 250 incandescent lights. Address Wm. Hilzinger, Main and First Sts., Royal Oak.

STURGIS, MICH.—Chas. A. Sturgis, Mayor, writes us that plans and specifications for a plant are not yet prepared. The plant will have a capacity for 100 to 125 arc and 1,500 16-c. p. incandescent lights. C. L. Hauer, Supt.

LINCOLN, ILL.—Arrangements are reported as being made for the construction of the plant for the Logan County Electric Light Co. The company has a capital stock of $10,000. John St. Cerny and Henry G. Harget, Pekin, Ill., and Adam Denger, Lincoln, are interested.

FOUNTAIN CITY, WIS.—H. & F. Roettiger have engaged A. M. Palitz, Milwaukee, Wis., as consulting engineer for the proposed plant. He will have charge of receiving bids. The city will be lighted by four arcs and 25 32 c. p. incandescent lights.

COUNCIL BLUFFS, IA.—The council has been asked to call an election to vote on the question of granting a 25-year franchise for a plant to the J. C. Hubinger Co., Keokuk, Ia.

WILLIAMSBURG, IA.—The council proposes to put in a plant, according to reports.

LITTLE FALLS, MINN.—Bids are asked until Dec. 16 for the purchase of $60,000 of 5% 20-year bonds for the proposed plant and water-works; population, 6,000. F. E. Hall, Cy. Clk.

INDEPENDENCE, MO.—H. B. Speechter, of Louisiana, Mo., is reported to have applied for a franchise to construct a $30,000 plant, and to operate it.

NORTHPORT, WASH.—W. R. Lee writes us that he has been granted a franchise. He was also awarded a 5-year contract for 10 arc lights. The plant will be operated by water power. No contracts will be let for some time.

ELGIN, ORE.—Reports state that a contract for a plant and water-works, to cost about $12,000, has been let.

INDEPENDENCE, ORE.—The committee has been instructed to purchase the L. C. Gilmore water power. It was also instructed to purchase the Independence electric light plant.

SAN PEDRO, CAL.—The city trustees have been asked to call an election to vote on the question of issuing $40,000 in bonds for a plant and water-works, and $20,000 for sewers.

PROVO, UTAH.—It is stated that the plant will be purchased by the council, and that it will be extended.

SHERBROOKE, QUE.—Bids are asked until Dec. 15 for lighting the streets with arc and incandescent lights. C.W. Cate, Chn. Com.

HAMILTON, ONT.—The Cataract Power Co. has submitted a proposition to furnish this city with electric lights. H. R. Leyden, Gen. Mgr.

INGERSOLL, ONT.—The council, it is stated, has appointed a committee to negotiate for the purchase of the plant of the Ingersoll Electric Power & Light Co.

VICTORIA, B. C.—Application will be made to the legislative assembly of the Province for an act to incorporate a company to construct, equip and operate a plant for the lighting by electricity of the townsites of Teslin Lake, Glenora, Telegraph Creek, and Atlin City, and also to erect and maintain telephone and telegraph lines, with all the necessary powers and privileges. Robert Cassidy is the solicitor for applicants.

NEW COMPANIES.—Huntingburg Light & Power Co., Huntingburg, Ind.; $4,500; C. S. Knight, M. L. Pohlamus.

Newaygo Transmission Co., Newaygo, Mich.; $15,000; to furnish electric light and power; Alston Gerry, Jas. F. Barry, of New York city; J. E. More, Chas. F. Peke, Grand Rapids, Mich.

Corona Light & Water Co., Klamath Falls, Ore.; $100,000; S. C. Ttayner, A. L. Leavitt, C. L. Parish.

Chemical Battery Light, Heat & Power Co., Pierre, S. Dak.; $5,000,000; Frank W. Lowery, E. O. L. Apel, E. L. Squire.

La Cigale Water & Power Co., Mercur, Utah; Martin Mahnken, Mercur.

East Chicago Light & Power Co., East Chicago, Ind.; $15,000; George W. Wilson, H. N. Haley, M. L. Pike.

Valley Electric Light Co., Valley Falls, N. Y.; $10,000; to furnish light in Lansingburgh, Melrose, Schagnticoke, Stillwater, Valley Falls, Johnsonville, Buskirk's Bridge and Eagle Bridge; Edward O'Neil, Hiland Carpenter, Augusta Carpenter, Valley Falls; Jonathan N. Carpenter, Hoosick Falls, N. Y.

Groton Electric Co., Groton, Conn.; $2,000.

Elmira Light, Heat & Power Co., Elmira, N. Y.; $10,000; James B. Rathbone, Elmira.

Sheridan Light & Water Co., Sheridan, Ind.; $9,500; H. C. Knight, M. L. Polhamus.

American Sun Light Co., New York; $10,000; J. L. Nisbet, Yonkers, N. Y.; R. H. Jaeger, R. H. Stearn, New York.

Clarendon Light & Heat Co., Clarendon, Ark.; $6,000; J. W. B. Robinson, Pres.; H. B. Bateman, Vice-Pres.; J. T. Jones, Secy. and Treas.

Red Lake Falls Electric Light Co., Red Lake Falls, Minn.; $8,000; Marcus Johnson, Atwater, Minn.; Anna B. Marshall, L. R. Smith, Red Lake Falls, Minn.

Rockford Electric Lighting Co., Rockford, O.; $6,000; C. S. Mauk, A. G. Stewart, D. C. Kuder, F. M. Kirby, J. D. Wagers, W. T. Palmer.

Carter-Hays Electric Co., Louisville, Ky.; $5,000; to manufacture and repair electric appliances and construct electric plants, etc.; E. W. Hays, Hugh Hays, L. D. Carter.

Bath Light & Power Co., Bath, Me.; $100,000, with $400 paid in; Pres., E. W. Hyde, Bath, Me.; Treas., H. H. McCarty, Bath, Me.

Millbrook Gas & Electric Co., Washington, N. Y.; $15,000; Wm. E. Smith, Millbrook; Rich'd J. Scoles, Samuel Thorn, New York.

Delaware Electric Light & Power Co., New York; $250,000; P. G. Stappens, D. McM. Niven, C. W. Phillips, New York.

Natchez Light, Power & Transit Co.; Natchez, Miss.; $200,000; Maurice Moses, Abram Moses, Natchez.

Eldora Resort & Power Co., Eldora, Colo.; $100,000; to build a summer resort, a power plant, etc., on the Paterson Lake property, Boulder county; T. B. Stuart, C. A. Murray, E. L. Alexander.

Crescent City Electric Co., New Orleans, La.; to build and operate a plant, the wires to be underground; Pres., Jos. H. DeGrange, Pres. Canal & Claiborne R. R. Co.; Secy. and Treas., Sidney H. March, of the Dock Comn.; Gen. Mgr., J. B. Craven.

Williamsport Water & Light Co., Williamsport, Ind.; $10,000; Jno. H. Brown, B. O. Mayer.

Citizens Electric Light & Water Co., Smithfield, Va.; $20,000; J. W. Holloway.

Hamburg Mining, Milling & Power Co., Washington, D. C.; $5,000,000, with $1,000 paid in; to develop the manufacturing, chemical, mining, milling interest of Huilota, Mex.; J. M. Wiley, H. O. Baker, W. T. Fitzgerald, D. Lester, H. Wasmuth, Washington.

Greenup Light Co., Greenup, Ky.; $5,000.

BRIDGES.

PLYMOUTH, MASS.—The board of selectmen is considering the question of replacing certain bridges destroyed by storms. Plans for a new iron bridge over Eel River, on Warren Ave., have been presented by Ernest Nickerson.

ALBANY, N. Y.—The Hudson River Bridge Co., New York, proposes to construct a new bridge to replace the present structure between Maiden Lane and East Albany, to cost about $500,000.

BINGHAMTON, N. Y.—Jerome De Witt, Mayor, informs us that no official action has been taken to construct the proposed bridge over the Susquehanna River.

BUFFALO, N. Y.—The grade crossing commission has in contemplation the construction of eight viaducts and ten subways. About two years will be required to complete these improvements, which will cost about $1,000,000.

SYRACUSE, N. Y.—Henry B. Seaman, New York, has been engaged to prepare plans and estimates for abolishing the grade crossings. Jas. K. McGuire, Mayor.

WATERVLIET, N. Y.—Reports state that the Hilton Bridge Co. has been awarded a contract for a new bridge over the canal on Broadway, near 23d St., to be constructed next spring.

ROSSIE, N. Y.—A bill has been introduced in the board of county supervisors, Ballston Spa, N. Y., to authorize this town to borrow $4,800 for the construction of an iron bridge.

LE ROY, N. Y.—A meeting of the town board and railway commissioners will be held Dec. 13, at the Buffalo, Rochester & Pittsburg Ry. station, to consider the question of constructing a highway bridge over the tracks at Haskin's Crossing.

HOOSICK FALLS, N. Y.—Reports state that plans and specifications for the abutments for the new bridge to be built at North Hoosick are on file with the town clerk.

CLIFTON, KY.—W. L. Cannon, Midway, Ky., writes us that a steel bridge will be constructed of one span, 100 or 110 ft. long, and 14 ft. wide; capacity, 100 lbs, per sq. ft. E. Thacker, Engr., 16 Savings Institute, Paterson, N. J.

INDEPENDENCE, KY.—Bids are asked until Dec. 10 for furnishing plans and constructing a bridge of two spans, 48 ft. each, capacity 150 lbs. per sq. ft., over Cruises Creek. Address Eugene Mann, Piner, Ky., or W. T. Loomis, Staffordsburg, Ky.

HARRISON, O.—It is proposed to construct a new bridge between Hamilton county, O., and Dearborn county, Ind.

MOLINE, ILL.—J. G. Wagner Co., of the Milwaukee Bridge & Iron Works, Milwaukee, Wis., was awarded a contract, Nov. 30, by Maj. W. L. Marshall, U. S. Engr., Chicago, for the construction of a high bridge over Rock Creek, to cost about $25,000.

EAST GRAND FORKS, MINN.—Bids are asked until 8 p. m., Dec. 9, for widening the approach to the De Mers Ave. bridge. Henry Harm, Cy. Recorder.

CORSICANA, TEX.—The county commissioners have awarded a contract to Mr. Flynn, Weatherford, Tex., at $1,500, for two iron bridges over Post Oak Creek.

SPOKANE, WASH.—The Washington St. bridge has been condemned by the board of public works. A new structure will probably have to be constructed.

YUMA, ARIZ.—The citizens are considering the question of having an addition to the new Southern Pacific Ry. bridge, for wagons, to cost from $10,000 to $15,000.

FRESNO, CAL.—The county supervisors have awarded a contract to the California Bridge & Construction Co., at $8,770, for the construction of a bridge over Kings River, near Sanger.

NAPA, CAL.—Newman & Wing have been awarded a contract, at $2,600, for the construction of a stone bridge across Fagan Creek. N. W. Collins, Clk. Bd. Supervisors.

CHARLOTTETOWN, P. E. I.—Bids are asked until Dec. 21 for constructing a bridge at Alberry Plains, according to reports. Richard Smith, Secy. Bd. Pub. Wks.

BUILDINGS.

BOSTON, MASS.—Bids are asked until Dec. 9 for erecting a grammar school building on Quincy and Perth Sts., Dorchester, for the city of Boston; bond, $20,000. Wm. T. Eaton, Chn. of Com.; A. Warren Gould, Arch., 2A Beacon St.

BOSTON, MASS.—Bids are asked until Dec. 12 for a feed-water heater, meters, etc., for the pumping station, Calf Pasture, Dorchester District. Benj. W. Wells, Supt. Sts.

CAMBRIDGE, MASS.—A new $50,000 infirmary building is to be erected here for Harvard University. James Stillman, 7 East 40th St., New York, is the donor.

PAWTUCKET, R. I.—Cram, Goodhue & Ferguson, of Boston, are stated to have been chosen as architects for the new public library building to be erected in this city; cost, between $100,000 and $200,000.

DANBURY, CONN.—D'Esope Bros., Hartford, Conn., were the lowest bidders, Nov. 30, for erecting a court house for Fairfield county in this city, at $35,649. Other bidders were: Tracy Bros., Waterbury, Conn.; Casey & Hurley, Bridgeport, Conn.; C. C. Crossley, Danbury; J. L. Bunnell, Danbury; Dowling & Bottomley, Bridgeport; Foster Bros., Danbury; Norcross Bros., Worcester, Mass.

MIDDLETOWN, CONN.—C. W. Page, Supt. of Hospital for the Insane, informs us that reports were premature stating that plans have been completed for additions to the buildings, to cost about $75,000. Recommendations have been made regarding the same, but no steps can be taken without the sanction of the state legislature.

ALBANY, N. Y.—Norcross Bros., Worcester, Mass., are reported to have been awarded the contract for erecting the new union station in this city, on the site of the old Delavan House, to cost about $400,000.

ALBANY, N. Y.—Plans are asked until Jan. 3 for a public bath house in this city. Horace Andrews, Cy. Engr.

BUFFALO, N. Y.—Reports state that Mayer & Weil, who recently bought the Manhattan Hotel, at Main and Mohawk Sts., and who will replace it with a 7-story brick fireproof building of steel construction, have closed a contract with Charles Mosier to tear down the present building and to build the new structure.

NEW YORK, N. Y.—A fire in this city, Dec. 4, destroyed the 5-story building at Warren St. and Broadway, occupied by Rogers, Peet & Co., Clothiers. The loss to this and the Home Life Building, which is adjacent, is estimated at about $800,000.——The St. Agnes Roman Catholic Church, 43d St., near 3d Ave., was damaged by fire, Dec. 4, causing a reported loss of $75,000.——Reports state that Andrew Carnegie, of Pittsburg, will erect a large dwelling at 91st St. and 92d St. and 5th Ave.——The 2-story brick car-house, 150 × 250 ft., of the Union Ry. Co., at 173d St. and Boston Road, was damaged by fire, Nov. 30. Estimated loss, $150,000; insurance, $100,000.——Plans have been filed by Paul B. Pugh & Co., 674 Columbus Ave., for a 7-story brick flat building at 92d St. and Central Park West, to cost $120,000. G. A. Schellenger, Arch., 128 Broadway; by Friedman & Feinberg, for four 6-story brick flat and store buildings, at 287 to 297 Elizabeth St., to cost $99,000; by C. B. Drew, 306 East 123d St., for a 7-story brick tenement building on 123d St., near 2d Ave., to cost $70,000. G. S. Drew, Jr., Arch.; by the New York Second Church of Christ Scientists, for a 4-story granite, marble and brick church building at Central Park West and 68th St., to cost $200,000. Frederic R. Comstock, Arch., 98 5th Ave.; by Mrs. Lottie Ratner, for eight 4-story brick flat buildings at 139th St. and St Ann's Ave., to cost $120,000. M. Bernstein, Arch., 145 Centre St.; by Lanrowitz & Fine, 307 East 74th St., for three 6-story brick flat buildings on Houston St., near Hancack St., to cost $84,000. G. Fred. Pelham, Arch., 503 5th Ave.; by Charles Wahlig, 678 East 134th St., for six 4-story brick buildings on 135th St., near Brook Ave., to cost $150,000. E. Wenz, Arch. and Owner, 2577 3d Ave.; by L. F. J. Weiher, Jr., for three 5-story brick flat buildings on Washington Ave., near 164th St., to cost $68,000; by Bernheimer & Schmid, for a 4-story brick storage house on 107th St., near Columbus Ave., to cost $60,000. Louis Oberlin, Arch., 15 Whitehall St.——John Weber & Son are reported to have the general contract for erecting a 3-story brick warehouse and stable at 613 and 615 West 48th St. for the Pabst Brewing Co. Lyndon P. Smith, Arch., 258 Broadway.——The following bids were received by the supervising architect, Washington, D. C., Nov. 24, for taking down and rebuilding the west end wall of rear building of the Assay Office: John F. Johnson, New York, $11,700, time, 90 working days; Michael Moore, New York, $5,750, 50 working days; Joseph H. Cuttey, New York, $5,639, 30 working days; Quincy & Crawford, New York, $6,660, 9 weeks; Hartman & Hogan, New York, $4,887, 33 days.——The following bids were received, Nov. 28, by the supervising architect, for the extension of the mailing platform and shed of the post office building in this city:

		Time.
Cooper & Wigand, 1133 Broadway, N. Y.	$13,896	3½ mos.
Kenny & Kenny, Syracuse, N. Y.	12,304	4 "
Post & McCord, ft. Clay St., B'klyn, N.Y.	14,270	4 "
[1]Prince & Kinkel Iron Wks., New York..	16,637	4 "
Stacy B. Opdyke, Jr., Philadelphia, Pa..	12,235	4 "
Ryan & McFerran, 106 E. 23d St., N. Y.	14,949	4 "
W. G. Triest, 39 Cortlandt St., N. Y.....	12,237	3 "
Kelley & Kelley, 220 Broadway, N. Y...	12,296	4 "
J. B. & J. M. Cornell, 143 Centre St., N.Y.	14,735	90 days.

LESTERSHIRE, N. Y.—This village, Nov. 29, voted to erect a new fire station and municipal building, to cost $24,000. M. S. Squires, Village Pres., informs us that architects are now submitting plans, but that no plan will probably be accepted before Dec. 10.

PORT CHESTER, N. Y.—It is reported that the board of education is arranging to submit to the voters at an early date a proposition to issue bonds for erecting a new high school building.

ROCHESTER, N. Y.—A fire in this city, Dec. 2, destroyed the Academy of Music; estimated loss, $80,000.

UTICA, N. Y.—It is reported that Jesse L. Oberdorfer, Mgr. of the Utica Opera House, has secured an option on the property at Blandina and Devereux Sts., until March 1, for the erection of a new theater building.

ATLANTIC CITY, N. J.—Plans are about completed for a new 5-story apartment house to be erected at Pacific and Kentucky Aves. for William Staiger; estimated cost, $30,000. Harold F. Adams, Arch.——Plans have been prepared for a 3-story brick and stone building apartment house, 40 × 100 ft., at New York and Atlantic Aves., for Bacharach & Sons. C. Hudson Vaughn, Arch.

CAMDEN, N. J.—A fire in this city, Nov. 29, damaged the store buildings at 216 to 220 Market St., causing a reported loss of $75,000; insurance, $70,000.

ALLEGHENY, PA.—It is reported that a new passenger station for the Buffalo, Rochester & Pittsburg R. R. Co. will be built early next year at Darragh, Balkam and Robinson Sts.; estimated cost, $150,000.

PITTSBURG, PA.—Plans are about completed, according to reports, for the erection of a new 14-story office building on the site of the Central Hotel, Smithfield St. and 2d Ave., for a syndicate of which I. P. Thurman, Allegheny, Pa., is president; estimated cost, $800,000. Chas. S. Bickel, 524 Penn Ave.——Plans have been prepared by Rutan & Russell, 111 4th Ave., and approved by E. M. Bigelow, Dir. of Dept. Pub. Wks., for an observatory at Highland Park. The tower will be constructed of rock-faced stone, will be 75 ft. high and will cost about $10,000. Work is to commence in the spring.——Bids are being received by Marlin & Co., Liberty Ave. and 24th St., according to reports, for erecting a steel shop building for their galvanized iron works.——Plans have been prepared by Alden & Harlow, Vandegrift Bldg., for the proposed addition to the Carnegie Institute, to cost about $750,000, work to begin in the spring. W. N. Frew, Chn. of Bd. of Trustees.

WILMINGTON, DEL.—Bids are asked by the board of education until Jan. 9 for erecting a new high school building on Delaware Ave. William Turner, Chn. of Com.

BALTIMORE, MD.—The council committee on education is considering the question of erecting a colored high school building on Pennsylvania Ave. Mayor Malster, and Henry F. New, Pres. of the School Bd.

WASHINGTON, D. C.—The following bids were received by the District Commissioners, Nov. 26, for the erection of an isolating building for minor contagious diseases on the grounds of Providence Hospital:

			Heat'g plant
Geo. W. Harrison	$29,650	$30,153	$3,400
Owen Donnelly	29,200	29,600	2,800
Andrew Gleeson	26,990	27,300	2,500
Meltar & Watts.........	26,538	27,000	2,800
Henry F. Getz	26,275	26,800	2,380
Richardson & Burgess...	25,284	28,757	2,681
Chas. S. Dunham	25,573	26,512	2,350
Pavarini & Grul	24,824	24,900	2,840
W. E. Spier	22,217	22,430	.....

WASHINGTON, D. C.—Bids are asked by the district commissioners until Dec. 12 for reconstructing and replacing a portion of the plumbing of the Grant School building, on G St., near 21st St., N. W.

NEWPORT NEWS, VA.—Judge Sims and Winston Bros., of Louisa county, according to reports, will erect a 5-story opera house on Washington Ave., costing about $80,000.

NORFOLK, VA.—McIlvain, Unkefer & Co., Pittsburg, Pa., have been awarded the contract for erecting the new U. S. building in this city, at $162,966; time, 16 mos.

CHARLESTON, S. C.—Bids are asked until Dec. 23 for the erection of an auditorium at this place. Bond, $10,000. Frank P. Milburn, Arch., Charlotte, N. C.; Samuel Lapham, Chn. Auditorium Com.

ATLANTA, GA.—The U. S. government will erect a prison in this city, costing about $2,500,000, according to local papers.

BLUERIDGE, GA.—Andrew J. Brvan & Co., Atlanta, Ga., are reported to have completed plans for the proposed county courthouse, to cost about $35,000.

GAINESVILLE, GA.—This city will vote on the question of erecting a city hall.

LEXINGTON, KY.—Bids are asked until Dec. 19 for the erection of a temporary structure at the Kentucky State Houses of Reforms, near Lexington. Address Mrs. L. E. Yandell, Pres., 315 Broadway, Louisville, Ky.; Richards & McCarty, Archs., Columbus, O.

SHEPHERDSVILLE, KY.—The Fiscal Court of Bullitt county has decided to build a new court house at this place.

CINCINNATI, O.—The plans of Saml. Hannaford & Sons, for the Saengerfest building to be erected here, to cost $30,000, have been accepted. Gen. Andrew Hickenlooper, J. A. Firnstein, C. Krager, Chas. Kuhl, H. Methorfer, L. Kleybolte and Edmund K. Stalls, compose the building committee.

COLUMBUS, O.—The bids received for the changes to be made in the steam heating apparatus for the Sullivan school building were rejected. New bids will probably be asked.

TOLEDO, O.—Park Superintendent Moore is receiving bids for the construction of three steel greenhouses, 125 ft. long, according to reports.

FRANKTON, IND.—A fire, Dec. 5, destroyed the Commercial block in this city; reported loss, $100,000.

GREENSBURG, IND.—The contract for the erection of the building, to cost $40,000, for the Home for Old and Helpless Odd Fellows, will be let soon. C. C. Binkley, Richmond, Ind., and Judge M. A. Chapman, Anderson, Ind., may be addressed.

KOKOMO, IND.—Fire destroyed the old Milton B. Hopkins University; reported loss, $45,000; insurance, $11,000.

RUSHVILLE, IND.—The school board has recommended the construction of a new $40,000 high school building; also a $5,000 school building for colored children.

GRAND RAPIDS, MICH.—James K. Johnson contemplates the erection of a 6-story brick business block on Louis St.

CHICAGO, ILL.—M. G. McIntosh contemplates the erection of a 3-story and basement apartment house, 138 × 46 ft., to cost $35,000. O. W. Marble, Arch., 218 La Salle St.——Armour & Co. will erect a 7-story brick warehouse at Packer Ave. and 43d St., to cost about $100,000; and a one-story brick fertilizing house at Loomis and 45th St., costing $35,000.——Edw. H. Salsbury, according to reports, will erect a 2-story apartment house, to cost $65,000; two 4-story apartment houses, each costing $40,000.——William Blair will erect a 7-story business block, 73 × 173 ft., at Nos. 430-434 Wabash Ave.; to cost $100,000.—The board of education is receiving bids for the erection of a 3-story and basement building, 191 × 91 ft., at 54th St. and Union Ave., to cost about $90,000.——Mrs. Mary Knauer will erect a 4-story and basement apartment house, 60 × 167 ft., to cost $50,000. Barfield & Hubbell, Archs., 87 Washington St.——The council will consider a plan for public markets. Alderman Nooak may be addressed.

EVANSTON, ILL.—The Masonic lodges of this city contemplate the erection of a 3-story building, 60 × 150 ft., on Davis and Maple Aves., to cost about $30,000.

KANKAKEE, ILL.—A 3-story and basement hotel, 100 ×85 ft., with an L 25 × 60 ft., costing $40,000, will be erected here. J. F. Fortin, Arch., 265 South May St., Chicago.

MOLINE, ILL.—The board of education has ordered that plans and specifications be prepared for a new 8-room brick school building to be erected here next summer.

CEDAR RAPIDS, IA.—The citizens of this city will vote on the question of issuing $125,000 in bonds for a city hall.

DES MOINES, IA.—Reports state that Norman Lichty and others contemplate the erection of a 7-story building at 6th and Walnut Sts., to cost about $125,000.

PARK RAPIDS, MINN.—Ferdinand Mueller, county auditor, informs us that the question of issuing the courthouse bonds was not voted upon at last election.

MILWAUKEE, WIS.—Reports state that Henry Herman, representing the North Lake Wisconsin Ice Co., has awarded George Mindeman the contract for the erection of 15 ice houses on the shore of North Lake, near the railway track. Each building will be about 80 ft. long, and the total cost about $35,000; work to be completed within 60 days.

LINCOLN, NEB.—A fire, Dec. 1, destroyed the main building of the Lincoln Normal University, a 4-story brick and stone structure, three miles from here. Reported loss, $100,000; insurance, $25,000.

THERESA, WIS.—John J. Fayel, late Supt. of the Holy Terror Mining Co., in his will gives $75,000 for a public library at this place, according to reports.

ST. LOUIS, MO.—The Second Presbyterian Church will erect a new structure, to cost $100,000, on Taylor Ave.——Isaac S. Taytor is preparing plans for a 7-story building, at Washington Ave. and 10th St., to cost $150,000.

SANTA BARBARA, CAL.—The citizens will vote Dec. 17 on the question of issuing $50,000 in school bonds.

DENVER, COLO.—The Walter Orpheum Co., of San Francisco, Cal., has been awarded the contract for erecting the new 5-story theatre building, at Arapahoe and 15th Sts. It will probably cost about $250,000.

ALBANY, ORE.—Bids are asked until Jan. 6 for labor and materials required in remodeling and improving a brick courthouse for Linn county, Albany. Frank Crabtree, County Clk.

SAN FRANCISCO, CAL.—The following bids were received at the Bureau of Yards and Docks, Navy Dept., Washington, for the construction of a shelter roof for boats at the Mare Island Navy Yard:

Ralston Iron Works, San Francisco	$13,490
Miller & Beck, San Francisco	13,939
Anderson & Grieg, San Francisco..............	11,825
James A. McMahon, San Francisco	13,250
Thomas Thompson, San Francisco	13,527
J. S. Van Winkle & Co., San Francisco	13,999
California Br. & Construction Co., Oakland, Cal.	14,790
Wm. P. Healy, San Francisco	11,997
New York Dredging Co., New York, N. Y.	12,142
Penn Bridge Co., Beaver Falls, Pa.	14,189

Also the following bids for the construction of a saw-mill, boiler house and steel chimney at the same yard were received: Z. O. Field, San Francisco, $70,655; Penn Bridge Co., Beaver Falls, Pa., $71,764; New York Dredging Co., New York, $65,942; Wm. H. Healy, 97 Stewart St., San Francisco, $59,997; J. H. McKay, San Francisco, $72,308, $2,100 deducted by telegram; Anderson & Greig, 48 New Montgomery St., San Francisco, $68,625; F. A. Williams, San Francisco, $68,918; California Bridge & Construction Co., Oakland, Cal., $55,939; James A. McMahon, San Francisco, $66,450; W. H. Wickersham, San Francisco, $68,900.

TORONTO, ONT.—Bids are asked until Dec. 8 for the office fittings for the new city buildings. E. J. Lennox, Arch., King and Yonge Sts.; John Shaw (Mayor), Chn. Bd. Control.

WATER-WORKS.

AMESBURY, MASS.—E. R. Sibley, Treas. Power Hill Water Co., writes us that plans for a new reservoir involve the relocation of a portion of one of the streets, the company, therefore, will have to wait until the annual town meeting in March before arrangements can be completed.

HOLYOKE, MASS.—The commissioners have instructed Jas. L. Tighe, Engr. Water-Works, to prepare plans for a sand bed filtration plant for purifying the water of the Whiting St. reservoir. This reservoir has a capacity of 450,000,000 gallons. The greater part of the material, such as sand, gravel and stone, is in the immediate vicinity. Work will probably be begun in the early spring. Estimated cost, $25,000.

SPENCER, MASS.—The question of building a standpipe at a cost of $5,000 is being considered.

WATERTOWN, CONN.—B. H. Mattoon, Dir., writes us that the Watertown Water Co. was organized Nov. 26. It is probable that arrangements to let contracts will be completed to begin the construction in the spring. Population, 3,000. C. B. Mattoon, Pres.; E. W. Wheeler, Secy.

CLAYTON, N. Y.—An election was held Dec. 6 to vote again on the question of building works and a sewerage system. Plans for works were prepared in 1896 by Hinds & Bond, of Watertown, N. Y.; estimated cost, $50,000. Population (1890), 1,748. F. L. Hall, Pres. Village.

DUNKIRK, N. Y.—Bids are asked until Dec. 20 for furnishing and installing a pump of about 6,000,000 gallons capacity daily, as described in our advertising columns. Chas. E. Hequembourg, Comr.; Lucius Thompson, Supt.

LESTERSHIRE, N. Y.—This place voted Nov. 29 to issue $14,000 in bonds for a new pumping station; $24,000 for a city hall, etc. Bids for making these improvements will be asked in a short time. M. S. Squires, Village Pres.

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[1] 553 West 33d St.

NORTH TARRYTOWN, N. Y.—The Pocantico Waterworks Co. has been incorporated with a capital stock of $250,000, by Ralph Olmsted Ives, Henry R. Winthrop, Henry F. Miller and others, of New York. This is a reorganization of the old company, which has supplied this place with water since 1888.

STRYKERSVILLE, N. Y.—The Crystal Springs Water Co., of Buffalo, has been incorporated, with a capital stock of $5,000, by Dr. Frank P. Vandenbergh, Erie County Bank Bldg., Buffalo, N. Y., and others.

CHESTERTOWN, MD.—The commissioners are again considering the question of purchasing the works of the Chestertown Water Co., for $23,000.

CONNEAUTVILLE, PA.—An election will be held in February to vote on the question of issuing $10,000 in bonds for granting a franchise for works.

NORFOLK, VA.—J. Thomas Peelle, Registrar, writes us that the contract for a Jewell gravity filtration plant has been let to the New York Filter Mfg. Co., 26 Cortlandt St., New York, at $55,000, exclusive of building. The plant will have a capacity of 60,000,000 gallons a day.

SMITHFIELD, VA.—The Citizens' Electric Light & Water Co. has been incorporated, with a capital stock of $20,000, to build works and a plant at once. J. W. Holloway is interested.

PARKERSBURG, W. VA.—It is proposed to purchase 13,500 ft. of 4 and 6-in. water-pipe for the outer portion of the city. The cost, with laying, will be about $8,000.

GAFFNEY, S. C.—Bids are asked until Jan. 3 for the purchase of $18,000 of 40-year bonds, with privilege of redemption in 20 years. A. N. Wood writes us that the water supply will be taken from wells. At present no further information can be given. Population, 5,000. Frederick Minshall, Engr., Pocomoke, Md., and 150 Nassau St., New York.

BRUNSWICK, GA.—The works and light plant of the Brunswick Light & Water Co. will be extended, the contracts for furnishing the additional machinery having been let. W. F. Greene, Civil Engr. and Receiver.

MONTGOMERY, ALA.—Geo. A. Ellis, Consult. Engr., Springfield, Mass., writes us that the city has nearly completed about nine miles of extension on its distribution system; is proposing to add about four miles of large force main for the reinforcement of its present system; to add 12 new artesian wells with conduit lines to the present basins, which are to be covered; to replace the present pumping plant with two new 5,000,000-gallon pumps, together with almost entire reconstruction of its pumping station; the whole work is expected to cost about $175,000. Except the work on the extensions, which was contracted for last July, none of this work is yet under contract. J. W. Persons, Cy. Engr.; Fred Crosby, Supt.

COLUMBUS, MISS.—This city is reported to have voted Nov. 29 to issue $70,000 in bonds for improving the works and for building a sewerage system.

ALLIANCE, O.—Bids will soon be asked for the purchase of $80,000 of water bonds. Joe. McConnell, Cy. Clk.; O. W. Pfouts, Cy. Engr.

CLEVELAND, O.—The following bids were received by the board of control Nov. 25 for furnishing a new portable boiler and a pulsometer pump and carriage for the Division St. pumping station: Wm. Pattison Supply Co., $1,237; Erie City Iron Works, $775; River Machine & Boiler Co., $1,025; Kaltenback & Dress Co., $1,200. Bids were also opened for repairing and rebuilding No. 4 Worthington pumping engine at the Division St. station: Henry R. Worthington, $10,000, and the Snider-Hughes Co., $16,800. The bids on the latter work were about $10,000 lower than expected.

WILLIAMSPORT, IND.—The Williamsport Water & Light Co. has been incorporated, with a capital stock of $10,000, by John H. Brown, B. O. Mayer and Geo. Mayer.

BELLEVILLE, ILL.—We are informed that the Belleville Deep Well Water Co. is laying a few miles of small water pipe. The materials have been purchased for the extensions.

BOWEN, ILL.—W. C. McClure, Clk., writes us that this place voted a few months ago against building works. The only thing wanted is some hose for the hand engine. Population, 1,000.

WEST SUPERIOR, WIS.—W. H. Winslow, Secy. Superior Water, Light & Power Co., writes us that the company is carrying on several experiments in filtration, and has had Allen Hazen, 220 Broadway, New York, here to look over the ground for the purpose of making a report and recommendations.

ALLISON, IA.—A committee has been appointed to investigate the question of building works.

DUBUQUE, IA.—The Dubuque Water-Works Co. is enlarging its works by the addition of another artesian well, which is to be about 1,500 ft. in depth, and 10 ins. in diameter at the bottom. The contract has been let to L. Wilson, 53 Dearborn St., Chicago, Ill., who has already begun work on it.——Alderman P. W. Crawford writes us that no steps have yet been taken toward securing municipal works, except to serve notice on the company that after the expiration of six months from date of notice the city will proceed to purchase the works, and calling on the company to propose terms. The time expires in February.

LITTLE FALLS, MINN.—Bids are asked until Dec. 16 for the purchase of $60,000 of 5% bonds for the proposed works and electric light plant, plans and specifications for which will be prepared at once. F. E. Hall, Cy. Clk.

WAMEGO, KAN.—We are informed that the following bids were received Nov. 30 for the construction of waterworks, including 15,900 ft. of 4-in. mains, 6,168 ft. of 6-in. mains and 864 ft. of 8-in. mains; stand-pipe, 12 × 80 ft.; tubular well system; one compound duplex million-gallon pump; one simple duplex million-gallon pump; power house; stack; two 60-HP. boilers, etc.:

		Expense outside of contract
Fairbanks, Morse & Co., Kansas City, Mo.*	$23,968	....
Moses & Heaton, Junction City, Kan.	26,010	$1,710
Cauldwell & Turner, Clyde, Kan.	25,117	1,710
W. W. Cook, Junction City, Kan.	23,925	1,710

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*Irregular bid; bond issue, $25,000; all bids rejected; engineer's estimate, $26,200. H. V. Hinckley, Engr., P. O. Box 242, Topeka, Kan.; F. S. Haacke, Cy. Clk.

ENID, OKLA.—The question of building works is being considered. Jos. Meibergen, Mayor; R. Millard and H. C. Henry, are on the committee.

LINCOLN, NEB.—Ferdinand Bonstedt, Cy. Engr., writes us that the council was considering the question of replacing in the heart of the city several larger mains. Nothing will be done at present, the question having been indefinitely postponed.

McKINNEY, TEX.—J. M. Pierson, Mayor, writes us that the contract for building the works, complete, was let Nov. 30 to Kelley & Steele, Georgetown and Gainesville, Tex., at $26,235. The following are the other bids for the work, complete: C. W. Olcott, Dallas, Tex., $26,899, and P. J. German, Dallas, $26,544. There were other bids for portions of the work.

BONHAM, TEX.—The council has voted to spend $5,000 for extending the works, according to reports.

DENVER, COLO.—The aldermen have passed Supervisor Drake's resolution authorizing an election in April to vote on the question of municipal works.

FLORENCE, COLO.—Mitchell Bros., Denver, Colo., are reported to have submitted the lowest bids Nov. 28 for constructing works, at $120,000. The highest bidders were Holme & Allen, Denver, at $172,000. Hiram Philips, Engr., Oriel Bldg., St. Louis, Mo.; P. T. McGuire, Mayor.

ALBUQUERQUE, N. MEX.—Bids are asked by E. A. Allen, Supt., U. S. Indian Service, Albuquerque, for furnishing a pump, tower, building, etc.

KETTLE FALLS, WASH.—An election will be held Dec. 28 to issue bonds for completing the works.

ELGIN, ORE.—Press reports state that this place has let contracts for building works and an electric light plant, to cost $12,000.

INDEPENDENCE, ORE.—The committee has been directed to purchase the works and electric plant owned by L. E. Gilmore.

SACRAMENTO, CAL.—The question of securing an increased water supply from the north fork of the American River at Auburn, is being considered. Estimated cost, $400,000. Mayor Land, Trustee McKay and City Surveyor Mulleney may be addressed.

SAN PEDRO, CAL.—The Chamber of Commerce has asked the town trustees to call an election to vote on the question of issuing $40,000 in bonds for works and a light plant.

HINTONBURG, ONT.—The council has adopted plans, estimates, etc., for works, to cost about $55,000. Chas. H. Keefer, Engr., The Rockliffe, Ottawa, Ont.; Reeve McLean and Councilman Merrill may be addressed.

INGERSOLL, ONT.—The council is reported to have appointed a committee to negotiate for the purchase of the works and electric light plant, owned by the Ingersoll Water-Works Co.

WATERLOO, ONT.—This place voted Nov. 21 against issuing $50,000 in bonds for the purchase of the works owned by Moffett, Hodgkins & Clarke, Syracuse, N. Y.

OSHAWA, ONT.—F. L. Fowke, Mayor, writes us that a by-law to issue $110,000 in bonds for works and a sewerage system will be voted upon about Jan. 20. The supply of water from a spring, eight miles distant, will be furnished by gravitation. Population, 4,300. John Galt, Des. Engr., Canada Life Bldg., Toronto, Ont.

IRRIGATION.

MONROE, LA.—J. C. Terry and L. P. Alexander contemplate the introduction of irrigation into Ouachita county.

BOZEMAN, MONT.—The West Gallatin Canal Co. has awarded a contract to Dean & Marlor for the construction of about 10 miles of irrigation canal.

HELENA, MONT.—A. Wormser, of Sweet Grass county, has been awarded the contract for the construction of two canals, one about 45 miles long, the other about 18 miles long to irrigate 52,600 acres of land at $12.50 an acre.

DENVER, COLO.—A plan is under consideration for the location of a reservoir on the south branch of the South Platte River, about 20 miles from Buffalo, Colo., to irrigate about 50,000 acres. John E. Field, State Engr., Denver, may be addressed.

CHEYENNE, WYO.—Ex-Senator Carey, Pres. Wyoming Developing Co., states that the company is arranging to build a reservoir to cost about $100,000, on the Laramie Plains, which will be used as a reserve water supply for the company's Wheatland colony lands. It is said that it will require the construction of 1,700 cu. yds. of masonry and concrete work, 100,000 yds. of rip-rap, 20,000 yds. of excavation and the placing of considerable piling.

FALL BROOK, CAL.—Reports state that the receiver of the Red Mountain ranch is preparing to construct dams and tunnels, to increase the water supply for irrigation, next season, to cost about $12,000.

SALINAS, CAL.—The Spreckels Sugar Co. has awarded a contract to W. W. Montague, San Francisco, for furnishing and constructing about 21,000 ft. of iron pipe line from 28 to 32 ins., for an irrigation system to cost about $150,000.

FILLMORE, UTAH.—Reports state that the state has awarded a contract to the Lake Bonneville Co. for the irrigation of about 217,000 acres. Work will probably not begin until about May 1.

KAMLOOPS, B. C.—The Thompson Valley Power Co. proposes to construct a dam, 450 ft. long and 25 ft. high, on Jamieson Creek, and a ditch 16 miles long and 4 ft. wide, from Jamieson Creek to Rogers Meadows, for irrigation, according to reports.

NEW COMPANIES.—Jennings Irrigation Co., Ltd., Crowley, La.; D. E. Sweet, Pres.; W. H. Simmons, Vice-Pres.; I. N. Pardee, Secy.; C. L. Pardee, Treas.; U. S. Phillips and P. B. Jones.

Cibola Canal Co., Yuma county, Arizona; to build a canal to irrigate 20,000 acres of land; C. O. McCarroll, M. Morris and E. G. Morris.

The Pine Ridge Ditch Co., Denver, Colo.; $1,600; to operate in La Plata county; Owen F. Boyle, S. W. McGuire, Joseph Coppinger.

SEWERAGE.

SOUTHBRIDGE, MASS.—M. S. Heath, of the committee, writes us that the town has appropriated the money for the proposed sewers. Nothing further has been done.

BUFFALO, N. Y.—The following bids were received by the Commissioners of public works Dec. 1, for constructing the proposed sewer in Van Rensselaer and Ainslie Sts.: Thomas F. Moore, $96,872; Brown, Stabell & Griffiths, $109,920; Henry Harter, $85,978; W. G. Smith, $96,898; Christopher Smith, $134,334; William Franklin, $101,614; Andrew Beaser, $74,974; John Harrer, $79,700; Ritzmann & Miller, $115,522; John Mumm, $93,657; George Dark and Thomas Dark, $120,500.

CLAYTON, N. Y.—The question of building a system and water-works was voted upon Dec. 6; estimated cost, $50,000. F. L. Hall, Pres., writes us that it will probably carry by a large majority.

NIAGARA FALLS, N. Y.—The board of public works has been petitioned to build certain sewers at a cost of about $42,000.

ROCHESTER, N. Y.—William Fuller has been awarded the contract for constructing 2,770 ft. of sewer on North St., at $10,555, and Thomas Holahan the contract for 1,110 ft. of sewer on Pearl and Meigs Sts., at $3,790.

STAPLETON (S. I.), N. Y.—The Richmond Borough Board has recommended to the New York city board of public improvements that $280,000 in bonds be issued for new sewers for that borough. H. P. Morrison, Deputy Comr. of Sewers, Richmond.

TUCKAHOE, N. Y.—The question of building sewers in this place is being considered.

WILKINSBURG, PA.—Bids are asked until 3 p. m., Dec. 8, for laying 1,200 ft. of 20 and 8-in. pipe sewers, and 4,600 sq. ft. of flagstone sidewalk. Frease & Spealing, Borough Engrs.

YORK, PA.—It is probable that councils will reject the proposition of the York Sewerage Co. to build a system, and will submit to the voters the question of issuing $250,000 in bonds for a municipal system.

CHESAPEAKE BEACH, MD.—George C. Morgan, 808 Royal Insurance Bldg., Chicago, is preparing plans and specifications for a system, water-works, etc., at this place, for the Chesapeake Beach Ry. Co. Otto Mears, Pres., Washington, D. C.

COLUMBUS, MISS.—This place voted Nov. 29 to issue $70,000 in bonds for a system and for new water-works.

CHATTANOOGA, TENN.—The city has been asked by the board of trustees of the Erlanger Hospital to build a sewer for the hospital, at a cost of $1,500.

LOUISVILLE, KY.—The board of public works has decided to build a new sewer in 34th St., to cost about $200,000. Bids will probably soon be asked.

ALLIANCE, O.—O. W. Pfouts, Cy. Engr., is preparing plans for sewers in Ward No. 6. Jos. McConnell, Cy. Clk.

EAST CLEVELAND, O.—Bids are asked until Dec. 30 for constructing sewers in a number of streets. Walter P. Rice Engineering Co., Engrs., Society for Savings Bldg., Cleveland; H. B. Chapman, Clk.

HAMILTON, O.—The following submitted bids Nov. 25 for constructing sewers in 3d and 2d Sts., to cost about $7,000: S. E. Irwin, W. H. Louthan, of Hamilton; Sam Van Zant, Meder and Louis Drach, Cincinnati; Railing & Cronin, Richmond, Ind.; Monger & Son, Dayton, O.

HAMILTON, O.—Bids are asked until Jan. 2 for constructing a storm sewer in 3d St., and also for the purchase of $8,200 in 4% bonds. L. A. Dillon, Cy. Engr.; M. O. Burns, Cy. Clk.

TOLEDO, O.—Plans for the construction of a sewer in the 31st district have been completed. Bids will probably soon be asked.

ELKHART, IND.—We are informed that D. F. Cordrey, Cy. Engr., has been directed to prepare plans for five miles of 24 to 12-in. pipe sewers. About $50,000 worth of brick paving will also be laid.

SOUTH BEND, IND.—Bids are asked until Dec. 26 for constructing pipe sewers in two streets. L. A. Hull, Cy. Clk.

DETROIT, MICH.—Bids are asked until Dec. 9 for furnishing labor and material, except cement and manhole covers, and building the vitrified pipe sewers in certain alleys, etc., D. W. H. Moreland, Pres. Bd. Pub. Wks.

MARSHALL, MICH.—H. E. Riggs, The Nasby, Toledo, O., has completed plans for a system for this place. Emil C. Sanchy, Cy. Recdr., informs us that nothing will be done until next year.

EAST ST. LOUIS, ILL.—Bids are asked until 12 o'clock noon, Dec. 9, for about 6,000 ft. of 24 to 6-in. pipe sewers, 25,000 brick in catchbasins and manholes, etc. M. M. Stephens, Mayor.

ST. PETER, MINN.—M. B. Haynes, Mankato, Minn., is preparing plans for a system for this place, to cost about $8,000. H. N. Benson, Cy. Clk.

MASON CITY, IA.—We are informed that the following bids were received Dec. 2 for constructing a main sewer: J. H. Killmer, Des Moines, Ia. (accepted), $23,900, sub drain, 68 cts. a foot; J. W. Gardiner, Mason City, Ia., $25,797, sub drain, $1.00; E. T. Webster, Dubuque, Ia., $29,200, sub drain, 75 cts., and O'Neil & Sons, Fairbault, Minn., $26,350, sub drain, 65 cts.

SIOUX CITY, IA.—It is proposed to lay about 2¼ miles of 8-in. pipe sewer from the manufacturing plants to the Missouri River, at a cost of $5,000.

ST. JOSEPH, MO.—The contracts with Gibson & Dunn for sewer work in two districts have been annulled, and the council, it is stated by local papers, will soon ask for new bids. Aldermen Hall and Finch may be addressed.

ST. LOUIS, MO.—B. H. Colby, Sewer Comr., has prepared plans for a brick sewer for North St. Louis. Local papers state that it will be over a mile long. The inside dimensions will be 24×18 ft. The side walls will be 6 ft. thick and the arch 2½ ft. The base will be 3 ft. thick, built of Portland cement and concrete brick. It will drain seven square miles of territory.

LONG BEACH, CAL.—Plans for a system, it is stated, are about completed; estimated cost, $25,000. Mayor Johnson may be addressed.

OAKLAND, CAL.—It is proposed to build sewers in that portion of the city known as Temescal.

OSHAWA, ONT.—F. L. Fowke, Mayor, writes us that this city will vote about Jan. 20 on the question of issuing $110,000 in bonds for a system and water-works. Population, 4,300. Plans and specifications were prepared by John Galt, Canada Life Bldg., Toronto, Ont.

VANCOUVER, B. C.—Alderman R. A. McMorvan writes us that Keene & Mowat, of Vancouver, have been awarded the contract for guilding 1,300 ft. of 10-in., and 9,590 ft. of 8-in. pipe sewers; 17 manholes, 5 flushtanks, and 21 lampholes, at $7,597. Col. Thos. A. Tracy, Cy. Engr.

MERIDA, YUCATAN, MEX.—Press reports state as follows: The municipality will be able to set aside annually about $260,000 to meet the cost of the proposed drainage of the city, which is estimated at about $2,500,000. It has not yet been decided whether the proposition of Charles Vezin, contractor for the Mexican sewers, or that of Preston & Son, will be accepted.

GARBAGE DISPOSAL—STREET CLEANING

NEW BEDFORD, MASS.—The garbage disposal plant owned by Edgar H. Gammons was destroyed by fire Dec. 2, causing a reported loss of about $30,000.

PHILADELPHIA, PA.—Local papers state that the following bids were received by the director of public works Dec. 5 for the cleaning of city streets and removal of garbage and snow during the ensuing year: Street cleaning—R. J. & David Peoples, 1st district, $91,000; 2d district, $148,880; 3d district, $52,000; 4th district, $138,400; 5th district, $88,000; 6th district, $28,000. Oliver Wilson, 1st district, $87,297; 2d district, $163,999. Daniel Dooley, 1st district, $87,700; 2d district, $160,000; 3d district, $43,900. Michael F. Gallagher, 6th district, $19,990. Richard P. Bemmis, 6th district, $21,800. R. W. Ellicott, 1st district, $84,777; 2d district, $159,899. Thos. Parker, 1st district, $90,000; 2d district, $149,900; 3d district, $53,000; 4th district, $139,444; 5th district, $84,900; 6th district, $26,000. Robt. Higgins, 3d district, $47,400. Jas. Curran, 4th district, $139,970; Geo. W. Ruch, 1st district, $85,339; 2d district, $147,225; 3d district, $134,980; 5th district, $83,864; 6th district, $21,700. He also put in a bid for removing ashes and cleaning the streets in the city for $519,000. Daniel McMahon, 1st district, $83,950; 2d district, $147,750; 3d district, $43,950; 4th district, $134,750; 5th district, $84,993; 6th district, $23,000. Edwin H. Vare, 1st district, $83,700; 2d district, $144,898; 3d district, $47,000; 4th district, $159,000; 5th district, $94,987; 6th district, $30,000. John Loughlin, 2d district, $148,944; 4th district, $138,690. Removal of garbage—Thos. Parker, 1st, 2d and 3d districts, $225,000. W. McClintock, 4th district, $139,000; 5th district, $129,000. American Product Co., entire city, $358,000. Removal of snow from central part of the city—R. J. & David Peoples, 90 cts. for single loads and $1.30 for double loads. D. J. McMeehall, 95 cts. a single load; $1.30 a double load.

RICHMOND, VA.—The council proposes to purchase several new street sweeping machines, etc. Julius Hobson, Chn. Com.

YOUNGSTOWN, O.—The board of health and the committee of the council are considering plans for the collection and disposal of the garbage of this city.

ST. PAUL, MINN.—The following bids were received by the assembly Dec. 1 for collecting and removing garbage and dead animals from the streets for the coming year; the bids for this year are also given for comparison:

	1899.	1898.
District 1—R. Langan	$749	$900
District 2—W. H. Burns	845	900
District 3—R. Langan	1,000	1,200
District 4—R. Langan	1,449	2,000
District 5—P. O'Donnell	1,320	1,285
District 6—F. Peters	820	850
District 7—R. Langan	1,698	2,341
District 8—W. J. Preston	1,690	1,329
District 9—Peterson & Anderson	1,212	1,212
District 10—R. Langan	480	740
District 11—R. Langan	480	699

LITTLE ROCK, ARK.—The question of constructing a garbage disposal plant is under consideration, according to reports.

HAVANA, CUBA.—President McKinley has authorized, from available funds, the expenditure of $50,000 for cleaning the streets, etc., of the city, so as to make it as healthful as possible for the residence of soldiers and citizens. Marquis Esteban, Mayor of Havana, and General Greene, U. S. A., may be addressed.

STREETS AND ROADS

ORLEANS, MASS.—The town voted Nov. 21 to appropriate $20,000 for the purchase of a stone crusher and the improvement of roads.

BUFFALO, N. Y.—Bids are asked until Dec. 13 for paving Park View Ave., between Winchester Ave. and Duerstein St. R. G. Parsons, Secy. Bd. Pub. Wks.

NEWARK, N. J.—The Essex County Park Commissioners are considering a proposition to construct a boulevard along the east bank of the Passaic River, from Woodside to the Passaic county line, according to reports.

ROCHESTER, N. Y.—The board of county supervisors has passed a resolution to improve East Ave. and Little Ridge Road, at an estimated cost of $42,000. Chairman Wellington may be addressed.

TROY, N. Y.—Reports state that plans and estimates for the macadamizing of the Hoosick Road, to cost about $20,000, will soon be submitted by the state engineer to the county supervisors.

YONKERS, N. Y.—Bids are asked by the council until Feb. 27 for the grading of Riverdale Ave., from Culver St. to the city line, according to reports.

ATLANTIC CITY, N. J.—The council has decided to ask bids for paving several cross streets with macadam. It has been decided to submit a proposition to the Pennsylvania R. R. Co. to pave Atlantic Ave., between Massachusetts and Florida Aves., with brick, the city to pay 60% of the original cost and the railroad company to pay the balance and keep the avenue in repair.

LOCK HAVEN, PA.—Reports state the county commissioners propose to construct a road about 20 miles long, to cost about $8,000 per mile.

MEADVILLE, PA.—Bids are asked until Dec. 15 for about 3,320 lin. ft. of curbing, 6 × 22 ins., including corners; 3,120 sq. yds. of brick paving on concrete foundation, including grading, and 300 ft. of sewer, etc., as described in our advertising columns. W. A. Doane, Cy. Engr.; D. F. McKay, Jr., Cy. Clk.

PITTSBURG, PA.—Bids are asked until Dec. 15 for grading, paving and curbing on Shakespeare St., and grading portions of Calvary, Graphic and Harlem Sts. E. M. Bigelow, Dir. Dept. Pub. Wks.

BALTIMORE, MD.—Reports state that the county commissioners will purchase a stone crusher to be used at Kingsville, Md.

JACKSONVILLE, FLA.—Bids are asked until Dec. 22 for grading an area of about 20,350 sq. yds., and furnishing and constructing about 15,454 lin. ft. of stone curbing and 21,000 sq. yds. of brick paving on Main St., as stated in our advertising columns. Philip Prioleau, Cy. Engr.

GEORGETOWN, KY.—Bids are asked until Dec. 29 for the purchase of $46,000 of turnpike bonds, according to reports. J. J. Yates, County Judge.

ALLIANCE, O.—This city is considering the question of paving Union Ave. with asphalt and South, West and Freedom Sts. with brick. J. McConnell, Cy. Clk.

LIMA, O.—Bids are asked until Dec. 19 for the purchase of $40,000 of 5% paving bonds. C. E. Lynch, Cy. Clk.

SANDUSKY, O.—A. W. Miller, Cy. Clk., informs us that nothing has been done as yet toward paving Campbell St. J. C. Brewer, Engr., Sandusky.

ELKHART, IND.—We are informed that the resolution to pave 40,000 sq. yds. with brick, at an estimated cost of $50,600 has been favored unanimously by the council. Payment will be made under Barrett law. Property owners will have choice of cash 30 days after acceptance or 10-year bonds at 6% interest. D. F. Cordrey, Engr.

VALPARAISO, IND.—Bids are asked until Jan. 7 for constructing the Valparaiso-Chesterton gravel road. Jas. S. Fulton, County Comr.; M. J. Stinchfield, Audr.

ST. LOUIS, MO.—The board of public improvements will hold a meeting Dec. 20, to consider the question of improving about 36 streets. Robt. E. McMath, Pres.; Emory S. Foster, Secy.

SAN DIEGO, CAL.—City Engineer Capps has reported to the council that 7,340 cu. yds. of excavation and 6,600 cu. yds. of fill is necessary for the grading of B St., between 21st and 25th Sts.

SAN PEDRO, CAL.—The chamber of commerce has asked the board of trustees to call an election to vote on the question of issuing $20,000 in bonds for street and sewer work.

MONTREAL, QUE.—The roads committee received estimates Nov. 29 from City Surveyor St. George, for work for the coming year, including $249,649 for macadamizing, $5,000 for pavement repairs and $75,332 for wooden sidewalks.

QUEBEC, QUE.—The road committee has resolved to ask the committee on amendments for authority to issue $250,000 in bonds for street paving and other improvements. The mayor has suggested paving with asphalt, portions of Grande Allee, St. John, Desfosses, St. Peter, St. Andrew, St. Paul and Crown Sts., and repairs for Mountain Hill.

AMHERSTBURG, ONT.—The council proposes to pave several streets at a cost of about $5,000, according to reports. J. H. C. Leggatt, Town Clk.

MANUFACTURING PLANTS.

GREAT WORKS, ME.—Merrill & Hartwell, of Oldtown, are reported to have been awarded the contract for the erection of an addition to the Penobscot Chemical Fibre Co.'s mill at this place.

OLDTOWN, ME.—Reports state that the Ounegan Woolen Mill Co. will erect a new woolen mill at this place. Lockwood, Green & Co., Archs., Boston, Mass.

FALL RIVER, MASS.—Chauncy H. Sears, of this city, has been awarded the contract for the erection of a hat factory building for Marshall Bros.

ALBANY, N. Y.—The shirt factory of Wallerstein & Co., at Broadway and North Ferry St., was damaged by fire Dec. 2; loss, about $61,000.

CANAJOHARIE, N. Y.—A fire here Dec. 1 destroyed the plant of the Pettit Candy Mfg. Co.; reported loss, about $35,000.

DURHAMVILLE, N. Y.—Reports state that a new glass factory will be erected at this place.

JOHNSTOWN, N. Y.—Styer & Behlen contemplate the erection of a 4-story addition to their mill on West State St.

NEW YORK, N. Y.—The 7-story brick building, 44 to 48 West 3d St., occupied by Heil & Fox, hat manufacturers, and others, was destroyed by fire Dec. 1; loss, about $175,000.

NEW YORK, N. Y.—It is reported that a 1-000-ton ice plant will be erected on 133d St., near Alexander Ave. Jacob Ruppert is said to be interested.

NIAGARA FALLS, N. Y.—The Union Carbide Co., of this place, will, according to reports, erect an addition to its plant, 500 × 100 ft.

NEWARK, N. J.—Reports state that the Otis Elevator Co., 38 Park Row, New York, will erect a factory in this city. James B. Dill, East Orange, N. J., is interested.

ATHENS, PA.—Fire here destroyed the Athens Car & Coach Works; loss, $12,000. C. F. Daly, Proprietor.

BLOOMSBURG, PA.—A fire Dec. 2 destroyed the Bloomsburg Novelty Works. Reported loss, $50,000; insurance, $25,000. It will probably be rebuilt.

BRIDGEWATER, PA.—Reports state that a new steel billet plant will be located here.

CANONSBURG, PA.—It is reported that the Canonsburg Iron & Steel Co. has awarded the contract for the erection of additional buildings to its plant to the Riter & Conley Mfg. Co., of Pittsburg, Pa.; also a contract for the erection of a keg factory to Schaff & Co., of Pittsburg.

GROVE CITY, PA.—Reports state that George Anderson, Greenville, Pa., will erect a spoke, rim and handle factory at this place.

KANE, PA.—The McCloy Glass Co., of this place, according to reports, will increase its capital stock from $125,000 to $250,000, in order to enlarge its plant.

MILTON, PA.—The nail plant of the F. A. Godcharles Co. was destroyed by fire Dec. 3. Estimated loss, $80,000; insurance, $25,000.

PHILADELPHIA, PA.—Bids are being received, according to reports, for a new 5-story factory building for Feis & Co., to replace the one recently burned on Tinicum Island Road. Hales & Ballinger, 102 South 12th St.

READING, PA.—The Reading Iron Co., according to reports, will erect two buildings for its rolling mill plant at this place.

SEWICKLEY, PA.—Reports state that the Berwind-White Co. will establish an extensive coal plant here.

SHARON, PA.—Reports state that the Aschman Steel Castings Co. will soon award contracts for erecting a 10-ton furnace, two electric traveling cranes, one gas producer, two annealing ovens, and a 100-HP. boiler.

BALTIMORE, MD.—The National Brewing Co. expects to erect a storage house, 57 × 65 ft., a warehouse, 35 × 65 ft., cooperage and additional underground cellars, two 200-HP. boilers, 35-ton ice machines, artesian well, and five iron water tanks, to cost about $100,000. Otto C. Wolf, Arch., 1345 Arch St., Philadelphia, Pa.

BALTIMORE, MD.—Reports state that Henry Ripple has been awarded the contract for erecting a new factory building for the Carr-Lowrey Glass Co., at Westport. J. C. Scott, Arch., Baltimore.

SALEM, VA.—The Salem Fertilizer Co. has been granted a permit to erect a plant here for the manufacture of bone meal and fertilizer.

WESTON, W. VA.—The West Virginia & Pittsburg R. R. Co. has awarded the contract for the erection of four new shops to McBride, Arnold & Co., at $17,732.

ROCKMART, GA.—The New York Mills Co., of New York Mills, N. Y., contemplates the erection of a plant at this place, the main building of which will be 275 × 128 ft.; reported cost, about $400,000. S. R. Campbell, Treas.

PADUCAH, KY.—J. R. Bennett, Wm. Roch, and L. W. Johnson, of St. Louis, Mo., will erect a brewery, having a capacity of 40,000 bbls. a year. Reported cost, $100,000.

IRONTON, O.—William Banfield, of Wallace, Banfield & Co., it is reported, will soon erect a sheet mill.——The Kelly Nail & Iron Co. will spend about $40,000 on improvements to its plants.

WEST BAY CITY, MICH.—A fire here Nov. 28 destroyed the hardwood factory of W. D. Young & Co. Loss, $100,000; insurance, $75,350. It will probably be rebuilt.

ESSEXVILLE, MICH.—It is reported that a new sugar factory will be erected here. Worthy L. Churchill, Alpena, Mich.; E. N. Salling, Manistee, Mich.; Thos. Pitts, Detroit, Mich., and others are interested.

HOUGHTON, MICH.—A fire in this city Nov. 28 destroyed the Franklin Stamp Mill. Loss, about $50,000; insurance, $30,000.

MONROE, MICH.—It is reported that a 3-story beet sugar factory, 150 × 40 ft., will be erected here. Col. Francis, of Chicago, Ill., is said to be interested.

JOLIET, ILL.—A fire Nov. 27 destroyed the Lakeside mill, owned by David Oliver, of Chicago. Reported loss, $40,000; insurance, $23,500.

JANESVILLE, WIS.—Mayor Thoroughgood, of this place, has asked for a loan of $20,000, so as to permit the Janesville Furniture Co. to increase the capacity of its plant.

MILWAUKEE, WIS.—The Schitz Brewing Co. is said to contemplate the erection of a $70,000 building. Kirchhoff & Rose, Archs., 201 Grand Ave.

QUINNESEC, WIS.—The Kimberley & Clark Co. contemplates the erection of a paper and a ground wood mill at this place.

PRICE, UTAH.—The Tait Milling Co. contemplates the erection of a flouring mill at this place. S. K. Strausmider, Business Mgr., Chickasha, Ind. Ter.

SHANGHAI, CHINA.—T. C. Yen, representing a Chinese syndicate, reports that the erection of a 500-bbl. flour mill in this city is projected.

GAS PLANTS.

BUFFALO, N. Y.—Wm. H. Pearson, Jr., Vice-Pres. Economical Gas Apparatus Co., Toronto, Ont., has been engaged by the commissioners of public works to prepare plans for the proposed municipal gas plant.

PHILADELPHIA, PA.—A contract has been awarded to Chas. E. Day, Camden, N. J., for the erection of a storehouse, 50 × 80 ft., of galvanized iron, for the Pittsburg & Philadelphia Oil Refining Co.——The United Gas Improvement Co. will construct a two-story brick and iron testing station, 22 × 44 ft. Wilson Bros. & Co., Archs.

WILLIAMSPORT, PA.—Reports state that the Williamsport Gas Co. proposes to erect a brick and iron building, estimated to cost $50,000; also to extend the mains through South Williamsport.

HILLSDALE, MICH.—The Hillsdale Gas Co. will expend $2,500 for new pipes, retorts, purifying boxes, scrubber, etc. F. H. Stone, Receiver.

JOLIET, ILL.—The Joliet Gaslight Co. has filed a trust deed for $300,000 with the American Trust & Savings Bank of Chicago. The money secured will be used to take up an old issue of bonds, amounting to $225,000, and for improvements in the local plant, according to reports.

OAK GROVE, IND.—Reports state that a gas company has been organized to sink wells and furnish gas for a portion of the city. John T. Ellis, Monroe Huntzinger, Frank P. Foster, J. Kirkham, Dr. Lail and others are interested.

GALT, ONT.—A by-law will be submitted to a vote Dec. 17 to issue $67,750 for the purchase of the gas and electric light plants, according to reports.

NEW COMPANIES.—The Great Eastern Oil & Gas Co. of Pennsylvania, Towanda, Pa.; to bore for oil and gas in Bradford county; Pres., S. D. Sterigere; Vice-Pres., Joseph Ochs; Treas., L. R. Frost; Secy., M. M. Spaulding.

Deka Oil Co., Cleveland, O.; $250,000; to operate oil and gas wells; S. J. Kerrnish, W. D. Kerrnish, M. R. Boals, George T. Chapman, F. M. Skinner.

Hamilton Natural Gas Co., Greensburg, Ind.; $10,000; G. L. Hamilton and others.

Kansas Gas Co., Topeka, Kan.; $25,000; to pipe gas from Iola, Kan., to Kansas City; Perry C. Phillips, Kansas City, and F. H. Hersch, A. P. Charles, J. H. Hufford and C. E. Birdsall, of Iola.

The Lone Star Acetylene Gas Co., Tyler, Tex.; $50,000; D. P. Ewing, A. W. Palmer, Thomas Henderson, W. A. Stapp.

New Cumberland Gas Co., Pittsburg, Pa.; $50,000, with $500 paid in; to deal in natural gas; M. C. Egbert, V. E. Egbert, F. M. Bullock, C. S. James, C. A. Dally, Pittsburg, Pa.

Essex & Hudson Gas Co., 575 Broad St., Newark, N. J.; $6,500,000; to manufacture, etc., illuminating and fuel gas; Thomas N. McCarter, Jr., 765 Broad St., Newark; George S. Philler and Elmer Smaling, Drexel Bldg., Philadelphia, Pa.

Millbrook Gas & Electric Co., Millbrook, N. Y.; $15,000; Wm. E. Smith, Millbrook; Richard Scoles, Samuel Thorn, New York city.

Menzie Oil & Gas Co., Peru, Ind.; $10,000; to drill and operate oil and gas wells; Julius Falk, Joseph Andrus, Jos. M. Bergman, Geo. R. Chamberlain, Chas. T. Clark, Jos. S. Young, Clarence Henzie.

Lawrence Gas, Oil & Mining Co., Lawrence, Kan.; $500; O. W. Murphy, J. H. Glathart, S. D. Bishop, Louis C. Poehler and Albert Glathart, all of Lawrence.

Connotton Oil & Gas Co., Scio, O.; $10,000; J. H. Beal, J. M. Spiker, W. G. Compher, J. M. Adams and S. W. Canagan.

MISCELLANEOUS CONTRACTS.

CONDUITS.—Atlantic City, N. J.—Chief Engineer Wiesenthal has advised the council to construct underground conduits for the placing of city electric wires.

FIRE ALARM SYSTEM.—Mobile, Ala.—The council has awarded a contract to the Gamewell Fire Alarm Telegraph Co., at $12,630, for installing a fire alarm system.

FIRE ALARM SYSTEM.—Lancaster, O.—The Gamewell Fire Alarm Telegraph Co., New York, N. Y., has a contract, at $5,400, to install a fire-alarm system of 35 alarm boxes.

DIKES, ETC.—Portland, Ore.—Bids are asked until Dec. 15 for constructing dikes, etc., in the Columbia River and Hayden Slough, Ore. Maj. W. L. Fisk, U. S. Engr., Portland.

FIRE ALARM SYSTEM.—South Orange, N. J.—The board of village trustees has awarded a contract to the Gamewell Fire Alarm Telegraph Co. to construct a system, to cost $2,700.

SALE OF TELEPHONE FRANCHISE.—Duluth, Minn.—Bids are asked until Jan. 16 for the purchase of a telephone franchise, as stated in our advertising columns. H. W. Cheadle, Cy. Clk.

CHANNEL WORK.—Sioux City, Ia.—Alderman Hermann, Chn. Health Com., recommends a proposition to straighten the channel of the Floyd River at the southern end, to cost about $4,000.

PIERS.—Brooklyn, N. Y.—Reports state that bids will be asked by the dock board in about two weeks for the construction of two piers on the Wallabout Basin, to cost $75,000. Ch. Engr., John A. Bensel.

TELEPHONE WORK.—Chattanooga, Tenn.—The Postal Telegraph Co. awarded a contract Nov. 26 to the East Telephone Co. for the construction of a line between this city and Knoxville on the existing poles.

PILES AND PLANK.—New York, N. Y.—Bids are asked until Dec. 16 for furnishing about 4,000 piles, from 60 to 85 ft. long, and about 500,000 ft. B. M. of sawed spruce plank. J. S. Cram, Comr. Docks, Pier A, North River.

POLICE TELEGRAPH SYSTEM.—St. Paul, Minn.—The council is considering the question of installing a new police patrol telegraph system. Comptroller McCardy, Assemblyman Kirke and Gustave Willus, Jr, Com.

TUNNEL WORK POSTPONED.—Boston, Mass.—In consequence of an injunction, served upon the Boston transit commission, the date of receiving bids for the construction of the East Boston tunnel has been postponed until further notice, as stated in our advertising columns. B. Leighton Beal, Secy.

DOCKS.—St. Lawrence River, N. Y.—Reports state that a contract has been awarded to Capt. E. W. Visger, Alexandria Bay, N. Y., for the construction of docks along the St. Lawrence River, comprising the international park.

HARBOR WORK.—Toronto, Ont.—The board of control and the harbor commissioners are considering a proposition to improve the eastern entrance of the harbor at a cost of about $260,000, and the western channel, at $403,500.

TELEPHONE LINE.—Joplin, Mo.—The Missouri & Kansas Telephone Co. is preparing to construct a long-distance line between Joplin and Fort Smith, and will also soon commence work on a line from Carthage to Springfield.

DIRT FILL.—Edgemont, S. Dak.—Reports state that the railway bridge over Sheep Canon north of this place is to be taken down and the gulch to be filled with dirt, requiring about 300,000 cu. yds. of material, at a cost of about $130,000.

CONDUIT SYSTEM.—St. Louis, Mo.—Superintendent Benedict received bids Nov. 28 for the construction of a conduit system for the city wires, from the Southern Electric Supply Co., at $13,618, and the Western Electric Supply Co., at $14,190.

LEVEE WORK.—New Orleans, La.—Bids are asked by the state board until Dec. 12 for constructing the Salem levee, East Carroll parish, to contain about 100,000 cu. yds. of earth, from 14 to 17 ft. high and about 2,500 ft. long. Sidney F. Lewis, Engr.

WHARF.—Havana, Cuba.—We are informed that the American Indies Co., 100 Broadway, New York, has received a contract from the U. S. government to build a wharf at Triscornio, on the harbor of Havana, and of 7 miles of railway, as stated under Railways.

TELEPHONE LINE.—Newtown, Pa.—Bids will be asked by the Standard Telephone Co. for the extension of their line from Newtown to Doylestown and from Eden to Bristol. It is proposed to later extend the line from Newtown to Trenton, via Yardley and Morrisville.

ENGINES AND BOILERS.—La Rochelle, France.—Reports state that several steam engines of 35 HP. and boilers to supply these engines, of American make, are desired in the consular district, the cost, including transportation, not to exceed $2,000. Address Grenfel Stewart, 13 Rue du Palais, La Rochelle.

TELEPHONE FRANCHISE.—Springfield, O.—I. Ward Freye, Charles H. Pierce, E. C. Guin, Robert Gotwald and Robert Mills, of this city, and others applied to the board of public affairs Nov. 30 for a franchise to organize the Springfield Telephone Co., with a capital stick of $50,000. E. D. Juvenal, representing a Chicago company, has also applied for a franchise, according to reports.

DRAIN TILE.—Philo, Ill.—J. L. Ray, Atty., Imbarras River Drainage District, Champaign, Ill., informs us that the following bids were received Nov. 29 for furnishing 8,870 ft. of drain tile from 6 to 16 ins.: James M. Waugh, Crawfordsville, Ind., $970; John R. Stanton, White Hall, Ill., $1,205; Geo. E. Zimminsky, Paris, Ill., $940, S. C. Cowgill, Summitville, Ind. (accepted), $749.

FIRE APPARATUS.—New York, N. Y.—Bids are asked until Dec. 14 for furnishing 12,000 ft. of 1½ and 2½-in. circular knit jacket cotton, rubber lined fire hose; three fourth size steam fire engines with La France pumps, and one fourth size steam fire engine with Fox sectional water-tube boilers; two first size steam fire engines with Fox sectional water-tube boilers and one first size La France steam fire engine. John J. Scannell, Fire Comr., 157 East 67th St.

REMOVING WRECK.—Philadelphia, Pa.—We are informed that the following bids were received Dec. 5 for removing the wreck of the schooner "Joseph R. Ellis," in the Delaware River, near Finicum Island. Lieut.-Col. C. W. Raymond, U. S. Engr., P. O. box 812, Philadelphia: Wm. H. Keates, Atlantic City, N. J. (recommended for acceptance), $395; River & Harbor Improvement Co., Camden, N. J., $600; Chas. W. Johnson, Lewes, Del., $845; Jas. J. Cowgill, Paulsboro, N. J., $844.

TELEPHONE SYSTEM.—Chicago, Ill.—Reports state that a company in which Messrs. Armour, Swift and Nelson Morris are interested has been incorporated to construct an independent telegraph and telephone line to connect the packing houses in the west with the Chicago houses. The proposed line is to connect East St. Louis, Omaha, Sioux City, St. Joseph and Kansas City. The company is offering for sale $500,000 of gold bonds. It will transact a general telegraph and telephone business.

FLOATING AND GRAVING DOCK.—Algiers, La.—We are informed that the navy department received bids Nov. 30 for constructing a combined floating and graving steel dock, from Charles R. Bradbury, New York, N. Y., at $850,000, and the Maryland Steel Co., Sparrow's Point, Md., at $810,000, to build the dock according to the plans of the bureau, and at $837,000, including additional equipment not provided. M. T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C.

BOILERS, MACHINERY, ETC.—Detroit, Mich.—The following bids were received Nov. 28 for furnishing two sets of boilers, machinery, etc., for four complete steam fog signals, advertised in Engineering News, Nov. 24. Lieut.-Col. M. B. Adams, U. S. Engr., Detroit:

Fulton Iron & Engine Works, Detroit	$4,496
D. Connelly, Cleveland, O.	4,634
John P. McGuire, Cleveland, O.	4,950
*Thomson Kingsford, Oswego, N. Y.	9,299
James Clark Co., Baltimore, Md.	11,966

*Alternative bid, $9,275.

CONTRACT PRICES.

FACE OF SEAWALL.—Tompkinsville (S. I.), N. Y.—The following bids were received by Lt.-Col. D. P. Heap, U. S. Engr., Dec. 1, 1898, for constructing the east face of the north seawall at the lighthouse depot, S. I., as advertised in Engineering News:

Michael Flaherty & Co., 135 Broadway, N. Y.	$170.00
Johnston & Reynolds, Girard Bldg., Philadelphia	177.95
Weil & Raynor, 258 Broadway, New York	197.00
Central Contracting Co., 99 Cedar St., New York	197.80
International Contracting Co., Syracuse, N. Y.	200.00
Frank Rinschler, Stapleton, S. I., N. Y.	212.00
Brown & Lowe, 99 Cedar St., New York	212.50
Frank Pidgeon, Saugerties, N. Y	214.00
Wm. H. Masterton, 231 East 86th St., New York.	239.00
Wm. H. Flaherty & Co., 80-82 Reade St., N. Y.	245.50
S. W. Frescoln & Co., Reading, Pa.	257.79
R. P. & J. H. Staats, 29 Broadway, New York	260.00
W. H. Jenks, 130-2 Pearl St., New York	285.87
P. Sanford Ross, 277 Washington St., Jersey City	290.50
John T. Rowland & Sons, 197 1st St., Jersey City.	294.60
Andrew McMillan, 894 East 135th St., New York	297.70
Spearing & Preston, 11 Broadway, New York	336.84

GUN FORGINGS.—Washington, D. C.—We are informed that the following bids were received Nov. 26, 1898, for 12 sets of 12-in. gun forgings: Bethlehem Iron Co., South Bethlehem, Pa., 18 cts. a lb.; and Midvale Steel Co., Philadelphia, Pa., 19 cts. a lb.

BRICK SEWER.—Toledo, O.—Thomas Kelly submitted the lowest bid Nov. 21, 1898, as follows, for building a brick sewer in Paine Ave.: 84-in. brick sewer with 13-in. shell, $7.64 a ft; 60-in., with 19-in. shell, $6,25.

STREET CLEANING.—Jersey City, N. J.—Henry Byrne has been awarded the contract for street cleaning as follows: Sweeping streets, a mile, $9.13; sweeping asphalt-paved streets, $6.64 a mile; removing ashes and garbage during the entire year, $14,110. The total appropriation for street cleaning and garbage removal is $40,000. With the $14,110 for garbage collecting deducted there will be $25,890 left to pay for street cleaning at $9.13 and $6.64 a mile for Belgian block and asphalt paved streets, respectively.

SEWERS.—Scranton, Pa.—The following bids were received by councils Dec. 1, 1898, for constructing sewers in Section C of the 5th district: Donohoe & O'Boyle, Scranton, $2.27 a ft., complete; extra basins, $97.00; extra manholes, $37.00. V. H. O'Hara, Scranton, $2.24 a ft., complete; extra basins, $90.00; extra manholes, $35.00; extra house connections, 60 cts. a ft. Length of sewer, 4,000 ft. of 8, 10, 12, 15, 18, and 24-in. pipe. Average depth, 10 ft. The price per ft. includes the building of 23 manholes, 16 basins, and 140 house connections (about 2,800 ft.). Jos. P. Phillips, Cy. Engr.

SIDEWALK.—Louisville, Ky.—The board of public works received the following bids Dec. 1, 1898, for constructing granitoid sidewalks in Hill St.: L. R. Figg, $1.60 a sq. yd.; L. D. Robertson, $1.71; Louisville Artificial Stone Co., $1.89; Charles Fitch, $1.94; National Roofing & Supply Co., $1.80.

ASPHALT PAVING.—Jersey City, N. J.—The New Jersey Mexican Asphalt Co. submitted the lowest bid Nov. 29, 1898, for asphalt paving in Prospect St., at $1.74 a sq. yd.

SAND.—New York, N. Y.—The U. S. Engineers, Army Bldg., received the following bids Nov. 28, 1898, for furnishing 3,000 cu. yds. of fine sand: Phoenix Towing & Transporting Co., 39½ cts. a cu. yd.; Murry & Reid, 36 cts.; H. Godwin, 38 cts.; W. J. McGuire, 31 9-10 cts.

RAILWAY SUPPLIES.—Havana, Cuba.—Col. A. S. Kimball, Q. M., U. S. A., Army Bldg., New York, received the following bids Nov. 30, 1898, for furnishing supplies for a small government railway in Cuba:

Bids Received at Havana, Cuba, Nov. 30, 1898, for Furnishing Railway Supplies.

Quantities.		A. Gerry.	Manhattan Supply Co.	F. W. McNeal.	Thornton Motley.	Stand. Sup. & Equipment Co.	Benj. Watson.
60-lb. steel rails (30 ft. 4¼ ins.)	370 each	$5.70	$22.00[1]	$5.47	$5.49	$5.47	$5.35
4-hole angle bars, 24-in., per pair	400 pairs	.50	.57	.47	.47	.....	.....
¾-in. track bolts (3½-ins. long)	1,700 each	.05	.0209	.01⅗	.01⅗	.....	.01½
5 × 9-16-in. spikes	25 kegs	...	3.30	2.90	3.00	3.20	3.00
7 × 9 ins. ? 8½ ft. oak cross ties	3,000 each	...	.70[2]	.57	.80	.69	.....
Foot-split switches	715 "	20.00	22.00	17.84	18.75	18.47	22.50
No. 8, 4½-in. frogs	8 "	15.00	16.00	12.49	13.50	19.72	15.00
Switch stands, 5-in. throw	7 "	12.00	14.00	.....	16.00	6.21	5.00
8 × 8 ins. × 15 ft. hemlock timbers	14 "	.....	3.00[3]	.17½	.....	.49	...
4 ft. × 8½-in gage, Sheffield push cars.	2 "	.....	34.70	49.35	.....	42.00	...
Sheffield hand-cars, same gage		.....	67.40	40.95	49.75	53.00	...
Lining bars, a lb.	12	.....	.05¼[4]	.76[4]	...	.72	...
Claw bars (L. S. & M. S. Ry. pattern), a lb	6	.....	.07½	1.05[4]	...	2.05	...
4 ft. 8½-in. gage Huntington track gage	3 each	.....	3.00	7.12[3]	...	1.24	...
8-lb. spiking mauls	12 "	.....	2.75	.49	.35	.34	...
Track wrenches, with 1⅝-in. jaw, a lb.	12	.....	.12	1.30	.36	.35	...
Track chisels	12 each	.....	.13	.89	.49	.43	...
Track level boards with spirit level	2 "	.....	5.00	1.22	1.45	1.70	...
Packer ratchets	2 "	.....	9.00	2.94	4.45	5.00	...
1⅛-in. horse twist drill bits	6 "	.....	.75	1.32	.82½	1.19	...

[1] A ton. [2] Best quality of pine. [3] The lot. [4] Each.

BRIDGE ABUTMENTS.—Charlemont, Mass.—A. B. Fletcher, Secy. Massachusetts State Highway Comn., Boston, informs us that the following bids were received Nov. 17, 1898, for building the abutments of a bridge over Mill Brook in this town: Cement masonry, 300 cu. yds.—W. N. Flynt Granite Co., Monson, Mass., $10.90; Jarvis Engineering Co., Boston, $8.67 (accepted); Wm. D. Carr, Boston, $9.97; M. A. Culbert, Boston, $11.75; Tuttle & Edgerly, Swampscott, $10.00.

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INDUSTRIAL NOTES.

THE NEW YORK DREDGING CO., World Bldg., New York, has the contract to dredge the Christiana River, at Wilmington, Del.

THE VULCAN IRON WORKS CO., Toledo, O., reports a good business during the past season, having run its plant day and night all summer.

W. G. NAGEL & CO., Toledo, O., has been organized for the purpose of conducting a general business in electrical machinery, supplies and construction, in Toledo.

THE OTTO GAS ENGINE WORKS, Philadelphia, has received the gold medal for gas and gasoline engines, exhibited at the Trans-Mississippi Exposition at Omaha, Neb.

THE PITTSBURG TERRA COTTA LUMBER CO., Pittsburg, has an order for 1,000 tons of dense fireproofing tile for the power-house of the Dublin Tramway Co., Dublin, Ireland. The company has also an order for fireproofing a new municipal building now being erected in the City of Mexico.

A. A. TALMADGE & CO., St. Paul Bldg., New York, have an order for switches and general track equipment, including tools, etc., and for bridge and dock timbers for the Government R. R., which is being built in Cuba. A similar order has also been received from the Clearfield Southern R. R. Co., Clearfield, Pa.

THE CONSOLIDATED PNEUMATIC TOOL CO., 11 Broadway, New York, has been placed in charge of Mr. John H. Hull, as Receiver, on application of Mr. Horace D. Gove, who holds a judgment for $11,198 against the company, according to report. The assets are said to consist only of the patents which, were originally valued at $50,000.

MR. EARL C. BACON, Havemeyer Bldg., New York, has recently shipped to Japan and China a number of winding engines for use in the coal and other mines of those countries. They were specified by the engineers of the Chinese and Japanese imperial governments. This concern has also sent considerable machinery to Siberia within the past 30 days.

THE MANHATTAN CONCRETE CO., 156 Fifth Ave., New York, is reported to have made an assignment to Mr. Henry L. Fridenberg, with liabilities of $60,000 and actual assets of about the same amount. The assignment is said to have been precipitated by liens being filed on the company's contracts in favor of the Standard Silica Cement Co., 66 Maiden Lane, New York.

THE COMMON-SENSE RAIL-JOINT CO., 304 Tacoma Bldg., Chicago, has succeeded the firm of Hill & Jennings, which for some time has controlled the patents and manufactured the Heath rail-joint. The new company has a form of rail-joint, to be known as the "New Common-Sense Rail-Joint," which was illustrated and described in Engineering News of Nov. 24. Mr. J. V. Ayer is secretary and president of the company, and Col. W. E. Dorwin is the manager.

THE GILLETTE-HERZOG MFG. CO., Minneapolis, Minn., is pushing the addition to the plant of the Minneapolis Rolling Mill Co., Minneapolis, and expects to have it completed and ready for the production of steel in January. The latter company has manufactured over 10,000 tons of bar iron in the 10 months it has been running, and with the addition of the open-hearth furnace plant, it expects to turn out 20,000 tons of iron and steel next year. Mr. E. R. Dutton is the Structural Engineer.

THE BETHLEHEM IRON CO., South Bethlehem, Pa., furnished the engine forgings and shafting for the new U. S. torpedo boat "Davis," constructed at the Wolf & Zwicker Iron Works, Portland, Ore. This boat on her trial trip made an average speed of 23½ knots an hour, which was a knot more than the contract speed, the shaft making on an average 382 revolutions a minute. The company also furnished the engine forgings and shafting for the U. S. torpedo-boat destroyer "Farragut," which made over 30 knots on her trial trip.

THE SPRINGFIELD GAS ENGINE CO., Springfield, O., has leased the first and second floors of a building on West Columbia St., in that city, in order to secure additional accommodations, and will increase its force of workmen as soon as the shop can be fitted up. The company recently furnished a gas engine to the Sun Publishing Co., Springfield, for use in running a large Cox duplex printing press. The officers of the company are: Pres., R. H. Rodgers; Vice-Pres., Chas. H. Paxton; Secy. and Gen. Mgr., Addison S. Rodgers.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., is erecting a fireproof blacksmith shop, about 40 ft. square and two stories high for the Waterbury Mfg. Co., Waterbury, Conn. The floor consists of concrete on corrugated iron arches, supported by steel beams and columns, and the roof is of steel trusses carrying a covering of corrugated iron lined with patent anti-condensation lining.——The company is also erecting a riveted latticed girder bridge of about 70 ft. span, with steel floor beams, for the town of Whitehall, N. Y., designed to carry the weight of a steel road roller, besides ordinary traffic.

THE MESTA MACHINE CO., Pittsburg, has been formed by the consolidation of the Robinson-Rea Mfg. Co., Pittsburg, and the Leechburg Foundry & Machine Co., Leechburg, Pa., and has purchased a tract of about 10 acres of land near Homestead, Pa., on which, reports state, it will erect a plant to cost about $500,000. The new company will manufacture sand, chilled and steel rolls, general rolling mill, steel works and tin-plate machinery; machine-molded steel gears and steel castings. The officers of the company are: Pres., Geo. Mesta; Treas., W. H. Rea; Secy., J. O. Horning; Auditor, W. D. Rowan.

FRASER & CHALMERS, of Chicago, Ill., makers of the Huntington mill, inform us that in the U. S. Circuit Court, of the District of New Jersey, Judge Kirkpatrick has granted an injunction against the Whitaker Cement Co., as a user of the Griffin mill, which is declared to be an infringement upon the mill patented by F. A. Huntington, May 8, 1883. The same firm reports that the 156 Bruckner roasting furnaces furnished to the Anaconda Copper Mining Co. ten years ago are still in use. The furnaces are 8 ft. 6 ins. diameter and 18 ft. 6 ins. long inside, but larger ones have since been built. Some of the fireboxes are stationary and others are mounted on wheels.

THE PITTSBURG BRIDGE CO., Pittsburg, reports good business, having averaged about 1,000 tons for the year. The larger contracts now on hand include: Library and assembly rooms for Leland Stanford Jr. University, Cal.; Forest St. bridge and viaduct, St. Paul, Minn., 235 ft. long; boiler house and engine room, Evansville, Ind., water-works; parochial school, Pittsfield, Mass.; three buildings for the Brandon Italian Marble Co., Middlebury, Vt.; 700 tons of structural material, Mexican Central Ry.; Bruekner roaster building, Pueblo Smelting & Refining Co.; trolley railway bridges over the Youghiogheny River, at Connersville, Pa., and shaker at Lewiston, Idaho.

RANDOLPH & CLOWES, Waterbury, Conn., report that the storm on Sunday morning, Nov. 27, caused the roof of their brass and copper rolling mill to cave in, on account of which they have been somewhat delayed in filling orders for this class of material. The debris of the wreck has been removed, and temporary roofs have been erected over the machinery. The crane mill was to be in running order Dec. 5. The entire brass and copper mill, it is hoped, will be in operation Dec. 12. No damage or interruption occurred in any other department of the works, and the damage to the machinery was less than $1,000, and the cost of a roof will not exceed $12,000, which expenditure will put the mill in better condition than before the accident.

NEW COMPANIES.—The Alabama Steel & Wire Co., Birmingham, Ala.; $2,000,000; Pres., E. T. Shuler, Chicago; Secy., G. H. Shuler, Cleveland, O.

Santiago Mining Co., New York; $200,000, commencing with $1,000; to do a general mining business; James McCallum, Charles R. Lee, H. C. Lum Suden, Charles F. Simes and Job W. Lord.

Federal Mfg. Co., Portland, Me.; $100,000, commencing with $220; to manufacture and sell gas appliances; Pres., George M. Butterick, Boston, Mass.; Treas., Freeman Emmons, Wakefield, Mass.

Contract Work Should Always be Advertised in a Paper Read by Contractors.

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PERSONAL.

Mr. John H. Mabbett has been appointed Water Commissioner of Saratoga, N. Y., to succeed Mr. Mark M. Cohn, deceased.

Mr. C. D. McKelvey, General Superintendent of the New York, Susquehanna & Western R. R., with headquarters in Jersey City, N. J., has resigned.

Prof. Sidney H. Short, Second Vice-President of the Walker Co., Cleveland, O., electrical manufacturers, has resigned, and will make a trip to Europe, it is stated.

Mr. Chas. L. Kesling, C. E., sailed Dec. 14 for Havana as Engineer for Drake & Stratton, who have a government contract for building a pier and a steam railway at Havana.

Mr. Chas. E. Webster, Chief Engineer of the Lehigh Valley R. R., with headquarters at South Bethlehem, Pa., has resigned his position, which he has held for the past 15 years.

Mr. Chas. P. Costello, of Portland, Me., has been appointed Superintendent and General Manager of the Water-Works of Springfield, Mo., which are controlled by eastern capitalists.

Mr. Willard A. Smith, of Chicago, Ill., has been appointed Director of the Department of Transportation and Civil Engineering of the U. S. Commission to the Paris Exposition of 1900.

Mr. Julius Le Roy Adams, Jun. Am. Soc. C. E., of Brooklyn, N. Y., son of Col. Julius W. Adams, Past President Am. Soc. C. E., was married Dec. 6, at Yonkers, N. Y., to Miss Georgiana Heermance.

The firm of Wilson Bros. & Co., architects, civil and consulting engineers, Drexel Building, Philadelphia, after Feb. 1, 1899, will be made up of the following members: Messrs. Joseph M. Wilson, Henry W. Wilson, John McArthur Harris and Howard S. Richards.

Mr. J. C. Patterson, Resident Engineer of the Great Northern Ry. Line, with headquarters at Great Falls, Mont., has resigned to accept the position of Chief Engineer of the Butte, Anaconda & Pacific Ry., with headquarters at Anaconda, Mont.

Mr. J. C. Howard, Assistant Superintendent of the Chicago, Burlington & Northern Ry., with headquarters in Minneapolis, Minn., has been appointed General Manager of the Brainerd & Northern Minnesota Ry., with headquarters at Brainerd, Minn., to succeed Mr. E. H. Hoar.

Mr. J. H. Manning, Master Mechanic of the shops of the Union Pacific R. R., Omaha, Neb., has been transferred to Cheyenne, Wyo., to succeed Mr. T. A. Davies, assigned to other duties. Mr. M. K. Barnum, of North Platte, Neb., has been appointed to succeed Mr. Manning at Omaha.

Mr. Gustav R. Tuska, Assoc. M. Am. Soc. C. E., Chief Engineer of the Panama R. R., with headquarters in New York city, arrived here Dec. 12, on the steamer "Finance" from Colon, where he has been acting as an expert in adjusting matters between the railway and the Panama Canal Co.

Mr. Samuel M. Gray, M. Am. Soc. C. E., of Providence, R. I., has been engaged as Consulting Engineer, to advise the city of Petersburg, Va., as to the best kind of street pavement to be laid, and to prepare specifications for the same. The city expects to expend upwards of $100,000 on this improvement.

Mr. Edward H. Lee, Assistant Engineer, in charge of the track elevation on the Chicago & Western Indiana R. R. and the Belt Ry. Co., of Chicago, has been appointed Chief Engineer and General Roadmaster, to succeed Mr. F. C. Doran, deceased. Mr. Lee was formerly for several years Chief Engineer of the Elgin, Joliet & Eastern Ry.

Lieut. Richmond P. Hobson, Assistant Naval Constructor, U. S. Navy, the chief hero of the "Merrimac" incident, of the Spanish War, has been promoted by President McKinley to be Naval Constructor, and has been ordered to the Asiatic station for duty in connection with the raising and repairing of vessels captured at Manila.

Mr. Edward C. Shankland, M. Am. Soc. C. E., has withdrawn from the firm of D. H. Burnham & Co., architects, of Chicago, Ill., and has formed a partnership with his brother, Mr. R. M. Shankland, mechanical engineer, under the firm name of E. C. & R. M. Shankland, civil engineers, with offices at 816 The Rookery, Chicago. The firm will make a specialty of building construction and foundations, especially of office buildings, warehouses and factories.

Col. Wm. Ludlow, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, and Major-General of Volunteers, has been appointed by President McKinley, Military and Civil Governor of Havana, Cuba, to report there before Jan. 1 next. General Ludlow's civil engineering experience, as well as his tried administrative ability acquired as Engineer Commissioner of the District of Columbia, especially fits him for this important post.

The following have been nominated as commissioners to codify the building laws of New York city: Wm. J. Fryer, Robt. A. McCafferty and Cornelius O'Reilly and Geo. A. Just, M. Am. Soc. C. E., of Manhattan Borough; Randolph L. Daus and Bernard Gallagher, of Brooklyn Borough; Daniel Callahan, of Queens; Assistant Corporation Council Rollin M. Morgan and Building Commissioners Thos. J. Brady, John Guilfoyle and Daniel Campbell.

OBITUARY.

Mr. Barnard Feeney, contractor, of Union Hill, N. J., died Dec. 4, aged 49.

Mr. Richard C. Anderson, mining engineer, of Deadwood, S. Dak., died Dec. 2.

Mr. James McCloud, of the firm of Jas. McCloud & Co., contractors, of Williamsport, Pa., and Columbus, O., died Dec. 2, in the latter city, aged 58.

Mr. Geo. Richardson, for many years Superintendent of the private water-works plant at Bridgeport, Conn., died in that city on Dec. 12, at the age of 51 years.

Mr. Andrew Hallen, Chief Engineer of the Pennsylvania Coal Co., Pittsburg, Pa., died Dec. 9, as the result of injuries received in a mine explosion Dec. 6. He was 36 years of age.

Mr. Geo. Tisdale Clark, a member of the board of arbitration to determine the price to be paid by the village of Fulton, N. Y., for the water-works of the private water company there, died at Oswego, N. Y., on Dec. 9.

Mr. George Richardson, Superintendent of the Bridgeport Hydraulic Co., Bridgeport, Conn., which supplies that city with water, died at his home, Dec. 11, aged 52. He was the son of the late Joseph Richardson, contractor and builder, of New York.

Mr. James McGee, Manager of the Devoe Works of the Standard Oil Co., died at his home in Plainfield, N. J., Dec. 6, aged 72. He was a member of the American Geographical Society, and of the American Museum of Natural History, as well as several other societies.

Mr. Geo. H. Parish, President of the Red Ash Coal Co., died at his home in Wilkesbarre, Pa., Dec. 11, aged 79. He built a large portion of the Louisville & Nashville R. R., and was interested in a number of other railways. He organized a number of coal companies and was the founder of the Vulcan Iron Works, of Scranton, Pa.

Lieut. Charles D. Kennedy, Manager of the Judson Powder Co., Berkeley, Cal., was killed, Dec. 7, by an explosion in the works. He was born in New Bedford, Mass., and graduated from service as cadet on the U. S. revenue cutter "Salmon P. Chase" in 1882. He was appointed to the U. S. revenue cutter "Dexter" and later distinguished himself in the Arctic service on the "Bear," "Rush" and "'Corwin." He resigned in 1888 to accept the position he held at the time of his death.

Sir William Anderson, M. Inst. C. E., of London, England, died Dec. 11. He was born in St. Petersburg, Russia, Jan. 5, 1835, of British parentage. In 1849 he went to King's College, London, where he studied applied sciences. He lived in Dublin, Ireland, from 1855 to 1864, engaged in engineering practice and was elected President of the Institution of Civil Engineers of Ireland in 1863. In 1864, he entered the firm of Easton & Amos, London, building the Erith Iron Works. In 1889, he was appointed Director-General of the Royal Ordnance Factories at Woolwich, Waltham Abbey, Enfield and Birmingham. He was elected a Member of the Institution of Civil Engineers in 1869, and was later a Vice-President. He was also a Vice-President of the Institution of Mechanical Engineers, and of the Society of Arts. In 1897 he was knighted and received the degree of Doctor of Civil Laws from Durham University. He was also a Fellow of the Royal Society.

Mr. Samuel McElroy, M. Am. Soc. M. E., a civil engineer, long identified with the public works of Brooklyn, N. Y., died of heart disease in that city, on Dec. 9, aged 74 years. Mr. McElroy was born in Albany, and in early life served as a steam engineer on the U. S. S. "Fulton." As early as 1854 he was an assistant of Gen. Ward B. Burnett, Engineer of the Long Island Water Works Co., in making the surveys for obtaining a constant supply of water from Long Island streams, as a substitute for a well supply. In 1855 Mr. McElroy, as Chief Engineer, prepared the specifications appended to the contract between the Nassau Water Co., the successors of the Brooklyn Water Co., and the Long Island Water-Works Co., with Henry S. Welles & Co., for the construction of a distributing pipe and hydrant system, the Prospect Hill and Ridgewood distributing reservoirs and a closed conduit from the Ridgewood Pumping station to Baiseley's Pond. In the same year Mr. James P. Kirkwood became Chief Engineer, and Mr. McElroy, with Moses Lane, and later Julius W. Adams, was appointed one of the Assistant Engineers for this work. Later McElroy was engaged in laying out streets in the outer wards of Brooklyn and in surrounding towns, and for the last twenty-five years he has been extensively employed as an expert and consulting engineer in matters connected with water supply. As an engineering expert for the city of Brooklyn he was prominently connected with the adjustment of the late controversy between that city and the Long Island Water Supply Co.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

AMERICAN INSTITUTE AND THE HENRY ELECTRICAL SOCIETY.
Dec. 16. "Light," William Hallock, Secy., D. R. Lovejoy, 111 W. 38th St., New York city.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 16. Secy., F. H. Olmsted, Byrne Bldg., Los Angeles, Cal.

ROCHESTER ENGINEERING SOCIETY.
Dec. 16. Secy., John F. Skinner, Reynolds Library Bldg., Rochester, N. Y.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 16. Secy., D. W. Meeker, St. Paul, Minn.

CHICAGO ELECTRICAL ASSOCIATION.
Dec. 16. "Wireless Telegraphy," Arthur V. Abbott. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

THE DETROIT ENGINEERING SOCIETY.
Dec. 16. "The Civil Engineer and National Public Works," Geo. Y. Wisner. Secy., Henry Goldmark, Wayne Co., Sav. Bank Bldg., Detroit, Mich.

THE ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Dec. 17. Secy., H. M. Gates, 12½ North High St., Columbus, O.

ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 17. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 19. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 19. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.

TECHNICAL CLUB OF OMAHA.
Dec. 19. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Dec. 20. Secy., R. A. Fessenden. 410 Penn Ave., Pittsburg, Pa.

WESTERN RAILWAY CLUB.
Dec. 20. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 21. Secy., Frank H. Olmsted, Los Angeles, Cal.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 21. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Dec. 21. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

ENGINEERS' CLUB OF ST. LOUIS.
Dec. 21. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 21. "Building Laws" Discussion. Secy., C. W. Hunt, 220 West 57th St., New York City.

WESTERN SOCIETY OF ENGINEERS.
Dec. 21. "Foundations for Railroad Bridge Across the St. Lawrence River at Cornwall, Ont.," George E. Thomas. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 22. Secy., C. A. McNab, 112 Mansfield St., Montreal, Canada.

ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 22. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 27. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Dec. 28. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.

ENGINEERS' SOCIETY OF WESTERN NEW YORK.
Jan. 2. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 2. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.

FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA.
Jan. 4. Secy., Howard Evans, Pier 45, Delaware Ave., Philadelphia, Pa.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Jan. 6. "The Electro-Metallurgy of Copper," John B.F. Hereschoff. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.

THE LOUISIANA ENGINEERING SOCIETY.
Jan. 9. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

ENGINEERS' CLUB OF KANSAS CITY.
Jan. 9. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 10. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.

NORTHWEST RAILWAY CLUB.
Jan. 10. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

NEW ENGLAND RAILWAY CLUB.
Jan. 10. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

CENTRAL RAILWAY CLUB.
Jan. 13. Secy., H. D. Vought, 114 Fifth Ave., New York city.

ST. LOUIS RAILWAY CLUB.
Jan. 13. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

SCRANTON ENGINEERS' CLUB.
Jan. 14. Annual meeting. Secy., F. E. Pratt, 730 Madison Ave., Scranton, Pa.

MONTANA SOCIETY OF ENGINEERS.
Jan. 14. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

AMERICAN INVENTORS' AND MANUFACTURERS' ASSOCIATION.
Jan. 15. Annual meeting, Washington, D. C. Secy., Arthur Steuart, Washington Loan and Trust Bldg., Washington, D. C.

FRANKLIN INSTITUTE.
Jan. 17. "The Clarification and Purification of Municipal Water Supplies," Mr. Allen Hazen; Jan. 20. "This Country of Ours," John Birkinbine. Secy., Wm. H. Wahl, 15 South Seventh St., Philadelphia, Pa.
NEW YORK RAILROAD CLUB.
Jan. 19. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.
ENGINEERS' CLUB OF CINCINNATI.
Jan. 19. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 19. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.
THE WEST VIRGINIA SOCIETY OF CIVIL ENGINEERS AND ARCHITECTS.
Jan. 19-20. Annual meeting, Charleston, W. Va. Secy., W. Steenbergen, Point Pleasant, W. Va.
NORTHWESTERN ELECTRICAL ASSOCIATION.
Jan. 19-21. Semi-annual meeting, Milwaukee, Wis. Secy., Thos. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.
TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 20. Annual meeting. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.
NATIONAL ASSOCIATION OF MANUFACTURERS.
Jan. 24-26. Annual convention, Cincinnati, O. Secy., E. P. Wilson, Room A, Chamber of Commerce, Cincinnati, O.
INDIANA ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Indianapolis, Ind. Secy., J. B. Nelson, 61 Baldwin Block, Indianapolis, Ind.
MICHIGAN ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Lansing, Mich. Secy., F. Hodgman, Climax, Mich.
ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 25-27. Annual meeting, Champaign, Ill. Secy., Jacob A. Harman, Peoria, Ill.

WEST VIRGINIA SOCIETY OF CIVIL ENGINEERS AND ARCHITECTS.—The 4th annual meeting of this society will be held at Charleston (Kanawha Co.), West Virginia, Jan 19-20. W. Steenbergen, Secy.

ENGINEERS' CLUB OF COLUMBUS.—The regular meeting of this club was held Dec. 3. The subjects discussed were: "Metal Protection, Lead vs. Zinc Paint"; "Best Method of Residence Heating"; "The Metric System: Can It be Brought Into Common Use in America."

MONTANA SOCIETY OF ENGINEERS.—The regular meeting of this society was held at Helena, Mont., Nov. 12, 1898.

The bill providing for the appointment of a State Engineer and defining his duties, was read and discussed, after which Mr. O. Jackson, recently from Alaska, addressed the society upon Railway, Tramway and other improvements now being made in that country. The reading of the paper by F. W. Blackford upon the Butte-Centerville Electric Railway, was postponed until the December meeting.

BROOKLYN ENGINEERS' CLUB.—The annual meeting of this club was held at the Argyle Hotel, Brooklyn, N. Y., on Dec. 8. The early part of the evening was devoted to the consideration of reports of the officers and various committees. This was followed by the election of officers for the ensuing year, as follows: Pres., Walter M. Meserole; Vice-Pres., Henry B. Seaman; Secy., A. J. Provost, Jr.; Treas., Calvin W. Rice.

SCRANTON ENGINEERS' CLUB.—This club held a regular meeting on Dec. 7, at which Mr. Edmund A. Bartt related his experience as a prospector in the Peace River district of the Northwest Territory. During this work he took copious notes of topography and location, which have been of great service to the Canadian Geological Survey, enabling it to correct the existing maps of this district, which he showed to be very inaccurate.

The following officers were nominated for the ensuing year: Pres., W. M. Marple; Vice-Pres., C. C. Rose; Secy., H. W. Rowley; Corres. Secy., Morgan Davis; Treas.; A. C. Lamont; Librarian, A. C. Lister. Directors: James Archbald, Capt. W. A. May and Chas. S. Farrer.

THE CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—The regular meeting of this society was held Dec. 5. An invitation to visit the shops of the Great Northern Ry., extended to the society by the Superintendent, Mr. J. F. Forbes, was accepted. A revised membership list was ordered printed.

The paper of the evening on "The Manufacture of U. S. 12-in. Mortar Carriages" was read by Mr. Oliver Crosby.

The American Hoist & Derrick Co, of St. Paul, have been turning out these carriages at the rate of two per month during the past year. Ten pieces of gun iron, the strength of which was twice that of ordinary cast iron, were exhibited. C. L. Annan, Secy.

AMERICAN INSTITUTE OF MINING ENGINEERS.—The 29th annual meeting of the Institute will be held in New York city, beginning Feb. 21. Hotel headquarters will be at the Murray Hill Hotel, and the sessions will be held, through the courtesy of the American Society of Mechanical Engineers, in its hall, No. 12 West 31st St.

A special topic of discussion at this meeting will be the paper on "The Evolution of Mine-Surveying Instruments," by Dunbar D. Scott, Ironwood, Mich. This paper surveys the history of mine surveying, describing, illustrating and criticising the successive types of apparatus employed in this and other countries.

R. W. Raymond, Secy.

ENGINEERS' CLUB OF ST. LOUIS.—The 480th meeting, which was also the annual meeting, was held Dec. 7, with 53 members and visitors present. The several standing committees presented reports, and the nominating committee presented a list of nominees for 1899. It was announced that the annual supper would be held Dec. 21.

The paper of the evening, by Mr. A. H. Zeller, was then read. The author was a delegate from the Engineers' Club of St. Louis to the celebration of the 50th anniversary of the Civil Engineers of France, and the paper described the manner in which the event was celebrated. After the reading of the paper, a number of lantern slides were exhibited, showing views of engineering works in Paris, Berlin and other European cities.

Richard McCulloch, Secy.

AMERICAN ECONOMIC ASSOCIATION.—The 11th annual meeting of this association will be held at New Haven, Conn., Dec. 27-29. The following are some of the papers to be presented:

Dec. 27.—"The Relation between Economics and Politics." Prof. Arthur T. Hadley.

Dec. 28.—Report of the committee on the 12th Census. Discussions: "Is it possible to get Statistics of Capital and Industry?" "What may and should Statistics of Municipal Finance be made to show?" "Early Canal, Railway, and Banking Enterprises of the States, in Relation to the Growth of Corporations in the United States," Dr. G. S. Callender.

Dec. 29.—Report of the Committee on Banking and Currency; "Dynamic Standards of Wages and Interest," Prof. J. B. Clarke; "The Present Study of Practical Labor Problems in France," Dr. W. F. Willoughby; "Municipal Taxation as a Means of Public Control of Corporations," C. W. Curtis; "The Nature of Municipal Franchises," Dr. Max West.

THE NEW JERSEY SANITARY ASSOCIATION.—The fourth annual meeting of the association was held at Lakewood, N. J., on Dec. 9 and 10. The president, Mr. Vernon H. Davey, Superintendent of the Schools of East Orange, devoted the greater part of his address to school house construction, school sanitation, and hygiene. Floors of school buildings should be made of some wood that will not shrink or splinter, like kiln dried Georgia pine. There should be 18 sq. ft. of floor space for each child. Reliance cannot be placed on gravity systems of ventilation, in mild weather.

A paper on "Methods of Sewage Disposal" was expected from Mr. Rudolph Hering, M. Am. Soc. C. E. He was unable to attend, and Mr. Jas. H. Fuertes, M. Am. Soc. C. E., presented a paper on the same subject. He outlined the various methods in use and spoke hopefully of Cameron's septic tank and Dibden's bacterial filter systems, of which so much is now heard in and from England. These systems, he said, are still in an experimental stage, but promise to simplify the sludge problem. The discussion on this paper was opened by Mr. M. N. Baker, who stated that the concentration of population in some portions of the state, and notably the Passaic valley, made it difficult to find sites for sewage purification plants. This fact, coupled with the economy of co-operation in such matters suggested the desirability of a joint system of sewage disposal, whether the final treatment be dilution or otherwise. Mr. Fuertes said that disposal by dilution sometimes involved the question of temperature. If the water receiving the sewage were cold, nuisance was less likely to result. Mr. Jas. Owen said he had just completed a septic tank for the sewage of a hospital located in Essex county, N. J. The tank has not been put in operation. It will serve about 1,000 people.

Besides acting as a substitute for Mr. Hering, Mr. Fuertes presented a paper on "Public Water Supplies and the Prevention of the Pollution of the Same." Some authorities hold that cities should own the whole drainage area from which their water supply comes. This is generally impracticable for large cities. Some English cities having such ownership do not show, by their typhoid statistics, any advantage over Boston or New York. The securing of a strip of land on the shores of reservoirs, lakes or streams used as water supplies is a practicable and valuable measure. It excludes sources of pollution from close proximity to the water. The drainage of county roads is sometimes kept out of surface supplies abroad, but Mr. Fuertes knew of no such practice here. In New York the State Board of Health, on application from local authorities, formulates rules for the sanitary protection of public water supplies, varying the rules to suit each case. In discussing the paper, Mr. Geo P. Olcott, of East Orange, urged that more attention should be given to the quality of water supplies in planning them, notwithstandihng the pressure often brought to bear in the case of municipal works to keep the cost down. Mr. Wm. Kent, M. Am. Soc. M. E., said that the engineering side of the case was clear, but how about its legal phases in New Jersey? Mr. Baker said the state legislation on the subject had improved of late, but there was great need of central supervision of sources of water supply in New Jersey. The commission recently appointed to investigate stream pollution could render a great service by pointing out the work to be done over the whole state, instead of confining itself to the Passaic River, both it and the public seeming to think it was created to look after one stream, whereas the language of the act includes the streams of the state.

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NEW PUBLICATIONS.

LITERARY MAGAZINES.—The November "Contemporary Review" contains a paper by Prof. Ramsay on "The Kinetic Theory of Gases," in which that eminent English scientist explains the remarkable manner in which purely theoretical studies led to the discovery of the new elements, Helium and Neon. In the "Fortnightly," the article of most interest to American readers is a very realistic account of life in the Klondike, written evidently by one who has been through that rough experience.

The December "McClure's" is notable for a paper by Capt. Alfred T. Mahan on the lessons of the Spanish War. He takes occasion to roundly condemn the building of monitors, and remarks that there was not an hour throughout the late war when we would not have been glad to exchange all our six monitors for two battleships of much less cost and total tonnage. In fact he declares that the two popular errors that have worked most injury to the nation's naval strength are that the navy should be designed for defensive instead of offensive action, and that the monitor is an efficient type of war vessel. "McClure's" also contains two good railway stories; one by Mr. John Hill, of the "American Machinist," and the other by Capt. J. E. Brady, describing the life of a train dispatcher.

In "The Cosmopolitan" we find a brief account of the late Col. Waring's work in organizing the street cleaning department of New York city; and Sir Norman Lockyer the English astronomer, tells of the expeditions to India of astronomers of all countries to observe the total eclipse of the sun, which occurred last January. In the Christmas "Harper's," the thrilling story of how the "Winslow" was rescued, is told by Lieut. Ernest E. Mead, of the U. S. Revenue Cutter Service. In "The Coming Fusion of the East and West," an American, long resident in Japan, urges that England, the United States and Japan join hands to rescue China from partition among European nations. The writer appears too enthusiastic, and deals too much in broad generalities to be a very safe guide; but he writes of many recent happenings in the East that are at least worth knowing by those interested in the study of international politics. A much more valuable paper in the same field we find in the December "Scribner," where Hon. Joseph Chamberlain writes on "Recent Developments of Policy in the United States." Mr. Chamberlain outlines the methods by which England has been successful in governing her tropical colonies, and thinks the United States can do as well. In the same magazine the capture of Manila is described by Capt. T. B. Mott; and R. H. Davis tells of life in the rifle-pits before Santiago during the two weeks that elapsed from Cervera's flight to the city's surrender.

The December "Atlantic" has three articles discussing the new "expansion policy," and an excellent paper on "California and the Californians," by President David Starr Jordan, of Leland Stanford University. In the "Review of Reviews," Wm. E. Curtis tells the story of the recent coup d'etat in China, and a very different story it is from that which has appeared in fragmentary shape in the newspapers. Dr. Albert Shaw writes a brief account of Col. Waring's life and work. The most valuable paper in the magazine, however, is that in which Lieut. John H. Parker criticises the methods by which our army supply departments are now conducted and points out the need of a general staff in our army—a need which it is to be hoped the present Congress may supply. "Forest Fires" and the methods of preventing them are considered by Mr. Henry Gannett, of the U. S. Geological Survey, in the December "Forum," and in the same magazine the very limited scope of the Sherman anti-trust act as interpreted by the Courts is explained.

In the December "Popular Science Monthly," Edward Atkinson writes on "The Wheat-Growing Capacity of the United States," and endeavors to prove that we have but just begun to show what we can do in producing breadstuffs to feed the world. "The Reorganization of the Naval Personnel" is the title of a symposium with which the "North American Review" opens. Among the contributors are Theodore Roosevelt, Commodores Philip and Melville and Hon. Francis H. Wilson. "The Latest Aspects of the Nicaragua Canal Problem" are discussed by C. M. Stadden; but the kaleidoscope is changing so rapidly here that this article is hardly up to date when it appears in print. Besides these articles the magazine also contains papers on the "Decision Against Railway Pooling," by President Roswell Miller, and "The Scientific Prevention of Yellow Fever," by Dr. A. H. Doty, Health Officer of the Port of New York. In the December "Century" Naval Constructor Hobson begins the story of the sinking of the "Merrimac," in the attempt to cork up the entrance to Santiago Harbor, and Capt. Sigsbee gives the second installment of his narrative of the loss of the "Maine." These "Century" articles undoubtedly deserve to rank among the most valuable contributions to the history of the recent war that have appeared in any of the magazines.

WATER SUPPLY DEPARTMENT OF QUEENSLAND.—Report of the Hydraulic Engineer, J. B. Henderson, M. Inst. C. E., for 1896-7. Address the Department, Brisbane, Queensland, Australia. Paper; 8 × 13 ins.; pp. 52; tables and plates.

This report contains a variety of interesting information regarding the urban and rural water supply of Queensland, including that from artesian wells. Rainfall and other diagrams and a number of maps are presented, together with some good reproductions of photographs of artesian wells.

DIVISION OF FORESTRY.—U. S. Department of Agriculture. Bulletin No. 19. Progress in Timber Physics. The Bald Cypress (Taxodium distichum). Paper; 11½ × 9¼ ins.; pp. 24.

The Bald Cypress, here described by Mr. Filibert Roth, is one of the important timber trees of the Southern States and differs from other conifers in losing its foliage in the winter. It has many local names but in the trade the adjective is usually dropped. The best authorities figure the supply of cypress at 27,000 million ft. B. M., and the annual cut is placed at about 500 million ft. B. M., mostly from Louisiana. The cypress wood is of dark color, medium weight and strength, great durability, fine even grain, slow to dry but easily worked, and especially adapted for use as shingles. The report enters fully into specific weights, moisture and shrinkage, strength and test results with differing percentages of moisture.

REVENUE AND EXPENSES OF BOSTON, 1892-6.—Special Publications, Department of Municipal Statistics. No. 1, Estimates, Appropriations and Actual Expenditures of Ordinary Revenue. No. 2, Ordinary Revenue. Address the Department. Paper; 9 × 12 ins.; pp. 105 and 38; tables.

These are the first issues of special publications of the recently established Department of Municipal Statistics. They present in some detail the ordinary receipts and expenditures of the city of Boston for the past five years, together with the estimates by and appropriations to the several departments. The figures were compiled from the reports of the city auditor and were designed, among other things, to aid the city officials in making up their appropriations for the coming year. As a survey of the financial operations of the whole city for five years, by a board having no possible interest in anything but a presentation of facts, these and the proposed supplementary reports promise to be of great value to Boston and suggestiveness to other cities.

TRADE PUBLICATIONS

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

ACETYLENE GAS FOR POPULAR LIGHTING.—Pan-American Acetylene Co., Buffalo, N. Y. Pamph.; 3½ × 6¼ ins.; pp. 32.

This little pamphlet describes the principles of the manufacture of carbide of calcium and of acetylene gas, and advertises the merits of the gas for domestic lighting purposes and of the "Buffalo" gas generator. It gives the best brief popular account of acetylene we have yet seen.

STEAM ENGINES.—The Westinghouse Compound Engine. Westinghouse Machine Co., Pittsburg, Pa. Pamph.; 9 × 6 ins.; pp. 94.

This pamphlet describes and illustrates the well-known Westinghouse automatic cut-off single-acting compound non-condensing engines, and discusses its various points of merit. It is written in an interesting and rather unusual style, and is well worth reading by steam engineers. We notice especially a photographic copy of an office record of a brake, indicator, and steam consumption test of an 11 and 19 × 11-in. engine at three different loads, viz., 113, 61 and 35 HP., showing a water rate per I. HP. per hour of 22.41, 23.61 and 29.15 lbs. and a water rate per brake HP. per hour of 24.16, 27.1 and 38.6 lbs., respectively, for the three different loads. This is no doubt excellent performance for a small non-condensing engine, but to us the most remarkable thing about the record is that, as far as we know, no other engine builder publishes in his catalogue any record whatever of actual steam consumption tests of engines under variable loads. The example set by the Westinghouse Company should be followed by other builders.

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CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Dec. 15.	Bridges (9) and viaduct, Valatie, N. Y. Advertised, Eng. News, Dec. 1 and 8.	Dec. 1
Dec. 15.	Dikes, etc., Portland, Ore.	Dec. 8
Dec. 15.	Electric lighting, Sherbrooke, Que.	Dec. 8
Dec. 15.	Paving (3 streets), Beaumont, Tex.	Dec. 1
Dec. 15.	Court house, Garner, Ia.	Dec. 1
Dec. 15.	Railway work, New York, N. Y. Advertised, Eng. News, Dec. 1 and 8.	Dec. 1
Dec. 15.	Water-works, Somerville, Tenn. Advertised, Engineering News, Dec. 1.	Dec. 1
Dec. 15.	Electric plant, Somerville, Tenn. Advertised, Engineering News, Dec. 1.	Dec. 1
Dec. 15.	**Church building, Webster City, Ia.**	**Nov. 24**
Dec. 15.	Warehouses (7), Havana, Cuba.	Dec. 15
Dec. 15.	Repairing asphalt pavements, Philadelphia.	Dec. 15
Dec. 16.	Fire hose (4,000 ft.), St. Louis, Mo.	Dec. 15
Dec. 16.	Pipe sewer, Boston, Mass.	Dec. 15
Dec. 16.	Valves, hydrants, etc., Chicago, Ill.	Dec. 15
Dec. 16.	Building bonds, Youngstown, O.	Dec. 15
Dec. 16.	Water pump, Millvale, Pa.	Dec. 15
Dec. 16.	Light bonds, Little Falls, Minn.	Dec. 8
Dec. 16.	Piles, planks, etc., New York.	Dec. 8
Dec. 16.	Paving, sewers, etc., Meadville, Pa. Advertised, Engineering News, Dec. 8.	Dec. 8
Dec. 16.	Water-bonds, Little Falls, Minn.	Dec. 8
Dec. 17.	Electric plants, etc., Brooklyn, N. Y.	Dec. 8
Dec. 17.	Macadam roads (20 miles), Crown Pt., Ind. **Advertised, Engineering News, Nov. 24.**	Nov. 24
Dec. 17.	Heating, ventilating, etc., Cincinnati, O.	Dec. 1
Dec. 17.	Plank sidewalks, etc., Kansas City, Mo.	Dec. 15
Dec. 17.	Pipe sewers, Owensburg, Ky.	Dec. 15
Dec. 17.	Improving Connecticut Ave., Washington.	Dec. 15
Dec. 19.	School buildings, New York, N. Y.	Dec. 15
Dec. 19.	Removing garbage, Atlantic City, N. J.	Dec. 15
Dec. 19.	Road, Atlantic City, N. J.	Dec. 15
Dec. 19.	Shell roads, Annapolis, Md.	Dec. 15
Dec. 19.	Gravel and brick paving, Indianapolis, Ind.	Dec. 15
Dec. 19.	Repairing roadway of bridge, Chicago, Ill.	Dec. 15
Dec. 19.	Grading and crosswalks, San Mateo, Cal.	Dec. 15
Dec. 19.	Engineers' supplies, New York, N. Y.	Dec. 15
Dec. 19.	Sidewalk shelters, Toronto, Ont.	Dec. 15
Dec. 19.	Heating plant, etc., Oshkosh, Wis.	Dec. 15
Dec. 19.	Asphalt or brick paving, Hamilton, O.	Dec. 1
Dec. 19.	**Tunnel sewer, Newburg, N. Y.** Advertised, Eng. News, Nov. 17 and 24.	**Nov. 17**
Dec. 19.	Paving bonds, Lima, O.	Dec. 8
Dec. 19.	Reformatory building, Lexington, Ky.	Dec. 8
Dec. 20.	Water pump, Dunkirk, N. Y. Advertised, Eng. News, Dec. 8 and 16.	Dec. 8
Dec. 20.	Electric plant, Royal Oak, Mich.	Dec. 8
Dec. 20.	**Revetments, Keweenaw Point, Mich.** **Advertised, Eng. News, Nov. 24 to Dec. 15.**	**Nov. 24**
Dec. 20.	Electric plant, Mount Pleasant, Mich.	Dec. 1
Dec. 20.	Police station, Cincinnati, O.	Dec. 15
Dec. 20.	Bridge work, Blair, Neb.	Dec. 15
Dec. 20.	Sluiceways, Wilmington, Del.	Dec. 15
Dec. 20.	Steam heating, etc., New York, N. Y.	Dec. 15
Dec. 20.	Asphalt paving, Buffalo, N. Y.	Dec. 15
Dec. 20.	Fire apparatus, etc., Philadelphia, Pa.	Dec. 15
Dec. 20.	Iron bridge, etc., Rensselaer, N. Y.	Dec. 15
Dec. 21.	Bridge bonds, Selma, Ala.	Dec. 15
Dec. 21.	Repair of fireboat, New York, N. Y.	Dec. 15
Dec. 21.	Electric lights, Cleveland, O.	Dec. 15
Dec. 21.	Fire apparatus, New York, N. Y.	Dec. 15
Dec. 21.	School building, Buffalo, N. Y.	Dec. 15
Dec. 21.	Hospital building work, New York, N. Y.	Dec. 15
Dec. 21.	Life-saving station, Toms River, N. J.	Dec. 15
Dec. 21.	Roads and park work, New York, N. Y.	Dec. 15
Dec. 20.	Macadamizing, Cincinnati, O.	Dec. 1
Dec. 21.	Street work, Hoboken, N. J.	Dec. 1
Dec. 21.	Glass for electric lamps, Cleveland, O.	Dec. 1
Dec. 21.	**Court house annex, Atlanta, Ga.**	**Nov. 3**
Dec. 21.	Bridge, Charlottetown, P. E. I.	Dec. 8
Dec. 22.	Bridge, superstructure, Lorain, O. **Advertised, Eng. News, Nov. 10 and 17.**	Nov. 10
Dec. 22.	Tunnel (500 ft.), Santa Barbara, Cal.	Dec. 15
Dec. 22.	Park work, New York, N. Y.	Dec. 15
Dec. 22.	Municipal building, Brooklyn, N. Y.	Dec. 15
Dec. 22.	Brick paving, Jacksonville, Fla. Advertised, Eng. News Dec. 8 and 15.	Dec. 8
Dec. 23.	Armory building, Whitehall, N. Y.	Dec. 15
Dec. 23.	Extending electric plant, Boston, Mass.	Dec. 15
Dec. 23.	Police station, New York, N. Y.	Dec. 15
Dec. 23.	Storehouse, Brooklyn, N. Y.	Dec. 15
Dec. 23.	Police station, Brooklyn, N. Y.	Dec. 15
Dec. 23.	Police station, Long Island City, N. Y.	Dec. 15
Dec. 23.	Brick paving, grading, etc., Zanesville, O.	Dec. 15
Dec. 23.	Paving and grading, St. Louis, Mo.	Dec. 15
Dec. 23.	Dredging, New York, N. Y.	Dec. 15
Dec. 23.	Lumber, etc., New York, N. Y.	Dec. 15
Dec. 23.	Public building, Liverpool, N. S.	Dec. 15
Dec. 23.	Wooden barrel sewer, New York, N. Y.	Dec. 15
Dec. 23.	Light station, Tompkinsville (S. I.), N. Y. Advertised, Eng. News, Nov. 10 and 17.	Nov. 17
Dec. 23.	Cement and seawall, Fort Morgan, Ala. Advertised, Eng. News, Dec. 1 to 22.	Dec. 1
Dec. 23.	Auditorium, Charleston, S. C.	Dec. 8
Dec. 26.	Electric lighting, Waterloo, N. Y. Advertised, Engineering News, Dec. 8.	Dec. 8
Dec. 24.	Court house work, Milwaukee, Wis.	Dec. 15
Dec. 24.	Water-works, Hawkins Point, Md.	Dec. 15
Dec. 26.	Street work, Atlantic City, N. J.	Dec. 15
Dec. 26.	Pipe sewers, South Bend, Ind.	Dec. 8
Dec. 27.	Electric plant, Woodsfield, O.	Dec. 8
Dec. 27.	Scow boat, New York, N. Y.	Dec. 15
Dec. 27.	Electric wiring, Paterson, N. J.	Dec. 15
Dec. 27.	Gas and electric fixtures, Washington, D.C.	Dec. 15
Dec. 28.	Steel truss bridge (140 ft.), Ogden, Utah.	Dec. 15
Dec. 28.	Cast-iron pipe sewer, New York, N. Y.	Dec. 15
Dec. 28.	Steel bridge, Norfolk, Va. Advertised, Eng. News, Dec. 1 to 15.	Dec. 1
Dec. 28.	**Railway bridge, Chicago, Ill.** **Advertised, Engineering News, Nov. 24.**	**Nov. 24**
Dec. 29.	Street bonds, Georgetown, Ky.	Dec. 8
Dec. 30.	Sewers, East Cleveland, O.	Dec. 8
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Dec. 31.	Bridge work, Plattsmouth, Neb.	Dec. 15
Dec. 31.	Steam boilers, Alexandria, Egypt.	Dec. 15
Dec. 31.	Clearing market grounds, Cleveland, O.	Dec. 15
Jan. 1.	**City hall plans, Bridgeport, Conn.**	**Aug. 18**
Jan. 1.	**Draw bridge, Cathlamet, Wash.**	**Nov. 17**
Jan. 1.	**Water-works, Pasadena, Cal.**	**Nov. 17**
Jan. 1.	Electric plant, Pasadena, Cal.	Dec. 1
Jan. 2.	**Bridge, Quebec, Que.** Advertised, Eng. News, Sept. 29 and Oct. 6.	**Sept. 29**
Jan. 2.	**Arc lighting, Vincennes, Ind.**	**Oct. 27**
Jan. 2.	Storm sewer, etc., Hamilton, O.	Dec. 8
Jan. 2.	Bridge, Aspen, Colo.	Dec. 15
Jan. 2.	Sea water pmpg franchise, Santa Cruz, Cal.	Dec. 15
Jan. 3.	Bridge work, Nelson, Neb.	Dec. 15
Jan. 3.	Pipe sewers, Mount Vernon, N. Y.	Dec. 15
Jan. 3.	Sewers, Cincinnati, O.	Dec. 15
Jan. 3.	Church, Ashland, Ky.	Dec. 15
Jan. 3.	Court house, jail, etc., Balsam Lake, Wis.	Dec. 15
Jan. 3.	Water-works bonds, Gaffney, S. C.	Dec. 8
Jan. 3.	**Steel bridge, Brookhaven, Miss.**	**Nov. 24**
Jan. 3.	Water-works, Gaffney, S. C.	Dec. 1
Jan. 3.	Bath plans, Albany, N. Y.	Dec. 8
Jan. 4.	Library building, Owatouna, Minn.	Dec. 15
Jan. 5.	Water-works, Darlington, Okla.	Dec. 15
Jan. 5.	Macadam roads (17½ miles), Decatur, Ind.	Dec. 1
Jan. 6.	Water-gas plant, Johannesburg, So. Africa.	Oct. 27
Jan. 6.	**Extension, electric plant, Johannesburg, S. Af.**	**Oct. 27**
Jan. 7.	Gravel road, Valparaiso, Ind.	Dec. 8
Jan. 9.	School building, Wilmington, Del.	Dec. 8
Jan. 9.	Water supply, Bucharest, Roumania.	Dec. 15
Jan. 9.	Excavating, paving, etc., Houston, Tex. Advertised, Eng. News, Dec. 15 to Jan. 5.	Dec. 15
Jan. 10.	Portland cemt (12,000 bbls.), Duluth, Minn. Advertised, Eng. News, Dec. 15 to Jan. 12.	Dec. 15
Jan. 10.	Pumping engine for dredge, Charleston, S.C. Advertised, Eng. News, Dec. 15 to Jan. 12.	Dec. 15
Jan. 10.	Capitol building, Phoenix, Ariz.	Dec. 1
Jan. 10.	Sewer bonds ($50,000), Grass Valley, Cal.	Dec. 1
Jan. 12.	Cement, St. Paul, Minn. Advertised, Eng. News, Dec. 15 to Jan. 5.	Dec. 15
Jan. 14.	**Park work and plans, Philadelphia, Pa.**	**Nov. 17**
Jan. 15.	Sewers and drainage, Callao, Peru.	Dec. 1
Jan. 15.	Street cleaning, Indianapolis, Ind.	Dec. 15
Jan. 16.	Sale of telephone franchise, Duluth, Minn. Advertised, Eng. News, Dec. 8 to Jan. 12.	Dec. 8
Jan. 18.	Sewers, Aiken, S. C. Advertised, Eng. News, Dec. 15 and 22.	Dec. 15
Jan. 24.	**Footway tunnel, London, England.**	**Nov. 10**
Feb. 1.	School building, Peoria, Ill.	Dec. 1
Feb. 2.	Electric lighting, New Orleans, La.	Nov. 3
Feb. 7.	Sale of canal, Annapolis, Md.	Dec. 1
Feb. 10.	Jail building, Keyser, W. Va.	Sept. 29
Mar. 15.	**Electric railway (23 miles), Shanghai, China.** **Advertised, Eng. News, Nov. 17 to Dec. 8.**	**Nov. 24**
Mar. 15.	Purchase of water-works, Belem, Brazil	Dec. 1
Mar. 31.	**Telephone concession, Shanghai, China.** **Advertised, Eng. News, Nov. 17 to Dec. 8.**	**Nov. 24**
No date.	Court house plans, Wilkesbarre, Pa.	Dec. 15

RAILWAYS.

ARGENTINE.—Press reports state that Herr Schiffner has returned to Berlin, Germany, from Buenos Ayres, with concessions approximately comprehending 2,000 miles of proposed railway.

ARIZONA.—Work has begun on the construction of a railway from Kingman to White Hill, Mojave county, Ariz., a distance of about 54 miles, according to reports. The line will pass through one of the richest mining sections of Arizona. Work will begin at McConnico Junction, four miles west of Kingman, and an entrance will be gained into Kingman over the tracks of the Atchison, Topeka & Santa Fe Ry.; the heaviest grade will not exceed 1.85%. Theodore B. Comstock, Ch. Engr., Los Angeles, Cal.

ATCHISON, TOPEKA & SANTA FE.—At the annual meeting of this company at Topeka, Kan., Dec. 8, the directors formally ratified the purchase of the San Francisco & San Joaquin Valley Ry., by which an entrance will be made into San Francisco, and also of the Kansas City, Topeka & Western Ry., the Leavenworth Northern & Southern Ry., the Southern Kansas Ry., the New Mexico & Southern Pacific Ry., the New Mexican Ry., the Rio Grande, Mexico & Pacific Ry., the Silver City, Deming & Pacific Ry., the Wichita & Western Ry., and the St. Joseph, St. Louis & Santa Fe Ry.

BLACK DIAMOND.—Col. Albert E. Boone, Pres., Zanesille, O., informs us that the Ghent-Vevay Bridge & Terminal Ry. Co. was incorporated in Kentucky, Dec. 6, and that it proposes to build across the Ohio River for the northern outlet of this projected system. Location has been made for this bridge and for that to be built by the Dover-Ripley Bridge & Terminal Ry. Co., on main line at Dover, Ky. We are also informed that contract for work between Cynthiana and Vevay will not be awarded until about May, but that the first steps towards receiving bids will be taken in January or February.

BRIDGEPORT & HELENA.—Reports state that this company, which was incorporated in Oregon last June to build a line from Bridgeport, Ore., to Helena, Mont., has completed surveys from Helena to the Seven Devils mining district. W. Thos. Hart, Pres., Weiser, Idaho.

BRITISH COLUMBIA.—Reports state that applications will be made to the legislature of British Columbia for power to construct the following lines: From Fort Simpson to Glenora or Telegraph Creek, on the Stikine River, B. C.; from the main line of the British Columbia Yukon Ry. to Tagish Lake, and thence to Atlin City; also for a railway from Golden, on the main line of the Canadian Pacific, to Cranbrook, on the Crow's Nest Pass branch, a distance of about 150 miles.

CALIFORNIA.—Plans are about consummated for the construction of a new narrow-gage railway from Truckee, Cal., to Lake Tahoe, about 15 miles south. N. K. Masten, Pres. of Maricopa & Phoenix and Salt River Valley R. R. Co., San Francisco, Cal., is said to be interested.

CHOCTAW & MEMPHIS.—Johnson Bros. & Faught, St. Elmo, Ill., and J. H. McCarthy & Reichardt, Little Rock, Ark., general contractors, have sub-let work to the following contractors for the construction of this new line from Little Rock, Ark., to Howe, Ind. Ter., 164 miles: M. A. Wogans, St. Joseph, Mo.; Mike Tansy, St. Louis, Mo.; W. M. Powell, Oklahoma City, Okla.; Jacob Collins, Kansas City, Mo.; A. G. Brown, St. Elmo, Ill.; R. Morris, Beloit, Kan., and Welch Bros., St. Elmo, Ill. J. F. Cullens, of St. Louis, will do the masonry work. Grading is now in progress from Little Rock west to Danville, 80 miles; the maximum grade is one per cent, compensated, and the maximum curves, seven degrees. F. A. Molitor, Ch. Engr., Little Rock, Ark.

CLEVELAND, LORAIN & WHEELING.—Press reports state that this railway has been purchased by the Federal Steel Co., and that several extensions will probably be built.

DAYTON & FAUNSDALE.—G. L. Siddons, Pres., Siddonsville, Ala., informs us that ten miles of this proposed line has been graded between Dayton and Faunsdale, and 40 miles located and rights of way secured; capital has been secured only for the first ten miles. N. McKay, of New York, is to build and equip this section before March 1, and other contracts will be let when bonds are sold. The projected route is 110 miles in length from Linden, via Dayton and Faunsdale, and thence to Greensboro and Tuscaloosa, or to Marion, Centerville and Blocton, Ala. J. D. Jones, Ch. Engr., Shiloh, Ala.

DETROIT & MACKINAC.—The railway commissioners have approved of the map for the extension of this railway through the counties of Presque Isle, Cheboygan and Iosco.

EGYPT.—Reports state that plans are being formulated for the extension of the Soudan Ry. to Khartoum, 180 miles, and to other points, and that orders for bridges are now being placed with British firms.

FARMVILLE & POWHATAN.—This company contemplates the extension of its lines from Chester to Manchester, Va., and has had J. S. Taylor, J. A. Brown and others appointed as commissioners to secure the right of way. C. P. E. Burgwyn, Ch. Engr., Richmond, Va.

GRAND RAPIDS, BELDING & SAGINAW.—Andrew Fyfe, Secy., Grand Rapids, Mich., informs us that the right of way has been secured and that surveys are being perfected for this proposed line from Lowell to Belding, via Alton and Smyrna, Mich., about 17 miles. It will serve as an extension of the Lowell & Hastings R. R. W. A. Smith & Co., Grand Rapids, Mich., is said to hold the contract. Thomas Hefferan, Pres., Grand Rapids; C. A. Gordon, Ch. Engr., Hermitage Bldg., Grand Rapids.

JAMESTOWN TERMINAL.—This company, which was incorporated Nov. 9, expects to build a short line in Jamestown, N. Y., from the terminus of the Jamestown & Lake Erie Ry., for freight purposes, with possible extensions later on to Falconer. The incorporators are: Samuel A. Briggs, William J. Maddox, John W. Doubleday, T. H. Smith, O. E. Jones, and others.

KANSAS & SOUTHERN.—This company was organized in Kansas, Dec. 3, with a capital stock of $100,000, to build nine miles of railway in Pottawatomie county. The directors are: Irving H. Wheatcroft, St. Louis, Mo.; C. B. Holmes, New York; A. J. Clark, New Orleans, La.; George C. Moore, Montreal, Que.; J. L. Rodgers, J. K. Codding and T. R. Cave, Westmoreland.

NEW YORK & PENNSYLVANIA.—Theodore Cobb, Contractor, Spring Mills, N. Y., informs us that he has about completed the construction of the extension to this line through Oswayo, Hebron and Clara townships, Potter county, Pa., six milus. William Cobb, Pres., Spring Mills; H. J. Rumsey, Ch. Engr., Oswayo, Pa.

NORTHERN PACIFIC.—Wren & Greenough, Spokane, Wash., are said to have been awarded the contract for the construction of a spur up Lapwai Creek, from Spaulding, Idaho. Right of way through the Caldwell grant has been secured.——Three and a half miles of the branch line being built from near Carbonado to the new Fairfax mines, in Pierce county, Wash., are finished, and it is expected to have the remainder of the line ready for use March 4. The extension will be about seven miles long and will be laid with 56-lb. rails. Three or four hundred men are working on the construction. E. H. McHenry, Ch. Engr., St. Paul, Minn.

OHIO.—The Eastern Ohio & West Virginia Mining has taken an option on 200,000 acres of land in the vicinity of the Ohio Valley, according to reports, on which extensive coal operations will soon be begun. The opening up of the district will require many miles of railway and sidings. O. E. Psarts, Ch. Engr., Canton, O.——Reports state that the Federal Steel Co. is considering the advisability of building a railway from its Lorain plant to Cleveland, O., about 25 miles.

PORTO RICO.—We are informed that J. G. White & Co., Engineers and Contractors, 29 Broadway, New York, have bought the eight existing miles of narrow-gage steam tram railway, now in operation in and near San Juan, Porto Rico. No immediate changes, either in the gage or the motive power, are projected.

RIO GRANDE. SIERRA NEVADA & PACIFIC.—J. Fewson Smith, Ch. Engr., P. O. Box 431 Salt Lake City, Utah, informs us that the current reports regarding the extension of this railway from Casa Grande, Mexico, to the Yaqui Gold country, 80 miles, are entirely premature, as no decision has yet been reached by the company.

SCRANTON, HONESDALE & EASTERN.—Press reports state that this company will soon be incorporated in Pennsylvania and New York, with a capital stock of $9,000,000, to construct a railway from Carbondale to the Hudson River, along the Delaware & Hudson Canal, via Honesdale, Pa., and Port Jervis and Rondout, N. Y., 138 miles. It is designed to provide an outlet from the Lackawanna coal fields to tidewater. It is also stated that the London Railway Construction Co., Ltd., has awarded to a Chicago firm the contract for constructing a tunnel through the Moosic Mountains, 8,642 ft. in length, 14 ft. high, and 14 ft. wide, to be completed by Jan. 1, 1900, at a cost of $421,730, or $65 a lin. ft.

SHAWNEE, GUTHRIE, & NORTHWESTERN.—This company was incorporated in Oklahoma, Nov. 29, with a capital stock of $50,000, to construct a railway from Shawnee to Guthrie and west, via Enid or Kingfisher, Okla. The officers are: Pres., Henry Hudson; Vice-Pres., H. L. Miller; Secy., A. H. Humphrey; Treas., J. W. McNeal; directors, Henry Hudson, of Chicago; H. L. Miller, Guthrie, Okla.; W. S. Search, Shawnee, Okla., and others.

SUMMITVILLE, BLUE MOUNTAIN, WALLA WALLA.—Reports from Walla Walla, Wash., state that surveys are being made for this proposed line between Walla Walla and Union, Ore., a distance of about 80 miles. P. J. Taylor, Pres.; L. B. Rhinehart, Supt. of Construction.

TENNESSEE CENTRAL.—Naugle, Holcomb & Co., 355 Dearborn St., Chicago, Ill., are reported to have been awarded the general contract for building this entire line, work to be done by the Cumberland Const'n Co.; N. C. Chapman, Pres., St. Louis, Mo. The contract includes grading, tracklaying, bridges and materials, except rails, and fastenings and equipment. The 60-mile section of the road between Monterey and Harriman, Tenn., will be completed first. Grading was completed on 45 miles several years ago under Jere. Baxter, Pres., Nashville, Tenn. G. T. Bigelow, Ch. Engr., Rockwood, Tenn.

STREET AND ELECTRIC RAILWAYS.

BRIDGEWATER, MASS.—The Brockton, Bridgewater & Taunton St. Ry. Co. has filed a petition with the selectmen of Bridgewater, asking permission to lay a branch track from the main line to the power station. G. H. Campbell, Pres., Brockton, Mass.

LAKEVILLE, MASS.—A public hearing will be given in this town, Dec. 17, on the application of the Taunton & Middleboro St. Ry. Co. for a location in Lakeville. Nathaniel G. Staples, First Selectman.

EAST GREENWICH, R. I.—The Providence & East Greenwich Electric Traction Association has been organized in Providence, R. I., to promote the extension of electric railway service between Providence and this village; the extension of the Union R. R. Co.'s tracks is especially desired. Louis K. Potter, Pres., Cowsett, R. I.; L. D. Pierce, Secy., Norwood, R. I.

CROMWELL, CONN.—It is reported that F. W. Siebert, Edward W. Shedd and C. Siebert will apply to the incoming legislature for a charter to build an electric railway in Cromwell.

MERIDEN, CONN.—The Meriden, Southington & Compounce Tramway Co. contemplates increasing its capital stock to $500,000, and the extension of its tracks from Milldale to Mt. Carmel, to Waterbury, to Meriden and to Berlin, by an independent route, and to Plainville from its present Southington terminus, from Dunham's on Queen St. to Compounce Lake; and to build a cable line to West Peak. Francis Atwater, Pres., Meriden.

MOUNT VERNON, N. Y.—The council, Dec. 6, granted a franchise to the New York, Westchester & Connecticut Traction Co. to build extensions connecting its lines through Mount Vernon with Pelham, White Plains and Harlem. Frederick C. Cocheu, 189 Montague St., Brooklyn, N. Y., is said to be interested.

ROME, N. Y.—A hearing will be given in this city, Jan. 16, on the application of the Rome City St. Ry. Co. and the Utica Suburban St. Ry. Co. for a franchise to build through this city. John W. Boyle, Pres., of Utica Co., Utica; J. S. Wardwell, Pres. of Rome Co., Rome.

SARATOGA, N. Y.—The Saratoga Traction Co., which runs from Saratoga to Saratoga Lake and the Geysers, will, it is stated, continue the trolley system from the Geysers to Ballston Spa, a distance of five miles. R. E. Dunston, Mgr.

BOUND BROOK, N. J.—The council has passed an ordinance granting a franchise to the Philadelphia Traction Co. to build an extension on East Main St. to connect the New Brunswick line with that running to Somerville and to Plainfield.

CLIFFSIDE, N. J.—Reports state that the Bergen County Traction Co., office address, foot West 130th St., New York, has decided to build a spur line from Fort Lee Ferry at Undercliff to Hudson county, via Cliffside, connecting with the North Hudson County Ry.

LODI, N. J.—Colin R. Wise, Ch. Engr., Passaic, N. J., informs us that surveys have all been made and franchises obtained for the proposed 2½ miles of electric railway to be built for the Saddle River Traction Co. from Passaic to Lodi. Rails, ties and poles are all purchased; power will be obtained from the Passaic Lighting Co. as stated in our issue of Dec. 1. the contract for the work has been let to Sanford & Stillman, 26 Exchange Place, Jersey City, N. J.

HARRISBURG, PA.—The extension of the lines of the Harrisburg Traction Co. from Progress to Linglestown and Cahoe's Springs is under contemplation.

PERKASIE, PA.—The council has granted a franchise to the Quakertown Traction Co. to build in this borough. C. Taylor Leland, Pres., Quakertown, Pa.——Messrs. Trelly and Pascoe, of the Inland Traction Co., also have franchises to build from Perkasie to Lansdowne.

PHILADELPHIA, PA.—The council has been petitioned to permit the Union Traction Co. to extend its tracks on 4th St., from Snyder Ave. to Ritner St., and to erect string wires on Island Road and Eastwick Ave.; also to permit the Delaware & Schuykill Electric Ry. Co. to lay tracks in the 28th and 32d Wards.

POTTSTOWN, PA.—The Montgomery & Chester Electric Ry. Co. was incorporated, Dec. 9, with a capital stock of $300,000, to construct and operate an electric street railway between Pottstown, Montgomery county, and Phoenixville, Chester county, Pa., a distance of 17 miles. The incorporators are: Daniel S. Mann, Pres., 49 North 13th St.; Wm. H. Grebe and Claude S. Jarvis, all of Philadelphia, Pa.; Geo. F. P. Wanger, Pottstown; J. G. MacPherson, Washington, D. C.

STONEYCREEK MILLS, PA.—Reports from Oley, Pa., state that Davis Bros., engineers for the Reading Traction Co., Reading, will soon begin surveys for an electric railway to connect Stonycreek Mills and Friendensburg.

BALTIMORE, MD.—Press reports state that the Baltimore & Northern Electric Ry. Co., H. A. Parr, Pres., has secured control of the Baltimore City Passenger Ry., including 26 miles of line.

CUMBERLAND, MD.—Isaac A. Walker & Son, engineers and contractors, 1218 Stephen Girard Bldg., Philadelphia, Pa., inform us that they have bought the franchises and charters of the Cumberland & Frostburg, the Frostburg & Lonaconing and the Lonaconing & Westernport R. R. Co.s, formerly controlled by J. W. Burchinal, Moundsville, W. Va., and others. The route is from Elkhart, Md., through Frostburg, Midland, Lonaconing, Westernport and ten other towns, 27 miles. Surveys are now being made, and construction is expected to be started by March 1. T. D. Howell, Ch. Engr., Philadelphia.

WASHINGTON, D. C.—Theodore J. King, Ch. Engr., 1509 Florida Ave., N. E., informs us that the grading for a new section of the Columbia Ry. along Benning Road, will be done by John Jacoby. The new power house and motor equipment will be furnished by the General Electric Co.; the engine by the E. P. Allis Co., and the boiler by Campbell & Zell Co. Nathaniel Wilson, Pres.——The following street railway bills have been introduced in Congress: To extend the Metropolitan R. R. by underground electric up Brightwood Ave. to Rock Creek Church Road; also up 11th St., extended through Columbia Heights and westward through Mount Pleasant; to extend the same line from its present terminus at Columbia Road and 18th St., through Lamier Heights and Mount Pleasant, and to extend the line from Lincoln Square down 11th St. east to connect with the Anacostia line.

PETERSBURG, VA.—The Virgina Traction Co. has been organized in this city, according to reports, with the following officers: T. O. Troy, Pres., Charlottesville, Va.; Augustus Wright, Vice-Pres., Petersburg; R. J. Spartley, Treas., Petersburg; and others.

BIRMINGHAM, ALA.—The Bloomfield & Orchard Lake Ry. Co. has been incorporated with a capital stock of $25,000, to construct a street railway to Orchard Lake, by Almeron Whitehead, of Birmingham, and others. The franchise was granted Nov. 26, as stated in our last issue.

GADSDEN, ALA.—The address of the Gadsden & Attala Union Ry. Co. which has made arrangements to operate its line by electricity is as above, and not Gadsden, Tenn., as stated in our last issue.

TOLEDO, O.—The Toledo, Maumee & Perrysburg Electric R. R. Co. is said to contemplate the construction of a $40,000 power house at Miami. Extensions in the spring to Waterville and Woodville are also projected. J. K. Tillotson, Pres. and Mgr.

WARREN, O.—It is reported that the Cleveland & Chagrin Falls Electric R. R. Co. has issued $300,000 in bonds, and that an extension to Warren will be built at once. V. A. Taylor, Pres., American Trust Bldg.

RICHMOND, IND.—Wm. A. Pickens, Indianapolis, Ind., through A. C. Lindemuth, of this city, has applied to the council for a franchise to build a railway through this city, using either steam, electric or other motive power.

HOWARD, ILL.—It is reported that H. N. Bates, Gen. Mgr. of the Continental Construction Co., Boston, Mass., has offered to build and equip the projected electric railway from Howard to the head of Geneva Lake.

OREGON, ILL.—Fred G. Jones, Vice-Pres., Rock River Electric R. R. Co., informs us that contracts will be let before Dec. 20 for the construction of this proposed electric railway from Oregon to Rockford, via Byron, Ill., 30 miles. Surveys have been made and most of the right of way secured. E. M. Hopkins, Chicago, Ill.; J. B. Bertolet, Ch. Engr., Leaf River, Ill.

MILWAUKEE, WIS.—George H. Sager, of Chicago, has applied to the council for a franchise to build a competitive street railway system in this city.

KANSAS CITY, MO.—Bids are asked by the North East Electric Ry. Co., according to reports, for the rebuilding of its road, including a new steel bridge at Agnes Ave.; estimated cost, about $200,000; W. M. Reid, Pres.

FORT SMITH, ARK.—Reports state that the Midland Land Co., recently organized in this city, contemplates the building of an electric line to Van Buren.

PINE BLUFF, ARK.—The Pine Bluff Electric Light & St. Ry. Co. was incorporated in Arkansas, Dec. 6, with a capital stock of $300,000, with $175,000 subscribed, to build an electric street railway in this city. Jeff. Hicks, Pres.; Thos. L. Chadbourne, Jr., Vice-Pres.; H. H. Hunn, Secy. and Treas.; all of Pine Bluff.

WARDNER, IDAHO.—The Wardner & Kellogg Electric Ry. Co. has been incorporated with a capital stock of $500,000, to construct a line between Kellogg and Wardner. The incorporators are: Bartlett Pressey, Kellogg, Idaho; Wm. W. Woods, Wallace, Idaho, and others.

PARIS, FRANCE.—Press reports state that the General Electric Co., Schenectady, N. Y., has received a large order for the equipment of a terminal section of the Chemin de Fer d'Orleans, a suburban railway to Paris.

ELECTRIC LIGHT AND POWER.

CAMPTON VILLAGE, N. H.—It is stated that this place has decided to put in electric lights.

BOSTON, MASS.—Bids are asked until Dec. 23 for extending the wiring system and power plant at the Boston navy yard. M. T. Endicott, Ch. Bureau Yards & Docks, Washington, D. C.

FAIRFIELD, CONN.—F. W. Siebert, Edward W. Shedd and C. Siebert, it is reported, will ask the legislature, soon to be in session, for a charter to furnish light and water to Southport and Fairfield. Chas. Sherwood, Pres. Bridgeport Hydraulic Co., Bridgeport, Conn., may be able to give information.

CAMILLUS, N. Y.—The Globe Milling Co., it is stated, proposes to put in electric lights at its mill. The plant may be used for street and commercial lighting.

LOCKPORT, N. Y.—Local papers state that the manufacturers at this place propose to build a dam for furnishing sufficient water power during the winter. Chas. T. Raymond, Mgr., and Jos. Eilers, Supt. Lockport Pulp Mill, may be addressed.

NORTH TONAWANDA, N. Y.—The aldermen have granted a franchise to the Niagara Falls Power Co. The city will, after three years, receive from the power company 2½% of the gross receipts.

ONONDAGA VALLEY, N. Y.—E. J. Clark writes us that no plant will be put in at present.

GIBBSTOWN, N. J.—The Repauno Chemical Co., Repauno, N. J., and 97 Cedar St., New York, has let the contract to the Tucker Electrical Construction Co., 14 Whitehall St., New York, for the entire lighting and power plant for the Repauno works. General Electric machinery will be used. The plant will have about 100 HP.

PATERSON, N. J.—Bids are asked until Dec. 27 for a system of iron armored conduits or cold-drawn steel tubing with interior non-corrosive lining, or tubing equal thereto, wiring and distribution tablets, in the U. S. post office. O. L. Spaulding, Acting Secy. Treasury Dept., Washington, D. C.

BELLEVUE, PA.—The Pennsylvania Light, Heat & Power Co. has asked for a franchise to operate a plant. The plant will be built on the Ohio River front.

ELLWOOD, PA.—It is stated that an election will be held Dec. 20 to vote on the question of issuing $8,000 in bonds for a plant.

PHILADELPHIA, PA.—Bids will soon be asked by the park commission for furnishing electric lights in the parks. The contractor will be required to lay 2,000 ft. of conduit in each park.

HAGERSTOWN, MD.—E. M. Schindel, Mayor, has signed the ordinance authorizing the establishment of a municipal plant, at a cost of $60,000. The city at present is lighted by the Hagerstown Ry. Co., the contract for which will expire in two years.——The Western Maryland R. R. Co., it is stated, has decided to build a plant for its yard in this city. J. M. Hood, Pres. and Gen. Mgr., Baltimore.

WASHINGTON, D. C.—Bids are asked until Dec. 27 for manufacturing and placing in the post office building combined gas and electric light fixtures. O. L. Spaulding, Acting Secy. Treasury Dept.

SMITHFIELD, VA.—J. W. Holloway writes us that the contracts for the proposed plant have been made.

ASHEVILLE, N. C.—M. W. Robertson, Cy. Clk., writes us that bids for electric lighting were not coming in to the satisfaction of the board; it was therefore decided on Dec. 2 to renew the contract with the Asheville Electric Co. for one year, at $85 a light. In the meantime, the city is open for a long term contract or for the purchase of a plant.

ORANGEBURG, S. C.—It is stated that bids are wanted until about Dec. 19 for furnishing the materials and for building a plant, water-works and a sewerage system; estimated cost, $55,000. Frederick Minshall, Engr., 150 Nassau St., New York, and Pocomoke City, Md.

YORKVILLE, S. C.—T. B. McClain, it is stated, proposes to build a plant for his cotton mill. The plant will probably have capacity to furnish light for the town.

NEW ORLEANS, LA.—The Western Electric Co., 227 South Clinton St., Chicago, has been awarded the contract for building the plant at Gravier and Clark Sts. for the Merchants' Electric Light & Power Co., to cost about $300,000. The plant will be operated under the franchise granted to Cohn & Ber. M. Ber, Pres.; C. A. Gaines, Ch. Engr.

NEW HAVEN, KY.—The "Echo" is urging the construction of a power plant at this place. Some years ago the late Col. John C. Broadhead made a survey for a water power plant to furnish 900 HP.

CLEVELAND, O.—Bids are asked until Dec. 21 for furnishing 878 arc lights for one year. Geo. R. Warden, Dir. Pub. Wks.

INDIANAPOLIS, IND.—Local papers state that the Chenoweth Light & Power Co. has filed with the board of public works an application for a franchise. A plan of overhead wires outside of the mile square was also filed. The company will cater only for that part of the city outlying the territory bounded by North, West, South and East Sts. Daniel A. Chenoweth, Pres., writes us that the plant will be operated by gas. Estimated cost, $25,000.

ALLEGAN, MICH.—The council has refused to award a 10-year contract to the Kalamazoo Valley Electric Co.

CHARLOTTE, MICH.—Press reports state that another election will soon be held to vote on the question of building a municipal plant.

FLAT ROCK, MICH.—Geo. Williams, Editor, writes us that a local merchant offered to put in a plant if he could get 300 lights subscribed for at 43 cts. a light a month. He could get but 150 lights engaged, and has decided not to put in the plant.

SAULT STE. MARIE, MICH.—Local papers state that the Chandler-Dunbar Water Power Co. will build a power plant at St. Mary's Falls, to develop about 30,000 HP. Plans are said to have been prepared and arrangements are soon to be made for the machinery. Estimated cost, $1,500,000. Wm. Chandler, Pres., Sault Ste. Marie.

ROCKFORD, ILL.—The Rockford Ry., Light & Power Co. has certified to an increase in the capital stock from $250,000 to $350,000.

MARSHALLTOWN, IA.—A committee is reported to have been appointed to consider the question of putting in a city plant. Population, 10,000. F. G. Pierce, Mayor.

OLIVIA, MINN.—F. McCormick, of Duluth, Minn., is reported to have made arrangements for a plant for this place.

HASTINGS, NEB.—It is stated that Denver parties have offered to purchase the plant of the Hastings Electric Co. If it is purchased a number of improvements to it will be made.

TOPEKA, KAN.—Bids are asked by the city clerk for a new engine for the electric plant, to cost $7,000.

MAYSVILLE, MO.—The question of having a municipal plant or of letting the contract for electric lighting is being considered.

ST. LOUIS, MO.—We are informed as follows in regard to the proposed municipal plant for this city: No plans have been secured, no money appropriated and no contracts awarded for the plant. The committee of the board of public improvements on electric lighting, consisting of M. L. Holman, Water Comr.; Robt. E. McMath, Pres., and B. H. Colby, Sewer Comr., has, within the past two years, drawn and sent to the municipal assembly 14 electric light ordinances, covering the field completely and providing for electric lighting and gas lighting, but every ordinance has been killed or filed, with the exception of the first one, which passed, and under which the board advertised for bids but received none. The committee has now drawn another ordinance for electric lighting, by contract, for a term of 10 years, and will present the same to the board of public improvements for approval about Dec. 13, and after approval it will go to the assembly for action the same day. The assembly can reject or pass ordinances sent from the board, but does not have the power to amend. The project for municipal ownership has, for the present, been abandoned, owing to financial reasons.

PALOUSE, WASH.—Codd & Mackenzie, owners of the plant at Colfax, Wash., have offered to erect a plant in this place, at a cost of about $10,000.

FULLERTON, CAL.—It is stated that sites for a plant are being considered.

WOODSTOCK, ONT.—Press reports state that the question of the city purchasing the plant of the Woodstock Electric Light, Power & St. R. R. Co. is being considered.

NEW COMPANIES.—Delaware County Electric Light & Power Co., Clifton Heights, Pa.; $5,000; Chas. M. Wagner, Lansdowne, Pa.; Richard L. Austin, Philadelphia; Jas. S. Austin, Yeador, Pa.

New York Gas and Electric Light, Heat & Power Co., Cable Bldg., New York; Wm. C. Whitney, Roswell P. Flower, New York; Thos. Dolan, Philadelphia.

BRIDGES.

BOSTON, MASS.—A hearing was given Dec. 8 by the street commissioners on the question of extending Atlantic Ave. to Dorchester Ave., South Boston, by a bridge over the tracks of the Terminal Co. and over Fort Point Channel. Nothing definite has been decided. It is proposed to give at least two other hearings. J. H. Benton, Jr., Counsel, Terminal Co.

MOUNT VERNON, N. Y.—The plans and specifications prepared by the New York, New Haven & Hartford R. R. Co. for a new bridge at Third Ave., have been approved by the board of aldermen. The contract is soon to be awarded.

RENSSELAER, N. Y.—Bids are asked until Dec. 20 for extending Washington St. and constructing an iron bridge over Mill Creek. The bids received Dec. 6 were rejected. C. A. Ryan, Cy. Clk.

WATERTOWN, N. Y.—The board of public works is considering the question of replacing the old bridge at Court St. The city engineer will correspond with several bridge companies, and an expert will probably be secured to examine the old structure.

PHILADELPHIA, PA.—A bill has been introduced by Councilman Large, appropriating $75,000 for the construction of a bridge over the Pennsylvania R. R. at 42d St.

WASHINGTON, D. C.—The committee on interstate and foreign commerce is considering the question of constructing a memorial bridge across the Potomac River to connect West Washington with the government reservation at Arlington, Va.; estimated cost, about $1,250,000.

SELMA, ALA.—Bids are asked by the county clerk until Dec. 21 for the purchase of $65,000 of 6% bridge bonds.

SCRANTON, MISS.—The county supervisors awarded a contract Dec. 6 to the Geo. E. King Bridge Co., Des Moines, Ia., for a steel bridge across Cedar Creek.

CANTON, O.—The construction of a viaduct from near Newton St. to Hazlett Ave. is being talked of. The question will probably be submitted to the council in a few weeks. Thos. J. Bidwell, Township Trustee.

ZANESVILLE, O.—The contract for the erection of the iron approach to the Monroe St. bridge was awarded by the county commissioners Dec. 7, to the King Bridge Co., Cleveland, at $13,600.

DETROIT, MICH.—Reports state that the Detroit & Lima Northern Ry. bridge over the Huron River, near Flat Rock, has fallen. C. H. Roser, Ch. Engr., Detroit.

SAGINAW, MICH.—The street railway company has decided to erect an iron bridge across the river at Bristol St. to replace the wooden structure, according to reports.

ARCADIA, WIS.—Reports state that at a special election this place voted to construct a bridge across the Trempealeau River.

MILWAUKEE, WIS.—G. H. Benzenberg, Cy.Engr., submitted plans Dec. 5 to the council for the construction of a viaduct over Kinnickinnie Ave., between Maple and Beacher Sts. The structure to be a double-deck rolling bascule 1,720 ft. long and about 60 ft. wide, estimated cost, $184,000.

DULUTH, MINN.—R. Murchison, Clk. Bd. Pub. Wks., informs us that the steel bridge across Fischer's Creek, which was destroyed Nov. 29, is being replaced by a temporary wooden structure under the direction of Thos. F. McGilvray, Cy. Engr.

MINNEAPOLIS, MINN.—The following bids were received Dec. 9 for the steel and iron work for widening the stone arch bridge over the East Channel of the Mississippi River. Material to be furnished f. o. b. cars:

Toledo Bridge Co., Toledo, O	$10,990
Chicago Bridge & Iron Co., Chicago, Ill	10,996
Hoff Bros., Minneapolis, Minn	11,787
Penn Bridge Co., Beaver Falls, Pa	11,240
American Bridge Works, Chicago, Ill	14,540
Wrought Iron Bridge Co., Canton, O	12,093
King Bridge Co., Cleveland, O	12,200
Edgemoor Bridge Works, Wilmington, Del	11,840
Milwaukee Bridge & Iron Works, Milwaukee, Wis.	12,799
Wisconsin Bridge & Iron Co., N. Milwaukee, Wis.	12,259
Youngstown Bridge Co., Youngstown, O	11,969
Pittsburg Bridge Co., Pittsburg, Pa	11,986
Gillette-Herzog Mfg. Co., Minneapolis, Minn	11,649

ST. PAUL, MINN.—It is reported that about 150 ft. of the St. Paul & Duluth R. R. bridge at 6th St., fell Dec. 7. C. J. A. Morris, Ch. Engr., St. Paul.

BLAIR, NEB.—Bids are asked until Dec. 20 for the construction of steel bridges for the year 1899, according to reports. Watt Gauldrie, County Clk.

GRAND ISLAND, NEB.—Arnold C. Koening, County Surveyor, writes us under date of Dec. 5 in regard to a proposed bridge over the Platte River, five miles south of this place, to be constructed by Hall county. The Platte River is divided into four channels at this point aggregating 2,100 ft. across. A plain wooden bridge, perhaps trussed stringers 40-ft. span, resting on piles, is contemplated, but nothing definite will be done for 30 or 60 days. The new county board upon organizing in January, will probably order the surveyor to prepare plans and specifications and then advertise for bids.

NELSON, NEB.—Bids are asked until Jan. 3 for repairing two 84-ft. combination bridges, according to reports. N. A. Clark, County Clk.

PLATTSMOUTH, NEB.—Bids are asked until Dec. 31 for constructing wooden and iron bridges for the year 1899, according to reports. James Robertson, County Clk.

LEAVENWORTH, KAN.—The county commissioners have awarded a contract to the Missouri Valley Bridge Co., at $1,150 for three iron bridges.

SMITHVILLE, TEX.—The county commissioners, Bastrop, Tex., awarded a contract Dec. 2 to the Indiana Bridge Co., Muncie, Ind., at $23,500, for the construction of a bridge over the Colorado River.

ASPEN, COLO.—Bids are asked until Jan. 2 for the construction of a bridge across the Roaring Fork River near Basalt. Geo. W. Nyce, County Surveyor; R. C. Parr, Clk.

TACOMA, WASH.—It is proposed to have the city engineer prepare plans of the location, etc., for a bridge over the Puyallup River on the extension of 11th St., and if the council passes a resolution, the question will be submitted to the war department for approval, according to reports. Senator John L. Wilson is interested.

OGDEN, UTAH.—Bids are asked until Dec. 28 for furnishing plans and constructing a steel truss bridge 140 ft. long and 18 ft. wide, across Weber River. Newton Farr, Clk. County Comrs.

KAMLOOPS, B. C.—M. P. Gordon, Mayor, writes us that the proposed bridge over Thompson River at the ferry, is government work and will cost about $40,000. Bids have not been asked. F. C. Gamble, Engr., Dept. Pub. Wks., Victoria, B. C.

BUILDINGS.

BROOKLYN, N. Y.—Bids are asked by the department of public buildings, 346 Broadway, New York, until Dec. 22, for certain repairs and alterations to the Municipal Building of the Borough of Brooklyn, city of New York. ——Bids are asked until Dec. 23 for erecting a storehouse for ordnance materials at the Navy Yard, in Brooklyn. Address Mordecai T. Endicott, Ch. of Bureau of Yards and Docks, Washington, D. C.——Bids are asked by the police department, at 300 Mulberry St., New York, until Dec. 23, for completing alterations, general repairs and improvements to the station house building of the 46th Precinct, 6th Ave. and Bergen St., Borough of Brooklyn, city of New York; bond, $5,000; time, 60 days.

BUFFALO, N. Y.—Bids are asked until Dec. 21 for the erection of a 12-room brick addition to School No. 9, on Bailey Ave., near Doat St. Address R. G. Parsons, Secy. Bd. of Pub. Wks.

LONG ISLAND CITY (L. I.), N. Y.—Bids are asked by the police department, at 300 Mulberry St., New York, until Dec. 23, for completing alterations, general repairs and improvements to the heating system at the 74th Precinct station house, at 162 Grand Ave., Astoria, in the Borough of Queens, city of New York; bond, $5,000; time, 30 days.

LOWVILLE, N. Y.—The erection of a town hall, to cost about $20,000, is being projected by H. A. Phillips, Fred. C. Schraub and others of this place.

NEW YORK, N. Y.—Bids are asked by the board of education, at 585 Broadway, until Dec. 19, for improving the sanitary condition of Public School 37, Borough of Manhattan, and for improving the sanitary condition of Public School 18, Borough of Richmond.——Bids are asked by the department of public buildings, 346 Broadway, until Dec. 20, for furnishing all labor, materials, etc., for erecting complete a steam heating apparatus in the Zbrowski Mansion, Claremont Park, Borough of the Bronx.——Bids are asked by the department of public charities, foot of East 26th St., until Dec. 21, for altering the old Morgue into a stable and carriage house, altering the present stable for the drug department and clothing storage, and for new plumbing in doctors' bathroom in main hospital building, Bellevue Hospital grounds, 26th St. to 28th St. and 1st Ave.; two sureties, $7,000 each.——Bids are asked by the police department, 300 Mulberry St., until Dec. 23, for furnishing materials and completing alterations, general repairs and improvements to the station house and stable buildings of the 41st Precinct, at Bronx Park; bond, $5,000; time, 60 days.——Plans have been prepared, according to reports, for a 2-story brick and iron winter garden to be erected on Broadway, near Central Park, to cost about $175,000. Werner & Windolph, 92 Liberty St.——Robert Maynicke, 725 Broadway, is said to be preparing plans for a 12-story business building to be erected at 632 and 634 Broadway for Henry Corn, 170 5th Ave.——Plans have been filed by John Acker, 119 West 114th St., for four 5-story brick flat buildings on 113th St., near 8th Ave., to cost $120,000. Chas Stegmayer, Arch., 306 East 82d St.; by Maurice Polk, 103 West 114th St., for three 6-story brick and stone flat buildings at St. Nicholas Ave. and 153d St., to cost $325,000. Janes & Leo, Archs., 967 Boulevard; by Michael Tully, for a 6-story brick and stone flat building on 80th St., near West End Ave., to cost $95,000. Janes & Leo, Archs.; by Wm. H. Picken, 61 West 113th St., for a 7-story brick flat and store building on West End Ave., near 106th St., to cost $110,000. Henry Anderson, Arch., 1180 Broadway; by Peter Talbot, 826 St. Nicholas Ave., for a 7-story brick flat building on Riverside Drive, near 95th St., to cost $140,000. John Woolley, Arch., 111 5th Ave.; by J. & G. J. Fleischmann, 7 West 112th St., for eight 5-story brick flat buildings at Madison Ave. and 119th and 120th Sts., to cost $180,000. G. F. Pelham, Arch., 503 5th Ave.; by the General Theological Seminary, 9th Ave. and 20th St., for a 2-story brick gymnasium and a 5-story apartment house at 10th Ave. and 21st St., to cost $100,000. Chas. C. Haight, Arch., 111 Broadway.

UTICA, N. Y.—Crouse & Brandegee, Clothiers, expect to erect a 4-story addition, 40 × 100 ft., to its present building at Main and 1st Sts. Pius Kerner has masonry contract and Williams & Thomas, the carpentry contract. F. H. Gouge, Arch.

WHITEHALL, N. Y.—Bids are asked until Dec. 23 for erecting and finishing, warming and ventilating, plumbing and drainage, and the electric wiring for a state armory building at Whitehall, Washington county. I. G. Perry, State Arch.; Chas. W. Tillinghast, Adj.-Gen., both of Albany, N. Y.

TOMS RIVER, N. J.—Bids are asked by the U. S. Life Saving Service, Treasury Dept., Washington, D. C., until Dec. 21 for the construction of a life saving station on Berkeley Beach, near the present Toms River life saving station, N. J. The superintendent of construction, 24 State St., New York, can furnish plans, etc.

BRADDOCK, PA.—It is reported that J. L. Litvitz, of Braddock, and others, will erect a 5-story store building at Braddock Ave. and 7th St., to cost $50,000.

PHILADELPHIA, PA.—Bids are being received by Allen B. Rorke, according to reports, for erecting a 7-story office building at 1302 Filbert St. M. Bunting, Arch., 1215 Filbert St.——Harmonie Hall, 11th Ave. and Brandywine St., was destroyed by fire Dec. 9; reported loss, $50,000.——A permit has been granted for the erection of a 7-story apartment house on 37th St., near Chestnut St., for C. H. S. Littleton, to cost about $65,000. Harry Peale, Jr., Arch., Harrison Bldg.; Frank S. Riggs, Contractor.——Joseph Bird has been awarded the contract for making extensive alterations to the building at 715 and 717 Market St., for Lit Bros. Collins & Autenrieth, Archs.——Charles McCaul has been awarded the contract for erecting the new Elkins station on the North Penn branch of the Philadelphia & Reading Ry., to cost about $25,000. Cope & Stewardson, Archs., 314 Walnut St.

WILKESBARRE, PA.—We are informed that competitive plans will soon be asked for a new court house for Luzerne county, to cost not more than $500,000.

WASHINGTON, D. C.—Mrs. Scott Townsend is said to contemplate the erection of a costly residence at Massachusetts and Florida Aves.——The Capital Construction Co. intends to enlarge the Portner House, so as to cover the entire square. It will have a frontage of 320 ft., be 6 and 7 stories high, and of fireproof construction; reported cost, $150,000. C. A. Didden, Arch.——Secretary of War Alger, in his annual report, recommends the erection of a fireproof building for the records of the department.

WILMINGTON, N. C.—The following bids for constructing a torpedo store house at Fort Caswell, N. C., were received by Capt. W. E. Craighill, U. S. Engrs.: Philadelphia Construction Co., Philadelphia, $6,300; Cullam & Weeks, Southport, N. C., $5,130; A. J. Robbins, Southport, N. C., $4.740; Structural Iron Co., Baltimore, Md., $15,000.

ATLANTA, GA.—Reports state that Jack Prince will erect a building to seat 10,000 people and to cost $25,000. ——Bids will soon be asked for the erection of an annex to the court house.

FERNANDINA, FLA.—Reports state that a new city building will soon be erected.

KNOXVILLE, TENN.—Reports state that a 14-story office building, to cost between $750,000 and $1,000,000, will be erected at this place. I. P. Thurman, of Allegheny, Pa., is interested. Chas. S. Bickel, Arch., Pittsburg.

MEMPHIS, TENN.—The following bids have been received by Custodian James Jeffreys for painting and other work on the Custom House: Cole Mfg. Co., $9,324; Balton Co., $9,200; True-Tagg Co., $9,177; Eberhardt, $7,477.

ASHLAND, KY.—Bids are asked until Jan. 3 for all or any portion of the labor and material for the construction of an edifice for the Episcopal Church at this place. J. R. Geiske, Arch., Ceredo, W. Va.

LOUISVILLE, KY.—The county commissioners have appointed a committee to receive bids and plans for an addition to the court house, to cost about $40,000.——The Mutual Life Insurance Co., of Kentucky, contemplates the expenditure of about $100,000 in improving the Bull Block.

BOWLING GREEN, O.—The people of Wood county are considering the erection of a new jail.

CINCINNATI, O.—Bids are asked until Dec. 20 for erecting a station house in the 6th Police District. W. H. Harrison, Clk. of Bd. of Police Comrs.; Hannaford & Sons, Archs.

CLEVELAND, O.—Wm. C. Wood will erect an apartment house, 56 × 81 ft., on Clinton St., to cost about $25,000. Steffens, Searles & Hirsch, Archs.——The Euclid Ave. Congregational Church will erect a new Sunday-school building, to cost between $30,000 and $40,000.

YOUNGSTOWN, O.—Bids are asked until Dec. 16 for the purchase of $54,000 of bonds for the equipping of the Mahoning County Infirmary, plumbing, lighting, etc. C. F. Brenner, County Audr.

FRANKFORT, IND.—A fire here Dec. 5 destroyed the Commercial Block; reported loss estimated at $100,000.

LEBANON, IND.—The commissioners of Boone county are considering the question of erecting a new $150,000 court house.

DETROIT, MICH.—The board of works, it is stated, will recommend that the contract for the G. A. R. memorial building be let to Spitzley Bros., 83 Beacon St., at $39,000.

CHICAGO, ILL.—The board of education will soon receive bids for the 3-story and basement Darwin School building, 90 × 188 ft., to be erected at Edgewood Ave. and Catalpa Place, and to cost $90,000.——The contract for the masonry work of the new post office building has been let by the contractor, John Pierce, of New York, to the E. F. Gobel Co., of this city.——William Deering will erect a 4-story brick apartment house on Lill Ave., to cost $40,000.——Atchison & Blaisdell will erect a 3-story brick store and apartment building on West Congress St., to cost $35,000.——Mrs. Lucy Morton proposes to erect seven 3-story brick residences on Washington Ave., to cost $42,000.——Marshall, Field & Co. will erect an 8-story brick warehouse on West Polk St., to cost $100,000.

APPLETON, WIS.—The council will soon receive plans for the proposed city hall and library building, according to reports.

BALSAM LAKE, WIS.—Bids are asked until Jan. 3 for furnishing the labor and materials required in the erection of the court house, jail and residence. H. P. Burdick, Secy. County Comrs.

KENOSHA, WIS.—The county board has appropriated $5,400 for remodeling and repairing the county jail.

MILWAUKEE, WIS.—Bids are asked by the supervisors of Milwaukee county until Dec. 24 for the remodeling of the south wing of the court house, etc.; bond, $2,500. Aug. F. Zentner, County Clk.

OSHKOSH, WIS.—Bids are asked by the board of public works until Dec. 19 for furnishing and installing a heating plant in the Punhoqua school. Wm. Waters, Arch. Bids are also asked on plans by bidders, and bids including fan system will receive special attention. Bond, $1,000.

WAUPACA, WIS.—The board of trustees of the Wisconsin Veteran's Home at this place will ask for an appropriation of $30,000 for the purpose of enlarging the capacity of the home. It will also act upon the plans for the new hospital to take the place of the one recently burned.

WEST SUPERIOR, WIS.—The contracts, it is stated, for the new theatre building to cost $100,000 will soon be let. Geo. A. Garnsey, Arch., Chicago. Arthur Miller, of Boston, and others, are interested.

LEAVENWORTH, KAN.—Capt. John Seaton, Atchison, Kan., is said to be contemplating the erection of a new opera house in this city.

DULUTH, MINN.—Reports state that new bids will be asked by the Eastern Minnesota R. R. Co. for the construction of a freight warehouse.

MINNEAPOLIS, MINN.—Pike & Cook have the contract for erecting a 9-story office building, 156 × 120 ft., to cost $200,000, for Mr. Andrus. F. B. & L. L. Long, Archs.

OWATONNA, MINN.—Bids are asked until Jan. 4 by the secretary of the board of directors for a brick and stone library building. Smith & Gutterson, Archs., Des Moines, Ia. B. E. Darby, Secy.

LEAVENWORTH, KAN.—The Metropolitan St. Car Co. contemplates the erection of a new street car barn in which will be located the machine shops of the company. Capt. W. D. Bethel may be addressed.

FORT TOTTEN, N. DAK.—Owen & Hille, of Minneapolis, Minn., have been awarded the contract for erecting the school building, at $29,000, and for putting in a water system, at $4,790.

FORT WORTH, TEX.—L. S. Thorne, Gen. Mgr. of the Texas & Pacific R. R., according to reports, states that the company will erect a passenger station to cost about $150,000, in this city.

COLORADO SPRINGS, COLO.—Plans are being prepared by Building Inspector Roby for the proposed addition to the city hall.

COLFAX, WASH.—W. W. Waite, Mgr. Colfax Military Band, contemplates erecting a 2-story opera house building, 50 × 120 ft.

SPOKANE, WASH.—The Spokane Lodge of Elks has decided to incorporate with a capital of $100,000, for the purpose of erecting a 3-story brick building, 100 × 150 ft., at Riverside Ave. and Lincoln St.

OAKLAND, CAL.—Contracts will soon be let for the erection of the buildings for a naval school for which the appropriation of $50,000 was secured by Senator Perkins.

SAN FRANCISCO, CAL.—Reports state that the contract will soon be let for the erection of permanent buildings for hospital at the Presidio, to cost about $80,000. ——The finance committee of the supervisors has decided to appropriate $60,000 for erecting now building and stables for the police department.

SANTA BARBARA, CAL.—This city will soon vote on the question of issuing $50,000 in school bonds.

STOCKTON, CAL.—Reports state that plans for a 3-story hotel to be erected near the Southern Pacific depot have been completed.

WATSONVILLE, CAL.—W. H. Weeks is preparing plans for a convent to be erected here to cost $120,000.

LIVERPOOL, N. S.—Bids are asked until Dec. 23 for constructing a public building. E. F. E. Roy, Secy. Dept. Pub. Wks., Ottawa, Ont.

NEW WESTMINSTER, B. C.—John Coughlin & Son have been awarded the contract for the new Bank of Montreal building. Rattenbury & Tiarks, Archs.

HAVANA, CUBA.—Bids are asked until 12 o'clock, noon, Dec. 15, for the construction of one warehouse on pier now under contract to be built on the east side of Havana Bay, and six warehouses on grounds adjacent; bond, $25,000. Col. Frank J. Hecker, Ch. of Bureau of Transportation, Washington, D. C.

NASSAU, BAHAMA ISLANDS.—James Reilly & Co., New Haven, Conn., have been engaged to do the stone work on the new $2,000,000 hotel at this place.

WATER-WORKS.

BATH, ME.—The question of this city and of Brunswick owning their water-works is being discussed. The legislature will be asked to grant a charter to the cities for this purpose.

ROCKPORT, ME.—This place has voted to accept the contract of the Camden & Rockport Water Co. to supply this place with water. Granville W. Carleton and L. H. Lovejoy are on the committee.

BUFFALO, N. Y.—The commissioners of public works have decided to ask for more money, in addition to the $18,000 appropriated last spring, for the construction of three new chimneys at the water-works pumping station, each to be 225 ft. high.

CLAYTON, N. Y.—This place voted Dec. 6 to issue bonds for works and a sewerage system to cost $50,000. It is said that bids will be asked at once. F. L. Hall, Village Pres.

MOUNT VERNON, N. Y.—Press reports state as follows in regard to the water question: The council has decided to enter into a contract for ten years with the New York Suburban Water Co. Under the new contract the city pays $30 a year for each hydrant, and a hydrant must be rented for every 500 ft. of new pipe laid. This means an aggregate rental to be paid by the city of about $10,100. According to George E. Hoffmaster, Supt., this is about the same as is now being paid. The company also agrees to furnish meters to its 3,400 private consumers and to establish a meter rate of 22½ cts. for 100 cu. ft. The consumer is to pay for the expense of placing the meter in the house.

WATERVLIET, N. Y.—This place voted Dec. 12 to build new works to cost about $234,000. Chas. G. Whitbeck, Cy. Engr.

FRENCHTOWN, N. J.—We are informed that the proposed works for this place and Milford, N. J., to be built by the Spring Mill Water Co., will consist of 7¾ miles of 4 to 10-in. pipe, together with hydrants, etc., a 1,000,000-gallon reservoir, etc. The work will probably be let in the spring. The supply will be by gravity. Howard Mutchler, Pres.; J. W. Fladd, Secy. and Treas.; L. A. Francisco, Engr., all of Easton, Pa.

JERSEY CITY, N. J.—The street and water commissioners have awarded the contract for the new water supply to Patrick H. Flynn, of Brooklyn, N. Y., at $7,595,000. This is for plan No. 1, the supply to be taken from the Rockaway watershed. Up to Dec. 10 the mayor had not approved the contract.

VINELAND, N. J.—Chas. J. Keighley has offered to sell the works of the Vineland Water-Works Co. to the city for $200,000.

DRAVOSBURG, PA.—The American Water-Works & Guarantee Co. has secured permission from the U. S. government to lay water pipes under the Monongahela River from its works in McKeesport to supply this place with water.

ALLEGHENY, PA.—Wm. F. Patterson, Erie, Pa., has been awarded the contract for furnishing a new 250-HP. boiler and a Playford stoker for the Howard St. pumping station, at $5,298.

CANONSBURG, PA.—The council is considering the question of granting a franchise for works to J. P. McNary & Son. Councilmen Chambers and Greer may be addressed.

MILLVALE, PA.—Bids are asked until 6 p. m., Dec. 16, for furnishing and installing a vertical pump of 2,000,000 gallons a day. C. W. Dankmyer, Clk.

OIL CITY, PA.—The following submitted bids Dec. 5 to the water board for furnishing a 3,300,000-gallon vertical cross-compound pumping engine: Barr Pumping Engine Co., Philadelphia; Snow Steam Pump Works, Buffalo, N. Y., and Loretz & Co., New York.

HAWKINS POINT, MD.—Bids are asked by the U. S. Quartermaster, Fort McHenry, Md., until Dec. 24, for furnishing the material and for installing works at Hawkins Point. The works will have an artesian well, a pumping engine and a 10,000-gallon tank on a skeleton tower.

SMITHFIELD, VA.—J. W. Holloway writes us that the proposed works will not be built until the spring.

HIGHPOINT, N. C.—W. G. Bradshaw, Mayor, writes us that nothing definite has yet been done towards establishing works. The legislature, which convenes in January, will be petitioned to grant the city authority to issue bonds for works. Then an election will be held, and if the proposition is carried arrangements for the construction will be begun. Population (1890), 2,179.

SPARTANBURG, S. C.—John H. Montgomery writes us that nothing has yet been done towards securing new works, noted in our issue of Dec. 1.

GATE CITY, ALA.—Nicholas S. Hill, Jr., Ch. Engr. Water Bd., Baltimore, Md.; Canfield & Irwin, St. Louis, Mo., and Thos. P. Grasty, of the "Manufacturers Record," Baltimore, are making tests for a water supply at this place. If the tests are successful it is said that works will be built to supply water to a number of manufacturing plants that it is proposed to erect here, and also to Birmingham, Ala. It is estimated that a flow of 4,000,000 gallons a day can be secured from artesian wells.

PRATT CITY, ALA.—The legislature will be asked to grant this place authority to issue $25,000 in bonds for the proposed works. Dr. George Brown and W. G. Powell, Mayor, may be addressed.

COLUMBUS, O.—The director of public works will again soon advertise for bids for constructing the proposed new storage reservoir in the Scioto River.

LISBON, O.—E. C. Cooke, Society for Savings Bldg., Cleveland, has submitted a report on the proposed improvements to the works. It is proposed to put in a filter plant of 500,000 gallons a day, to cost $12,000.

SHERIDAN, IND.—The council has granted a 30-year franchise for works to the Sheridan Light & Water Co., Fort Wayne. The works will cost about $35,000. Chas. Pape, Sr., and others of Fort Wayne, Ind., are interested. The machinery will be built by the Fleming Mfg. Co., Fort Wayne, of which Mr. Pape is president.

GRAND RAPIDS, MICH.—O. N. Watson, Chn. Com. on Ways and Means, is making efforts to have the board of public works authorized to buy a 20,000,000-gallon pump. It is probable that bids for furnishing the machinery will be asked in a short time.

CHICAGO, ILL.—Bids are asked until 11 a. m., Dec. 16, for furnishing brass castings, hydrants, and stop valves, etc. L. E. McGann, Comr. Pub. Wks.

MONMOUTH, ILL.—The council, it is reported, will soon order plans prepared for the proposed improvements to the works. D. W. Mead, Rockford, Ill., will probably prepare the plans. I. Trumbull, Chn. Com.

ALLISON, IA.—W. F. Roy, Mayor, writes us that an election will probably be held in January to vote on the question of building works. Population, 500.

OTTUMWA, IA.—John A. Cole, Old Colony Bldg., Chicago, is preparing plans for certain improvements to the works of the City Water Co., according to reports. E. F. Starkweather, Mgr.

BERMIDJI, MINN.—This place voted Dec. 6 to issue $7,000 in bonds for works.

CANBY, MINN.—M. B. Haynes, 201 South Front St., Mankato, Minn., is preparing plans for works for this place. The contract for the work will soon be let.

MINNEAPOLIS, MINN.—We are informed that the council on Dec. 9 rejected the bids received Aug. 26 for furnishing one or two 10,000,000-gallon vertical triple expansion pumping engines for the north side pumping station. The bids were given in our issue of Sept. 1. F. W. Cappelen, Cy. Engr.

PELICAN RAPIDS, MINN.—This place voted Dec. 7 to issue $14,000 in bonds for works and an electric light plant, according to reports.

WHEATON, MINN.—The question of securing works is again being considered, according to reports. M. B. Haynes, Engr., 201 South Front St., Mankato, Minn.

CORSICANA, TEX.—The Corsicana Water Co. has secured a lease for 20 years of 3,000 acres of land about four miles from here for an increased water supply. W. N. Coler, Jr., may be addressed.

DARLINGTON, OKLA.—Bids are asked until Jan. 5 for furnishing the materials and for constructing works for the Arapahoe Boarding School at the Cheyenne and Arapahoe Indian Agency, Darlington. Address W. A. Jones, Indian Comr., Washington, D. C., or Maj. A. E. Woodson, Acting Indian Agent, Cheyenne Agency, Darlington.

COLORADO SPRINGS, COLO.—It is stated that General Palmer, of this city, has filed plans for works for Glen Ayrie.

FLORENCE, COLO.—We are informed that the following bids were received Nov. 28 for furnishing the materials and for constructing the works, as advertised in Engineering News; Geo. Killian, Town Clk.; Hiram Phillips, Engr., Oriel Bldg., St. Louis:

Bidder.	Complete Using cast iron pipe.	Complete Spiral riveted pipe.
Ruemmeli & Siebert Refrigerating Mach. Co., St. Louis, Mo.	$177,205	$165,740
Orman & Crook, Pueblo, Colo.	169,578	148,020
*H. C. McCreary, Denver, Colo.	75,802	6,000
Holmes & Allen, Denver, Colo.	172,375	164,375
R. P. McDonald, Denver, Colo.	144,200	†132,000
Greenville Const'n Co., Greenville, O.	139,300	129,800
Mitchell Bros., Denver, Colo.	138,000	‡130,675
Shutt Improvement Co., Pueblo, Colo.	138,000	128,000
Geddes & Searie Stone Co., Denver, Colo.	137,000	....
J. M. O'Rourke, Denver, Colo.	136,200	....

*First bid for cast iron only; second bid for standpipe, without foundation. †Complete with wooden pipe, $140,200. ‡Wooden pipe, $119,687.

BERKELEY, CAL.—Money is being subscribed for the proposed new works, 10 citizens having offered to give $1,000 each. About 122 acres of land will be purchased near San Pablo for the source of water supply. The works will cost about $450,000. J. N. Le Conte, Capt. W. H. Marston, J. J. Mason and Anson S. Blake are on the committee.

LAKEPORT, CAL.—An election will be held Dec. 20 to vote on the question of building works to cost about $17,250. In 1896 A. L. Adams, 401 California St., San Francisco, prepared plans. H. V. Keeling, Town Clk.

PORT COSTA, CAL.—The Port Costa Water Co. has been incorporated by G. W. McNear, P. E. Bowles, G. W. McNear, Jr., F. W. McNear and S. B. McNear. Capital stock, $250,000, of which $110,000 has been subscribed.

JEROME, ARIZ.—John Burkes writes us that the water supply will be secured from springs 500 ft. above the city. It is proposed to construct tanks at the springs and to lay pipes to the city. The citizens are now formulating plans. Population, 3,000.

PRESCOTT ARIZ.—This city has sold $150,000 of bonds to the U. S. Mortgage & Trust Co., 59 Cedar St., New York, for the proposed works. It is stated that arrangements will be made at once to construct the works. J. J. Fisher, Cy. Engr.

CHATHAM, N. B.—It is stated that plans are being prepared for the proposed works.

MONTREAL, QUE.—Alderman Laporte, of the committee, is urging the committee to consider the advisability of filtering the drinking water.

MIDLAND, ONT.—The question of building works is being considered, according to reports.

BUCHAREST, ROUMANIA.—Bids are asked until Jan. 9 for sinking two tubular wells for collecting water for a water supply and for furnishing the city with drinking water. The wells will cost about $36,000, and the piping, etc., for the water supply, about $470,000. Address Mr. Radu, Ch. Dept. of Construction, 9 Strada Mihai Voda, Bucharest, or the Roumanian Legation at Washington, D. C., where plans and specifications (in French) may be seen.

IRRIGATION.

BEAUMONT, TEX.—Reports state that the Southern Rice & Trust Co. has purchased 6,500 acres of rice land in Jefferson county, near this place, and proposes to construct an irrigation system at once. Alfred F. Bissell, Secy. and Mgr., Des Moines, Ia. An office will be opened in the First National Bank Bldg.

SAN BERNARDINO, CAL.—Hiram H. Smith filed a claim Nov. 28 to 5,000 ins. of water for irrigation on the Rancho San Bernardino, between the north and south slope of Live Oak canon.

SPOKANE, WASH.—It is reported that E. B. Palmer, 530 Pioneer Block, Seattle, Wash., has filed a claim to Liberty Lake, for irrigation purposes.

LOVELOCKS, NEV.—Chas. N. Sain, Secy. Humboldt Irrigation Co., is making efforts to have eastern capitalists become interested in a proposed irrigation system to reclaim land along the Humboldt River, to cost about $200,000, according to reports.

NEW COMPANIES.—McElmo Water Supply Co., McElmo, Colo.; $500,000; to furnish water for irrigation; Morris B. Colt, Alamosa, Colo.; John H. Knabel, Ernest Knabel, of Colorado, and others.

SEWERAGE.

BOSTON, MASS.—Bids are asked until Dec. 16 for building about 1,025 ft. of pipe sewers in Dorchester District. B. W. Wells, Supt. of Sts.

MIDDLEBORO, MASS.—The state board of health has decided that the system for this place must be improved as it pollutes the Nemasket River. The improvements are estimated to cost about $40,000. F. S. Tanzey, Mayor.

CLAYTON, N. Y.—This place voted Dec. 6 to issue $50,000 in bonds for a system and water-works. It is stated that bids for the work will soon be asked. F. L. Hall, Village Pres.

DEPEW, N. Y.—S. Jay Ohart, Village Pres., writes us that next year the village shall probably construct lateral sewers to cost $10,000, sewage disposal works to cost $20,000, etc., in addition to the work already done at a cost of $55,000.

MOUNT VERNON, N. Y.—Bids are asked until Jan. 3 for constructing 12-in. pipe sewers in two streets. W. N. Hoyt, Clk.

NEW YORK, N. Y.—Bids are asked until Dec. 23 for constructing a wooden barrel sewer under pier No. 36, North River. Jas. Kane, Comr. of Sewers, 265 Broadway, Manhattan.——Bids are asked until Dec. 28 for furnishing and laying a cast-iron sewer pipe on Randall's Island, N. Y. H. J. W. Keller, Pres. Dept. of Charities, foot East 26th St., Manhattan.

BAYONNE, N. J.—The bids for constructing a main sewer through the Centreville district received Dec. 6 have been returned to the bidders.

EAST ORANGE, N. J.—The Essex County Park Commission has adopted plans for a storm sewer to drain the valley through which the East Orange Boulevard runs. Estimated cost, $60,000. Wm. H. V. Reimer, Engr., East Orange.

JERSEY CITY, N. J.—The board of education wants the council to appropriate $12,000 for improving the drainage of school No. 12.

RED BANK, N. J.—A. C. Harrison, Town Clk., writes us that the following bids were received Nov. 29 for constructing certain sewers, as advertised in Engineering News:

* P. H. Harrison & Son, 220 Broadway, New York	$9,652
Doolittle & Brooks, 26 West Broadway, New York	12,333
J. Erwin Hillpot, Bound Brook, N. J.	13,502
A. Costa, Orange, N. J.	13,519
F. Kohlmeyer & Co., 102 Park St., New York	10,704

* Awarded contract.

KINGSTON, PA.—Bids are asked by the secretary of the council for building sewers in certain streets. P. B. Reynolds, Pres. Council; W. P. Somers, Secy.

NORRISTOWN, PA.—The trustees of the state hospital want an appropriation for repairing the system at the hospital. Frank C. Smith, Treas.

STEELTON, PA.—It is stated that the council is arranging for the construction of the proposed system to cost about $54,000. The system will require about 52,600 ft. of 8-in. sewer pipe, 8,400 ft. of 10-in. pipe, 3,730 ft. of 12-in., 890 ft. of 15-in. and 2,250 ft. of 18-in.; 100 ft. of 12 and 16-in. outlet pipe. Under the canal will be laid 75 ft. of 16-in. siphon and the same length of 12-in. pipe. There will be 73 flush tanks, 74 manholes, 117 lampholes and one flush inlet. H. H. Campbell, Pres. Council.

CUMBERLAND, MD.—The council has decided to build a sewer in South Cumberland at a cost of $6,000. Councilmen Shriver and E. F. Rizer may be addressed.

AIKEN, S. C.—Bids are asked until Jan. 18 for constructing pipe sewers and a filtration plant, as stated in our advertising columns. N. Wilson Davis, Engr.; M. B. Woodward, Mayor.

MONROE, LA.—J. M. Kelley, Secy., writes us that nothing will be done toward building the proposed system, water-works, etc., until the bonds are sold, which will be next year. The bonds were voted in November.

OWENSBORO, KY.—Bids are asked until Dec. 17 for constructing 1,500 ft. of 20-in. pipe sewers and 250 ft. of open ditch. W. P. Small, Mayor.

CINCINNATI, O.—Bids are asked until Jan. 3 for constructing sewers in Bassett Road. Geo. H. Spellmire, Clk. Bd. City Affairs.

COLUMBUS, O.—Julian Griggs, Ch. Engr. Dept. Pub. Improvements, informs us that no definite steps for sewers in the west side have yet been taken. There is under contract 2,212 ft. of 42-in. brick drain and about half a mile in Mound St., on the west side, which will connect the Mound St. storm sewer with the Renick Run system and overflow into the latter when the former is two-thirds full.

YOUNGSTOWN, O.—Bids are asked until Dec. 17 for constructing sewers in Hayes Ave. H. W. Calvin, Clk.

FORT WAYNE, IND.—The question of building a new intercepting sewer is being considered by the board of public safety. Estimated cost, $150,000. Geo. H. Wilson, and Dr. Kessler, a member of the board of health, may be addressed.

OTTUMWA, IA.—The council proposes to build a system in the south side. Councilmen Keefe, Chn. Com., and Peck may be addressed.

GUTHRIE, OKLA.—The council has decided to engage an engineer to prepare plans for the proposed system. Councilman Saunders may be addressed.

MACON, MO.—S. D. Lamb, Mayor, writes us that this place voted on Dec. 6 to build a system to cost about $24,000. Of this amount Col. Blees has offered to contribute $5,000. No arrangements have been made for building the system. C. L. Farrer, Clk.

ST. LOUIS, MO.—We are informed that Robt. Wycoff submitted the lowest bid Dec. 6 for sewers in Branch St., sewer district No. 35. Patrick McIntyre submitted the lowest bid for sewers in Elliott Ave., district No. 46. B. H. Colby, Sewer Comr.

BAKERSFIELD, CAL.—A. I. Lightner, Cy. Clk., writes us that no definite action has yet been taken in regard to the proposed system, to cost $100,000. The matter may come up early next year.

NEVADA CITY, CAL.—The board of trustees has engaged W. F. Englebright to prepare plans for the proposed system.

GARBAGE DISPOSAL—STREET CLEANING

ATLANTIC CITY, N. J.—Bids are asked until Dec. 19 for collecting and removing the garbagee of this city to the present crematory until the new one is completed; check, $100. E. D. Irelan, Cy. Clk.

PASSAIC, N. J.—Dr. A. Warde Van Riper, Pres. Bd. of Health, is urging the board to take definite steps toward securing better arrangements for the disposal of the garbage of the city.

ATLANTA, GA.—A bill has been introduced in the legislature amending the charter of the city to provide for the construction of a crematory in the center of the city.

COVINGTON, KY.—The aldermen have awarded the contract for removing the garbage and ashes in both districts of the city for one year to Gerhard Exterkamp.

LOUISVILLE, KY.—Dr. M. K. Allen, Health Officer, has submitted a report on garbage crematories, and has recommended the appointment of a committee to consider the question of a plant for this city.

CLEVELAND, O.—Bids are asked until Dec. 31 for cleaning the market grounds for one year. E. A. Abbott, Dir. of Police.

INDIANAPOLIS, IND.—Bids are asked by the board of public works until Jan. 15 for cleaning the streets for 1899. The specifications call for two sets of bids and contractors will be permitted to bid on both forms. Bid A calls for the work as done last year. That is, the contractor estimates his price for keeping an area of 10,000 sq. ft. clean for the whole year. The new form is known as bid B, and calls for an estimate for cleaning the streets of the whole city. At present the city is paying 14¾ cts. a 10,000 ft. in addition to the expense that it has to bear to maintain the orderly or day service. Bid B fixes the time limit from March 15, 1899, to Dec. 15, 1899. It also calls for machine sweeping from Jan. 1, to March 15, 1899, and from Dec. 15, 1899, to Jan. 1, 1900. The specifications require that all work must be done during the night time and provides a penalty for violation of this provision. It also sets forth that any work which the board or its representatives deem unsatisfactory will be subject to fine at the board's discretion. The sweepings are the property of the contractor, and he is held responsible for the disposal thereof. Both forms of bids require hand carts in the down-town portion of the city to collect all dirt, droppings and accumulations. The specifications require these carts to be similar to those which the city has introduced a short time ago, and they shall go on duty at 8 o'clock in the morning and be on until 5 o'clock in the afternoon.

MILWAUKEE, WIS.—Judge Sutherland, in the Superior Court, has rendered a decision in favor of the construction of the proposed crematory by the Engel Sanitary Crematory Co.

ST. JOSEPH, MO.—City Physician Graham is securing information, estimates, etc., for the disposition of the city garbage. Population, 75,000.

SAN FRANCISCO, CAL.—The Garbage Sanitary Cremation Co. has been incorporated, with a capital stock of $100,000, of which $25,000 has been subscribed. Incorporators, Adolph Ramish and Martin C. Marsh, Los Angeles, Cal., and Charles L. Asher, John Malowansky and Jacob Shaen, San Francisco.——The supervisors have cancelled the contract with the Sanitary Reduction Co., which provided that the city should pay the operating expenses and a reasonable profit to the company. The supervisors had appropriated $150,000 for this work.

SAN FRANCISCO, CAL.—Bids were asked until Dec. 12 for cleaning the paved streets, alleys, etc., to Jan. 1, 1901. John A. Russell, Secy. Bd. of Supervisors.

SANTA CRUZ, CAL.—Bids are asked until Jan. 2 for the purchase of a 50-year franchise for pumping sea water and for laying pipes, etc., the franchise having been applied for by Jno. E. Armstrong and Wm. Armstrong. J. L. Wright, Cy. Clk.

STREETS AND ROADS

BOSTON, MASS.—The town of Revere has voted to appropriate $3,000 for the repair of roads.

WETHERSFIELD, CONN.—It has been voted to macadamize a portion of Newington Ave.

JOHNSTOWN, N. Y.—It is reported that a bill will soon be presented to the state legislature to authorize the construction of a macadam road from Amsterdam to Northville, Fulton county, a distance of about 20 miles. The county supervisors will also be asked to pass the same bill.

BUFFALO, N. Y.—Bids are asked until Dec. 20 for furnishing and constructing asphalt pavement on portions of Erie St., Booth Alley, Mills Alley and for an 18-in. sewer on Miami St. R. G. Parsons, Secy. Bd. Pub. Wks.——The park board on Dec. 6 authorized the committee on grounds and roads to construct the proposed speedway on Humboldt Parkway.

DEPEW, N. Y.—S. Jay Ohart, Village Pres., informs us that $15,000 will probably be spent next year for macadamizing.

NEW ROCHELLE, N. Y.—C. Oliver Iselin made a proposition to the village trustees Dec. 5 to rebuild the entire street system of New Rochelle and keep it in repair for five years. President Clark may be addressed.

NEW YORK, N. Y.—Bids are asked until Dec. 21 for furnishing material and for constructing roads, sidewalks, curbing, grading, excavating and landscape gardening on the grounds of Bellevue Hospital. John W. Keller, Pres. Dept. Pub. Charities, East 26th St.

ATLANTIC CITY, N. J.—Bids are asked until Dec. 19 for constructing a road from Baltic Ave. to the crematory, and until Dec. 26 for paving certain streets, according to reports. Emery D. Irelan, Cy. Clk.

HACKENSACK, N. J.—Ernest Koester, Atty., Hackensack, writes us that at the election in Franklin township Dec. 6 it was voted, by a large majority, to issue $75,000 in bonds for the construction of macadam roads.

BRADFORD, PA.—Main St. will probably be paved with brick next summer, to cost from $15,000 to $20,000.

LEBANON, PA.—This city is beginning to agitate the question of having paved streets. With the exception of about half a block of asphalt block paving, the streets are of limestone and cinder macadam. A project is now before the council to have North Eighth St. substantially paved. George W. Hayes, Cy. Engr.

PHILADELPHIA, PA.—Bids are asked until Dec. 15 for constructing and repairing sheet asphalt pavement for the year 1899, according to reports. Thos. M. Thompson, Dir. Dept. Pub. Wks.

ANNAPOLIS, MD.—Bids are asked until Dec. 19 for distributing 6,000 bus. of shells on the Mill Creek Road and 30,000 bus. of shells on the road from Mountain Road to the Curtis Creek bridge. Charles Duvall, Road Comr.

WASHINGTON, D. C.—Bids are asked until Dec. 17 for improving Connecticut Ave. west of Rock Creek. John B. Wight, District Comr.

CLEVELAND, O.—The council passed resolutions Dec. 5 to improve portions of nine streets. Howard H. Burgess, Cy. Clk.

ZANESVILLE, O.—Bids are asked until Dec. 23 for furnishing and constructing brick paving, grading, etc., on North Seventh St. Chas. N. Bainter, Cy. Clk.

INDIANAPOLIS, IND.—Bids are asked until Dec. 19 for gravel and brick paving on Clifton and Miami Sts., respectively. M. A. Downing, Comr. Pub. Wks.

SULLIVAN, IND.—Bids are asked until Dec. 13 for grading and paving on Cross and Washington Sts. Jacob Mahley, Pres. Bd. Trustees.

CHICAGO, ILL.—Bids are asked until Dec. 19 for repairing the roadway and sidewalks of the Jackson St. bridge and viaduct. L. E. McGann, Comr. Pub. Wks.

ST. PAUL, MINN.—L. W. Rundlett, Cy. Engr., submitted plans to the board of public works Dec. 8 for the macadamizing of Como Ave., between Dale and Rice Sts.; estimated cost, $42,715. The park board will be consulted before any action is taken.

TOPEKA, KAN.—A petition to pave portions of Huntoon St. with brick, 30 ft. wide, has been referred to the street committee.

KANSAS CITY, MO.—Bids are asked until Dec. 17 for furnishing the material and constructing plank sidewalks on portions of eight streets, and grading three streets. Henry A. Wise, Cy. Engr.

ST. LOUIS, MO.—Bids are asked until Dec. 23 for grading portions of 20 streets, brick paving on eight streets and macadamizing on nine streets. Robt. E. McMath, Pres. Bd. Pub. Improvements.

HOUSTON, TEX.—Bids are asked until Jan. 9 for 8,500 cu. yds. of excavation, 19,000 sq. yds. of paving and 4,500 lin. ft. of stone curbing on Main St., as stated in our advertising columns. S. H. Brashear, Mayor; J. Austin Miller, Cy. Engr.

SAN MATEO, CAL.—Bids are asked until Dec. 19 for constructing 10 cross-walks of concrete foundation, and for grading C St. R. H. Jury, Cy. Clk.

MANUFACTURING PLANTS.

HYANNIS, MASS.—A fire here, Dec. 11, destroyed the engine house and carpenter shop of the New York, New Haven & Hartford R. R. Co.; loss, about $75,000.

WORCESTER, MASS.—Vernon Price, of this place, will erect a factory and boiler house, 102 × 75 ft., on Mill St. near Gates Lane, for the American Drug Plate Co.

ALTON, R. I.—A fire in this village, Dec. 5, destroyed the Walton Woolen Mill; estimated loss, about $75,000. W. A. Walton, owner.

DANBURY, CONN.—The hat factory of John W. Green & Co. was destroyed by fire Dec. 7. Loss, $110,000; insurance, $110,000.

SOUTH MANCHESTER, CONN.—Frank Goetz contemplates the erection of a 2-story brick cracker factory building, 150 × 40 ft.

BINGHAMTON, N. Y.—E. A. Beman will erect a 4-story brick factory building, 40 × 85 ft., on Chenango and State Sts., to cost between $10,000 and $12,000.——The Binghamton Cold Storage Co., according to reports, will erect an ice manufacturing plant. O. S. Heller, R. E. Hooper and G. G. Kappael are interested.

MECHANICSVILLE, N. Y.—The Duncan Co. contemplates enlarging its plant at a cost of over $100,000, according to reports.

NEW YORK, N. Y.—Reports state that the Manhattan Dry Dock & Construction Co. will build a dry dock and ship building yard in this harbor. E. C. Machen and Frank Brooks are said to be interested.

ALLEGHENY, PA.—The Pennsylvania Car Wheel Co. will erect a storage house, boiler house and foundry, to cost about $6,000.

CHESTER, PA.—The Keystone Plaster Co. will erect an addition, 180 × 60 ft. to its plant on Deleware Ave.

IRWIN, PA.—Reports state that the Penn Electrical Co. of Pittsburg will remove its plant to this place. F. C. Hockensmith and D. M. Wagner, of Irwin, are interested.

GREENVILLE, PA.—The Kimberly Iron Co., of Sharon, Pa., contemplates improving its plant at this place, to cost about $25,000.——The Shelby Tube Co., according to reports, will install considerable machinery in its plant.

KUTZTOWN, PA.—The plant of the Kutztown Foundry & Machine Co. was partially destroyed by fire, Dec. 10, causing a reported loss of $ 0,000. The new addition to the plant was not burned.

MONESSEN, PA.—It is reported that the Page Woven Wire Fence Co., Adrian, Mich., has been given ten acres of land at this place for the erection of a plant.

PITTSBURG, PA.—Laughlins & Co., according to reports, will erect a $750,000 furnace on 2d Ave.

UPPER BLACK EDDY, PA.—The Hero Knitting Mill Co. has been organized, and according to reports will erect a mill soon.

YORK, PA.—Reports state that a 3-story silk factory building, 250 × 50 ft. with engine room and boiler house, will be erected at Norway Park, a suburb of this place. Judge Stewart is said to be interested.

BALTIMORE, MD.—The Thistle Mfg. Co. contemplates making a number of improvements to its plant.

TANEYTOWN, MD.—T. E. Eckenrode, Taneytown, and Geo. W. Albaugh, Westminster, Md., expect to erect a roller mill, with capacity of 50 bbls. a day, at this place.

NEWPORT NEWS, VA.—Reports state that the Marsden Cellulose Co., of Philadelphia, Pa., will establish a main plant at this place, to cost $250,000.

CLEVELAND, O.—The Forest City Foundry & Mfg. Co. will erect a 5-story steel and brick building, 133 × 90 ft. on Washington and West Centre Sts. Fugman & Ulrich, Architects.——M. A. Bradley will erect a steel factory building 74 × 114 ft., on St. Clair St. and Park Place.

HAMLET, IND.—Reports state that Jamison & Heidrich, Peoria, Ill., will erect a beet sugar plant at this place.

DETROIT, MICH.—The Michigan Forge Co. will erect a large steel plant on the site of its present plant, the buildings of which are now being demolished.

PONTIAC, MICH.—The Oakland Sugar Mill Co., according to reports, will erect a factory building, to cost from $350,000 to $500,000.

WYANDOTTE, MICH.—The Michigan Alkali Co. will erect an addition to plant No. 1 for the manufacture of Portland cement and an addition to plant No. 2 to increase its facilities for the manufacture of soda ash.

OMAHA, NEB.—Metz Bros. contemplate the erection of a brewing plant here to cost about $225,000.

GAS PLANTS.

WASHINGTON, D. C.—Bids are asked until Dec. 27 for installing gas and electric light fixtures in the U. S. post office building. O. L. Spaulding, Acting Secy. Treasury Dept.

FINDLAY, O.—Wm. B. Cutter, Buffalo, N. Y., has purchased the city natural gas plant for $150,000. It is proposed to construct a plant for the manufacture of artificial gas, according to reports.

MILWAUKEE, WIS.—Reports state that the Western Gas Co. wishes to let a contract for a gas holder of 3,000,000 cu. ft. capacity.

LOS ANGELES, CAL.—It is reported that the works of the Standard Oil Co. at this place have been destroyed by fire, at an estimated loss of $225,000.

EVANSTON, ILL.—The Northwestern Gas Light & Coke Co., Evanston, has filed a trust deed with the Equitable Trust Co., Chicago, to secure a $2,000,000 bond issue, for the extension and improvement of the works, according to reports. Rufus C. Dawes, Pres.

NEW COMPANIES.—Acme Acetylene Gas Co., New York city; to manufacture, sell and use gas machines and generators; $500; William A. Newell, E. J. Fenlon, John Forman, George H. Graham and W. H. Graham, all of New York.

Patt Oil Co., Elmira, N. Y.; $5,000, with $500 paid in; to deal in natural gas and oil; Thos. S. Flood, Howard H. Hallock, Boyd McDowell, Edgar Denton, Alfred E. Ackley, Elmira.

Natural Gas & Development Co., Ottawa, Ont.; $9,000; to drill for natural gas, oil and minerals; H. L. T. Skinner, H. J. Allen, R. A. Wasson, A. M. Blair, G. L. Pancoast, J. Halloren, S. F. Beele, J. E. Byers, N. A. Hamilton, Ottawa.

Carolina Gas & Chemical Co., Washington, N. C.; $20,000; to construct and maintain gas plants for light and heat, also the manufacture of chemicals, etc.; A. McDowell, Robert Green, U. S. Fulford, C. W. Bilfinger, and Stephen C. Bragaw.

MISCELLANEOUS CONTRACTS.

PARK.—Joliet, Ill.—The council has purchased 40 acres of land for a park.

STEEL WALK.—Cape May, N. J.—The council has decided to construct an elevated steel walk along the beach.

TELEPHONE LINE.—Carlisle, Pa.—Reports state that the Pennsylvania Telephone Co. will establish an exchange at this place.

TUNNEL.—Santa Barbara, Cal.—Bids are asked by the city clerk until Dec. 22 for constructing 500 ft. of additional tunnel, according to reports.

SCOW BOAT.—New York, N. Y.—Bids are asked until Dec. 27 for furnishing a 200-ton scow boat. F. J. Lantry, Comr. Dept. Correction, 148 East 20th St.

SLUICEWAYS.—Wilmington, Del.—Bids are asked by the Levy Court until Dec. 20 for constructing four sluiceways on the St. Augustine marsh, to cost $3,500.

FIRE APPARATUS.—Averill Park, N. Y.—The council has decided to purchase a second-hand fire engine, a hose cart and to erect a fire station; estimated cost, $2,000.

DAM.—Indianapolis, Ind.—The board of public works proposes to construct a dam across the White River below the proposed parkway, according to reports.

FIRE HOSE.—St. Louis, Mo.—Bids are asked until Dec. 16 for furnishing 4,000 ft. of 2½-in. rubber-lined fire hose and for rubber suction hose. Jas. Richardson, Comr. Supplies.

TELEPHONE LINE.—Pocomoke City, Md.—It is reported that the Worcester Telephone Co. decided Dec. 8 to extend a line to Pocomoke City, Stockton and other points in the county.

LUMBER, ETC.—New York, N. Y.—Bids are asked until Dec. 23 for furnishing pine boards and spruce plank, joist, timbers, etc. Geo. C. Clausen, Comr. Parks, Arsenal, Central Park.

HOSPITAL VESSEL.—New York, N. Y.—Mrs. Helen C. Julliard has appropriated $32,000 for the construction of a floating hospital for the St. John's Guild. Wm. L. Strong, Pres.

TELEPHONE LINE.—Piedmont, W. Va.—The Gordon Telephone Co., Piedmont, will extend a line to Barnum, W. Va., and to Bloomington, Md., and Cumberland, Md., according to reports.

REPAIR OF FIRE BOAT.—New York, N. Y.—Bids are asked until Dec. 21 for furnishing material and repairing the fire boat "Zophar Mills." John J. Scannell, Fire Comr., 157 East 67th St.

TELEPHONE WORK.—Petersburg, Va.—Reports state that the Long Distance Telephone Co. has secured franchises in every town between Petersburg and Lynchburg, for the construction of a telephone line.

STEAM BOILERS.—Alexandria, Egypt.—Bids are asked by the administration of ports and lighthouses at the controller general's office, Alexandria, until Dec. 31, for furnishing two steam boilers, according to reports.

SIDEWALK SHELTERS.—Toronto, Ont.—Bids are asked until Dec. 19 for furnishing material and constructing corrugated iron sidewalk shelters under the bridges at Queen St. subway. John Shaw, Chn. Bd. Control.

TELEPHONE EXCHANGE.—Adairsville, Ga.—Reports state that a company is being organized to construct a telephone exchange for the near-by towns. J. P. Bowdoin is receiving estimates for 50 miles of telephone line.

PORTLAND CEMENT.—St. Paul, Minn.—Bids are asked until Jan. 12 for furnishing American Portland cement, f. o. b. cars, as stated in our advertising columns. Maj. Frederic V. Abbot, U. S. Engr., Globe Bldg.

ENGINEERS' SUPPLIES.—New York, N. Y.—Bids are asked until Dec. 19 for furnishing packing, plumbing material, earthen pipe, brass pipe, valves, tools, etc. John W. Keller, Pres. Dept. Pub. Charities, East 26th St.

TELEPHONE CONDUITS.—Boston, Mass.—The Massachusetts Telephone & Telegraph Co. was granted a franchise Dec. 12, by the board of aldermen, to construct an underground system of conduits in all the public streets.

POLICE SIGNAL SYSTEM.—Los Angeles, Cal.—The board of police commissioners awarded a contract to the Gamewell Fire Alarm Telegraph Co. Dec. 3 for installing a police signal system of 50 signal boxes, to cost about $10,000.

PUMPING ENGINE.—Charleston, S. C.—Bids are asked by the U. S. Engineer, at Charleston, until Jan. 10, for removing old and furnishing and placing new pumping engine on board the dredge "Charleston," as stated in our advertising columns.

TELEPHONE FRANCHISE.—McKees Rocks, Pa.—The Central District & Printing Telegraph Co. has been granted a franchise to construct and maintain a telephone and telegraph system in this borough. J. P. Gillen, Clk.; David Shaw, Burgess.

DREDGING.—New York, N. Y.—Bids are asked until Dec. 23 for dredging in the East River, near Catharine St., about 11,000 cu. yds. of mud, 7,200 cu. yds. of sand, loose stones, etc., and 3,750 cu. yds. of cribwork. J. S. Cram, Comr. Docks, Pier A, North River.

PORTLAND CEMENT.—Duluth, Minn.—Bids are asked until Jan. 10 for furnishing 12,000 bbls. of Portland cement for the concrete superstructure for piers for the Duluth ship canal, as stated in our advertising columns. Maj. Clinton B. Sears, U. S. Engr., Duluth.

TELEPHONE SYSTEM.—Sharon, Pa.—Reports state that it is proposed to consolidate the Citizens' Telephone Co., of Mercer and Lawrence counties, and extend the lines to Meadville, Franklin, Oil City, Erie and Youngstown, O. R. H. Adams, Baltimore, Md., is interested.

TIMBER BULKHEADS.—Boston, Mass.—We are informed that the following bids were received Dec. 7 for the construction of timber bulkheads on Summer St. extension: Ross & Fowler (accepted), $7,425; Wm. J. Lawler, $7,859; Miller & Ellis, $8,570. All local bidders. Wm. Jackson, Cy. Engr.

FIRE APPARATUS, ETC.—Philadelphia, Pa.—Bids are asked until Dec. 20 for furnishing fire hose, hand fire extinguishers, several steam fire engines, hose wagons and chemical engines; also water towers, aerial trucks, extension ladders, general fire supplies, general electrical supplies and bicycles. Dir., Frank M. Riter, City Hall.

FIRE APPARATUS.—New York, N. Y.—Bids are asked until Dec. 21 for furnishing one Holloway double tank chemical engine; one fourth size steam fire engine with La France pumps and one fourth size steam fire engine with Fox sectional water tube boiler; 3,600 ft. 2½-in. rubber lined fire hose. J. J. Scannell, Fire Comr., 157 East 67th St.

TUBULAR BOILERS.—San Francisco, Cal.—U. Sebree, Commander U. S. Navy, Inspector 12th Lighthouse District, informs us that the following bids were received Nov. 28 for furnishing two return tubular boilers of the Scotch type, for the lighthouse tender "Madrona:" Patrick F. Dundon, $18,443; Union Iron Works, $22,800; Risdon Iron & Locomotive Works, $24,950; T. J. Moynihan, $27,000. All local bidders.

PARK WORK.—New York, N. Y.—Bids are asked until Dec. 22 for constructing and improving grounds for use of the New York Zoological Society, in Bronx Park, including 12,500 cu. yds. of earth excavation, 3,600 cu. yds. of rock excavation, 9,700 cu. yds. of fill, 6,050 lin. ft. of 8 to 18-in. vitrified drain pipe, 2,000 lin. ft. of blue stone steps, 132,000 sq. ft. of gravel walks, 7,100 sq. yds. of telford and 3,700 sq. yds. of macadam pavement; surety $20,000. Geo. C. Clausen, Comr. Parks, Arsenal, Central Park.

CONTRACT PRICES.

BULKHEAD, WALLS, ETC.—Boston, Mass.—We are informed that the park commissioners received the following bids Dec. 5, 1898, for filling and bulkhead at the Ferns between Beacon St. and the Harbor Commissioners' line:

Bidder.	Filling, a cu. yd.	Bulkhead.	Total.
Perkins & White, Charlestown...	$0.51	$4,375	$13,555
J. W. Hurley, Melrose, Mass.....	.59	4,583	15,203
W. L. Miller, 17 Milk St., Boston.	.57	4,995	15,255
Johnson & Letteney, Boston	.65	5,900	17,600

Bidder.	Walls at Jamaica Park, a lin. ft.	Walls at Franklin Park, a cu. ft.
D. F. O'Connell, 34 School St., Boston	$1.70	$1.95
J. Sutherland, 17 Otis St., Boston....	1.81	1.79
M. Ruso, 240 North St., Boston......	1.95	2.30
Woodbury & Leighton, Boston......	1.95	1.95
W. L. Miller & Co., 17 Milk St., Boston	2.24	2.24
J. A. Whittemore's Sons, Roslindale..	2.24	1.77
Cogan Bros. & Forschner, Atlantic..	2.25	2.25
G. R. Dugad & Son, 40 State St., Boston	2.33	....
R. L. Barrett, 69 Windsor St., Roxbury	2.35	2.35
W. B. Cass, 23 Court St., Boston.....	2.37	2.57
McHale & Quinn	2.39	2.54
T. F. Welch, West Roxbury..........	2.63	....
C. H. Dodge, 23 Conmore St., Boston.	2.93	2.93
J. C. Coleman & Sons, Boston.	3.00	3.00

STONE HEADS.—Newark, N. J.—We are informed that the following bids were received Dec. 5, for furnishing and constructing stone heads to subways Nos. 1 and 2, under driveway at Branch Brook Park, advertised in Engineering News; A. Church, Secy. Eessex County Park Comn., 800 Broad St.:

Bids Received at Newark, N. J., Dec. 5, 1898, for Furnishing and Constructing Stone Heads to Subways.

		Vitrified pipe,											
	Earth excavation, 45,000 cu. yds.	24-in., 700 lin. ft.	12-in., 700 lin. ft.	8-in., 2,000 lin. ft.	2-in. tile, 10,000 lin. ft.	3-in. tile, 1,800 lin. ft.	Brick masonry, 75 cu. yds.	Rubble masonry, 25 cu. yds.	Concrete, 20 cu. yds.	Cast iron, 5,000 lbs.	Granite curb, 350 lin. ft.	Telford roadway, 15,000 sq. yds.	Total.
Ludwig Batt, So. Orange, N.J.	$11,025	$686	$245	$440	$1,100	$216	$562	$100	$75	$125	$525	$7,425	$22,525
Wright & Lindsley, Orange, N.J.	15,750	1,750	350	750	900	216	750	175	120	150	245	8,550	29,706
O'Connor & McManus, Newark.	15,750	805	315	620	1,800	342	675	131	100	175	612	9,750	31,076
Fell & Minahan, Orange, N. J.	12,150	1,120	350	800	1,000	180	675	162	110	150	332	9,000	26,030
F. C. O'Reilly, Orange, N. J...	13,500	910	525	1,000	1,400	288	825	150	120	175	437	9,750	29,081
John T. Shanley, Newark, N.J.	18,900	959	616	1,300	2,300	486	960	150	115	187	437	12,750	39,161

PARK WORK.—Brooklyn, N. Y.—The park commissioners, the Arsenal. Central Park, Manhattan, received the following bids Dec. 8, 1898, for certain park work, to cost in all about $40,000: Grading, curbing, guttering and paving with macadam pavement, Fort Hamilton Ave., from 79th St. to the shore of New York Bay, and keeping the same in good repair for one year from date of acceptance of the completed work; total length of improvement, 6,800 lin. ft.:

Bidder.	Excavation, 9,620 cu. yds.	Curbing, 13,480 lin. ft.	Belgian blk. gutter, 3,025 sq. yds.	Brick paving, 250 sq. yds.	Macadam paving, 31,785 sq. yds.
Borough Const'n Co.....	$0.12	$0.42	$1.25	$2.25	$0.60
Thos. F. Byrnes	.20	.47	1.20	2.15	...
Mack Paving Co.........	.24	.54	1.50	2.25	.74
Edw. W. Roach	.175	.53	1.67	1.79	.97
John F. Mailie	.18	.38	1.10	1.50	.61
C. H. Cornell	.20	.45	1.50	2.30	.50
Henry J. Mullen	.20	.45	1.30	2.15	.60
Pierce Bros.	.22	.50	1.44	2.50	.80
DeWitt C. Bouker.......	.22	.60	1.50	2.00	.75
Newman & Co.	.10	.45	1.25	2.00	.70
Charles Hart	.29	.55	1.75	2.57	.70
Geo. F. Doak	.27	.67	2.07	3.00	.77
Denis Norton	.20	.55	1.39	2.73	.73
Frank J. Gallagher......	.30	.48	1.60	2.43	.84
P. Fruh & J. Siegretto..	.27	.50	1.10	1.80	.55
Thos. P. Murphy	.19	.47	1.53	2.50	.585
Brown & Quinn	.28	.33	1.50	2.25	.85
Thomas Monahan.	.15	.50	1.20	1.50	.70
Wm. H. Masterson	.30	.45	1.60	1.89	.58
Manhattan Const'n Co..	.10	.20	.75	2.50	.59

Garden mould, 3,000 cu. yds. for Red Hook Park, and 3,000 yds. for Fort Green Park: DeWitt C. Bouker, $1.65 a cu.yd.; J. Frank Quinn, $1.40; Harris & McGuire, $1.50; John F. Mailie, 68 cts.; F. O'Brien, $1.28; John M. Fox, 68 cts.; Denis Norton, 73 cts. For constructing wrought-iron picket fence along the 15th St. and Coney Island Ave. boundaries of Prospect Park, 4,100 lin. ft., set in granite foundations: M. J. Drummond, $3.40 a lin. ft.; Herman I. Hawk, $2.75; Eastern Stone Co., $3.40; Michael J. Dady, $3.21; Acker & Bloom, $3.41; Kelly & Kelly, $2.22; Paph & Spindle Iron Co., $2.65; P. Fox and James Dillon, $4.05; Heckla Iron Works, $2.19; Van Dorn Iron Works, $1.85; and P. J. Carlin & Co., $2.49. Blue limestone screenings for Ocean Parkway, 500 cu. yds.: N. Ryan, $1.85 a cu. yd.; Calvin Tompkins, $1.69¾; Denis Norton, $1.43; J. Frank Quinn, $1.65, and Harris & McGuire, $1.87½. Gravel screenings for Prospect Park, 800 cu. yds.: J. Frank Quinn, $2.45 a cu. yd.; Harris & McGuire, $2.40, and John F. Mailie, $1.10.

EARTHWORK.—Tampico, Ill.—The following bids were received Dec. 6, by Maj. W. L. Marshall, U. S. Engr., Chicago, for constructing eight miles of feeder of the Illinois and Mississippi Canal, from Mile 9 to Mile 16, inclusive, as advertised in Engineering News; for this work there is available $200,000:

Bids Received at Tampico, Ill., Dec. 6, 1898, for Constructing 8 Miles of Feeder; Illinois & Mississippi Canal.

	Miles 9 to 16, inclusive							
Bidder.	9, 111,966 cu. yds., cts.	10, 105,778 cu. yds., cts.	11, 132,182 cu. yds., cts.	12, 129,014 cu. yds., cts.	13, 189,520 cu. yds., cts.	14, 180,162 cu. yds., cts.	15, 160,278 cu. yds., cts.	16, 137,237 cu. yds., cts.
Phelan & Drach, Omaha, Neb..........	10.5	9.25	25	12.80	12.80	12.80	13.75	13.75
Callahan Construction Co., Omaha, Neb.	9.95	13.75	17.75	12.75	12.75	12.75	14	14
E. V. Johnson, Chicago, Ill...........	....	....	....	11.9	11.9	11.9	....	....
Cogan & Pound, Chicago, Ill...........	12	15	50	35	35	35	25	25
M. Riley & Co., Chicago, Ill...........	12.75	16.5	12.64	15	15	15	17.5	17.5
Corbett & Currie, Chicago, Ill.	....	9.45	16.95	....	....	....	....	....
John J. McCaughey, Summit, Ill.......	10.92	13.84	24.5	24.5	24.5	24.5	24.5	24.5
McArthur Bros. Co., Chicago, Ill.......	....	....	....	16	16	16	16.5	16.5
John Berhery, New York..............	8.40	8.40	16.5	13.45	13.45	13.45	13	13
Bryne & Shortall, Chicago, Ill.........	....	....	....	13.9	13.9	13.9	12.9	12.9
T. W. Kinser & Sons, Boston, Mass.....	9	9	18	11	11	11	10	10
Canal Construction Co., Chicago, Ill. ..	....	....	....	14	14	14	11.9	11.9

PAVING.—Baltimore, Md.—The following bids were received Dec. 6, 1898, for paving and repaving Gay St., from Jones Falls to Exeter St., the paving to be on a 6-in. sand base, the blocks to be jointed with tar and asphalt; O. W. Cormet, Acting City Comr.:

Quantities.		Southern Asp. Paving Co.	I. S. Filbert.	J. L. Robertson.*
Grading	800 cu. yds.	$0.43	$0.39	$0.40
Belgian blk pav'g.	1,550 sq. yds.	2.18	1.99	1.79
New flagstones ...	600 sq. ft...	.33	.35	.30
10-in. g't'rstones	100 lin. ft..	.30	.30	.25
6-in. (strght) crb	50 " "	1.10	.87	.85
6-in. (circlr) crb	16 " "	2.62	1.60	.70
Belgian blk repavg	1,100 sq. yds.	.87	.87	.79
Old 6-in. crb, reset	950 lin. ft..	.17	.135	.12
6-in. crb rejnted	25 joints..	.17	.15	.12
G. stones, reset.	1,000 lin. ft..	.06	.04	.06
Rejointed	50 joints..	.12	.10	.10
Flagstones, reset	716 sq. ft...	.08	.12	.10
Rejointed	200 " "	.05	.05	.10
Cobble repaving .	4,000 " "	.04	.03	.045
Restg crb cross sts	100 lin. ft..	.12	.15	.10
Total	....	$5,476	$5,071	$4,702

*Accepted.

RENT OF WAGONS, ETC.—Chattanooga, Tenn.—The following bids were received by the board of public works, Nov. 29, 1898, for the use of garbage wagons, etc., for the coming year: Garbage Wagons—T. N. Cunningham, one-horse wagon, 15 cts. per hour; 2-horse wagon, 22½ cts. per hour; G. L. Gillespie, one-horse, 15 cts.; 2-horse, 25 cts.; Whiteside & Carbough, one-horse, 15½ cts.; 2-horse, 21 cts.; G. M. Masterson, one-horse, 13 cts.; 2-horse, 20 cts.; B. Benkonitz, one-horse, 14 cts.; 2-horse, 19 cts.; J. F. Bryan, one-horse, 15½ cts.; 2-horse, 25 cts.; R. P. Mann, one-horse, 14 cts.; 2-horse, 20 cts. Street-Cleaning Wagons—T. N. Cunningham, street sweeper horses, 35 cts. per hour; sprinkler wagon, with driver, 25 cts. per hour; without driver, 20 cts. per hour; dirt wagon, 25 cts. per hour; G. L. Gillespie, street sweeper horses, 27½ cts.; sprinkler wagon, with driver, 20 cts.; without driver, 15 cts.; dirt wagon, 25 cts.; J. F. Bryan, street sweeper horses, 50 cts.; sprinkler wagon, with driver, 25 cts.; without driver, 20 cts.; dirt wagon, 25 cts.; R. M. Mann, street sweeper horses, 20 cts.; sprinkler wagon, with driver, 20 cts.; without driver, 14 cts.; dirt wagon, 20 cts.; Amos Teppenpaw, dirt wagon, 20 cts.

GRAVEL.—Chattanooga, Tenn.—The following bids were received by the board of public works, Nov. 29, 1898, for furnishing f. o. b. Chert gravel for the year: Alex. Bonnyman, 60 cts. a cu. yd.; Geo. L. Gillespie, 70 cts.; delivered, 95 cts.; H. L. Bible, 63 cts.; delivered, 83 cts.; J. F. Bryan, 89 cts.; delivered, 89 cts.; Aaron Simpson, 53 cts. (accepted).

SNOW REMOVAL.—New York, N. Y.—The street cleaning commissioner received the following bids, Dec. 9, 1898, for removing snow: Herbert Tate, 37½ cts. a cu. yd.; Bart Dunn, 321 East 81st St., New York, 30 cts.; American Transfer Co., 33.4 cts.; Edwin J. Schaefer, 38 cts.; National Contracting Co., 39⅓ cts. The contract was let to Bart Dunn. Last year the contract was awarded to G. M. Furman, at 36 cts. a cu. yd.

DREDGING.—Brooklyn, N. Y.—The following bids were received by the department of sewers, 265 Broadway, Manhattan, for 7,000 cu. yds. of dredging in New York Bay at the foot of 49th St., Brooklyn: Dubois Bros., 29½ cts. a cu. yd.; total, $2,065; Wm. H. Taylor, Jr., 23½ cts.; total, $1,645.

PAVING.—Council Bluffs, Ia.—E. A. Wickham & Co., Council Bluffs, has been awarded the contract, at $1.27½ a sq. yd., for paving in Harrison St. and Washington Ave. with Council Bluffs brick bottom and top courses. Bids were also received for asphalt paving, based on 5, 7 and 10-year guarantees, as follows: Barber Asphalt Co., 5-year guaranty, $2.05 to $2.60; 7-year guaranty, $2.15 to $2.70; 10-year guaranty, $2.30 to 2.85; E. A. Wickham & Co., 5-year guaranty, $1 92½ to $2.47; 7-year, $2.03½ to $2.56½ 10 year, $1.18½ to 2.71½; Hugh Murphy, 5-year guaranty, $1.39 to $2.45; 7-year, $1.99 to $2.57; 10-year, $2.27 to $2.78. The following are the bids for brick paving: Frank Cooper & Co.— A-1: Des Moines brick, $1.69 and $1.80; Galesburg, $1.745 and $1.87; St. Joseph, $1.70 and $1.95; Council Bluffs, $1.51 and $1.65. B-1: Council Bluffs, top and bottom, $1.285 and $1.395; Des Moines and Council Bluffs, $1.48 and $1.535; St. Joseph and Council Bluffs, $1.48 and $1.90; Atchison and Council Bluffs, $1.48 and $1.90. E. A. Wickham & Co.—A-1: Des Moines, $1.67 and $1.79; Galesburg, $1.73 and $1.85; Council Bluffs, $1.52 and $1.67. B-1: Des Moines and Council Bluffs, $1.46 and $1.58; Galesburg and Council Bluffs, $1.53 and $1.67; Council Bluffs, top and bottom, $1.275 and $1.39. E. A. Wickham & Co. add 5% to the above prices if payment is made in warrants, and Frank Cooper & Co. add 6%.

ASPHALT PAVING.—Louisville, Ky.—The following bids were received by the board of public works, Dec. 2, 1898, for asphalt paving in certain streets: Assyrian Asphalt Co., 5-year guarantee, No. 1 asphalt, $18.90; No. 2, $18; 10-year guarantee, No. 1 asphalt, $28.90; No. 2, $28; Barbour Asphalt Co., 5-year guarantee, No. 1, $19.50; No. 2, $17.50; 10-year guarantee, No. 1, $24.30; No. 2, $22.30; L. R. Figg, 5-year guarantee, No. 1, $22; No. 2, $21; 10-year guarantee, No. 1, $28; No. 2, $27; Alcatraz Asphalt Co., 5-year guarantee, No. 1, $19.40; No. 2, $17.40; 10-year guarantee, No. 1, $23.40; No. 2, $21.40; Boston Paving Co., 5-year guarantee, No. 1, $18.90; No. 2, $17.90; 10-year guarantee, No. 1, 27.90; No. 2, $26.90. The bids of L. R. Figg and the Boston Paving Co. were rejected as informal, because samples of the asphalt to be used had not been deposited in the office of the board of public works three days before the bids were opened.

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INDUSTRIAL NOTES.

THE MICHIGAN CENTRAL BRIDGE CO., Lansing, Mich., is reported to have changed its name to the Detroit River Bridge Co.

THE WATSON MACHINE CO., Paterson, N. J., is reported to have a contract for $50,000 worth of rope making machinery for the Boston Navy Yard.

JOSEPH W. CODY & CO., engineers and general contractors, have removed their offices from 120 Broadway, to the Empire Building, 71 Broadway, New York.

THE GENERAL ELECTRIC CO., Schenectady, N. Y., has an order for eight electric locomotives and other equipment for the Paris, France, underground street railway.

THE CONSOLIDATED STONE CO., Bloomington, Ill., has a contract for 150,000 cu. ft. of Bedford stone, to cost about $27,000, to be delivered in New York for use in a government building on Ellis Island. Mr. E. E. Worthington is president of the company.

THE MURRAY IRON WORKS CO., Burlington, Ia., was awarded a gold medal at the Trans-Mississippi and International Exposition at Omaha, Neb., for its Sioux Corliss engine, which furnished the power used on the grounds, running 24 hours a day during the greater part of the exposition.

THE WEBER RAILWAY JOINT MFG. CO., New York, will remove its principal office on or about Dec. 15, from the Cotton Exchange Building, to rooms 1813 to 1816 Empire Building, 71 Broadway. The company announces also that it has opened a new branch office in the Equitable Building, Baltimore, Md.

THE NEW YORK FILTER MFG. CO., 26 Cortlandt St., New York, through its patent solicitors, has brought suit in the U. S. Circuit Court, Eastern District of Missouri, against Mr. Powell Jackson, trading as the Jackson Filter Co., St. Louis, Mo., to restrain him from manufacturing or selling the Jackson filter which, it is claimed, infringes patent No. 293,740, owned by the plaintiff.

THE EUGENE DIETZGEN CO., of Chicago and New York, has recently put on the market a new paper for positive prints, called "Vandyke Solar Paper." Its principal advantage over ordinary blue-prints lies in the fact that the copies made have either blue lines or black lines on a clear white background. It is claimed by the manufecturers that the paper is easily manipulated, keeps well, does not become brittle, prints rapidly, saves original tracing, and does not spoil positive prints by over-exposure. The same firm has a rapid-printing blue-print paper, with which a blue-print can be made in cloudy winter weather within 7 to 12 minutes, when the regular paper requires an exposure of hours.

J. S. MUNDY, Newark, N. J., shipped a carload of hoisting engines to Chicago last week and a pile driving engine, derrick and hammer to Mexico. The Missouri Pacific R. R. Co. has ordered a double-cylinder, double-drum hoisting engines with a special boiler to be mounted on a pile driving car. An order was recently received from the Horseheads (N. Y.) Bridge Co., for a special bridge-erecting engine at Calicoon, N. Y. The works are also engaged at present in constructing a 38,000-lb. hoisting engine for the Merritt-Chapman Derrick & Wrecking Co. to be placed on a combined lighter and wrecker. The engine has a capacity of 100 tons and has two main hoisting drums, two auxiliary swinging drums and four large extension winches.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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PERSONAL.

Mr. J. C. Munn, Secretary of the Pittsburg Bridge Co., has been elected Secretary and General Manager.

Mr. Louis J. Affelder, Jun. Am. Soc. C. E., has been appointed Principal Assistant Engineer of the Pittsburg Bridge Co.

Mr. Albert Heller has been promoted to be Chief Engineer of the Youngstown Bridge Co., vice Mr. Chas. E. Fowler, M. Am. Soc. C. E., resigned.

Mr. F. D. Anthony, Chief Engineer, New York & Ottawa R. R., has removed his office from Cornwall to Ottawa, Ont., where the principal offices of the road will be located hereafter.

Mr. Alex. Cox, Principal Assistant Engineer of the Imperial Railways of North China, is now passing through the United States on his way to England and Australia, on leave of absence.

Mr. H. E. Astley has been appointed Assistant Roadmaster of the Providence Division of the New York, New Haven & Hartford R. R., vice Mr. C. S. Shafter, resigned. Mr. Astley was formerly employed in the engineering department of the Pennsylvania R. R.

Mr. M. J. Martinez, M. Am. Soc. M. E., has received the appointment of resident agent at Havana, Cuba, for the Snow Steam Pump Works, of Buffalo, N. Y. The business will be conducted under the name of M. J. Martinez, Consulting and Contracting Engineer.

Mr. John W. Gates has resigned as President of the Illinois Steel Co., the resignation to take effect on Dec. 31, 1898. The Illinois Steel Co., is one of the corporations that make up the new Federal Steel Co., of which Judge Elbert H. Gary, of Chicago, Ill., is President.

Capt. Jos. H. Crawford, civil engineer, Pennsylvania R. R., has returned from Cuba, where he has been for the past two months assisting Col. Frank J. Hecker, Chief of the Division of Transportation of the United States, in looking after the transportation means of that country. In speaking of the railroads in that island, he states that they show that about $50,000 a mile was invested in them, No attempt is made to keep the roads in order. Grass has grown in the ditches and sidings, and the bridges are of obsolete design, and are not capable of bearing heavy traffic. The culverts are fairly good, being built of concrete.

Capt. J. Francis Le Baron, M. Am. Soc. C. E., Jacksonville, Fla., late of the 10th U. S. Volunteer Infantry, has just returned from Honduras, Central America, where he went last August as Chief Engineer of the American-Honduras Co., to make examinations and surveys of the bar and river Potuca, for the purpose of designing a system of jetties for deepening the channel through the bar. He is now engaged in the preparation of detailed plans and estimates, and work has been commenced at the harbor by the company and will be pushed to a rapid conclusion. The company has a valuable land grant of 250,000 acres, and exclusive rights of navigation of the river.

OBITUARY.

Mr. Alfred Stephen Adams, Superintendent of the Hyde Park Water Co., of Hyde Park, Mass., died Dec. 15, at the age of 73 years.

Mr. Najah Taylor, Superintendent of the Brooklyn Polytechnic Institute, died in Brooklyn, N. Y., on Dec, 16, at the age of 53 years.

Mr. James Duane Wheeler, at one time a prominent railway contractor, died at St. Paul, Minn., on Dec. 11. Mr. Wheeler was born in Massachusetts in 1820.

Mr. John E. Wooten, at one time General Manager of the Philadelphia & Reading R. R., and well known as the inventor of the Wooten firebox for locomotives, died in Philadelphia, Pa., on Dec. 16, aged 76 years.

Mr. Charles E. Leary died in New York city on Dec. 13, after a long illness. At the close of the Civil War he was a member of the firm of Ravanel & Co., of Charleston, S. C., and built a large number of steamships, operating a line of vessels from New York to Charleston, and another from New York to Savannah. The line was afterward extended from Charleston to Fernandina, Fla. Mr. Leary was also active in marine insurance, being connected with the National Lloyds Co., of New York. He was for some years Vice-President of the Mutual Gas Light Co., of the same city.

Mr. Charles G. Lundborg died in New York city, on Dec. 3, at the age of 74 years. Mr. Lundborg was born in Stockholm, Sweden, and was an officer in the Swedish navy before coming to this country. He gained a reputation in marine circles through an unsuccessful attempt to raise the sunken Russian vessels of Sebastopol during the Crimean war, and turned his attention to naval architecture, in which work he continued until the sickness preceding his death.

Ex-U. S. Senator Calvin Stewart Brice, prominently interested in railway and other enterprises, died suddenly at his residence in New York, of pneumonia, on Dec. 15. Mr. Brice was born in Denmark, O., on Sept. 17, 1845, and was the son of a Presbyterian clergyman. He graduated in 1863 from the Miami University, at Oxford, O., but in the meantime had served in the army; in 1864 he was again in the field with the 23d Army Corps, and was appointed a Lieutenant-Colonel. He took the law course at Michigan University in 1865, and practiced law at Lima, O. Here he became interested in the affairs of the old Lake Erie & Louisville Railroad Co., and was so successful that he later undertook the construction of the Nickel Plate system in opposition to the Lake Shore. At the time of his death he was President of the Lake Erie & Western R. R., and the Cleveland, Akron & Columbus Ry., was Vice-President of the Duluth, South Shore & Atlantic Ry. He was also a director of the Chicago, Indianapolis & Louisville Ry., of the Pacific Mail Steamship Co., the Welsbach Commercial Co., and the Chase National Bank. He was also largely interested in the American China Development Co., which lately secured a concession to build a railway from Hankow to Canton.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 27. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Dec. 28. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.

ENGINEERING SOCIETY OF WESTERN NEW YORK.
Jan. 2. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 2. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.

FRANKLIN INSTITUTE.
Jan. 3. "Methods for the Examination of Explosives," Dr. W. J. Williams. Jan. 17. "The Clarification and Purification of Municipal Water Supplies," Mr. Allen Hazen. Jan. 20. "This Country of Ours," John Birkinbine. Secy., Wm. H. Wahl, 15 South 7th St., Philadelphia, Pa.

WESTERN SOCIETY OF ENGINEERS.
Jan. 3. Annual meeting. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA.
Jan. 4. Secy., Howard Evans, Pier 45, Delaware Ave., Philadelphia, Pa.

ENGINEERS' CLUB OF ST. LOUIS.
Jan. 4. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 4. Secy.,C. W. Hunt, 220 West 57th St.,New York city.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Jan. 6. "The Electro-Metallurgy of Copper," John B.F. Hereschoff. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.

CHICAGO ELECTRICAL ASSOCIATION.
Jan. 6. "Telephone Engineering: Some Problems, Solved and Unsolved," S. G. McMeen. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

THE ENGINEERS' CLUB OF PHILADELPHIA.
Jan. 7. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Jan. 7. Secy., H. M. Gates, 12½ North High St., Columbus, O.

THE LOUISIANA ENGINEERING SOCIETY.
Jan. 9. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

ENGINEERS' CLUB OF KANSAS CITY.
Jan. 9. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 10. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.

NORTHWEST RAILWAY CLUB.
Jan. 10. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

NEW ENGLAND RAILWAY CLUB.
Jan. 10. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 12. Annual meeting. Secy., C. A. McNab, 112 Mansfield St., Montreal, Can.

ENGINEERING ASSOCIATION OF THE SOUTH.
Jan. 12. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

CENTRAL RAILWAY CLUB.
Jan. 13. Secy., H. D. Vought, 114 Fifth Ave., New York city.

ST. LOUIS RAILWAY CLUB.
Jan. 13. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

SCRANTON ENGINEERS' CLUB.
Jan. 14. Annual meeting. Secy., F. E. Pratt, 730 Madison Ave., Scranton, Pa.

MONTANA SOCIETY OF ENGINEERS.
Jan. 14. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

AMERICAN INVENTORS' AND MANUFACTURERS' ASSOCIATION.
Jan. 15. Annual meeting, Washington, D. C. Secy., Arthur Steuart, Washington Loan and Trust Bldg., Washington, D. C.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Jan. 16. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

TECHNICAL CLUB OF OMAHA.
Jan. 16. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Jan. 16. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Jan. 17. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

WESTERN RAILWAY CLUB.
Jan. 17. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Jan. 18. Annual meeting. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Jan. 18. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

NEW YORK RAILROAD CLUB.
Jan. 19. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

ENGINEERS' CLUB OF CINCINNATI.
Jan. 19. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 19. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

THE WEST VIRGINIA SOCIETY OF CIVIL ENGINEERS AND ARCHITECTS.
Jan. 19-20. Annual meeting, Charleston, W. Va. Secy., W. Steenbergen, Point Pleasant, W. Va.

NORTHWESTERN ELECTRICAL ASSOCIATION.
Jan. 19-21. Semi-annual meeting, Milwaukee, Wis. Secy., Thos. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 20. Annual meeting. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

ROCHESTER ENGINEERING SOCIETY.
Jan. 20. Secy., John F. Skinner,Reynolds Library Bldg., Rochester, N. Y.

THE DETROIT ENGINEERING SOCIETY.
Jan. 20. Secy, Henry Goldmark, Wayne Co., Sav. Bank Building, Detroit, Mich.

NATIONAL ASSOCIATION OF MANUFACTURERS.
Jan. 24-26. Annual convention, Cincinnati, O. Secy., E. P. Wilson, Room A, Chamber of Commerce, Cincinnati, O.

INDIANA ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Indianapolis, Ind. Secy., J. B. Nelson, 61 Baldwin Block, Indianapolis, Ind.

MICHIGAN ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Lansing, Mich. Secy., F. Hodgman, Climax, Mich.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 25-27. Annual meeting, Champaign, Ill. Secy., Jacob A. Harman, Peoria, Ill.

AMERICAN CHEMICAL SOCIETY.—The 18th annual meeting of this society will be held Dec. 27-28, at the Chemists' Club House, 108 W. 55th St., New York city.

ROCHESTER ENGINEERING SOCIETY.—The annual meeting and the meeting for the election of officers was held on Dec. 16. The paper of the evening, on "Topographic Methods of the U. S. Geological Survey," was presented by Mr. Warner W. Gilbert.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.—This association enjoyed an excursion on Dec. 16 to the Santa Ana Canyon, where the plant of the Redlands Electric Co. was inspected. The company furnished transportation and hotel accommodations for the visiting members.

THE CIVIL ENGINEERS' CLUB OF CLEVELAND.—The regular monthly meeting was held Dec. 13. A committee of three was appointed to consider the feasibility of renting new and better quarters for the club.

Mr. Edwin L. Thurston read a paper on "The Nature and History of Patent Rights." W. H. Searles, Secy.

NATIONAL BOARD OF TRADE.—The 29th annual meeting of this commercial association was held in Washington, D. C., on Dec. 13. The National Board of Trade was organized in 1868, and holds yearly meetings for the consideration of ways and means of securing unity and harmony of action in reference to commercial and financial matters of the country as a whole.

Committees were appointed on the following subjects: Banking and Currency; War Revenue Taxation; Interstate Commerce and Pooling; Interoceanic Canal; Postal Matters; American Merchant Marine; Reciprocity and American Trade; Inland Waterways; Department of Commerce.

The matter of protection and preservation of timber lands, with reference to the maintenance of sources of supply, and the influence of forest lands upon climatic conditions, was considered, and a resolution urging the various state legislatures to enact laws with this object in view was adopted.

A resolution favoring irrigation, storage reservoirs and means for increasing the agricultural products of arid sections of the country, all under the direction of United States authorities, was adopted.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.—The following is the list of nominations for officers of this Society for 1899:

President—Henry Adams, Washington, D. C.; J. H. Kinealy, St. Louis,Mo. First Vice-President—D. M. Quay, Chicago, Ill.; H. D. Crane, Cincinnati, O. Second Vice-President—A. E. Kenrick, Brookline, Mass.; John A. Fish, Boston, Mass. Third Vice-President—F. A. Williams, New York; A. C. Mott,Philadelphia,Pa. Secreatry—W. M. Mackay, New York; L. B. Sherman, New York. Treasurer—Judson A. Goodrich, New York; J. J. Blackmore, New York. Board of Managers—W. F. Wolfe, New York; S. A. Jellett, New York; Henry C. Meyer, Jr., New York; U. G. Scollay, Brooklyn, N. Y.; B. H. Carpenter, Wilkesbarre, Pa.; John D. Hibbard, Chicago, Ill.; A. A. Cary, New York; J. A. Connolly, New York; Thomas Barwick, New York; W. A. Russell, New York. Council—R. C. Carpenter, Ithaca, N.Y.; W. McMannis, New York; W. S. Hadaway, Jr., New York; John Gormly, Philadelphia, Pa.; D. M. Nesbit, London, Eng.; W. H. Bryan, St. Louis, Mo.; B. F. Stangland, New York; T. J. Waters, Chicago, Ill.; George Mehring, Chicago, Ill.; F. W. Foster, Boston, Mass.

NEW YORK ELECTRICAL SOCIETY.—The 192d meeting of this society was held on Dec. 14. The principal address of the evening was on "Ideas Underlying the Organization of the Volunteer Engineer Corps; the Work Accomplished by it in Porto Rico and the Opportunity for Further Usefulness," by Col. Eugene Griffin, Colonel of the First Regiment, U. S. Volunteer Engineers, and also First Vice-President of the General Electric Co. The topic, "Electrical and Engineering Work in the Navy During the War," was discussed by Mr. F. W. Roller, late Chief Engineer of U. S. S. "Nashville," who divided all electrical devices used on shipboard into two classes, the sucessful and the unsuccessful. Annunciators, range finders and various indicating and firing appliances apparently failed completely. On the other hand, incandescent lamps, motors and search lights proved of the greatest value. The failure of the lighter devices was attributed to defective design or wrong principle, or they could not be adapted to the conditions that obtained on board a ship of war. The range finder, for instance, was utterly valueless and was not used during the war. Elevations were found on the vessels by means of test shots with 6-pounders. The electrical firing apparatus was uncertain and unsatisfactory. The indicating apparatus was too delicate and complicated to stand the shocks which necessarily come on a warship, and it was continually getting out of order. Mr. Roller then read a brief paper on the same subject by Mr. W. D. Weaver, Editor of the "American Electrician," and late Chief Engineer of U. S. S. "Glacier," which strongly recommended the substitution of electricity for steam for operating all auxiliary apparatus on shipboard.

Capt. Zalinski, well known as the inventor of the dynamite gun that bears his name, spoke briefly of the work of the "Vesuvius" during the war.

LOUISIANA ENGINEERING SOCIETY.—The regular meeting of this society was held on Dec. 12. The paper of the evening was the "History of Street Pavements in New Orleans," by Mr. A. C. Bell, City Engineer.

The paper opened with a description of the site of New Orleans and a sketch of the history of the city. This was followed by an account of the development of street paving and improved sidewalks. In August, 1898, the character and mileage of street pavements in New Orleans was as follows, the estimated unit cost being given in the last column:

Material.	Miles.	Estimated cost per sq. yd.
Plank	40.64	*
Cobble-stone	40.49	2.00
Square block	26.14	5.00
Belgian block	2.32	4.25
Vitrified brick	5.83	2.50
Asphalt	11.98	3.10
Wood block	0.06	3.40
Shell	21.83	1.00
Gravel	42.55	1.50
Chert	2.78	1.75
Total	194.62	....

*$16 per M. ft. B. M.

The total mileage of streets open to use is 700, of which only about 18% have been improved.

Mr. Bell recommends Belgian blocks, asphalt and chert for heavy, medium and light traffic, respectively. The Belgian blocks are bedded in 2 ins. of sand on 6 ins. of concrete, the latter being placed on a tamped or rolled earth surface. The blocks are rammed or rolled, then their joints are partly filled with fine gravel and finally with pitch. The blocks are of granite, 4 × 10 ins., 5 ins. deep. The asphalt has the same kind of foundation as the block. On the concrete is laid a 1½-in. binder, and on this is placed the 2-in. wearing surface of asphalt. Chert roads are constructed as follows: After proper excavation the earth is rolled or tamped and 1 × 12-in. cypress boards laid on it. The first layer of chert is then spread to a depth of 6 ins., sprinkled and rolled. Two 3-in. layers, sprinkled and rolled, follow in succession, the last layer being worked until a compact, uniform surface is obtained.

NEW PUBLICATIONS.

AMERICAN WATER-WORKS ASSOCIATION.—Proceedings of the Eighteenth Annual Meeting, Held at Buffalo, N. Y., June 14 to 18, 1898. Peter Milne, Secretary, 12 John St., New York City. Paper; 6 × 9 ins.; pp. 208; illustrations. Price, $1.

Abstracts of the papers and discussions included in this report were published in our issue of June 23, 1898. Quite a wide range of subjects relating to water-works construction and operation are presented.

MISSOURI BUREAU OF LABOR STATISTICS AND INSPECTION.—Report for 1897-8. Compiled and Published by Arthur Rozelle, Commissioner of Labor, Jefferson City, Mo. Paper; 6 × 9 ins.; pp. 284; tables.

A large part of this report is taken up with statistics of various manufacturing industries of the state and a general review of the industries and condition of each county. The bureau has recently established a free employment bureau.

U. S. GEOLOGICAL SURVEY.—Bulletin 150: The Educational Series of Rock Specimens Collected and Distributed by the U. S. Geological Survey. By J. S. Diller; pp. 400; illustrated. Bulletin 151: The Lower Cretaceous Gryphæas of the Texas Region. By Robt. T. Hill and T. Wayland Vaughan; pp. 66; illustrated. Bulletin 152: A Catalogue of the Cretaceous and Tertiary Plants of North America. By Frank Hall Knowlton; pp. 247. Bulletin 153: A Bibliographic Index of North American Carboniferous Invertebrates. By Stuart Weller; pp. 653. Bulletin 154: A Gazeteer of Kansas. By Henry Gannett; pp. 246; maps. Bulletin 155: Earthquakes in California in 1896 and 1897. By Charles D. Perrine; pp. 45. Bulletin 156: Bibliography and Index of North American Geology, Paleontology, Petrology and Mineralogy for 1897. By Fred Boughton Weeks; pp. 130; Washington, D. C.; paper; 9 × 6 ins.

PROCEEDINGS OF THE 18TH ANNUAL MEETING OF THE INDIANA ENGINEERING SOCIETY. Held at Indianapolis, Jan. 4, 5 and 6, 1898. James B. Nelson, Secretary, Indianapolis, Ind. Published by the Society. Paper; 9 × 6 ins.; pp. 170.

Contents: Officers and Committees: Roads and Road Building, J. F. O'Brien; Brick vs. Asphalt for Small Cities, Harry L. Weber; National Road and Wernwag Bridge over White River at Indianapolis, Ed. Hill; The Columbia City, Ind., Sewer System, C. G. H. Goss; Engineering Expert Testimony, Prof. R. L. Sackett; The Municipal Engineer, A. J. Hammond; Methods of Construction and Assessment for Tile Drains, J. W. Fawcett; The Business End of Civil Engineering, C. G. H. Goss; Some Difficulties Encountered in City Surveying, H. B. Fatout; Retracing Old Lines, J. W. Fawcett; How we Make Ditches in Jasper County, John Alter; Minimum Grades for Drain Tiles, Wm. M. Whitten; Relation of the Board of Health to the Engineer, Dr. J. N. Hurly; Cement Testing, John W. Dickinson; Summary of proceedings at annual meeting.

METRIC TABLES FOR THE TRANSIT MAN.—By H. H. Filley, M. Am. Soc. C. E., Kansas City, Mo. Paper; 4 × 6½ ins.; pp. 14. Unbound so as to slip in note book.

Mr. Filley has been engaged for 15 years or more in railway surveys in Mexico, where the metric system is used in all measurements. He found that the field books used were not properly arranged for that system; and that considerable time was lost, and errors crept into the work of reducing radii, tangents and externals from the foot to metric measures. He then made a set of tables covering these reductions, and added to them a collection of trigonometric and curve formulas and a condensed table of "chords to a radius of 1," for protracting. The radii are computed for 20 m. chords down to a radius of 100 m., and for 10 m., or a half-chain, for all curves of less than 100 m. radius. This provides for the use of short chords where most needed, and keeps the correction so small, in sharp curves, that it may be readily and mentally interpolated. Mr. Filley has had these tables stereotyped, and offers to mail copies without charge to any engineer who may have use for the tables, and who will write him at the address given above.

LIVERPOOL TRIALS OF MOTOR VEHICLES FOR HEAVY TRAFFIC, May 24 to 27, 1898, conducted by the Liverpool Centre of the Self-Propelling Traffic Association; President, the Right Honorable the Earl of Derby, K. G. Judges' Report. Edited by E. Shrapnell Smith. Liverpool: Winstanley & Watkins. Paper; 9¾ × 6 ins.; pp. 126; illustrated. 5 shillings. Address the Association at Royal Institution, Colquitt St., Liverpool, England.

This report gives the regulations and conditions for competition, the points considered by the judges, rules for ascertaining cost of working, the general arrangements, and the methods of keeping records. Then follow illustrated descriptions of the vehicles which took part in the trial, with details of mechanism, and the results in each case. While notes of this trial have already been published in this journal, some of the conclusions of the judges are interesting. The vehicles used were all propelled by steam. The judges concluded that they were well fitted for many trade purposes and could economically take the place of horses, and they were capable of hauling loads up to 4 tons 30 to 40 miles. But the volume of traffic between Liverpool and the manufacturing districts is too large and varied to be dealt with by any isolated scheme of motor wagon transport. Although the calculated cost per net ton-mile shows a saving on existing railway rates the judges do not consider that motor vehicles could successfully compete for traffic in opposition to reduced railway rates, except under exceptional circumstances. The severity of the service on common roads, at useful speed, is such as to involve, perhaps, greater cost for maintenance than was used in the trials. As to the vehicles themselves, the wheels and tires used, though efficient as carriers were all structurally inefficient as drivers; none of the vehicles were handled quite as well as was expected, though the general control was at least as good as with the best type of horse-drawn vehicles. The motors would climb hills better than horses. At least two speed gears, or an equivalent reserve of power, are essential to successful working on common roads with steep or even average gradients. The most onerous conditions, however, are those involved in the limitations of the "Locomotives on Highways Act," of 1896. Legislative relief is here required. The judges believe that the experience gained in this trial will tend to obviate some of the difficulties encountered and they propose new trials with eight months' previous notice to builders of motor vehicles.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

ROLLER BEARINGS.—Hyatt Roller Bearing Co., Harrison, N. J. Pamph.; 6 × 9 ins.; pp. 34.

This is an illustrated catalogue and price-list of the "Hyatt" flexible roller bearings. It is claimed that these bearings save from 25 to 60% of the work of overcoming the frictional resistance of ordinary bearings. The pamphlet contains records of tests made at the Franklin Institute, showing reductions of the coefficient of friction, as compared with solid roller bearings.

ORNAMENTAL IRONWORK.—The Winslow Bros. Co., Chicago, Ill. Paper; 7 × 6 ins.; pp. 12.

This pamphlet contains excellent half-tone engravings of specimens of the company's work in the way of grilles, elevator cars and enclosures, balustrades, railings, stairways, lamps, etc.

METALINED OR OILLESS BEARINGS. North American Metaline Co., 6 West Ave., Long Island City, N. Y. Small circulars and leaflets.

These circulars, besides describing "metaline" and its merits, give directions for inserting metaline plugs in bearings. Metalined bushings are largely used on loose pulleys, and instances are given of their running for eight years at 380 revolutions per minute.

ELECTRIC SUPPLIES.—General Catalogue No. 14.—Western Electrical Supply Co., St. Louis, Mo. Cloth; 7⅜ × 10⅜ ins.; pp. 754; illustrated.

This is a full general catalogue of the principal lines of standard electrical goods and appliances handled by the Western Electrical Supply Co.

The book is very complete and will make a useful addition to any engineer's library, particularly as a supplement giving discounts is included.

ENGINES AND DIRECT-CONNECTED GENERATORS.—B. F. Sturtevant Co., Boston, Mass. Pamph.; 8 × 10½ ins.; pp. 8.

This is an illustrated circular of the "Sturtevant Generating Sets," with automatic horizontal and upright engines, direct-connected to dynamos of various forms. A novelty is a "midget" set, which has a 2½ × 2-in. engine, to run 1,000 revolutions per minute, with a 1,500-watt dynamo capable of furnishing current for 25 16-c. p. lights, the whole combination weighing only 400 lbs.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work. Place.	See Eng. News.
Dec. 22.	Bridge superstructure, Lorain, O.	Nov. 10
	Advertised, Eng. News, Nov. 10 and 17.	
Dec. 22.	Tunnel (500 ft.), Santa Barbara, Cal.	Dec. 15
Dec. 22.	Park work, New York, N. Y.	Dec. 15
Dec. 22.	Brick paving, Jacksonville, Fla.	Dec. 8
	Advertised, Eng. News Dec. 8 and 15.	
Dec. 22.	School bldg. improvements, Jersey City	Dec. 22
Dec. 22.	Breakwater block, Miminegash, P. E. I.	Dec. 22
Dec. 22.	Paving, etc., Philadelphia, Pa.	Dec. 22
Dec. 23.	Bridge, Santa Cruz, Cal.	Dec. 22
Dec. 23.	Repairing bridge, Chehalis, Wash.	Dec. 22
Dec. 23.	Brick sewer, Springfield, Mass.	Dec. 22
Dec. 23.	Armory building, Whitehall, N. Y.	Dec. 15
Dec. 23.	Extending electric plant, Boston, Mass.	Dec. 15
Dec. 23.	Police station, New York, N. Y.	Dec. 15
Dec. 23.	Storehouse, Brooklyn, N. Y.	Dec. 15
Dec. 23.	Police station, Brooklyn, N. Y.	Dec. 15
Dec. 23.	Police station, Long Island City, N. Y.	Dec. 15
Dec. 23.	Brick paving, grading, etc., Zanesville, O.	Dec. 15
Dec. 23.	Paving and grading, St. Louis, Mo.	Dec. 15
Dec. 23.	Dredging, New York, N. Y.	Dec. 15
Dec. 23.	Public building, Liverpool, N. S.	Dec. 15
Dec. 23.	Wooden barrel sewer, New York, N. Y.	Dec. 15
Dec. 23.	Light station, Tompkinsville (S.I.), N.Y.	Nov. 17
	Advertised, Eng. News, Nov. 17 and 24.	
Dec. 23.	Cement and seawall, Fort Morgan, Ala.	Dec. 1
	Advertised, Eng. News, Dec. 1 to 22.	
Dec. 23.	Auditorium, Charleston, S. C.	Dec. 8
Dec. 24.	Court house work, Milwaukee, Wis.	Dec. 15
Dec. 24.	Water-works, Hawkins Point, Md.	Dec. 15
Dec. 26.	Pipe sewers, South Bend, Ind.	Dec. 8
Dec. 26.	Electric lighting, Waterloo, N. Y.	Dec. 8
	Advertised, Engineering News, Dec. 8.	
Dec. 27.	Electric plant, Woodsfield, O.	Dec. 8
Dec. 27.	Scow boat, New York, N. Y.	Dec. 15
Dec. 27.	Electric wiring, Paterson, N. J.	Dec. 15
Dec. 27.	Gas and electric fixtures, Washington, D.C.	Dec. 15
Dec. 27.	Electric machinery, Topeka, Kan.	Dec. 22
Dec. 27.	Asylum building, New Bedford, Mass.	Dec. 22
Dec. 27.	School building repairs, New York, N. Y.	Dec. 22
Dec. 27.	Removing garbage, New Haven, Conn.	Dec. 22
Dec. 27.	Paving, curbing, etc., Atlantic City, N.J.	Dec. 22
	Advertised, Engineering News, Dec. 22.	
Dec. 27.	Barracks, etc., Hiltonhead, S. C.	Dec. 22
Dec. 27.	Water pipe, Jersey City, N. J.	Dec. 22
Dec. 27.	Timber and planks, Montreal, Que.	Dec. 22
Dec. 28.	Bridge work, Brooklyn, N. Y.	Dec. 22
Dec. 28.	Sewer bonds, Hackensack, N. J.	Dec. 22
Dec. 28.	Dredging, fill, lime, etc., Brooklyn, N. Y.	Dec. 22
Dec. 28.	Asphalt and granite paving, New York	Dec. 22
Dec. 28.	Paving, Baltimore, Md.	Dec. 22
Dec. 28.	Electric light plants, New York, N. Y.	Dec. 22
Dec. 28.	Cement, Providence, R. I.	Dec. 22
Dec. 28.	Steel truss bridge (140 ft.), Ogden, Utah	Dec. 15
Dec. 28.	Cast-iron pipe sewer, New York, N. Y.	Dec. 15
Dec. 28.	Steel bridge, Norfolk, Va.	Dec. 1
	Advertised, Eng. News, Dec. 1 to 15.	
Dec. 28.	Railway bridge, Chicago, Ill.	Nov. 24
	Advertised, Engineering News, Nov. 24.	
Dec. 29.	Street bonds, Georgetown, Ky.	Dec. 8
Dec. 29.	Asphalt paving, Louisville, Ky.	Dec. 22
Dec. 29.	Bridge superstructure, Boston, Mass.	Dec. 22
Dec. 30.	Repairs to workhouse, New York, N. Y.	Dec. 22
Dec. 30.	Station house repairs, New York, N. Y.	Dec. 22
Dec. 30.	Towing garbage scows, New York, N. Y.	Dec. 22
Dec. 30.	Scow, New York, N. Y.	Dec. 22
Dec. 30.	Self-dumping cars (6), New York, N. Y.	Dec. 22
Dec. 30.	Sewers, East Cleveland, O.	Dec. 8
Dec. 31.	Plans for station, etc., Stockholm, Sweden.	June 23
Dec. 31.	Bridge work, Plattsmouth, Neb.	Dec. 15
Dec. 31.	Steam boilers, Alexandria, Egypt	Dec. 15
Dec. 31.	Cleaning market grounds, Cleveland, O.	Dec. 15
Dec. 31.	Electric lighting, Eau Claire, Wis.	Dec. 22
Dec. 31.	Water bonds, Bemidji, Minn.	Dec. 22
Dec. 31.	Road materials, etc., New York, N. Y.	Dec. 22
Dec. 31.	Wooden pier, New York, N. Y.	Dec. 22
Jan. 1.	Electric lighting, Pleasantville, O.	Dec. 22
Jan. 1.	City hall plant, Bridgeport, Conn.	Aug. 18
Jan. 1.	Drawbridge, Cathlamet, Wash.	Nov. 17
Jan. 1.	Water-works, Pasadena, Cal.	Nov. 17
Jan. 1.	Electric plant, Pasadena, Cal.	Dec. 1
Jan. 2.	Bridge, Quebec, Que.	Sept. 20
	Advertised, Eng. News, Sept. 29 and Oct. 6.	

Jan. 2. Arc lighting, Vincennes, Ind............Oct. 27
Jan. 2. Storm sewer, etc., Hamilton, O. ....Dec. 8
Jan. 2. Bridge, Aspen, Colo......................Dec. 15
Jan. 2. Sea water pmpg franchise, Santa Cruz, Cal. Dec. 15
Jan. 2. Cutting and logging, Cherokee County, N.C. Dec. 22
Jan. 2. Drainage ditch, Ponca, Neb. ....Dec. 22
Jan. 2. Water bonds, Stanberry, Mo..............Dec. 22
Jan. 3. Bridge work, Nelson, Neb................Dec. 15
Jan. 3. Pipe sewers, Mount Vernon, N. Y. ....Dec. 15
Jan. 3. Sewers, Cincinnati, O. ....Dec. 15
Jan. 3. Church, Ashland, Ky. ....Dec. 15
Jan. 3. Court house, jail, etc., Balsam Lake, Wis.. Dec. 15
Jan. 3. Steel bridge, Brookhaven, Miss...........Nov. 24
Jan. 3. Water-works, Gaffney, S. C.................Dec. 1
Jan. 3. Bath plans, Albany, N. Y. ....Dec. 8
Jan. 4. Library building, Owatonna, Minn........Dec. 15
Jan. 4. Bridge work for 1899, Denison, Ia........Dec. 22
Jan. 4. Drainage ditch (8,300 ft.), Burlington, Ia.. Dec. 22
Jan. 4. Steamboat, Fort McHenry, Md. ....Dec. 22
Jan. 5. Library building, Cincinnati, O...........Dec. 22
Jan. 5. Pile trestles (3), Sacramento, Cal.........Dec. 22
Jan. 5. Water-works, Darlington, Okla...........Dec. 15
Jan. 5. Macadam roads (17½ miles), Decatur, Ind... Dec. 1
Jan. 6. Water-gas plant, Johannesburg, So. Africa.. Oct. 27
Jan. 6. Extension electric plnt, Johannesburg, S. Af. Oct. 27
Jan. 7. Gravel road, Valparaiso, Ind. ....Dec. 8
Jan. 7. Macadam road (10 miles), Cincinnati, O... Dec. 22
Jan. 9. School building, Wilmington, Del.........Dec. 8
Jan. 9. Water supply, Bucharest, Roumania......Dec. 15
Jan. 9. Excavating, paving, etc., Houston, Tex... Dec. 15
Advertised, Eng. News, Dec. 15 to Jan. 5.
Jan. 10. Portland cemt (12,000 bbls.), Duluth, Minn. Dec. 15
Advertised, Eng. News, Dec. 15 to Jan. 12.
Jan. 10. Pumping engine for dredge, Charleston, S.C. Dec. 15
Advertised, Eng. News, Dec. 15 to Jan. 12.
Jan. 10. Capitol building, Phoenix, Ariz...........Dec. 1
Jan. 10. Sewer bonds ($50,000), Grass Valley, Cal... Dec. 1
Jan. 10. Bridge work for 1899, Hastings, Neb......Dec. 22
Jan. 10. Jail building plans, Boone, Ia............Dec. 22
Jan. 12. Cement, St. Paul, Minn. ....Dec. 15
Advertised, Eng. News, Dec. 15 to Jan. 5.
Jan. 12. Power house, Annapolis, Md.............Dec. 22
Jan. 12. Sea wall, Annapolis, Md.................Dec. 22
Jan. 14. Park work and plans, Philadelphia, Pa... Nov. 17
Jan. 14. Steam tenders (3), St. Louis, Mo. ....Dec. 22
Jan. 14. Piles and stones, St. Louis, Mo. ....Dec. 22
Jan. 15. Sewers and drainage, Callao, Peru........Dec. 1
Jan. 15. Street cleaning, Indianapolis, Ind. ....Dec. 15
Jan. 16. Sale of telephone franchise, Duluth, Minn. Dec. 8
Advertised, Eng. News, Dec. 8 to Jan. 12.
Jan. 16. Pipe sewers, Elizabeth, N. J. ....Dec. 22
Jan. 17. Bridge and plans, Binghamton, N. Y.....Dec. 22
Advertised, Eng. News, Dec. 22 and 29.
Jan. 18. Court house plans, Mineola (L.I.), N. Y... Dec. 22
Jan. 18. Water-works, Winchester, Ind...........Dec. 22
Jan. 18. Extending electric plant, Winchester, Ind.. Dec. 22
Jan. 18. Sewers. Aiken, S. C.....................Dec. 15
Advertised, Eng. News, Dec. 15 and 22.
Jan. 24. Footway tunnel, London, England.......Nov. 10
Jan. 24. Iron bridges (2), St. Thomas, Ont.........Dec. 22
Advertised, Eng. News, Dec. 22 and 29.
Feb. 1. School building, Peoria, Ill. ....Dec. 1
Feb. 2. Electric lighting, New Orleans, La.........Nov. 3
Feb. 7. Sale of canal, Annapolis, Md.............Dec. 1
Feb. 10. Jail building, Keyser, W. Va............Sept. 29
Feb. 13. Water bonds, Reno, Nev.................Dec. 22
Mar. 15. Electric r'y (23 miles), Shanghai, China... Nov. 24
Advertised, Eng. News, Nov. 17 to Dec. 8.
Mar. 15. Purchase of water-works, Belem, Brazil... Dec. 1
Mar. 31. Telephone concessions, Shanghai, China.. Nov. 24
Advertised, Eng. News, Nov. 17 to Dec. 8.
No date. Artesian well, Victoria, Tex.............Dec. 22

RAILWAYS.

ALLEGHENY & WESTERN.—Reports state that the headings of the tunnel near Curwensville, Pa., on this extension of the Buffalo, Rochester & Pittsburg Ry., have been brought together. The tunnel is about 2,317 ft. long, 24 ft. high and 20 ft. wide. The excavating is expected to be completed before Dec. 25, and the work on constructing the arches will soon begin. The completion of the tunnel leaves only two extensive pieces of work to be done in that section. They are the Lyons cut, 104 ft. deep, between Curwensville and Adrian, and the Prenter cut, south of Curwensiville, which is 40 ft. deep. It is not expected to complete the Lyons cut before early spring. Bennett, Talbott & Smith, Contractors, Greensburg, Pa.; J. M. Floesch, Ch. Engr., Kittanning, Pa.

AUSTRALIA.—Press reports state that bids are being received for supplying 32,180 tons of steel rails and 3,258 tons of fish plates to the railway commissioner of Victoria, at Melbourne, Australia. The Agent-General for Victoria. at London, England, can give particulars.

BALTIMORE & SOUTHERN.—Reports state that negotiations are pending for the immediate construction of this proposed railway to connect Baltimore, Md., and Drum Point, via Millersville. Considerable work has already been done under the charter of the Baltimore & Drum Point Ry. Co., and much of the right of way obtained. The principal promoters are said to be Edward Lauterbach, of New York, and Frank R. Biedler, of Baltimore.

BANGOR & PORTLAND.—Henry I. Hoffman, Ackermanville, Pa., is reported to have been awarded the contract for building a two-mile extension of this line, from Pen Argyle, Pa., to the American Bangor slate quarry, to cost about $11,000. C. Miller, Pres., Bangor, Pa.

CENTRAL VERMONT.—P. H. Fitzgerald, New London, Conn., has been awarded the contract for the construction of a spur track from the main line at Montville, to Palmertown, Pa. Work was to begin this week. The siding will be about 2½ miles in length, with a graded incline of 200 ft.; estimated cost, $100,000. D. Mackenzie, Division Supt., New London.

CLEARWATER SHORT LINE.—This company has filed articles of extension in Washington for a branch line from Ainsworth, in Walla Walla county, to the state line near the mouth of the Clearwater River, a distance of 135 miles, and for a branch from the main line at or near the junction of Potlach Creek and the Clearwater River, Nez Perces county, Idaho, to the main line of the Northern Pacific near Connell, Wash., 140 miles. C. S. Mellen, Pres., St. Paul, Minn.; Thomas Cooper, Resident Agt., Tacoma, Wash.

COAHUILA CENTRAL.—We are informed that C. E. Corn, Saltillo, Mexico, has the contract for grading and track-laying on this proposed line, from Saltillo to Trevino, a distance of 60 miles. A further extension to Sierra Majada, in the State of Chihuahua, is also projected. The maximum grade is 2% and the maximum curve, 8°. Additional contracts will be let after Jan. 15. S. J. Martin, Pres. of Coahuila Central Construction Co., Saltillo, Mex.; John C. McMynn, Vice-Pres., The Rookery, Chicago; W. E. Dorwin, Gen. Mgr., 304 Tacoma Bldg., Chicago, Ill.; S. Potis, Ch. Engr., Saltillo.

COLUMBIA & WESTERN.—Steel is now being laid on the Robson-Picton branch of this new railway in British Columbia at the rate of about 2,000 ft. a day, beginning at West Robson. Three tunnels have been finished between Robson and Brooklyn, respectively 246 ft., 350 ft. and 700 ft. in length, but a number of trestles and culverts still remain to be built. Most of the grading has been completed, and when several large cuts shall have been made work will begin on a 3,000 ft. tunnel, four miles west of Brooklyn. Mann, Foley Bros. & Larson are the general contractors for this 105-mile piece of work.

COLORADO & SOUTHERN.—This company, which has obtained control of the reorganizd Gulf and South Park lines, has been incorporated in Colorado, with a capital stock of $48,000,000. The incorporators are: E. E. Whitte, Alexis D. Parker, John E. Macbeth, Thomas E. Dunaway and B. T. Winchell.

GUTHRIE, LANGSTON & DOWNS.—This company has been organized at Guthrie, Okla., according to reports, to construct a railway from Langston to Guthrie, thence southward to Downs, Okla., a distance of about 40 miles. The capital stock is $2,000,000, and the line is expected to serve as a connecting link for some proposed through line.

HANNIBAL & ST. JOSEPH.—Reports state that plans and specifications are being prepared for the construction of a new terminal system for the Hannibal & St. Joseph R. R. and the Kansas City, St. Joseph & Council Bluffs R. R. in Kansas City, Mo.; estimated cost, about $200,000. A new freight station will also be built at 12th and Mulberry Sts. L. F. Goodale, Ch. Engr., St. Joseph, Mo.

LITCHFIELD, CARROLLTON & WESTERN.—It is announced that Johnson Bros. & Faught, Contractors, St. Elmo, Ill., who purchased this line on foreclosure, will probably extend it from Litchfield, Ill., east to St. Elmo, via Coffeen, about 45 miles, and from Columbiana, Ill., to Qunicy, about 60 miles. The present route is from Columbiana to Litchfield, via Carrollton, 58 miles.

LOUISIANA & ARKANSAS.—This company has filed amended articles of incorporation in Arkansas, in order to increase its capital stock from $150,000 to $300,000. It is intended to construct an additional line from a point on the Vicksburg, Shreveport & Pacific R. R., at or near Sibley, La., in a southwesterly direction, through the parishes of Webster, Bienville, Natchitoches and Winn, and unite with a line in operation from Minden to Sibley. J. A. Buchanan, Gen. Mgr., Stamps, Ark.

MINNESOTA.—The Empire Lumber Co., of Winona, Minn., and other logging firms are said to contemplate the construction of a line of railway from Dedham into the Black River region for the purpose of hauling logs to the St. Croix, a distance of from 12 to 20 miles. It is thought that work will be commenced next spring.

NEWFOUNDLAND.—Reports state that Joseph Chamberlain, English Colonial Secy., has refused to disallow the railway contract made by this colony with W. G. Reid, 30 St. John St., Montreal, Que.

PENNSYLVANIA.—Reports state that Ora L. Nichols, County Surveyor, Coudersport, Pa., has been making surveys for the Lackawanna Lumber Co. for a railway to be built from Mina, Pa., to the top of "Lookout Mountain," for timber purposes. Many switch-backs will be needed as the grade is in some places 200 ft. to the mile. In the spring, an extension will probably be built to Austin and the line made permanent.

PITTSBURG & ALLEGHENY RIVER.—This company was incorporated in Pennsylvania, Dec. 15, with a capital stock of $30,000, to build a steam railway from 32d St., in Pittsburg, to Herrs Island, in Allegheny, Pa. The incorporators are: J. H. Park, Pres.; C. E. Clapp and John A. Sutton, all of Pittsburg; D. E. Park, Allegheny; W. G. Park, New York.

SAUGATUCK & SOUTH HAVEN.—This company was incorporated in Michigan, Dec. 16, with a capital stock of $176,000, of which $11,000 is subscribed and $550 paid in, to build a standard gage railway between the towns named. The incorporators are: A. A. Patterson, Jr., D. H. Patterson, J. W. Johnston, S. H. Kelly, Benton Harbor, Mich.; H. T. Leslie, Chicago; W. A. Patterson, Saratoga, N. Y.; F. McOmber, Berrien Springs, Mich.

TENNESSEE CENTRAL.—M. Schwerin, Vice. Pres. and Secy., Crossville, Tenn., informs us that the contract for the construction of this railway has been awarded to Naugle, Holcomb & Co., 355 Dearborn St., Chicago, Ill. The contractors agree to complete the first 60 miles from Harriman, Tenn., on the line of the Cincinnati Southern, via Rockwood, to Monterey, Tenn., in about 8 months. From Rockwood the road begins to ascend the Waldens Ridge to the top of the Cumberland Plateau, which is about 2,000 ft. above sea level; it will pass the Roane Iron Works on a steel viaduct of considerable height, and three miles from Rockwood the line will pass through a long tunnel; in fact, the entire line is cut through solid rock in many places at a very heavy outlay of labor and of dynamite. The line also passes through the celebrated Crab Orchard Gap, which is the only pass for a railway from Rockwood to Crossville, and from thence to Crossville a fairly level country is traversed. The distance from Harriman to Crossville is about 34 miles. From Crossville the company intends to run branch lines to the different coal banks west of Crossville. The coal seams will average nearly 6 ft., and has been declared by Mr. Fulton, a coal expert, of Johnstown, Pa., to be first class for cooking purposes. The coal fields cover 25 square miles, and there is also a plentiful supply of fine limestone, building stone, fire clay, and a good indication of coal oil and iron ore; also plenty of timber. The climate is good. Jere. Baxter, Pres., Nashville, Tenn.; Geo. T. Bigelow, Ch. Engr., Rockwood, Tenn.; George Westeon, Ch. Engr. of the construction company; temporary office, Rockwood, Tenn. The officers of the Central Land & Coal Co. are: W. F. Niedringhaus, Pres., St. Louis, Mo.; M. Schwerin, Vice-Pres. and Secy., Crossville, Tenn.; W. Niedringhaus, Treas., St. Louis. The company is a close one, for none of the stock is on the market. The grade of the railway from Harriman to Monterey is more than half finished, and the ties for nearly 20 miles are also on the line. The capitalists who are behind the project have ample means to finish the entire work from Harriman to Clarksville, Tenn., a distance of 220 miles. By the opening up of this new line the distance from New York to Nashville by the Southern R. R., via Knoxville and Harriman, will be shortened fully 100 miles, saving the distance from Knoxville to Chattanooga.

STREET AND ELECTRIC RAILWAYS.

HUDSON, MASS.—The selectmen have granted a franchise to the Clinton & Hudson St. Ry. Co. to build and operate an electric railway through this town.

MILFORD, MASS.—It is reported that the Pittsfield St. Ry. Co. contemplates the extension of its lines to Peck's and Onota. J. Tucker, Pres.

ANSONIA, CONN.—The Seymour Electric Ry. Co. has been organized in Ansonia, which proposes to apply for a charter granting it permission to build a trolley line from this city to Seymour, and thence to Beacon Falls, a distance of 10 miles. Connections are to be made with the Derby St. Ry. Co., H. H. Wood, Pres., of Derby, and the Waterbury Traction Co.'s line, which is expected to be extended from its present terminus at Naugatuck to Beacon Falls.

HARTFORD, CONN.—W. E. Goodwin, of Elmwood, Conn., and Fred C. Rockwell, of Hartford, are said to be the promotors of a project to build an electric line from Hartford to New Britain, via Prospect Ave. A charter will be applied for.

MERIDEN, CONN.—The Meriden Electric R. R. Co. expects to petition the next state legislature for permission to extend its lines in this city. N. H. Heft, Pres., 127 Pratt St.

NEW BRITAIN, CONN.—It is announced that the Central Ry. & Electric Ry. will ask the state legislature for permission to build several extensions to its system. A. M. Young, Pres., Chestnut St.

NEW HAVEN, CONN.—Reports state that Thos. M. Waller, Lieut.-Gov. Jas. D. Dewell, Israel I. Kelsey, Vice-Pres. of Winchester Ave. R. R. Co.; S. Harrison Wagner, of the New Haven St. Ry. Co., and W. B. Ferguson, Pres. of Winchester Ave. Co., have petitioned the general assembly for an act of incorporation empowering them to form a new street railway company, and to lay tracks through several streets in New Haven and through surrounding towns.

ELMIRA, N. Y.—It is reported that the American Engineering Co., Bound Brook, N. J., has been awarded the general contract for the construction of the proposed Elmira & Seneca Lake Electric Ry., which is to connect Elmira and Seneca Lake, via Watkins, Montour Falls, Millport and Pine Valley. Samuel Knapp, Montour Falls, will furnish the cross ties and trolley poles, and Michael Frank is to furnish 200 laborers. Work on the construction of the culverts, bridges, etc., will be commenced soon, but track will not be laid until the spring. Harry M. Herbert, Ch. Engr.

NEW YORK, N. Y.—It is announced that the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., has been awarded the contract for the steam and electrical equipment of the power house and street railway lines of the Third Ave. R. R. Co. The contract involves the expenditure of several million dollars, and covers the steam engines, boilers and entire steam plant, and the electric generators, rotary transformers and all other electrical apparatus required. The power house will be built at 216th St. Albert J. Elias, Pres., 1119 Third Ave.

NYACK, N. Y.—Work has been suspended on the proposed line of the Nyack Traction Co. until the spring.

CLIFFSIDE, N. J.—The Bergen County Traction Co., foot of West 130th St., New York, informs us that the construction of an extension of its line, from Fort Lee Ferry to Hudson county, via Cliffside, has not yet been positively decided upon, but will depend largely upon the terms of the franchises offered the company.

HARRISBURG, PA.—F. B. Musser, Supt., of Harrisburg Traction Co., informs us that the proposed extension to Lingleston was surveyed several years ago. Nothing has since been done, nor is it expected to build very soon. E. C. Felton, Pres.

PERKASIE, PA.—The Inland Traction Co. has been granted a franchise to build on certain streets in this borough. Pascoe & Crilly, Contractors, Allentown, Pa., are said to be interested.

PHOENIXVILLE, PA.—It is reported that work will soon be begun on a trolley line to be built by the Montgomery & Chester Electric Ry. Co., between Phoenixville and Spring City, six miles, with possible extensions to Limerick Square and Pottstown. John J. Ridgway, Pres., Philadelphia, Pa.

STONYCREEK MILLS, PA.—We are informed that Davis Bros., of Reading, Pa., have about completed preliminary surveys for an electric railway from this place to Friedensburg, a distance of 6 miles. It is expected that the right of way will be secured this winter, and that actual construction will begin in the spring.

VICKSBURG, MISS.—It is reported that Geo. F. McCullough, of Richmond, Ind., will have charge of the construction of the proposed electric railway and light plant in Vicksburg, for J. C. Shaffer, of Chicago.

CHATTANOOGA, TENN.—It is announced that the Chattanooga Electric Ry. Co. will expend $55,000 in improving and equipping its system. J. H. Warner, Pres.

ALLIANCE, O.—The Stark county commissioners have granted an extension of six months' time to the Stark Electric Ry. Co., within which to complete its line between Alliance and Canton.——H. Blakeley, of Alliance, is said to be interested in a projected electric railway to connect Alliance and Akron, to be 30 miles in length.

BUCYRUS, O.—Press reports state that F. Coleman Boyd, Vice-Pres. of New Haven Bar Register Co., and C. W. Blakeslee, Contractor, of New Haven, Conn., are interested in the construction of a proposed electric railway between Bucyrus and Galion.

CHAGRIN FALLS, O.—We are informed that all the grading has been completed on a 50-ft. private right of way for the Chagrin Falls & Eastern Electric R. R. Co., which proposes to build from South Newbury to Garretville, via Burton, Troy, and Hiram, a distance of 26 miles. Capital for construction has been secured. Jay E. Latimer, Cleveland, O., has the contract for the overhead work, and the contract for the tracklaying will be awarded Jan. 1. R. S. Hubard, Pres., Cleveland.

HAMILTON, O.—The Hamilton & Eaton Electric St. Ry. Co. was incorporated in Ohio, Dec. 15, with a capital stock of $10,000, to construct an electric railway between Hamilton and Eaton, via Camden, Somerville, Collinsville and Seven Mile, a distance of 125 miles. Incorporators are: J. H. Shallenberger, J. A. Walker, A. T. Elliott, J. C. Unzicker.

XENIA, O.—Reports from Xenia state that J. Wayne Neff writes from Philadelphia that he has made a contract with contractors in that city for constructing the proposed line between Xenia and Dayton.

TERRE HAUTE, IND.—Forbes Holton, of the Union Glass Works, and M. R. Williams, Mgr. of Strawboard Trust plants, of Anderson, Ind.; and Crawford Fairbanks, of Terre Haute, have formed a company for the purpose of building an electric railway from Terre Haute to Charleston, via Mattoon, Ill. The line will be joined to the Indiana system by a line from Indianapolis to the Terre Haute via Green Castle and Brazil.

LIBERTYVILLE, ILL.—The council has granted a 50-year franchise to the Chicago & Fox Lake Electric Ry. Co., to build in this village. A. W. Waldo, Village Pres.

SPRINGFIELD, O.—An electric railway between this city and Decatur is projected by a Chicago company, represented by F. L. Sparrow.

OSHKOSH, WIS.—The Citizens' Traction Co. has secured the right of way along the Ridge Road, between this city and Neenah. The company has 60 days in which to accept the franchises, and, if accepted, agrees to pay a forfeiture of $4,000 if the road is not completed by August 1. The plan is said to be independent of the Tillotson Interurban road along the lake shore.

LOS ANGELES, CAL.—The board of public works has recommended that the council grant a franchise to the Los Angeles Traction Co. to build an extension on 11th St. from Georgia to Hoover St. T. J. Hook, Pres.

LEAVENWORTH, KAN.—The commissioners of Leavenworth county have granted a 50-year franchise to A. A. Fenn and others, to construct an electric line connecting Kansas City and Leavenworth. Work is to begin by April 1, and to be completed before Jan. 1, 1900.

DENVER, COLO.—The Denver City Cable Ry. was sold at auction Dec. 15, to H. E. Rogers, representing Fred. P. Olcott, of New York, at $500,000.——It is also stated that the West End Electric Ry. was purchased by the same company at $40,000.

DARTMOUTH, N. S.—The council has appointed a subcommittee to prepare a by-law authorizing the town to supply its own electric light and operate an electric railway.

HAMILTON, ONT.—An act incorporating the Hamilton & Caledonia Co. will be applied for at the next session of the Ontario Legislature, for power to build a railway from Hamilton to Caledonia and Selkirk, thence to some pleasure resort on the shore of Lake Erie. The company proposes to try compressed air as a motive power, according to reports.

HAVANA, CUBA.—The property of the Ferro Carril Urbano was sold, Dec. 14, to a syndicate, headed by Col. G. B. M. Harvey, 32 Nassau St., New York, at $1,472,000, or $92 a share. Others that are interested are: Hanson Bros., Montreal, Que.; the Bank of Toronto; B. F. Pearson, Halifax, N. S.; Harry P. Whitney, New York, and others.

ELECTRIC LIGHT AND POWER.

SOUTHBRIDGE, MASS.—C. W. Weld, who owns the water privilege on the Quinebaug River, below Sanderdale, is considering the question of building a power plant. A local paper stated that a company may be formed.

CHERRY VALLEY, N. Y.—Dr. Geo. L. Merritt, S. W. Barnum and Alva Pearson have been appointed a committee to consider the question of electric lighting.

CROGHAN, N. Y.—The question of lighting this place with electricity is being considered.

ILION, N. Y.—It is proposed to vote at the next municipal election on the question of the city's ownership of the plant.

LOCKPORT, N. Y.—C. T. Raymond, Secy. Lockport Mfg. Association, writes us that plans are being prepared by state engineering department for a dam at this point, to furnish power during the winter. It is not known when bids for the work will be asked.

MANLIUS, N. Y.—W. J. Phillips, who has a franchise, proposes to build a new lighting and power plant.

MIDDLEPORT, N. Y.—Thos. P. Hammond, Village Clk., writes us that S. J. Lawrence, Niagara Falls, N. Y., has been awarded the contract for furnishing 25 lights for the streets at $68 a year. Another bid was received from J. A. Murray, Wilkes-Barre, Pa., at $95 a light.

NEWFANE, N. Y.—T. L. Bunting, of Hamburg, N. Y., and W. T. Ransom, of Lockport, N. Y., are reported as interested in a proposed power plant at this place.

NEW YORK, N. Y.—Bids are asked until Dec. 28 for furnishing the materials and for installing lighting plants for the fireboats "Zophar Mills," "The New Yorker," and the "Robert A. Van Wyck." John J. Scannell, Comr. Fire Dept., 157 East 67th St., Manhattan, New York.

ROCHESTER, N. Y.—Geo. E. Warner, Mayor, writes us that nothing has been done in reference to a municipal plant, save the mayor's recommendation to the committee.

CAMDEN, N. J.—The council committee has decided to ask for new bids for lighting the city with electricity for three or five years.

WILDWOOD, N. J.—Estimates for a plant have been submitted to the council.

BELLEFONTE, PA.—The council is considering estimates for a municipal plant, to be operated in connection with the water-works; estimated cost, about $9,000.

BELLEVUE, PA.—The Pennsylvania Light, Heat & Power Co. has asked for a franchise to operate in this city. The company proposes to build a plant on the Ohio River front.

HOMESTEAD, PA.—The Homestead Electric Light & Power Co. is reported to have purchased 400 ft. of ground along the river front, on which it is proposed to build a new plant.

ANNAPOLIS, MD.—Bids are asked by the bureau of navigation, Navy Dept., Washington, D. C., until Jan. 12, for constructing a power house at the naval academy. Ernest Flagg, Arch., 35 Wall St., New York.——The council has adopted an order offered by Mr. Moss to enter into a contract with the Annapolis Gas & Electric Light Co. for lighting the city for five years upon plans and specifications prepared by Charles G. Edwards, Baltimore, Md., and the street committee. It is upon the express condition that the company put in new lamps, the amount to be paid not to be greater than the present price, which is 25 cts. a light. It was thought impracticable and expensive for the city to build a plant of its own.

SALISBURY, N. C.—Press reports state that money is being subscribed to begin the construction of the proposed power plant on the Yadkin River, for the Yadkin Power Co. Plans for the construction will be considered at once. W. C. Bulliet and Howard Lippincott, Philadelphia, Pa., and Theo. F. Kluttz and Walter Murphy, Salisbury, are interested.

SPARTANBURG, S. C.—Press reports state that Julius L. Carson, Spartanburg, is considering estimates of cost for a plant. It will consist of a 500-HP. water-wheel for 26-ft. head, 125 arc lights of 2,000 c. p., transmitting the currrent 10 miles to the city; dynamo for 2,000 incandescent lights, wire, insulators, transformers, etc.

YORKVILLE, S. C.—T. B. McClain writes us that bids are wanted at once for furnishing the machinery and for building a plant of 25 2,000-c. p. arc and 600 16-c. p. incandescent lights.

DALTON, GA.—This place voted Dec. 10 to issue $7,000 in bonds for a plant, according to reports.

CULLMAN, ALA.—W. H. Jones, Cy. Clk., writes us that this place voted Dec. 12 in favor of asking the legislature for authority to build a plant and water-works. The bill will probably be passed in January, after which steps will be taken to issue the bonds.

HUNTINGDON, TENN.—This place, it is stated, will soon vote on the question of issuing bonds for a plant.

GREENUP, KY.—We are informed that the Greenup Light Co., recently incorporated with a capital stock of $5,000, has purchased the plant now in operation. It does not propose to build an extension.

LISBON, O.—Press reports state that the council will soon establish a plant in connection with the water-works.

PLEASANTVILLE, O.—Bids are asked until Jan. 1 for lighting the streets of this village. Geo. L. Gebhart, Clk.

HARTFORD CITY, IND.—The question of purchasing the plant of the Hartford Light & Power Co. is being considered by the council.

WABASH, IND.—Press reports state as follows: A syndicate has been formed to acquire possession of 12 electric light and power plants now illuminating as many towns and cities in this part of Indiana, ranging in population from 4,000 to 25,000. These plants are all within a radius of 60 miles of Wabash, and the scheme originated in this city. Options on nine of the 12 plants have been obtained at favorable figures, and it is expected options on the remaining three will soon be closed. The aggregate price of the nine is $360,000, but the syndicate, which intends to add many and important improvements and extend the scope of operation to other fields, will be capitalized at $1,500,000. The capital for carrying out the scheme has been pledged in this and neighboring cities, together with parties in Indianapolis, Hamilton, O., and New York.

WINCHESTER, IND.—Bids are asked until Jan. 18 for furnishing the materials and for constructing an extension of the plant and for building water-works. S. D. Fox, Cy. Clk.

BELDING, MICH.—The council, it is reported, wants to grant a franchise for lighting the city by electricity.

LAWTON, MICH.—The council has awarded the contract for furnishing the machinery for the proposed plant to the General Electric Co., Schenectady, N. Y., and to the Wray-Austin Machinery Co., Detroit, Mich. The equipment will cost about $5,000, the building not included.

EDWARDSVILLE, ILL.—Plans have been completed for a plant for the Edwardsville Electric Light & Power Co., to take the place of the one recently destroyed. The company has asked for an extension to its franchise. C. A. Vallette, Secy. and Treas.

EAU CLAIRE, WIS.—Bids are asked until Dec. 31 for lighting the streets and public places with electricity. J. P. Cockrane, Cy. Clk.

MILWAUKEE, WIS.—The committee on public buildings of the county board is considering the advisability of installing a heat, light and power plant in the courthouse, to cost about $10,000. Nothing definite will be done until after Jan. 1.

FONDA, IA.—R. F. Beswick writes us that an election will be held in March to vote on the question of building a plant.

MADRID, IA.—The council has been asked to grant a franchise for electric lighting.

TOPEKA, KAN.—Bids are asked until Dec. 29 for furnishing and installing one 26 × 48 simple, heavy duty Corliss engine, a line of shafting and pulleys, one 40-in. two-ply belt, one 12-in. belt for the electric plant. Engine and shafting to include foundations, the setting, and the operation of same for two weeks. C. A. Fellows, Mayor; S. S. McFadden, Cy. Clk.

WELLINGTON, KAN.—John T. Stewart, A. Graff and W. A. Renn, of the Commercial Club, have been appointed a committee to urge the council to submit to the voters the question of issuing $100,000 of 4% bonds for a plant and improvements to the water-works.

ABERDEEN, S. DAK.—We are informed that the private plant is rather unsatisfactory, but no change has been made yet, although it is under consideration. The question of the city's putting in a plant is being considered.

EDGERTON, MO.—It is proposed to build a plant here, according to reports.

ELDORA, COLO.—It is stated that a 20-year franchise has been granted to the Eldora Mining, Milling & Power Co. to put in water-works and electric lights for this town. Work will be commenced in the spring. The same company is erecting a 75-ton chlorination plant here at a cost of $80,000.

LAKE CITY, COLO.—The Hinsdale Electric Light & Power Co. is reported to have purchased land and a water right near Argenia Falls, which it will use for power purposes.

PRINEVILLE, ORE.—H. V. Gates, Albany, Ore., is considering the question of building a plant and water-works here.

SANTA CLARA, CAL.—The question of putting in incandescent lights in addition to the arc lights already in is being considered by the council. Councilmen Miller and Bray may be addressed.

EAST SOURIS, P. E. I.—The question of building a plant to be operated by water power is being considered, according to reports.

OTTAWA, ONT.—The Metropolitan Electric Light Co. of Ottawa, is arranging for the immediate construction of its plant at the Britannia water power lands. A canal 180 ft. wide, 9 ft. deep and 2,000 ft. long will be built. Thos. Lindsay, Pres.; Geo. Albert Wanners, Secy.; Henry Aylen, Solicitor.

PRESCOTT, ONT.—James Fowler, of Arnprior, Ont., it is stated, has asked for a franchise.

CASCADE CITY, B. C.—Press reports state that work has been begun on the proposed power plant on the Kettle River cascades. About 20,000 HP. will be developed. A dam 400 ft. and 35 ft. high will be built. The Dominion Mining & Development Agency, Ltd., London, England, and C. K. Millbourne, Civil Engr., Nelson, B. C., may be addressed.

WINNIPEG, MAN.—An election will be held Feb. 20 to vote on the question of issuing $50,000 in bonds for a municipal plant according to reports.

NEW COMPANIES.—Bradford Electric Light Co., Bradford, Ill.; $10,000; Robert Thompson, Daniel J. Phoenix, Edmund F. Deyo, John P. Code.

James River Construction Co., Richmond, Va.; $1,000,000; to construct a power plant and mills on the James River, etc.; R. Lancaster Williams, Pres., 227 East German St., Baltimore, Md.; A. W. Weddell, Secy. and Treas., Richmond.

Merchants' Electric Light & Power Co., New Orleans, La.; $300,000; to operate under a franchise recently granted to Cohn & Ber; M. Ber, Pres.; Jos. Simon, Vice-Pres.; E. W. Goldschmidt, Secy. and Treas.; C. A. Gaines, Ch. Engr.

Manhattan Lighting Co., New York; $250,000; to manufacture and supply gas and electricity for lighting, heating and power purposes in New York and Westchester counties; Henry D. Brenner, New York; H. E. Bowen, Brooklyn, and Henry P. Keith, Hempstead, L. I.

South African General Electric Co., Schenectady, N. Y.; $50,000; S. D. Greene, Henry W. Darling, J. R. Lovejoy, Schenectady.

Standard Automatic Lighting Co., East Orange, N. J.; $100,000; to erect light plants; Edmund K. Sargeant, Jr., Joseph Stretch, East Orange, N. J.; R. T. Stout, Asbury Park, N. J.

W. E. Douley Electric Light & Power Co., Big Rapids, Mich.; $40,000, fully subscribed; to supply electricity for light, heat and power; W. E. Douley, J. S. Douley, D. M. Martindale, Chicago, Ill.; J. W. Morton, W. I. Trott, Big Rapids.

Elizabeth Lake Water & Power Co., Los Angeles, Cal.; S. R. Thorpe, W. H. McCoy, P. C. Kennedy, C. C. Wright, H. L. Flast.

Swedesboro Light, Heat & Power Co., Swedesboro, N. J.; $25,000; Chas. D. Lippincott, Henry M. Ridgway, Chas. B. Mitchell, Thos. B. Turner, John C. Rulon, Benj. F. Lawrence, Jas. J. Davidson.

Pine Bluff Electric Light & St. Ry. Co., Pine Bluff, Ark.; $300,000, of which $175 has been subscribed; Jeff. Hicks, Pres.; Thos. L. Chadbourne, Jr., Vice-Pres.; H. H. Hunn, Secy. and Treas.

Tuolumne County Water & Electric Power Co., Columbia, Cal., to furnish water and electric power and light; $550,000, with $143,000 paid in; J. W. Ellis, Wm. Mansfield, Thomas Conlin, J. B. Pawnall, Columbia; M. B. Harrimann, Shaws Flat, Cal.; Geo. Wright, Springfield, Cal.; Geo. W. Hale, Sonora, Cal.

BRIDGES.

BOSTON, MASS.—Bids are asked until Dec. 29 for constructing the superstructure of fixed spans of the bridge on Summer St. extension across Fort Point Channel. Wm. Jackson, Cy. Engr.——The county commissioners are considering the question of having the Fitchburg R. R. Co. widen the bridge at Massachusetts Ave., North Cambridge.

MEDFORD, MASS.—A bridge of steel or masonry, from 50 to 60 ft. in width and of 60 to 70-ft. span, at the Mystic Ry., crossing by Boston Ave. into Somerville, is in contemplation at Medford.

NEW BEDFORD, MASS.—The county commissioners propose to construct a temporary bridge between New Bedford and Fish Island, to be used during the construction of the Fairhaven bridge.

BINGHAMTON, N. Y.—Bids are asked until Jan. 17 for furnishing plans and constructing a bridge across the Susquehanna River at Tompkins St., as stated in our advertising columns. B. W. Mosher, Cy. Clk.——At a meeting of the board of trade Dec. 13 it was decided to urge the council to take steps for the construction of a viaduct across the railroad on Chenango St. E. F. Jones, Pres.

BROOKLYN, N. Y.—Bids are asked until Dec. 28 for furnishing the material and constructing the Blissville bridge over Newtown Creek, at Greenpoint Ave.; surety, $10,000; for constructing a new superstructure, including electrical equipment and fender rack, for the Union St. bridge over Gowanus Canal; building safety gates for five bridges over the Gowanus Canal; installing electric circuit and furnishing electric motive power for the Washington Ave. bridge over Wallabout Canal and the Carroll St. bridge over Gowanus Canal. John L. Shea, Comr. Bridges, 280 Broadway, New York.

LE ROY, N. Y.—It has been decided to construct a bridge over the Buffalo, Rochester & Pittsburg R. R. at Haskins Crossing, 50 ft. long and 16 ft. wide, with 220 and 240 ft. approaches, to cost about $8,400. Half of the cost will be paid by the railroad company and $2,000 each by the state and town.

WATERTOWN, N. Y.—C. O. McComb, Cy. Engr., writes us that contracts will be let during January for the repair of the old Court and Factory St. bridges and possibly to build a new bridge at Pearl St.

NEWARK, N. J.—The Pennsylvania R. R. Co. has awarded a contract to the Edgemoor Bridge Works, Wilmington, Del., for the construction of a steel drawbridge 500 ft. long of three spans, across the Passaic River.

PHILADELPHIA, PA.—The following bids were received Dec. 13 for the steel superstructure drawbridge over the Schuylkill River at Gray's Ferry. To consist of pin-connected trussed spans on each side of the draw span, with plate girder viaduct approaches, entire length of metallic structure 1,660 ft. Thos. M. Thompson, Dir. Dept. Pub. Wks.:

New Jersey Steel & Iron Co., Trenton, N. J.	$189,000
Pennsylvania Steel Co., Steelton, Pa.	167,422
Phoenix Bridge Co., Phoenixville, Pa. (accepted).	145,000
Elmira Bridge Co., Elmira, N. Y.	164,750
Carnegie Steel Co., Pittsburg, Pa	186,493

NEWPORT NEWS, VA.—The Edgemoor Bridge Works, Wilmington, Del., has been awarded a contract to furnish the material and construct a viaduct 750 ft. long, requiring 1,000,000 lbs. of steel, for the Newport News Shipbuilding & Dry-Dock Co.

JACKSON, MISS.—We are informed that this place will issue Jan. 1 $20,000 of 6% 20-year bonds for the construction of a double span Melan arch bridge; also a number of small rolled girder bridges; by day labor. Walter G. Kirkpatrick, Cy. Engr.

GHENT, KY.—Reports state that the Ghent-Vevay Bridge & Terminal R. R. Co., with a capital stock of $35,000, has been chartered to construct a bridge over the Ohio River, between this place and Vevay, Ind. Albert E. Stone, Fred. Stucy, Sam Stucy and Sam Brown are interested.

CINCINNATI, O.—Robert McRoberts, Legislator, proposes to have the board of legislation submit a proposition to the board of city affairs to abolish the high bridges over the canal and construct draw bridges, at a cost of about $7,000 each.

TOLEDO, O.—It is reported that the receivers of the Detroit & Lima Northern Ry. Co. have been authorized by the U. S. court to expend $6,500 for repairing the bridge over the River Raisin. C. H. Roser, Ch. Engr., Detroit, Mich.

SAGINAW, MICH.—Geo. M. Brown, Ch. Engr., Flint & Pere Marquette R. R. Co., Saginaw, writes us that a contract has been awarded to the Toledo Bridge Co., Toledo, O., for the construction of a bridge over the river one mile west of Saginaw. One truss span 130 ft. long and 6 girder spans 15 ft. wide on pile foundation, capacity 4,000 lbs. per lin. ft.; estimated cost, $15,000. No other work is proposed. C. C. Bothfeld, Des. Engr., Detroit.

QUINCY, ILL.—A bridge 108 ft. long and 20 ft. wide will be constructed over Curtis Creek on Eighth St., to cost about $3,500, the city and county each to pay half.

ST. PAUL, MINN.—The following estimates for bridge work have been submitted to the council: High Bridge—New floor and pavement, $25,800; 3d St. Bridge—New floor, pavement and painting, $11,400; Edgerton St. Railway Bridge—New floor and pavement, $4,800; University Ave. Railway Bridge—New floor, pavement and painting, $17,600; Westminster St. Railway Bridge—New stringers, floor and painting, $5,100; So. Robert St. Railway Bridge—New floor, pavement and painting, $3,100; Western Ave. Bridge—Rebuilding, $6,000; Raymond Ave. Bridge—Rebuilding, estimated cost $46,000, funds on hand $25,000, necessary to raise $21,000; Wabasha St. Bridge—Rebuilding, estimated cost $110,000, funds on hand $27,000, necessary to raise $83,000; 6th St. Bridge—Rebuilding 180 ft., $15,000.

MILWAUKEE, WIS.—Ed. C. Lydon, Secy. Bd. Park Comrs., informs us that negotiations for the proposed bridges and viaducts on the extension of Highland Boulevard are still pending in court.

DENISON, IA.—Bids are asked until Jan. 4 for constructing and repairing bridges for the year 1899, according to reports. J. T. Carey, County Audr.

MAQUOKETA, IA.—Fred. Fischer, County Audr., informs us that the proposed 200-ft. iron bridge at Royertown will not be built this season.

HASTINGS, NEB.—Bids are asked until Jan. 10 for bridge work for the year 1899. D. P. Bigelow, County Clk., informs us that there are no specifications mentioned.

DENVER, COLO.—The committee, consisting of John Henderson, J. P. Carrigan, and T. D. Cobbey, will report Dec. 26 on the legality of constructing a viaduct over the railroad and river at 19th St. G. R. Weir, Pres.——The board of public works is contemplating the reconstruction of the old Blake St. Cherry Creek bridge and placing the old structure at Stout St.; also a bridge forming part of the old viaduct across the Platte River to be placed in location across Cherry Creek at South 14th St.——Reports state that surveys have been made by the city engineer for the proposed Bryant St. bridge.

GAINESVILLE, TEX.—The county commissioners' court has decided to construct several bridges across the Red River, and negotiations will be taken up immediately, according to reports.

DENVER, COLO.—The board of public works has decided to have D. W. Campbell prepare estimates for the proposed viaduct from 7th or South 7th Sts. to Highlands Boulevard and West Colfax Ave.

CHEHALIS, WASH.—Bids are asked until 5 p. m., Dec. 23, for putting in new truss timbers and braces for a 185-ft. span Pratt combination truss bridge. Albert Schooley, County Audr.

SEATTLE, WASH.—The county commissioners have awarded a contract to the San Francisco Bridge Co., at $3,695, for the construction of a bridge over the Green River.

SPOKANE, WASH.—A proposition to construct a bridge to connect the west end of Main Ave. with West Riverside Ave., and an incline bridge from the west end of Main Ave. to Peaceful Valley, will probably be brought before the council in the near future, according to reports.

LOS ANGELES, CAL.—The committee has recommended that a contract be awarded to Sawyer & Arthur, at $13,664, for constructing the Los Feliz, Ave. 26 and 9th St. bridges, and J. D. Mercereau, at $6,890 for the 6th St. bridge.

SACRAMENTO, CAL.—Bids are asked until Jan. 5 for constructing three pile trestles, a total length of about 214 ft., on Grand Island. W. B. Hamilton, Clk. Bd. Supervisors.

SACRAMENTO, CAL.—Marco Verozza, Comr., Placerville, Cal., has reported to the governors that $45,000 is required for new bridges along the Lake Tahoe wagon road. There are four bridges crossing the American River, one crossing Truckee River and one crossing Front Creek, which will have to be rebuilt within the next two years.

SANTA CRUZ, CAL.—Bids are asked until 10 a. m., Dec. 23, for a bridge across Valencia Creek. E. Martin, County Clk.

CHATHAM, ONT.—Owen McKay, Ch. Engr., Lake Erie & Detroit River Ry. Co., Walkerville, Ont., writes us that proposals are wanted at the earliest possible date for the superstructure of the Thames River bridge over the Erie & Huron Ry., at this place. It will consist of two girder spans each 75 ft. in length and a draw span of 278 ft.; estimated cost, $25,000.

ST. THOMAS, ONT.—Bids are asked until Jan. 24 for the construction of two iron bridges, each 120-ft. span, across Kettle Creek, as stated in our advertising columns. Jas. A. Bell, Cy. Engr.

BUILDINGS.

BOSTON, MASS.—Andrew Lumsden & Co., 30 Oliver St., Boston, has received the contract for heating and ventilfiating the hall of the Redemptorist Fathers' Mission Church, according to reports, at $2,800.

NEW BEDFORD, MASS.—Bids are asked until Dec. 27 for erecting a brick building at the city poor farm, Clark's Point; deposit, $500; Edmund O'Keefe, Supt. of Pub. Bldgs.; S. C. Hunt, Arch., Odd Fellows' Bldg.

BROOKLYN, N. Y.—Eight 3-story brick and stone flat and store buildings will be erected at Stuyvesant and De Kalb Aves. for Lewis Beers Sons, 1124 Myrtle Ave., to cost $80,000. H. Vollweiler, Arch., 483 Hart St.——The following were the lowest bidders Dec. 13 for making improvements to the Kings County Hospital in this city: Ryan & McFerran, 106 East 23d St., New York, for the erection of two new wings, $83,600, and for alteration to the central top story, $9,400; P. J. Carlin & Co., 26 Court St., Brooklyn, for the erection of an idiot pavilion, $5,700; for a nurse's home, $27,743.——Bids were received by the bureau of yards and docks, Washington, D. C., Dec. 10, for constructing a storehouse for ordnance materials at the Navy Yard, in Brooklyn, according to plans and specifications, as follows: Mordecai T. Endicott, Ch. of Bureau: Herman Probst, New York, $78,000. Berlin Iron Bridge Co., East Berlin, Conn., $74,431. W. & T. Lamb, New York, $76,755. Prinn & Tinker Iron Works, 555 West 33d St., New York, $68,800. Wm. H. Ellis, Washington, D. C., $77,009. Leonard Bros., 735 Bergen St., Brooklyn, $67,492. Thos. B. Rutan, Brooklyn, $69,540. Stacy B. Opdyke, Jr., Philadelphia, Pa., $83,394. King Bridge Co., Cleveland, O., $75,662. Grace & Hyde Co., 26 East 42d St., New York, $69,000. John H. Deeves, 287 4th Ave., New York, $63,738. Dequon-McLean Construction Co., 1 Broadway, New York, $85,700. Cooper & Egan, 1133 Broadway, New York, $68,884. John H. Parker Co., New York, $67,934. Post & McCord, Brooklyn, $74,855. Assurance Construction Co., 32 Broadway, New York, $68,498. W. G. Triest, New York, $63,226. Penn Bridge Co., Beaver Falls, Pa., $69,873. Ryan & McFerran, 106 East 23d St., New York, $76,754. M. Gibbons & Son, 318 Columbia St., Brooklyn, $62,975. John Thatcher, 54 Park Ave., Brooklyn, $72,682. P. J. Carlin & Co., 26 Court St., Brooklyn, $64,925. Mapes-Reeves Construction Co., 150 Nassau St., New York, $69,934. Structural Iron Co., Baltimore, Md., $68,150.

BUFFALO, N. Y.—Charles Mosier is reported to have been awarded the contract for building a freight house, 500 × 60 ft., for the Wabash R. R. Co., to cost about $10,000, and also a trestle for tracks alongside the freight house, to cost an additional $10,000.

LESTERSHIRE, N. Y.—M. S. Squires, Village Pres., informs us that the plans of J. Lewis Weir have been accepted for the proposed municipal building and central fire station.

MINEOLA (L. I.), N. Y.—Plans and specifications will be received by the supervisors of the new county of Nassau on Jan. 18 for the proposed court house and jail; estimated cost, about $100,000.

NEW YORK, N. Y.—Bids are asked by the Department of Correction, 148 East 20th St., until Dec. 30, for material and labor required for installing new bath room and wash room in workhouse, Blackwell's Island, and new showers, plumbing and partitions in the bath house in penitentiary, Blackwell's Island; two sureties, $3,000 each. Bids are asked by the police department of the city of New York, 300 Mulberry St., until Dec. 30, for furnishing materials and making and completing alterations, general repairs and improvements to the station house of the 18th Precinct, at 327 East 22d St.; also for completing alterations, general repairs and improvements to the station house of the 6th Precinct, at 17 and 19 Elizabeth St., Borough of Manhattan. Time for completion, 60 and 90 days respectively.——Bids are asked by the board of education, at 585 Broadway, until Dec. 27, for improving the sanitary condition of Public Schools 63, 101, 114 and 135, Boroughs of Manhattan and the Bronx; Public Schools 16, 22 and 27, Richmond, and Public School 45, Queens; for installing electric light plants in Public Schools 14 and 20, Richmond; and for removing the electric light plant now in Public School No. 93.——Plans have been filed by Francis J. Schnugg for four 5-story brick flat and store buildings, at 2d Ave. and 92d St., to cost $101,000. Martin Johnson, Arch., 78 East 96th St.; by Joseph Spota, 43 Spring St., for a 6-story brick apartment building on 114th St., near Amsterdam Ave., to cost $75,000. Neville & Bagge, Archs., 217 West 125th St.; by Emily Felt, 246 West 106th St., for a 7-story brick flat and store building, at 114th St. and St. Nicholas Ave., to cost $250,000. Neville & Bagge, Archs.; by John F. Scannel, 551 West 147th St., for an 8-story brick store building, at 39 East 19th St., to cost $90,000. Henri Fouchaux, Arch., 11th Ave. and 162d St.; by W. G. Webber, 55 West 101st St., for two 6-story brick flat buildings, at 120th St. and 7th Ave., to cost $170,000. G. F. Pelham, Arch., 503 5th Ave.; by Louis Cohen, 230 Sackman St., for eleven 2-story frame dwellings on Creston Ave., near 184th St., to cost $62,700. R. Werner, 7 Teasdale Place; by Jacob Fischel, 197 Henry St., for a 6-story brick flat and store building at 26 and 28 Market St., to cost $50,000. Horenburger & Straub, Archs., 122 Bowery.

NEW YORK, N. Y.—W. G. Triest, Contracting Engr., 39 Cortlandt St., New York, has been awarded the contract for building the mailing platform extension and shed for the New York Post Office, using galvanized iron instead of copper, at his bid of $11,437.

NEW BRIGHTON (S. I.), N. Y.—Francis A. Williams, 362 West Broadway, New York, is reported to have received the contract for installing a steam heating apparatus in the village hall, at $1,841.

BRIDGETON, N. J.—Bird P. Evans, Philadelphia, Pa., is stated to have received the contract for erecting a new insane asylum building for Cumberland county, at $57,393. E. Keeler & Co., Philadelphia, was awarded the contract for steam heating at $13,772, and Lewis W. Gould, Vineland, N. J., for the plumbing at $5,074. The other bidders for erecting the building were: Philip Anns, Philadelphia, $59,206; Jos. P. Best, Woodbury, N. J., $59,695.17; Bennett & Rothrock, Williamsport, Pa., $59,715; M. P. Wells & Co., Philadelphia, $59,907; R. C. Ballenger & Co., Philadelphia, $60,400; Jos. Steelman, Bridgeton, N. J., $60,991; F. A. Souders, Atlantic City, N. J., $61,200; J. E. & A. L. Pennock, Philadelphia, $61,234; Macy, Henderson & Co., Philadelphia, $63,495; Girard Construction Co., Philadelphia, $64,300; Jas. W. Lanning, Trenton, N. J., $65,000; Wm. Severns, Camden, N. J., $65,447; J. S. Rogers & Co., Stanwick, N. J., $65,498; B. F. Sweeten & Son, Camden, N. J., $67,698.87; Chas. W. Kaffer, Trenton, N. J., $67,921; Harry T. Nichols & Co., Philadelphia, $67,930; A. S. Reed & Bro., Wilmington, Del., $67,990; Harry B. Shoemaker & Co., Philadelphia, $69,990; Smith & Conover, Bridgeton, N. J., $72,300; Jas. Stewart & Co., Buffalo, N. Y., $77,500.

JERSEY CITY, N. J.—Bids are asked by the board of education, City Hall, until 9 p. m., Dec. 22, for alterations and improvements to Public School building No. 12, on Crescent Ave. J. J. Wiseman, Clk.

CARLISLE, PA.—The First Lutheran Church has decided to erect a new church building to cost about $50,000. Dr. Henry B. Wile, Pastor.

CHESTER, PA.—A new $100,000 high school building will soon be erected at Chester. Seymour Davis, Arch., 907 Walnut St., Philadelphia.

PHILADELPHIA, PA.—The Edgemoor Bridge Co., Wilmington, Del., has been awarded the contract for the erection of two large steel freight sheds for the Pennsylvania R. R. Co., at Piers 13, 14 and 15 North Wharves, foot of Vine St.; estimated cost, $42,000.——Plans have been approved of for a 4-story brick building to be erected at 15th and Cherry Sts., for the Young Friends' Association, to cost $32,000. Wm. L. Price, Arch., 731 Walnut St.——The following bids were received by Thos. M. Thompson, Dir. Pub. Wks., Dec. 13, for erecting the superstructure of a pavilion on Chestnut St. pier; (a) according to plans and specifications; (b) substituting copper for galvanized iron; (c) using galvanized iron in pavilion, and granolithic instead of wooden floors; (d) using copper in pavilion and granolithic instead of wooden floors; all local bidders:

	(a)	(b)	(c)	(d)	Time.
D. J. McNichol......	$85,185	$87,685	$84,685	$87,150	6 mos.
J. E. & A.L. Pennock	85,600	86,900	84,700	86,200	6 "
Armstrong & Printzenhoff	83,220	85,445	83,089	85,364	6 "
Ryan & Kelly	90,669	93,420	88,239	91,000	6 "
Charles McCaul	87,580	89,555	85,874	87,849	......
Macy,Henderson&Co.	84,287	86,760	87,737	90,170	5 mos.

WEST CHESTER, PA.—The trustees of the Westminster Presbyterian Church of this borough have decided to erect a $30,000 church building, at Church and Barnard Sts., on which work will be commenced early next spring.

WASHINGTON, D. C.—The Senate has passed bills providing for the erection of a new municipal building on Judiciary Square, to cost about $2,500,000, and a new U. S. Supreme Court building, at 1st, 2d, B and North Capitol Sts. N. E.

HILTONHEAD, S. C.—Bids are asked at the office of the chief quartermaster, Atlanta, Ga., until Dec. 27, for constructing one set of officers' quarters, two barracks, one hospital, etc., at Hiltonhead.

OPELIKA, ALA.—The commissioners of Chambers county have decided to issue $25,000 of 6% gold bonds with which to build a new courthouse. The contract will be let in January.

NEW ORLEANS, LA.—It is reported that the Stewart Bros., St. Louis, Mo., will probably erect a 12-story building in this city for the American Sugar Refining Co. H. E. Niese, Gen. Supt.

CINCINNATI, O.—Bids are asked until Jan. 5 for brick work, cut stone work, galvanized iron and tin work, plastering, painting and glazing, carpenter work and wrought and cast-iron work and plumbing for proposed alterations and additions to the Public Library building; also for erecting an elevator therein. L. L. Sadler, Chn. of Bldg. Com.; G. W. Drach, Arch., 519 Main St.; Thos. G. Smith, Jr., Consulting Engr., Hammond Bldg.

MARION, IND.—The grand jury has recommended that a new county jail be erected at once.

TERRE HAUTE, IND.—A fire in this city, Dec. 19, destroyed the buildings occupied by Havens & Geddes, Breinig & Miller and others, causing a total reported loss of $800,000.

ALTON, ILL.—The building occupied by Pierson & Carr, dry goods, was destroyed by fire Dec. 17; reported total loss, $50,000.

ELWOOD, IND.—A new city hall building will be erected here. Theodore Harnach, Chn. Bldg. Com.

MILWAUKEE, WIS.—The department store of G. Harstein Sons, at 18th St. and Fond du Lac Ave., was burned Dec. 16, causing a reported loss of about $80,000.

SHELL LAKE, WIS.—The commissioners of Washburn county have decided to erect a new jail to cost not less than $5,000.

CHICAGO, ILL.—Plans have been completed for the rebuilding of the Lincoln Theatre, to cost about $75,000. Carl Zimmerman is reported to be interested.——Postle & Postle, 204 Dearborn St., have completed plans for the reconstruction of the building at 150 Michigan Ave. for the Women's Athletic Club, at a cost of $50,000.—— William Dearing will build a 4-story brick apartment house at 1543 and 1545 Lill Ave., to cost $40,000.

MINNEAPOLIS, MINN.—Reports state that sketch plans have been prepared for an addition to the post office in this city, to cost about $75,000. James Knox Taylor, Supervising Arch., Washington, D. C.

BOONE, IA.—Plans and specifications are asked until Jan. 10 for a new jail building to cost about $10,000. M. D. McGregor, County Audr.

DES MOINES, IA.—It is announced that J. S. Polk, Pres. of Des Moines St. Ry Co., and others, will erect an 8-story building at 6th and Mulberry Sts., to cost about $250,000. Other buildings are planned to be erected in this city during the coming year to bring the total up to about $2,000,000.

NADEAU, KAN.—The following bids were received by the Office of Indian Affairs, Washington, D. C., Dec. 13, for the erection of a frame dormitory and school building on the Kickapoo Reservation: L. D. Eversole, P. O. Box 246, Topeka, Kan., $12,968; Samuel J. Thompson, Holton, Kan., $13,874; Thomas J. Bowers, 407 Monroe St., Topeka, Kan., $13,898; James Nesbit, Atchison, Kan., $12,800; Joseph H. Betts, 1029 Quincy St., Topeka, Kan., $14,402. Victor Bauer, Horton, Kan., $15,750; Herman & Babcock, Hiawatha, Kan., $13,482.

FLANDREAU, S. DAK.—The following bids were received by the office of Indian Affairs, Washington, D. C., Dec. 15, for (a) installing a steam heating plant in the Indian school at Flandreau, and (b) for conduits:

	(a)	(b)
American Heating Co., Duluth, Minn......	$16,157	$13,997
Hess & Rau, Watertown, S. Dak..........	13,098	10,598
J. J. Hanighen, Omaha, Neb...........	13,900	....
Pittsburg Htg. Supply Co., Pittsburg, Pa	17,944	10,500
Allen Black & Co., Minneapolis, Minn....	11,850	9,850
Augustus J. Archambo, Minneapolis, Minn.	11,660	9,160
Charles D. Symms	11,500	9,150
H. Moors Co., Milwaukee, Wis...........	11,000	9,316

ST. LOUIS, MO.—Christian Peper will erect a new 6-story warehouse on Main St., between Morgan and Lucas Aves., to cost $50,000.

ARKADELPHIA, ARK.—Reports state that Chas. L. Thompson will prepare plans and specifications for a $30,000 jail for Clark county. J. H. Crawford, Comr.

EL PASO, TEX.—This city has voted to issue $51,000 in bonds, of which $30,000 will be used for school purposes.——Maydwell & McClintock, 22 and 24 Sheldon Block, have prepared plans for a new city hall building, to cost $30,000, and for which bids were to be opened on Dec. 20.

ROSEBURG, ORE.—The court house of Douglas county was destroyed by fire Dec. 7. Reported loss, $40,000; insurance, $15,000.

FRESNO, CAL.—A fire in this city, Dec. 16, damaged the Voorman block, occupied by Radin & Kemp; reported loss, $100,000.

SACRAMENTO, CAL.—Plans have been accepted for the proposed 12-room high school building, to cost about $75,000. Bids will soon be asked. J. M. Curtis, 126 Kearney St., Arch., San Francisco.

WATER-WORKS.

PLYMOUTH, N. H.—A. F. Wentworth, Jas. N. McCoy, Frank H. Romins, Chas. J. Ayer and Warren G. Chase have been appointed a committee to purchase the works of the Plymouth Aqueduct & Water Co., for not more than $40,000, or, if failing in this, to arrange for the construction of new works.

ESSEX JUNCTION, VT.—E. R. Russell writes us that the legislature has authorized the village to increase its indebtedness to build works. No plans have been prepared and no decided action will be taken until April. Population, 1,000. J. S. Reynolds may be addressed.

PITTSFIELD, MASS.—The water mains will be extended at a cost of $5,000.

WESTERLY, R. I.—A syndicate has offered to purchase the works from the city at cost. L. W. Arnold may be addressed.

FAIRFIELD, CONN.—F. W. Siebert, Edward W. Shedd and C. Siebert have applied to the legislature for permission to build works for this place and Southport. This is probably an application for the renewal of the charter of the Southport Water Co., which was granted in 1889 and lapsed last month.

BUFFALO, N. Y.—The commissioners of public works have decided to put in apparatus at the pumping station for purifying the water for the boilers; estimated cost, $9,000. The apparatus will be purchased from Irlbecker & Son, Agents.

HUNTER, N. Y.—Press reports state that money is being subscribed for the construction of the proposed works, for which a franchise was granted in March, 1897, to John A. Longyear, of Kingston, N. Y. The capital stock of the company is $20,000. W. H. Cowan, of Montgomery, N. Y., is interested.

NIAGARA FALLS, N. Y.—The board of public works is again considering the question of improving the works, putting in a filter, etc. After estimates have been made the question will be submitted to the voters.

JAMESBURG, N. J.—It is reported that specifications for works have been adopted, and that bids for the construction will soon be asked by the city clerk.

JERSEY CITY, N. J.—Bids are asked until Dec. 27 for furnishing 1,020 lengths of 6, 8 and 12-in. cast-iron water pipe. Anthony Hauck, Chn. Com.

ORANGE, N. J.—Col. Daniel F. Minnihan, Orange, and the Borough Construction Co., New York, submitted the only complete bids, at $66,667 and $50,000, respectively, Dec. 12, for the engine house, pumping station, 16 and 20-in. cast-iron pipe, masonry dam, etc., for the improvements to the works and the increased water supply from Campbell's Pond. Fred. T. Crane, Cy. Engr.

HARRISBURG, PA.—At the election in February this city will vote on the question of purchasing new pumping engines, at a cost of about $75,000. E. Mather, Pres. Water Comrs.; M. G. Stoner, Select Councilman, may be addressed.

PUNXSUTAWNEY, PA.—The Punxsutawney Water Co. is considering the question of securing an increased water supply.

STEELTON, PA.—The Steelton Home Water Co. proposes to purchase a new pumping engine.

OAKLAND, MD.—G. S. Hamill, City Attorney, writes us that, due to the fact that the law authorizing the issuance of $30,000 in bonds for works was defective, no works will be built. Population, 2,000.

WASHINGTON, D. C.—The board of engineers in charge of the Washington Aqueduct is preparing a report on the matter of filtering the water supply, and will soon submit it to Congress. Lt.-Col. A. M. Miller, Chn. Bd.; John B. Wight, Pres. Bd. Comrs.

WEST TAMPA, FLA.—The contract for building the proposed works, as advertised in Engineering News, has been let to Guild & Co., Chattanooga, Tenn., at about $35,000. J. N. Hazlehurst, Engr., Tampa; M. E. Gillette, Chn. Com.

CULLMAN, ALA.—W. H. Jones, Cy. Clk., writes us that this place voted Dec. 12 in favor of building works and a light plant. The legislature will be petitioned in January to grant the city authority to issue the necessary bonds. Population (1890), 1,017.

AVONDALE, ALA.—The house of the legislature has passed the bill granting this place authority to issue $25,000 in bonds for works, the water supply to be secured from the Avondale Park Springs. J. R. Ellard may be addressed.

GADSDEN, ALA.—The legislature has been asked to grant this place authority to build municipal works.

PRATT CITY, ALA.—G. W. Brown, Chn. Citizens' Meeting, writes us that a committee has drafted a bill to present to the legislature asking for authority to issue $25,000 in 30-year 6% gold bonds for constructing works. The supply will be secured from wells. Population of city and that in in the immediate vicinity is 6,000; inside of corporate limit, 3,500. It is expected to extend the city limits. P. M. McNeil, Chn. Com.

COLUMBUS, MISS.—W. D. Humphries, Mayor, writes us that it will be about two months before anything definite will be done in regard to the proposed extension to the works. The new supply will be secured from the river and overflow wells. No engineer has yet been decided upon. Population, 6,000.

HOLLY SPRINGS, MISS.—We are informed that this city will bore two or three 8-in. wells, to be 500 ft. deep. Walter G. Kirkpatrick, Engr., Jackson, Miss.; D. C. Cannon, Cy. Clk.

CHATTANOOGA, TENN.—The water and gas rates committee has directed the city engineer to prepare a report and estimates for municipal works. After the report is made the legislature will be asked to grant the city authority to issue bonds, and if the request is granted a vote will be taken. J. J. Brown, Chn. Com.; E. Watkins, Mayor.

HILL CITY, TENN.—The Chattanooga Co., Ltd., Chattanooga, will soon begin the construction of the works, which, along with other improvements, will cost about $45,000. H. C. Beck, of the company, may be addressed.

KNOXVILLE, TENN.—Arrangements are being made for the purchase of the works of the Knoxville Water Co., which it is proposed to take possession of on Aug. 1.

RUSSELLVILLE, KY.—H. G. Frederick, Boonsboro, Md., has applied to the council for a franchise to build works. Population, 3,500. B. B. Andrews, Mayor.

IRONTON, O.—Press reports state that John W. Hill, Glenn Bldg., Cincinnati, O., has submitted a report for a better water supply, to cost about $55,000.

YOUNGSTOWN, O.—Press reports state that F. Herbert Snow, consulting engineer, Brockton, Mass., who has been in Warren, O., advising the commissioners of Trumbull county as to means of purifying the sewage at the county infirmary, has also been asked to visit Youngstown to confer with the water-works trustees relative to a source of supply other than the present source.

BROWNSTOWN, IND.—The council, it is stated, will take immediate steps looking towards the construction of works.

FORT WAYNE, IND.—The council has awarded the contract for furnishing a 6,000,000-gallon pumping engine to the Holly Mfg. Co., Lockport, N. Y., at $20,500.

FRANKTON, IND.—It is stated that this place has decided to build works.

SHERIDAN, IND.—We are informed that nothing will be done towards building the proposed works for the Sheridan Light & Water Co. before the spring. Chas. Pape, Sr., Pres. Fleming Mfg. Co., Fort Wayne, Ind., is interested.

SOUTH BEND, IND.—The council proposes to extend the water mains in certain streets. J. T. Kelley, Pres. Bd.

WINCHESTER, IND.—Bids are asked until Jan. 18 for furnishing and constructing works and for extending the electric plant. Estimated cost, about $50,000. S. D. Fox, Cy. Clk.

BAY CITY, MICH.—City Engineer Bloomshield has submitted preliminary plans for securing a pure water supply from Saginaw Bay, at a cost of about $55,000. The intake pipe will cost about $40,000.

DETROIT, MICH.—The water board will prepare estimates for an addition to the works sufficiently extensive to operate three high pressure pumps, two high pressure engines with a capacity of at least 24,000,000 gallons each a day, and a boiler plant with power enough for a subpumping station in the northern part of the city.

GRAND HAVEN, MICH.—The board of public works has recommended the purchase of new boilers for the works and electric light plant, to cost about $3,500.

JONESVILLE, MICH.—T. C. Brooks & Sons, Jackson, Mich., have been awarded the contract for furnishing the materials and for constructing the works, described in our issue of Nov. 10. J. D. Cook, Engr., Law Bldg., Toledo, O.; W. M. Wetmore, Clk.

IRONWOOD, MICH.—Press reports state that Edward Nelson, Mayor, has purchased the plant of the Ironwood Water Co. for $25,000, besides assuming the debt of $225,000 in outstanding bonds.

BEMIDJI, MINN.—Bids are asked until Dec. 31 for the purchase of $7,000 of 6% bonds for constructing the proposed works, noted last week. Ted Smith, Pres. Council; C. F. Schroeder, Village Recdr.

LITTLE FALLS, MINN.—F. E. Hall, City Clerk, informs us that the bond sale set for Dec. 17 has been postponed until some time in January.

MINNEAPOLIS, MINN.—Supervisor McConnell is urging the city to complete the new basins at a cost of about $100,000, and also to construct a filter plant at a cost of about $150,000. It is probable that the council will not ask for new bids for furnishing new pumping engines for some time to come.

DUBUQUE, IA.—The Dubuque Water Co. has given a trust deed for $800,000 to secure bonds issued for raising funds to improve its works.

SIBLEY, IA.—The question of building works is reported as being considered.

WELLINGTON, KAN.—The Commercial Club has appointed John T. Stewart, A. Graff and W. A. Renn a committee to urge the council to submit the question to the voters of issuing $100,000 in 4% bonds for municipal works and an electric light plant.

STANBERRY, NEV.—Bids are asked until Jan. 2 for the purchase of $3,000 of 20 year 5% bonds for the proposed water tower. W. A. Erwin, Mayor.

ABILENE, TEX.—The Lytle Water Co., it is stated, has decided to enlarge Lytle Lake so as it may hold 200,000,000 gallons more water than at present. Other improvements to the works may also be made. N. Werenskiold, Engr., P. O. Box, 511, Dallas, Tex.

DALLAS, TEX.—The question of improving the works is being considered.

GREENVILLE, TEX.—Tests are being made by Lestargetter & Co. for a new water supply to be owned by the city, according to reports.

MARLIN, TEX.—C. C. Chatham, it is stated, has purchased 35 acres of land, about 1½ miles from here, on which it is proposed to build new works and sink wells for a water supply for this place.

VICTORIA, TEX.—Bids are wanted at once by J. H. Schneider, Jr., Chn. Com., for sinking a 6-in. artesian well for an additional water supply.

ENID, OKLA.—Joe. Meibergen, Mayor, writes us that the city is corresponding with manufacturers for estimates for works. The supply will be secured from wells. Population, 3,500.

ELDORA, COLO.—The trustees have granted a 20-year franchise for works and a light plant to the Eldora Mining, Milling & Power Co. Work will be begun early in the spring.

FLORENCE, COLO.—Judge M. S. Bailey has granted an injunction restraining the city from putting in works at a cost of $135,000. The injunction was sustained because Trustee Deibert failed to receive official notice of the special meeting of the town board when the ordinance was passed calling an election. The board is determined to build the works on the original proposition. The bids for the construction were given in our last issue. Another election will be held Dec. 29.

LEADVILLE, COLO.—The Leadville Water-Works Co. was incorporated Dec. 14 by C. N. Priddy, Supt. and Secy., Leadville; Andrew N. Dix, B. L. Carr and W. E. Hawks, Bennington, Vt. The company is formed to acquire by purchase the property and franchises of the Leadville Water Co. for supplying the city with water for fire and domestic purposes; to erect plants for the generation of electricity and the compression of air. Capital stock, $400,000. The principal business of the company will be carried on at Leadville. Branch offices will be established at Boston, Mass., and Portland, Me.

KETTLE FALLS, WASH.—D. H. Brown writes us that an election will be held in January, to vote on the question of issuing bonds for works.

RITZVILLE, WASH.—This place voted Dec. 6 to sell the works to a company. The plant is said to be very incomplete, and the new owners will probably take steps at once to improve it. Population (1890), 700. M. R. Peters, Mayor.

PRINEVILLE, ORE.—H. V. Gates, of Hillsboro and Albany, Ore., proposes to build works and an electric light plant in this place.

OAKGROVE, CAL.—The Oakgrove Water Co. has been incorporated, with a capital stock of $10,000, by E. Fleur, M. Regnier and Edgar E. Lefebie.

PLEASANTON, CAL.—The question of the municipal ownership of the works is being considered.

SAUSALITO, CAL.—John H. Dickinson, Pres. Bd. of Trustees, writes us that nothing is likely to be done for some time towards a new water supply, which a new company proposes to secure.

PHOENIX, ARIZ.—An election will be held Jan. 12 to vote on the question of issuing $265,000 in bonds for municipal works and a sewerage system, or of issuing $150,000 for the works alone. Ernest Abs Hagen, Engr., Byrne Bldg., Los Angeles, Cal., and Adams Hotel, Phoenix; J. C. Adams, Mayor.

RENO, NEV.—Bids are asked until Feb. 13 for the purchase of $130,000 of 6% bonds for the proposed works. (Postponement from Dec. 12.) F. B. Porter, Cy. Clk.

STAYNER, ONT.—This place voted Dec. 13 to issue $24,000 in bonds for works.

INGERSOLL, ONT.—M. Mills, Mayor, writes us that no action will be taken towards the purchase of the works and light plant of the Ingersoll Water-Works Co. before next year.

UXBRIDGE, ONT.—It is stated that the question of building new works and a sewerage system is being considered. The supply will be received from wells. Population (1890), 2,023.

SEWERAGE.

SPRINGFIELD, MASS.—Bids are asked until 12 o'clock noon, Dec. 23, for completing the construction of the brick sewer in Fulton, Sargeant and Carew Sts. There will be about 1,000 ft. of 84×56-in. to 81×54-in. brick sewer. W. L. Dickinson, Supt. of Sts.; C. M. Slocum, Cy. Engr.

ROCHESTER, N. Y.—It is proposed to build a sewer in North St. Paul St. and to pave with macadam a portion of Alexandria St.; at a cost of $6,000 and $6,800, respectively. Peter Sheridan, Cy. Clk.

EAST ORANGE, N. J.—Wm. H. V. Reimer, Township Engr., 28 Maple Ave., writes us that the construction of the drains in the East Orange Boulevard is awaiting some definite action by the Essex County Park Commissioners as to the share of the cost which the commissioners will bear. The ordinance for the building of the drain has passed its first reading and will probably be laid over from time to time until the financial problem is solved. There will be 7,000 ft. of 66 to 34-in. brick sewer; average cut, 10 ft.; estimated cost, $53,000.

ELIZABETH, N. J.—Bids are asked until Jan. 16 for constructing about 800 ft. of 18 and 12-in. pipe sewers, etc. N. K. Thompson, St. Comr.

HACKENSACK, N. J.—Bids are asked until Dec. 28 by the Hackensack Improvement Commission for the purchase of $56,000 of 5% sewer bonds. L. A. Campbell, Clk., 76 Main St., Hackensack.

OCEAN GROVE, N. J.—The township committee has been asked to grant a franchise to the Sanitary Sewer & Sewage Utility Co. The company proposes to build a reservoir at Duck Creek of sufficient size to accommodate the sewage of the township, including Asbury Park, Ocean Grove, Bradley Beach and Avon. Capital stock, $1,250,000.

CARLISLE, PA.—Chauncey D. Ives, Chambersburg, Pa., has submitted plans and estimates for certain sewers to cost about $11,000. Councilmen J. E. Einstein, Pres., and Porter may be addressed. Councilman M. Cherry writes us that further information can be secured at an early date.

CHAMBERSBURG, PA.—The council has been petitioned to have surveys for a system made. Councilmen Hoffeditz and Kennedy may be addressed.

BALTIMORE, MD.—It is proposed to build a sewer from Eutaw St., near Druid Hill Park, to Jones Falls.

LAKEWOOD, O.—It is stated that this place is arranging to build a system.

LEBANON, IND.—Press reports state that it is proposed to clean and deepen about 30 miles of Prairie Creek and its tributaries. After this is completed it is possible that plans for a sewerage system will be considered.

BLOOMINGTON, ILL.—The council has voted to construct a brick sewer to drain the Sugar Creek Valley.

BUSHNELL, ILL.—An election was held Dec. 19 to vote on the question of issuing $17,000 in bonds for sewers.

ELGIN, ILL.—The commissioners have recommended the construction of new sewers, at a cost of about $7,000.

HAVANA, ILL.—H. C. Breidert, Cy. Engr., writes us that the city will advertise in the early spring for bids for extending the system. J. M. Henninger, Mayor; W. C. McKinney, Chn. Com.

MILWAUKEE, WIS.—The city authorities of Wauwatosa have asked the county board of supervisors to consider plans for improving the system of the county institutions near that city. A joint committee has been appointed to consider the question. The present system for the county buildings was built at a cost of about $22,500. D. G. Hathaway, Health Comr.

GRAND ISLAND, NEB.—A. C. Koenig, Cy. Engr., writes us that the city proposes to build 7,200 ft. of 8-in. pipe sewers in three districts. About 2,400 ft. will probably be built this season, and the balance will be postponed until next spring.

ST. JOSEPH, MO.—The council has decided to ask for new bids for building new sewers in Sewer Districts Nos. 56 and 16.

DENVER, COLO.—Wm. H. Taylor, Secy. Bd. Pub. Wks., writes us as follows in regard to the proposed Capitol Hill storm sewers: The bill for an ordinance creating Capitol Hill Storm Sewer District No. 1 of this city passed the board of supervisors unanimously, and is now in committee of the board of aldermen. It is hoped that the aldermen will pass the bill within the next few days. If it does, a notice calling for bids for the construction will then be published for 10 days. The bids would then probably be received and opened early in January. The entire work will cost about $1,000,000.

GUTHRIE, OKLA.—A. P. Saunders, Chn. Fire Comrs., writes us that the council has passed an ordinance directing the engagement of an engineer to prepare plans for a system. An election will be held to vote on the question of issuing bonds for the improvement.

SPOKANE, WASH.—The council is reported to have voted to build new sewers in Post and Pacific Sts. Councilmen Acuff and Schiller may be addressed.

LONG BEACH, CAL.—Estimates for a system have been submitted. There will be about 24,370 ft. of pipe; estimated cost, $25,000. C. J. Gouncher, Cy. Engr.; T. H. James, Consult. Engr.

PALO ALTO, CAL.—The question of building an outfall sewer, to cost about $35,000, jointly with the University, is reported as being considered by the board of city trustees. Trustee Mark may be addressed.

WATSONVILLE, CAL.—Plans are to be prepared at once for a system to cost about $35,000, according to reports.

PHOENIX, ARIZ.—Ernest Abs Hagen, Byrne Bldg., Los Angeles, Cal., has submitted plans for a system and waterworks to cost about $255,000. An election will be held Jan. 12.

GARBAGE DISPOSAL—STREET CLEANING

NEW HAVEN, CONN.—Bids are asked until Dec. 27 for removing the garbage from the city for one year from Feb. 1. Ward Bailey, Clk. Bd. of Health.

NEW YORK, N. Y.—Bids are asked by the department of correction, 148 East 20th St., Manhattan, until Dec. 30, for furnishing six self-dumping cars for Riker's Island and for furnishing a 200-ton scow, and also by Jas. McCartney, Comr. St. Cleaning, 346 Broadway, until Dec. 30, for the towing of loaded deck scows from the several dumps of the Boroughs of Manhattan and the Bronx to Riker's Island, and the return to the said dumps from Riker's Island of light scows.

CHICAGO, ILL.—The finance committee of the council has adopted specifications for moving the city garbage. Bids will be asked at once by L. E. McGann, Comr. of Pub. Wks.

STREETS AND ROADS

BOSTON, MASS.—The town of Revere has voted to improve Dolphin, Ware, Waverly and Garfield Aves., at a cost of about $10,000.

BRAINTREE, MASS.—A contract has been awarded to Charles McDermott & Sons, at $5,640, for constructing retaing walls, culverts and widening Commercial St.

HULL, MASS.—At a town meeting Dec. 13 it was decided to appropriate $3,000 for the repair of roads.

MERIDEN, CONN.—This place will make an effort to secure legislative authority to issue $200,000 in street improvement bonds.

NORFOLK, N. Y.—A resolution by County Commissioner Mein, Canton, N. Y., was adopted Dec. 9 for the improvement of about 2½ miles of highway.

NEW YORK, N. Y.—Bids are asked until Dec. 28 for granite block paving on concrete foundation on portions of four streets and asphalt paving on five streets. James P. Keating, Comr. Highways, 150 Nassau St.——Bids are asked until Dec. 31 for furnishing 11,000 cu. yds. of top soil, 4,250 cu. yds. of crushed trap rock, a 12-ton steam road roller, 10 750-gallon road sprinklers and six dump carts. Geo. C. Clausen, Comr. Parks, Arsenal, Central Park.

JAMESTOWN, N. Y.—Bids will soon be asked by the board of public works for paving Chandler St. with brick on concrete, between East Second and Windsor Sts.

ATLANTIC CITY, N. J.—Bids are asked until Dec. 27 for about 21,340 sq. yds. of macadam, including excavation; 5,025 sq. yds. of brick paving on concrete, 13,840 lin. ft. of straight curbing, 512 lin. ft. of curved curbing, etc., as described in our advertising columns. J. W. Hackney, Cy. Surveyor.

JERSEY CITY, N. J.—The street and water commissioners will give a hearing Dec. 27 for the proposed improvement of Claremont, Orient, West Side and Greenville Aves., and the Hudson and Old Bergen Roads. Geo. T. Bouton, Clk.——A contract has been awarded to the New Jersey Mexican Asphalt Co. for the improvement of Prospect St.

MIDVALE, N. J.—The state road commission has passed favorably on a petition to have four miles of the Greenwood Lake Road improved next spring.

PHILADELPHIA, PA.—Bids are asked until Dec. 22 for furnishing and constructing asphalt, brick and macadam paving and electric lighting, sewers, etc., at Fairmount and Hunting Parks, according to reports. J. T. Vogdes, Ch. Engr. and Supt.

BALTIMORE, MD.—Bids are asked until Dec. 28 for paving on Forrest St. and two alleys. O. W. Connet, Acting Cy. Comr.

GULFPORT, MISS.—S. S. Bullis, Mayor, informs us that plans will be ready and a contract let about Jan. 1 for street and drainage work, for which $10,000 in bonds has been authorized.

LOUISVILLE, KY.—Bids are asked until Dec. 29 for asphalt paving on Von Borries Ave., Hepburn Ave., East Broadway and Chestnut St. Chas. F. Granger, Bd. Pub. Wks.

CINCINNATI, O.—Bids are asked until Jan. 7 for the construction of 10 miles of macadam on the Montgomery pike, between Norwood and Silverton; estimated cost, $15,000. Engr., J. A. Stewart, 518 Johnston Bldg.

CLEVELAND, O.—The council has resolved to grade, drain and curb Montgomery St., from Geddings Ave. to Parker St. Howard H. Burgess, Clk.

CROWN POINT, IND.—Michael Grimmer, County Audr., informs us that the following bids were received Dec. 17 for the construction of about 20 miles of macadam roads; advertised in Engineering News:

Chicago Crushed Stone Co., Chicago, Ill.	$127,890
Dolese Bros., Chicago, Ill.	125,750
Peters, Sullivan & Runyan, Orleans, Ind......	127,000
John Holloran, Hobart, Ind.	127,000
Brownell Improvement Co., Chicago, (accepted)	124,500

EAU CLAIRE, WIS.—Alderman E. S. Hammond writes us that the ordinance for brick paving on South Barstow, Kelsey and four other streets, has passed the council and the specifications were to be decided upon Dec. 21. Bids will soon be asked. C. A. Alderman, Cy. Engr.

LA CROSSE, WIS.—A special committee, composed of the mayor and three aldermen, will be appointed to investigate the present method of street paving and to recommend such new system as it may find on investigation to be preferable.

KEOKUK, IA.—Bids are asked until Dec. 31 for 2,100 cu. yds. of excavation, 3,767 sq. yds. of macadamizing and 2,204 lin. ft. of stone gutter, on Franklin St. G. M. Walker, Cy. Engr.

BRYAN, TEX.—The council has under consideration the question of issuing $15,000 in bonds for grading and graveling Main and intersecting streets.

DENVER, COLO.—The board of public works has requested an appropriation of $6,500 for paving repairs and about $24,000 for resurfacing Larimer and 16th Sts.

SEATTLE, WASH.—A hearing will be given Jan. 2 to consider the proposed improvement of 9th Ave., 10th Ave. and Lee St. W. V. Rinehart, Pres. Council; W. H. Parry, Comptroller.

SPOKANE, WASH.—The council has authorized the board of public works to prepare plans for asphalt paving on First, Monroe and Bridge Aves.

PORTLAND, ORE.—A petition for the paving of Alder St., from Sixth to Lownsdale Sts., with wooden block, has been granted by the council.

AUBURN, CAL.—J. B. Hayford informs us under date of Dec. 10 that the board of county supervisors wish to purchase a rock crusher and an upright boiler. Two members of the board have been to Stockton and San Francisco, but did not find what was wanted.

OAKLAND, CAL.—Resolutions have been passed by the council for macadamizing portions of Filbert, Jackson, Third, Sixth, Seventh and Harrison Sts.

SACRAMENTO, CAL.—Marco Varozza, Comr., Placerville, Cal., has reported to the governor that about $20,000 will be necessary for the maintainence of the Lake Tahoe wagon road for the next two years.

EDMONTON, ALTA.—The dominion parliament, Vancouver, B. C., has voted to appropriate $15,000 toward the construction of a wagon road from this place to the Yukon River.

MANUFACTURING PLANTS.

BOSTON, MASS.—It is reported that L. Edgar Trinson and others have petitioned the legislature for authority to construct and operate in the streets and highways of the commonwealth the refrigerating works for the purpose of distributing liquid ammonia and other like compounds.

NEW BEDFORD, MASS.—The W. S. Hill Electric Co. will soon erect a 4-story brick building, 30 × 80 ft., on the corner of Elm and Water Sts. Caleb Hammond & Son, Archs.

NORWICH, CONN.—H. P. Cummings, Ware, Mass., is said to have been awarded the contract for the construction of a one-story brick mill, 150 × 150 ft., and a boiler house, 35 x 77 ft., in this city, for the J. B. Martin Co., Ltd., Lyons, France; work to be completed by March 1.

BALDWINSVILLE, N. Y.—A fire here Dec. 19 destroyed the plants of the Kenyon Paper Mill, the New Process Rawhide Works, and the G. H. & A. T. Hotaling Flour Mill; reported loss, about $60,000.

LAUREL HILL (L. I.), N. Y.—The Nichols Chemical Works has filed plans for a proposed 3-story building, 115 × 78 ft., for the manufacture of its fertilizers.

LEONARDSVILLE, N. Y.—Reports state that the Eureka Mower Works will remove its plant from Utica, N. Y., to this place.

NEWARK, N. Y.—The Hunt Mfg. Co., Cato, N. Y., is considering the matter of removing its plant to Newark.

NIAGARA FALLS, N. Y.—The Electro-Chemical Co. has awarded the contract for the mason work on the 50 × 125-ft. addition to its plant to John Sandstrum, and the contract for carpenter work to Schumacher & Moyer.

BAYONNE, N. J.—Reports State that the Erie Dry-Dock & Shipbuilding Co. will establish an iron shipbuilding yard on Shooter's Island, near Bayonne. Andrew Carnegie is said to be interested.

NEWARK, N. J.—The tannery of the Chrome Patent Leather Co., at Ave C. and Thomas St., was destroyed by fire, Dec. 20, causing a reported loss of about $150,000; partly insured.

ALLEGHENY, PA.—A new $500,000 brewery building will be erected by the First National Brewery Co., between Preble Ave. and the river, according to reports. V. Wyss Thallman, Arch., Bissel Bldg.

CHESTER, PA.—S. I. Birkin & Co., lace manufacturers, will erect an addition to their plant at 2d and Clayton Sts., according to reports.

CONSHOHOCKEN, PA.—The pattern works and boiler house of John Wood, Jr.'s iron plant were destroyed by fire Dec. 14; estimated loss, $40,000.

ELLWOOD CITY, PA.—Reports state that Clark Bros., chief owners of the American Lamp & Brass Co., Trenton, N. J., will remove their western factory from Blairsville, Pa., to this city.

BALTIMORE, MD.—Bids are asked for the new Baltimore & Ohio R. R. Co.'s warehouse at Camden Station. Baldwin & Pennington, Archs., 44 South St, Baltimore.

DAHLONEGA, GA.—It is reported that the Dahlonega Consolidated Gold Mining Co. contemplates installing new machinery, and will erect a 200-stamp mill or two 100-stamp mills and a plant to treat the shipments. H. D. Ingersoll, Mgr.

DECATUR, ALA.—The Louisville & Nashville R. R. Co.'s shops, according to reports, will be enlarged. R. Montfort, Ch. Engr., Louisville, Ky.

NEW ORLEANS, LA.—The Home Ice Distilling Water Mfg. Co., Ltd., contemplates the erection of an ice plant at Water and Milan Sts., according to reports.

NEW ORLEANS, LA.—The plant and franchises of the New Orleans Abattoir Co., Ltd., will be sold at auction Jan. 4. W. C. H. Robinson, Special Master, Hennen Bldg.

TOLEDO, O.—W. C. McElhenny and C. H. Burchenal, of Pittsburg, Pa., are said to contemplate the erection of a dock and an asphalt plant in this city.

CONVERSE, IND.—The erection of a plate glass factory at this place is projected. R. M. Crouch is said to be interested.

EVANSVILLE, IND.—It is reported that a $100,000 distillery will be erected here by William Schelhorn, of Evansville, and others.

FAIRMOUNT, IND.—The Fairmount Zinc Co., according to reports, will erect a factory at this place. W. B. Pershing, Geo. E. and Chas. E. Potter, Directors.

DETROIT, MICH.—The Edward Armstrong Mfg. Co. has been organized, with a capital stock of $60,000, with $30,000 paid in, to manufacture window shade cloth, oil cloth, etc. A plant will be erected here, the main building to be 50 × 170 ft. Edward S. Madden, Pres.; Geo. S. Clark, Secy.

CHICAGO, ILL.—The American Stove Board Co. has awarded contracts to Geo. H. Fuller for erecting two main buildings, 80 × 250 ft. each, with one addition, 22 × 40 ft., for baking purposes; an engine room, 21 × 35 ft.; a boiler room, 25 × 34 ft.; coal room, 21 × 25 ft., and a 60-ft. smokestack. All to be built of brick, stone and iron. ——The plant of the Johnson Chair Co. was burned Dec. 23, causing a loss of about $90,000; insurance, $75,000.

PEORIA, ILL.—William M. Allen has been awarded the contract for the erection of additional buildings to the Great Eastern distilling plant.

APPLETON, WIS.—Reports state that the Riverside Fiber Co. contemplates the erection of a 30-ton sulphite plant here.

KAUKAUNA, WIS.—It is reported that the Badger paper mills may be rebuilt. Col. H. A. Frambach is interested.

WEST SUPERIOR, WIS.—The Great Northern R. R. Co. will erect a new steel elevator on St. Louis Bay, next spring, to have a capacity of 3,000,000 bushels.

ELY, MINN.—Simpson & Brown have awarded the contract for the machinery for their mill on Fall Lake, near here, to the Diamond Iron Co., Minneapolis, Minn.

SACRAMENTO, CAL.—The Union Iron Works of Root, Belson & Co. were destroyed by fire Dec. 14. Loss, $60,000; insurance, $20,000.

SALT LAKE CITY, UTAH.—The erection of a beet sugar factory at this place is projected. H. O. Fisher is interested.

MONTREAL, QUE.—Reports state that a company has been organized to erect a smelter for the treatment of ores of the Old Ironsides and Knot Hill companies, in the Boundary Creek District. Jay P. Graves, Montreal, is interested.

HAVANA, CUBA.—Reports state that a number of Chicago packers will erect cold storage plants at Havana, Santiago and in Porto Rico. P. D. Armour, G. F. Swift, Nelson Morris and Thos. J. Lipton are said to be interested.

MEXICO, MEX.—Press reports state that the Panuco Sugar Co. will erect a large refinery at this place. Denis Oliver, Pres.

SHANGHAI, CHINA.—The E. P. Allis Co., Milwaukee, Wis., has been awarded the contract for the construction of a new 500-bbl. flour mill at Shanghai, according to reports; shipments to be made by Feb. 1.

GAS PLANTS.

LAWRENCE, MASS.—Reports state that the Lawrence Gas Co. proposes to extend its mains next season.

SHARPSBURG, PA.—W. J. Barton, Borough Solicitor, will present an ordinance at the next meeting of the council, on the application of the American Gas Co. for right of way through the borough.

LOUISVILLE, KY.—The Louisville Gas Co. is preparing to construct a new plant and apparatus at a cost of about $100,000, according to reports. President Morris may be addressed.,

BELLEVUE, O.—It is reported that Baxter & Lynn have been awarded a contract for installing an artificial gas plant.

CHICAGO, ILL.—The People's Gas, Light & Coke Co. will construct a foundry building, 130 × 240 ft., of brick, stone and iron, at Townsend and Superior Sts., including a traveling crane; estimated cost, $15,000. Arch., Minard L. Beers.

IOLA, KAN.—This place will vote Dec. 26 on the question of issuing $40,000 in bonds for the purchase of the plant of the Iola Gas Co., according to reports.

MONROE, WIS.—It is reported that the Monroe Water-Works Co. has applied to the council for a franchise to construct and operate a gas plant, to cost about $25,000. W. H. Wheeler, Pres.

VENTURA, CAL.—Reports state that the Pacific Coast Oil Co. has awarded a contract to Lacy & Co., Los Angeles, Cal., for the construction of a 10,000 bbl. oil tank estimated to cost about $15,000; a compound Worthington pump will be installed, with a capacity of 1,200 gals. of oil per minute; also a pipe line, 2,500 ft. long, to conduct oil to the wharf.

NEW COMPANIES.—Kennedy Mfg. Co., Indianapolis, Ind.; $50,000; to manufacture gas meters; H. C. Jordan, J. P. McGrath, H. L. Kennedy, E. M. Bose and John E. Kennedy.

Gartlan Oil & Gas Co., Sistersville, W. Va.; $500,000, with $3,000 paid in; to mine and deal in oil, gas and materials; Thomas Gartlan, Parkersburg; J. C. Cappeau, Pittsburg; G. F. Dunham, U. J. Nevenschander, H. A. Jackson, Sistersville.

Home Natural Gas Co., Clarion county, Pa.; $6,000; to produce and supply natural gas; W. E. Davis, Treas. and John W. Buzard, West Monterey, Pa.; Thos. G. Christie, Allegheny City, Pa.; Calvin G. Christie, Butler, Pa.; E. Ralph Buzard, West Monterey, Pa.

MISCELLANEOUS CONTRACTS.

FIRE ENGINE.—Salem, Mass.—The council has appropriated $5,100 for a new steam fire engine.

DRAINAGE DITCH.—Ponca, Neb.—Bids are asked until Jan. 2 for constructing a drainage ditch. J. F. Ekeroth, County Clk.

PILES AND STONES.—St. Louis, Mo.—Bids are asked until Jan. 14 for furnishing piles and stones. Maj. Thos. H. Handbury, U. S. Engr., St. Louis.

STEAM TENDERS.—St. Louis, Mo.—Bids are asked until Jan. 14 for furnishing three steel-hulled steam tenders. Maj. Thos. H. Handbury, U. S. Engr., St. Louis.

DITCH.—Burlington, Ia.—Bids are asked until Jan. 4 for constructing a ditch 8,300 ft. long requiring about 26,000 cu. yds. of excavation. M. P. Sharts, County Audr.

DOCK.—Toledo, O.—It is reported that the Toledo Dock & Warehouse Co. has purchased land on Water St., between Jefferson and Monroe Sts., for the construction of docks.

STEAMBOAT.—Fort McHenry, Md.—Bids are asked until Jan. 4 for furnishing a steamboat for government service. N. G. McAlexander, A. Q.-M., Governor's Island, N. Y. H., N. Y.

CHANNEL WORK.—Chicago, Ill.—The board of local improvements has decided to straighten the Chicago River from Belmont Ave. to Lawrence Ave., to cost about $45,000.

TIMBER AND PLANKS.—Montreal, Que.—Bids are asked until Dec. 27 for furnishing timber and planks for the Harbor Commissioners. Alex. Robertson, Secy.; John Kennedy, Ch. Engr.

FREIGHT CARS.—New York, N. Y.—Reports state that the New York, Ontario & Western Ry. Co. and the Central R. R. of New Jersey, are in the market for 500 and 2,000 freight cars, respectively.

SEA WALL.—Annapolis, Md.—Bids are asked by the navy department, Washington, until Jan. 12, for constructing a sea wall at the naval academy. Arch., Ernest Flagg, 35 Wall St., New York.

WOODEN PIER.—New York, N. Y.—Bids are asked by the department of docks, Pier A, Battery Place, Manhattan, until Dec. 31, for building a new wooden pier at Catharine St and the East River.

PIER.—Philadelphia, Pa.—The Pennsylvania R. R. Co. has awarded to the Edge Moor Bridge Co. the contract for a steel and wooden pier, to be constructed at the foot of Wharves 13, 14 and 15, to cost about $40,000.

OLD STEEL RAILS, ETC.—Genoa, Italy.—It is stated that Edward Lambatti, of Genoa, is visiting the United States with a view to purchasing old steel rails and scrap for use in open-hearth steel manufacturing plants.

WHARF, ETC.—St. John, N. B.—Nicholas & Michael Connolly have been awarded a contract by the department of railways and canals for the construction of a wharf, including dredging, at the Intercolonial Ry. terminus.

FIRE ALARM SYSTEM.—Rochester, N. Y.—Commissioner Whalen will present a petition to the finance committee at the beginning of the year for an appropriation of about $35,000 for the construction of a fire alarm telegraph system.

CUTTING AND LOGGING.—Cherokee county, N. C.—Bids are asked by the Apalachian Land & Lumber Co., Apalachia, Cherokee county, until Jan. 2, for cutting and logging 35,000 to 50,000 ft. of logs per day, distance not to exceed 1½ miles.

BREAKWATER BLOCK.—Miminegash, P. E. I.—Bids are asked until Dec. 22 for constructing a new block at the outer end of the northern breakwater. Engr., Jas. B. Eagan, Charlottetown, P. E. I.; E. F. E. Roy, Secy. Dept. Public Wks., Ottawa, Ont.

EARTH FILL, LIME, DREDGING, ETC.—Brooklyn, N. Y.—Bids are asked until Dec. 28 for constructing an embankment of earth filling, furnishing 12,045 bbls. of Maine rock lime and dredging in Newtown Creek at Metropolitan Ave. Jas. Kane, Comr. Sewers, 265 Broadway, New York.

DOCK, DREDGING, ETC.—Two Harbors, Minn.—Reports state that the Duluth & Iron Range R. R. Co. will construct a new dock, No. 1, and dredge the harbor basin. The contract is soon to be awarded. J. L. Greatsinger, Pres. and Gen. Mgr., Duluth, Minn.; W. A. McGonagle, Supt. Bridges and Bldgs., Two Harbors.

JETTIES.—Honduras, Central America.—J. Francis Le Baron, Ch. Engr. American-Honduras Co., Jacksonville, Fla., is preparing plans and specifications for a system of jetties for deepening the Patuca River channel through the bar. The company has a valuable land grant of 250,000 acres and exclusive rights of navigation of the river.

PUMPING MINES.—Leadville, Colo.—The question of pumping the water from the workings of the claims of several of the mines in this vicinity is being considered. Operations will probably be conducted from the standard shaft of the Wolftone Co., which is now 600 ft. deep. It is proposed to make it deeper. Address the Wolftone Co., Leadville.

TELEPHONE SYSTEM.—Fergus Falls, Minn.—The Fergus Falls Telephone Co. is planning to establish toll lines in the spring, to connect the villages in this vicinity with the local telephone system, and has employed J. A. Colehour to secure the right of way for a line which will pass through Underwood, Battle Lake, Henning, Vining, Clitherall and Deer Creek, terminating in Wadena, according to reports.

RAISING VESSELS, ETC.—Washington, D. C.—Press reports state that at a meeting of the board on construction, held at the Navy Department, Dec. 19. It was decided to recommend to the Secretary of the Navy that public bids be invited for raising the battleship "Maine," in Havana Harbor; the Spanish armored cruiser "Cristobal Colon," lying 60 miles to the west of Santiago, and to recover or remove other property on the Cuban coast, including several Spanish gunboats and auxiliary cruisers sunk by Americans, or by the Spaniards, to prevent them from falling into the hands of the United States.

CEMENT.—Providence, R. I.—Bids are asked until Dec. 28 for furnishing cement for use in the sewer, water, highway and bridge departments during the coming year. The cement is to be of the best quality, fresh, fine tested in a sieve of 2,500 mesh a sq. in. At the option of the contractor, it may be contained in well-made, tight casks or in tight, good cloth sacks, and shall not have been exposed to dampness. The contents of each cask of natural cement shall be of the full net weight of 300 lbs. or three sacks to a cask, and of each cask of Portland cement of the full net weight of 375 lbs. or four sacks to a cask. Before the cement is received it shall be subjected to inspection and vigorous tests. Robt. E. Smith, Comr. Dept. Pub. Wks.

CONTRACT PRICES.

EARTHWORK.—Tampico, Ill.—In our issue last week it was stated that M. Riley & Co., Chicago, Ill., submitted a bid at 12.64 cts. a cu. yd. for 132,182 cu. yds. of earthwork for mile 11 of the Illinois and Mississippi Canal. This was a mistake, the bid being 92.64 cts. a cu. yd. This makes the bid of John Berhery, New York, the lowest, at 16.5 cts. a cu. yd. The work on this mile is considered very difficult, and the bids were much higher than for any other mile. Frank L. Wheaton, Civil Engr., 37 South Arlington Ave., East Orange, N. J., is interested in the lowest bid.

ELECTRIC LIGHTING.—Pasadena, Cal.—The council has awarded the following contract to the Pasadena Electric Light Co. for furnishing electric lights: The contract, which goes into effect Jan. 1, calls for 105 2,000-c. p. arc lights at $6.50 a month, all night on a moonlight schedule. Additional lights are demanded at the same rate. The former price paid for the same service was $10.25. It gives the city power to substitute, on 60 days' notice, 10 16-c. p. incandescent lights for each arc light, or 1,200-c. p. lights for the 2,000-c. p. lights. The incandescent lights, if required, must be placed in a continuous circuit on poles with extension arms of 6-ft., and to be scattered with a reflector. The public buildings, city hall, library, etc., will be lighted for one-third the commercial rate or single lights at $1 a month.

INTERCEPTING SEWERS.—Washington, D. C.—The following bids were received by the district commissioners Dec. 10, 1898, for building the northerly portion of the Tiber Creek and New Jersey Ave. high-level intercepting sewer, as advertised in Engineering News; the work will include 2,310 ft. of 14×14¼ ft. D-shaped sewer, 320 ft. of 9×11 ft. D-shaped sewer in C St., 35 ft. of bell section, and connections with existing sewers:

Bidder.	Price, a cu. yd.				
	Excavation, &c.	Br'k mas'ry, nat'l cem. mortar.	Vit. br'k masonry, Portland cem. mortar.	Concrete masonry in place.	Rubble stone masonry.
Lyons Bros., Washington	$0.80	$9.50	$18.00	$6.00	$7.00
J. K. Murphy, Washington	.83½	7.85	14.66	3.84	6.00
A. Williams, Washington	.61	8.60	15.50	4.52	5.00
T.B.Jones & Co, Baltimore	.65	8.10	15.00	4.40	5.00
B. J. Coyle, Washington.	.74	9.88	18.00	6.00	7.00
J. Jacoby, Wilmington...	.70	8.20	16.00	4.30	7.00
Lenman Bros.*	.99½	8.39	16.65	5.35	5.75

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*Grand Rapids, Mich.

IMPROVING ROAD.—Cincinnati, O.—The following bids were received by the board of city affairs Dec. 6 for improving Margins Ave.:

Bids Received at Cincinnati, O., Dec. 6, 1898, for Improving Margins Ave.

Bidder.	Concrete, 176 cu. yds.	Curbs, 564 lin. ft.	Curbs, circlr., 38 lin. ft.	Grading, 150 cu. yds.	Brick, 1,056 sq. yds.	Rolling, 1,056 sq. yds.	Repav'g granite, 20 sq. yds.	Total.
J. W. Sullivan, 230 Beresford Ave.	$2.20	$0.50	$0.50	$0.01	$0.88	$0.03	$0.30	$1,657
H. Diekmeier, 166 W. McMillan St.............	2.75	.45	.65	.01	.90	.03	.90	1,764
D. A. Walker, Cincinnati, O. (accepted).........	2.15	.48	.70	.15	.79	.05	.01	1,585
O. E. Robinson, 4647 Hamilton Ave............	1.90	.50	1.00	.01	1.00	.05	1.00	1,785
A. J. Henkel & Bro., 140 University Ave........	1.00	.45	.50	.01	1.05	.05	.01	1,612
D. Folz Asphalt Paving Co., 8th and Plum......	2.50	.48	.75	.01	.90	.03	.50	1,733
M. T. Flynn, 1252 Chase Ave..................	2.40	.47	.94	.01	.85	.03	.50	1,664

PIPE SEWERS.—Scranton, Pa.—The following bids were received by councils Dec. 8, 1898, for constructing pipe sewers in the 16th district: V. H. O'Hara, Scranton, $2.75 a lin. ft., complete; extra manholes, $35.00 each; extra basins, $90.00 each; extra house connections, $1.00 a lin. ft. M. J. Gibbond, Scranton, Pa., $2.35; extra manholes, $50; extra basins, $80; extra house connections, $1.25. Donohoe & O'Boyle, Scranton, $2,47½ a lin. ft. complete. Length of sewer, 4,352 lin. ft., of 8, 10, 12 and 15-in. pipe; average depth, 11 ft. The price a lin. ft. to include the building of 30 manholes, 12 basins, and 140 house connections to curb line (about 2,634 lin. ft.). Jos. P. Phillips, Cy. Engr.

ELECTRIC LIGHTING.—Lowville, N. Y.—The Wetmore Electric Co. has submitted to the board of trustees the following bids for street lighting: 32 arc lights of 2,000-c. p. to run from twilight to 1 o'clock a. m. on all but moonlight nights, and 5 lights on State St. to run every night, $50 a light a year; the same number of lights to run all night, $60 a year each; 40 arc lights until 1 a. m., same conditions as above, $50 a light; 40 arc lights all night, $60 a year each; 50 arc lights until 1 a. m., 5 all night, $50 a light; 50 arc lights all night, $55 a year each. In years past $1,800 a year has been paid for 32 arc lights until 12 o'clock midnight. According to the above proposition, the Wetmore company offers to give the same number of lights that have been the case in the past, giving an additional hour's service, for $1,600, or $200 less than has been paid. It seems to be conceded that more lights are needed, and there is also a strong sentiment in favor of all-night lighting. The present contract does not expire until May 5, 1899. The annual charter election occurs in March.

INDUSTRIAL NOTES.

THE W. S. DICKEY CLAY MFG. CO., Kansas City, Mo., has a contract for furnishing pipe for the new sewer system in the city of Mexico.

THE PHOENIX BRIDGE CO, Phoenixville, Pa., has been awarded the contracts for the iron work for the Gray's Ferry bridge, in Philadelphia, at its bid of $145,000.

THE F. W. EMERSON MFG. CO., Rochester, N. Y., has just shipped three of its adjustable drafting tables to the Civil Engineering department of the University of California, Berkeley, Cal.

THE CARNEGIE STEEL CO., Pittsburg, is announced in press despatches from London to have received an order for 40,000 tons of steel rails for the Cape, at 15 shillings a ton under the English bids.

THE DETROIT GRAPHITE MFG. CO., Detroit, Mich., has removed its New York office to the St. James' Building, 1133 Broadway, corner 2 th St. The office was formerly in the Home Life Building, which was injured by the recent fire.

THE PENNSYLVANIA STEEL CO., Steelton, Pa., has just shipped 2,000 steel poles to the city of Mexico, for use in the construction of a new electric railway. It is stated that the poles are of steel, 28 ft. in height, and that 8,000 will be required.

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, has received orders for 16 more locomotives for the Imperial Ry. of China, 30 for the Reading, 10 for the Chicago & Northwestern, 10 for the Midland R. R., of England, besides various smaller orders.

J. S. MUNDY, Newark, N. J., shipped last week a carload of hoisting engines to Portland, Ore., one being a special steel logging engine; a hoisting engine to Cuba for use in the sugar cane business, and also two double-cylinder double-drum engines to Pittsburg. Other recent shipments include two 60-ft. pile-driving machines, with 4,000-lb. hammers and 30 HP. engines and boilers complete to the Broklyn Navy Yard.

THE GROTON BRIDGE & MFG. CO., Groton, N. Y., reports a large increase in its output during the past year, the shops having run overtime since June 1. During the year the company has erected lift bridges over the Erie Canal at Syracuse and Utica, N. Y., a large shop for the Ingersoll-Sergeant Drill Co., at Easton, Pa., and important heavy highway bridges in Texas, Arkansas and the Southern Middle States. Shop work is now about completed on upwards of 75 bridges for the Lehigh Valley R. R.

THE SCHENECTADY LOCOMOTIVE WORKS, Schenectady, N. Y., has an order from the Midland R. R., of England, for ten Mogul freight locomotives. The engines will have 18 × 24-in. cylinders, and will be of American design. The works has just completed an order for 27 locomotives to Japan, and 14 of its heaviest locomotives for the Northern Pacific Ry. The works has an order for four 8-wheel passenger locomotives for fast service between Indianapolis and St. Louis on the Vandalia Line.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., has recently built for the town of Newport, N. Y., a bridge having two spans of about 70 ft. each. This bridge is of the parabolic type, with steel floor beams and stringers. The company has the contract for the steel work for a building which the Boston & Maine R. R. Co. is erecting at Portsmouth, N. H., for its electric power station. The building is 118 × 64 ft., divided into two rooms, one for the boilers and the other for the engines and electric generators.

THE AMERICAN TIN-PLATE CO. was incorporated in New Jersey, Dec. 15, with a capital stock of $50,000,000, as a consolidation of practically all of the tin-plate mills in this country. The local office of the company is given as at 525 Main St., East Orange, N. J. The capacity of the combination is said to be 8,000,000 100-lb. boxes of tin a year. At a meeting of the stockholders in Chicago Dec. 15, Daniel G. Reid was elected President, Wm. B. Leads, First Vice-President, and Richard R. Quay, of Philadelphia (son of Senator Quay), one of the directors.

THE OLIN GAS ENGINE CO., Buffalo, N. Y., reports a good business, its plant now being run overtime and employing extra hands. Among engines which the company has just installed are the following: A 25-HP. engine at Grove City, Pa., for the town water-works; a 30-HP. engine using gasoline for the water-works at Cambridge Springs, Pa., and a 15-HP. engine for the water-works at Lawrenceville, Va. The company has also installed a number of gas engines for electric lighting service, among others being the following: A 35-HP. engine for the mill of E. M. Upton, Carlton Station, near Rochester, N. Y., and a 35-HP. engine for H. Adler, of Pittsburg, Pa. The latter is the second order for an engine of this type received from Mr. Adler.

THE BROOKS LOCOMOTIVE WORKS, Dunkirk, N. Y., has an order from the Lake Shore road, according to press reports for 45 loco-express freight engines with 19 × 30-in. cylinders, 62-in. driving wheels and weighing 150,000 lbs. each; 15 consolidated freight engines with 19½ × 28-in. cylinders, 56-in. driving wheels, and weighing 150,000 lbs. each, and 15 6-wheeled switching engines, with 19 × 26-in. cylinders, 52-in. driving wheels, and weighing 128,000 lbs. each. The company has also an order for four new 10-wheel passenger locomotives for the Buffalo, Rochester & Pittsburg R. R.

THE AMERICAN WOOD FIREPROOFING CO., 11 Broadway, New York, is building works at Newark, N. J., and will be in a position to fireproof all kinds of timber and lumber needed in naval, marine and architectural work, also all kinds of shingles. The company will sell rights outright for the control of territory, or will give the right to manufacture under royalties, and will superintend the building of the works. The officers of the company are: Pres., Guy Phelps Dodge; Vice-Pres., J. S. H. Clark; Treas., Geo. H. Clark, Jr.; Secy. and Mgr., A. Eugene Kirby; Asst. Mgr., Samuel A. Clark.

NEW COMPANIES.—St. Peter Telephone Co., St. Peter, Minn.; $10,000; H. P. Proctor, Augustus Proctor, Frank A. Chase, J. H. Chase, Viroqua, Wis.; Walter S. Proctor, St. Peter.

Yukon Prospect Corporation, Ltd., New York; $1,000,000, commencing with $10,000; to acquire, own and hold mineral and other lands in Alaska; F. W. Watkins, James R. Mullett, H. H. Russell, George C. Grey and Seymour Kisch, all of New York.

Clarksville Furnace Co., Clarksville, Tenn.; Milton H. Smith, Pres., of Louisville & Nashville R. R., Louisville, Ky.; Cushman Quarrier, and J. H. Ringold, H. W. Bruce, W. D. Hines and E. C. Lewis.

Honduras Ice Co., 106 Market St., Camden, N. J.; $100,000; to manufacture ice and conduct a general cold storage business; George F. Archer, 330 North Sixth St., and Franklin M. Archer, 106 Market St., Camden, N. J.; Thomas S. Nekervis, Merchantville, N. J.

Atlantic Land & Improvement Co., Richmond, Va.; $500,000; to carry on a general real estate business; H. Walters, Baltimore, Pres. Atlantic Coast Line, is believed to be interested.

Chama Improvement Co., Louisville, Ky.; $5,000,000, commencing with $10,000; to operate and sell railways, electric plants, improve lands, etc.; J. M. Hunter, Warwick Villa, Ky.; Ed. H. Schoening, W. E. Rapp, Claude Buckley and Curran Pope, of Louisville, Ky.

Columbia Exploration & Tunnel Co., San Francisco, Cal.; $1,000,000, commencing with $625; to own and otherwise dispose of water rights, power, light, etc.; J. E. Chilton, Wm. C. Leonard, Geo. S. Chilton, John F. Noyes and J. E. Scroggs, of Charleston, W. Va.

Colton Export & Import Co., New York; $250,000, commencing with $10,000; to establish and operate manufactures of all kinds, etc.; Chas. W. Colton, Pelham Manor, N. Y.; M. F. Colton, B. J. Radigan, P. M. Allo and Alexander Richardson, of New York.

St. Louis Gasoline Motor Co., St. Louis, Mo.; $50,000; J. H. Daman, O. L. Anderson, J. D. Fishback and Louis Langan.

Midland Appliance Co., 127 Market St., Camden, N. J.; $100,000; to deal in appliances of all kinds; C. A. Wilson, Howard H. Sypher and C. S. Rushing, Philadelphia; Norman Grey, Woodbury, N. J.; Alexander Duer, Camden.

Lake Michigan & Lake Superior Ship Canal & Dock Co., Lansing, Mich.; commencing with $50,000; to connect Lakes Michigan and Superior by canal, across the counties of Delta, Schoolcraft and Alger; D. C. Dennison, A. H. Parker and C. W. Parker.

Sawyer Mfg. Co., 227 Market St., Camden, N. J.; $50,000, commencing with $30,000; to manufacture gas and electric fixtures, etc.; H. H. Sawyer and H. S. Sawyer, Ridley Park, Pa.; Geo. L. Rowland, Philadelphia, Pa.

Essex Iron Co., Corporation Trust Co.'s Bldg., Jersey City, N. J.; $50,000; mining, smelting, etc., of iron ores; Hugh A. Bayne, 128 East 24th St.; Acton C. Bassett, 11 West 31st St., and Edwin O. Holter, 6 East 9th St., New York; Walter E. Stewart, Jr., 526 West 7th St., Plainfield, N. J.

Mohawk Mining Co., Houghton, Mich.; $2,500,000, commencing with $750,000; Wm. Paine, Boston; Fred Smith, Allouez, Mich.; F. M. Stanton, Houghton; John Stanton and Jos. Gay, of New York.

South American Co., New York; $1,000,000, commencing with $500; to acquire and develop mines in South America; Thos. Holden, Jr., White Plains, N. Y.; Chas. Engle, W. F. Craig, W. A. Kissan and Dewitt H. Lyon, of New York.

Antilles Syndicate of America, New York; $5,000,000, commencing with $1,000; to develop mines, sugar, tobacco and coffee estates; A. J. Weir, H. G. Weil, D. H. Monjo, D. L. Monjo and Lyman Elmore, of New York.

Forge Mining Co., 60 Grand St., Jersey City, N. J.; $20,000, commencing with $3,000; to mine, sell and manufacture iron and other ores; Chas. Seymour, Wm. Fillingham and Kenneth McLaren, of Jersey City.

Gray Eagle Gold Mining Co., New York; $100,000, commencing with $10,000; Wm. O. Saxton, Henry Harms, John Doscher, John Meyer and Christopher Bargrede, of New York.

Tuscarawas Telephone Co., New Philadelphia, O.; $75,000; to operate line between New Philadelphia, Canal Dover, Uhrichsville, Denison, Canton, Carrollton, Cadiz, Cambridge, Coshocton, Millersburg, Wooster and neighboring towns; J. S. Bailey, F. W. Bainbridge, J. W. Yeagley, O. S. Welty and J. H. Mitchell.

Ohio Telephone Co., Columbus, O.; $100,000; to operate a telephone system throughout the state; R. E. Jones, T. A. Simons, David C. Beggs, F. D. Simons, Howard Park, L. D. Myers and William C. Orr.

Riverside Telephone Co., Burlington, N. J.; $15,000; Mitchell B. Perkins, Beverley; Henry V. Massey, Philadelphia; Nathan Haines, J. Howard Pugh, and Geo. C. Gunn, of Burlington.

Columbus Brewing Co., Columbus, O.; $100,000, commencing with $875; Phillip A. Effler, Jos. C. Huston, Chas. H. Engle, Louis Goetz and Martin Heinmann, of Columbus, O.

Pacific Automatic Telephone Exchange Co., Seattle, Wash.; to operate telephone and telegraph lines in Washington; E. F. Sweeney, Jas. D. Hoge, Jr., H. C. Henry, E. W. Price, F. D. Schuyler, A. L. Kasson and Frank B. Ingersoll, of Seattle, and R. B. Lehman, Tacoma, Wash.

New Rochelle & Westchester Telephone Co., New Rochelle, N. Y.; $150,000; to operate lines between New Rochelle, New York, Boston, Providence, New Haven, White Plains, Yonkers, Albany, Buffalo, Ogdensburg, and elsewhere; Heinrich Meyer, New York; Geo. W. Sutton and Joseph Claudet, New Rochelle, N. Y.; John H. Scofield, Grand View, N. Y., and others.

Price Rail-Joint Co., Philadelphia, Pa.; $5,000,000, commencing with $100; to manufacture rail-joints, metallic ties, etc.; F. E. Martin, Wm. C. Wolfersberger, Carl de Mall, Edwin G. Evans and D. F. Lightfoot, all of Philadelphia.

American Fireproof Wood Co., Philadelphia, Pa.; $1,000,000, commencing with $700,000; Adam Tindel, Samuel G. Morris and Samuel Huekel, Jr., of Philadelphia, and Robt. H. Groff, Berlin, N. J.

Annapolis Ice Mfg. Co., 310 Market St., Camden, N. J.; $100,000; Robt. J. Berryman, 1009 North 43d St.; W. C. Berryman and Samuel D. Berryman, 3884 Emerald St., Philadelphia, Pa.; Wm. J. Thompson, Jr., Gloucester City, N. J.

Powers & Robinson Foundry & Machine Co., Garwood, N. J.; $100,000; to make boilers, engines, etc.; Jas. T. Powers, Houghton B. Robinson, Roland S. Brotherhood, Chas. G. Robinson, Halcyon M. Close and Fred'k Brotherhood, all of Garwood.

United States Automatic Telephone Co., New York; $1,000,000; Elias E. Ries, Martin Lowenstein, Henry A. J. Wilkens, Israel Steinhart and Henry J. Furling, New York.

Electric Haulage & Mfg. Co., Brazil, Ind.; $10,000; to manufacture motors and machinery; Jas. H. McClelland, Brazil; Edmund C. Morgan, Chas. B. Nibbloch, Chicago.

Kennedy Mfg. Co., Indianapolis, Ind.; $50,000; to manufacture gas meters; J. P. McGeath, John E. and Harry L. Kennedy, E. M. Bose and H. C. Jordan.

Gallipolis Foundry & Machine Co., Gallipolis, O.; $25,000; to manufacture steam, milling and mining machinery; H. R. Bradbury, T. E. Bradbury, C. R. Comer, Hollis C. Johnston.

Manhattan Oil Motor Co., 11½ Beaver St., Newark, N. J.; $1,000,000; to manufacture gasoline and acetylene gas motors, etc.; George T. Harris, The Bourse, Philadelphia; G. Waldron Blake, 11½ Beaver St., Newark, N. J.; Edwin W. Preston, Merchantville, N. J.

Colonial Contract Co., Corporation Trust Co.'s Bldg., Jersey City, N. J.; $100,000; to construct vessels, wharves, etc.; Wm. H. Sackett, Washington, D. C.; Colin McLean, St. George (S. I.), N. Y.; Charles C. Dodge, 1 West 83d St.; J. G. Batterson, Jr., 31 Nassau St., New York; J. L. Cunningham, 145 Fair St., Paterson, N. J.

West Side Hygeia Ice Co., Jersey City, N. J.; $100,000; Joseph H. Furl, Wallace A. Downs and John Furl, Jersey City.

Girard Machine Works, 106 Market St., Camden, N. J.; $50,000; to manufacture engines and machines; Charles A. Gildemeyer, Haddonfield, N. J.; Horace S. Glazier and Jessie L. Doyle, Philadelphia.

Co-operative Telephone Co., Columbus, O; $50,000; to operate local telephone system; George Riddle, Frank H. Howe, Charles A. Spinny, W. B. Childers, W. B. Earnhart, and others.

Fallek Telephone & Automatic Switch Co., San Francisco, Cal.; $100,000, commencing with $500; A. K. Andriano, W. T. Hess, Frederick Hess, Jr., Nathan Fallek, San Francisco; I. Harris, Oakland, Cal.

Richmond & Potomac Construction Co., 259 Washington St., Jersey City, N. J.; $100,000; to construct public works of all kinds; Oliver W. Barnes, Charles H. Cooke, Simeon F. Sullivan, John M. Enright, Jersey City.

Acme Electric Lamp Co., New Brunswick, N. J.; $500,000; to manufacture electric lamps; Louis A. Jackson, Ralph W. Booth, Jr., New Brunswick.

Spring Lake Ice Co., Chicago, Ill.; $100,000; John J. Warde, Miles E. Barry and Levi Wendermuller.

Homestead Telephone Co., Homestead, Pa.; $10,000; G. Gladden, R. Kennedy, J. Purman, D. H. Carus, A. J. Kuhn, W. S. McConegby, H. J. O'Donnell, of Homestead.

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PERSONAL.

Mr. Abram Wing, Superintendent of the Iowa Water Co., Ottumwa, Ia., has resigned.

Mr. H. Nelson Hyde, for 20 years Superintendent of the water-works at Newton, Mass., has resigned.

Mr. Samuel Sloan, President of the Delaware, Lackawanna & Western R. R., will, it is reported, resign that office in February at the annual meeting of the company. He has held the office for 32 consecutive years.

Mr. Henry B. Seaman, M. Am. Soc. C. E., and M. Am. Soc. M. E., with offices at 40 Wall St., New York city, has resigned as Chief Engineer of the Audit Co., of New York, and will devote his entire time to private practice.

Prof. W. H. Dean, for several years past Water Inspector under the direction of the city council of Wilkes-Barre, Pa., has resigned to accept the position of Expert on Chemical Analysis for the Spring Brook Water Supply Co., of that city.

Mr. Rudolph Hering, M. Am. Soc. C. E., hydraulic and sanitary engineer, of New York city, has been appointed Expert Mechanical and Sanitary Engineer to review the plans of the City Engineer of Buffalo, N. Y., to abate the Hamburg Canal nuisance.

Mr. George W. Jones, who has just completed a large bridge over the Magdalena River in the United States of Colombia, arrived in New York, Dec. 19, on the steamer "Altai." The bridge has taken seven years to build on account of the swiftness of the river.

Mr. Clemens Herschel, M. Am. Soc. C. E. and M. Inst. C. E., has been awarded the Elliott Cresson gold medal by the Franklin Institute, of Philadelphia, for his invention of the Venturi water-meter. This is a well-deserved recognition of the value of a most useful discovery in hydraulic engineering.

Mr. Frederick H. Mason has opened an office as a consulting mechanical engineer, at 1020 Monadnock Block, Chicago, and will also act as the Western representative of the Frankford Steel & Forging Co., Philadelphia, Pa. He has been associated with a number of engineering firms in the West, until recently having been with the Railroad Supply Co., Chicago.

Mr. George Lewis Bradbury, Vice-President and General Manager of the Lake Erie & Western R. R., with headquarters in Chicago, has been elected President of that railway, to succeed the late Senator Calvin S. Brice, whose death was noted in our last issue. Mr. Bradbury is also Vice-President of the Cleveland, Akron & Columbus Ry., General Manager of the Northern Ohio Ry., and President of the Peoria & Pekin Union Ry.

OBITUARY.

Mr. Charles Hessean, architect, of Danville, Ill., died Dec. 16.

Capt. John Adams, of the Adams Bros. Co., bridge contractors, of Findlay, O., died Dec. 18, aged 58.

Mr. Charles Hillman, President of the Chas. Hillman Ship & Engine Building Co., Philadelphia, Pa., died Dec. 22, aged 75.

Mr. Walter Rosser, Sr., Division Superintendent of the Nashville, Chattanooga & St. Louis Ry., died at his home in Stevenson, Ala., Dec. 26.

Mr. Charles Hughes, senior partner of the firm of Hughes Bros. & Bangs, government contractors, of Syracuse, N. Y., died Dec. 18.

Mr. Charles G. Martin, brass manufacturer, of Mount Vernon, N. Y., died Dec. 21, aged 84. He was a brother of the late Daniel B. Martin, who was an engineer in the U. S. navy.

Col. Daniel Morris, civil engineer, of Atlantic City, N. J., died Dec. 21, aged 79. He laid out the city, and was the constructing engineer of the first railway from Camden to Atlantic City.

Mr. Albert C. Robinson, architect, of East Kingston, N. H., died Dec. 18, aged 52. He was for several years Superintendent of water-works at Knoxville, Tenn.; Fort Paine, Ala., and other places in the South.

Mr. Edward F. Randolph, of the firm of Randolph & Clowes, manufacturers of brass and copper tubing, etc., of Waterbury, Conn., died Dec. 18, of pneumonia, at his residence in New York city, aged 68. The business, we are informed, will continue under the same management as heretofore.

Dr. Wellington Adams, an electrical engineer and inventor, of St. Louis, Mo., died Dec. 20, aged 42. He came into prominence some years ago as the promoter of an electric railway from St. Louis to Chicago.

Major Frederick Henry Smith, M. Am. Soc. C. E., civil engineer and bridge builder, died at Baltimore, Md., on Dec. 24, aged 59 years. He was a brother of the late C. Shaler Smith, M. Am. Soc. C. E., and was associated with the latter in many of his bridge enterprises.

Col. Philip Henry Moore, Editor and owner of "The Ohio Valley Manufacturer," died at Wheeling, W. Va., Dec. 26, of paralysis. He served in the Engineer Corps of the Confederate Army during the Civil War. In 1859 he established the "Daily Union" of Wheeling, W. Va.

Mr. Stephen A. Morse, inventor and founder of the firm of Morse, Williams & Co., Philadelphia, Pa., elevator manufacturers, died in that city Dec. 22. He was born in Holderness, N. H., May 28, 1828, and learned the trade of a machinist. He went to Philadelphia about 25 years ago and soon after began the manufacture of elevators. He was the inventor of the well-known Morse twist drill.

Mr. R. T. McDonald, President of the Fort Wayne Electric Corporation, Fort Wayne, Ind., died in Dallas, Tex., Dec. 24, of pneumonia, aged 49. He was born in Pennsylvania, and removed to Fort Wayne in 1859, where he identified himself with various business enterprises and was instrumental in introducing electric lighting into that city. Later he gave his attention to electric railways and assisted in the formation of the company of which he was the head at the time of his death. He was also interested in a large ice-making plant in New Orleans, La., and had lately obtained the contract to build sewers in that city.

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ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

ENGINEERING SOCIETY OF WESTERN NEW YORK.
Jan. 2. Secy., H. J. March, Library Bldg., Buffalo, N. Y.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 2. Secy., C. L. Annan, City Engineer's Office, St. Paul, Minn.

FRANKLIN INSTITUTE.
Jan. 3. "Methods for the Examination of Explosives," Dr. W. J. Williams. Jan. 11. "Segregation Tests on Steel Ingots," A. W. Allen. Jan. 17. "The Clarification and Purification of Municipal Water Supplies," Mr. Allen Hazen. Jan. 20. "This Country of Ours," John Birkinbine. Secy., Wm. H. Wahl, 15 South 7th St., Philadelphia, Pa.

WESTERN SOCIETY OF ENGINEERS.
Jan. 3. Annual meeting. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA.
Jan. 4. Secy., Howard Evans, Pier 45, Delaware Ave., Philadelphia, Pa.

ENGINEERS' CLUB OF ST. LOUIS.
Jan. 4. Secy., Richard McCulloch, 2401 N. Spring Ave., St. Louis, Mo.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Jan. 4. Secy.,C. W. Hunt, 220 West 57th St.,New York city.

AMERICAN INSTITUTE, AND THE HENRY ELECTRICAL SOCIETY.
Jan. 6. "Polarized Light," Louis H. Laudy. Jan. 20. "Alternating Currents," Wm. H. Freedman. Secy., D. R. Lovejoy, 111 W. 38th St., New York city.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 6. Secy., O. Von Geldern, 19 Market St., San Francisco, Cal.

BROOKLYN INSTITUTE OF ARTS AND SCIENCES.
Jan. 6. "The Electro-Metallurgy of Copper," John B.F. Hereschoff. Secy., Henry I. Weed, Brooklyn Institute of Arts and Sciences, Brooklyn, N. Y.

CHICAGO ELECTRICAL ASSOCIATION.
Jan. 6. "Telephone Engineering: Some Problems, Solved and Unsolved," S. G. McMeen. Secy., J. R. Cravath, 825 Monadnock Block, Chicago, Ill.

THE ENGINEERS' CLUB OF PHILADELPHIA.
Jan. 7. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia, Pa.

ENGINEERS' CLUB OF COLUMBUS.
Jan. 7. Secy., H. M. Gates, 12½ North High St., Columbus, O.

THE LOUISIANA ENGINEERING SOCIETY.
Jan. 9. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

ENGINEERS' CLUB OF KANSAS CITY.
Jan. 9. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

DENVER SOCIETY OF CIVIL ENGINEERS.
Jan. 10. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Col.

NORTHWEST RAILWAY CLUB.
Jan. 10. Secy., T. A. Foque, Soo Line, Minneapolis, Minn.

NEW ENGLAND RAILWAY CLUB.
Jan. 10. Secy., Edw. L. Janes, P. O. Box 1158, Boston, Mass.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Jan. 10. Secy., Wm. H. Searles, Case Library Bldg., Cleveland.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Jan. 12. Annual meeting. Secy., C. A. McNab, 112 Mansfield St., Montreal, Can.

ENGINEERING ASSOCIATION OF THE SOUTH.
Jan. 12. Secy., C. B. Wilson, 1000 Broad St., Nashville, Tenn.

CENTRAL RAILWAY CLUB.
Jan. 13. Secy., H. D. Vought, 114 Fifth Ave., New York city.

ST. LOUIS RAILWAY CLUB.
Jan. 13. Secy., H. H. Roberts, 511 Commercial Bldg., St. Louis, Mo.

SCRANTON ENGINEERS' CLUB.
Jan. 14. Annual meeting. Secy., F. E. Pratt, 730 Madison Ave., Scranton, Pa.

MONTANA SOCIETY OF ENGINEERS.
Jan. 14. Annual meeting, Helena, Mont. Secy., A. S. Hovey, National Bank Bldg., Helena, Mont.

AMERICAN INVENTORS' AND MANUFACTURERS' ASSOCIATION.
Jan. 15. Annual meeting, Washington, D. C. Secy., Arthur Steuart,Washington Loan and Trust Bldg.,Washington, D. C.

ENGINEERS' AND ARCHITECTS' CLUB OF LOUISVILLE.
Jan. 16. Secy., Marshall Morris, 16 Norton Bldg., Louisville, Ky.

TECHNICAL CLUB OF OMAHA.
Jan. 16. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
Jan. 16. Secy., H. E. Smith, 1620 S. E. 14th St., Minneapolis, Minn.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA
Jan. 17. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

WESTERN RAILWAY CLUB.
Jan. 17. Secy., F. M. Whyte, 225 Dearborn St., Chicago, Ill.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Jan. 18. Annual meeting. Secy., S. E. Tinkham, City Hall, Boston, Mass.

WESTERN FOUNDRYMEN'S ASSOCIATION.
Jan. 18. Secy., B. M. Gardner, 1522 Monadnock Block, Chicago, Ill.

THE IOWA ENGINEERING SOCIETY.
Jan. 18-19. Annual meeting, Iowa City, Iowa. Secy., E. P. Boynton, Cedar Rapids, Ia.

NEW YORK RAILROAD CLUB.
Jan. 19. Secy., W. W. Wheatley, 168 Montague St., Brooklyn, N. Y.

ENGINEERS' CLUB OF CINCINNATI.
Jan. 19. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 19. Secy., F. A. Charpiot, P. O. Box 13, Savannah, Ga.

THE WEST VIRGINIA SOCIETY OF CIVIL ENGINEERS AND ARCHITECTS.
Jan. 19-20. Annual meeting, Charleston, W. Va. Secy., W. Steenbergen, Point Pleasant, W. Va.

NORTHWESTERN ELECTRICAL ASSOCIATION.
Jan. 19-21. Semi-annual meeting, Milwaukee, Wis. Secy., Thos. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Jan. 20. Annual meeting. Secy., O. Von Geldern, 819 Market St., San Francisco, Cal.

ROCHESTER ENGINEERING SOCIETY.
Jan. 20. Secy., John F. Skinner,Reynolds Library Bldg., Rochester, N. Y.

THE DETROIT ENGINEERING SOCIETY.
Jan. 20. Secy, Henry Goldmark, Wayne Co., Sav. Bank Building, Detroit, Mich.

NATIONAL ASSOCIATION OF MANUFACTURERS.
Jan. 24-26. Annual convention, Cincinnati, O. Secy., E. P. Wilson, Room A, Chamber of Commerce, Cincinnati, O.

INDIANA ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Indianapolis, Ind. Secy., J. B. Nelson, 61 Baldwin Block, Indianapolis, Ind.

MICHIGAN ENGINEERING SOCIETY.
Jan. 24-26. Annual meeting, Lansing, Mich. Secy., F. Hodgman, Climax, Mich.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Jan. 25. Secy., Ralph W. Pope, 26 Cortlandt St., New York city.

ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
Jan. 25-27. Annual meeting, Champaign, Ill. Secy., Jacob A. Harman, Peoria, Ill.

ROCHESTER ENGINEERING SOCIETY.—The annual meeting of this society was held on Dec. 16. The following officers were elected for the ensuing year: Pres., William Jordan; First Vice-Pres., Wm. R. Storey; Second Vice-Pres., C. C Laney; Secy., John F. Skinner; Treas., Robert Cartwright.

THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—A regular meeting of this society was held at Pittsburg, Pa., on Dec. 20. The paper of the evening, entitled "Design and Construction of the 29th St. Power Station of the Consolidated Traction Company," was read by Mr. G. F. Greenwood, Chief Engineer and General Manager of the company.

THE ELECTRICAL TRADES SOCIETY OF NEW YORK, a society composed of manufacturers of electrical goods, held a meeting at the Astor House, New York city, on Dec. 6, at which it was decided to file incorporation papers under the New York State laws.

The following officers were elected for the ensuing year: Pres., R. E. Gallaher; Vice-Pres., C. P. Geddes; Secy.-Treas., A. P. Eckert.

ENGINEERS' CLUB OF CINCINNATI.—This club held its annual meeting on Dec. 15 with an attendance of over 40. Routine business was transacted, after which the customary banquet was enjoyed. The officers elected for the ensuing year are as follows: Pres., Schuyler Hazard; Vice-Pres., T. B. Punshon; Secy.-Treas., J. F. Wilson; Directors, A. O. Elzner, W. C. Jewett and L. E. Bogen.

BOSTON SOCIETY OF CIVIL ENGINEERS.—This society attended a meeting of the Society of Arts held in the new Pierce Building of the Institute of Technology, on Dec. 22, to inspect the equipment of the new building. Descriptions of the heating and ventilating, and electric light equipments were given by Prof. S. Homer Woodbridge and W. L. Puffer. The apparatus in the mechanical laboratories was inspected and the large Emery testing machine was shown in operation.

ENGINEERS' CLUB OF ST. LOUIS.—The annual meeting and dinner of this club was held at the Mercantile Club, Dec. 21. Previous to the toasts officers for the ensuing year were elected as follows: Pres., B. H. Colby; Secy., E. R. Fish; Treas., Thos. B. McMath; Librarian, E. J. Jolley; Directors, J. H. Kinealy and John A. Laird; Members of the Board of Managers of the Association of Engineering Societies, J. B. Johnson and Richard McCulloch.

Richard McCulloch, Secy.

THE AMERICAN CHEMICAL SOCIETY.—The 18th annual meeting of this society opened on Dec. 27 at the House of the Chemists' Club of New York, 108 W. 55th St., New York city. Hon. Randolph Guggenheimer, President of the City Council, welcomed the society to New York. Prof. Alexander S. Webb, President of the College of the City of New York, spoke in behalf of the educational institutions of the city. The President of the society, Mr. Chas. E. Monroe, responded, and the reading of the papers was then taken up.

CONNECTICUT ELECTRIC LIGHTING ASSOCIATION. —The annual meeting of this association was held at New Haven, Conn., on Dec. 17. Papers were read by Prof. W. L. Robb on the "Use of Rotary Transformers and Storage Batteries by the Hartford Electric Light Co.," and on "The Merits and Demerits of the Welsbach Lamp," by H. L. Purrington.

The following officers were elected for the ensuing year: Pres., James English; First Vice-Pres., C. A. Learned; Second Vice-Pres., C. H. Nettleton; Secy., A. F. Hunie; Treas., A. M. Young.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION.—The 6th annual meeting of the Electrical Committee of this association was held in New York city, Dec. 6-8. Such matters as specifications for standard electric light fittings and slight changes in the national electrical code were discussed. A committee was appointed to formulate specifications for tests of rubber covered wires.

Several resolutions were passed recommending the general adoption by all underwriters' associations of a List of Approved Electrical Fittings. This is a list of fittings approved by the National Board of Fire Underwriters.

MONTANA SOCIETY OF ENGINEERS.—A regular meeting of this society was held on Dec. 10, at which Mr. Francis W. Blackford read a paper on the "Butte-Centerville Electric Ry.," in which the construction of this road was fully described. The next meeting, to be held at Helena, Mont., Jan. 12-14, will be the 12th annual meeting. Mr. M. S. Parker will present a paper upon the "Big Hole River Dam." The State Engineer's Bill will also come up for discussion. Excursions will be made to the dam at Canyon Ferry, Missouri River, the Peck concentrator, East Helena and the East Helena smelter.

A. S. Hovey, Secy.

NORTHWESTERN ELECTRICAL ASSOCIATION.— The 7th annual convention of this association will be held at Milwaukee, Wis., on Jan. 18-19.

The following papers will be read: "Trend of Central Station Design," B. J. Arnold, Chicago; "Meter-rate Systems," E. L. Debell, Sheboygan, Wis.; "Design of Secondary Circuits in Alternating Plants," George L. Thayer, Belle Plaine, Ia.; "Electricity Direct from Coal," Prof. A. J. Rogers, Milwaukee, Wis.; "Inductive Loads on Alternating Current Transformers," Prof. D. C. Jackson, Madison, Wis.; "Electric Vehicles and Their Relation to Central Stations," H. M. Maxim, Hartford, Conn.; "Association Management," H. L. Doherty, Madison, Wis.

WESTERN SOCIETY OF ENGINEERS.—At the meeting on Dec. 21, Mr. W. H. Finley, Bridge Engineer of the Chicago & Northwestern Ry., described the design and erection of the new Kinzie St. drawbridge over the Chicago River. It is a riveted lattice structure, replacing an old pin-connected bridge built of "Hay" steel, which is hard and brittle. In order to provide an increased width of channel and still prevent interference with the adjacent Kinzie St. highway bridge, the railway bridge has its pivot under one of the trusses. On the inner side of the roller tracks are top and bottom racks, with which engage spur wheels on roller shafts. This is done to prevent any tendency of the rollers to work out from under the bridge. The structure was partially erected on launching ways on land, then hauled out 30 ft. to allow of its completion, the completed structure being then carried by scows to the site, the old bridge being floated away on scows at the same time.

NEW PUBLICATIONS.

THE USE OF COKE BREEZE IN SEWAGE PURIFICATION.—A Paper by Jno. W. Alvord, C. E., read before the Western Society of Civil Engineers, May 18, 1898. Paper; 6 × 9 ins.; pp. 11. Address the author, The Rookery, Chicago.

A number of experiments with filters designed to work at a high rate, both in this country and abroad, are reviewed in this pamphlet.

MUNICIPAL REPORTS.—The following reports have been received, the reports and the names given being those of city engineers, unless otherwise specified: Boston, Mass., Benj. Wells, Superintendent Street Department. Cambridge, Mass., Special Report on Means to Prevent Back Flooding from Sewers, L. M. Hastings. Newton, Mass., H. D. Woods. Central Falls, R. I., W. F. Keene. Easton, Pa., Harrison R. Fehr. Philadelphia, Pa., Thos. M. Thompson, Director Public Works. Wilmington, Del., T. Chalkley Halton, Engineer Sewers. Glenville, O., Report on Sewerage and Sewage Purification for Glenville, O., by John P. Force, Columbus, O. Indianapolis, Ind., J. Clyde Power, Engineer and Superintendent of Parks. Detroit, Mich., Henry D. Ludden. Duluth, Minn., Thos. F. McGilvray, Minneapolis, Minn., W. M. Berry, Superintendent of Parks. St. Paul, Minn., L. W. Rundlett. St. Louis, Mo., A. N. Milner, Street Commissioner. Toronto, Ont., Report on Sewage Disposal, C. H. Rust.

TRADE PUBLICATIONS.

(The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

STEEL LATH.—Bostwick Steel Lath Co., Niles, O. Pamph.; 6 × 9 ins.; pp. 28; illustrated.

This catalogue contains descriptions and illustrations of the Bostwick patented, perforated metal lath, Holton's patent slip joint eave trough, and a general line of gutters, ventilators, etc., etc.

IRON AND STEEL ROOFING.—Sykes Iron & Steel Roofing Co., Niles, O. Pamph.; 9 × 6 ins.; pp. 40; illustrated.

This is a descriptive catalogue of a general line of corrugated iron and steel roofing and siding.

FRICTION CLUTCHES.—G. D. Grannis, Syracuse, N. Y. Pamph.; 3¾ × 5½ ins.; pp. 15; illustrated.

This pamphlet describes and illustrates the construction and operation of the Jackson friction clutch for which several advantages are claimed in economy and efficiency.

WIRE CABLE FERRIES.—Trenton Wire Co., Trenton, N. J. Pamph.; 5¾ × 8¼ ins.; pp. 7; illustrated.

This pamphlet gives a pretty complete illustrated description of the above company's system of wire rope ferry construction.

VALVES, INJECTORS, STEAM SPECIALTIES, ETC.— The Lunkenheimer Co., Cincinnati, O. Pamph.; 4¾ × 7¼ ins.; pp. 208.

This is a very complete illustrated catalogue of the well-known Lunkenheimer specialties for steam, water, gas and oil.

STRUCTURAL STEEL WORK.—The Pittsburg Bridge Co., Pittsburg, Pa. Pamph.; 6 × 3¼ ins.; pp. 40; illustrated.

This pamphlet is made up chiefly of illustrations of a great variety of bridges and buildings for which the company named has furnished the steel work.

VALVES, EXPANSION JOINTS, STEAM AND WATER APPLIANCES.—Caldwell Wilcox Co., Newburgh, N. Y. Pamph.; 9 × 5 ins.; pp. 20.

This is an illustrated catalogue of a variety of appliances used in connection with steam and water piping, including screens, flexible joints, steam and water separators, or water-catchers, slip joints, etc.

RECENT BALDWIN LOCOMOTIVES.—Baldwin Locomotive Works, Philadelphia, Pa. Pamph.; 9 × 6 ins.; pp. 32; illustrated.

This is No. 9 of the 1898 series of pamphlets describing the locomotives built by the above-named company to American and foreign orders, and it is devoted mostly to heavy locomotives for freight service.

WINTER TOURS: LEHIGH VALLEY R. R.—Passenger Department, Lehigh Valley R. R., New York, N. Y. Pamph.; 5½ × 8 ins.; pp. 74; illustrated.

This pamphlet outlines a large number of tours to the winter resorts of Florida and other southern states, with such details of the natural attractions, hotel accommodations, railway and hotel rates, etc., as are likely to interest the prospective tourist.

STEEL ROOFING.—Canton Steel Roofing Co., Canton, O. Pamph.; 6 × 9 ins.; pp. 128; illustrated.

This is a catalogue and price list of the different forms of stamped sheet metal manufactured by the above company. Among the various forms of plain and stamped work produced are sidings, ceilings, moldings, cornices, gutters and eaves troughs, roofing, ridges, skylights, vanes, ventilators, finials, etc.

FIREPROOF GRAIN ELEVATORS.—Steel Storage & Elevator Cons. Co., Buffalo, N. Y. Pamph.; 6 × 9 ins.; pp. 31; illustrated.

This catalogue gives a very good illustrated description of the steel storage grain elevators and pneumatic grain conveying system of which the above company makes a specialty. Views of a number of elevator plants built by the company in the Western and Central States are given.

STREET SWEEPING MACHINES.—Improved Street Sweeper Co., German National Bank Building, Pittsburg, Pa. Paper; 4½ × 7 ins.; pp. 12; illustrated.

This catalogue describes a pick-up street sweeping machine. The broom is of wire, instead of fiber. The dirt is accumulated in a tank, which is emptied mechanically either at intervals on the street, or at the dump, the broom being raised in case the dirt is to be hauled to the dump.

STEEL ROOFING.—Niles Iron & Steel Roofing Co., Niles, O. Pamph.; 6 × 9 ins.; pp. 25; illustrated.

This catalogue describes the construction of the different forms of steel roofing, ceilings, ridges, gutters and other forms of stamped sheet metal work produced by the company named. Special qualities of roof paints and tools used in laying sheet metal roofing are also described and a price list of all articles is given.

STEAM SHOVELS AND DREDGES.—The Toledo Foundry & Machine Co., Toledo, O. Pamph.; 9½ × 6¾ ins.; pp. 94; illustrated.

The several classes of "Victor" shovels which are built by this firm are quite fully described and illustrated in this pamphlet. It also contains a number of illustrations of dipper dredges built by the same company, together with the "Victor" railway pile driver and the "Victor" turntable.

HOISTING AND CONVEYING MACHINERY.—G. D. Grannis, Syracuse, N. Y. Pamph.; 8½ × 6 ins.; pp. 16; illustrated.

This pamphlet describes and illustrates quite fully the Jackson hoister and conveyor for sewer and trench work, the Jackson rotating hoister and conveyor, and the Jackson revolving, self-propelling pile driver. These machines have been quite extensively used on the Erie Canal enlargement, and on various pieces of sewer work.

"SALAMANDER" FIREPROOFING.—The American Fireproofing Co., Boston, Mass. Pamph.; 6 × 3½ ins.; pp. 32; illustrated.

Salamander is made in rolls, like roofing felt, and is designed to be used as a lining between floors, and in other places where a sound deadener or a dust and air-proof lining is desired. Among the claims made for the material are that it is non-inflammable and a non-conductor of heat, and this pamphlet describes more particularly the results of various tests made to demonstrate these characteristics.

ELECTRICALLY OPERATED TURNTABLES. — The Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Pamph.; 9 × 6 ins.; pp. 12; illustrated.

In this pamphlet the company presents a brief description and a number of illustrations of its special motor car, or "donkey," for turntable operations. The device requires no changes in the turntable proper, and can be attached to any construction of table, and a quite complete account of its construction and operation was given in Engineering News of May 27, 1897, and Aug. 25, 1898.

BRIDGE RAILINGS.—Chester B. Albree, Allegheny, Pa. Pamph.; 9 × 6 ins.; pp. 130; illustrated.

This pamphlet illustrates and describes very briefly a large number of structural and special styles of railings, portal castings, lamp posts, cornice and facias, stairways, etc., for bridges, which are manufactured by the above-named firm. The variety of designs shown is very large and most of them are examples of actual work. In a supplement the pamphlet devotes several pages to the special forms of bridge riveters designed and built by Mr. Albree.

THE REMINGTON TYPEWRITER AFLOAT.—Wyckoff, Seamans & Benedict, New York, N. Y. Pamph.; 9 × 7 ins.; pp. 24; illustrated.

This pamphlet contains handsome half-tone engravings of the different larger vessels of the United States Navy, each accompanied by a brief description giving dimensions, armament, a general outline of the machinery, and other similar details. The statement that each vessel's equipment also includes one or more Remington typewriters constitutes the "trade" feature of the pamphlet, which is in many respects a better handbook of our larger war ships than many more formal and pretentious books which we have seen.

TRANSFORMER DESIGN AND OPERATION.—General Electric Co., Schenectady, N. Y. Pamph.; 8 × 10½ ins.; pp. 38.

This pamphlet, number 9,064 of the General Electric series, is a reprint of two papers on transformers, one, "Alternating Current Transformers from the Station Manager's Standpoint," by Mr. W. F. White, read before the American Institute of Electrical Engineers, and the other, "Transformer Economy," by Prof. W. E. Goldsborough, read before the National Electric Light Association. These are supplemented by several maps of Conshohocken, Pa., showing how a few large transformers were substituted for a number of smaller ones, with a considerable saving in operating expenses. As a further example of the economy of large transformers, the alternating current distribution system at Pueblo, Colo., is shown in the same way. Instruments for making transformer tests are also illustrated and briefly described.

TARGET-READING TACHEOMETER.—Bell-Elliott patent, Messrs. Elliott Brothers, Opticians to the Government, 101-102 St. Martin's Lane, London, England. Paper; 8 × 5½ ins.; pp. 22.

This pamphlet describes the method of using a target-reading tacheometer invented by Mr. George Joseph Bell, Assoc. M. Inst. C. E., of Carlisle, England. The instrument is intended to measure distances and altitudes, when a graduated staff is placed on the point to be measured, and it accomplishes the work of a transit, level and chain at one operation and with extreme accuracy. In general the instrument resembles a transit with level divided wide and compass attached. But it is also provided with a tangent scale, moved by a micrometer drumhead, dividing one full division of 1-16 in. on the tangent scale into 1,000 equal parts; it is read by a microscope. The instrument reads the actual natural tangent of the observed angle, and books of tables are not required for field work. While instruments of this type are not much used in this country, the results obtained with the Bell-Elliott tacheometer are said to be accurate to five places of decimals, and to be more precise than when obtained by the chain. The cost of the instrument complete ranges from $200, for a 4-in. reading to 1′, to $250 for a 6-in. reading to 20″.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	See Eng. News.
Dec. 29.	Street bonds,	Georgetown, Ky.	Dec. 8
Dec. 29.	Asphalt paving,	Louisville, Ky.	Dec. 22
Dec. 29.	Bridge superstructure,	Boston, Mass.	Dec. 22
Dec. 29.	Heating, etc.,	Brockton, Mass.	Dec. 29
Dec. 29.	Pumping station,	Boston, Mass.	Dec. 29
Dec. 29.	Street lighting,	Camden, N. J.	Dec. 29
Dec. 29.	Removing garbage, etc.,	Hudson, N. Y.	Dec. 29
Dec. 30.	Laundry machinery,	Danville, Ill.	Dec. 29
Dec. 30.	Electric light wiring,	Syracuse, N. Y.	Dec. 29
Dec. 30.	Building alterations,	Wilkesbarre, Pa.	Dec. 29
Dec. 30.	Riveted steel pipe,	Pittsburg, Pa.	Dec. 29
Dec. 30.	Repairs to workhouse,	New York, N. Y.	Dec. 22
Dec. 30.	Station house repairs,	New York, N. Y.	Dec. 22
Dec. 30.	Towing garbage scows,	New York, N. Y.	Dec. 22
Dec. 30.	Scow,	New York, N. Y.	Dec. 22
Dec. 30.	Self-dumping cars (6),	New York, N. Y.	Dec. 22
Dec. 30.	Sewers,	East Cleveland, O.	Dec. 8
Dec. 31.	Plans for station, etc.,	Stockholm, Sweden.	June 23
Dec. 31.	Bridge work,	Plattsmouth, Neb.	Dec. 15
Dec. 31.	Steam boilers,	Alexandria, Egypt.	Dec. 15
Dec. 31.	Cleaning market grounds,	Cleveland, O.	Dec. 15
Dec. 31.	Electric lighting,	Eau Claire, Wis.	Dec. 22
Dec. 31.	Water bonds,	Bemidji, Minn.	Dec. 22
Dec. 31.	Road materials, etc.,	New York, N. Y.	Dec. 22
Dec. 31.	Wooden pier,	New York, N. Y.	Dec. 22
Dec. 31.	Bridge,	Columbus, Neb.	Dec. 29
Dec. 31.	Bridges for 1899,	Geneva, Neb.	Dec. 29
Jan. 1.	Electric lighting,	Pleasantville, O.	Dec. 22
Jan. 1.	City hall plant,	Bridgeport, Conn.	Aug. 18
Jan. 1.	Drawbridge,	Cathlamet, Wash.	Nov. 17
Jan. 1.	Water-works,	Pasadena, Cal.	Nov. 17
Jan. 1.	Electric plant,	Pasadena, Cal.	Dec. 1
Jan. 2.	Bridge,	Quebec, Que.	Sept. 20

Advertised, Eng. News, Sept. 29 and Oct. 6.

Jan. 2.	Arc lighting, Vincennes, Ind.	Oct. 27
Jan. 2.	Storm sewer, etc., Hamilton, O.	Dec. 8
Jan. 2.	Bridge, Aspen, Colo.	Dec. 15
Jan. 2.	Sea water pmpg franchise, Santa Cruz, Cal.	Dec. 15
Jan. 2.	Cutting and logging, Cherokee County, N. C.	Dec. 22
Jan. 2.	Drainage ditch, Ponca, Neb.	Dec. 22
Jan. 2.	Water bonds, Stanberry, Mo.	Dec. 22
Jan. 2.	Sewers, Kingston, Pa.	Dec. 29
Jan. 2.	Bridge work for 1899, Newton, Ia.	Dec. 29
Jan. 2.	Bonds, Chatham, N. B.	Dec. 29
Jan. 3.	Steel plates, Mare Island, Cal.	Dec. 29
Jan. 3.	Naval supplies, New York, N. Y.	Dec. 29
Jan. 3.	Public works and supplies, Philadelphia	Dec. 29
Jan. 3.	Bridge work, Nelson, Neb.	Dec. 15
Jan. 3.	Pipe sewers, Mount Vernon, N. Y.	Dec. 15
Jan. 3.	Sewers, Cincinnati, O.	Dec. 15
Jan. 3.	Church, Ashland, Ky.	Dec. 15
Jan. 3.	Court house, jail, etc., Balsam Lake, Wis.	Dec. 15
Jan. 3.	Steel bridge, Brookhaven, Miss.	Nov. 24
Jan. 3.	Water-works, Gaffney, S. C.	Dec. 1
Jan. 3.	Bath plans, Albany, N. Y.	Dec. 8
Jan. 4.	Library building, Owatonna, Minn.	Dec. 15
Jan. 4.	Bridge work for 1899, Denison, Ia.	Dec. 22
Jan. 4.	Drainage ditch (8,300 ft.), Burlington, Ia.	Dec. 22
Jan. 4.	Steamboat, Fort McHenry, Md.	Dec. 22
Jan. 4.	Sewers, Oshawa, Ont.	Dec. 29
Jan. 4.	Repair of bridge, Trent, S. Dak.	Dec. 29
Jan. 4.	Electric lights, Columbus, Ga.	Dec. 29
Jan. 4.	School building, Wapakoneta, O.	Dec. 29
Jan. 5.	Sewer, Scranton, Pa.	Dec. 29
Jan. 5.	Asphalt paving and sewers, Rochester, N. Y.	Dec. 29
Jan. 5.	Library building, Cincinnati, O.	Dec. 22
Jan. 5.	Pile trestles (3), Sacramento, Cal.	Dec. 22
Jan. 5.	Water-works, Darlington, Okla.	Dec. 15
Jan. 5.	Macadam roads (17½ miles), Decatur, Ind.	Dec. 1
Jan. 6.	Water-gas plant, Johannesburg, So. Africa	Oct. 27
Jan. 6.	Extension electric plnt, Johannesburg, S. Af.	Oct. 27
Jan. 6.	Dredging, New York, N. Y.	Dec. 29
Jan. 7.	Gravel road, Valparaiso, Ind.	Dec. 8
Jan. 7.	Macadam road (10 miles), Cincinnati, O.	Dec. 22
Jan. 9.	School building, Wilmington, Del.	Dec. 8
Jan. 9.	Water supply, Bucharest, Roumania	Dec. 15
Jan. 9.	Excavating, paving, etc., Houston, Tex.	Dec. 15
	Advertised, Eng. News, Dec. 15 to Jan. 5.	
Jan. 10.	Portland cemt (12,000 bbls.), Duluth, Minn.	Dec. 15
	Advertised, Eng. News, Dec. 15 to Jan. 12.	
Jan. 10.	Pumping engine for dredge, Charleston, S. C.	Dec. 15
	Advertised, Eng. News, Dec. 15 to Jan. 12.	
Jan. 10.	Capitol building, Phoenix, Ariz.	Dec. 1
Jan. 10.	Sewer bonds ($50,000), Grass Valley, Cal.	Dec. 1
Jan. 10.	Bridge work for 1899, Hastings, Neb.	Dec. 22
Jan. 10.	Jail building plans, Boone, Ia.	Dec. 22
Jan. 10.	Telegraph poles, Alberni, B. C.	Dec. 29
Jan. 10.	Brick paving, etc., Oskaloosa, Ia.	Dec. 29
Jan. 11.	Water-works, Vailsburg, N. J.	Dec. 29
	Advertised, Engineering News, Dec. 29.	
Jan. 12.	Cement, St. Paul, Minn.	Dec. 15
	Advertised, Eng. News, Dec. 15 to Jan. 5.	
Jan. 12.	Power house, Annapolis, Md.	Dec. 22
Jan. 12.	Sea wall, Annapolis, Md.	Dec. 22
Jan. 13.	Loading garbage scows, etc., New York	Dec. 29
Jan. 14.	Park work and plans, Philadelphia, Pa.	Nov. 17
Jan. 14.	Steam tenders (3), St. Louis, Mo.	Dec. 22
Jan. 14.	Piles and stones, St. Louis, Mo.	Dec. 22
Jan. 15.	Sewers and drainage, Callao, Peru	Dec. 1
Jan. 15.	Street cleaning, Indianapolis, Ind.	Dec. 15
Jan. 16.	Sale of telephone franchise, Duluth, Minn.	Dec. 8
	Advertised, Eng. News, Dec. 8 to Jan. 12.	
Jan. 16.	Pipe sewers, Elizabeth, N. J.	Dec. 22
Jan. 16.	Broken stone, etc., Tampa Bay, Fla.	Dec. 29
	Advertised, Eng. News, Dec. 29 and Jan. 5.	
Jan. 17.	Water-works bonds, Bozeman, Mont.	Dec. 29
Jan. 17.	Macadamizing, Cincinnati, O.	Dec. 29
Jan. 17.	Bridge and plans, Binghamton, N. Y.	Dec. 22
	Advertised, Eng. News, Dec. 22 and 29.	
Jan. 18.	Court house plans, Mineola (L.I.), N. Y.	Dec. 22
Jan. 18.	Water-works, Winchester, Ind.	Dec. 22
Jan. 18.	Extending electric plant, Winchester, Ind.	Dec. 22
Jan. 18.	Sewers, Aiken, S. C.	Dec. 15
	Advertised, Eng. News, Dec. 15 and 22.	
Jan. 19.	Heating, etc., Pottsville, Pa.	Dec. 29
	Advertised, Eng. News, Dec. 29 and Jan. 5.	
Jan. 19.	Steam heating, etc., Akron, O.	Dec. 29
Jan. 19.	Docks, dredging, etc., Cleveland, O.	Dec. 29
Jan. 20.	Street lighting, Belding, Mich.	Dec. 29
Jan. 20.	Revetments, Houghton, Mich.	Dec. 29
Jan. 20.	Wharves and dredging, Honolulu, H. I.	Dec. 29
Jan. 20.	Boilers and machinery, St. Joseph, Mich.	Dec. 29
	Advertised, Eng. News, Dec. 29 and Jan. 5.	
Jan. 21.	Building, Washington, D. C.	Dec. 29
Jan. 23.	Broken stone, etc., New London, Conn.	Dec. 29
	Advertised, Eng. News, Dec. 29 to Jan. 19.	
Jan. 24.	Water-works bonds, Wamego, Kan.	Dec. 29
Jan. 24.	Footway tunnel, London, England	Nov. 10
Jan. 24.	Iron bridges (2), St. Thomas, Ont.	Dec. 22
	Advertised, Eng. News, Dec. 22 and 29.	
Jan. 25.	Dormitory building, etc., Phoenix, Ariz.	Dec. 29
Jan. 26.	Brick, etc., Washington, D. C.	Dec. 29
	Advertised, Eng. News, Dec. 29 to Jan. 19.	
Feb. 1.	Electric light plant, Menahga, Minn.	Dec. 29
Feb. 1.	School building, Peoria, Ill.	Dec. 1
Feb. 2.	Electric lighting, New Orleans, La.	Nov. 3
Feb. 3.	Dredging (1,750,000 c.yds.), Houghton, Mich.	Dec 29
Feb. 7.	Sale of canal, Annapolis, Md.	Dec. 1
Feb. 10.	Jail building, Keyser, W. Va.	Sept. 29
Feb. 13.	Water bonds, Reno, Nev.	Dec. 22
Feb. 20.	Lift bridge near Taylor St., Chicago, Ill.	Dec. 29
	Advertised, Engineering News, Dec. 29.	
Feb. 25.	Court house, Douglass, Ga.	Dec. 29
Mar. 15.	Electric r'y (23 miles), Shanghai, China	Nov. 24
	Advertised, Eng. News, Nov. 17 to Dec. 8.	
Mar. 15.	Purchase of water-works, Belem, Brazil	Dec. 1
Mar. 31.	Telephone concessions, Shanghai, China	Nov. 24
	Advertised, Eng. News, Nov. 17 to Dec. 8.	

RAILWAYS.

ARKANSAS & CHOCTAW.—We are informed that this company has built 13 miles in Arkansas and two miles in Indian Territory this year. The line has been located some 12 miles west from Choctaw City, Ark., into Indian Territory, and a preliminary line surveyed to the Chickasaw and Choctaw boundary line, via Doaksville, Goodland and Atoka, a distance of about 130 miles. Mr. Valliant will make a location through Indian Territory and Oklahoma, following Red River; and probably before any more contracts are let. This will require about four or five months. R. H. Keith, Pres., of Kansas City, can furnish any other information. F. W. Valliant, Ch. Engr., Rocky Comfort, Ark.

ARKANSAS, GUTHRIE & CALIFORNIA.—Henry Hudson, Pres., Guthrie, Okla., informs us that surveys were expected to begin last week for this proposed railway from Shawnee to Guthrie and thence northwest to a point on the Chicago, Rock Island & Pacific Ry., a distance of 250 miles. The line will cross the St. Louis & San Francisco at Shawnee, the Choctaw, Oklahoma & Gulf, and the Chicago, Rock Island & Pacific if the road is built to Enid. The prospects for construction are good. J. W. McNeal, Treas.

CHICAGO, ROCK ISLAND & PACIFIC.—Reports state surveys have been completed and that construction work will soon be commenced on the proposed extension from the main line at Chilaska, Ind. Ter., to Fort Sill, Okla., a distance of about 33 miles. W. E. Dauchy, Supt. of Construction, Topeka, Kan.

CHINA.—Press reports from St. Petersburg, Russia, state that the embankment of the Russian railway will soon be partially completed as far as Port Arthur. The railway to Shan Haikwan is making progress. The embankment and cuttings at Niu-chwang have been begun, and are completed for 50 miles from Shan Haikwan onwards. The rails are now being laid, and a temporary bridge erected; the final bridge will consist of 30 spans of 100 ft. each. Thus Niu-chwang will soon be connected with Peking by railway.

CINCINNATI, HILLSBORO & WELLSTON.—C. Gillilan, Portsmouth, O., informs us that a second expert examination of the resources and practicability of this proposed line will be made next January. The route is from the coal fields at Wellston to Cincinnati, via Jackson, Piketon and Milford, O., 112 miles. It is hoped that this report may help to secure the capital needed to commence work early next spring. M. McKeehan, Pres., Hillsboro, O.; P. H. Doyle, Columbus, O.

CLEVELAND, CANTON & SOUTHERN.—Press reports state that this railway will be sold in Cleveland, O., on Feb. 2, at 10 a. m., by Special Master Commissioner Carleton. J. W. Wardwell, Recvr. and Gen. Mgr., Cleveland.

CLEVELAND TERMINAL & VALLEY.—Reports state that the Magnolia Coal Co. has made a contract with this company for the construction of six miles of track from Sandyville to the company's mines at Magnolia, O. Work is expected to begin at once. E. G. Lane, Ch. Engr., Cleveland, O.

COAHUILA & PACIFIC.—We are informed that an important charter has been granted by the Mexican Government to A. W. Lilliendahl for a standard gage railway, 310 kilometers long, from Saltillo to Torreon, the junction of the Mexican Central Ry. and the Mexican International R. R. This line will traverse the rich "Laguna," the great cotton producing belt of Mexico, also passing through Parras, the wine and fruit district. Throughout its entire length the line will be through haciendas of wealth and importance, the owners of which are large subscribers. Surveys are in progress by T. S. Abbott, Ch. Engr., of New York, with headquarters at Saltillo, Mexico. Construction work is expected to begin within one year.

COLORADO, UTAH & WYOMING.—E. H. Saltiel, Trustee, Rawlins, Wyo., informs us that this company was incorporated in Wyoming in 1895, to build a railway 600 miles in length, and that the first proposed section of line to be built is from the Union Pacific Ry., six miles east of Rawlins, to Iron, Wyo., 28 miles, with eight spurs to various iron mountains, coal mines and limestone quarries, about 15 miles additional. Negotiations are now pending and will possibly be concluded in January. The Wyoming Land, Iron & Coal Co., of which Mr. Saltiel is president, has offered to guarantee 500 tons of coal a day to the first company building to Iron, and to further agree to double the tonnage or guarantee 300,000 tons a year, to commence six months after line shall have been put in operation. Many offers have been made, but all except one, which is expected to be considered in January, have been unsatisfactory. It will be a cheap railway to construct, as the country is largely a flat alkali desert, with about 2½ miles of sand hills, and without any rivers.

FARMINGTON & IRONDALE.—Surveys have commenced at Irondale, Mo., according to reports, for this proposed railway from Irondale, Washington county, to Farmington, through the Flat River lead district, about 20 miles. The company was incorporated Nov. 26 by H. J. Cantwell, William Carter and others.

GEORGES VALLEY.—Reports state that this line, now in operation between Warren and Union, Me., eight miles, will probably be extended to Searsmont, about eight miles north of Union. J. Mitchell, Pres. and Mgr., Union, Me.

HUMBOLDT, DYERSBURG & TIPTONVILLE.—This company was incorporated in Tennessee, Dec. 21, with an authorized capital stock of $1,500,000 to build a railway from Humboldt, in Gibson county, to Dyersburg, and then to Tiptonville, in Lake county, about 60 miles. The incorporators are: F. S. Blake, J. S. McTighe, J. D. McClerkin, W. H. Tucker, J. N. Parker, W. F. Fowler and John F. Hamilton.

KANSAS & SOUTHERN.—J. L. Rodgers, Westmoreland, Kan., informs us that surveys have not yet been made for this proposed line to connect with Blaine or Wheaton, Kan., on the Union Pacific Ry., a distance of 9 or 11 miles, but that they will most likely be completed by Jan. 15. Capital has not been fully secured, but an election has been called to vote aid to the project. The Southern Construction Co., of St. Louis, will do the construction work. Irving H. Wheatcroft, Pres., St. Louis, Mo.

KANSAS, OKLAHOMA CENTRAL & GULF.—Jacob H. Bartles, Pres., Bartlesville, Ind. Ter., informs us that surveys have been made and location completed for 200 miles of this proposed line from Cherryvale, Kan., to Vernon, Tex., via Bartlesville, Ind. Ter., Guthrie and El Reno, Okla., a total distance of 350 miles. About 45 miles have already been graded and are ready for ties and rails. B. J. Dalton, Ch. Engr., Caney, Kan.

KANSAS SOUTHWESTERN.—This company was incorporated in Kansas, Dec. 23, with a capital stock of $8,000,000. The incorporators own the old Anthony branch of the St. Louis & San Francisco Ry., which as bondholders they lately purchased at the foreclosure sale. The property is now operated by the Santa Fe, which, it is reported, will buy it in due time. It is stated in the articles of incorporation that the road is to be extended into Oklahoma and the Indian Territory. The directors are: Samuel Barker, Patrick M. Banker, John S. Hendrie and William N. Long, of Hamilton, Ont.; John Penman, Paris, Ont.; James N. Young of Chicago; Albert A. Newman, of Arkansas City, Kan.; W. E. Blackburn, Anthony, Kan., and James Glover, of Bluff City, Kan. The offices of the company are at Kansas City.

LAKE TAHOE.—This company has been incorporated in California, with a capital stock of $100,000, to construct a narrow gage line from Tahoe City, Cal., to Truckee, on the Central Pacific Ry. Surveys have already been made. The directors are: D. L. Bliss, Carson City, Nev.; D. O. Mills, N. K. Masten and others.

MEXICAN INTERNATIONAL.—Reports state that the extension of this line from Reata to Monterey, Mexico, about 50 miles, will soon be completed. Thos. H. Hubbard, 23 Broad St., New York.

MINNESOTA & IOWA.—This company was incorporated in Iowa, Dec. 23, with a capital stock of $50,000, to construct and operate a line from Sanborn, on the Winona & St. Peter Ry., south to the state line, via Brown, Cottonwood, Watonwan and Martin counties. Marvin Hughitt, Pres.; M. M. Kirkham, Vice-Pres. and Treas.; J. B. Redfield, Secy.; J. M. Whitman and J. B. Redfield, of Chicago; Edward C. Cartney, of Evanston, and W. A. Scott and J. C. Stuart, of St. Paul, are the incorporators.

ONTARIO & RAINY RIVER.—D. F. Burke, Port Arthur, Ont., is stated to have said that the construction of this new line from Port Arthur towards Rainy Lake, 200 miles, is progressing, and that about 400 men are at work on the line. It is expected that by the end of next May the rails will be laid on 20 miles of the roadbed, extending from Stanley station, on the Port Arthur, Duluth & Western Ry., to the Mattawan River. A further extension of ten miles will be made by July, bringing the railway to the Mattawan iron range, thus permitting the shipment of iron ore. There are now 12 survey parties at work between Stanley station and the mouth of the Rainy River. The company hopes to obtain a grant of the $6,400 a mile at the coming session of the legislature, in which case about 4,000 men will be put on construction work next summer, and an effort made to complete the line within two years. E. F. Fauquier, Ottawa, Ont., is the contractor for the first 20 miles. Wm. Mackenzie, Pres., Toronto; T. H. White, Ch. Engr., Port Arthur.

QUEEN ANNE'S.—Reports state that this company has decided to build a branch from Queenstown to Centreville, Md., a distance of seven miles. Right of way has already been secured and the survey is now being made. It is expected that construction will begin this winter or early in the spring and the line will be opened next summer. The company is also considering the advisability of establishing steamer service between Rehoboth Beach and Cape May, a distance of 12 miles. I. W. Troxel, Gen. Mgr. and Ch. Engr., Queenstown, Md.

SABINE PASS & NORTHWESTERN.—This company, which has been incorporated in Texas, with a capital stock of $400,000, proposes to construct a line from Sabine Pass to Bonham, via Palestine, Athens, Canton and Greenville, Tex., a distance of about 300 miles. Surveys have been made between Greenville and Palestine, 100 miles, and contracts on this section will probably be let about Jan. 15. W. H. Brooker, Gen. Mgr., Fort Worth, Tex.

ST. LOUIS, IOWA & NORTHERN.—Preliminary surveys have been made by C. J. Dubois, Macon, Mo., according to reports, for this proposed line. The company is expected to be incorporated soon in Missouri, and to begin work about 25 miles east of Macon and extending north and south.

ST. LOUIS & O'FALLON.—Press reports state that the St. Louis & O'Fallon Coal Co. will soon let contracts for the construction of 12 miles of railway from East St. Louis to the company's mines near O'Fallon, Ill.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—Foley Bros. & Muir, St. Paul, Minn., and Grant Bros., San Francisco, Cal., have been awarded contracts for different pieces of grading between Port Richmond and Pinole, a distance of nine miles. Work on the Franklin tunnel is said to be about half finished. East of this tunnel, two more will be built, one 1,200 ft. in length and the other 300 ft. East of the Contra Costa hills no grading has yet been done. It will be easy work, and the contract will soon be let. From Antioch east 12 miles to the tules half the grading has been completed. Through the tules seven miles of embankment has been thrown up and two miles of bridges and trestles are being built; the embankment is 16 ft. high. The grading from the tules to Stockton, a distance of eight miles, is also being rushed forward. Across the San Joaquin River at Stockton a bridge 240 ft. in length will have to be constructed. Plans for the bridge are now being prepared. A steel viaduct one-half mile long will also be built across one end of the Alhambra Valley. W. B. Storey, Jr., Ch. Engr., San Francisco, Cal.

SAN JUAN & RIO PIEDRAS.—This company has been incorporated in New York, with a capital of $300,000, to construct and operate an electric or steam railway, 7½ miles in length, from San Juan to Rio Piedras, Porto Rico. The directors are: George H. Walbridge, Fernando G. Echeveddia, H. H. Harrison, Edward Schmidt, Lathrop R. Bacon, F. Kingsbury Curtis, Philip H. McMillan, Augustin N. Hand and Wm. B. Parsons, of New York. Reports state that this company recently purchased the street railway in San Juan, which is operated by steam and was formerly owned by Count Ubarri, and that the new owners purpose to change the motive power from steam to electricity. As stated in our issue of Dec. 15, J. G. White & Co., Engineers and Contractors, of New York and Baltimore, informed us that they were interested, and that no immediate changes were contemplated.

SOMERSET.—This company has issued a notice that it will petition the legislature for permission to build an extension to Moosehead from Bingham, Me., the present terminus. On account of previous unsettled litigation the extensions could not be made. As yet no survey has been made of an extension to Moosehead or to a point where connections might be made with the Canadian Pacific or the Bangor & Aroostook. R. W. Dunn, Pres., Oakland, Me.

SOUTHERN PACIFIC.—This company is said to contemplate extending its double track from Oliver to Segura, La., a distance of eight miles. J. T. Mahl, Ch. Engr., Houston, Tex.——Reports state that the Southern Pacific Co. has just placed with several Eastern firms contracts for new cars and locomotives of the aggregate value of about $2,000,000. The new rolling stock comprises 2,500 box cars, 250 flat cars, 250 gondolas or coal cars and 50 locomotives. Most of the locomotives will be of the 10-wheel type, and are intended for the freight service. Quite a number of them will be used on the mountain sections of the road in California. The new box cars will mostly be used in the overland freight service. This is said to be the largest order ever given for equipment at one time by the company.

WABASH.—Reports state that this company is unloading material for the construction of its 27-mile cut-off between Moulton and Albia, Ia. The surveys are completed, specifications are out and contracts will be awarded early in the spring. W. S. Lincoln, Ch. Engr., St. Louis, Mo.

WASHINGTON.—Malcolm M'Dougall, Colonial Bldg., Seattle, Wash., has applied to the commissioners of Kings county for a franchise for the construction and operation of a standard gage railway from Tacoma northward, presumably to Seattle.

WASHINGTON & COLUMBIA RIVER.—The trustees of this company have declared their intention to build seven branch lines in Oregon and Washington of a total length of 160 miles. J. G. Cutler, Ch. Engr., Walla Walla, Wash.

WISCONSIN & MICHIGAN.—Press reports state that this railway, 60 miles in length, has been sold to the Toledo & Ann Arbor R. R. Co. The Wisconsin & Michigan is to be extended six miles, to connect with the Holmes & Son logging line, which extends 40 miles in a northwesterly direction from Pembina. The Holmes road will be extended to tap a big tract of pine timber in Forest and Vilas counties, estimated at 1,000,000,000 ft. This timber will be brought to Marinette to be sawed in Marinette and Menominee mills, and will prolong the life of the mills here many years. Ultimately the Holmes road will be extended to Duluth. The Wisconsin & Michigan extends from Peshtigo Harbor to Faithorn Junction. The company will lay its own tracks into Marinette, Wis. Next year the extension will reach the Menominee iron range.

STREET AND ELECTRIC RAILWAYS.

BIDDEFORD, ME.—It is announced by F. A. Hobart, of Boston, that a contract has been closed and executed with Isaac A. Walker & Son, contractors, of Philadelphia, Pa., to build, equip and put in operation early in the season of 1899 the Saco River Electric R. R., from the Biddeford line to Bonny Eagle, in the town of Standish.

PORTSMOUTH, N. H.—The stockholders of the Portsmouth & Dover R. R. Co. have voted to authorize the Boston & Maine R. R. Co. to extend the Portsmouth Electric St. Ry. through Newcastle, Rye and Hampton, and accept its proposition for the loan of money to complete the road until new stock could be issued to repay the loan. The project of equipping the Portsmouth and Dover line with electricity was not acted upon.

LAKEVILLE, MASS.—N. G. Staples, First Selectman, Lakeville, informs us that no opposition was made to the granting of a franchise to the Taunton & Middleboro St. Ry. Co., at the public hearing on Dec. 17. The proposed route is from Taunton to Lakeville, six miles. Chas. H. Wilson, Pres., Exchange Bldg., Boston, Mass.

TEMPLETON, MASS.—It is reported that work will begin in the spring on the proposed Templeton & Gardner Electric St. Ry., in which P. Blodgett, of Templeton, and others are interested. The company has been incorporated for two years, but its charter has been extended to next March.

WAITSFIELD, MASS.—This town has voted to issue $19,000 in bonds to aid in the construction of the proposed Mad River Valley Electric Ry., from Montpelier to Warren, via Middlesex, Moretown and Waitsfield, a distance of about 26 miles. F. C. Kennedy, Pres., Burlington, Vt.; V. K. Nash, Ch. Engr., Woonsocket, R. I.

BRANFORD, CONN.—The Branford Electric Co., has organized the Branford Electric Ry. Co., with a capital stock of $200,000 to build a line to East Haven. A. M. Young, Pres.; A. E. Hammer, Secy.; A. O. Shepardson, Treas.

ELMIRA, N. Y.—H. M. Herbert, Ch. Engr., Bound Brook, N. J., informs us that the news item in our last issue referring to the construction of the Elmira & Seneca Lake Ry., was correct, except that no contract has yet been made for the ties, poles or labor. The American Engineering Co., Bound Brook, N. J., and 710 Harrison Bldg., Philadelphia, Pa., has the contract to build and equip the line, which will be 17 miles in length, and will be put in operation by May 15. The final location of the line is now being made, after which the dry masonry culverts will be built, piles driven, and the iron work ordered for bridges. Grading and track laying will not be commenced until the frost is out of the ground. The route is from Horseheads to Watkins, via Pine Valley, Millport and Montour Falls. Fourteen miles of the line is on private right of way, all of which has been secured. Gen. John E. Mulford, Pres., of Montour Falls, N. Y.; John Blair MacAfee, Pres. of American Engineering Co.

SCHUYLERVILLE, N. Y.—The company which proposes to build a line from Greenwich to Schuylerville, and in which J. A. Powers, Lansingburg, N. Y., is interested, has bought the water power at Middle Falls, on the Batten Kill.

MORRISTOWN, N. J.—J. E. Melick, of Morristown, informs us that definite facts regarding the proposed electric railway from Paterson to Trenton, N. J., can not be given until about April.

ROSELLE, N. J.—A public hearing will be given here Jan. 6, on the application of the Westfield & Elizabeth Electric Ry. Co., for a franchise to build through this place. Should the franchise be granted it will complete the company's right of way between Elizabeth and Plainfield.

LANCASTER, PA.—It is reported that the Inter-Urban Ry. Co., has decided to build a trolley line from 63d and Market Sts., Philadelphia, to Lancaster, via Willistown Inn, Westchester, Unionville and Quarrytown, with a branch between Oxford and Westchester. For the construction and equipment of the line an issue has been made of $1,000,000 of 5 per cent. 40-year gold bonds, being at the rate of $12,000 a mile. Among those interested are: W. T. Forsyth, Ch. Engr., of Avondale, Pa.; J. P. Thomas, Whitford, Pa.; Dr. G. N. Philips and Marshall S. Way.

MACUNGIE, PA.—An extension of the trolley line from Emaus to this borough, a distance of 3½ miles, is projected. Hugh E. Crilly, Allentown, Pa., is said to be the promoter.

POTTSTOWN, PA.—Joseph MacCarroll, Pres. of Fairmount Construction Co., 723 Walnut St., Philadelphia, Pa., informs us that his company has already received the contract for the construction of the proposed Montgomery & Chester Electric Ry. from Pottstown to Phoenixville, via Limerick Square, Royersford and Spring City, a distance of 16 miles. The rights of way between Spring City and Phoenixville have been obtained and the necessary capital for construction secured. The incorporation of this company was noted in our last issue. John S. Ridgway, Pres., Philadelphia.

BALTIMORE, MD.—J. G. White & Co., of Baltimore, and 29 Broadway, New York, have the contract for building an extension of one mile to connect the Baltimore, Middle River & Sparrow's Point Electric Ry. with the Fairmount Ave. line of the Central Ry.

NORFOLK, VA.—Reports state that the Norfolk & Atlantic Terminal Ry. Co. has asked permission of the city council to build a trolley line in the city. This road is proposed from Norfolk to a point on Chesapeake Bay, nearly opposite Old Point Comfort. D. Lowenburg, Pres., Norfolk.

CHATTANOOGA, TENN.—The Chattanooga Electric Ry. Co. is said to contemplate the extension of its Carter St. line to the factories west of Cameron Hill. J. H. Warren, Pres.

HAMILTON, O.—Press reports state that a company has been incorporated by J. C. Hooven, G. A. Rentschler, C. E. Hooven, George Helvey, Fred. Shaffer and Stanley Shaffer, of Hamilton, with a nominal capital of $25,000, to build from the terminus of the Cincinnati Consolidated line at Anderson's Ferry, seven miles below Cincinnati, to the towns of Lawrenceburg, Aurora and Rising Sun and the "Queen City," a distance of 38 miles. Rights of way and franchises have been secured from the Indiana line to Aurora, and the preliminaries necessary for a continuation to Rising Sun, will soon be completed.

MARION, IND.—Charley L. Harry, Supt. of Kokomo St. Ry. Co., has filed petitions with the commissioners of Tipton and Hamilton counties asking for the right of way for an electric railway extending from Tipton south through Atlanta, Arcadia and Cicero to this city. E. H. Shirk, Pres. of the Tipton National Bank, is also said to be interested in the proposed line.

NEW CASTLE, IND.—The commissioners of Henry county, Dec. 16, granted a franchise to the New Castle Electric Ry. Co., consisting of E. B. Phillips, R. Wisehart, Thad. Gordon, D. P. Jennings, Dr. J. F. Thompson and T. B. Millikan. The franchise requires work to begin before Oct., 1899, and one of its proposed lines to be finished within six months from that time.

FLINT, MICH.—The common council Dec. 21 granted W. E. Avery, of Detroit, and Dan. L. Davis, of Pontiac, Mich., a 30-year franchise to build an electric street railway system in Flint, to be operated in connection with a line to be built to Long Lake. Work is to begin March 1, and cars are to be running to the lake by June 15. The franchise provides for a guarantee bond of $5,000.

CHICAGO, ILL.—The People's St. Ry. Co., of Chicago, has been incorporated with a capital stock of $10,000, by Joseph W. Latimer, Robert R. Reynolds and J. Guy Latimer, according to reports.——It is announced that the Northwestern Elevated R. R. Co., of this city, has closed negotiations for $4,500,000 whereby it will be enabled to resume work on its proposed elevated system. The directors of the company will be C. Ledyard Blair, of New York; Edward L. Brewster, Clarence Buckingham, Bryan Lathrop and D. H. Louderback, of Chicago; W. W. Miller, of New York, and John C. Welling, of Chicago.

HARVEY, ILL.—It is announced that the Chicago Electric Traction Co., will extend its line from Blue Island to Harvey in the spring. J. S. Bache, Pres., 88th St. and Vincennes Road.

KENOSHA, WIS.—John C. Wegner, of Milwaukee, Wis., has made application for a street railway franchise in Kenosha in behalf of the Kenosha Traction Co.

IOLA, KAN.—Work has begun, according to reports, on the proposed line of the Iola Rapid Transit Co., in this city. This company was incorporated May 17, with a capital stock of $10,000, to build between Iola and Laharpe and Moran. Alfred W. Beck, Secy.

LEAVENWORTH, KAN.—Amos A. Fenn, of Leavenworth, and others, have been granted a franchise to build an electric line between this city and Kansas City, to cost about $400,000. A power house will be built near Wallula.

OMAHA, NEB.—An extension of the Omaha St. Ry. in the spring is said to be projected. D. H. Goodrich, Secy.

FENTON, MO.—Reports from St. Louis state that the McCoy Construction Co. will begin at once the construction of the proposed Fenton & Southwestern Ry., from Fenton to Carondelet, St. Louis, a distance of 28 miles. Thos. F. Sneed, Pres.

GALENA, MO.—A. H. Rogers, Pres. of Southwest Missouri Electric Ry. Co., is stated to have said that his company intends to build a power house at Galena, so as to be able to extend the line through to Empire City, Riceville and Spring Grove.

ST. LOUIS, MO.—The St. Louis County St. Ry. Co. has filed a petition with the county commissioners for leave to substitute electricity for the present mule motive power. M. B. Greenfelder, Pres., Central P. O., St. Louis county.

PINE BLUFF, ARK.—Jeff Hicks, Pres. of Pine Bluff Electric Light & St. Ry. Co., of Pine Bluff, informs us that contracts for the construction of the proposed seven miles of electric railway for this company will be let not later than Jan. 10. Bonds are now being placed. This company was incorporated Dec. 6, with a capital stock of $300,000.

ELECTRIC LIGHT AND POWER.

EVERETT, MASS.—The petition of Perry D. Blackden for permission to construct and maintain an electric lighting plant here will be referred to the next city government.

HARTFORD, CONN.—The Housatonic Power Co. will petition the general assembly for an amendment to its charter, giving it the right to build a dam across the Housatonic River, between Bridgewater and Brookfield, and the right to conduct electricity from New Haven county to points in Hartford county. The company intends to obtain power from the water fall created by the construction of one or more dams for the generation of electricity.

ALBANY, N. Y.—Plans for the establishment of an electric light plant at the penitentiary whereby all the county building in this city and possibly Watervliet and Cohoes will be lighted, have been presented to the board of county supervisors.

CANANDAIGUA, N. Y.—Reports state that the village trustees have refused the petition of M. D. Munger for the operation of an electric light plant. Mr. Munger will petition the new board when organized.

CLEVELAND, N. Y.—A fire here, Dec. 18, destroyed the electric light plant which furnished the light and power for the United Glass Co.; loss, about $2,000.

ILION, N. Y.—John V. Schmidt informs us that the question of municipal ownership of light and power plant is being agitated.

LOCKPORT, N. Y.—W. T. Ransom informs us that the plans for developing power at Lockport are not yet completed, and that it cannot be stated at present when work will be started.

NEW YORK, N. Y.—The following bids were received Dec. 17 by the bureau of yards and docks, Washington, D. C., for enlarging the wiring system at the navy yard: Blake & Williams, New York, $19,577; Chas. L. Eidlitz, New York, $16,529; Commercial Construction Co., New York, $16,108; J. F. Buchanan Co., Philadelphia, Pa., $15,555; T. M. Mowrey, New York, $21,000; New York Electric Equipment Co., New York, $16,870; Western Electric Co., New York, $18,360.——The following bids were also received, according to reports, for extending the electric light system at the navy yard (a, engines, dynamos, etc.; b, condensors, insulators, pumps, piping, etc.): Eddy Electric Mfg. Co., Windsor, Conn., a, $18,300; b, $6,366; a, Ball engines, $21,500. Ridgway Dynamo & Engine Co., Ridgway, Pa., a, $20,977; alternate, deduct $650. Burhorn & Granger, 136 Liberty St., New York, a, $19,191.62; b, $6,371, Sheppard engines. Triumph Electric Co., Cincinnati, O., a, $20,575. Francis Bros. & Jellett, Philadelphia, a, $22,700, $23,100, $23,700 and $24,200; b, $21,200. Northern Engineering Co., New York, a, $19,167; Ball engines, $21,972; Armington-Sims engines, a, $20,982; b, $5,278. Thresher Electric Co., Dayton, O., Buckeye engines, a, $18,401; Ball engine, a, $20,026; $26,766; Watertown, $16,486. Siemens & Halske Electric Co., Philadelphia, a, Ball, $21,237; Ball, $21,987; A. & S. engines, $19,962; do., one wheel, $20,362; Watertown, $18,612, type I dynamos; Ball, $20,762; do., $21,512, A. & S., $19,962, A. & S., $20,362; Watertown, $12,612. Type D internal armature dynamos. Bullock Electric Co., New York, a, Wells engine, $18,975, or Watertown engines, $21,150; Ball engines, $21,150. General IncandescentArc Light Co., New York, a, $19,000. General Electric Co., New York, a, $18,500; one extra engine, $1,500 more. Western Electric Co., New York, a, (a) $20,932, (b) $21,614, (c) $27,845; b, (a) $6,602, (b) $7,896; (a) Standard Ball; (b) Standard Ball, Western dynamos; (c) Ball & Wood engines; (d) Western dynamos.

NEW YORK, N. Y.—Reports state that the New York Gas, Electric Light, Heat & Power Co. has purchased land between 95th and 96th Sts., 1st Ave. and the East River, and also on Berrian's Island. The erection of a power plant on the latter and a distributing station on the former in order to furnish light and power for New York city is projected. W. C. Whitney and John D. Crimmins are interested.

CAMDEN, N. J.—Bids are asked until 7.30 o'clock, Dec. 29, for lighting the streets of this city with incandescent and arc lights for the terms of one, three and five years, beginning July 1, 1899. Chas. C. Southard, Chn.

SYRACUSE, N. Y.—Bids will be received until Dec. 30 for the wiring, etc., of the Washington Irving school building for electric lighting. P. D. Cooney, Clk.

SWEDESBORO, N. J.—H. W. Ridgway, Secy., informs us that nothing has been done towards the proposed electric light plant.

VINELAND, N. J.—The Citizens' Committee of this place will petition the property holders for $140,000 in bonds for electric light, water and sewerage improvements.

WILDWOOD, N. J.—L. R. Baker informs us that no steps have been taken towards securing an appropriation or awarding contracts for proposed electric light plant.

EASTON, PA.—The Easton Power Co., according to reports, will soon begin the erection of an electric light plant at this place. T. A. H. Hay, Easton, Pres.; L. I. Fletcher, Boston, Mass., Supt. of Construction.

BALTIMORE, MD.—Reports state that Thos. F. Hayward has purchased the charter of the Wenstrom Electric Light Co.

SALISBURY, S. C.—It is reported that the Yadkin Power Co. contemplates the erection of a plant.

SPARTANBURG, S. C.—J. L. Carson informs us that preliminary estimates for an electric light and power plant are being sought to see whether it would be a paying investment.

ATLANTA, GA.—George Hillyer informs us that the people voted in favor of municipal ownership of power plant last October, and that the problem will be considered by the new council taking office Jan. 1.

COLUMBUS, GA.—Bids will be received until Jan. 4 for 100 arc lights in old city and 15 in annex, 200 c. p. each. M. M. Moore, Clk. of Council.

TUSKEGEE, ALA.—The legislature has passed a bill authorizing the issuance of $30,000 water-works and electric light bonds.

TUSKEGEE, ALA.—Alber & Byrne, Engrs., Birmingham, Ala., have been engaged by this city to prepare plans and specifications for a plant in this city. Contracts will be let about Feb. 1.

LAKE PROVIDENCE, LA.—This city has voted in favor of the issuance of $7,500 of water and electric light bonds.

NEW ORLEANS, LA.—Alfred Raymond, Cy. Electrician, informs us that no plans have been made for an electric light plant for this city. Light will be supplied by the present contractor until the end of 1902.

RICHMOND, KY.—The Richmond Electrical Co. has been organized with a capital stock of $10,000 to erect a plant at this place. J. D. Hariss, Pres., Cincinnati, O.; F. H. Adair, Supt., Carlisle, Ky.

NEW PHILADELPHIA, O.—The injunction which restrained the work being done by Mr. Beyer has been dissolved.

NEW RICHMOND, O.—The following contracts were awarded for the construction of an electric light and water-works plant, the engine only being omitted: Rumsey & Co., Seneca Falls, N. Y., pump, $1,950; American Pipe & Foundry Co., Chattanooga, Tenn., pipes and special castings, $6,766; R. D. Wood & Co., Philadelphia, Pa., hydrants, 6-in., $22.50, 4-in., $19.80; Bourbon Copper & Brass Works, Cincinnati, O., valves, 10-in. at $18.50, 8-in. at $13, 6-in. $9, 4-in. $5.65,; Standard Boiler & Bridge Co., Bellaire, O., building (including smokestack), boilers, well and intake, reservior and pipe-laying, $11,268; Westinghouse Electrical & Mfg. Co., Pittsburg, Pa., electric light system complete, $5,000.

SIDNEY, O.—The council proposes to issue $15,000 in bonds for constructing a plant.

INDIANAPOLIS, IND.—A power house is being designed for John H. Murphy for supplying power and light to small manufacturing concerns in this city. The building will be five stories high, 90 × 250 ft., and will cost from $40,000 to $45,000.

MUNCIE, IND.—The electric light plant here was damaged by a natural gas explosion, Dec. 16, to the extent of about $5,000.

BELDING, MICH.—We are informed that bids will be received until Jan. 20 for street lighting. Fred. P. Smith, Cy. Clk.

DETROIT, MICH.—It is probable that an additional plant will be necessary for Belle Isle; estimated cost, $10,000. D. W. Simons, Comr.

GRAND RAPIDS, MICH.—The council has decided to spend $16,000 for the purchase of the electric light towers from the Grand Rapids Electric Light & Power Co.

MOUNT PLEASANT, MICH.—The following bids were received Dec. 20 by the Indian Office, for installing an electric light plant at the Mount Pleasant School: Arthur Frantzen & Co., Chicago, Ill., plant complete, $4,351; Fort Wayne Electric Corporation, Fort Wayne, Ind., plant complete, $3,500; W. C. Nagel & Co., Toledo, O., plant complete, $2,500; Fisher Electric Mfg. Co., Detroit, Mich., dynamo and switchboard, $790; Ridgway Dynamo & Engine Co., Ridgway, Pa., engine, generators and foundation, $2,221; Westinghouse, Church, Kerr & Co., New York, engine belting, etc., $1,410; Bullock Electric Mfg. Co., Cincinnati, O., generators, $735; switchboard, $115.

WAUKEGAN, ILL.—Reports state that the committee on electric lighting has engaged Foree Bain, of Chicago, to furnish estimates for an electric light plant. Com., Aldermen Rice, Garvin and Welch.

LITTLE FALLS, MINN.—F. E. Hall, Cy. Clk., informs us that nothing will be done towards the proposed water and electric light plant until some time in January.

MENAHGA, MINN.—Carl Eastwood informs us that bids for the electric light plant will probably be received Feb. 1; estimated cost, $4,000.

EAU CLAIRE, WIS.—Reports state that the Chippewa Valley Electric Ry. Co. contemplates the construction of a power plant and will bid for the contract for city lighting.

SIOUX CITY, IA.—The Iowa Building Co. has closed a contract for the purchase of a $4,000 electric light plant for the Iowa building, according to reports.

CENTRAL CITY, NEB.—Reports state that the construction of an electric light plant in this city is contemplated.

O'NEILL, NEB.—Reports state that the electric light plant will be started again. G. W. Johnson, Treas. Western Electric Association of Omaha, and A. Minnick, Falls City, Neb., are interested.

HASTINGS, NEB.—Reports state that the establishment of another electric light plant at this place is projected.

WICHITA, KAN.—The construction of the electric light plant will begin soon. L. B. Bradley, of the Western Engineering & Construction Co., Chicago, Ill., will superintend the work.

SEDALIA, MO.—W. H. Powell has petitioned the city for an electric light franchise.

PRAIRIE GROVE, ARK.—Reports state that this place will soon build water-works and an electric light plant.

HOUSTON, TEX.—The Citizen's electric light plant will be constructed by the General Electric Co. Gus. Warnecke has contracted with the Electric Company for supplying the new plant with a 6-in. artesian well.

REDLANDS, CAL.—F. G. Ferand, Secy., informs us that the Redlands Electric Light & Power Co. desires bids for 13 tunnels, ten miles of pipe line 22 to 28-in., four generators, and four water-motors, power house, two excitors, switchboard, transformers, and 80 miles of transmission line. Cost of plant is estimated at $250,000. F. C. Finkle, Engr., San Bernardino, Cal.; H. H. Sinclair, Gen. Mgr.

PRESCOTT, ONT.—The citizens of this place will vote for $15,000 electric light bonds on Jan. 2.

WINNIPEG, MAN.—F. A. Cambridge, Cy. Electrician, informs us that the issuance of bonds for the proposed electric light plant has been dropped for the present; estimated cost, $50,000.

NEW COMPANIES.—Milo Electric Light & Power Co., Milo, Me.; $10,000, commencing with $150; to supply electricity for lighting, heating and manufacturing purposes; Julian d'Este, Pres., Boston, Mass.; Frank E. Guernsey, Clk., Dover, Me.

Donley Electric Light Co., Lansing, Mich.; $40,000.

Perry Electric Co., Peoria, Ill.; $2,500; Nathaniel V. Perry, Ralph E. Seymour and Dwight R. Chapman.

Britton Power & Electric Light Co., Britton, S. Dak.; $3,500; to operate artesian well, water-works system and an electric light plant at this place; Charles Hamilton, Henry L. Stokes, Eugene A. Cooper, George Thiel and Joseph Barber.

Artesian Water, Ice, Light & Fuel Co., Arkansas City, Ark.; $25,000; J. E. Lacy, Pres.; H. F. Bailey, Vice-Pres.; H. Thane, Secy. and Treas.

Elizabeth Lake Water & Power Co., Los Angeles, Cal.; $500,000, commencing with $250,000; S. R. Thorpe, W. H. McCoy, C. E. Hayne, P. J. Kennedy and C. C. Wright, all of Los Angeles.

Cuban Electric Co., Asbury Park, N. J.; $1,000,000; to manufacture electricity for light, heat and power; Wm. R. S. Melvin, East Orange, N. J.; G. K. B. Wade, 1 East 42d St.; Herbert A. Howell, 350 West 22d St.; Henry K. Davis, 534 East 104th St., New York; Francis A. Fuller, 455 Halsey St., Brooklyn, N. Y.

BRIDGES.

BOSTON, MASS.—Wm. J. Marvin, Bridge Comr., Cambridge, has recommended in his annual report the construction of two new bridges over the Charles River, to replace the Craigil and North Harvard St. bridges.

BRIDGEPORT, CONN.—The board of aldermen voted Dec. 19 to ask the state legislature for power to issue $60,000 in bonds for the proposed new draw bridge over Yellow Mill Pond.

BATAVIA, N. Y.—The town board is considering a proposition to construct a bridge over the New York Central & Hudson River R. R. and the Erie R. R., at Jackson St. Justice Leavenworth, Com.

RENSSELAER, N. Y.—Robert H. Strong submitted the lowest bid, Dec. 20, at $4,982, for extending Washington St., and constructing a bridge over Mill Creek. C. A. Ryan, Cy. Clk.

TROY, N. Y.—The Albany Ry. Co. will construct a new bridge over the canal, according to reports.

TUPPER LAKE, N. Y.—W. E. La Fountain, Supervisor, Tupper Lake, writes us that he awarded a contract, Dec. 22, to the Groton Bridge Co., Groton, N. Y., for the construction of a steel bridge 160 ft. long, roadway 16 ft., capacity 100 lbs. per sq. ft., on four cylinder piers, 4 × 24 ft.

PHILADELPHIA, PA.—Bids were received Dec. 13 for a bridge at Sheaf Lane, from S. Gourley, Jr., 21st St. and Ridge Ave., Philadelphia (accepted), at $6,392, and Delaplaine & West, Fidelity Bldg., Philadelphia, at $4,957. Thos. M. Thompson, Dir. Dept. Pub. Wks.

CARROLLTON, KY.—The fiscal court has appropriated $20,000 for the construction of a bridge over the Kentucky River.

LORAIN, O.—We are informed that the following bids were received Dec. 22 for constructing the superstructure of a lift bridge over the Black River at Erie Ave., as advertised in Engineering News. Geo. H. Lewis, County Audr., Elyria, O.:

*King Bridge Co., Cleveland, O.	$145,000
Variety Iron Works, Cleveland, O.	150,000
Youngstown Bridge Co., Youngstown, O.	154,000
Groton Bridge Co., Groton, N .Y.	148,800
**C. L. Strobel, Chicago, Ill.	144,100
Wrought Iron Bridge Co., Canton, O.	148,000
Mt. Vernon Bridge Co., Mt. Vernon, O.	150,000
Toledo Bridge Co., Toledo, O.	150,000
J. Wagner Co., Milwaukee, Wis.,	147,000
Edge Moor Bridge Works, Wilmington, Del.	149,000
Horsehead Bridge Co., Horsehead, N. Y.	160,000
Massillon Bridge Co., Massillon, O.	150,000
Champion Bridge Co., Wilmington, O.	155,000

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*Plan B, $145,200; C. $140,000.

**Plan B, $146,050; C, $144,150.

NORWALK, O.—The council proposes to construct a new steel viaduct at Linwood Ave., to cost about $15,000.

CHICAGO, ILL.—Bids are asked by the board of trustees of the sanitary district until Feb. 20 for furnishing the material and constructing the substructure and superstructure of a two-track Scherzer rolling lift bridge over the Chicago River, near Taylor St., as described in our advertising columns. Wm. Boldenweck, Pres.; Joseph F. Haas, Clk.

FOOSLAND, ILL.—Walter Ritchie, Comr. Highways, Foosland, informs us that a contract has been awarded to the Massillon Bridge Co., Massillon, O., for a bridge south of Bellflower Road.

MINNEAPOLIS, MINN.—The contract for furnishing the steel and iron work f. o. b. cars for the widening of the stone arch bridge over the East Channel of the Mississippi River was awarded by the council, Dec. 21, to the Toledo Bridge Co., Toledo, O., at $10,990. F. W. Cappelen, Cy. Engr.

NEWTON, IA.—Bids are asked until Jan. 2 for bridge work for the year 1899, according to reports. Frank Fisk, County Audr.

COLUMBUS, NEB.—Bids are asked until Dec. 31 for constructing a bridge across Shell Creek, according to reports. G. W. Phillips, County Clk.

GENEVA, NEB.—Bids are asked until Dec. 31 for constructing bridges for the year 1899, according to reports. A. M. Strickland, County Clk.

TRENT, S. DAK.—Bids are asked until Jan. 4 for replacing the Trent bridge, according to reports. H. W. B. Souther, County, Audr., Flandreau, S. Dak.

LEXINGTON, MO.—A bill has been presented to congress for the construction of the proposed bridge over the Missouri River, to cost about $50,000. Frank Bowman, Secy. Com., Lexington.

SEATTLE, WASH.—Reports state that the Great Northern Ry. Line proposes to replace all the wooden bridges with steel structures and fill in trestles west of Minot St., aggregating about 172,560 lin. ft., in the spring. N. D. Miller, Ch. Engr., St. Paul, Minn.

MULBERRY, CAL.—R. T. Stone, County Surveyor, Hollister, writes us that it is proposed to construct a combination bridge of one span, 100 × 18 ft., capacity, 1,400 lbs. per lin. ft., on two cylinder piers 40 ft. in diameter and 22 ft. high, filled with Portland cement 1 to 5 parts; estimated cost, $1,800. There is no other work projected at present.

LEWISTON, IDAHO.—W. E. Moore, Engr., Lewiston Water Power Co., informs us that the Pittsburg Bridge Co., Pittsburg, Pa., has the contract for the sub and superstructure of a cantilever Pratt truss bridge with viaduct approaches. Work was commenced Dec. 15 on the concrete piers. Des. Engr., J. R. Worcester, Boston, Mass.

ELORA, ONT.—The Wellington county court has adopted a resolution to construct a steel bridge at this place, to cost $3,100, according to reports.

SUMMERHILL, ONT.—Reports state that the county commissioner at Seaforth, Ont., recommends the construction of a bridge 100 ft. long on concrete abutments, next spring.

BUILDINGS.

BARRE, MASS.—Competitive plans are being prepared by six architects of Boston and Worcester for a new high school building in this town, to cost $30,000.

BOSTON, MASS.—The contract for erecting the new Quincy St. school building is reported to have been let to James Fagen, at $81,670.

BROCKTON, MASS.—Bids are asked until Dec. 29 for heating and ventilating the Copeland school building (four rooms). A. E. Woodward, Supt. of Pub. Property.

PAWTUCKET, R. I.—The council has appropriated $52,000 for the erection and furnishing of two new school buildings, one to cost $32,000 and the other $20,000.

BROOKLYN, N. Y.—Newman & Co., 355 Allen St., Brooklyn, were the lowest bidders, Dec. 22, for repairs and alterations to the Municipal Building in this city, at $31,750. Other bidders were: Leonard Bros., 963 Bergen St.; Charles Hart, 4th Ave. and Degraw St., Brooklyn; Kelly & Kelley, 220 Broadway, New York.——M. Gibbons & Son, Brooklyn, are said to have been the lowest bidders, Dec. 23, for the erection of a storehouse at the Navy Yard, at $62,975.

NEWARK, N. Y.—The Sherman House in this village was destroyed by fire Dec. 27, causing a reported loss of about $25,000. Stephen F. Sherman, Mgr.

NEW YORK, N. Y.—It is announced that Jacob H. Schiff will erect a new building at 92d St. and Lexington Ave., which he will present to the Young Men's Hebrew Association; estimated total cost, $150,000.——Plans have been filed by Roberts & Haines, 703 East 135th St., for four 5-story brick flat buildings on 136th St., east of Willis Ave., to cost $88,000. Harry T. Howell, Arch., 748 East 138th St.; by Arthur Moore, 232 West 112th St., for three 5-story brick tenement buildings on 108th St., near Columbus Ave., to cost $54,000. C. A. Millner, Arch., 81 East 125th St.; by A. L. Norrie, 17 East 41st St., for a 2-story brick stable at 14 and 16 East 86th St., to cost $85,000. Renwick, Aspinwall & Owen, Archs.; by L. F. J. Weiher, Jr., Owner and Arch., 125th St. and Park Ave., for a 6-story brick flat and store building at 3d Ave. and 81st St., to cost $100,000; by C. F. Rodgers, 1663 Amsterdam Ave., for a 6-story and two 7-story brick flat and store buildings at 142d St. and Hamilton Place, to cost $240,000. Neville & Bagge, Archs., 217 West 125th St.; by Charles Naarden, 138 East 104th St., for four 6-story brick flat and store buildings at 621 to 629 East 9th St., to cost, $100,000. Schneider & Herter, Archs., 46 Bible House; by Leopold Kaufman, 35 Nassau St., for two 6-story brick flat and store buildings at 633 to 637 East 11th St., to cost $50,000. Schneider & Herter, Archs.; by Goodman & Silverson, 233 East 50th St., for five 6-story brick flat and store buildings at 408 to 418 Cherry St., to cost, $110,000. M. Bernstein, Arch., 145 Centre St.; by Mary C. Dempsey, Astoria (L. I.), N. Y., for a 7-story brick flat building at Central Park West and 98th St., to cost $90,000. Neville & Bagge, Archs.——Plans have been prepared for the reconstruction of the burned portion of the Home Life Bldg., 265 and 267 Broadway, and the mason work will be done by John Downey. N. Le Brun & Sons, Archs.—The following bids were received Dec. 20 for installing a steam heating apparatus in the Zbrowski Mansion, Claremont Park: Wm. W. Tobin, 532 Columbus Ave., (accepted), $1,140; Phillips, Doup & Co., Brooklyn, N. Y., $1,164; E. Rutzler, 176 Centre St., $1,222; Wells & Newton Co., 235 Eldridge St., $1,238; Frank Dobson, 576 West 142d St., $1,374; Jas. D. Duffy, 344½ East 16th St., $1,386; Jas. Curran Mfg. Co., 512 West 36th St., $1,421; F. A. Williams, 362 West Broadway, $1,464.

NEW YORK, N. Y.—We are informed that the following bids were received Dec. 23 by the engineer of the 3d Light House District, Tompkinsville (S. I.), N. Y., for the erection of West Bank light house, lower bay, New York Harbor; advertised in Engineering News:

	1st Site.	2d Site.
R. G. Packard, 130 Pearl St., New York	$43,950	$47,775
Philadelphia Construction Co., Phila., Pa.	31,400	35,400
Engineering Contract Co., New York	32,800	36,700
W. H. Flaherty, 7 South St., New York	34,500	37,000
Jas. Symington, 16 Exchange Pl., N. Y.	35,000	40,000

——The following bids were also received for metal work for West Bank light house:

	1st Site.	2d Site.
Emil Severin, Aurora, Ind.	$18,287	$22,677
Snead, Van Alstine, Meldrum Co.[1]	15,430	17,150
Chamblin & Scott, Richmond, Va.	16,993	18,954
Russel Wheel & Foundry Co., Detroit, Mich.	15,645	16,595
Atlanta Machine Works, Atlanta, Ga.	12,445	13,930
Builders' Iron Foundry, Providence, R. I.	14,800	16,300
Jno. P. McGuire, Cleveland, O.	11,700	13,100

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[1] Louisville, Ky.

WHITEHALL, N. Y.—The following bids were received by the adjutant-general of this state Dec. 23 for erecting and furnishing a new armory building in this city: John J. Turner, Amsterdam, N. Y., $36,493; Henry E. Wieber, Rondout, N. Y., $45,800; A. Pasquini, Albany, N. Y., $41,512; Peter Keeler, Albany, N. Y., $39,440; Pat McCann, Albany, $38,400; O'Brien & Hoolihan, Syracuse, N. Y., $39,780; William P. Buckley, Oxford, N. Y., $36,854; P. J. McCaffery, Utica, N. Y., $42,000; H. Probst, New York, $47,600; R. Richards & Son, Utica, N. Y., $39,070.50; Andrew Douglass, Rome, N. Y., $32,368.47; J. W. Whalen, Whitehall, $39,000; J. & L. McCarthy, $40,779; Reardon & Burnham, Glens Falls, N. Y., $38,100; For electric wiring the following offered bids: Blake & Williams, $1,683; Gaylord & Eitapence, $1,290; Com. Car Co., $2,155; Seymour Taylor, $1,250. The contracts were to be awarded on Dec. 28, at a meeting of the armory board.

PATERSON, N. J.—A fire in the city last week destroyed Continental Hall; estimated loss, $60,000.

TOM'S RIVER, N. J.—The following bids were received Dec. 21 for the construction of a life-saving station on Berkeley Beach, near the present station at Tom's River:

Bernard Johnson, West Hoboken, N. J., April 15	$8,966
L. J. Stone, Haddonfield, N. J., June 1	7,100
Henry A. Tolbert, Barnegat, N. J., Sept. 1	6,650
N. H. Glover Co., Rockland, Me., June 1	6,700
Wm. L. Butler, Beach Haven, N. J., May 1	6,499
Chas. W. Kafer, Trenton, N. J., May 1	7,468

McKEESPORT, PA.—McCallum & Ely, Washington, Pa., have been selected as the architects for the new 3-story brick, stone and terra cotta high school building to be erected on Shaw Ave., McKeesport, at a cost of about $80,000.

PHILADELPHIA, PA.—Bids are being received by J. E. & A. L. Pennock, contractors, according to reports, for the erection of an 11-story flat building for the Clarendon Flats Co., at 23d and Walnut Sts. Jas. D. Allen, Arch., 1017 Chestnut St.

POTTSVILLE, PA.—Bids are asked by the supervising architect, Washington, D. C., until Jan. 19, for the low pressure, return circulation, steam heating and ventilating apparatus for the U. S. post-office building at Pottsville.

WILKESBARRE, PA.—Bids are asked until 12 o'clock noon, Dec. 30, for alterations to the City Building. B. H. Carpenter, Chn. of Pub. Property Com.; A. H. Kipp, Arch., Wilkesbarre.

WASHINGTON, D. C.—Bids are asked until Jan. 21, according to reports, for erecting a new building for the "Evening Star" Newspaper Co. Marsh & Peters, Archs., 1503 Pennsylvania Ave.

ATLANTA, GA.—We are informed that the following bids were received Dec. 21 for the erection of a new court house for this county: The Butler-Ryan Co., St. Paul, Minn., granite, $144,080; oolite limestone, $143,420; marble, $146,920; sandstone, $144,350. F. P. Heifner, Atlanta, granite, $136,561; marble, $139,111; oolitic, $135,611; sandstone, $134,461. Lewis B. Beman, Cincinnati, O., granite, $145,835; marble, $148,672; limestone, $144,789. William Bensel & Co., Atlanta, marble, $137,000; granite, $135,400; oolitic, $133,600. Gude & Walker, Atlanta, granite, $131,010; oolitic limestone, $130,040; marble, $133,560; sandstone, $129,900. Chapman & Son, Atlanta, granite, $149,278; oolitic, $148,233; marble, $152,083; sandstone, $149,267. As the appropriation was but $100,000, all of the bids were rejected.

DOUGLASS, GA.—Bids are asked by the commissioners of Coffee county, until Feb. 25, for the erection of a new court house; surety, certified check for $500. Andrew J. Bryan & Co., Archs., 444 Equitable Blydg., Atlanta, Ga.

LEITCHFIELD, KY.—A fire in this city Dec. 27 caused a reported loss of about $80,000; partly insured.

AKRON, O.—Bids are asked by the supervising architect, Washington, D. C., until Jan. 19, for the low pressure, return circular steam heating and ventilating apparatus and pipe covering for the U. S. postoffice building.

WAPAKONETA, O.—Bids are asked until Jan. 4 for erecting a new school building for St. Joseph's Church. Leech & Leech, Archs., Lima, O.

DANVILLE, ILL.—Bids are asked by the National Home for Disabled Volunteer Soldiers, until Dec. 30, for the laundry machinery, engine, etc., for the laundry building at the Danville branch. W. B. Franklin, Pres. Bd. of Mgrs.; W. C. Gunnell, Engr., Danville.

DANVILLE, ILL.—It is reported that the L. J. Mueller Furnace Co., of Milwaukee, has been awarded the contract for supplying the heating apparatus in the Danville Soldiers' Home. The contract is one for material worth $35,000.

JOLIET, ILL.—The Auditorium Block, valued at $80,000, was damaged by fire, Dec. 27.

DES MOINES, IA.—Frost & Granger, Archs., 806-184 La Salle St., Chicago, Ill., inform us that bids will be let in March for the proposed passenger station to be erected in this city at a cost of about $75,000. The main station will be 280 × 40 ft., of stone and pressed brick and tile roof, with a shed 600 ft. in length. Low pressure boilers and electric lights will be installed.

MALDEN, MO.—A fire at Malden, Dec. 20, damaged the Eexton Merchandise Co.'s block and other buildings; reported loss, $70,000.

PHOENIX, ARIZ.—Bids are asked by the Office of Indian Affairs, Jan. 25, for the construction of one brick dormitory and of one water and sewer system at the U. S. Indian school. S. M. McCowan, Supt., Phoenix.

WATER-WORKS.

LIVERMORE FALLS, ME.—The Livermore Falls Water Co. has been incorporated with $100,000 capital; $1,200 paid in. D. J. Bogan, Pres.; J. H. Maxwell, Treas.

WATERVILLE, ME.—A mass meeting was held, Dec. 15, to take steps towards obtaining a new water supply, and a committee was appointed to confer with the cities of Winslow, Fairfield and Benton, with a view to presenting a bill to the legislature for the municipal ownership of the water system now in operation in these places. The Maine Water Co. owns the present system.

BOSTON, MASS.—Bids have been asked until Dec. 29 from the contractors of this city for constructing the new pumping station to be built at Spot Pond, in Stoneham. Shepley, Rutan & Coolidge, Archs.

CLAYTON, N. Y.—Sidney S. Snell, Lowville, N. Y., writes us that the specifications for the water-works and sewerage system for this town will be completed in about two weeks. There will be about five miles of mains and an equal amount of sewers.

EASTHAMPTON, N. Y.—The Home Water Co. has been incorporated with $25,000 capital, to build a plant in this village. A. M. Parsons, A. G. Terbell and J. Hunting are the incorporators.

LESTERSHIRE, N. Y.—Bids have been received for the machinery required for the new works to be built in this village. The contract involves the following: Two triplex pumps with a capacity of 350 gallons a minute; one triplex pump with a capacity of 60 gallons a minute; two gasoline engines of about 40 HP. each, and one gasoline engine of about 8 HP. Two 12-in. wells will be sunk. W. G. Faatz, Chn.; C. A. Cockroft, Engr.

MASSENA, N. Y.—A company is being organized in this place to build works, according to reports. H. B. Chase, Atty.

WHITESBORO, N. Y.—It is reported that the taxpayers voted, Dec. 19, to build works.

JERSEY CITY, N. J.—The board of finance has approved the contract to build a plant in this city, recently awarded to Patrick H. Flynn, of Brooklyn, N. Y., as noted in our issue of Dec. 15.

RIDGEWOOD, N. J.—A committee has been appointed to secure propositions for the building of works, according to report. Trustees Crouter, Stavens and Edwards have been instructed to consider them and report on Feb. 15.

VAILSBURG, N. J.—Bids are asked by the council until Jan. 11 for furnishing the material and constructing a system of water-works, including about 31,680 lin. ft. of 8, 6 and 4-in. iron pipe, 14,000 lbs. of special castings, 45 valves and valve boxes, and 43 hydrants, as stated in our advertising columns. Eugene A. McMurray, Borough Engr., 22 Clinton St., Newark, N. J.

PHILADELPHIA, PA.—Plans for the new 84,000,000-gallon Belmont reservoir, at George's Hill, have been approved of by the committee. Reports state that bids will be called for at once. Thos. M. Thompson, Dir. Pub. Wks.

PITTSBURG, PA.—Bids are asked by the bureau of water supply and distribution until Dec. 30, for laying a 48-in. riveted steel force main to the reservoir in Highland Park. Edw. M. Bigelow, Dir. Pub. Wks.

ROBESONIA, PA.—The Robesonia Water Co. has been incorporated with a capital stock of $10,000, with $1,000 paid in, to build works in this town. H. F. Fidler, of Womelsdorf, Pa., Treas. The other incorporators are Geo. H. Valentine and Wm. D. Filbert, of Womelsdorf; Saml. P. Keppel, Sinking Spring, Pa.; W. W. Light, Reading, Pa.

WASHINGTON, D. C.—It is reported that plans have been completed for a new 15,000,000-gallon reservoir, for which bids will soon be asked. W. A. MacFarland, Supt. of Water Dept.

TUXEDO, MD.—Press reports state that plans and specifications have been prepared by the Tuxedo & Embla Park Water & Light Co. for a system of water-works to be built in this place and Embla Park, and that bids will soon be asked for the construction of the same, involving a 300,000-gallon steel tower, a pump house and about two miles of 4-in., 6-in. and 8-in. cast-iron pipe. Kennedy & Beck have the contract for the 8-in. artesian wells, two of which have been sunk. D. G. Addsberger, Engr.

ROME, GA.—It is reported that this city has decided to install a filtration system.

TUSKEGEE, ALA.—We are informed that Alber & Byrne, Engrs., Birmingham, Ala., have been engaged by the city to prepare plans and specifications, and to superintend the construction of the proposed water-works and electric light plant. The city will be prepared to let the contracts about Feb. 1.

NEW ORLEANS, LA.—A. Brittin, Pres. of Council, writes us that an ordinance has just been adopted for a special tax of 2½ mills to purchase the existing water-works, owned by a private company, and to extend the same, and for building sewers. The ordinance will be voted upon on Feb. 2.

CLEVELAND, TENN.—Reports state that Judge Clark has decided in favor of the city, in a suit against the National Water-Works Construction Co., on the ground that the charter of the company is void. The company has been doing business in Cleveland under the name of the Cleveland Water & Electric Light Co. R. J. Cunningham, Recr.

KNOXVILLE, TENN.—Press reports state that the council has refused to pass an ordinance allowing the Knoxville Water Co. and the Lonsdale-Beaumont Water Co. to consolidate, as the city will soon make an effort to purchase both plants. W. A. Gage, Cy. Engr.

WELLSVILLE, N. Y.—John A. George, East Liverpool, writes us that bids will be asked in about 30 days for furnishing and laying about 1¾ miles of 12-in. water pipe.

GOSHEN, IND.—Bids have been asked for three miles of water mains for an extension across the Elkhart River, at an estimated cost of $10,000, according to press reports.

ROCKPORT, IND.—It is stated that citizens of this town are in correspondence with the state board of health with regard to building works.

HARTFORD, MICH.—It is reported that this town would vote, Dec. 27, on the question of issuing $12,000 in bonds for the erection of works.

MINNEAPOLIS, MINN.—It is reported that the Minnesota Sugar Co., St. Louis Park, has awarded a contract to S. Stenson to sink an artesian well on its property, at a cost of $6,000, with a guarantee of a supply of 1,000,000 gallons a day.

COLFAX, IA.—The council has just bought a pump for $460 from the Gardner Governor Co., Quincy, Ill., having a capacity of 500,000 gallons in 24 hours; it will be installed at once.

GIRARD, KAN.—J. B. Gratham, Cy. Clk., writes us that the council has advertised for bids for a reservoir 80 ft. in diameter and 12 ft. deep to be built of brick and cement. W. S. Hitch, Chn. Water-Wks. Com.

WAMEGO, KAN.—Bids are asked until Jan. 24 for the purchase of $25,000 of water-works bonds. F. S. Haacke, Cy. Clk., write us that the contract for constructing works has been awarded to W. W. Cook, Junction City, Kan., at $22,473. B. F. Evans, Newton, Kan., $22,500.

BOZEMAN, MONT.—Bids are asked until Jan. 17 for the purchase of $165,000 of water-works bonds; check, $2,500. Geo. D. Pease, Cy. Clk.

NEVADA, MO.—J. B. Quigley is reported to have bought the works at this place.

ARKANSAS CITY, ARK.—The Artesian Water, Ice, Light & Fuel Co. has been incorporated with $25,000 capital, to build works in this place. J. E. Lacy, Pres.; H. F. Bailey, Vice-Pres.; H. Thane, Secy. and Treas.

ABILENE, TEX.—N. Werenskiold, Engr., P. O. Box 511, Dallas, Tex., writes us that the work which the Lytie Water Co. proposes doing, as noted last issue, consists of raising the masonry spillway and dam 18 inches, and in building a flood levee to prevent high water from spreading over the land near the dam. The work will be done by day labor. Fred. Cockrell, Pres.; J. Lowdon, Secy. and Treas.

CORSICANA, TEX.—J. S. Thatcher, Dallas, Tex., has just completed a survey for the Corsicana Water Co. of the land on which it proposes to build a large reservoir. A pumping station will also be built.

WACO, TEX.—The city is reported to have secured several acres in East Waco for the establishment of a new system of artesian wells and a large reservoir.

LAKEPORT, CAL.—A special election was held Dec. 20 to vote on bonding the town for $15,400 for the construction of works.

BILLINGS BRIDGE, ONT.—The proposition to build works in this village was defeated, Dec. 15, according to reports.

GANANOQUE, ONT.—The town council is reported to be preparing plans and specifications for the construction of water-works and a sewerage system.

UXBRIDGE, ONT.—Wm. Hoster, Mayor, writes us that the resolution to build works passed the public meeting but nothing more will be done until after the elections are over.

CASCADE CITY, B. C.—The Cascade Water Power & Light Co. has begun the construction of a water supply and electric light plant, according to report. Engr. Anderson may be addressed.

NIAGARA, B. C.—It is reported that S. K. Crocker has secured a franchise to build a water supply system at this place. A dam across Fisherman Creek, 1,500 ft. above the village, will be built, and 5,000 ft. of pipe will be laid.

IRRIGATION.

BEAUMONT, TEX.—The Beaumont Irrigation Co. awarded a contract to the Connorsville Blower Co., Connorsville, Ind., Dec. 15, for installing a pumping plant with a capacity of about 60,000 gals. per minute, to cost about $40,000. J. T. Wilkins, Engr., Connorsville.

PERRIS, CAL.—Reports state that C. J. Ritchie, Los Angeles, Cal., will sink a well and put in a pumping plant at once, to irrigate about 160 acres.

SALT LAKE CITY, UTAH.—R. S. Carberry and F. S. Dettrich, of the Marysville Power & Canal Co., Idaho Falls, Idaho, have applied to the state land board for permission to reclaim about 20,000 acres.

PHOENIX, ARIZ.—A meeting was held by the canal companies in the city hall, Dec. 12, to consider the question of constructing a storage reservoir for the Salt River valley. The building of a reservoir by private capital was considered the most feasible plan. No definite action was taken. Aaron Goldberg of the Territorial Council, may be addressed.——N. W. Haggart and J. H. Ivy have filed a claim for 5,000 ins. of water in Salt River. A canal will be constructed about 8 miles long.

GUERRERO, MEX.—The state government has been asked to give its aid for the sinking of a number of artesian wells in the waterless regions of the state, which, experts say, can be sunk without great expense or difficulty, and would provide ample water for irrigation.

NEW COMPANIES.—Yokohl Water Co., Exeter, Cal.; $24,000; to do an irrigation business; B.T. Teagan, A. D. Moore, Harvey Ferris, James Kirk, E. H. Miles, Exeter.

Silver Lake Irrigation Co., Silver Lake, Ore.; $100,000; to carry on an irrigation business; James M. Small, Gilbert B. Wardwell, James M. Martin, Francis M. Chrisman.

SEWERAGE.

HARTFORD, CONN—A petition is being circulated requesting the selectmen and sewer commissioners to construct sewers in the section known as Charter Oak, according to report. Neil Stalker, New Park Ave., is interested.

NEW BRITAIN, CONN.—Saml. M. Gray, Providence, R. I., has been engaged to furnish plans and specifications for sewerage disposal systems with a view to introducing a system in this city.

ONEIDA, N. Y.—Geo. S. Miller was awarded the contract Dec. 19 to construct a sewer, at $587, according to report.

KINGSTON, PA.—Bids are asked until Jan. 2 for the construction of 9,462 ft. of sewers. P. B. Reynolds, Pres.; Wm. P. Somers, Secy.; Thos. Wright, Borough Engr., Luzerne, Pa.

SCRANTON, PA.—Bids are asked until Jan. 5 for constructing a sewer on Von Storch Ave. and Honesdale St. M. T. Lavelle, Cy. Clk.

STEELTON, PA.—John D. Young, Secy. of council, writes us that the borough has voted to build a sewer system during next summer from plans prepared some years ago by the late Geo. E. Waring. Bids will be asked within a short time.

SALISBURY, N. C.—Dowd & King are reported to have a contract for a private sewerage system in this place.

BIRMINGHAM, ALA.—The aldermen have decided to construct a sanitary sewer to cost about $250. F. V. Evans, Mayor; A. J. Camp, Cy. Clk.

GREENSBORO, ALA.—It is reported that the city will construct about two miles of sewers within the next three months. E. B. Randolph, Mayor.

JACKSON, MISS.—The board of aldermen has ordered an election Feb. 1 on the proposition of issuing $100,000 in bonds for a sewerage system. W. G. Kirkpatrick, Cy. Engr.; D. P. Porter, Jr., Cy. Clk.

DAYTON, O.—Bids will be asked for the construction of a sanitary sewer on Simpson St., from Howard St. to Madriver St., according to report. City Engineer Turner.

EAST LIVERPOOL, O.—John A. George, Cy. Engr., writes us that specifications for about seven miles of 8-in., 10-in. and 12-in. pipe sewers, to cost about $30,000, will be ready in about two weeks. Proposals for pipe will be called for in about a month and for construction in the spring.

ZANESVILLE, .—The city council has voted to construct brick and tile sewers on five streets and alleys. J. F. Brown, Pres.; C. N. Bainter, Cy. Clk.

TOLEDO, O.—Plans and specifications have been prepared for the construction of sewers in several streets and alleys. Lem. P. Haris, Cy. Clk.

WELLSVILLE, O.—John A. George, East Liverpool, O., writes us that this place is considering the advisability of building a sewerage system.

YOUNGSTOWN, O.—M. Rochford & Sons, are reported to have received the contract for the construction of a sewer in Hayes Ave., noted in our issue of Dec. 15. H. W. Calvin, Clk.

LEBANON, IND.—J. H. Busby, Mayor, writes us that the council is contemplating some improvements in the spring, but has made no definite plans as yet.

NEENAH, WIS.—The board of public works has prepared plans for a sewerage system, with an outlet into Little Lake Butte des Morts, and will hear objections from property owners Jan. 21. W. L. Davis and Ole O. Myhre may be addressed.

NEWTON, KAN.—H. H. Hendershot, Designing and Constructing Engr., Wichita, writes us that the outfall was finished Dec. 6, and work on 1½ miles of 6-in. lateral pipe sewers, to cost about $3,800, has been suspended until spring.

McKINNEY, TEX.—Kelly & Steele, Gainesville, have the contract to build a sewerage system in this city of about seven or eight miles in length.

OKMULGEE, IND. TER.—H. H. Hendershot, Engr., Wichita, Kan., writes us that this city contemplates the construction of a system of sewers.

DENVER, COLO.—The board of aldermen has passed the Capitol Hill storm sewer bill, noted in our last issue.

GANANOQUE, ONT.—The town council is preparing plans and estimates for the construction of a sewerage system, according to report.

OSHAWA, ONT.—Bids are asked until Jan. 4, 1899, for the construction of a complete system of sewers and water-works in this town, at an estimated cost of about $110,000. C. French, Chn. Fire and Water-Works Com.

PEMBROKE, ONT.—The town council has passed a bylaw to raise $12,000 to construct main sewers, according to report. A public election to vote on the question will be held Jan. 2.

WINNIPEG, MAN.—W. F. Lee is reported to have received the contract to furnish $909 worth of sewer pipe.

MEXICO, MEX.—Vezin & Letellier are reported to have received the contract to construct sewers in this city.

GARBAGE DISPOSAL—STREET CLEANING

WOONSOCKET, R. I.—The people of this city are discussing the question of garbage disposal.

BINGHAMTON, N. Y.—The board of health is preparing a resolution to be presented to the council, calling attention to the need of a crematory at this place.

HUDSON, N. Y.—Bids are asked until Dec. 29 for removing garbage, etc., for three years. Wm. S. Hallenbeck, Secy.

NEW YORK, N. Y.—Bids are asked until Jan. 13 by the department of street cleaning, at 346 Broadway, for loading and trimming deck scows and dumpers, and unloading the pocket dumps in the boroughs of Manhattan and the Bronx. James McCartney, Comr.

ATLANTIC CITY, N. J.—The following bids were received for the collection of garbage for one, two or three years, beginning Jan. 9, and for building road to the new crematory: Joseph M. Johnson, first year, $10,373, with a deduction of $500 if city provided stabling for horses required; Benj. F. Leeds, first year, $9,875, second year, $10,575, third year, $10,995, with an allowance of $5 a year for city stabling; Alvin P. Risley, Pleasantville, N. J., $15,000 for one, two or three years, with allowance of $5 a year for city stabling; John Unsworth, first year, $13,500, $27,900 for two years, or $43,000 for three years, with an allowance of $5 a year for stabling; Andrew P. Jeffries and Samuel Gregson, bidding jointly, offered to do the work for three years at $10,000; Sylvester Leeds, $14,000 one year, $28,000 two years, and $43,000 for three years, allowing $200 a year for city stabling; John Murtland, first year, $6,400, second year, $6,800, and third year for $7,200. The bids received for building the road to the new crematory, to be 2,800 ft. in length, were those of Alvin P. Risley, of Pleasantville, $5,800, and of Benjamin G. Leeds, $6,878.

MILLMONT, PA.—Beard & McConnell, Reading, Pa., have been awarded the contract, at $2,098, for erecting a building, 30 ft. high and 40 × 65 ft., for the General American Reduction Co.

NEWPORT, KY.—W. L. Glazier, Cy. Engr., has made a report on the disposition of garbage for this city, and has recommended the erection of a crematory and the destruction of garbage by burning. Report will be acted on in January and appropriations then made for same if the council approves of the plans.

STREETS AND ROADS

BRIDGEPORT, CONN.—The board of aldermen voted Dec. 19 to apply to the legislature for power to issue $100,000 for street improvements. Address, Chairman Foster.

ROCHESTER, N. Y.—Bids are asked until Jan. 5 for asphalt paving on South Fitzhugh St., estimated cost, $11,100, and constructing a pipe sewer on Caroline St. and Weddale Way. Chas. M. Beattie, Clk.; Edwin A. Fisher, Cy. Engr.——An ordinance has been passed to pave Bartlett St. with asphalt, to cost about $9,700.

NISKAYUNA, N. Y.—A committee, consisting of John A. De Remer, Andrew J. McMillan and Wm. Kohring, are considering the question of reconstructing the Dennison Road, a distance of 2,000 ft.

PHILADELPHIA, PA.—The department of public works has received the lowest bid for repairing and maintaining roads during 1899, from David McMahon, at $94,800. It will require about 50,000 tons of broken stone.

SCRANTON, PA.—The council received the following bids Dec. 17 for the repair of asphalt pavement for five and ten years respectively: Barber Asphalt Paving Co., $87,600 and $175,200; Pennsylvania Asphalt Paving Co., $93,500 and $187,000; Alcatraz Co., $108,680 and $234,058; George McDonald, $141,756 and $305,293. M. T. Lavell, Cy. Clk.

JACKSONVILLE, FLA.—The board of public works has passed resolutions to pave portions of Adams, Bay, Myrtle and Forrest Sts., with shells.

CINCINNATI, O.—Bids are asked until Jan. 17 for grading, macadam, etc., on Hopson St. Geo. H. Spellmire, Clk. Bd. Cy. Affairs.

HAMILTON, O.—The board of control awarded a contract Dec. 20 to the David Folz Asphalt Paving Co., Cincinnati, O., at $46,100, for paving Second St. from Black to Wood Sts., with sheet asphalt and limestone curbing.

EVANSVILLE, IND.—Bids will soon be asked by the county commissioners for asphalt paving around the courthouse square, including Vine, Fourth, Division and Fifth Sts.

OWOSSO, MICH.—Engineer Riggs has submitted estimates of the cost to the board of public works, for the proposed paving of Main St., between Washington St. and the river, with asphalt, at $42,365, and brick $38,515.

PEORIA, ILL.—The board of local improvements has recommended the proposed paving of St. James St. with brick, a distance of 3,000 ft.

OSKALOOSA, IA.—Bids are asked until Jan. 10 for 15,600 sq. yds. of brick paving, 8,900 lin. ft. of Portland cement curbing, and 500 cu. yds. of grading, on D St. Sam Ver Ven, Cy. Engr.; D. C. Waggoner, Clk.

OMAHA, NEB.—A petition is being circulated for the paving of Farnan St., between 10th and 15th Sts., with sheet asphalt.

HESSELTINE, WASH.—Reports state that the county commissioners, Sprague, Wash., have ordered surveys for the construction of a new road from the post office to the ferry at Columbia River.

LOS ANGELES, CAL.—Ordinances have been passed to grade and gravel portions of Willow and six other streets. J. H. Drain, Supt. Sts.

SEATTLE, WASH.—The council has decided to pave portions of Mattison St. with macadam and sandstone, according to reports.

BELLEVILLE, ONT.—The city clerk desires to obtain prices from the manufacturers of stone crushers and road rollers, according to reports.

MANUFACTURING PLANTS.

MADISON, ME.—O'Keefe & Orbison, Archs., Appleton, Wis., have been awarded the contract for altering the mill of the Manufacturing Investment Co., of this place, according to reports.

OLDTOWN, ME.—The contract for the mill for the Ounegan Woolen Mill Co., has been awarded to M. C. Foster & Son, Waterville, Me.

LINCOLN, N. H.—A fire at this place Dec. 24 destroyed the steam saw mills of J. E. Henry & Sons. Loss, about $80,000; insurance, $51,000.

BURLINGTON, VT.—The plant of the Shepard & Morse Lumber Co., of Boston, Mass., and this city, was destroyed by fire Dec. 24; estimated loss, $250,000.

NORTH ANDOVER, MASS.—The North Andover Cotton Mill was damaged by fire to the extent of $30,000; fully insured.

TIVERTON, MASS.—Billings, Clapp & Co., chemical manufacturers of Newton Upper Falls, Mass., are said to contemplate establishing a plant here.

WORCESTER, MASS.—Reports state that Rice & Hutchins, shoe manufacturers, contemplate moving their factory from Marlboro, Mass., to this city.

NEW BRITAIN, CONN.—A new brewery plant for this city is projected. W. E. Hexamer, Philadelphia, Pa., is said to be interested.

BUFFALO, N. Y.—The Fleischmann Yeast & Vinegar Co., of New York, is reported to contemplate moving its plant to this city.

NEWBURGH, N. Y.—The Granite City Soap Co. will erect an addition 50 ft. square to its factory.

OSWEGO, N. Y.—A. Paine & Son have been awarded the contract for the carpentry work on the new McGowan brewery work, to be completed by Feb. 15.

JERSEY CITY, N. J.—A fire in this city, Dec. 23, destroyed Wittemann Bros.' box factory on Greene St.; estimated loss, $30,000.

DUQUESNE, PA.—Reports state that the Carnegie Steel Co., Pittsburg, will tear down the plant of the Duquesne Tube Works, and erect new works on the site.

EAST LIBERTY, PA.—Local papers report the sale of the property of the National Lead Co., at Sallos Ave. and the Pennsylvania R. R., to the Crystal Lake Ice Co., of Allegheny, which will expend about $100,000 on the erection of an artificial ice plant.

ERIE, PA.—The Ohio Gum Co., Lisbon, O., will remove its plant to this city, according to reports——The Erie Car Works Co., is said to contemplate the enlargment of its plant.

HOMESTEAD, PA.—The Carnegie Steel Co., Pittsburg, is reported to have bought 35 acres of land near this place upon which will be erected a shop, 250 × 1,500 ft., for the manufacture of flat and hopper-bottom freight cars, etc.

MONONGAHELA, PA.—A company is being organized for the purpose of establishing a brewery near here. John A. Senner, Monessen, Pa., is interested.

PHILADELPHIA, PA.—A permit has been granted to Macey, Henderson & Co., Ltd., contractors, for the erection of a 2-story brick machine and smith shop, 169 × 102 ft., to cost $44,000, on Hamilton St., for the Baldwin Locomotive Works. The above contractors have also submitted plans to the bureau of building inspection for a 3-story brick machine repair shop, 193.6 × 60.4 ft., to cost $40,000, for the same firm, to be erected on Buttonwood St.

PITTSBURG, PA.—The Pittsburg Reduction Co. is reported as about to enlarge its plant at New Kensington and to increase the horse power of the Niagara Falls plant to 12,000 HP.——The contracts have been let for the extension of the plant of the Westinghouse Electric & Mfg. Co., which will include a 6-story office building and a large machine shop; reported cost, about $200,000.

READING, PA.—The Reading Iron Co. has been granted a permit for the erection of a building, 40 × 145 ft. and another 45 × 160 ft., for its new rolling mill plant.

SAYRE, PA.—It is reported that the car department of the Lehigh Valley shops will be moved from South Easton, Pa., to this place.

ANNAPOLIS, MD.—The Annapolis Ice Mfg. Co. expects to erect an ice plant on St. Johns St.

BALTIMORE, MD.—The Smith Flexible Chair Co., Washington, D. C., contemplates moving its plant to this city. Eldridge Smith, Washington, D. C., is interested.

WHEEL, MD.—A fire here destroyed the Hollingsworth Spoke & Wheel Co.'s plant; estimated loss, about $40,000.

WHEELING, W. VA.—A fire in this city, Dec. 15, destroyed the Wheeling Paper Mill; estimated loss, $25,000. ——The La Belle Iron Co. is said to contemplate the erection of two new plate mills as additions to its plant.

BREWTON, ALA.—It is reported that a contract has been made with Allen, Scott & Co., Chicago, Ill., by the citizens of this place and the Louisville & Nashville R. R., for the erection of a glucose and starch factory here. The plant will probably cost about $500,000.

OWENTON, KY.—Reports state that Arnold & Riley will erect a flour mill with 50 bbls. daily capacity, to be operated by a gasoline engine, in the spring. The firm also contemplates establishing an electric plant.

EVANSVILLE, IND.—The erection of a distillery at this place is projected.

TERRE HAUTE, IND.—The rim, stock and drying rooms of the Standard Wheel Works plant were destroyed by fire Dec. 13; loss, about $20,000; fully insured.

BAY CITY, MICH.—W. D. Young & Co., whose planing mill was recently destroyed by fire will rebuild at once.

COLDWATER, MICH.—Reports state that the Michigan Portland Cement Co. has awarded contracts for the erection of a steel building, 80 × 350 ft., to cost about $100,000.

PONTIAC, MICH.—Woodward Bros., according to reports, will erect a 5-story brick carriage factory, 60 × 80 ft., at a cost of $20,000.

SAGINAW, MICH.—The National Iron Co. is said to contemplate the consolidation of its plants at Toledo and Cleveland, O., and removing them to this place. A. O. Dunk, Treas.

WYANDOTTE, MICH.—The Michigan Alkali Co. have placed an order with the Riter & Conley Mfg. Co., Pittsburg, Pa., for a new steel building for the cement department.

CHICAGO., ILL.—It is reported that the Titan Steel Co. and the Federal Steel Co. will unite and erect a plant at South Chicago and at Kensington for the manufacture of armor plate and shells.

NEW LONDON, WIS.—The factories and warehouse of Page & Lyon, which were destroyed by fire recently, at a loss of $16,000, will probably be rebuilt at once.

ELY, MINN.—The S. Simpson Co. is said to contemplate the erection of a mill on Fall Lake, near this place. The Diamond Iron Works is to supply all the machinery except the engines.

OMAHA, NEB.—The Fred Krug Brewing Co. will soon let the contract for erecting a bottling works, to cost $10,000, according to reports.——The Union Pacific Co. is said to contemplate the erection of new shops in this city.

COLORADO SPRINGS, COLO.—Reports state that the Gillette-Herzog Mfg. Co., Minneapolis, Minn., has been awarded the contract for the erection of two steel and asbestos buildings for the Colorado Midland Co. The locomotive erecting shop will be 45 × 125 ft., and the boiler and blacksmith shop, 60 × 150.

WOODLAND PARK, COLO.—The erection of three cyanide works is projected. John Annisfield and A. B. Marshall, Cleveland, O.; J. Stanley Brown, Washington, and the Treadwell Co., are said to be interested.

MARIOPOL, RUSSIA.—Press reports state that Robert G. Wells, of the Nicopol-Mariopol Mining & Metallurgical Co., Mariopol, is in Pittsburg, Pa., to place orders for machinery for the mills to be erected at this place. It is said that the plans have been prepared by Julian Kennedy, Pittsburg, and the contracts for their construction will be under his direction.

GAS PLANTS.

CINCINNATI, O.—Reports state that the Cincinnati Gas Light & Coke Co. has increased its capital stock from $500,000 to $9,000,000.

GLOUCESTER, N.J.—The city gas works were damaged by fire Dec. 23, at a reported loss of $15,000. Harry C. Chew, Supt.

DURANT, IND. TER.—Reports state that capitalists of Sherman, Tex., and Gainesville, Tex., will construct an oil plant at this place, to cost about $40,000.

NEW COMPANIES.—Home Gas, Oil & Mining Co., Arcadia, Ind.; $3,000; C. C. Ray, J. F. Tudor, J. M. Driver, Clayton Martz and A. Guy.

Modern American Light Co., Kittery, Me.; $300,000; to manufacture and sell vapor gas; John W. Chase, Pres., Dedham, Mass.

MISCELLANEOUS CONTRACTS.

DAM.—Chelan, Wash.—It is proposed to construct a dam on Lake Chelan, to cost about $1,750. M. M. Kingman is interested.

BONDS.—Chatham, N. B.—Bids are asked until Jan. 2 for the purchase of $10,000 of bonds, according to reports. T. M. Gaynor, Town Clk.

STEEL PLATES.—Mare Island, Cal—Bids are asked until Jan. 3 for furnishing steel plates, at the navy yard. Edwin Stewart, Paymaster Gen., Navy Dept., Washington.

FIRE ALARM AND ILLUMINATING SYSTEM.—San Jose, Cal.—The city clerk has been directed to ask bids for installing an automatic fire alarm and illuminating system.

DREDGING.—New York N. Y.—The dock department has awarded a contract to the Morris & Cummings Dredging Co., at $4,690, for dredging near Catharine St., East River.

DRY DOCK.—Boston, Mass.—Bids are asked by the navy department until Jan. 31 for the construction of a new dry dock, 700 × 300 ft., of stone and cement. Appropriation, [illegible]025,000.

DREDGING.—New York, N. Y.—Bids are asked until Jan. 6 for dredging in the East and Harlem rivers, about 100,000 cu. yds. of mud. J. Sargeant Cram, Comr. Docks, Pier A, North River.

NAVAL SUPPLIES.—New York, N. Y.—Bids are asked until Jan. 3 for furnishing bolts and nuts, machinery steel, brass pipe, lumber, etc., at the navy yard. Edwin Stewart, Paymaster Gen., Navy Dept., Washington.

TUNNEL.—Wheeling, W. Va.—Reports state that surveys are being made for a tunnel, 2,400 ft. long, to be driven through Whitehall Hill, near Clayville, on the Wheeling division of the Baltimore & Ohio R. R.

BOILERS AND MACHINERY.—St. Joseph, Mich.—Bids are asked by Capt. J. C. Warren, U. S. Engr., Milwaukee, Wis., until Jan. 20, for furnishing boilers and machinery for six steam fog signals, in sets of two, as stated in our advertising columns.

DOCKS, DREDGING, ETC.—Cleveland, O.—Bids are asked until Jan. 19 for constructing pile and timber docks, protecting the south abutment of Main St. bridge, removing old docks and dredging the Cuyahoga River. Geo. R. Warden, Dir. Pub. Wks.

REVETMENTS AND DREDGING.—Houghton, Mich.—Bids are asked until Jan. 20 for constructing 8,000 ft. of revetments, and until Feb. 3 for 1,750,000 cu. yds. of dredging, according to reports. Maj. Clinton B. Sears, U. S. Engr., Duluth, Minn.

BRICK CHIMNEYS.—Buffalo, N. Y.—The department of public works has received the lowest bids for constructing three brick chimneys, each 8 ft. in diameter and 225 ft. high, at the pumping station, from B. I. Crooker, at $13,380, $13,855 and $12,430, respectively.

WHARVES AND DREDGING.—Honolulu, H. I.—Bids are asked by the navy department, Washington, D. C., until Jan. 20 for the construction of wharves and dredging the slips at the coaling station, according to reports. R. R. Bradford, Ch. of Bureau, Washington.

TELEGRAPH POLES.—Alberin, B. C.—Bids are asked until Jan. 10 for furnishing telegraph poles for a line to be constructed between Alberin and Cape Beale, a distance of 38 miles, according to reports. Address the department of public works, Ottawa, Ont., or Wm. Henderson, Clk., Victoria, B. C.

BROKEN STONE, ETC.—Tampa Bay, Fla.—Bids are asked until Jan. 16 for furnishing at Mullet Key and Egmont Key, Tampa Bay, broken stone or gravel and random stone, as stated in our advertising columns. Lt.-Col. W. H. H. Benyaurd, U. S. Engr., St. Augustine, Fla.

BRICK, SPECIAL CASTINGS, ETC.—Washington, D. C.—Bids are asked until Jan. 26 for furnishing at shafts of Washington aqueduct tunnel, brick, cement, sand, special castings and bolts, as stated in our advertising columns. Lt.-Col. A. M. Miller, Engr., 2728 Pa. Ave.

BROKEN STONE, STEEL BEAMS, ETC.—New London, Conn.—Bids are asked until Jan. 23 for furnishing at New London and Fisher's Island, N. Y., broken stone, sand, lumber, steel beams, angles, sewer pipe, manhole covers, etc., as stated in our advertising columns. Maj. Smith S. Leach, U. S. Engr., New London.

ORE DOCK.—Two Harbors, Minn.—The Duluth & Iron Range R. R. Co., J. L. Greatsinger, Pres., Duluth, has awarded a contract to the Barnett & Record Co., Minneapolis, for tearing down and rebuilding ore dock No. 1. The new dock will be 49 ft. wide, 59½ ft. high and 1,400 ft. long, and contain 200 ore pockets with a capacity for 40,000 tons; estimated cost, $260,000.

PUBLIC WORKS AND SUPPLIES.—Philadelphia, Pa.—Bids are asked by the department of public works, City Hall, until Jan. 3 for furnishing oils, hardware, brass fittings, cocks and valves, wrought iron pipe, cast iron water pipe and castings, iron and steel, repairs to boilers and roofs, lumber, brick, lime, cement, etc., asphalt paving, curbing, etc. Thos. M. Thompson, Dir.

PNEUMATIC ODORLESS EXCAVATORS. — Puerto Principe, Cuba.—We are informed that Maj. S. T. Armstrong, M. D., Ch. Surgeon, U. S. Army, Puerto Principe, desires prices and full information regarding pneumatic oderless excavating apparatus for the removal of night soil, etc., complete with an air pump, wheeled tank, 300 ft. of coupled hose and harness for two mules, delivered at Nuevitas, Puerto Principe Province, Cuba, via Munsen Line.

DIKES.—Newport, Ky.—Congressman Berry and a committee consisting of ex-Aldermen L. Hehmann, A. J. Mossett, Charles Mauget, Squire Donelan and John Holloran, were to meet Maj. W. H. Bixby, U. S. Engr., Cincinnati, O., Dec. 23, to discuss the bill for the improvement of the Licking River, and providing for the building of dikes, to prevent a flood in Newport at 62 ft. of water. W. L. Glazier, Cy. Engr., writes us that an effort will be made to pass the bill at this session of Congress.

CONTRACT PRICES.

FIRE HOSE.—St. Louis, Mo.—Jas. Richardson, Comr. Supplies, opened bids Dec. 16 for furnishing 4,000 ft. of 2½-in. rubber-lined fire hose, and for rubber suction hose. Contracts have been awarded as follows: Manhattan Rubber Co., 1,000 ft., at 90 cts. a ft.; New York Belting & Packing Co., 1,000 ft., at 85 cts; Day Rubber Co., 1,000 ft., at 90 cts.

BRICK PAVING.—Jacksonville, Fla.—Philip Prioleau, Cy.Engr., writes that the following bids were received Dec. 22, 1898, for paving a portion of Main St. with brick, the work including 21,431 sq. yds. of vitrified brick pavement, together with the furnishing of all labor and material, grading for paving, grading for 20-ft. parkway in center, four lines of stone curbing, etc.: W. M. Lasley, Chattanooga, Tenn., $1.47 a sq. yd. for work complete (awarded contract); S. S. Leonard Co., Jacksonville, $1.49⅓; J. E. Bryan, Jacksonville, $1.58½; Geo. R. Foster, Jr., Jacksonville, $1.75.

PUMPING ENGINE.—Dunkirk, N. Y.—The following bids were opened by the water commissioners Dec. 20, for a pumping engine:

Bids Received by the Board of Water Commissioners, Dunkirk, N. Y., Dec. 20, 1898, for Pumping Engine.

Bidder.	Type.	Cylinders, ins.	Stroke, ins.	Plung'r ins.	Per min. Revo-tions.	Per min. Feet.	Capacity 1,000,000 galls.	Duty, ft-lbs per 1000 lbs. steam.	Weight, lbs.	Price.
For Horizontal Engine.										
Loretz & Son.......	Cross compound.	28 × 56	42	(2) 16	23	238	7	120,000,000	.....	$17,160
" "	" "	28 × 56	36	(2) 16	34	238	7	120,000,000	.....	15,660
Snow S. Pump Wks.	" "	24 × 48	36	16	34	204	6	120,000,000	270,000	17,490
					17	102	3	110,000,000		
Holly Mfg. Co......	Comp. condens'g	(2) 20 × 36	32	(2) 20	26	135	6	110,000,000	250,000	18,400
Nordberg Mfg. Co...	" "	22 × 40	36	13¼	50	300	6	110,000,000	230,000	16,250
Henry R. Worthington	Triple expansion	(2) 13×21×34	24	(2) 19	37½	150	6	105,000,000	70,000	12,270
					25	100	4	80,000,000		
	Comp. condens'g	(2) 18 × 36	24	(2) 19½	35	140	6	110,000,000	100,000	18,135
					24	95	4	100,000,000		
Barr Pmp'g Eng.Co.	Cross compound.	24 × 48	36	18	30	180	0	110,000,000	240,000	22,000
For Vertical Engine.										
Pioneer Iron Works.	Triplex comp'nd.	26 × (2) 38	42	(3) 18	..	252	7	120,000,000	.....	$23,000
Loretz & Son.....	Triplex comp'nd.	....	36	...	..	...	..	120,000,000	.....	20,86[illegible]
	Triplex comp'nd.	26 × (2) 38	36	(3)*	42	252	7	125,000,000	.....	21,966
	Cross comp. diff.	30 × 48	36	16 × 22	..	...	..	125,000,000	.....	20,800
Snow S. Pump Wks.	Cross compound.	24 × 48	36	16	34	204	6	120,000,000	350,000	23,996
	Same pump at half-speed..	....	..	...	17	...	..	110,000,000		23,99[illegible]
Holly Mfg. Co......	Cross compound.	24 × 46	36	17½	30	180	6	110,000,000	300,000	22,600
Barr Pmp'g Eng.Co.	" "	24 × 48	36	18×25½	30	180	6	110,000,000	300,000	25,500

Remarks.—Loretz & Son: Deduct $1,500 from each bid if foundations are furnished by city; Barr Pumping Engine Co.: Deduct $1,500 from bid if time was extended to July 1, 1899. *Three tubular plungers, 12½×18 ins.

REVETMENT WORK.—Duluth, Minn.—Maj. Clinton B. Sears, opened the following bids Dec. 20, 1898, for revetment work, Portage Lake Ship Canals, Mich., as advertised in Engineering News:

	Completed work, per lin. ft.				
	Revetment				
Bidder.	Pile, 8,000 ft.	Special pile, 230 ft.	Protect'n work, 300 ft.	Repair work, etc., (Cut 1), 17 M.ft., pr M.ft. B.M.	Total.
Fitzgerald & Norris[1]...	$6.81	$9.37	$4.10	$50.00	$58,715
Edward Gillen[2]........	10.25	7.16	13.16	58.00	88,581
Powell & Mitchell[3]....	7.58	10.50	4.00	55.00	65,190
Frank Campbell[1]......	8.00	10.20	4.90	57.00	68,785
John M. Borgman[4]....	8.80	12.30	6.70	94.30	76,842
Frederick Davis[1]	7.68	10.33	3.91	46.73	65,783
Frank P. Tims[5].......	7.00	10.00	4.00	50.00	60,350

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[1] Duluth. [2] Racine, Wis. [3] Marquette, Mich. [4] Kewanee, Wis. [5] West Duluth.

BRICK PAVING.—Meadville, Pa.—D. T. McKay, Jr., Cy. Clk., writes us that the contract for 3,120 sq. yds. of brick paving on concrete foundation in Terrace St., as advertised in Engineering News, has been awarded to Ross & Robinson, Meadville, at $1.24 a sq. yd. for Brady Run repressed brick. The bids were opened Dec. 16 and 10 different makes of brick were submitted. The bidders included Thomas McGuigan, Meadville; James McAfee & Co., Allegheny; Peter Schenck, Butler, Pa.

WATER-WORKS SUPPLIES.—Honolulu, H.I.—Contracts were awarded Nov. 30 as follows: Crane Co., 12 and 8-in. water pipe, $28.75 a ton; pig lead, $3.35 per 100 lbs.; connections and fittings, $54 a ton; packing yarn, 3 cts. a lb.; 8-in. gate valves, $16; 12-in. gate valves, $36.

MAIN SEWER.—Newburgh, N. Y.—The following bids were opened Dec. 19, for constructing the 1st St. main sewer, as advertised in Engineering News:

BIDS RECEIVED AT NEWBURGH, N. Y., DEC. 19, 1898, FOR CONSTRUCTING MAIN SEWER.

Bidder.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No.10.	No.11.	No.12.	No.13.	No.14.	54-in. tunnel sewer; Forms A.	B.	C.
	Price, a lin. ft.								A cu.yd.		Each		Lin.ft.	Per M.	Price a lin. ft.		
Mack Paving Co.	$4.95	$9.45	$6.95	$7.95	$6.95	$6.45	$5.75	$1.75	$2.95	$2.95	$95.00	$75.00	$5.75	$27.50	$8.95	$14.95	$14.95
M. J. Curley	7.00	8.50	9.00	9.00	9.00	8.00	6.00	2.00	3.00	4.00	60.00	60.00	3.00	40.00	22.00	22.00	22.00
John Sutcliffe	9.00	9.90	11.50	13.00	12.00	9.00	7.50	2.25	2.50	6.00	100.00	75.00	12.00	25.00	11.00	15.25	13.00
John A. Doolittle & Co.	7.00	9.00	7.50	9.40	7.90	6.00	5.00	2.30	2.25	6.00	55.00	60.00	3.00	50.00	23.50	26.00	30.00
R. D. Maynard	10.00	9.79	8.00	9.72	9.72	7.50	6.32	2.50	2.50	6.00	111.00	75.00	5.00	25.00	15.90	17.32	20.32
H. E. Wieber & Co.	20.00	10.12	9.50	11.00	10.00	9.40	6.59	2.37	5.50	10.00	55.00	65.00	3.50	30.00	13.50	15.50	11.50
Farrell & Hopper	9.00	10.00	6.25	6.25	6.25	5.50	4.75	2.25	2.50	6.50	100.00	40.00	6.50	45.00	25.00	28.00	32.00
M. J. Dwyer and W. Sager	6.32	9.65	7.60	8.61	7.93	6.41	4.48	2.14	1.49	4.00	73.00	51.00	2.43	24.00	8.50	14.46	12.25
Troy Public Works Co.	8.20	8.20	8.20	8.20	8.20	8.20	6.50	3.25	2.00	5.40	40.00	50.00	5.00	25.00	14.50	18.50	15.50
W. J. Flanagan	6.00	11.25	12.00	10.50	8.50	8.00	7.00	3.50	2.25	5.00	50.00	80.00	7.00	50.00	16.35	16.35	16.35
E. R. Pateson Construction Co.	4.00	8.25	8.50	9.00	8.75	7.35	5.55	2.00	1.95	5.00	40.00	60.00	3.00	35.00	17.00	20.00	20.00
T. Henry Dumary	10.00	6.75	9.37	9.94	9.37	7.87	6.65	2.10	1.50	6.00	150.00	75.00	3.25	34.00	10.50	20.00	27.50
E. M. Haines & Co.	8.00	7.54	12.00	14.25	11.90	9.59	8.40	1.99	3.50	6.00	89.00	65.00	3.55	25.00	17.91	17.91	17.91
Callery & Murphy	11.50	9.00	9.20	9.20	9.20	6.55	5.45	2.50	1.45	5.00	100.00	60.00	2.50	30.00	13.50	17.00	14.75
E. Brown Baker	5.00	8.50	8.00	9.50	8.50	7.00	6.00	3.00	3.00	6.00	80.00	60.00	5.00	25.00	12.00	15.00	18.00
Frank Pidgeon	20.00	15.00	16.66	22.25	23.10	11.88	9.30	3.87	2.50	6.00	90.00	60.00	15.00	25.00	20.00	26.00	30.00
J. D. Wilson	9.50	10.50	12.00	18.00	14.50	11.00	9.50	3.25	2.30	4.75	98.00	68.00	3.00	35.00	15.00	16.50	17.00

The estimated quantities are as follows: No. 1—About 30 ft. timber trunk sewer, 4 × 4 ft., at Hudson River; No. 2—About 860 ft. cast-iron pipe sewer, 42-in., with average depth of about 8 ft.; No. 3—About 320 ft. brick sewer with invert blocks, 54 ins. diameter, and average depth of 12 to 20 ft.; No. 4 About 500 ft. 54-in. brick sewer with invert blocks and average depth of 20 to 23 ft.; No. 5—About 110 ft. of 54-in. brick sewer with invert blocks and average depth of 15 to 20 ft.; No. 6—About 250 ft. of 48-in. brick sewer with invert blocks and average depth of about 13 ft.; No. 7—About 250 ft. of 36-in. brick sewer with invert blocks and average depth of 13 ft.; No. 8—about 13 ft.; No. 7—About 250 ft. of 36-in. brick sewer depth of about 9 ft.; No. 9—About 2,750 cu. yds. rock excavation in trench, if made open; No. 10—About 150 cu. yds. concrete with American cement; No. 11—About 8 manholes built with brick: No. 12—About 3 manholes built with special castings; No. 13—About 120 ft. of sewer to connect Chambers, Lander, Johnston, and Dubois St. sewers with main sewer; No. 14—About 1,000 ft. B.M. of timber grillage in place.

INDUSTRIAL NOTES.

THE MONASH WATER HEATER CO., Pittsburg, has leased the 4-story building, 306 Wood St., for its new factory.

THE RITER-CONLEY MFG. CO., Pittsburg, has a contract for cyanide tanks, to cost $30,000, for the Gold Hill Mining Co., Johannesburg, South Africa.

THE Q. & W. TIE PLATE, illustrated in our issue of Dec. 15, has been declared in interference in the patent office with a plate known as the Glendon Flange tie-plate, patented by Wm. Goldie, of Dilworth, Porter & Co., Sept. 6, 1898, Patent No. 610,179.

THE CRUMLISH FORGE CO., 18 and 20 Elk St., Buffalo, N. Y., announces that the increasing demand for its forges has necessitated the removal of its shops to the above address. The company was formerly located at 80 Virginia St.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, is said to have a oontract from the Kings County Electric Light Co., Brooklyn, for two 3,000 K-W. generators, which will produce about 4,000 HP. each, and reported as to cost $80,000 to $85,000.

THE F. W. EMERSON MFG. CO., Rochester, N. Y., informs us that there were about 50 adjustable drafting tables in the large shipment just made to the University of California. These tables are now in use in many drafting rooms, and are said to give excellent satisfaction.

THE NEW YORK & OHIO CO., Warren, O., manufacturer of the Packard incandescent lamps and transformers, received a contract Dec. 22 for 15,000 incandescent lamps of from 8 to 100 c. p. from the Bangkok Electric Light Syndicate, Bangkok, Siam, which has a 20-years' contract to light the king's palace. The order is for one year's supply.

THE ERIE CAR CO., Erie, Pa., reports that it has so many orders on hand that it has been obliged to enlarge the plant. The company has an order for 400 gondola cars for the Pennsylvania R. R., and another order for 300 gondola cars for the Pennsylvania Lines West of Pittsburg. The cars are to be of 80,000 lbs. capacity each. Mr. William H. Hamilton is the President of the company.

THE CARNEGIE STEEL CO., Pittsburg, is reported in local papers to have purchased 35 acres west of Homestead upon which will be erected a 250 × 1,500-ft. shop for the manufacture of flat and hopper-bottom freight cars, similar to those now made by the Schoen Pressed Steel Co., of Allegheny. It is said that the new plant will have a capacity of 40 cars a day, in addition to a forge for the manufacture of car axles.

THE THOMSON METER CO., 79 Washington St., Brooklyn, states that it recently received from a large city, a 6-in. water meter, No. 44,368, for repairs. On examination it was found that this meter was sold Oct. 17, 1893, since which time it has registered 99,989,870 cu. ft., or 749,924,025 gallons, of water, and it has never been repaired before. The cost of repairs necessary to put it in as good shape as new was less than $28.

THE PENNSYLVANIA & MARYLAND STEEL CO., is announced in press despatches to have contracts from the Russian Government for 80,000 tons of steel rails for the Eastern Chinese Railway, and from the government of Victoria, Australia, for 35,000 tons. One cargo of rails has already been sent to the latter country. It is stated that each contract was secured because the American bidder named a lower price than any competitor.

THE ERIE GAS ENGINE CO., Erie, Pa., is now installing a 200-HP. gas engine in the plant of the McCoy Glass Co., Kane, Pa. This is claimed to be the largest gas engine ever built in the United States. The company has, among other orders on hand, one for a 100-HP. gas engine for the Grand Driller Co., New Kensington, Pa., and an order for seven 50-HP. gas engines for use in the natural gas district. Mr. F. F. Curtze is the Secretary of the company.

THE LOMBARD WATER WHEEL GOVERNOR CO., 61 Hampshire St., Boston, reports that the demand for its governors is constantly on the increase. Last month orders were received for upwards of 20 governors to regulate 41 water wheels, which will develop 15,750 HP. More than half of this machinery will be used in electric stations, principally in power transmission plants, and electric railway stations, the balance being in textile and other manufacturing plants driven by water power.

THE LAIDLAW-DUNN-GORDON CO., Cincinnati, has just shipped to Shanghai, China, four carloads of machinery, consisting of two cross-compound condensing pumping engines, with condensers, boilers and other equipments. It is said that the machinery goes to New York and from there direct through the Suez Canal. The Shanghai Inland Water Co. secured the concession for the water-works, and will also take an engineer from Cincinnati to put up the plant and operate it under contract for one year or 18 months.

THE RUBBER GOODS MFG. CO. is announced in press reports as about to secure a charter at Trenton, N. J., with a capital stock of $30,000,000. Mr. Chas. R. Flint, who organized the United States Rubber Co., which makes boots and shoes, is conducting the preliminary negotiations for the new company. It is claimed that these two companies will tontrol five-eights of the annual world's production of crude rubber. Among the companies mentioned as included in the new concern are the Boston Belting Co., New York Belting & Packing Co., B. F. Goodrich, Akron, Ohio; New York Mechanical Rubber Co., Cleveland Rubber Co., New York Gutta Percha & Rubber Co., New York Rubber Co., Stoughton Rubber Co., Stoughton, Mass.; Hartford Rubber Co., and Morgan & Wright, Chicago.

THE BALL ENGINE CO., Erie, Pa., reports a good business in Ball engines, having a number of government orders on hand, among them the following: A 300-HP. vertical, double Ball engine, direct-connected to a Siemens-Halske dynamo, for the New York Navy Yard; two 175-HP. double Ball engines, direct-connected to Siemens-Halske dynamos, for the Norfolk Navy Yard, and a 175-HP. double Ball engine, direct-connected to a General Electric dynamo, for the naval station on Puget Sound, at Bremerton, Wash. The company also has orders for a 250-HP. engine and a 275-HP. engine to be direct-connected to Western Electric dynamos, by means of the Arnold system of connecting, for the Garrett Building, Chicago; also orders for three 250-HP. cross-compound engines, to be direct-connected to Western Electric dynamos, for the Great Northern Hotel, Chicago. The officers of the company are: Pres. and Mgr., Jas. McBrier; Vice-Pres., D. N. McBrier, and Secy. and Treas., H. L. McBrier.

THE PLAYFORD STOKER CO., Cleveland, O., received the following orders for stokers on Dec. 19: From the Apollo Iron & Steel Co., Pittsburg, 24 stokers, to be attached to 24 250-HP. Cahall vertical water-tube boilers at Vandergrift, Pa., where the former company has just completed installing six stokers, and for which it also has six more under construction; from the Heine Safety Boiler Co., Pittsburg, one stoker for a 200-HP. water-tube boiler, for the H. J. Heintz Co., Allegheny, Pa., and from W. F. Patterson, Pittsburg, one stoker to be fitted to a 250-HP. Erie City water-tube boiler, for the Howard St. pumping station of the Allegheny, Pa., water-works. The Playford Co. is also installing eight stokers to 300 HP. boilers for the National Tube Works, McKeesport, Pa.; three to 250-HP. boilers for the Crystal Ice Co., Allegheny, Pa., and three to 250-HP. Babcock & Wilcox boilers in the electric light plant, Allegheny. The company, since Sept. 1, has had orders for 58 stokers, of which all but one were 250 HP. or over. The exception is noted above.

NEW COMPANIES.—American Central Contracting Co., 127 Market St., Camden, N. J.; $100,000; to do general contracting; John C. Calhoun, 617 West End Ave.; James McNaught, Syndicate Bldg., New York; John W. Gephart, Bellefonte, Pa.; Samuel P. Langdon, 315 Drexel Bldg., Philadelphia, Pa.; Norman Grey, Woodbury, N. J.

Paragon Fan & Motor Co., New York; $2,500; to manufacture electric fan motors; James P. Williams, of 39 Cortlandt St., New York, and two others.

Yaryan Hot Water Distributing Co., Chicago, Ill.; $200,000; to operate hot water plants; H. T. Yaryan, H. C. Adams, T. P. Keater.

Metropolitan Water Filtering Co., New Jersey Guarantee & Trust Co. Bldg., Camden, N. J.; $2,000,000; Leander P. Randall, Edward P. Evans, Howard H. Sypher and Christian Pflaum, Jr., of Camden.

Mexican Land & Colonization Co., New Jersey Registration & Trust Co. Bldg., Orange, N. J.; $100,000; to deal in rubber, fruit, etc., construct bridges, canals, etc.; F. M. Crawford, S. M. Biddison, J. W. Le Rieur and John W. Burns, 67 Clark St., Chicago, Ill.

Moritz-Borwick Construction Co., St. Louis, Mo.; $10,000; Olive J. Borwick, Ellwin P. Moritz and M. W. Hoff.

Franklin H. Bullis Mfg. Co., New York; $100,000, commencing with $500; to manufacture and sell snow melting machines; Franklin H. Bullis, V. L. Haines, Frank Kugler, Brooklyn, N. Y.

Philadelphia & Baltimore Ice Cold Storage & Produce Co., 127 Market St., Camden, N. J.; $100,000; R. H. Parker, Joseph H. Young, Thomas Williams, James G. Pratt and James W. Gill, of Philadelphia, Pa.; Alexander Duer, Camden.

Pacific Coast Coal Co., Philadelphia, Pa.; $2,500,000, with $2,500 paid in; to own and lease lands; to mine and sell coal; to build and operate railroads; W. H. Ingham, F. T. Patterson, A. L. Green, F. B. Lee, W. D. Marks, Philadelphia.

Harbor Water Front Co., Portsmouth, Va.; $10,000; to buy and develop real estate and maintain factories, warehouses and wharves; to do general storage and wharfage business and to furnish light, water and sewerage; O. F. Byrd, L. C. W. Page, I. L. Watson, T. J. Wool, F. D. Gill, A. A. Blisoly, I. S. Crawford

Speed Elevator Co., Louisville, Ky.; $20,000; to conduct an elevator and storage business, and to buy and sell coal; J. S. Speed, W. S. Speed, F. M. Locket, Louisville.

South African General Electric Co., Schenectady, N. Y.; $50,000; to deal in electrical apparatuses and construct works and plants involving their use in the United States, South Africa, and other foreign countries; S. D. Greene, Henry W. Darling, D. Mazent, J. R. Lovejoy and M. F. Westover, of Schenectady.

Massies Mills Telephone Co., Massies Mills, Va.; $2,000; telephone and telegraph business; W. D. Meeks, James Dickie, J. C. Bentz, M. B. Hughes, E. P. Parsons, W. H. Miller, Massies Mills; A. G. Bryant, W. M. Boyd, Bryant; R. K. Anderson, Roseland, Va.

Randsburg Reduction Works, Los Angeles, Cal.; $50,000, with $23,000 paid in; Austin Granville, Edward Osborn, George R. Wilton, E. W. Gilmore, John A. Fairchild, Chas. St. Moris and James McLachlan.

Garretson Engine Co., Buffalo, N. Y.; $5,000, commencing with $3,000; to deal in engines and machinery; Albert F. Garretson, 786 Ellicott Sq.; N. H. Wolcott, R. L. Cox, all of Buffalo.

Dennison Motor Carriage Co., 1 Montgomery St., Jersey City, N. J.; $100,000; to manufacture engines and electrical and other motors; Geo. L. Record and Ernest Merrick, 1 Montgomery St., Jersey City; J. F. Dennison, New Haven, Conn.

Knoble Filter Co., Chicago, Ill.; $10,000; to manufacture filters; T. J. Knoble, M. E. Knoble, J. A. O'Donnell.

Liquid Pressed Casting Co., Chicago, Ill.; $60,000; to manufacture metal castings; F. G. Hewser, T. B. McGregor, R. I. Terry.

American Chemical Co., St. Louis, Mo.; $100,000; John E. Keller, Frank C. Lewis and Harmon J. Bliss.

Finlayson Steam Generator Co., Detroit, Mich.; $25,000, with $16,800 paid in; to manufacture steam generators, heaters and engines; A. W. Finlayson, J. L. Hacket, E. Lutz, C. A. Howell, Detroit.

Missouri Wrecking Co., St. Louis, Mo.; $4,000; G. M. Cherry, J. W. Drabelle and Robert A. Cherry.

Western Railway Equipment Co., East St. Louis, Ill.; $300,000, commencing with $100,000; to manufacture railway equipments; E. S. Barreiras, R. Payne, J. D. Houseman, Jr., G. W. Taussig, H. P. Taussig, H. L. Magee.

Manhattan Dry-Dock Construction Co., New York; $5,000,000, commencing with $100; to build, repair, sell and operate ships, vessels, etc.; C. F. Peck, J. A. McDuffie, W. A. Davis, G. H. Smith, W. H. Brower, New York.

Kitson Lighting & Heating Co. of Japan and China, Charleston, W. Va.; $1,000,000, commencing with $100; to buy, sell and manufacture apparatus or materials for the production of heat, light or power; A. D. MacCorkle, J. W. Malcom, J. E. Chilton, J. E. Scaggs, W. E. Chilton, Charleston.

Norwich Construction Co., Norwich, Conn.; $1,000, commencing with $200; to encourage new industries in Norwich; H. H. Osgood, C. P. Cogswell, C. D. Noyes, C. W. Gale, Z. P. Learned, A. Reid, J. C. Averill, J. T. Desmond, Norwich.

Western Iron Works, Los Angeles, Cal.; $50,000; Frank S. Livingston, Arthur H. Ruggles, Frank P. Snow, Wm. W. Wood, Cassius Smith.

Lafayette Telephone Co., Mexico, Mo.; $12,500; D. P. Moore, M. B. Moore, E. D. Graham, E. C. Kennan, P. M. Kennan.

Electrical Construction Co., Waco, Tex.; $35,000; to construct, maintain and operate telephone lines; E. Rotan, W. W. Seley, S. Sawyer, E. N. Stephenson, J. B. Earle, J. E. Boynton, C. C. Barrett.

Hygienic Filter & Refrigerating Co., Chicago, Ill.; $25,000; general manufacturing; W. S. Kammerer, J. H. McDonnell, J. J. Purcell.

Pelley River Mining Co., 259 Washington St., Jersey City, N. J.; $125,000; to mine silver, gold and copper; Roscoe M. Wiers, Ralph M. Jacoby, John M. Enright, Jersey City.

Thompson & Moab Telephone Co., Salt Lake City, Utah; $1,400; to build and operate a telephone line between Thompson and Moab, Utah; Arthur A. Taylor, Pres.; J. C. Taylor, Vice-Pres.; Robert James Thompson, Treas.; Chas. Wilson, Secy.

Eagle Iron Co., Attalla, Tenn.; $20,000; to manufacture iron, etc.; company has secured and will put in blast the furnace at Attalla; L. S. Colyar, George H. Webb and James H. Barr, all of Chattanooga, Tenn.

Mail Delivery Notice.

Special efforts are made to deliver our paper to its readers each week at the earliest possible moment. The largest binding and mailing establishment in New York begins work on Engineering News early each Wednesday evening, and all papers for Boston, Philadelphia and Washington are usually in the New York post-office by midnight; all Brooklyn and New York city papers by 3 o'clock—in ample time for the first delivery Thursday morning. The entire edition, including foreign copies, is in the mail soon after 6 o'clock Thursday morning. If your paper is not received promptly we advise that you make a complaint to your local post-office officials.

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